APPENDIX A

AGENDAS AND MINUTES FOR GMA 12 JOINT GROUNDWATER PLANNING MEETINGS FROM 2012 TO 2017

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Groundwater Management Area 12 Meeting
Milano Civic Center
120 West Avenue E
Milano, Texas 76556
October 18, 2012 – 10:00 a.m.

MINUTES

Name	Entity
Nathan Ausley	Post Oak Savannah GCD (POSGCD)
Gary Westbrook	POSGCD
Billy Sherrill	Lost Pines GCD (LPGCD)
David Bailey	Mid-East Texas GCD (METGCD)
Joe Cooper	LPGCD
David Van Dresar	FCGCD
Alan Day	BVGCD
James Miller	City of Bastrop
Robert Bradley	Texas Water Development Board (TWDB)
Larry French	TWDB
Shirley Wade	TWDB
Leo Jwick	FCGCD
Jackie Scott	Brazos River Authority
James Beach	LBG-Guyton
Andy Donnelly	Daniel B Stephens & Assoc.

1. **Call meeting to order and establish quorum**
The meeting was chaired by Nathan Ausley, President of the Post Oak Savannah Groundwater Conservation District (GCD). Chairman Ausley noted that a quorum was present as all Districts in GMA 12 were represented at the meeting, including himself representing Post Oak Savannah GCD (POSGCD), David Bailey of Mid-East Texas GCD (METGCD), Alan Day of Brazos Valley GCD (BVGCD), Joe Cooper of Lost Pines GCD (LPGCD), and David Van Dresar of Fayette County GCD (FCGCD).

2. **Welcome and introductions**
Chairman Ausley welcomed all to the meeting and invited the head table to introduce themselves to those in attendance.

3. **Minutes of November 15, 2011 GMA 12 Meeting**
After reviewing the draft minutes of the November 15, 2011 meeting, David Van Dresar moved, and Joe Cooper seconded, to approve the minutes as presented. The motion carried unanimously.

4. **Representatives and alternates to serve on Region C, G, H, and K Water Planning Groups**
After discussion concerning the need to appoint alternates to each of the planning groups, Nathan Ausley moved, and Joe Cooper seconded, that representatives and alternates be appointed to the State's Regional Planning Groups for GMA 12 as follows:
Region C: Representative David Bailey of METGCD, Alternate John Alford, Jr. of METGCD
Region H: Representative David Bailey of METGCD, Alternate Wade Hedrick of METGCD
Region G: Representative Gary Westbrook of POSGCD, Alternate Alan Day of BVGCD

Region K: Representative Joe Cooper of LPGCD, Alternate Billy Sherrill of LPGCD
The motion carried unanimously.

5. **Final Modeled Available Groundwater runs and values recently prepared by TWDB**
Chairman Ausley asked if there was any comment from any of the GCDs in GMA 12 concerning the final Modeled Available Groundwater recently prepared by the TWDB. After brief discussion on this item, no action was taken.

6. **Update from Groundwater Conservation Districts of GMA 12 on possible Management Plan amendments and plans for monitoring water levels to accomplish Desired Future Conditions**
Chairman Ausley opened this item and asked for each District's input as to progress in satisfying the requirements of Section 36.108 Texas Water Code, specifically that representatives of the Districts meet at least annually to conduct joint planning with the other Districts in GMA 12 to review management plans and accomplishments for GMA 12. It was noted that GCDs were not required to amend Management Plans until the normal five year anniversary of its last adoption. Reports were given as follows:
POSGCD- Gary Westbrook presented the POSGCD's Management Plan, recently adopted on October 9, 2012, as well as Section 16 of the District's Rules, and explained that the District had adopted necessary strategies and methodologies for POSGCD to comply with the Desired Future Conditions adopted by GMA 12.
FCGCD- David Van Dresar stated that FCGCD was progressing towards amending its Management Plan and Rules to comply with these statutory requirements, and that he expected FCGCD to accomplish these tasks early in 2013.
LPGCD- Joe Cooper stated that LPGCD had also recently amended its Management Plan, including incorporating the GMA 12 DFCs and MAGs, and would be amending its Rules soon, to include necessary strategies and methodologies for LPGCD to comply with the Desired Future Conditions adopted by GMA 12.
METGCD- David Bailey stated that METGCD is in the process of conducting work toward amending its Management Plan and Rules to comply with these statutory requirements.
BVGCD- Alan Day stated that BVGCD is working towards completing the process of incorporating the necessary information and work into possible amendments to the District's Management Plan and Rules.

Robert Bradley of TWDB reminded the GCDs that the process would flow much more smoothly if the GCDs would present any changes or amendments to a Management Plan to the TWDB for a review prior to adoption.

All GCD representatives agreed to revisit this requirement of 36.108 during a GMA 12 meeting during 2013, using the annual reports of 2012 from each GCD.

7. **Improvements to current Queen City-Sparta (Central Carrizo) Groundwater Availability Model**
Chairman Ausley opened this item and asked if there was still interest from the Districts in GMA 12 to make improvements to the Groundwater Availability Model (GAM) that the GMA is required to use for joint planning. After brief discussion concerning past discussions of this item in past years, and all GCD representatives being in agreement that the issue should again be considered, Larry French of TWDB was asked to describe the process of other GMAs in working to improve the models used in their areas so that the GCDs in GMA 12 might have an idea of what might be necessary to move forward in discussion of this item.

Mr. French described the work being done in GMA 1 and 2 on the Ogallala Model, and GMA 8 on the Trinity Model, as well as USGS efforts in the Pecan Valley area to improve that model. Mr. French then stated that TWDB had been working on a technical information packet to be used as an assistance to those who desired to participate in improvement of the States' GAMs, and that he would be sending it out in the next week. After further discussion, it was agreed that the previous document which had been derived for this purpose in 2009 should be redistributed to the Districts of GMA 12 for evaluation by each District, and further discussion at the next GMA 12 meeting.

8. **Public Comment**
   Chairman Ausley asked for public comment. None was offered.

9. **Agenda items for next meeting**
   Chairman Ausley opened this item and asked for items to be included on the GMA 12 agenda. Topics which were named included:
   Improvements to the Queen City-Sparta (Central Carrizo) GAM, discussion of next round of work to be accomplished in joint planning, reports from GCDs in GMA 12, any other topics deemed appropriate.

10. **Adjourn**
    Chairman Ausley adjourned the meeting at 11:16 a.m.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON OCTOBER 18, 2012 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON JULY 25, 2013.

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
July 25, 2013 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

Name	Entity
Alan Day	BVGCD
Pat Reilly	Blue Water
Steve Box	Environmental Stewardship
Shirley Wade	TWDB
Chelsea Weatherford	TWDB
Matt Uliana	METGCD/Martin Geologic
Dave Coleman	City of College Station
Andy Donnelly	DBS&A
Sarah Backhouse	TWDB
David Van Dresar	TWDB
Monique Norman	BVGCD & FCGCD
James Beach	LBG Guyton
Gary Westbrook	POSGCD
Nathan Ausley	POSGCD
David Bailey	METGCD
Bobby Bazan	POSGCD
Keith Hansberger	LPGCD
Travis McPhaul	LPGCD
B. Sherrill	LPGCD
Meng Tia	Intera, Inc.
Steve Young	Intera, Inc.
John Seifert	LBG Guyton Associates
Joe P. Cooper	LPGCD
Ross Cummings	Blue Water
Bob Harden	R W Hardin, & Assoc.
Terry Zrubek	Landowner
Brian Ellis	CH2M Hill
Jackie Scott	BRA
Cutis Chubb	Central Texas Aquifer Coalition
Kodi Sawin	Sawin Group

1. **Call meeting to order and establish quorum**
   The meeting was chaired by Nathan Ausley, President of the Post Oak Savannah Groundwater Conservation District (GCD). Chairman Ausley called the meeting to order at 10:05 am. and noted that a quorum was present as all Districts in GMA 12 were represented at the meeting, including himself representing Post Oak Savannah GCD (POSGCD), David Bailey of Mid-East Texas GCD (METGCD), Alan Day of Brazos Valley GCD (BVGCD), Joe Cooper of Lost Pines GCD (LPGCD), and David Van Dresar of Fayette County GCD (FCGCD).

2. **Welcome and introductions**
   Chairman Ausley welcomed all to the meeting and invited the head table to introduce themselves to those in attendance. All representatives of GCDs mentioned above and Gary Westbrook of POSGCD, serving as secretary, introduced themselves.

3. **Minutes of October 18, 2012 GMA 12 Meeting**
   After reviewing the draft minutes of the October 18, 2012 meeting, David Van Dresar moved, and David Bailey seconded, to approve the minutes as presented. The motion carried unanimously.

4. **Resolution of Groundwater Management Area (GMA)14 regarding Reassignment of the Brazos Valley GCD in Brazos County to GMA 12**
   Chairman Ausley invited Alan Day to explain the resolution, which Mr. Day did. Chairman Ausley moved, and David Van Dresar seconded, to approve and sign the resolution as presented.

5. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   Chairman Ausley invited each of the Districts to give updates of how their District is remaining compliant with the joint planning requirements of Chapter 36.108 of the Texas Water Code.

   Gary Westbrook, General Manager of POSGCD presented information from POSGCD's 2012 Annual Report and current Management Plan. He then introduced Bobby Bazan of POSGCD who provided a breakdown of the total number of wells and monitor wells in each aquifer of the District. Mr. Westbrook then noted that POSGCD was working cooperatively with BVGCD on monitor wells and sharing information on those wells, and that soon POSGCD would hope to do the same with LPGCD. He then concluded by stating that the District's Management Plan and Annual Report, as well as all monitoring well information for POSGCD was available to the public on the District's website at www.posgcd.org .

   Joe Cooper, General Manager of LPGCD reported on LPGCD permits and monitoring wells and activities, as well as expansion of the current monitoring well system of the District and that this information was available from the District. He also stated that LPGCD looked forward to working with their neighbors in sharing monitoring information.

David Bailey, General Manager of METGCD reported on the number of wells, monitoring wells, and permits in METGCD, and that the District continues to seek new wells to add to their monitoring network.

David Van Dresar of FCGCD reported on the number of monitor wells in the District, and that the District was actively seeking more. He also noted that water quality was an important issue for FCGCD and that the District was working cooperatively with the Texas Water Development Board (TWDB) and the United States Geologic Survey to monitor and report water quality.

Alan Day, General Manager of BVGCD, reported on the number of wells, monitoring wells, and permits issued in 2012, as well as an evaluation of current aquifer conditions compared to the District's DFCs and MAG. He also noted that BVGCD was seeking more monitoring wells, and had a desire to possibly convert abandoned oil and gas wells to monitor wells as had been accomplished by POSGCD.

Mr. Westbrook stated that POSGCD now required permits for Oil and Gas Well Frac stimulation and asked if other District's in GMA 12 did so, and how that might be accounted for in the DFC process. Brief discussion ensued.

6. **Desired Future Conditions of aquifers in GMA 12**
Chairman Ausley opened this item and invited representatives of the Districts to comment on whether they anticipated changes in the DFCs of the aquifers in their Districts. David Baily of METGCD stated that his District may need to adjust some of the DFCs due to some issues identified with the GAM. Gary Westbrook of POSGCD noted that his District had not identified any necessary changes to the District's DFCs, but that since POSGCD is in the middle of GMA 12, any changes of DFCs in neighbors formations would naturally affect POSGCD, and that POSGCD would work with their neighbors towards needed amendments. Alan Day of BVGCD noted that his District is continuing evaluations, but that no changes in DFCs for BVGCD had been identified to date. Joe Cooper of LPGCD noted that his District had identified several possible amendments which might be needed to the DFCs in the aquifers in LPGCD and that they were continuing to evaluate their situation. David Van Dresar of FCGCD stated that his District was continuing to evaluate the need to amend DFCs.

7. **Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions**

Chairman Ausley opened this item and invited discussion on the requirements which now exist for the next round of the process of adopting DFCs. Gary Westbrook noted that there were requirements for this round which did not exist in the previous round of GMA 12 work and adoption of DFCs. Monique Norman read the requirements from Chapter 36.108 of the Texas Water Code (TWC) for all to hear and then commented on the process. Sarah Backhaus of TWDB provided comment on TWDBs role in the process, and noted that TWDB had provided documents at this meeting concerning the process and how GMAs were to submit DFCs, and the process that follows. Steve Young asked Monique Norman to outline the process necessary for the GMA in the DFC adoption process. She did so as she cited from TWC 36.108 again. Mr. Van Dresar asked about the anticipated date of the TWDB report on total usable water in aquifers. Shirley Wade of TWDB noted that this report should be out in the

Fall. Andy Donnelly asked about aquifer boundaries to be used in this and other TWDB reports. Mr. Van Dresar asked about additional details regarding the calculation of recoverable storage for the Carrizo-Wilcox formation and if fresh water and brackish groundwater would be accounted for separately, and noted that a more uniform definition of brackish groundwater was needed. Shirley Wade stated that TWDB had planned to calculate recoverable storage for the entire Carrizo-Wilcox formation and not by individual geological formations (a.k.a. Carrizo, Hooper, Simsboro, Calvert Bluff) and that there were not plans to partition the recoverable storage into fresh water and brackish water. Discussion ensued about who would write the necessary explanatory report for the DFCs which would be adopted. Chairman Ausley asked for comments from the consultants of the Districts in GMA 12. All agreed that they could work together as they had done in the past on GMA 12 issues to write the report. James Beach stated that the consultants of GMA 12 could work together to return a scope of work for this task for GMA 12 in 60-90 days. After discussion by the representatives of the GMA, Chairman Ausley moved to have the consultants work together to establish a scope of work for this process and return it to the GMA for consideration. Alan Day seconded and the motion passed unanimously.

8. **Improvements to current Queen City-Sparta (Central Carrizo) Groundwater Availability Model**

Chairman Ausley opened this item and invited discussion on the concerns of each District in GMA 12 with improvements to the current Queen City-Sparta (Central Carrizo) Groundwater Availability Model GAM. Gary Westbrook stated that each District had voiced interests about these improvements to date, including POSGCD, whose main concerns were groundwater-surface water interaction as well as the way the GAM performs in evaluating the faults in the area of the GAM in POSGCD. Joe Cooper asked if this work would lead to an improved GAM which would be recognized as the official State GAM for this area. Shirley Wade of TWDB explained the public process necessary for this to happen. Alan Day and John Seifert of BVGCD noted that they did not think the process of improvements to the GAM was a major process but rather a “tweeking” process. Mr. Cooper asked about the cost to the Districts to perform this work and Chairman Ausley inquired about the process and timing. James Beach stated that 3 to 6 months would be needed to assemble the data to be included in an update of the GAM, and that 5 to 6 months would be required to input the new data into the GAM. Steve Young explained that a part of this process had already taken place within the Districts.

9. **Public Comment**

Chairman Ausley invited anyone who wished to give public comment to state their name and address the representatives of the GMA. Keith Hansberger, Board member from LPGCD, addressed concerns with GMA 12 making changes to the GAM. Steve Box, Executive Director of Environmental Stewardship, addressed items contained in his written comments, filed with the GMA, which included addressing groundwater-surface water interaction and availability of water in the region. Curtis Chubb of the Central Texas Aquifers Coalition addressed the importance of the use of recharge, DFCs and Modeled Available Groundwater (MAG) in management of the aquifers, as well as conflicts of interest in the GMA. Bob Harden of R.W. Harden and Associates commented on the process and methods which might be used to update the GAM.

10. **Agenda items for next meeting**
Chairman Ausley invited input from the representatives of the Districts of GMA 12 for items to be included on the next GMA 12 Agenda. Items 6, 7, and 8 from today's agenda were mentioned, as well as any other items which might be identified at a later date. The date for the next GMA 12 meeting would be determined at a later date and upon completion of the scope of work approved under item 7 of today's agenda.

11. **Adjourn**
The meeting adjourned at 11:34 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON JULY 25, 2013 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON DECEMBER 19, 2013.

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
December 19, 2013 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

Name	Entity
Alan Day	BVGCD
Pat Reilly	Blue Water
Steve Box	Environmental Stewardship
Shirley Wade	TWDB
Chelsea Weatherford	TWDB
Matt Uliana	METGCD/Martin Geologic
Dave Coleman	City of College Station
Andy Donnelly	DBS&A
Sarah Backhouse	TWDB
David Van Dresar	FCGCD
Monique Norman	BVGCD & FCGCD
James Beach	LBG Guyton
Gary Westbrook	POSGCD
Nathan Ausley	POSGCD
David Bailey	METGCD
Bobby Bazan	POSGCD
Keith Hansberger	LPGCD
Travis McPhaul	LPGCD
B. Sherrill	LPGCD
Meng Tia	Intera, Inc.
Steve Young	Intera, Inc.
John Seifert	LBG Guyton Associates
Joe P. Cooper	LPGCD
Ross Cummings	Blue Water
Bob Harden	R W Hardin, & Assoc.
Terry Zrubek	Landowner
Brian Ellis	CH2M Hill
Jackie Scott	BRA
Cutis Chubb	Central Texas Aquifer Coalition
Kodi Sawin	Sawin Group

1. **Call meeting to order and establish quorum**
   The meeting was chaired by Nathan Ausley, President of the Post Oak Savannah Groundwater Conservation District (GCD). Chairman Ausley called the meeting to order at 10:05 am. and noted that a quorum was present as all Districts in GMA 12 were represented at the meeting, including himself representing Post Oak Savannah GCD (POSGCD), David Bailey of Mid-East Texas GCD (METGCD), Alan Day of Brazos Valley GCD (BVGCD), Jim Totten of Lost Pines GCD (LPGCD), and David Van Dresar of Fayette County GCD (FCGCD).

2. **Welcome and introductions**
   Chairman Ausley welcomed all to the meeting and invited the head table to introduce themselves to those in attendance. All representatives of GCDs mentioned above and Gary Westbrook of POSGCD, serving as secretary, introduced themselves.

3. **Minutes of July 25, 2013 GMA 12 Meeting**
   After reviewing the draft minutes of the July 25, 2013 meeting, David Van Dresar moved, and David Bailey seconded, to approve the minutes as presented. The motion carried unanimously.

4. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   Chairman Ausley asked the consultants of the Districts in GMA 12 for a report on progress made toward the work previously tasked to them by the Districts of GMA 12 concerning the process facing the GMA during the current round of joint planning. John Seifert presented an outline of work to be completed by the GMA in the process of adopting DFCs for the current round of planning, including work to be completed by the District's consultants, development of DFCs, refinement of water demands, meetings to receive stakeholder input, etc., with a target completion date for the process of March 2016. He also stated that a more complete schedule would be completed soon. Mr. Seifert also addressed the explanatory report needed to be submitted to TWDB with the Desired Future Conditions. Monique Norman provided a brief overview of the statutory requirements placed on the GMA and each District during the process. Questions and discussion ensued about the report presented, with staff from the Texas Water Development Board providing clarification on several issues. After further discussion, David Van Dresar moved, and Alan Day seconded, to task the consultants to complete the schedule and timeline for all work to be completed by the GMA during this round of joint planning by the end of January 2014. The motion carried unanimously.

5. **Desired Future Conditions of aquifers in GMA 12**
   Chairman Ausley opened this item and asked if any of the District's or consultants had any discussion on DFCs for GMA 12. After brief discussion, Robert Bradley of TWDB provided clarification that during this and future rounds of joint planning, any aquifer declared to be non-relevant has a list of qualifications to be satisfied. David Van Dresar asked if TWDB had completed studies of mapping of brackish water in the aquifers of GMA 12. Mr. Bradley stated that he would check to see if TWDB was involved in this process, and if so, where in the process they might be.

6. **Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions**

   Chairman Ausley opened this item and invited discussion. Gary Westbrook noted that POSGCD had just completed another round of monitoring of water levels in the District and provided a report to the POSGCD Board and that the results of the monitoring were available on the District's website. After evaluation of the report, the Board saw no need to change management at this time. Alan Day noted that BVGCD was beginning the process of updating their Management Plan, due in early 2015. Also BVGCD has ongoing monitoring of water levels as well. Mr. Day also noted that BVGCD and POSGCD were cooperating in an educational effort concerning Brazos Alluvial water production for irrigation and the effects of some water quality issues, on January 7, 2014. David Van Dresar noted that FCGCD's management plan had recently been completed, including the DFCs adopted in the last round of joint planning. David Bailey reported that METGCD is also in the process of updating and readopting their management plan, due by the end of 2014. Jim Totten reported on the monitoring work of LPGCD, including use of SCADA technology to monitor the Simsboro aquifer, and that they are looking to add monitoring wells in the shallow parts of their aquifers.

7. **Improvements to current Queen City-Sparta (Central Carrizo) Groundwater Availability Model**

   Chairman Ausley opened this item for discussion and asked for any updates on progress towards this effort. John Seifert gave a brief update on the process necessary to accomplish this, and if the entire model would not be improved, what improvements could be allowed and the process for including some minor or local improvements during modeling for the next round of joint planning. Mr. Seifert and Wade Oliver gave brief discussion on a recent meeting with TWDB staff on this item, and noted that a handout with notes from that meeting was available. Chairman Ausley returned to agenda item # 7 after finishing with item agenda item #8 at the request of John Seifert to discuss GMA 12 efforts to update the Central Queen City/Sparta Groundwater Availability Model (GAM). Mr. Seifert and Mr. Day stated that Brazos Valley GCD felt that the time was at hand to move forward with efforts to update the GAM as had been discussed over the past several years. Mr. Ausley agreed and noted that Post Oak Savannah GCD was also ready to move forward as well. Mr. Ausley asked Mr. Bradley to comment on the process required to update the GAM. Mr. Bradley outlined the public process needed to update a state GAM so that the GAM would be the state's GAM. Wade Oliver of Intera, Inc. also offered comment. Funding of updating the GAM was discussed. David Van Dresar moved, and Alan Day seconded, to task the consultants to bring back to the GMA within six months a scope of work and time frame with costs and state requirements with amounts of available state participation in those costs for updates to the Queen City/Sparta GAM. The motion carried unanimously.

8. **Representation for GMA 12 on Regional Water Planning Groups**

   Chairman Ausley opened this item and noted that this item was specific to Region K. He noted that it was necessary to appoint a representative from GMA 12 to Region K due to Joe Cooper stepping down from this appointment. Chairman Ausley asked for nominations for this position.

David Van Dresar moved, and Alan Day seconded to appoint Jim Totten of LPGCD to this position. Jim Totten stated that he would abstain from voting on this item. The motion carried 4-0 with Mr. Totten abstaining. Chairman Ausley returned the meeting to agenda item #7.

9. **Brazos Alluvium Groundwater Availability Model**
   Wade Oliver of Intera, Inc. provided an update on efforts from the Texas Water Development Board to complete the groundwater Availability Model for the Brazos River Alluvium.

10. **Public Comment**
    Chairman Ausley invited anyone who wished to give public comment to state their name and address the representatives of the GMA. Keith Hansberger, Board member from LPGCD, addressed concerns with GMA 12 making changes to the GAM. Steve Box, Executive Director of Environmental Stewardship, addressed items contained in his written comments, filed with the GMA, which included addressing groundwater-surface water interaction and availability of water in the region. Curtis Chubb of the Central Texas Aquifers Coalition addressed the importance of the use of recharge, DFCs and Modeled Available Groundwater (MAG) in management of the aquifers, as well as conflicts of interest in the GMA. Bob Harden of R.W. Harden and Associates commented on the process and methods which might be used to update the GAM.

11. **Agenda items for next meeting**
    Chairman Ausley invited input from the representatives of the Districts of GMA 12 for items to be included on the next GMA 12 Agenda. Items 6, 7, and 8 from today's agenda were mentioned, as well as any other items which might be identified at a later date. The date for the next GMA 12 meeting would be determined at a later date and upon completion of the scope of work approved under item 7 of today's agenda.

12. **Adjourn**
    The meeting adjourned at 11:15 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON DECEMBER 19, 2013 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON JUNE 6, 2014.

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

Lost Pines Groundwater Conservation District

Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
June 6, 2014 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

Name	Entity
Alan Day	BVGCD
Cynthia Lopez	BVGCD
Robert Bradley	TWDB
Shirley Wade	TWDB
Dave Coleman	City of College Station
Andy Donnelly	DBS&A
David Van Dresar	FCGCD
Monique Norman	BVGCD & FCGCD
James Beach	LBG Guyton
Gary Westbrook	POSGCD
Nathan Ausley	POSGCD
Meredith Earwood	POSGCD
David Bailey	METGCD
Bobby Bazan	POSGCD
Keith Hansberger	LPGCD
B. Sherrill	LPGCD
Steve Young	Intera, Inc.
John Seifert	LBG Guyton Associates
Joe P. Cooper	LPGCD
Jim Totten	LPGCD
James Bene	R W Hardin, & Assoc.
Bob Harden	R W Hardin, & Assoc.
Kirk Holland	Self
Ann Stanislaw	Self
Jackie Scott	BRA
R. Brent Locke	Bistone MWSD, Mexia
Kodi Sawin	Sawin Group

1. **Call meeting to order and establish quorum:**
Nathan Ausley, Chairman, called the Groundwater Management Area 12 Meeting to order and established a quorum at 10:07 am.

2. **Welcome and introductions:**
Chairman Nathan Ausley asked each member to introduce themselves to the general public.

3. **Minutes of December 19, 2013 GMA 12 Meeting:**
After reviewing the draft minutes, David Van Dresar of Fayette County GCD moved to accept the December 19, 2013 GMA 12 meeting minutes. David Bailey of Mid-East Groundwater Conservation District 2nd the motion. The motion carried unanimously.

4. **Report from Steve Box concerning Groundwater-Surface Water interaction in GMA 12:**
Steve Box was unable to attend.

5. **Texas Water Development Board GAM Task 13-035 Version 2: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 12:**
Delayed to present with item 8 as requested by the presenters.

6. **Review and discussion of information from State Water Plan:**
Delayed to present with item 8 as requested by the presenters

7. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code:**
Chairman Ausley invited each of the Districts to give updates of how their District is remaining compliant with the joint planning requirements of Chapter 36.108 of the Texas Water Code.

   Alan Day of Brazos Valley Groundwater Conservation District spoke on the updates of the District. Alan Day discussed the handout that was available to the public which summarized the updates of the BVGCD's management plan that is currently under review and revision. He stated the management plan was due June 2015 and BVGCD will have a public comment and stakeholder meeting in July 2014. Day proceeded to report on the number of monitoring wells for the monitoring program. He explained that the District ran water quality tests in the Brazos Valley Alluvium and found there was high salinity, so the District held a presentation, along with Post Oak Savannah Groundwater Conservation District, in January 2014 to address the issue. BVGCD is also working with hydrologists to develop a DFC. He noted that BVGCD was seeking to improve the Central Queen City-Sparta/ Carrizo-Wilcox Groundwater Availability Model with Texas Water Development Board. He also stated that BVGCD was considering bringing frac wells under permit. He expressed that the BVGCD's education program has become a major program. Day concluded with the current development of a lawn care water management program, and is partnering with the cities of Bryan-College Station to develop a website. This program will include strategies to implement water management for lawn care, as well as the possibility of an ASR project with College Station after rules and parameters are established

David Bailey of Mid-East Texas GCD, stated that METGCD is currently working on their management plan, and are continuing efforts to identify and incorporate new wells in their monitoring program, especially in the Hooper aquifer. He reported that the next board meeting for METGCD will be on June 24th to readopt their management plan.

David Van Dresar, FCGCD, reported that the District is currently under rules revision, working to set up permits for frac. He explained the District is conducting a county wide water quality study, mirroring a test done in 1965 to find bad water lines and find old wells in every grid of every aquifer. He commented that the monitoring network has seen more depreciable change, having localized issues with oil and gas. He noted that FCGCD's management plan was reviewed and updated.

Jim Totten, Lost Pines GCD, reported that the District is working with consultants to improve the monitoring network. He noted that the District has reached 4th and 5th graders in the District on educational outreach focusing on water awareness and conservation principles.

Gary Westbrook of POSGCD reported on the management of the monitoring program and noted that the District had a rules revision in February concerning regulation on oil and gas frac wells. He explained that details of the monitoring program were in the annual report and could be found at www.posgcd.org. he further noted that Bobby Bazan of POSGCD would give a report on monitoring results later in the meeting.

8. **Desired Future Conditions of aquifers in GMA 12:**
The Chairman opened items 5, 6, 8, & 9 simultaneously for discussion. John Seifert, consultant for BVGCD, discussed how to define the Modeled Available Groundwater, and reviewed the Total Estimated Recoverable Storage for each aquifer. He then discussed the Groundwater Availability Models, evaluating the effects from pumping and projecting demands. Discussion arose about how Mr. Seifert arrived at his demand numbers, and if water being transported out of the district were included, at which Seifert explained each factor that is included in the table. Bob Harden of RWH Associates then provided comment on the demands stating, "Examples of what we thought was going to happen, didn't happen, and something dramatically different did happen, so I would try and not predict the future, and focus on property rights, physical hydrology instead of political hydrology". Monique Norman, attorney for BVGCD, responded to the public question, stating that the law only requires having a planning number, not a regulating number, leaving room to evaluate the results of the demand table. Steve Young, hydrologist for POSGCD, then discussed the information packet compiled for GMA 12. Within the packet, Mr. Young discussed the water budget based on GAM runs, to help understand flow from different counties, cities, and recharge zones. He noted the State Water Plan Values for 2012 – 2017, the TERS for Milam and Burleson County, and recorded pumping reports on permits and pumping. At this time, Bobby Bazan, Water Resource Management Specialist, POSGCD, discussed the monitor well changes for POSGCD having less than 5ft of change. Mr. Young then expressed interest in a stakeholder meeting to improve monitoring well programs and discuss DFC's in a way for the public to understand. Brent Lock, General Manager for Bistone WSC then questioned if there are accurate results with only 49% of wells being permitted. Mr. Young and Mr. Bazan gave an explanation of the differences between registered, exempt, and permitted wells, and how they still are all included in the estimated water use.

9. **Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions:**
Mrs. Norman addressed the process to adopt DFC's for Chapter 36.108. Consultants suggested the bookend approach for receiving comments on GMA 12's DFCs, and to be open to comment but give

guidance on items which would be helpful, and requested that the GMA 12 agree on the approach. James Beach, hydrologist for BVGCD, made comment that requests for considerations be on a regional scale. A motion was made by Alan Day for the consultants to create a form for written comment and concerns of DFCs in order to create a paper trail, and to be available at the next meeting. Nathan Ausley 2nd the motion. Motion passed unanimously.

10. **Improvements to current Queen City-Sparta (Central Carrizo) Groundwater Availability Model:** Mr. Seifert reported on the improvements of calibration pumping, extending the time period to 2010. He stated it is not a re-calibration, but an extension of the calibration period. Mr. Beach explained in order to include the calibration in the models, it must be an extension, not a re-calibration of this year's DFC. Mr. Seifert reported that they were currently looking for funding with TWDB to move forward. A Public Comment was made, questioning the ruling on RFQ for public funds being used for consultants for the extension work, and Mrs. Norman answered that since the Districts already have hired hydrologists on their own, there is no need for an RFQ according to the law. Robert Bradley with Texas Water Development Board commented that GMA 8 did the same process so he felt comfortable with how to handle the costs of the extension. Mr. Day of BVGCD stated that BVGCD was ready to move forward with a major update to the GAM.

11. **Representation for GMA 12 on Regional Water Planning Groups:**
Mr. Totten made comment about who to primarily represent Region K, the board discussed and concluded to move this item to the next meeting.

12. **Public Comment:**

Keith Hansberger, Lee County: Voiced concern on property value going down if there is not any water under the property.

Bob Harden (RWH Associates): "Texas has not done a good job of setting up this process" "1985 report done on this area for management, the area most suited for the management of the aquifer is GMA 12, not the district" Issues related to private property, it means there's constitutional constraint on the government for restricting water.

Ann Stanislaw Milam County Community Member: Wants the meetings to be at a time that most working community members can attend, and advertise better so that public comment can be made.

Kirk Holland (Independent Austin): Difficulty dealing with drawdown measurements between unconfined and confined areas, GMA 12 should consider using change in storage measurement, instead of drawdown measurements.

13. **Agenda items and Date for next meeting:** One stakeholder GMA wide public meeting to take comments on Demands and options for DFCs in GMA 12 prior to consideration for initial proposed DFC on June 27 motioned by Mr. Van Dresar, 2nd by Mr. Totten. Motion passed unanimously.

Bradley: DFC options is the correct word to use

Andy Donnelly: Need to have a meeting date that is consistent so that we can have a routine to get DFC completed on time.

After discussion, the 2nd Friday of every bimonthly, with next meeting August 8th was agreed.

14. Adjourn

The meeting adjourned at 12:10 pm.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON JUNE 6, 2014 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON JUNE 27, 2014.

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT
Groundwater Management Area 12 Meeting
Milano Civic Center
120 West Avenue E
Milano, Texas 76556
June 27, 2014 – 10:00 a.m.

MINUTES

Present	Entity
Gary Westbrook	POSGCD
Bobby Bazan	POSGCD
Meredith Earwood	POSGCD
Robert Bradley	TWDB
Nathan Van Oort	TWDB
Nathan Ausley	POSGCD
Steve Box	Environmental Stewardship
Phil Cook	Sierra Club
Leo J Wick	FCGWA
David Van Dresar	FCGCD
Steve Young	Intera
David Bailey	METGCD
Scott Carlson	Met Water
James Bene	RW Harden
Michele Gangnes	Neighbors for Neighbors
Andy Donnelly	DBS&A
Alan Day	BVGCD
Cynthia Lopez	BVGCD
Ann Stanislaw	Self
Judith Slusher	Self
Bob Harden	RWH&A
Ken Hall	SWM – WSC
John Burke	JEB & Assoc.
Michael Simmang	LPGCD
Jim Totten	LPGCD
Dave Barkemeyer	Milam County

1. **Call meeting to order and establish quorum**
The meeting was chaired by Nathan Ausley, President of the Post Oak Savannah Groundwater Conservation District (GCD). Chairman Ausley called the meeting to order at 10:05 am and noted that a quorum was present as all Districts in GMA 12 were represented at the meeting, including himself representing Post Oak Savannah GCD (POSGCD), David Bailey of Mid-East Texas GCD (METGCD), Alan Day of Brazos Valley GCD (BVGCD), Jim Totten of Lost Pines GCD (LPGCD), and David Van Dresar of Fayette County GCD (FCGCD).

2. **Welcome and introductions**
Chairman Ausley welcomed all to the meeting and invited the head table to introduce themselves to those in attendance. All representatives of GCDs mentioned above and Gary Westbrook of POSGCD, serving as secretary, introduced themselves.

3. **Minutes of June 6, 2014 GMA 12 Meeting**
After reviewing the draft minutes of the June 6, 2014 meeting, Alan Day motioned, and David Van Dresar seconded to approve the minutes as presented. The motion carried unanimously.

4. **Report from Steve Box concerning Groundwater-Surface Water interaction in GMA 12**
Chairman Nathan Ausley invited Mr. Steve Box of Environmental Stewardship to give his presentation. Mr. Box presented information on the relationships between the Brazos River, Colorado River and Carrizo-Wilcox aquifer. He reported on Groundwater Availability Modeling (GAM) predictions, river leakage, and protection of environmental flows. He referenced several studies when reviewing the condition of the Simsboro pumping and GAM data. Mr. Box recommended the board consider an adaptive management process for the Desired Future Condition (DFC), and set different DFCs for different regions.

5. **Receive comments on Demands and DFC options for GMA 12**
Chairman Ausley invited comments on recently discussed Demands and DFC options for GMA 12. James Bene of RW Harden & Associates gave a presentation and made comments and suggestions for improving the DFC process. He reported on shortcomings of the current DFCs and issues he sees with the Modeled Available Groundwater (MAG) being used by GCDs.

   Gary Westbrook of POSGCD gave a presentation and made comments that POSGCD has formed a subcommittee to evaluate DFC's. He explained the estimate time for the planning cycle, and noted that POSGCD would maintain its focus on protection of water levels in shallow management zones.

6. **Texas Water Development Board GAM Task 13-035 Version 2: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 12**
No comments were given.

7. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   No updates were given.

8. **Desired Future Conditions of aquifers in GMA 12**
   Chairman Nathan Ausley asked Gary Westbrook to explain the submission form created by the GMA consultants to accept written requests from stakeholders. Chairman Ausley then moved to accept the form. Jim Totten of LPGCD seconded the motion. The motion carried unanimously.

9. **Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions**
   Chairman Nathan Ausley briefly reviewed the requirements for addressing DFCs. There were no questions from the audience.

10. **Improvements to current Queen City-Sparta (Central Carrizo) Groundwater Availability Model**
    No comments were given.

11. **Representation for GMA 12 on Regional Water Planning Groups**
    Jim Totten of LPGCD noted that GMA 12 is in need of an alternate for Region K in place of Joe Cooper, former General Manager for LPGCD, and that no replacement had been named yet.

12. **Public Comment**
    Phil Cook of the Sierra Club commented on the testimony from Bill Hutchinson presented at the Texas House of Representatives Natural Resources Committee hearing. Mr. Cook noted that in Mr. Hutchinson's testimony included information on the Hueco-Bolson aquifer and the Rio Grande river turning into a losing river. Mr. Cook noted the pumping issues that the area is facing. Mr. Cook expressed concern for the same issue happening in GMA 12.

    Michele Gangnes of Neighbors for Neighbors also commented about Mr. Bill Hutchinson's testimony from the Texas House of Representatives Natural Resources Committee hearing. She included a handout with more information and noted that surface/groundwater relationships are becoming very important. She requested that the GMA included the surface/groundwater relationship issues during the DFC process.

    Bob Harden of RW Harden & Associates commented that in order to create sustainability, groundwater outflow and surface water discharge will have to reduce. He recommended the GMA to include groundwater evaporation and to focus on the source of supply instead of the transportation reduction. He noted that the GAM does not work vertically because water prefers to move laterally, making the GAM somewhat inaccurate in those evaluations. Mr. Harden noted that the quality of the groundwater was not an issue because quality had not degraded. He explained that Aquifer Storage and Recovery (ASR) was not a good idea for this GMA, and recommended that the GMA not break into geographic areas but use GMA 12 as an entity itself and consider constitutional restraints protecting private property in groundwater. He also recommended an adaptive management approach for the GMA. He commented that that averaging water levels will not work to predict an accurate DFC.

13. Agenda items and Date for next meeting

The date for the next GMA 12 meeting was set for August 8, 2014 at Milano Civic Center.

14. Adjourn

Chairman Nathan Ausley adjourned the meeting at 11:37 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON JUNE 6, 2014 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON JUNE 27, 2014.

ATTEST:

David M. Bailey

Mid-East Texas Groundwater Conservation District

Dale Van Dam

Fayette County Groundwater Conservation District

Brazos Valley Groundwater Conservation District

Lost Pines Groundwater Conservation District

Mark Cauley

Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
December 4, 2014 – 11:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

Name	Entity
Alan Day	BVGCD
Dave Coleman	City of College Station
Andy Donnelly	DBS&A
David Van Dresar	Fayette County GCD
Robert	TWDB
Cindy Ridgeway	TWDB
Monique Norman	BVGCD & FCGCD
James Bene	RW Hardin
Gary Westbrook	POSGCD
Nathan Ausley	POSGCD
David Bailey	METGCD
Bobby Bazan	POSGCD
Elaine Gerren	POSGCD
Tommy Tietjen	POSGCD
Jim Totten	LPGCD
Steve Young	Intera, Inc.
Cynthia Lopez	BVCCD
John Siefert	LBG Guyton
Mike Keester	LBG Guyton
Phil Cook	Sierra Club
Matthew Ulianna	MGC/METGCD
Charles Ellison	Franklin
David Wheelock	LCRA
Brent Covert	Forestar Group

1. **Call meeting to order and establish quorum**
   The meeting was chaired by Nathan Ausley, President of the Post Oak Savannah Groundwater Conservation District (GCD). Chairman Ausley called the meeting to order at 11:02 a.m. and noted that a quorum was present as all Districts in GMA 12 were represented at the meeting, including himself representing Post Oak Savannah GCD (POSGCD), David Bailey of Mid-East Texas GCD (METGCD), Alan Day of Brazos Valley GCD (BVGCD), Jim Totten of Lost Pines GCD (LPGCD), and David Van Dresar of Fayette County GCD (FCGCD).

2. **Welcome and introductions**
   Chairman Ausley welcomed all to the meeting and invited the head table to introduce themselves to those in attendance. All representatives of GCDs mentioned above and Gary Westbrook of POSGCD, serving as secretary, introduced themselves. Chairman Ausley then introduced staff members of the Texas Water Development Board (TWDB). Cindy Ridgeway, of TWDB, commented on recent actions of the TWDB in efforts to perform improvements to the Central Queen City/Sparta/Carrizo-Wilcox Groundwater Availability Model, and noted that information could be found on TWDB's website.

3. **Minutes of June 27, 2014 GMA 12 Meeting**
   After reviewing the draft minutes of the June 27, 2014 meeting, Nathan Ausley moved, and David Bailey seconded, to approve the minutes as presented. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
   John Seifert of LBG Guyton presented a report on preliminary modeling results for consideration by the GMA, and answered questions.

5. **Updates to Pumping Files used in Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model**
   Steve Young of Intera presented a report on recent updates to the pumping files used in the Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model, and answered questions. He also noted that each GCD had participation in the process and would document their work in these updates.

6. **Receive comments on Demands and DFC options for GMA 12**
   Gary Westbrook, General Manager of Post Oak Savannah GCD, presented a report on POSGCD's management strategies for the shallow parts of the aquifers of the District, and a request from the Board of POSGCD for all other GCDs in GMA 12 to join POSGCD in adopting DFCs for the shallow parts of the aquifers of GMA 12. Mr. Westbrook answered questions about POSGCD management and Rules.

7. **Texas Water Development Board GAM Task 13-035 Version 2: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 12**
   Steve Young of Intera presented a report on this topic and included slides from a recent presentation received by POSGCD concerning this topic.

8. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   Each District representative gave a brief update on water level monitoring in their District. Alan Day stated that BVGCD is finishing an update of the District's Management Plan.

9. **Update on Legislative issues of possible interest to the Districts of GMA 12**
Monique Norman and Gary Westbrook gave brief reports concerning interim legislative efforts of the Texas Water Conservation Association and the Texas Alliance of Groundwater Districts concerning several issues, including incentivizing Aquifer Storage and Recovery projects, brackish groundwater production, as well as other efforts.

10. **Report on Monitoring activities by Districts of GMA 12**
Dr. Steve Young of Intera presented a report on behalf of POSGCD concerning the District's monitoring activities and methods to be considered in evaluating the information received from those activities.

11. **Desired Future Conditions of aquifers in GMA 12**
District representatives gave brief updates on each Districts progress in evaluating information to be used in the process of developing the next set of DFC for GMA 12.

12. **Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions**
John Seifert requested feedback from the Districts on today's presentations, and noted the need for a consultants meeting soon. After discussion, representatives of the GMA agreed to task the consultants to continue with model runs and studies to present at the next GMA 12 meeting.

13. **Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model**
Cindy Ridgeway of TWDB reported that improvements to the CQC-S/C-WGAM were approved at a recent TWDB meeting and were contingent on financial participation from GCDs in GMA 12. She noted that a minimum commitment of $200,000 from the GMA GCDs would be needed for the approved scope of work. Gary Westbrook stated that the POSGCD Board had recently approved 200,000 to be disbursed over the next 2 years to help with the model improvements and encouraged the other Districts to aid in this process. when asked about additional funding being made available from the GCDs of GMA 12, Ms. Ridgeway stated that additional funds would allow the scope of work for the improvements to the GAM to be expanded.

14. **Representation for GMA 12 on Regional Water Planning Groups**
No action was taken on this item.

15. **Public Comment**
Chairman Ausley asked for public comment. No Public Comment was offered.

16. **Agenda items for next meeting**
Chairman Ausley invited input from the representatives of the Districts of GMA 12 for items to be included on the next GMA 12 Agenda. Discussion was held and the decision was made to have any feedback from this meeting's presentations returned to the consultants by January 7, 2014. It was also agreed that Mr. Westbrook would accept input from consultants to assemble

an agenda for the next GMA 12 meeting, and that the next scheduled meeting will be held on January 23, 2015.

17. Adjourn

The meeting adjourned at 1:28 pm

Attest:

David M. Bailey

Mid-East Texas Groundwater Conservation District

Wendi Denton

Fayette County Groundwater Conservation District

Brazos Valley Groundwater Conservation District

Lost Pines Groundwater Conservation District

Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
February 26, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

Name	Entity
Alan Day	BVGCD
Dave Coleman	City of College Station
Andy Donnelly	DBS&A
Robert Bradley	TWDB
Monique Norman	BVGCD & FCGCD
James Bene	RW Hardin
Gary Westbrook	POSGCD
Nathan Ausley	POSGCD
David Bailey	METGCD
Bobby Bazan	POSGCD
Steve Box	Environmental Stewardship
Steve Young	Intera, Inc.
Cynthia Lopez	BVCCD
John Siefert	LBG Guyton
Phil Cook	Sierra Club
Matthew Ulianna	MGC/METGCD
Ross Cummings	Blue Water
Paul Terrill	Terrill Firm
David Wheelock	LCRA
Steven Siebert	San Antonio Water Systems
Lisa Guarrdiola	San Antonio Water Systems
Darren Thompson	San Antonio Water Systems
Keith Hansberger	LPGCD
Michelle Gangnes	League of Independent Voters
Wendi Denton	Fayette County GCD
Leo J. Wick	Fayette County GCD
Richard Morgan	Abengoa
Mike Southerland	City of Caldwell
Jayson Barfknecht	City of Bryan

1. Call meeting to order and establish quorum
   Chairman Ausley called the meeting to order at 10:01 am

2. Welcome and introductions
   Head table- Gary Westbrook from POSGCD serving as secretary, David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Jim Totten representing LPGCD, and Wendi Denton representing FCGCD

3. Minutes of December 4, 2014 GMA 12 Meeting
   Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of Dec. 4, 2014. None were offered. Chairman Ausley moved and Mr. Totten seconded that the minutes be approved as presented. The motion carried unanimously.

4. Update and report from consultants regarding ongoing evaluations and studies
   John Seifert of LBG Guyton and Associates presented a presentation entitled "Update of Preliminary Groundwater Modeling Results" which covered work completed to date by the consultants of GCDs in GMA 12, for considerations and evaluations by the GCDs and public. Much of this presentation covered information originally covered at the previous GMA 12 meeting. Mr. Seifert then covered additional information which would be added to this presentation within the next day so that it could be made available to the public.

   Next, Steve Young of Intera gave a presentation summarizing DFC work completed by POSGCD and BVGCD during the last round of joint planning with respect to the Brazos River Alluvium. Next, Mr. Young gave an update of the current efforts to develop the groundwater availability model for the Brazos River Alluvium. Mr. Ausley asked when the GAM would be available. Mr. Young stated possibly by August 2016. Mr. Young also stated that the Conceptual Report would be completed in a few days and that this report might be available to the public for comment.
   Steve Box asked if there would be a period for public comment on the Conceptual Report. Robert Bradley of Texas Water Dev. Board stated there would be when appropriate.

5. Updates to Pumping Files used in Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model
   This information was included in Mr. Seifert's presentation under item 4 of this agenda.

6. Alternative analytical method for evaluation of DFCs for the Queen City and Sparta Aquifers in the Mid- East Texas GCD
   Matt Uliana of Martin Geologic provided information and comment on issues in Leon County with respect to recharge in the Queen City and Sparta formations, and noted that METGCD was in conversation with TWDB and using this method to evaluate and address these issues during this round of joint planning.

7. Receive comments on Demands and DFC options for GMA 12
   Alan Day reported that BVGCD had considered the model runs identified and reported by GMA 12 consultants at the December 4, 2014 GMA 12 meeting, as well as the predicted population growth in Brazos county, and additional pumping in other GCDs in GMA 12, and had determined that they would

like to begin DFC discussions with the PS2 scenario GAM run. He asked other GCDs to provide comment on this GAM run, and hoped that the GMA would encourage the public and other entities and groups to provide comment as well. He then reported that for this round of planning the BVGCD would consider the Brazos River Alluvium as a relevant aquifer.

Nathan Ausley reported that POSGCD had considered all of the GAM runs presented at the December 4, 2014 GMA 12 meeting and that POSGCD was continuing to evaluate impacts of these runs on specific shallow areas of the aquifers in the District. After this exercise the POSGCD would be prepared to provide comment. Mr. Ausley invited Gary Westbrook, General Manager of POSGCD to comment on these efforts. Mr. Westbrook noted that this work had already begun. He also reported that POSGCD was working to develop a more simple approach to evaluating progress by the District with respect to confirming compliance with DFCs adopted by the GMA by developing methodology to tie aquifer conditions to specific monitor wells. He then asked if other GCDs in the GMA 12 had considered POSGCD's request that the GMA identify shallow areas across the GMA in which shallow zones with DFCs might be developed as in POSGCD.

Mr. Day reported that BVGCD had discussed this item and was progressing towards development of data and information which would be useful in developing a shallow management zone.

Mr. Totten reported that there was certainly interest in this concept of a shallow management zone in LPGCD, but that no progress toward this had begun. Mr. Totten also stated that, other than minor changes needed in the minor aquifers, LPGCD desired no change in the DFCs from their current values in the Carrizo and Simsboro.

Mr. Seifert asked Mr. Westbrook about the process used by POSGCD to establish POSGCD shallow management zones. Mr. Westbrook provided a description of the process followed by POSGCD in the development of shallow zones of each aquifer in the District, noting the considerations given to areas with fault zones in the Carrizo-Wilcox formations.

Mr. Ausley inquired to the extent of faulting present in BVGCD, and Mr. Seifert gave a brief description of faulting and outcrop areas of these formations in BVGCD.

After further discussion, Mr. Day moved all GCDs in GMA 12 publish and make available all files for GAM run PS2a, and encourage comment by all interested parties. Mr. Totten seconded. The motion passed unanimously.

Mr. Westbrook asked for a timeline to be identified to receive comment. Mr. Totten agreed, and asked to consider this under agenda item 15.

8. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code

   Mr. Westbrook presented a draft copy of the POSGCD Annual Report for 2014 containing information on water level monitoring efforts by the District as well as permits issued during 2014.

   Mr. Day provided a copy of the newly adopted BVGCD Management Plan to each of the GCDs in GMA 12 and noted that the BVGCD Annual Report covering permits issued and water level monitoring was available on the BVGCD website.

Mr. Westbrook inquired as to progress of the GMA 12 consultants toward development of a form for receiving comments on DFCs. MR. Andy Donnelly of DBS&A noted that the form had been developed and that he would send it out to the GCDs for consideration at the next GMA 12 meeting.
Mr. Totten inquired as to the interest of development of a GMA 12 website, after discussion, Mr. Totten volunteered to bring information to the next GMA 12 meeting to consider.

9. Update on Legislative issues of possible interest to the Districts of GMA 12
Monique Norman provided a brief update of legislation related to this item. Mr. Totten also noted legislation pertaining to responding to public information requests.

10. Report on Monitoring activities by Districts of GMA 12
Mr. Westbrook noted that POSGCD had begun annual water level monitoring, and noted the POSGCD Annual Report for 2014 contained information on water level monitoring efforts by the District during 2014.
Mr. Day also noted that BVGCD had begun annual monitoring and noted that the BVGCD Annual Report covering water level monitoring was available on the BVGCD website.
Mr. Totten reported on expansion of LPGCD monitoring efforts.
Mr. Bailey reported efforts toward annual monitoring and expansion of the METGCD network of monitoring wells.
Mrs. Denton reported no change at this time.

11. Desired Future Conditions of aquifers in GMA 12
No new discussion was held on this item.

12. Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions
It was noted that this was covered earlier in the meeting under agenda item 4 during Mr. Seifert's presentation.

13. Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model
Mr. Westbrook reported that the four GCDs in GMA 12 which had committed funds and work towards this effort had submitted a letter to TWDB with a list of those commitments as well as a list of items required to be addressed by any group undertaking this task.
Mr. Bradley responded to a question of when TWDB would choose the group to complete this task with the answer of during the first part of March.

14. Public Comment
Chairman Ausley invited public comment. None was offered.

15. Agenda items and Date for next meeting
After discussion, the next meeting date was chosen to be March 27, 2015, and the list of items currently on this agenda would be amended to include approval of the form to receive comments on DFCs, as well as an item to receive comments on GAM run PS2a. It was also decided that comments on this GAM run PS2a would be accepted by any GCD within GMA 12 through Thursday, April 2, 2015.

16. Adjourn

The meeting adjourned at 11:27 am.

Attest:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
March 27, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent
None

Others Present	**Entity**
Gary Westbrook	POSGCD
Bobby Bazan	POSGCD
Meredith Earwood	POSGCD
Larry Hoffmann	Concerned Citizen
David Wheelock	Lower Colorado River Authority
Monique Norman	BVGCD & FCGCD
Steve Box	Environmental Stewardship
Jayson Barfknecitt	City of Bryan
Mike Sutherland	City of Bryan
Cynthia Lopez	BVGCD
Dave Coleman	City of College Station
James Bene	RWH
Robert Bradley	TWDB Staff
Ann Stanislaw	SWMWSC
Kirk Holland	self
Rick Morgan	Abengoa
Barret Lyne	Lyne Ranch
Steve Young	Intera
Amy Muttoni	BRA
Andy Donnelly	DBS&A
Kodi Sawin	
John Seifert	LBG Guyton

MEETING

1. **Call meeting to order and establish quorum:**
   Nathan Ausley, President, called the Groundwater Management Area 12 Meeting to order and established a quorum at 10:04 am.

2. **Welcome and introductions:**
   President Nathan Ausley asked each member to introduce themselves to the general public.

3. **Minutes of February 26, 2015 GMA 12 Meeting:**
   After reviewing the draft minutes, Alan Day of Brazos Valley GCD moved to accept the February 26, 2015 GMA 12 meeting minutes. Jim Totten of Lost Pines GCD 2nd the motion. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
   John Seifert of LBG-Guyton and Associates gave a review of ongoing evaluations and studies. Mr. Seifert reminded the public of the deadline of April the 2nd for comments.

5. **Receive comments on GMA 12 Groundwater Availability Model Run PS2a, later renamed PS4**
   Steve Box Environmental Stewardship, Exec. Director:

   Steve Box reviewed the packet given to the board as written comments for the DFC. He noted he would like the board to consider to hold the DFC as it currently is without movement increasing or decreasing. He noted that the Colorado and Brazos rivers are gaining rivers, and he urged the board to look into groundwater and surface water interactions near those rivers. He requested the board research the significance of the interaction and include findings in the DFC.

   Barret Lyne, Citizen Brazos Valley:

   Barret Lyne of Brazos County emphasized the nexus between surface and groundwater interactions. He explained that flow across the soil is interrupted as groundwater pumping occurs. He noted that the lack of flow across the surface effects crop growth due to limited soil moisture, and requested more data on the relationship of groundwater and surface water.

   Steve Young, Intera:

   Steve Young gave a presentation on behalf of POSGCD on the results of the PS1-4 GAM runs.

6. **Updates to Pumping Files used in Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model**
   President Ausley asked for reports from the districts. Mr. Totten noted that Lost Pines was taking comments on the pumping files to be used in the GAM. No other updates were given.

7. **Receive comments on Demands and DFC options for GMA 12**
   David Wheelock, LCRA:

   Mr. Wheelock commented that there is a built in bias in the current model that says more pumpers have a higher drawdown and a greater effect to the MAG. He commented that he is still learning the 9 criteria and is interested in the Use Category. He noted that storage depletion is appropriate for the DFC in the view of the LCRA, and the GMA should only limit a small percent of depletion.

Nathan Ausley, POSGCD Director:

Mr. Ausley commented on Post Oak Savannah GCD's work on the DFC process, and reported what the POSGCD DFC committee had discussed, and noted that POSGCD would prefer to hold DFCs at the current levesl at this time, and that POSGCD would maintain a separate DFC for the unconfined area of the Simsboro in the District.

Barret Lyne, Brazos Valley Citizen:

Mr. Lyne asked about the development of a firm yield for the aquifer using the drought of record. Steve Young from Intera commented on the history of sustainable yields, and stated that firm yields are a term for surface water and not used in the same way for groundwater.

Mr. Westbrook noted that Curtis Chubb, Concerned Citizen, and David Coleman of the City of College Station had provided written comments.

8. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**

John Seifert with LBG Guyton provided an update to the joint planning process with respect to the list in Chapter 36.108. He also provided a list of other GMA's use of websites. The GMA 12 representatives agreed that more information was needed on different costs associated with the different options for a future website. They requested that Mr. Seifert gather more information. Mr. Westbrook noted that POSGCD would continue to host all GMA 12 information and presentations and that the new POSGCD website would be published soon, and that other GCDs in GMA 12 could link to the POSGCE GMA 12 page from their websites.

9. **Update on Legislative issues of possible interest to the Districts of GMA 12**

Monique Norman of BVGCD and FCGCD recommended each District to address legislative issues individually, except a bill relating to regional water planning groups. She noted this bill would control areas that are not under a GCD, known as "unprotected areas", and this might need further review by the GMA as a whole.

10. **Report on Monitoring activities by Districts of GMA 12**

Each District commented on the monitoring activities. Brazos Valley GCD stated that they are developing a monitoring network for both the Hooper and Simsboro unconfined areas. Mid-East Texas GCD stated the same, and that a report would be available soon. Lost Pines GCD reported current monitoring information. Fayette County GCD and Post Oak Savannah GCD both stated that their annual monitoring activities were currently in process.

11. **Desired Future Conditions of aquifers in GMA 12**

President Ausley noted there were no further information at the time, and the topic would be continued through public comments and future meetings.

12. **Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions**

President Ausley noted this item was addressed in a previous presentation.

13. **Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model**

No comments were given at this time.

14. Public Comment

Larry Hoffman, Spicewood TX, concerned citizen:

Mr. Hoffman stated that he does not want to mine the aquifer, and does not like the current DFC process as it should be expressed by acre-feet per year instead of drawdown. He pushed for groundwater/surface water interaction research and noted that current rate payers should not be subsidizing growing populations.

15. Agenda items and Date for next meeting

The next meeting was tentatively set for April 30, 2015, with the current agenda items less item 9, and changing item 5 from "receiving comments" to "discussing comments received" on GMA 12 GAM Run PS4. Also the addition of adding an item to adopt a form for receiving comments on DFCs should be added.

16. Adjourn

The meeting was adjourned at 12:05pm.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON MARCH 27, 2015 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON APRIL 30, 2015.

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
April 30, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent

Others Present	**Entity**
Gary Westbrook	POSGCD
Bobby Bazan	POSGCD
Cynthia Lopez	BVGCD
Steve Box	Environmental Stewardship
Cathy Lazarus	Robertson County
Shirley Wade	TWDB
Kathleen Jackson	TWDB
Larry French	TWDB
Jennifer White	TWDB
James Bene	RWU
Stephen Allen	TWDB
Dave Coleman	City of College Station
Bill Harris	BVGCD
Elizabeth Ferry	Thornhill Group Inc.
Kirk Holland	Self
Phil Cook	Sierra Club
David Wheelock	LCRA
Edmond McCarthy	JSMT
Amy Muttoni	BRA
Richard Morgan	Abengoa
Steve Young	Intera
Kodi Sanin	Self
Pat Reilly	Blue Water
Andrew Donnelly	DBS&A
Michael J. Simmang	Lost Pines
Sandra Traweek	landowner
Monique Norman	BVGCD, FCGCD
Melvin Wall	landowner
Eugene Baumann	landowner
Charlie Ahrens	SAWS
Darren Thompson	SAWS

1. **Call meeting to order and establish quorum**
Nathan Ausley, Chaired, and called the Groundwater Management Area 12 (GMA 12) Meeting to order and established quorum at 10:08 am.

2. **Welcome & Introductions**
Chairman Ausley introduced the head table, and then Larry French of the Texas Water Development Board (TWDB). Mr. French then introduced TWDB Board member, Kathleen Jackson and Mrs. Jackson addressed the crowd on recent and current work by the Texas water development board.

3. **Minutes of March 27, 2015 GMA 12 Meeting**
Alan Day moved and David Bailey seconded to approve the minutes as previously sent out. The motion carried unanimously.

4. **Update and report from Consultants regarding ongoing evaluations and studies**
Andy Donnelly presented a report on previous work by consultants in GMA 12 on GAM Runs PS-1 through PS-4, including how these results could be considered. He also covered the nine factors to be considered which must be addressed in the process of adoption of Desired Future Conditions (DFCs), and possible ways they might be evaluated. Alan Day asked how the group would break down the nine factors to be able to address them over the next three meetings. Andy Donnelly noted that there are actually only six factors which are applicable and will need to be addressed. Mr. Donnelly suggested dividing those six factors amongst the next 2 to 3 meetings. Monique Norman noted that she would address areas concerning property rights. Monique Norman also discussed uses of desired future conditions in the state water plan as well as those factors required in chapter 36.108 which provides balance between conservation and highest practical production from the aquifers of GMA 12. Nathan Ausley asked for clarification on the process moving forward and whether it was appropriate to discuss these items prior to adoption of DFCs. Andy Donnelly provided several reasons why it would be appropriate to review criteria and concerns associated with the factors prior to adopting a DFC. Monique Norman, Andy Donnelly, and Larry French addressed the process moving forward, including deadlines and adoption.

5. **Discuss comments received on GMA 12 Groundwater Availability Model Run PS2a, later renamed PS4**
Steve Young of Intera, summarized comments from Curtis Chubb and Larry Hoffman and reviewed these points from a handout. Mr. Ausley inquired about the availability of a water budget. Steve Box also questioned whether a complete water budget would be available. Steve Young replied that it could be provided. Steve Box stated that water budgets provided by district would be a sufficient. Mr. Young then discussed Mr. Chubb's comments on depletion. Mr. Ausley asked a question concerning drawdown versus depletion. Mr. Young explained that depletion may be an appropriate term for the management of the Ogallala but not for the Carrizo-Wilcox. In the Ogallala aquifer drawdown is equated with desaturation (or depletion) of the aquifer because the aquifer is unconfined. In the Carrizo-Wilcox the vast majority of drawdown occurs in the confined aquifer where drawdown only decreases the amount of pressure on the groundwater and does not "deplete" or desaturate the aquifer. Mr. Young also noted there are significant differences in how the Carrizo-Wilcox aquifer and the Ogallala aquifer is managed. . Mr. Westbrook explained the use of correlative rights in Post Oak Savannah GCD. Mr. Young then covered comments received from Mr. Larry Hoffman and noted that all would be addressed when the GMA discussed the nine factors to be considered and contained in chapter 36.108.
John Siefert of LBG-Guyton presented a handout containing summaries of comments from Dr. Lyne concerning recharge, improvements to the GAM., and uncertainty with the GAM. He then presented a summary of comments received from Cathy Lazarus which raised questions of water level decline, data

collection, and how static water level declines are evaluated in her district. Mrs. Lazarus briefly commented. Alan Day then noted that he appreciated Mrs. Lazarus's input. Comment was then given by Larry French who complimented the ground water conservation districts of GMA 12 for participation in improvements to the groundwater availability model. Next Mr. Siefert presented a summary of comments from Dave Coleman of College Station, Texas. Mr. Coleman urged the GMA to retain the current DFCs for the Simsboro aquifer in the current cycle of planning.

Andy Donnelly then presented a handout containing a summary of comments received from ForeStar. Most of these would be addressed by the balance and evaluation of the nine factors. He noted their discussion of distribution of pumping in modeling and its effects on availability of production to landowners. Jim Totten noted that differences in thickness of sands can change results and should be considered as well. Mr. Donnelly also noted that some of the discussion raised in points to be addressed by individual district management, and some noted subjective terms. Mr. Donnelly then covered comments received from LCRA in a handout and noted their comments concerned the methodology of modeling, and their suggestion that it would be more appropriate to consider depletion of storage then drawdown. Comment was then heard from Mr. David Wheelock of LCRA for clarification. Mr. Donnelly then handed out a summary of points discussed by Environmental Stewardship. They noted some scenarios which exceeded the modeled available groundwater and encouraged the GMA to retain its current DFCs. Mr. Donnelly then noted that most of the concerns raised would be addressed in the evaluation of the balance of the nine factors. Steve Box then provided additional comment. He noted the need to understand the capability of the aquifer, and understand what it can provide without impacts to surface water bodies and water wells. Mr. Box was also concerned about property rights, and the relationship of impacts between aquifers due to pumping, as well as the use of a Total Estimated Recoverable Storage (TERS) in adoption of desired future conditions.

6. **Updates to Pumping Files used in Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model**
   It was noted that this process was currently completed.

7. **Receive comments on Demands and DFC options for GMA 12**
   Chairman Ausley asked if anyone desired to give comments on this item. No comments were offered.

8. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   The GMA received a brief report from Monique Norman on this item.

9. **Monitoring activities by Districts of GMA 12**
   POSGCD General Manager Gary Westbrook reported that the District had completed its annual monitoring and had given a report to the POSGCD Board at its April 14 meeting.

   BVGCD General Manager Alan Day reported that the District had added several Simsboro and Hooper wells to its monitoring network, and was continuing its efforts to identify and locate wells in the Simsboro and Hooper formations to be used in development of an unconfined management zone and DFCs in each of these aquifers.

   LPGCD General Manager Jim Totten stated that the District had added Simsboro wells in its unconfined area and would look for more as it moves toward development of a DFC for the unconfined arae of the Simsboro aquifer.

10. **Desired Future Conditions of aquifers in GMA 12**
    METGCD GM David Bailey presented preliminary DFCs for METGCD.

11. Process for addressing requirements of Chapter 36.108 in adopting Desired Future Conditions
After discussion, it was agreed that these would be addressed at the next 2-3 GMA 12 meetings.

12. Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model
Steve Young of Intera announced that Intera had been awarded the opportunity to negotiate a contract with the Texas Water Development Board to accomplish this task. Larry French of TWDB provided discussion of the process moving forward including stakeholder and public input.

13. Adopt form to be used to provide comment on DFCs of GMA 12
A form developed by the consultants of GMA 12 for the purpose of receiving proposed DFCs for the aquifers of GMA 12 was distributed and discussed. David Van Dresar moved and Alan Day seconded to adopt this form as presented. The motion passed unanimously.

14. Public Comment
Chairman Ausley asked for public comment. None was offered.

15. Agenda items and date for next meeting
The next meeting date was set for May 28, 2015 in the Milano Civic Center. Agenda items are to include discussions of: aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another; and hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge;

16. Adjourn
The meeting adjourned at 12:04 pm.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON APRIL 30, 2015 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON MAY 28, 2015.

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

GROUNDWATER MANAGEMENT AREA 12 MEETING
May 28, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

Name	Entity
Alan Day	BVGCD
Dave Coleman	City of College Station
Andy Donnelly	DBS&A
Robert Bradley	TWDB
Steven Allen	TWDB
Monique Norman	BVGCD & FCGCD
James Bene	RW Hardin
Gary Westbrook	POSGCD
Nathan Ausley	POSGCD
David Bailey	METGCD
Bobby Bazan	POSGCD
Steve Box	Environmental Stewardship
Cynthia Lopez	BVCCD
Phil Cook	Sierra Club
David Wheelock	LCRA
Steven Siebert	San Antonio Water Systems
Tim Skoglynd	San Antonio Water Systems
Jim Totten	LPGCD
Michael J. Simmang	LPGCD
David Van Dresser	Fayette County GCD
Richard Morgan	Abengoa
Bill Harris	BVGCD
Kirk Holland	Self
Gerardo Rodriguez	Thornhill Group, Inc.
Neil Deeds	Intera
Elaine Gerren	POSGCD
James Beach	LBG Guyton
Kodi Sawin	Sawin Group

1. Call meeting to order and establish quorum
   Chairman Ausley called the meeting to order at 10:00 am

2. Welcome and introductions

Head table- Gary Westbrook from POSGCD serving as secretary, David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Jim Totten representing LPGCD, and David Van Dresser representing FCGCD

3. Minutes of December 4, 2014 GMA 12 Meeting
   Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of Dec. 4, 2014. None were offered. David VanDresser moved and Alan Day seconded that the minutes be approved as presented. The motion carried unanimously.

4. Update and report from consultants regarding ongoing evaluations and studies
   No discussion or action was taken

5. Discuss Comments received on GMA 12 Groundwater Availability Model Run PS2a, later renamed PS4
   No discussion or action was taken

6. Updates to Pumping Files used in Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model
   No discussion or action was taken

7. Receive comments on Demands and DFC options for GMA 12
   Alan Day commented that all comments had been forwarded on to the consultants, there were three (3) sets consisting of 7 pages submitted.

8. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code
   Mr. Day commented that we were still in compliance, he stated that we had 8 shallow wells and 7 Hooper shallow wells.

9. Report on Monitoring activities by Districts of GMA 12
   No discussion or action was taken

10. Desired Future Conditions of aquifers in GMA 12
    No discussion or action was taken

11. Discuss requirements of Chapter 26.108 in adopting Desired Future Conditions
    Received a report from Andy Donnelly of D.B. Stevens. Comment was made to the affect that IPP shows Alcoa projection up for the future. Mr. Steve Box questioned rather we would be doing something similar as far as need, strategies and future demands. Kirk Holland questions the estimate usage for Exempt Wells. Robert Bradley with TWDB commented that we are supposed to supply estimates and stated that when usage is referenced this is where water is used and not where it is supplied. Neil Deeds offered comment on the effects of the faults. Steve Box questioned the difference in the Imperacal Data of the model and the effects on the faults. Neil Deeds asked the question to what extent were we going to evaluate the Aquifers and how they communicate with each other. James Bene defined the impacts on pressurization of the Simsboro and the Calvert Bluff and asked if we had any comparative data. He also discussed faults during depressurization, i.e. Alcoa. Bill Harris asked the question of how you can have TERS if you have pools of storage that are not communicating.

Comment was made that TERS estimates are on how much are in the total pools and not necessarily in one area.

12. Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model

13. Public Comment
    Chairman Ausley invited public comment. None was offered.

14. Agenda items and Date for next meeting

15. Adjourn
    The meeting adjourned at 11:45 am.

Attest:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
JUNE 25, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent

Others Present	**Entity**
Gary Westbrook	POSGCD
Bobby Bazan	POSGCD
Meredith Earwood	POSGCD
John Seifert	LBG Guyton
Barney Knight	POSGCD
Steve Box	Environmental Stewardship
Stephen Allen	TWDB
Phil Cook	Sierra Club
David Wheelock	LCRA
Richard Morgan	Abengoa
Pat Reilly	Blue Water
Andrew Donnelly	DBS&A
Michael J. Simmang	Lost Pines
Monique Norman	BVGCD, FCGCD
Tyler Lewis	KHA
Tim Skoglund	SAWS
Steven Siebert	SAWS
Keith Hansberger	LPGCD
Billy Sherrill	LPGCD
Neil Deeds	Intera
Bob Harden	RW Harden
Michele Ganges	League Independent Voters
Amy Muttoni	BRA
Scott Shoemaker	The Terrill Firm, P.C.

1. **Call meeting to order and establish quorum:**
   Chairman Ausley called the meeting to order at 10:10 am.

2. **Welcome and introductions**
   Head table – Gary Westbrook from POSGCD serving as secretary, David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Jim Totten representing LPGCD, and David Van Dresser representing FCGCD.

3. **Minutes of May 28, 2015 GMA 12 Meeting**
   Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of May 28, 2015. None were offered. Alan Day moved and Jim Totten seconded the minutes be approved as presented. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
   John Seifert, hydrology consultant, noted this item would be handled under item 7.

5. **Receive comments on Demands and DFC options for GMA 12**
   Steve Box of Environmental Stewardship summarizing written comments he had submitted recently.

6. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   No comments were heard and no action was taken.

7. **Discuss requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
   A. the water supply needs and water management strategies included in the state water plan;
      Neil Deeds of Intera presented strategies and needs for the upcoming adoption of Desired Future Conditions. Discussion ensued from presentation, Mr. Deeds answered questions from audience.
   B. the impact on subsidence;
      Andy Donnelly of DB Stephens reported that subsidence was not an issue for any district in GMA 12 at this time.
   C. the impact on the interests and rights in private property, including ownership and the rights of management
      Monique Norman gave a presentation on current private property law, including changes to Chapter 36, TWC, in the most recent legislative session, and how it affects groundwater management. Discussion ensued from the presentation, Ms. Norman answered questions from the audience.

   Keith Hansberger asked if the GMA should consider changes in water levels as relative to property values.

   Steve Box asked the GMA to consider the Texas Conservation Act in deliberations.

   Bob Harden stated that he believed the GMA 12 consultants had given excellent presentations, and requested that the GMA consider DFCs in a different way than the traditional change in water levels based on pressure change as adopted in the past by GMA 12 and other GMAs. He then asked the GMA to consider adopting one DFC for the area being managed.

Steve Box noted that Environmental Stewardship had concerns with groundwater-surface water interactions in the current groundwater availability model (GAM), and stated that he supported maintaining current DFCs for aquifers in GMA 12 until the improvements to the GAM are completed.

8. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   Jim Totten mentioned the option of the GMA building a website, and the members agreed to continue this discussion at a later date.

9. **Report on Monitoring activities by Districts of GMA 12**
   All districts reported that monitoring activities are ongoing and each district continues to add monitoring to their respective networks.

10. **Desired Future Conditions of aquifers in GMA 12**
    No discussion or action was taken.

11. **Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model**
    Neil Deeds of Intera gave a brief report on this process.

12. **Public Comment**
    Steve Box, Environmental Stewardship – Mr. Box made brief comments on his appreciation of transparency by the GMA, as well as the GMA's willingness to accept comment and discuss issues in open meetings, and applauded the group for its dedication for conservation of the aquifers.

13. **Agenda items and Date for next meeting**
    The next agenda items will include environmental and socioeconomic impacts. The meeting was set for August 13, 2015 10:00 am.

14. **Adjourn**
    The meeting adjourned at 11:17 pm.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON JUNE 25, 2015 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON AUGUST 13, 2015.

ATTEST:

Daniel M. Bailey

Mid-East Texas Groundwater Conservation District

Heidi Denton

Fayette County Groundwater Conservation District

Brazos Valley Groundwater Conservation District

Lost Pines Groundwater Conservation District

Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
August 13, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
Wendi Denton	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent
None

Others Present	Entity
Gary Westbrook	POSGCD
Bobby Bazan	POSGCD
Meredith Earwood	POSGCD
Elaine Gerren	POSGCD
Steve Box	Env. Stewardship
James Bene	RWU
Steve Young	Intera
Pat Reilly	Blue Water
Monique Norman	BVGCD, FCGCD
Tim Skoglund	SAWS
Rebekka Dudensing	AgriLife Extension
Stephen Allen	TWDB
Liz Ferry	Thornhill Group
Joan Eichelberger	Land Owner
Debbie Wahrmund	Citizen
Michelle Gangnes	League Ind. Voters
Andy Donnelly	DBS&A
Amy Muttoni	BRA
Jennifer Nations	City-College Station
Keith Hansberger	LPGCD
T. Barret Lyne	Landowner
John Seifert	LBG-Guyton

Others Present	Entity
James Bene	RWN
David Wheelock	LCRA
Phil Cook	Sierra Club

1. **Call meeting to order and establish quorum**
   The meeting was called to order and a quorum established at 10:00am.

2. **Welcome and introductions**
   Each member introduced themselves. Note that Wendi Denton was in place of David Van Dresser for Fayette County Groundwater Conservation District

3. **Minutes of June 25, 2015 GMA 12 Meeting**
   The minutes of the June 25, 2015 GMA 12 Meeting was approved and adopted with a motion made by Alan Day of BVGCD and the motion was 2nd by David Bailey of LPGCD.

4. **Update and report from consultants regarding ongoing evaluations and studies**
   This item was moved to item 7

5. **Receive comments on Demands and DFC options for GMA 12**
   No comments were received.

6. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   No comments were received.

7. **Discuss requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
   a. **Socioeconomic impacts reasonably expected to occur**
      Presentation by GMA 12 Consultant Team – John Seifert presented on the socioeconomic impacts expected to occur. This presentation will be available on the website.

      Keith Hansberger asked questions about possibility of decrease in land values, when the water available decreases, and noted there is an increase in property values in area receiving water. He stated that is not figured in the socioeconomic impact considerations.

      Mr. Siefert answered that proper management of groundwater would prevent loss of value, and that there were many factors to consider.

      Barret Lyne stated that there are problems with Blue Water leases, and Caperton Real Estate in Caldwell told him that land with a current groundwater lease could not be sold.

      Monique Norman noted that the leases were contractual agreements between landowners and lessor.

      Steve Box stated that the socioeconomic impact on the area of supply should be considered.

Alan Day stated that the GMA considers the supply side and protects property rights, manages, conserves, preserves the resource. The leases are agreements between the landowners and lessors, and the GCDs do not enter those agreements.

Steve Box agreed.

Keith Hansberger stated that the GCD should consider impacts to landowners who do not have a lease to sell their water.

Alan Day stated that he believes the GCDs in GMA 12 are capable of adopting DFCs which will protect the aquifers and ensure availability and managing the resource to ensure water available for future for landowners in GMA 12.

Debbie Wahrmund- Lee County asked about the point of this meeting- It is to connect the dots between planning and DFCs, to adopt or amend Desired Future Conditions, that the study is from 2011, and wants to know if we can use updated information.

John Seifert stated that GCDs in GMA are required to use most recent information. Monique Norman offered further explanation.

b. **Other environmental impacts, including impacts of spring flow and other interactions between groundwater and surface water**
Presentation by GMA 12 Consultant Team – Steve Young presented on the environmental impacts of spring flow and other interactions between groundwater and surface water. This presentation will be available on the website.

Barret Lyne – Presented on issues with Modeling. His presentation discussed several issues that can arise when using a model for groundwater. This presentation will be available on the website.

8. **Update from Groundwater Conservation Districts of GMA 12 on join planning and compliance with Chapter 36.108, State Water Code**
No comments were heard at this time.

9. **Desired Future Conditions of aquifers in GMA 12**
Preliminary DFC has been set from Mid-East Texas GCD. David Bailey requested to discuss at a later date when the District's hydrologist is present.

10. **Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model**
Steve Young of Intera discussed that Intera won the contract and will begin preliminary research and organization.

Steve Box of Environmental Stewardship made comments on the proposed improvement to the model. Mr. Box stated his concern with the grid spacing, and would like to see smaller grid size, from ½ mile to ¼ mile grid size, near surface water for better understanding of groundwater – surface water interaction. Mr. Box stated that Environmental Stewardship is actively searching for funding and also provide $5,000 to improving the model.

11. Website for GMA 12 shared by GCDs in GMA 12

After research, GMA 12 decides to leave the information on the posgcd.org website at this time.

12. Public Comment

Debbie Wahrmund, Citizen – Encouraged the GMA to continue improving the models.

13. Agenda items and Date for next meeting

Alan Day suggested to the GMA to return Subsidence to the agenda, and have consultants prepare comments received in bullet point format for discussion at next meeting, and would like to deal with one or two heavy discussion, and one or two light discussion items. Next meeting will be on September 24, 2015 at 10am.

14. Adjourn

The meeting adjourned at 12:27 pm.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON AUGUST 13, 2015 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON SEPTEMBER 24, 2015.

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

GROUNDWATER MANAGEMENT AREA 12 MEETING
September 24, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

Name	Entity
Alan Day	BVGCD
Dave Coleman	City of College Station
Andy Donnelly	DBS&A
Monique Norman	BVGCD & FCGCD
Gary Westbrook	POSGCD
Nathan Ausley	POSGCD
David Bailey	METGCD
Bobby Bazan	POSGCD
Steve Box	Environmental Stewardship
Cynthia Lopez	BVCCD
Phil Cook	Sierra Club
Barney Knight	Knight & Partners
Steven Siebert	San Antonio Water Systems
Tim Skoglynd	San Antonio Water Systems
Jim Totten	LPGCD
Michael J. Simmang	LPGCD
David Van Dresser	Fayette County GCD
Pat Riley	Blue Water
Pete George	Collier Consulting, Inc.
Leonard Oliver	LCRA
Damian A. Kemper	
Steve Young	Intera
Elaine Gerren	POSGCD
Scott Carlson	Metropolitan Water
Kodi Sawin	Sawin Group
Stephen Allen	TWDB
John Seifert	LBG Guyton
John Eicherberger	Property Owner Burleson County
Keith Hansberger	LPGCD
Matt Uliana	METGCD
Larry French	TWDB

1. Call meeting to order and establish quorum
   Chairman Ausley called the meeting to order at 10:00 am and noted that representatives for all GCDs in GMA 12 were present.

2. Welcome and introductions
   Head table introduced themselves- Gary Westbrook from POSGCD serving as secretary, David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Jim Totten representing LPGCD, and David Van Dresser representing FCGCD

3. Minutes of December 4, 2014 GMA 12 Meeting
   Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of August 13, 2015. Gary Westbrook offered correction of a minor typo. Alan Day moved and David Bailey seconded that the minutes be approved as presented and corrected. The motion carried unanimously.

4. Update and report from consultants regarding ongoing evaluations and studies
   This item will be discussed with item # 7. No discussion or action was taken under this item.

5. Receive Comments on Demands and DFC options for GMA 12
   Chairman Ausley asked for comments on this item. Steve Box with Environmental Stewardship handed out comments to the members of the GMA and offered brief discussion.

6. Receive comments on requirements of Chapter 36.108(d) in adopting desired future conditions.
   Chairman Ausley asked for comments on this item. No Comments were received.

7. Receive and discuss previous presentations and comments received on requirements of chapter 26.108(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;
      A presentation was given by Andy Donnelly on behalf of the GMA 12 consulting team summarizing the previous presentation given by the consultants and comments received to date on this item. Discussion ensued concerning the presentation and comments received. Also discussed were status of the Colorado River Alluvium, methodology of this and other GMAs in adopting DFCs in formations not considered either a major or minor aquifer of the state, requirements of inclusion of being considered for DFCs, and process for declaring small portions of an aquifer referred to as a "sliver" as non-relevant for purposes of joint planning. Those sharing in the discussion were members of the GMA, Mr. Box, Larry French of the Texas Water Development Board, Andy Donnelly, and Monique Norman. Following discussion, Alan Day moved to declare the Trinity Aquifer non-relevant for the purposes of joint planning in GMA 12. The motion was 2nd by Jim Totten. The motion carried.

   B. the water supply needs and water management strategies included in the state water plan;
      A presentation was given by Steve Young with Intera on behalf of the GMA 12 consulting team summarizing the previous presentation given by the consultants and comments received to date on this item. Steve Box offered comment. Brief discussion of the presentation and comments received ensued.

   C. the impact on subsidence;
      A presentation was given by Matt Uliana of Martin Geologic on behalf of the GMA 12 consulting team summarizing the previous presentation given by the consultants and comments received to date on

this item. John Sievert asked what the effects the Gulf Coast settlements had on subsidence. Brief discussion ensued concerning this item, and including all formations in GMA 12. All agreed that subsidence was not an issue affecting the formations in GMA 12.

D. 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.
A presentation was given by Monique Norman, Legal Counsel for Brazos Valley GCD and Fayette County GCD on behalf of the GMA 12 consulting team summarizing the previous presentation given by the consultants and comments received to date on this item. Mrs. Norman stressed the balance of property rights versus conservation, and discussion ensued about the role of the Rule of Capture in a GCD, as well as the difference in takings of property rights versus management of the resource. Alan Day noted the difficulty of keeping this balance. Mrs. Norman noted that well spacing and production limits do affect property rights. She also noted that impacts to an aquifer are not a takings of property rights. Mr. Day noted again that balance is the theme in this issue and balance of benefits of use should be considered against impacts to the aquifers. Steve Young, Mrs. Norman, and Andy Donnelly briefly discussed the explanatory report to be generated. Gary Westbrook of POSGCD noted the importance to POSGCD in establishing shallow DFCs. Steve Box noted the proposed DFC's should conserve aquifers first, and balance after. Balancing act of Chapter 36.108 was discussed and Mr. Ausley noted his hope of finding balance that the "highest practicable use" as required would also be sustainable by the aquifer. After further discussion, the group moved to agenda item 8.

8. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code
Chairman Ausley asked if any GCDs had any updates to offer at this time. No updates were offered under this item.

9. Desired Future Conditions of aquifers in GMA 12
Chairman Ausley asked for any comment or discussion under this item. No discussion or comment was offered.

10. Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model
Steve Young offered an update on the process to date and moving forward. Funding, process, and timing were briefly discussed.

11. Public Comment
Chairman Ausley invited public comment.
Keith Hansberger, Board Member for Lost Pines GCD requested that the GMA take a conservative approach in adopting DFCs.
No other comment was offered.

12. Agenda items and Date for next meeting
After discussion, the next date for a GMA 12 was set for October 22, 2015, 10:00 am, at the Milano Civic Center. Agenda items were determined to include current items plus a presentation from the Texas Water Development Board on items including characteristics of the Central Queen City/Sparta Groundwater Availability Model, as well as the role of TWDB in improvements to the model. Also, the

consultants will include presentations for discussion on remaining factors yet to be covered from Chapter 36.108, including Hydrological conditions, Socio-economic impacts and environmental impacts.

13. Adjourn
    The meeting adjourned at 11:40 am.

Attest:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
OCTOBER 22, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent

Others Present	**Entity**
Gary Westbrook	POSGCD
Bobby Bazan	POSGCD
Elaine Gerren	POSGCD
Meredith Earwood	POSGCD
Barney Knight	POSGCD
Steve Young	Intera
John Seifert	LBG Guyton
Steve Box	Environmental Stewardship
Dave Coleman	City of College Station
John Schnautz	Office of the Speaker of the House
Stephen Allen	TWDB
David Wheelock	LCRA
Joan Eichgerberger	Burleson Co. landowner
Gary Eichgerberger	Burleson Co. landowner
Andrew Donnelly	DBS&A
James Bene	RW Harden
Monique Norman	BVGCD, FCGCD
Tyler Lewis	KHA
Tim Skoglund	SAWS
Keith Hawsberger	LPGCD
B Sherrill	LPGCD
Amy Muttoni	BRA
Kodi Sawin	

MINUTES

1. **Call meeting to order and establish quorum**
   Chairman Nathan Ausley called the meeting to order and established quorum at 10:02am.

2. **Welcome and introductions**
   Head table – Gary Westbrook from POSGCD serving as secretary, David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Jim Totten representing LPGCD, and David Van Dresar representing FCGCD.

3. **Minutes of September 24, 2015 GMA 12 Meeting**
   Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of May 28, 2015. None were offered. Chairman Ausley moved and David Van Dresar seconded the minutes be approved as presented. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
   John Seifert, hydrology consultant, requested item be covered in item 8.

5. **Receive comments on Demands and DFC options for GMA 12**
   No comments were offered or received.

6. **Presentation from the Texas Water Development Board (TWDB) on characteristics of the Central Queen City/Sparta Groundwater Availability Model, as well as the role of TWDB in improvements to the model**
   At the request of Larry French of TWDB, this item was tabled, and deferred to next meeting.

7. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   No comments received.

8. **Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
   A. socioeconomic impacts reasonably expected to occur;
   A presentation was given by John Siefert on behalf of the GMA 12 consulting team summarizing the previous presentation and comments received to date on this item. Discussion and questions ensued on subject matter, including whether real estate values in GMA 12 would be affected by water leaving the area. Steve Box mentions needs of evaluation and comprehensive look at the counties where water is transported from and other counties receiving the water. Jim Totten noted that where there are shortages there is economic impact, and that concern should be addressed. Mr. Box noted that Bastrop County could experience a shortage of water available in the future, and thus an economic impact, if water is exported. James Bene noted that GMA 12 could asses impacts caused in the event water levels are lowered. Billy Sherrill stated that Lee County needed to keep enough water in the county to allow for growth.

   Next, a presentation was given by David Coleman, representing the City of College Station, on their previous socioeconomic impact study for groundwater management. Mr. Coleman noted that an updated and current presentation and comments would be given at the appropriate time during the comment period, and would include ASR project discussions. Mr. Coleman noted that the report would only focus on the Simsboro aquifer. David Wheelock asked if the current GMA 12 DFCs allowed for Bryan/College Station demands to be met with no alternate sources of water needed. Mr. Coleman said yes, they do, and no alternate sources are necessary.

B. other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water;
A presentation was given by Andy Donnelly on behalf of the GMA 12 consulting team summarizing the previous presentation and comments received to date on this item. Discussion ensued about the future planning and input for the DFC process. Mr. Ausley asked if this information included water quality. Mr. Donnelly answered it did. Mr. Box asked Mr. Donnely to explain the difference between volumes of water available water from the unconfined versus the confined. Mr. Day noted that TERS was required to be considered. Mr. Box asked about the process of reviewing and responding to comments received.

C. hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge
A presentation was given by Steve Young on behalf of the GMA 12 consulting team summarizing the previous presentation and comments received to date on this item, as well as feasibility of a DFC. Discussion ensued, including improvements to the GAM.

9. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code
Jim Totten informed the GMA that the Lost Pines GCD Board of Directors approved and signed off to declare the Trinity Aquifer not relevant for joint planning in GMA 12.

10. Desired Future Conditions of aquifers in GMA 12

11. Improvements to current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model
Steve Young reported on the process to date. James Bene added comments on process and accuracy of model.

12. Public Comment
Chairman Ausley invited public comment. No public comment was offered.

13. Agenda items and Date for next meeting
After discussion, the next agenda items will include the presentation from TWDB which was tabled from this meeting, considerations of model runs and aquifer conditions, and potential DFC suggestions. The meeting was set for December 17th, 2015 at 10am.

14. Adjourn
The meeting adjourned at 12:15pm.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON OCTOBER 22, 2015 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON DECEMBER 17, 2015.

ATTEST:

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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

GROUNDWATER MANAGEMENT AREA 12 MEETING
December 17, 2015 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent None

Others Present	**Entity**
Gary Westbrook	POSGCD
Bobby Bazan	POSGCD
Elaine Gerren	POSGCD
Barney Knight	POSGCD
Steve Young	Intera
John Seifert	LBG Guyton
Dave Coleman	City of College Station
David Wheelock	LCRA
Andy Donnelly	DBS&A
James Bene	RW Harden
Monique Norman	BVGCD, FCGCD
Tim Skoglund	SAWS
Keith Hansberger	LPGCD
Steven Siebert	SAWS
Leo Swick	FCGCD
Cindy Ridgeway	TWDB
Shirley Wade	TWDB
Larry French	TWDB
Diane Weidcrupt	Self
Liz Ferry	TGI
Pat Reilly	Blue Water
Michael Simang	LPGCD
Bill Sherrill	LPGCD
Carmen Cernosek	TWDB

MINUTES

1. **Call meeting to order and establish quorum**
   Chairman Nathan Ausley called the meeting to order and established quorum at 10:02 am.

2. **Welcome and introductions**
   Head table – Gary Westbrook from POSGCD serving as secretary, David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Jim Totten representing LPGCD, and David Van Dresar representing FCGCD.

3. **Minutes of October 22, 2015 GMA 12 Meeting**
   Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of May 28, 2015. None were offered. Alan Day moved and David Bailey seconded the minutes be approved as presented. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
   John Seifert with LBG Guyton gave a presentation entitled Status Report of Groundwater Modeling Results, including updates to the GMA-12 7B well file, which was used for current DFC's, updates to historical pumping from 2000 to 2010, predictive pumping updates, and comparing results of average drawdowns for 2060 to drawdowns for 2070 contained in GAM Run PS5 (Predictive Scenario 5). Mr. Seifert noted the PS5 model run was an updated version of the earlier 7B model run which continues to 2070 instead of stopping at 2060, which was the extent of predictive scenario of 7B. During and following the presentation, both model runs were discussed, including where information included in the pumping files originated. No action was taken.

5. **Receive and discuss comments on Demands and DFC options for GMA 12**
   Chairman Ausley opened this item and asked if anyone would offer information. No comments were offered or received.

6. **Presentation from the Texas Water Development Board (TWDB) on characteristics of the Central Queen City/Sparta Groundwater Availability Model, as well as the role of TWDB in improvements to the model**
   Cindy Ridgeway with the TWDB gave a presentation entitled "What's GAMs got to do with DFC/MAGs", in which she gave an overview of the TWDB Groundwater Availability Modeling (GAM) program, covered updates to the GAM for the Carrizo-Wilcox, Queen City, and Sparta aquifers, and discussed the feasibility of using GAMs to evaluate and monitor DFCs. During and following the presentation, discussion included the stakeholder process for updating or improving GAMs, the scope of work and timeline for this update, and varying methods of using the GAMs in the joint planning process.

7. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   Chairman Ausley opened this item and asked if anyone would offer information. No comments were received.

8. **Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
   A. **Feasibility on achieving the desired future conditions of GMA12**

The most recent presentation, presented by Dr. Steven Young at the October 22, 2015 GMA 12 meeting, on this item was reviewed and discussed. Discussion centered around possible updates to data, purpose of the presentation, compatibility of DFCs for GMA 12, and different methodology for expressing ranges for DFCs in GMA 12.

B. **Other information relevant to a specific desired future conditions.**
Chairman Ausley opened this item and asked if anyone would offer information. Alan Day noted that many comments had been received from Environmental Stewardship, and that the GMA should request they make those comments more concise and specific so the members of GMA 12 might better understand the intent of those comments.

9. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code

A presentation entitled "POSGCD Monitoring Report" was given by Bobby Bazan, Water Resource Management Specialist of POSGCD, on the POSGCD's 2015 monitoring and evaluation of current aquifer conditions to DFCs. He stated that Post Oak Savannah GCD has monitored 103 wells in 2015 and discussed monitoring locations and results. He also discussed the comparison between the DFC's and the calculated average drawdown, and noted that currently POSGCD is compliant with its identified DFCs and management goals.

10. Desired Future Conditions of aquifers in GMA 12

The presentation given earlier by John Seifert was discussed, and all agreed to forward this information to their individual boards for comment and return to the next GMA 12 meeting to discuss possible DFCs.

11. Consideration and possible action on declaring the Trinity Aquifer within the boundaries of the Lost Pines GCD as a non-relevant for GMA 12 planning

A motion was made by Jim Totten declaring the Trinity Aquifer within the boundaries of the Lost Pines GCD as a non-relevant for GMA 12 planning. The motion was 2nd by Alan Day. The motion carried unanimously.

12. Content and process of Explanatory Report of GMA 12

Discussion was held and all agreed to bring this back at the next scheduled meeting.

13. Improvements to the current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model

Cindy Ridgeway stated that the Inter-local Agreements for this effort had been mailed out to all of the Districts. She also explained the process for the additional scope of work, and stated that the additional Scope of Work should be considered by TWDB by March of 2016.

14. Public Comment

Chairman Ausley invited public comment. No public comment was offered.

15. Agenda items and Date for next meeting

The meeting was set for February 4th, 2016 at 10am.

16. Adjourn

The meeting adjourned at 11:25 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON DECEMBER 17, 2015 WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON FEBRUARY 4, 2016.

ATTEST:

David M. Bailey

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

GROUNDWATER MANAGEMENT AREA 12 MEETING
February 4, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent None

Others Present	Entity		
Gary Westbrook	POSGCD	Bobby Bazan	POSGCD
Elaine Gerren	POSGCD	Barney Knight	POSGCD
Steve Young	Intera	James Beach	LBG Guyton
John Seifert	LBG Guyton		
David Wheelock	LCRA		
Andy Donnelly	DBS&A		
James Bene	RW Harden		
Monique Norman	BVGCD, FCGCD		
Tim Skoglund	SAWS		
Keith Hansberger	LPGCD		
Steven Siebert	SAWS		
Carmen Cernosek	TWDB		
Stephen Allen	TWDB		
Michael Ganges	Neighbors for Neighbors & League of Ind. Voters		
Micheal J. Simmang	Lost Pines		
Todd Disher	Terrel Firm		
Matt Ulliana	METGCD		
Kodi E. Sawin	Sawin Group		
Brent Covert	Forestar		
Amy Muttoni	BRA		
Steve Box	Environmental Stewardship		
Phil Cook	Sierra Club		
Wesley Bluvstein	Thornhill Group		
Elizabeth Ferry	Thornhill Group		
Billy Sherrill	Lost Pines GCD		

MINUTES

1. **Call meeting to order and establish quorum**
Chairman Nathan Ausley called the meeting to order and established quorum at 10:05 am.

2. **Welcome and introductions**
Head table- David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Jim Totten representing LPGCD, David Van Dresar representing FCGCD, and Gary Westbrook from POSGCD serving as secretary.

3. **Minutes of December 17, 2015 GMA 12 Meeting**
Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of December 17, 2015. None were offered. Alan Day moved and David Bailey seconded the minutes be approved as presented. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
John Seifert with LBG Guyton gave a presentation entitled "Status Report of Groundwater Modeling Results", including updates to the GMA-12 7B well file, which was used for current DFC's, updates to historical pumping from 2000 to 2010, predictive pumping updates, and comparing results of average drawdowns for 2060 to drawdowns for 2070. Mr. Seifert noted the pumping files had been updated with the exception of the Hooper which was adjusted in Mid-East Texas from 835 AF to 5550 AF bringing the total from 281,914 AF to 286,630 AF.
Mr. Seifert then gave a presentation entitled "Brazos River Alluvium DFCs" on behalf of BVGCD, and stated the Brazos River Alluvium was principally used for irrigation and that pumping had occurred there for decades. His report also included pumping, DFC's, and the development of a reasonable approach for DFC's, as well as the DFCs proposed by the BVGCD Board in this process. Steve Box of Environmental Stewardship and Phil Cook with the Sierra Club asked questions concerning the objectives and methodology of BVGCD in this process, and % of saturation based on the well depth to ratio. Mr. Seifert answered and provided discussion. David Wheelock of LCRA commented on the % of saturation vs. the water level. Mr. Seifert also discussed the use of well depth as opposed to depth to base of aquifer.

5. **Receive and discuss comments on Demands and DFC options for GMA 12**
Chairman Ausley opened this item and asked if anyone would offer information. No information was offered.

6. **Summary of comments received to date from Environmental Stewardship on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
Steve Box with Environmental Stewardship gave a presentation entitled, "GMA-12 DFCs: Summary of ES Comments and Recommendations". Mr. Box spoke on the need for improved predictive capabilities of the current Central QC-Sparta/C-W Groundwater Availability Model with respect to drawdowns, recharge, water budgets, and groundwater-surface water interactions. He further commented on affects of pumping from the Carrizo-Wilcox Aquifers on the contributions to the Colorado and Brazos Rivers, as well as the need for GMA 12 to identify sustainable pumping in the Carrizo-Wilcox Aquifer. Mr. Box stated that ES supports re-adoption of current GMA 12 DFCs, and continue to work to establish DFCs for unconfined parts of the aquifers in GMA 12.

Andy Donnelly, of DB Stephens, and Assoc., asked Mr. Box if he understood that continuing to use the current pumping files would not allow the same DFCs to be adopted, as the time frame would be extended to 2070. Mr. Box agreed that this would change the DFCs. Mr. Donnelly asked if ES would be agreeable to extending the current pumping file for the additional 10 year period from 2060 to 2070, and adopt those results as GMA 12 DFCs. Mr. Box stated that he understood the process as discussed and ES would be agreeable to this approach. Mr. Seifert asked Mr. Box if it was acceptable to ES to not increase pumping in the file discussed and extend the period to 2070. Mr. Box stated this was agreeable to ES. Steve Young of Intera asked Mr. Box to identify standards or thresholds in groundwater-surface water interactions ES desired. Mr. Box stated he could not quantify those at this time.

Alan Day of Brazos Valley GCD extended his appreciation to Mr. Box for his presentation, and support for current process GMA 12 is following in adoption of DFCs. Mr. Day then asked for clarification on Mr. Box's request for in depth discussions on certain items which might be better addressed after improvements to the GAM were completed. Mr. Box agreed he did not expect these discussions at this time, because reliable information and data is not available, but rather these discussion should take place after the GAM is updated. Mr. Box then stated he and ES were very supportive and appreciative of the thoroughness of each GCDs efforts and transparency in this process.

7. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   Chairman Ausley opened this item and asked if anyone would offer information. No comments were received.

8. **Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
   Chairman Ausley opened this item and asked if anyone would offer information. No comments were received.

9. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   Gary Westbrook noted that POSGCD had tasked Intera to perform evaluations on all wells with water columns between 100 and 600 feet and return to the POSGCD Board with recommended changes to the definition of the shallow management zones of the District, and to analyze monitoring data for the period from 2000 to 2014. GM Westbrook further encouraged other GCDs in GMA 12 to continue to develop shallow management zone DFCs, and to work together to develop consistent standards for identification of model layers for monitor wells throughout GMA 12.
   Mr. Day agreed, and reported on BVGCDs progress in developing shallow management zones in the District.

10. **Desired Future Conditions of aquifers in GMA 12**
    Mr. Day submitted proposed DFCs approved by he BVGCD Board, and noted that BVGCD supported adoption of GMA wide DFCs. Mr. Seifert clarified the GMA wide DFC for the Yegua-Jackson was 64 feet.
    These DFCs were as follows:
    Sparta- 12 feet in BVGCD, 16 feet aquifer wide
    Queen City- 12 feet in BVGCD, 16 feet aquifer wide
    Carrizo- 61 feet in BVGCD, 75 feet aquifer wide
    Calvert Bluff- 125 feet in BVGCD, 114 feet aquifer wide
    Simsboro- 295 feet in BVGCD, 228 feet aquifer wide
    Hooper- 207 feet in BVGCD, 168 feet aquifer wide
    Yegua- 70 feet in BVGCD
    Jackson- 114 feet in BVGCD
    Yegua-Jackson- 64 feet aquifer wide

Additionally, BVGCD proposed both District and GMA-wide DFCs be adopted with an allowable 10% variance for the Sparta, Queen City, Carrizo, Calvert Bluff, and Hooper aquifers, with a 5% variance allowable for the Simsboro.
Mr. Day also stated that BVGCD proposed DFCs for the Brazos Alluvium, and those DFCs are based on a percent of saturated thickness of 30% in all of Robertson County and northern Brazos County and 40% saturated thickness for southern Brazos County.

Mr. Ausley then stated the POSGCD Board approved adopting GMA-wide DFCs in GMA 12, and adoption of DFCs as predicted in GAM Run PS5 with a 10% range of variance for all aquifers in the QC-Sparta/Carrizo-Wilcox GAM, with the exception of the Simsboro, which would be held within 5% variance of the GAM Run. Mr. Ausley also added POSGCD shallow Management Zone restrictions would be maintained by POSGCD. Mr. Ausley also stated that POSGCD approved maintaining current DFCs in the Brazos Alluvium of 5 feet in Milam County and 6 feet in Burleson County.

Other members stated their Board would meet prior to the next GMA 12 meeting to discuss DFCs.

11. Content and process of Explanatory Report of GMA 12

Mr. Seifert reported the consultants would be prepared to address this issue at the next meeting. David Wheelock, representing LCRA, asked about timeliness of submitting comments. After discussion, it was agreed that GMA 12 would continue its policy of accepting comments throughout the entire process, but also recognized that there would soon come a point in time where comments would be submitted too late to include in considerations due to time restraints and deadlines imposed by statute.

12. Improvements to the current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model

Steve Young with Intera gave a brief update on the process.

13. Public Comment

Chairman Ausley invited public comment.
Michelle Ganges stated she represented the League of Independent Voters and Neighbors for Neighbors, and summarized her comments which were also handed out to each member of GMA 12. Mrs. Ganges stated the two groups she represented supported the work, conclusions, and recommendations of Steve Box and Environmental Stewardship, including his statements made at this meeting.

Stephen Allen of the Texas Water Development Board (TWDB) presented a handout to the members of GMA 12 and the public entitled, "TWDB Updates- GMA 12".

Carmen Cernosek, TWDB Ag and Rural Ombudsman asked for suggestions concerning applications for agricultural and rural projects for TWDB SWIFT funding.

14. Agenda items and Date for next meeting

The meeting was set for March 24th, 2016 at 10am.

15. Adjourn

The meeting adjourned at 11:58 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON DECEMBER FEBRUARY 4, 2016, WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON MARCH 24, 2016.

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
March 24, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Michael Simmang	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent None

Others Present	**Entity**
Gary Westbrook	POSGCD
Elaine Gerren	POSGCD
John Seifert	LBG Guyton
Andy Donnelly	DBS&A
James Bene	RW Harden
Monique Norman	BVGCD, FCGCD
Tim Skoglund	SAWS
Keith Hansberger	LPGCD
Steven Siebert	SAWS
Kodi E. Sawin	Sawin Group
Cindy Ridgeway	FCGWCD
Alice Darnell	Lost Pines
Steve Box	Environmental Stewardship
Scott Carlson	Met Water
Stephen Allen	TWDB
Kirk Holland	Self
David Dunn	HDIZ
Bobby Bazan	POSGCD
Barney Knight	Knight & Partners
Dave Coleman	City of College Station
Bruce Smith	City of College Station
Steven Wise	POSGCD
Leonard Oliver	Lower Colorado Authority
Jevon Harding	Intera
John Melvin	BV Groundwater Rights Association

MINUTES

1. **Call meeting to order and establish quorum**
Chairman Nathan Ausley called the meeting to order and established quorum at 10:00 am.

2. **Welcome and introductions**
Head table- David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Michael Simmang representing LPGCD, David Van Dresar representing FCGCD, and Gary Westbrook from POSGCD serving as secretary.

3. **Minutes of February 4, 2015 GMA 12 Meeting**
Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of February 4, 2016. None were offered. David Van Dresar moved and Alan Day seconded the minutes be approved as presented. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
John Seifert with LBG Guyton gave a presentation entitled "Summary of Groundwater Modeling Results", including minor modifications of PS5 with an added PS4 ramp-up scenario for the Hooper in the METGCD. The pumping in the Hooper in the METGCD was increased from 835 AF in 2070 to 5,550 AF in 2070. He gave a summary on the DFCs and MAGs for 2060. The same well file was used with modifications to extend the file for a period of 10 years. Mr. Seifert then covered modeling work by the consultants of the Yegua-Jackson, which utilized the previously developed well file and extended 2060 pumping through 2070. Mr. Seifert then reviewed 2010-2070 pumping and drawdowns across GMA 12. Finally he discussed BVGCD's methodology for DFCs in the Brazos Alluvium. A question was asked by Steve Box wanting to know what the difference between the current DFC's and the main difference in the 10 year extension. Both Mr. Seifert and Andy Donnelly discussed this issue for Mr. Box and the GMA.

5. **Receive and discuss comments on Demands and DFC options for GMA 12**
Chairman Ausley opened this item and asked if anyone would offer information.
Steve Box gave a presentation entitled, "GMA 12 DFCs Supplementary Comments Rice Report" on behalf of Environmental Stewardship. Mr. Box also handed out additional supporting documents entitled, "GAM Predictions of the effects of Baseline Pumping Plus Proposed Pumping by Vista Ridge, End Op, Forestar, and LCRA" and "Proposed Desired Future Condition(s) for Aquifer(s) in GMA 12." Alan Day asked if the Rice report considered the pumping already contained in the Baseline pumping of the GAM. Mr. Box stated he believed it did, but would have to verify that with Mr. Rice.
Mr. Westbrook reminded GMA 12 LCRA had submitted comments through email and asked if anyone from LCRA desired to address the GMA concerning those comments. Leonard Oliver with LCRA stated there were no further comments to offer at this time.

6. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
Chairman Ausley opened this item and asked if anyone would offer information. No comments were received.

7. **Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
Chairman Ausley opened this item and asked if anyone would offer information. No comments were received.

8. **Report from Brazos and Robertson counties interests regarding the socio-economic impacts of large groundwater withdrawals.**
A presentation was given by David Dunn on behalf of the City of College Station entitled " Socioeconomic Considerations when Regulating Groundwater Development." The purpose of their evaluation is to assist by providing input regarding potential economic impacts within the Brazos Valley GCD of future groundwater development and over-regulating groundwater resources and to evaluate the impact of groundwater development and overprotection in the Brazos and Robertson counties. Their hydrology and engineering will utilize groundwater modeling to determine future hydrologic conditions and to determine the impacts of future pumping on existing wells and to estimate to cost to existing well owners.
Barney Knight asked Mr. Dunn if the report contained any evaluations of socioeconomic impacts anywhere other than these two counties. Mr. Dunn stated it did not. He further noted the report did not examine any of the economics realized from transport of groundwater, and discussed the use of accelerated timeliness for pumping. Keith Hanspard asked if the report took into account the effects of pumping on rivers. Mr. Dunn stated it did not. Mr. Van Dresar asked if the report took into account regulatory actions by GCDs to curtail production and protect the resource. Mr. Dunn stated it did not. John Melvin asked about considerations of acquiring property rights where cities would drill new wells.

9. **Update from Groundwater Conservation Districts of GMA 12on Joint Planning and compliance with Chapter 36.408, state Water Code**
Alan Day stated BVGCD had recently adopted rules for curtailment of production to protect aquifer water levels similar to the rules of POSGCD. He also stated BVGCD had developed a structured process to evaluate reduction in pressure identified in specific monitor wells. Mr. Westbrook noted that POSGCD was near completion of its Winter water level monitoring, and at the March POSGCD Board meeting Intera had presented a report showing POSGCD's compliance with current DFCs and management strategies.

10. **Desired future Conditions of aquifers in GMA 12**
David Van Dresar presented proposed DFCs for FCGCD as follows:
Carrizo- limit drawdown to an average of 110 feet across FCGCD
Queen City- limit drawdown to an average of 64 feet across FCGCD
Sparta- limit drawdown to an average of 47 feet across FCGCD
Yegua-Jackson- limit drawdown to an average of 77 feet across FCGCD
Wilcox- Declare this aquifer not relevant at this time.

David Bailey then presented DFCs for METGCD.
Yegua-Jackson- limit drawdown to an average of 15 feet across METGCD
Sparta- limit drawdown to an average of 5 feet across METGCD
Queen City- limit drawdown to an average of 2 feet across METGCD
Carrizo- limit drawdown to an average of 80 feet across METGCD
Calvert Bluff- limit drawdown to an average of 90 feet across METGCD
Simsboro- limit drawdown to an average of 138 feet across METGCD
Hooper- limit drawdown to an average of 146 feet across METGCD
Additionally, METGCD requests GMA 12 to adopt these values for METGCD with a 5% allowable variance for the Simsboro and 10% allowable variance for all other aquifers.

Michael Simmang presented proposed DFCs for LPGCDerw as adopted at their February 17 Board meeting.
Sparta- limit drawdown to an average of 5 feet across LPGCD
Queen City- limit drawdown to an average of 15 feet across LPGCD
Carrizo- limit drawdown to an average of 62 feet across LPGCD
Calvert Bluff- limit drawdown to an average of 100 feet across LPGCD

Simsboro- limit drawdown to an average of 240 feet across LPGCD
Hooper- limit drawdown to an average of 165 feet across LPGCD

After discussion, a motion was made by David Van Dresar to authorize Monique Norman to compose a resolution memorializing proposed DFCs for all relevant aquifers in GMA 12 to be brought back to the next meeting for consideration. The motion was 2nd by Director Alan Day. The motion carried unanimously.

11. Content and process of Explanatory Report for GMA 12

John Seifert noted the consultants would be prepared to report at the next GMA 12 meeting.

12. Improvements to the current Central Queen City-Sparta/Carrizo-Wilcox Groundwater Availability Model

No update was given.

13. Public Comment

Chairman Ausley invited public comment. None was offered.

14. Agenda items and Date for next meeting

The meeting was set for April 15, 2016 at 10am.

15. Adjourn

The meeting adjourned at 11:45 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON MARCH 24, 2016, WERE APPROVED AND ADOPTED BY GMA 12 AT A MEETING ON APRIL 15, 2016.

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

<u>MINUTES</u>

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent None

Others Present	**Entity**
Gary Westbrook	POSGCD
Elaine Gerren	POSGCD
Bobby Bazan	POSGCD
John Seifert	LBG Guyton
Andy Donnelly	DBS&A
Monique Norman	BVGCD, FCGCD
Tim Skoglund	SAWS
Steven Siebert	SAWS
Kodi E. Sawin	Sawin Group
Steve Box	Environmental Stewardship
Stephen Allen	TWDB
David Wheelock	LCRA
Barney Knight	Knight & Partners
Pat Riley	Blue Water Systems
Larry French	TWDB
Tom Barnett	TWDB
Jeff Singleton	The Singleton Co.
Leo J. wick	FCGWD

MINUTES

1. **Call meeting to order and establish quorum**
Chairman Nathan Ausley called the meeting to order and established quorum at 10:06 am.

2. **Welcome and introductions**
Head table- David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Tim Totten representing LPGCD, David Van Dresar representing FCGCD, and Gary Westbrook from POSGCD serving as secretary.

3. **Minutes of March 25, 2015 GMA 12 Meeting**
Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of March 25, 2016. None were offered. Alan Day moved and David VanDresar seconded the minutes be approved as presented. The motion carried unanimously.

4. **Update and report from consultants regarding ongoing evaluations and studies**
John Seifert with LBG Guyton and Monique Norman stated that all comments would be incorporated together and then a report would be formulated but that this was a work in progress. No action was taken.

5. **Receive and discuss comments on Demands and DFC options for GMA 12**
Chairman Ausley opened this item and asked if anyone would offer information. No comments were received.

6. **Receive Comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions:**
Chairman Ausley opened this item and asked if anyone would offer information. Steve Box with Environmental Stewardship commented that he was pleased with the process of the board and their transparency and that he appreciated the board being open to comments on the process. He also commented that he has concerns on the FDC's protecting and conserving the Aquifers. No action was taken

7. **Review and Discuss Previous Presentations and Comments received on requirements of chapter 36.108(d) in adopting Desired Future Conditions.**
Chairman Ausley opened this item and asked if anyone would offer information. No comments were received.

8. **Update from Groundwater Conservation Districts of GMA 12on Joint Planning and compliance with Chapter 36.108, State Water Code**
Alan Day of BVGCD stated that they are monitoring all levels quarterly and stated that this would be good for all Districts to do and then the districts could compare the data. No action was taken.

9. **Adoption of Proposal for Desired Future Conditions of aquifers in GMA 12 and accompanying resolution**
A resolution to Adopt Proposed Desired Future Conditions for Aquifers in Groundwater Management 12 was prepared by Monique Norman and Submitted for approval by the Board. The motion prevailed by the following vote:

Hooper	5 Ayes and 0 Nays
Simsboro	5 Ayes and 0 Nays

Carrizo	5 Ayes and 0 Nays
Calvert Bluff	5 Ayes and 0 Nays
Queen City	5 Ayes and 0 Nay
Sparta	5 Ayes and 0 Nays
Yegua Jackson	5 Ayes and 0 Nays
Brazos Alluvium	5 Ayes and 0 Nays

A motion was made by David Van Dresar to adopt the resolution establishing proposed desired future conditions for the above described aquifers. The motion was 2nd by Alan Day. The motion carried unanimously.

10. Content and process of Explanatory Report for GMA 12

John Seifert noted that this was an ongoing process and that they will take comments from each District that was received today and over the next 90 days this information will be presented. Hearings??????

11. Public Comment

Chairman Ausley invited public comment. None was offered.

12. Agenda items and Date for next meeting

The next meeting will be held after the 90 day period expires and hearings have been held. Probably in late September or October.

13. Adjourn

The meeting adjourned at 10:45 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON APRIL 15, 2016, WERE APPROVED AND ADOPTED BY GMA 12 AT OCTOBER 11, 2016

ATTEST:

Daniel M. Bail

Mid-East Texas Groundwater Conservation District

Wendi Pyle

Fayette County Groundwater Conservation District

Brazos Valley Groundwater Conservation District

Lost Pines Groundwater Conservation District

Post Oak Savannah Groundwater Conservation District

Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
October 11, 2016 – 2:00 pm
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
Wendi Pyle	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent None

Others Present	**Entity**
Gary Westbrook	POSGCD
Elaine Gerren	POSGCD
Bobby Bazan	POSGCD
John Seifert	LBG Guyton
Andy Donnelly	DBS&A
Monique Norman	BVGCD, FCGCD
Hope Wells	SAWS
Kodi E. Sawin	Sawin Group
Steve Box	Environmental Stewardship
Stephen Allen	TWDB
David Wheelock	LCRA
Ross Cummings	Blue Water Systems
Pat Riley	Blue Water Systems
Jenvon Harding	Intera
Paul Terrill	Terrill & Waldrop
Jeff Davis	LBG Guyton
Jason Barfknecht	City of Bryan
Lou Fleischhauer	Collier Consulting, Inc.
Kirk Holland	Self
Michael Seymour	R W Harden & Associates
James Bernson	Brazos Valley Groundwater Rights Assoc.
Brian Bohun	Thornhill & Associates
Amy Muttoni	BRA
Matt Uliona	METGC

MINUTES

1. **Call meeting to order and establish quorum**
Chairman Nathan Ausley called the meeting to order and established quorum at 2:00 pm.

2. **Welcome and introductions**
Head table- David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Tim Totten representing LPGCD, Wendi Pyle representing FCGCD, and Gary Westbrook from POSGCD serving as secretary.

3. **Minutes of April 15, 2016 GMA 12 Meeting**
Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of April 15, 2016. None were offered. Alan Day moved and David Bailey seconded the minutes be approved as presented. The motion carried unanimously.

4. **Presentation of DFC Summary Reports by each District Representative.**
Alan Day stated that comments had been received from the City of Bryan and also one form an individual. Mr. Day stated that a redistribution of pumping was need to allow for areas that were experienced higher pumping in the past. Comment was made that adjustments need to be made for future pumping in the Northern areas of Brazos County. Mr. Day turned the discussion over to John Seifert and he presented comments received and corrections to the locations and amounts of future pumping in the Brazos Valley GCD area. Alan Day made a motion to submit PS10 instead of PS 6 to the Texas Water Development Board. The motion died for a lack of a 2nd. Gary Westbrook comment on comment received by POSGCD by Curtis Chubb. Comment was given on the Curtis Chubb received comment with reference to 5 areas he would like to see addressed and a presentation was given by Jevon Harding. Jim Totten with the LPGCD said they had received 3 comments and he referred to Andy Donnely and Mr. Donnely stated that the 3 comments were lengthy and had been summarized. No other comments were received. No action was taken.

5. **Discussion and consideration of any changes to proposed DFC's**
Chairman Ausley opened this item and asked if anyone had any changes. Monique Norman commented and clarified the change process. No changes were considered at this time. No action was taken

6. **Update and report from consultants regarding ongoing evaluations and studies**
Chairman Ausley opened this item and asked if anyone had any comments. No comment was heard. No action was taken

7. **Review and Discuss Comments received on demands and DFC options for GMA 12**
Chairman Ausley opened this item and asked for comment. A motion was made by Alan Day to shut off the comment period. The motion was 2nd by Jim Totten. The motion carried unanimously.

8. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
Jevon Hardin with URS gave a report from the POSGCD May 2016 Meeting on monitoring methodology and values, with emphasis on the 2020 DFC considerations. Gary Westbrook gave a modeling update. No action was taken.

9. Review and discuss previous presentations and comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions.

Chairman Ausley opened this item and asked if anyone had any comments. No comment was heard. No action was taken.

10. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water

Comment was made by Alan Day that they were continuing to monitor and were moving from monthly to quarterly, and developing methodology. Jim Totten gave a brief update. No action was taken.

11. Comment and process of Explanatory Report for GMA 12

Comment was heard from John Seifert stating that some work was done and parts are in draft form but the report was not completed or composed at this time.

12. Public Comment

Chairman Ausley invited public comment. David Wheelock with LCRA asked for clarification on PS 10. He was informed that the vote died for a lack of a 2nd.

13. Agenda items and Date for next meeting

The next meeting will be scheduled at a later date.

14. Adjourn

The meeting adjourned at 2:50 pm. Nathan Ausley invited all attendees to stay for the Madisonville FFA Presentation.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON OCTOBER 11, 2016, WERE APPROVED AND ADOPTED BY GMA 12 ON DECEMBER 1, 2016

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

GROUNDWATER MANAGEMENT AREA 12 MEETING
December 1, 2016 – 10:00 am
Milano Civic Center
120 West Ave. E
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresser	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent None

Others Present	**Entity**
Gary Westbrook	POSGCD
Elaine Gerren	POSGCD
Bobby Bazan	POSGCD
John Seifert	LBG Guyton
Monique Norman	BVGCD, FCGCD
Kodi E. Sawin	Sawin Group
Stephen Allen	TWDB
David Wheelock	LCRA
Pat Riley	Blue Water Systems
Jeff Davis	LBG Guyton
Brian Bohm	Thornhill & Associates
Amy Muttoni	BRA
Ivan Langford	GCWA
David Sauer	GCWA
Bill Mullen	CDM Smith
Steve Young	Intera

MINUTES

1. **Call meeting to order and establish quorum**
   Chairman Nathan Ausley called the meeting to order and established quorum at 10:04 a.m.

2. **Welcome and introductions**
   Head table- David Bailey representing METGCD, Alan Day representing BVGCD, Nathan Ausley representing POSGCD, Tim Totten representing LPGCD, David Van Dresser representing FCGCD, and Gary Westbrook from POSGCD serving as secretary.

3. **Minutes of October 11, 2016 GMA 12 Meeting**
   Chairman Ausley asked for corrections or additions to the minutes of the previous GMA 12 meeting of October 11, 2016. None were offered. Jim Totten moved and David Bailey seconded the minutes be approved as presented. The motion carried unanimously.

4. **Discussion and consideration of PS10 GAM Run in Lieu of PS6 GAM Run for purposes of evaluation of proposed DFC's**
   Chairman Ausley opened this item for discussion. A presentation summary on the pumping changes for PS6 and PS10 was given by John Siefert with LBG Guyton. Summary Comments from the City of Bryan were discussed. After further discussion, a motion was made by Alan Day to accept the PS10 Gam Run for inclusion with DFC submission. The motion was 2nd by Jim Totten. The motion carried unanimously.

5. **Discussion and consideration of any changes requested to proposed DFC's**
   Chairman Ausley opened this item for discussion. No changes were requested from any of the GCDs in GMA 12 and no action was taken.

6. **Update and report from consultants regarding ongoing evaluations and studies**
   Chairman Ausley opened this item for discussion. Comment was heard from John Siefert stating that the consultants are working on the explanatory report and hoping to have the draft by the 2nd week in January for submission for internal review. No action was taken.

7. **Demands and DFC option for GMA 12**
   Chairman Ausley opened this item for discussion. It was noted that the only comments received were from the City of Bryan on November 30th, 2016, and they were sent via email too late for distribution to members prior to this meeting. No action was taken

8. **Review comments on requirements of Chapter 36.108(d) in adoption Desired Future Conditions**
   Chairman Ausley opened this item for discussion. No discussion was offered and no action was taken.

9. **Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   Chairman Ausley opened this item for discussion. No comments were received. No action was taken

10. **Update from Groundwater Conservation Districts of GMA12 on joint planning and compliance with Chapter 36.108 State Water Code**

Chairman Ausley opened this item for discussion. Comment was heard from Gary Westbrook with the Post Oak Savannah GCD stating that an Agenda had been posted that would cover this and additional items following this meeting. No action was taken.

11. Content, process, and status of Explanatory Report for GMA 12

There was no discussion or action on this item.

12. Public Comment

David Wheelock with LCRA asked if DFCs were changing due to the adoption PS10 instead of PS6. Monique Norman provided clarification that the DFCs would not change as the result of the model runs were within the limits adopted when GMA 12 adopted its proposed DFCs.

13. Agenda Items and date for next meeting

The next meeting will be scheduled possibly in early February with the date to be set after receiving the draft explanatory report.

14. Adjourn

The meeting adjourned at 10:24 A.M.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON DECEMBER 1, 2016, WERE APPROVED AND ADOPTED BY GMA 12 ON FEBRUARY ??, 2017

ATTEST:

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Mid-East Texas Groundwater Conservation District

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Fayette County Groundwater Conservation District

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Brazos Valley Groundwater Conservation District

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Lost Pines Groundwater Conservation District

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Post Oak Savannah Groundwater Conservation District

GROUNDWATER MANAGEMENT AREA 12 MEETING
April 27, 2017 – 10:00 am
Post Oak Savannah GCD Offices
310 East Avenue C
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent
None

Others Present	Entity
Gary Westbrook	POSGCD
Elaine Gerren	POSGCD
Bobby Bazan	POSGCD
John Seifert	LBG Guyton
Monique Norman	BVGCD, FCGCD
Kodi E. Sawin	Sawin Group
Stephen Allen	TWDB
David Wheelock	LCRA
Bill Mullen	CDM Smith
Steve Young	Intera
Sheril Smith	LPGCD
Shirley Wade	TWDB
Cindy Ridgeway	TWDB
Megan Haas	BVGCD
Cynthia Lopez	BVGCD
Mike Keester	LRE Water
Jevon Harding	INTERA
Larry French	TWDB
Barney Knight	Knight Law Firm
Dave Erchinger	Burleson County Resident
Philip Price	BRA
Andy Donnelly	DBS&A
John Waugh	SAWS
Steven Siebert	SAWS
Jeff Davis	LBG Guyton
John Waugh	SAWS
Amy Muttoni	BRA
HC Clark	
Leonard Oliver	LCRA
Judith McGeary	Farm & Ranch Freedom Alliance
Leo J. Wick	FCGWD
Dave Coleman	City College Station
Mike Rubinov	R.W. Harden
Liz Ferry	R.W. Harden
Russell Labus	Evergreen UWCD
Phil Cook	Environmental Stewardship

MINUTES

1. **Invocation**
   Gary Westbrook offered the invocation.

2. **Call meeting to order and establish quorum**
   Nathan Ausley, serving as chair noted that all GCDs in GMA 12 were appropriately represented.

3. **Welcome and introductions**
   The five representatives of the GCDs of GMA 12 introduced themselves

4. **Minutes of December 1, 2016 GMA 12 Meeting**
   After brief discussion, a motion was made by David Van Dresar, and seconded by Jim Totten, to approve the minutes as presented. The motion passed unanimously.

5. **Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   Phil Cook presented a handout with comments on behalf of Steve Box. No further comment was offerd.

6. **Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions**
   As discussion ensued, Chairman Ausley opened agenda items 6 and 10 simultaneously. Alan Day presented revised numbers for inclusion in the explanatory report on behalf of Brazos Valley GCD. After discussion, Mr. Day moved and Mr. Ausley seconded, to add these corrected numbers to the explanatory report. The motion passed unanimously.

7. **Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code**
   POSGCD General Manager Gary Westbrook reported on Spring monitoring of POSGCD, and that POSGCD was in the process of defining methodology for determining compliance with DFCs and management strategies of the District. Mr. Day reported on Spring monitoring of BVGCD, and the District's conversion of abandoned oil and gas wells into deep monitoring wells.

8. **Formally declare non-relevant aquifers**
   Mr. Van Dresar noted corrections for FCGCD on page 12 of the draft explanatory report. Mr. Day noted that in 2013 BVGCD had petitioned the Texas Water Development Board (TWDB) to remove BVGCD entirely from GMA 14 and that BVGCD had declared the Gulf Coast aquifer in BVGCD as non-relevant. Mr. Van Dresar stated the Wilcox aquifers were declared non-relevant in FCGCD. Mr. Totten noted the Trinity as a non-relevant aquifer for Bastrop, Lee, and Williamson Counties, and the Yegua-Jackson as non-relevant in LPGCD. After discussion for clarification, Mr. Ausley moved and Mr. Day seconded, to formally declare the aforelisted aquifers as non-relvant for planning purposes in GMA 12. The motion passed unanimously.

9. **Resolution adopting Desired Future Conditions for relevant aquifers of GMA 12**
   Monique Norman, general counsel for BVGCD and FCGCD, presented and reviewed a resolution prepared for adopting DFCs of GMA 12. Mr. Van Dresar noted the need to add the Yegua-Jackson aquifer to the list of aquifers listed on page 2. After further discussion, Mr. Van Dresar moved, and Mr. Totten seconded, to approve the amended resolution to adopt Desired Future Conditions for relevant aquifers in GMA 12.
   Mr. Ausley called for a roll call vote. Mr. Totten voted yes. Mr. Van Dresar voted yes. MR. Ausley voted yes. Mr. Day voted yes. Mr. Bailey voted yes. The motion passed unanimously.

10. Explanatory Report for GMA 12

Having discussed this item simultaneously with agenda item 6, it was noted there were still some amendments needed in the Explanatory Report. After discussion, all agreed to take no action at this meeting, and to review the report and submit any appropriate corrections or additions to the consultants so the report could be considered at the next GMA 12 meeting.

11. Authorization to make any necessary non-substantive revisions, submit transmittal letter, DFC Resolution, Explanatory Report, GAM memo, and any other necessary documentation to the Texas Water Development Board

After discussion of the intent of this agenda item, Mr. Day moved, and Mr. Ausley seconded, to authorize POSGCD staff to make any necessary non-substantive revisions, submit transmittal letter, DFC Resolution, Explanatory Report, GAM memo, and any other necessary documentation to the Texas Water Development Board to complete the process necessary on behalf of GMA 12. The motion passed unanimously.

12. Report from Intera, Inc. on update to Central Queen City-Sparta GAM

Cindy Ridgeway of TWDB introduced this agenda item and gave a brief history and background of the process. She then introduced Dr. Steve Young of Intera, who recognized members of TWDB staff, present for the meeting, as Dr. Shirley Wade, Ms. Cindy Ridgeway, and Mr. Larry French. Dr. Young then presented a stakeholder report on the project entitled, "Effect of Faults on Groundwater Flow in the Carrizo-Wilcox Aquifer in Central Texas: Contract 1548301856." Questions were heard from H.C. Clark, Dave Erchinger, Jim Totten, Alan Day, and Nathan Ausley, concerning defferent facets of the presentation, and each questions was addressed.

13. Public Comment

Chairman Ausley invited public comment. The following parties offered comment:

Mike Keester representing Rice Engineering reported on working on a request with TWDB.

Bill Mullican addressed the GMA on behalf of the City of Bryan and asked if the GMA would accept comments on the Explanatory Report. After brief discussion, it was noted that any party could offer comments.

Dave Erchinger expressed general concerns for DFCs being expressed in drawdowns of the aquifer. He encouraged members of GMA 12 to manage these aquifers as the Edwards Aquifer is managed, so they would be long-term sustainable.

14. Agenda items and Date for next meeting

After discussion it was agreed to hold the next GMA 12 meeting at POSGCD offices on May 25, 2017 at 10:00 am. It was also agreed the agenda would contain an item to consider adoption of the Explanatory Report, and any other items identified necessary.

15. Adjourn

The meeting was adjourned at 11:56 am.

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON APRIL 27, 2017, WERE APPROVED AND ADOPTED BY GMA 12 ON MAY 25, 2017.

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

GROUNDWATER MANAGEMENT AREA 12 MEETING
May 25, 2017 – 10:00 am
Post Oak Savannah GCD Offices
310 East Avenue C
Milano, Texas

MINUTES

GMA 12 Members Present

Nathan Ausley	POSGCD
Jim Totten	LPGCD
David Van Dresar	FCGCD
David Bailey	METGCD
Alan Day	BVGCD

GMA 12 Members Absent

None

Others Present	**Entity**
Gary Westbrook	POSGCD
Elaine Gerren	POSGCD
Bobby Bazan	POSGCD
Megan Homeyer	POSGCD
John Seifert	LBG Guyton
Monique Norman	BVGCD, FCGCD
Kodi E. Sawin	Sawin Group
Jevon Harding	Intera
Steve Young	Intera
Sheril Smith	LPGCD
Mike Seymour	R.W. Harden
Pat Reilly	Blue Water
Robert Bradley	TWDB
Leo Wick	FCGCD
Andy Donnelly	DBS&A
Bobby Walker	Burleson County Landowner
Steve Box	Environmental Stewardship
Michael Summing	Lost Pines

MINUTES

1. **Invocation**
The invocation was given by Gary Westbrook

2. **Call meeting to order and establish quorum**
Nathan Ausley, serving as chair noted that all GCDs in GMA 12 were appropriately represented, and he called meeting to order at 10:05 am

3. **Welcome and introductions**
The five representatives of the GCDs of GMA 12 introduced themselves as Alan Day of BVGCD, Jim Totten of LPGCD, David Bailey of METGCD, David Van Dresar of FCGCD, and Nathan Ausley of POSGCD.

4. **Minutes of April 27, 2017 GMA 12 Meeting**
After brief discussion, a motion was made by Alan Day and seconded by David Van Dresar, to approve the minutes as presented. The motion passed unanimously.

5. **Re-adoption of corrected resolution of Desired Future Conditions for relevant aquifers of GMA 12 that reflects the Desired Future Conditions and reasonable deviations initially adopted on April 15, 2016; as wells as the approval of non-relevant aquifers in GMA 12.**
Alan Day noted that there had been an error for the average drawdown number for METGCD in the Yegua-Jackson in the previously adopted resolution, as well as some omissions of information. David Bailey noted the average drawdown should have been listed at 7 feet instead of the 15 feet that was put in the Yegua-Jackson in Mid-East Texas GCD. A motion was made by David Bailey to make this change and the motion was 2nd by Alan Day. The motion passed unanimously.
Mr. Day also noted inclusion of additional language which was previously used and discussed, and necessary, had been overlooked. He noted the correction needed was to add 5 feet allowance to the qualifying language for DFCs to be in tolerance with modeled results, and to include the Yegua-Jackson in the tolerance language as well. He then restated the intent of the necessary language as "GMA 12 considered the DFCs to be compatible and physically possible if the difference between modeled drawdown results and the DFC drawdown targets are within 5 feet or within a 10 percent range, whichever is greater, in all aquifers in the Queen City-Sparta/Carrizo-Wilcox GAM and the Yegua-Jackson GAM, with the exception of the Simsboro, which would be held within 5 feet or within a 5 percent variance, whichever is greater, of the GAM simulation." After discussion, Mr. Day moved, and Nathan Ausley seconded, to make these changes to appropriate language in the resolution. The motion passed unanimously.

Mr. Ausley then asked Monique Norman to summarize the discussion and amendments. After the summary, and discussion, a motion was made by Mr. Day to adopt the resolution with amendments. The motion was 2nd by David Van Dresar. The motion carried unanimously.

6. **Explanatory Report for GMA 12**
Gary Westbrook, POSGCD General Manager, reminded all that the Draft Explanatory Report had been made available at the previous GMA 12 Meeting on April 27, 2017. Jevon Harding with Intera then presented an overview of the explanatory report changes and amendments since that date. Discussion ensued, including

additional recommended minor amendments. Following this discussion, a motion was made by Alan Day to approve and adopt the Explanatory Report with all changes and amended language agreed on, and for this report to then be submitted to the Texas Water Development Board for approval. The motion was 2nd by David Van Dresar. The motion carried unanimously.

Steve Box asked if Environmental Stewardship's comments had been considered. Jevon Harding of Intera noted comments were addressed in Section 7 and appendices of the Explanatory Report. Mr. Westbrook reminded all the consultants of GMA 12 had developed, and GMA 12 representatives had adopted, a form to be used to submit comments on DFCs. Mr. Box also requested all participants in the improvement to the Groundwater Availability Model be listed in the report. Steve Young of Intera agreed and stated the correction would be made to the report. After further discussion concerning comments on DFCs, Monique Norman and Andy Donally noted all comments were responded to as appropriate.

After further discussion, Jim Totten moved and Alan Day seconded to add clarifying language to the Explanatory Report that comments considered were from the 90 day comment period ending July 12, 2016, and to include an exhaustive list of funding partners for improvements to the GAM in the appropriate item in the Explanatory Report. After further discussion concerning the listing of DFCs in the report, Jim Totten moved and Alan Day seconded to amend the motion to include adding language as suggested to include overall DFCs for GMA 12 aquifers in Tables 2-1, 2-2, 4-1, and 4-2, in the Explanatory Report. Chairman Ausley called for the vote on the amendment. The amendment passed unanimously. Chairman Ausley then called for the vote on the motion. The motion carried unanimously.
After further discussion, Alan Day moved, and David Van Dresar seconded, to approve and adopt the Explanatory Report as amended, and forward to the Texas Water Development board. The motion carried unanimously.

7. **Public Comment**
   Steve Box with Environmental Stewardship stated that he was pleased with the transparency and process of GMA 12 in adopting DFCs, and the DFCs which were adopted as well. He stated he felt we were in a good place for the next planning cycle. He thanked the GMA 12 representatives for their work and participation.

8. **Agenda items and Date for next meeting**
   The agenda items and next meeting will be determined at a later date.

9. **Adjourn**
   The meeting adjourned at 10:54 am

THE ABOVE MINUTES OF THE MEETING OF GROUNDWATER MANAGEMENT AREA 12 HELD ON MAY 25, 2017, WERE APPROVED AND ADOPTED BY GMA 12 ON ????????????

ATTEST: David M. Baily

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

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APPENDIX B

GMA-12 RESOLUTION FOR PROPOSED DFCS DATED APRIL 15, 2016

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RESOLUTION TO ADOPT PROPOSED DESIRED FUTURE CONDITIONS FOR AQUIFERS IN GROUNDWATER MANAGEMENT AREA 12

THE STATE OF TEXAS §
§
GROUNDWATER MANAGEMENT AREA 12 §
§
GROUNDWATER CONSERVATION DISTRICTS §

WHEREAS, Texas Water Code § 36.108 requires the groundwater conservation districts located in whole or in part in a groundwater management area ("GMA") designated by the Texas Water Development Board to adopt desired future conditions for the relevant aquifers located within the management area;

WHEREAS, the groundwater conservation districts located wholly or partially within Groundwater Management Area 12 ("GMA 12"), as designated by the Texas Water Development Board, as of the date of this resolution are as follows: Brazos Valley Groundwater Conservation District, Fayette County Groundwater Conservation District, Lost Pines Groundwater Conservation District, Mid-East Texas Groundwater Conservation District, and Post Oak Savannah Groundwater Conservation District (collectively hereinafter "the GMA 12 Districts");

WHEREAS, the GMA 12 Districts are each governmental agencies and bodies politic and corporate operating under Chapter 36, Water Code;

WHEREAS, the GMA 12 Districts desire to fulfill the requirements of Texas Water Code §36.108 through mutual cooperation and joint planning efforts;

WHEREAS, the GMA 12 Districts have had numerous public meetings, including stakeholder meetings for the specific purpose of receiving comments and input from stakeholders within GMA 12, and they have engaged in joint planning efforts to promote comprehensive management of the aquifers located in whole or in part in Groundwater Management Area 12;

WHEREAS, GMA 12 held meetings on July 12, 2013; December 19, 2013; June 6, 2014; June 27, 2014; February 26, 2015; March 27, 2015; April 30, 2015; May 28, 2015; June 25, 2015; August 13, 2015; September 24, 2015; October 22, 2015; December 17, 2015; February 4, 2016; March 24, 2016 and April 15, 2016, in compliance with its statutory duty to publically consider the desired future conditions considerations listed in § 36.108(d);

WHEREAS, the GMA 12 Districts have considered the following factors, listed in §36.108(d), in establishing the proposed desired future conditions for the aquifer(s), set forth under Appendix B:

(1) groundwater availability models and other data or information for the management area;

(2) aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another;

(3) the water supply needs and water management strategies included in the state water plan;

(4) hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the Texas Water Development Board Executive Administrator and the average annual recharge. inflows, and discharge;

(5) other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water;

(6) the impact of subsidence;

(7) socioeconomic impacts reasonably expected to occur;

(8) 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 Texas Water Code §36.002;

(9) the feasibility of achieving the desired future conditions; and

(10) any other information relevant to the specific desired future conditions;

WHEREAS, the proposed desired future conditions provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater in the management area;

WHEREAS, after considering the factors listed in 36.108(d), Texas Water Code, the GMA 12 Districts may establish different desired future conditions for: (1) each aquifer, subdivision of an aquifer, or geologic strata located in whole or in part within the boundaries of GMA 12; or (2) each geographic area overlying an aquifer in whole or in part or subdivision of an aquifer within the boundaries of GMA 12;

WHEREAS, the GMA 12 Districts recognize that GMA 12 includes a geographically and hydrologically diverse area with a variety of land uses and a diverse mix of water users;

WHEREAS, at least two-thirds of the GMA 12 Districts had a voting representative in attendance at the April 15, 2016, meeting in accordance with Section 36.108, Texas Water Code; and the following districts had a voting representative in attendance at the meeting: Brazos Valley Groundwater Conservation District, Fayette County Groundwater Conservation District, Lost Pines Groundwater Conservation District, Mid-East Texas Groundwater Conservation District, and Post Oak Savannah Groundwater Conservation District, and;

WHEREAS, it is the intent and purpose of the GMA 12 Districts, by adoption of this resolution, to meet the requirements of Texas Water Code §36.108, and establish proposed "desired future conditions for the relevant aquifers" within GMA 12 for the specific aquifer(s) and desired future conditions described under "Appendix B," attached hereto and incorporated herein for all purposes;

WHEREAS, at the April 15, 2016, meeting, after a motion was duly made and seconded, the GMA 12 Districts adopt this resolution establishing proposed desired future conditions for the aquifer(s) described under "Appendix B", the motion prevailed by the following vote:

Hooper	5 Ayes, 0 Nays;
Simsboro	5 Ayes, 0 Nays;;
Carrizo	5 Ayes, 0 Nays;
Calvert Bluff	5 Ayes, 0 Nays;
Queen City	5 Ayes, 0 Nays;
Sparta	5 Ayes, 0 Nays;
Yegua-Jackson	5 Ayes, 0 Nays;
Brazos Alluvium	5 Ayes, 0 Nays;

NOW, THEREFORE, BE IT RESOLVED BY THE AUTHORIZED VOTING REPRESENTATIVES OF THE GMA 12 DISTRICTS AS FOLLOWS:

1. The above recitals are true and correct.

2. The authorized voting representatives of the GMA 12 Districts hereby establish the proposed desired future conditions of the aquifer(s) as set forth in Appendix B by the vote reflected in the above recitals.

3. The GMA 12 Districts and their agents and representatives, individually and collectively, are further authorized to take any and all actions necessary to implement this resolution.

4. The proposed desired future conditions of the aquifer(s) adopted by the GMA 12 Districts and attached hereto shall be sent to the GMA 12 Districts to commence the public comment and hearing period required by Section 36.108(d-2), Texas Water Code.

AND IT IS SO ORDERED.

PASSED AND ADOPTED on this 15th day of April, 2016.

ATTEST:

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

ATTACHMENTS
Appendix A: Copies of notices of April 15, 2016, meeting
Appendix B: Proposed Desired Future Conditions

Subject: S.O.S. Acknowledgment of Receipt
Date: Friday, April 1, 2016 at 2:00:45 PM Central Daylight Time
From: Texas Register
To: gwestbrook@posgcd.org

Appendix A - Notices (10 pages)

Acknowledgment of Receipt

Agency: Groundwater Management Area 12

Liaison: Gary Westbrook

The Office of the Secretary of State has posted

notice of the following meeting:

Board: GROUNDWATER MANAGEMENT AREA 12

Committee: GROUNDWATER MANAGEMENT AREA 12

Date: 04/15/2016 10:00 AM "TRD# 2016002160"

Notice posted: 04/01/16 02:00 PM

Proofread your current open meeting notice at:

http://texreg.sos.state.tx.us/public/pub_om_lookup$.startup?Z_TRD=2016002160

BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT

P.O. Box 528 · Hearne, TX 77859 · (979)279-9350 · Fax: (979)279-0035

WWW.BRAZOSVALLEYGCD.ORG

NOTICE OF MEETING
GROUNDWATER MANAGEMENT AREA 12
April 15, 2016 – 10:00 a.m.
Milano Civic Center, 120 West Ave. E
Milano, Texas
AGENDA

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 12, as designated by the Texas Water Development Board, consisting of the Post Oak Savannah Groundwater Conservation District (GCD), Fayette County GCD, Lost Pines GCD, Mid-East Texas GCD, and Brazos Valley GCD, will hold a ***Joint Planning meeting at 10:00 a.m. on Friday, April 15, 2016***, in the Milano Civic Center, located at 120 West Ave. E, Milano, Texas. The meeting will be open to the public. **The subjects to be discussed or considered, or upon which any formal action may be taken, are as listed below. Items may or may not be taken in the same order as shown on this meeting notice.**

1. Call meeting to order and establish quorum
2. Welcome and introductions
3. Minutes of March 24, 2016 GMA 12 Meeting
4. Update and report from consultants regarding ongoing evaluations and studies
5. Receive and discuss comments on Demands and DFC options for GMA 12
6. Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions
7. Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions
8. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code
9. Adoption of proposal for Desired Future Conditions of aquifers in GMA 12 and accompanying resolution
10. Content and process of Explanatory Report for GMA 12
11. Public Comment
12. Agenda items and Date for next meeting
13. Adjourn

Signed this 1st day of April, 2016.

Alan M. Day, General Manager, BVGCD
112 W. 3rd Street, Hearne, Texas 77859
Phone: 979-279-9350

**Questions, requests for additional information, or comments concerning the subjects listed above may be submitted to the person posting this notice.

BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT

P.O. Box 528 · HEARNE, TX 77859 · (979)279-9350 · FAX: (979)279-0035
WWW.BRAZOSVALLEYGCD.ORG

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11. Public Comment
12. Agenda items and Date for next meeting
13. Adjourn

Signed this 1st day of April, 2016.

[signature]
Alan M. Day, General Manager, BVGCD
112 W. 3rd Street, Hearne, Texas 77859
Phone: 979-279-9350

**Questions, requests for additional information, or comments concerning the subjects listed above may be submitted to the person posting this notice.

Fayette County Groundwater Conservation District
255 Svoboda Lane, Room 115
La Grange, Texas 78945
Telephone: (979) 968-3135
Fax: (979) 968-3194

COPY
THE ORIGINAL INSTRUMENT WAS FILED IN FAYETTE COUNTY TEXAS ON
4/1/16 11:15Am PV

NOTICE OF MEETING
GROUNDWATER MANAGEMENT AREA 12
April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

AGENDA

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11. Public Comment
12. Agenda items and Date for next meeting
13. Adjourn

Signed this 1st day of April, 2016.

David A. Van Dresar General Manager, FCGCD
255 Svoboda Lane, Room 115, La Grange, Texas 78945
Phone: 979-968-3135

***Questions, requests for additional information, or comments concerning the subjects listed above may be submitted to the person posting this notice.*

Mid-East Texas Groundwater Conservation District

NOTICE OF MEETING
GROUNDWATER MANAGEMENT AREA 12

April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

FILED FOR RECORD
At 12:30 o'clock P M
APR 04 2016
LINDA JARVIS
Clerk County Court, Freestone County, Texas
By Callie Brookshire

Agenda

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 12, as designated by the Texas Water Development Board, consisting of the Mid-East Texas Groundwater Conservation District (METGCD), Fayette County GCD, Lost Pines GCD, Post Oak Savannah GCD, and Brazos Valley GCD, will hold a ***Joint Planning meeting at 10:00 a.m. on Friday, April 15, 2016,*** in the Milano Civic Center, located at 120 West Ave. E, Milano, Texas. The meeting will be open to the public.

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11. Public Comment
12. Agenda items and Date for next meeting
13. Adjourn

Signed this 4th day of April, 2016

David M. Bailey

David M. Bailey, General Manager, METGCD
101 W. Main Rm B22, Madisonville, TX 77864
Phone: 936-348-3212

***Questions, requests for additional information, or comments concerning the subjects listed above may be submitted to the person posting this notice.*

Mid-East Texas Groundwater Conservation District

NOTICE OF MEETING
GROUNDWATER MANAGEMENT AREA 12

April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

FILED
10:55am
APR - 4 2016
CHRISTIE WAKEFIELD
CLERK COUNTY COURT
BY
LEON COUNTY, TEXAS

Agenda

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 12, as designated by the Texas Water Development Board, consisting of the Mid-East Texas Groundwater Conservation District (METGCD), Fayette County GCD, Lost Pines GCD, Post Oak Savannah GCD, and Brazos Valley GCD, will hold a ***Joint Planning meeting at 10:00 a.m. on Friday, April 15, 2016,*** in the Milano Civic Center, located at 120 West Ave. E, Milano, Texas. The meeting will be open to the public.

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Signed this 4th day of April, 2016

David M. Bailey, General Manager, METGCD
101 W. Main Rm B22, Madisonville, TX 77864
Phone: 936-348-3212

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Mid-East Texas Groundwater Conservation District

NOTICE OF MEETING
GROUNDWATER MANAGEMENT AREA 12

April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

COPY
Original Filed
AT 8:45 O'CLOCK A M
APR 4 2016
SUSANNE MORRIS, Madison County Clerk
BY
DEPUTY
Copies NOT Compared

Agenda

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Signed this 4th day of April, 2016

David M. Bailey, General Manager, METGCD
101 W. Main Rm B22, Madisonville, TX 77864
Phone: 936-348-3212

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GROUNDWATER MANAGEMENT AREA 12
April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

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11. Public Comment
12. Agenda items and Date for next meeting
13. Adjourn

Signed this 1st day of April, 2016.

Peggy Campion

Peggy Campion, Lost Pines GCD
P O Box 1027, Smithville, TX 78957
Phone: 512-360-5088

***Questions, requests for additional information, or comments concerning the subjects listed above may be submitted to the person posting this notice.*

FILED AND RECORDED

APR 01 2016

Sharon Blasig
SHARON BLASIG
COUNTY CLERK, LEE COUNTY TEXAS

COUNTY COURT OF LEE COUNTY TEXAS

FILED 12:15 PM
APR 01 2016
Rose Pietsch
Bastrop County Clerk

NOTICE OF MEETING
GROUNDWATER MANAGEMENT AREA 12
April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

AGENDA

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 12, as designated by the Texas Water Development Board, consisting of the Post Oak Savannah Groundwater Conservation District (GCD), Fayette County GCD, Lost Pines GCD, Mid-East Texas GCD, and Brazos Valley GCD, will hold a ***Joint Planning meeting at 10:00 a.m. on Friday, April 15, 2016,*** in the Milano Civic Center, located at 120 West Ave. E, Milano, Texas. The meeting will be open to the public.

The subjects to be discussed or considered, or upon which any formal action may be taken, are as listed below. Items may or may not be taken in the same order as shown on this meeting notice.

1. Call meeting to order and establish quorum
2. Welcome and introductions
3. Minutes of March 24, 2016 GMA 12 Meeting
4. Update and report from consultants regarding ongoing evaluations and studies
5. Receive and discuss comments on Demands and DFC options for GMA 12
6. Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions
7. Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions
8. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code
9. Adoption of proposal for Desired Future Conditions of aquifers in GMA 12 and accompanying resolution
10. Content and process of Explanatory Report for GMA 12
11. Public Comment
12. Agenda items and Date for next meeting
13. Adjourn

Signed this 1st day of April, 2016.

FILED
at 4:19 o'clock P M
APR 04 2016
ANNA L. SCHIELACK
COUNTY CLERK, BURLESON CO., TEX.
By ______ Deputy

Gary Westbrook

Gary Westbrook, General Manager, POSGCD
310 East Avenue C, Milano, Texas 76556
Phone: 512-455-9900

***Questions, requests for additional information, or comments concerning the subjects listed above may be submitted to the person posting this notice.*

NOTICE OF MEETING
GROUNDWATER MANAGEMENT AREA 12
April 15, 2016 – 10:00 a.m.
Milano Civic Center
120 West Ave. E
Milano, Texas

AGENDA

Notice is hereby given that the groundwater conservation districts located wholly or partially within Groundwater Management Area (GMA) 12, as designated by the Texas Water Development Board, consisting of the Post Oak Savannah Groundwater Conservation District (GCD), Fayette County GCD, Lost Pines GCD, Mid-East Texas GCD, and Brazos Valley GCD, will hold a ***Joint Planning meeting at 10:00 a.m. on Friday, April 15, 2016,*** in the Milano Civic Center, located at 120 West Ave. E, Milano, Texas. The meeting will be open to the public.

The subjects to be discussed or considered, or upon which any formal action may be taken, are as listed below. Items may or may not be taken in the same order as shown on this meeting notice.

1. Call meeting to order and establish quorum
2. Welcome and introductions
3. Minutes of March 24, 2016 GMA 12 Meeting
4. Update and report from consultants regarding ongoing evaluations and studies
5. Receive and discuss comments on Demands and DFC options for GMA 12
6. Receive comments on requirements of Chapter 36.108(d) in adopting Desired Future Conditions
7. Review and Discuss Previous Presentations and Comments received on requirements of Chapter 36.108(d) in adopting Desired Future Conditions
8. Update from Groundwater Conservation Districts of GMA 12 on joint planning and compliance with Chapter 36.108, State Water Code
9. Adoption of proposal for Desired Future Conditions of aquifers in GMA 12 and accompanying resolution
10. Content and process of Explanatory Report for GMA 12
11. Public Comment
12. Agenda items and Date for next meeting
13. Adjourn

Filed 4th day of April
in 2016, At 1:55 M.
BARBARA VANSA
County Clerk, Milam County, Texas
By [signature]
Deputy

Signed this 1st day of April, 2016.

Gary Westbrook

Gary Westbrook, General Manager, POSGCD
310 East Avenue C, Milano, Texas 76556
Phone: 512-455-9900

***Questions, requests for additional information, or comments concerning the subjects listed above may be submitted to the person posting this notice.*

APPENDIX B
GMA 12 Desired Future Conditions
April 15, 2016

Sparta, Queen City, Carrizo, Calvert Bluff, Simsboro, Hooper Aquifers

GMA 12 member Groundwater Conservation Districts (GCDs) submitted Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069. Table B-1 lists the set of initially proposed DFCs submitted by GMA 12 for the Sparta, Queen City, Carrizo, Calvert Bluff, Simsboro and Hooper aquifers. Fayette County did not submit a DFC for the Calvert Bluff, Simsboro and Hooper units for the Wilcox Aquifer because the district has declared the Wilcox Aquifer as a non-relevant aquifer.

Table B-1. Adopted Desired Future Condition for GMA 12

Groundwater Conservation District or County	Average Aquifer Drawdown (ft) Measured from January 2000 thru December 2069					
	SPARTA	QUEEN CITY	CARRIZO	CALVERT BLUFF	SIMSBORO	HOOPER
BRAZOS VALLEY	12	12	61	125	295	207
FAYETTE COUNTY	47	64	110	-	-	-
LOST PINES	5	15	62	100	240	165
MID-EAST TEXAS	5	2	80	90	138	125
POST OAK SAVANNAH	28	30	67	149	318	205
FALLS COUNTY	-	-	-	-	-2	27
LIMESTONE COUNTY	-	-	-	11	50	50
NAVARRO COUNTY	-	-	-	-1	3	3
WILLIAMSON COUNTY				-11	47	69
GMA 12	16	16	75	114	228	168

Based on the principle of using the GAM as a joint planning tool and the fact that the GAM predictions contain uncertainty, GMA 12 considered the DFCs to be compatible and physically possible if the difference between modeled drawdown results and the DFC drawdown targets are within a 10 percent range for all aquifers in the Queen City-Sparta/Carrizo-Wilcox GAM with the exception of the Simsboro, which would be held within 5 percent variance of the GAM simulation. Factors considered for determining tolerance criteria include:

- model calibration results and statistics,
- information used to calibrate the GAM,
- aquifer and recharge information collected since the GAM was developed,
- sensitivity of the GAM calibration and GAM predictions to change in the model parameters, and
- range of uncertainty in the model parameters including historical and future pumping, and temporal variation in recharge distribution and magnitude.

Reference:
Kelley, V.A., Deeds, N.E., Fryar, D.G., and Nicot, J.P., 2004. Groundwater Availability Models for the Queen City and Sparta Aquifers, prepared for the Texas Water Development Board, Austin, Texas.

Yegua-Jackson Aquifer

GMA 12 adopted DFCs for its member districts based on the average aquifer drawdown (ft) from January 2010 to January 2070. All GCDs, except Brazos Valley GCD, considered the Jackson Aquifer and the Yegua Aquifer as a single unit. Therefore, a single DFC was adopted for the Yegua-Jackson Aquifer. Table B-2 lists the final set of DFCs submitted by each district. Lost Pines GCD did not submit a DFC for the Yegua-Jackson Aquifer because the district declared it as a non-relevant aquifer.

Table B-2. Adopted Desired Future Conditions for GMA 12 for the Yegua and Jackson Aquifers

DISTRICT	AQUIFER(S)	TIME PERIOD	AQUIFER AVERAGE DRAWDOWN (FT)
BRAZOS VALLEY	Yegua	2010 to 2070	70
	Jackson		114
FAYETTE COUNTY	Yegua-Jackson	2010 to 2070	77
LOST PINES	Yegua-Jackson	-	declared as non-relevant
MID-EAST TEXAS	Yegua-Jackson	2010 to 2070	15
POST OAK SAVANNAH	Yegua-Jackson	2010 to 2070	100
GMA 12	Yegua-Jackson	2010 to 2070	65

Reference:

Deeds, N. E., Yan, T., Singh, A., Jones, T. L., Kelley, V. A., Knox, P. R., and Young, S. C., 2010, Groundwater Availability Model for the Yegua-Jackson Aquifer, final report prepared for the Texas Water Development Board, March, 2010, 582 pp.

Brazos Alluvium Aquifer

In GMA 12, the Brazos River Alluvium is present within two GCDs in GMA 12: the Post Oak Savannah GCD and the Brazos Valley GCD. GMA 12 adopted DFCs for Post Oak Savannah GCD and the Brazos Valley GCD as listed in Table B-3.

Table B-3. Adopted Desired Future Conditions for GMA 12 for the Brazos Alluvium Aquifer in POSGCD and BVGCD

County	DFC Statement
Milam County	A decrease of 5 feet in the average saturated thickness over the period from 2010 to 2070. The baseline average saturated thickness for 2010 is estimated at 24.5 feet and is based on an analysis of historical water level data and well depth values
Burleson County	A decrease of 6 feet in the average saturated thickness over the period from 2010 to 2070. The baseline average saturated thickness for 2010 is estimated at 38.5 feet and is based on an analysis of historical water level data and well depth values.
Brazos and Robertson Counties	Percent saturation above well depth shall average at least 30 percent for wells located north of State Highway 21 and 40 percent for wells located south of State Highway 21. If the percent saturation criteria are reached for three consecutive years then the DFC would be reached.

APPENDIX C

NOTICES OF AND MINUTES FOR GCD PUBLIC HEARINGS ON PROPOSED GMA 12 DFCS

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BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT
112 W. 3rd Street – Hearne, Texas

Public Comments

Proposed Desired Future Conditions for Area Aquifers

The Brazos Valley Groundwater Conservation District is currently receiving public comments on the proposed desired future conditions for the area aquifers that were recently adopted by Groundwater Management Area 12 under §36.108, Texas Water Code. Groundwater Management Area 12 includes the following groundwater conservation districts: Brazos Valley Groundwater Conservation District, Fayette County Groundwater Conservation District, Lost Pines Groundwater Conservation District, Mid-East Texas Groundwater Conservation District, and Post Oak Savannah Groundwater Conservation District. The proposed desired future conditions and supporting materials for the area aquifers are available at the District's office at 112 W. 3rd Street, Hearne, Texas or on the District's website at https://brazosvalleygcd.org. The District will hold two public hearings on the proposed desired future conditions at the following times and places.

Robertson County Public Hearing

Brazos Valley GCD Office
112 W. 3rd Street
Hearne, Texas

Thursday, May 12, 2016
2:00 p.m.

Brazos County Public Hearing

College Station Utilities Training Facility
1603 Graham Road – Assembly Room
College Station, Texas

Thursday, June 9, 2016
2:00 p.m.

Public comments will be accepted by the District through July 18, 2016 at the District Office, by mail or email, or at the public hearings. For more information, please contact the District at aday@brazosvalleygcd.org or 979-279-9350.

Alan M. Day
General Manager
Brazos Valley Groundwater Conservation District

Minutes

BRAZOS VALLEY GROUNDWATER
CONSERVATION DISTRICT
112 W 3rd Street, Hearne, TX 77859

Public Comments Proposed Desired Future Conditions for Area Aquifers
Public Permit Hearing and Regular Board Meeting
Thursday, May 12, 2016 at 2:00 p.m.

President, Bill Harris called the Board Meeting to order at 2:00 p.m.

Directors present:	Bill L. Harris,	President
	Jan A. Roe,	Vice-President
	Mark J. Carrabba,	Secretary
	Pete Brien,	Treasurer
	Bryan F. Russ, Jr.	Director
	David Stratta,	Director
	Kent Watson,	Director
Directors absent:	Tom McDonald,	Director
Staff present:	Alan M. Day,	General Manager
	Monique Norman,	Attorney
	Cynthia Lopez,	Office Manager

Call meeting to order
Declare quorum present
Public Comment

Public Comments Proposed Desired Future Conditions for Area Aquifers

No comments were presented.

Public Permit Hearing
Public Comment
a) Non-agenda items
b) Agenda items (1)

2. Discussion and possible action of the following **Operating Permit Amendment Application:**

- **One (1) existing well for Anthony Scamardo (BVDO-0206)** located at N 30.726933° W 96.562733° 0.30 miles W of the intersection of FM 50 and N. Astin Road in Robertson County lengthening the permit term to five (5) years for Agricultural use. Total maximum annual production from the well will be 80 acre feet/year. The well produces from the Brazos River Alluvium Aquifer. **A motion was made by Bryan F. Russ, Jr., second by David Stratta to approve the amendment Operating Permit application for Anthony Scamardo as presented. The motion passed unanimously.**

- **One (1) existing well for Hill Ranch (BVOP-0218)** located at N 30.913981° W 96.287597° 1.53 miles NNW of the intersection of FM 974 and Edge School House Road in Brazos County lengthening the permit term to five (5) years for Industrial use. Total maximum annual production from the well will be 150 acre feet/year. The well produces from the Sparta Aquifer. **A motion was made by David Stratta, second by Mark J. Carrabba. The motion passed with 6 Director's for and one Director against Bryan F. Russ, Jr.**

3. **Adjourn Permit Hearing**

Call meeting to order
Pledge of Allegiance
Declare quorum present
Public Comment

a) Non-agenda items
b) Agenda items - Jayson Barfknecht, City of Bryan

1. Discussion and possible action on the Minutes from the April 14, 2016 Public Permit Hearing/ Regular Board Meeting. **A motion was made by David Stratta, second by Pete Brien to approve the Minutes from the April 14, 2016 Public Permit Hearing and Regular Board Meeting as presented. The motion passed with Director Bryan F. Russ, Jr. , abstaining due to not being present at the meeting.**

2. Review and authorization of payments made for services rendered for the month of April 2016. **A motion was made by Mark J. Carrabba, second by David Stratta to approve the authorization of payments made for services rendered for the month of April 2016 as presented. The motion passed unanimously.**

3. Financial Report. **A motion was made by David Stratta, second by Pete Brien to approve the financial reports as presented. The motion passed unanimously.**

4. Discussion and possible action on adopting protocol for measuring static water levels in wells monitored by the District relating to desired future conditions of the aquifers. **A motion was made by Bryan F. Russ, Jr., second by David Stratta to approve the subcommittee's work with regard to the four protocol for making measurements with discussed changes. The motion passed with one abstention Director Kent Watson.**

5. Discussion and possible action on Halff Associates Task Order No. 10 enhancing the water level measurement application provided as part of the District database. **A motion was made by David Stratta, second by Jan A. Roe to approve Task Order No. 10 with Halff Associates. The motion passed unanimously.**

6. Discussion and possible action on proposed amendments to District Rule 7.2 relating to Action Based on Aquifer Response to Pumping. The discussion and possible action of proposed Rule 7.2 amendments is limited to:

1) the date that the District's well monitoring data should commence to be used for the purpose of Rule 7.2, and the District will use Texas Water Development Board well monitoring data prior to that date;

(2) the well monitoring protocol should be adopted according to the District's rulemaking notice and adoption procedures;

(3) clarification that the District-approved methodology to calculate the District-wide average aquifer drawdown will comply with the District's rulemaking notice and adoption procedures;

(4) clarification that permit amendments under Rule 7.2 are subject to the District's permit hearing process; and

(5) deletion of the phrase "or within a designated management zone" from Rule 7.2, first paragraphs of (d)(1) and (d)(2).

A motion was made by David Stratta, second by Pete Brien to approve the amendments of November 1, 2015 for use of BVGCD water level measurement data to District Rule 7.2. The motion passed unanimously.

7. Discussion and possible action on the conversion of abandoned oil wells to Simsboro static water level monitoring wells. **No action taken at this time.**

8. Discussion and possible action regarding design plans for possible remodeling and renovation of the District Office. **No action taken at this time.**

9. General Manager's Report

   - Drought Monitor Report
   - Monitoring Well Report
   - Wells permitted pursuant to District Rule 8.3(j)
   - District Activities
   - Management Plan Update

Alan M. Day, General Manager presented the Board brief updates on the reports listed above.

10. Discussion and possible future agenda items.

11. **Adjournment at 3:42 p.m.**

Signed this 9th day of June, 2016

Mark J. Carrabba sec.

Mark J. Carrabba
Secretary,
BVGCD

The Board of Directors may meet in closed session, pursuant to the Texas Open Meetings Act, Texas Government Code §§ 551.071-551.076, to:

(1) consult with attorney ;

(2) deliberate regarding the purchase, exchange, lease, or value of real property if deliberation in an open meeting would have a detrimental effect on the position of the District in negotiations with a third person;

(3) deliberate a negotiated contract for a prospective gift or donation to the District if deliberation in an open meeting would have a detrimental effect on the position of the District in negotiations with a third person;

(4) to deliberate the appointment, employment, evaluation, reassignment, duties, discipline or dismissal of a Board member or District employee;

(5) to receive information from employees or question employees, but not deliberate public business or agency policy that affects public business; and

(6) to deliberate the deployment or specific occasions for implementation of security personnel or devices.

The Board may also meet in open session on these matters as required by the Texas Open Meetings Act, Texas Government Code § 551.102.

* **Agenda items may be taken out of order at the discretion of the Board Chairman**

Minutes

College Station Utilities Meeting & Training Facility
1603 Graham Road
College Station, Texas

Public Comments Proposed Desired Future Conditions for Area Aquifers
Public Permit Hearing and Regular Board Meeting
Thursday, June 9, 2016 at 2:00 p.m.

President, Bill Harris called the Board Meeting to order at 2:00 p.m.

Directors present:	Bill L. Harris,	President
	Mark J. Carrabba,	Secretary
	Pete Brien,	Treasurer
	Bryan F. Russ, Jr.	Director
	David Stratta,	Director
	Tom McDonald,	Director
	Kent Watson,	Director
Directors absent:	Jan A. Roe,	Vice-President
Staff present:	Alan M. Day,	General Manager
	Cynthia Lopez,	Office Manager

Call meeting to order
Declare quorum present
Public Comment

Public Comments Proposed Desired Future Conditions for Area Aquifers

No comments were presented.

Public Permit Hearing
Public Comment
a) Non-agenda items
b) Agenda items (1&2)

3. Discussion and possible action of the following Drilling/Operating Permit:

- **One (1) new well for Creek Meadow Partners, LP (BVDO-0207)** located at N 30.529000º W 96.287000º 0.42 miles NNE of the intersection of Greens Prairie Road and Royder Road in Brazos County for Industrial use. Total maximum annual production from the well will be 25 acre feet. The well will produce from the Yegua-Jackson Aquifer. **A motion was made by Tom McDonald, second by Pete Brien to approve the Creek Meadow Partners, LP application for a Drilling/Operating Permit as presented. The motion passed unanimously.**

4. Discussion and possible action of the following Operating Permit Amendments:

- **One (1) existing well for A&F Farms, Inc. #1 (BVOP-0119)** located at N 30.667623° W 96.443274° 0.06 miles SW of the intersection of Pleasant Hill Road and Dobrovolny Road in Brazos County correcting the aquifer of origin. The well produces from the Sparta Aquifer.

- **One (1) existing well for A&F Farms, Inc. #1 (BVOP-0120)** located at N 30.667377° W 96.443165° 0.07 miles SSW of the intersection of Pleasant Hill Road and Dobrovolny Road in Brazos County correcting the aquifer of origin The well produces from the Sparta Aquifer.

- **One (1) existing well for A&F Farms, Inc. #2 (BVOP-0121)** located at N 30.667227° W 96.461370° 0.37 miles E of the intersection of Smetana Road and Julie Circle in Brazos County correcting the aquifer of origin. The well produces from the Sparta Aquifer.

- **One (1) existing well for A&F Farms, Inc. #2 (BVOP-0122)** located at N 30.667006° W 96.461749° 0.36 miles ENE of the intersection of Smetana Road and Julie Circle in Brazos County correcting the aquifer of origin. The well produces from the Sparta Aquifer.

- **One (1) existing well for A&F Farms, Inc. #2 (BVOP-0123)** located at N 30.667083° W 96.461584° 0.37 miles ENE of the intersection of Smetana Road and Julie Circle in Brazos County correcting the aquifer of origin. The well produces from the Sparta Aquifer.

- **One (1) existing well for Sahara Realty Group (BVDO-0024)** located at N 30.634443° W 96.326039° 0.06 miles ESE of the intersection of University Drive E and Tarrow Street E in Brazos County correcting the aquifer of origin. The well produces from the Yegua-Jackson Aquifer.

  A motion was made by Tom McDonald, **second by Kent Watson to approve the correction of aquifers of six (6) Operating Permit Amendments as presented. The motion passed unanimously.**

5. **Adjourn Permit Hearing at 2:10 p.m.**

Call meeting to order
Pledge of Allegiance
Declare quorum present
Public Comment

a) Non-agenda items
b) Agenda items - Darrell S. Peckham, Texas Association of GW Owners & Producers
Charles Ellison, Judge for Robertson County
John M. Fultz, Attorney for Lake Limestone Coves
John Melvin, Brazos Valley Groundwater Rights Association

1. Discussion and possible action on the Minutes from the May 12, 2016 Public Permit Hearing/ Regular Board Meeting. **A motion was made by Pete Brien, second by Bryan F. Russ, Jr., to approve the Minutes from the May 12, 2016 Public Permit Hearing and Regular Board Meeting as presented. The motion passed unanimously.**

2. Review and authorization of payments made for services rendered for the month of May 2016. **A motion was made by David Stratta, second by Mark J. Carrabba to approve the authorization of payments made for services rendered for the month of May 2016 as presented. The motion passed unanimously.**

3. Financial Report. **A motion was made by Pete Brien, second by Mark J. Carrabba to approve the financial reports for the month of May 2016 as presented. The motion passed unanimously.**

4. Discussion and possible action on bids received on the possible renovation and remodeling of the District Office. **No action taken on this agenda item.**

5. Discussion and possible action on proposed amendments to District Rules relating to changes created during the 84th Legislative Session to Chapter 36 of the Texas Water Code. **A motion was made by Pete Brien, second by David Stratta to approve the proposed amendments to the District Rules relating to changes created during the 84th Legislative Session to Chapter 36 of the Texas Water Code. The motion passed unanimously.**

6. Discussion and possible action regarding the location of wells and jurisdiction of the Brazos Valley Groundwater Conservation District related to the following District-issued permits: BVHU-0302, BVOP-0134, BVHU-0303, BVOP-0135. **A motion was made by Mark J. Carrabba, second by Bryan F. Russ, Jr., to approve for the General Manager, acting on behalf of the District, to hire a surveyor for locating the Robertson/Limestone county line and the two (2) Lake Limestone Coves wells with respect to the county line. Monies from both BVGRA ($2,000) and Lake Limestone Coves ($2,000) will be paired with District money to pay for the project. The motion passed unanimously with Kent Watson recusing himself from the discussion and vote.**

7. General Manager's Report

    - Drought Monitor Report
    - Monitoring Well Report
    - Wells permitted pursuant to District Rule 8.3(j)
    - District Activities
    - Management Plan Update

    Alan M. Day, General Manager presented the Board with the above stated reports for the month of May 2016. (see attached reports)

8. Discussion and possible future agenda items.

9. **Adjournment at 4:10 p.m.**

Signed this 14th, day of July, 2016

Mark J. Carrabba

Mark J. Carrabba
Secretary,
BVGCD

The Board of Directors may meet in closed session, pursuant to the Texas Open Meetings Act, Texas Government Code §§ 551.071-551.076, to:

(1) consult with attorney ;
(2) deliberate regarding the purchase, exchange, lease, or value of real property if deliberation in an open meeting would have a detrimental effect on the position of the District in negotiations with a third person;
(3) deliberate a negotiated contract for a prospective gift or donation to the District if deliberation in an open meeting would have a detrimental effect on the position of the District in negotiations with a third person;
(4) to deliberate the appointment, employment, evaluation, reassignment, duties, discipline or dismissal of a Board member or District employee;
(5) to receive information from employees or question employees, but not deliberate public business or agency policy that affects public business; and
(6) to deliberate the deployment or specific occasions for implementation of security personnel or devices.

The Board may also meet in open session on these matters as required by the Texas Open Meetings Act, Texas Government Code § 551.102.

* **Agenda items may be taken out of order at the discretion of the Board Chairman**

Fayette County Groundwater Conservation District

255 Svoboda Lane, Room 115
La Grange, Texas 78945
Telephone: (979) 968-3135
Fax: (979) 968-3194

NOTICE OF PUBLIC HEARING ON PROPOSED DESIRED FUTURE CONDITIONS ADOPTED BY GROUNDWATER MANAGEMENT AREA 12

Notice is hereby given that a public hearing by the Fayette County Groundwater Conservation District will be held on the **11th day of July 2016, at 8:30 a.m.** in the **Fayette County Agricultural Building, 255 Svoboda Lane, Conference Room 104, La Grange, Texas**, at which time the following subjects will be discussed, to wit:

The Fayette County Groundwater Conservation District is currently receiving public comments on the proposed desired future conditions for the area aquifers that were recently adopted by Groundwater Management Area 12 under §36.108, Texas Water Code. Groundwater Management Area 12 includes the groundwater conservation districts as follows: Brazos Valley GCD, Fayette County GCD, Lost Pines GCD, Mid-East Texas GCD, and Post Oak Savannah GCD. The proposed desired future conditions and supporting materials for the area aquifers are available at the District's office at 255 Svoboda Lane, Room 115, La Grange, TX 78945 or on the District's website at www.fayettecountygroundwater.com. The District will hold a public hearing on the proposed desired future conditions on July 11, 2016 at 8:30 a.m., at the Fayette County Agricultural Building, 255 Svoboda Lane, Conference Room 104, La Grange, Texas. Public comments will be accepted by the District through July 20, 2016, at the District office, by mail or email, or at the public hearing. For more information, please call the District at (979)968-3135.

Public Hearing to be held on Monday, July 11, 2016 at 8:30 a.m., in Conference Room 104, located in the Fayette County Agricultural Building, 255 Svoboda Lane, La Grange, Texas, 78945.

Agenda items may be considered, deliberated and/or acted upon in a different order then set forth above.

At any time during the meeting and in compliance with the Texas Open Meetings Act, Chapter 551, Government Code, Vernon's Texas Codes, Annotated, the Fayette County Groundwater Conservation District Board may meet in executive session on any of the above agenda items for consultation concerning attorney-client matters (§551.071); deliberation regarding real property (§551.072); deliberation regarding prospective gifts §551.073 ; personnel matters (§551.074); and deliberation regarding security devices (§551.076). Any subject discussed in executive session may be subject to action during an open meeting.

Fayette County
Groundwater Conservation District

255 Svoboda Lane, Room 115
La Grange, Texas 78945
Telephone: (979) 968-3135
Fax: (979) 968-3194

MINUTES
Of the July 11, 2016
Public Hearing on the Proposed Desired Future Conditions Adopted by Groundwater Management Area 12

Directors Present: Cynthia Rodibaugh, Leo Wick, Sr., Terry Hays, Harvey Hayek, Robert Leer
Directors Absent: None
Others Present: David A. Van Dresar, General Manager; Wendi Denton, Administrative Assistant; Monique Norman, Legal Counsel; Paul Kirby and Andy Donnelly, Daniel B. Stephens & Associates;

The Public Hearing was called to order by President Wick at 8:34 a.m., on July 11, 2016, at the Fayette County Agricultural Building Conference Room 104 located at 255 Svoboda Lane, in La Grange, Texas. A quorum to conduct business was declared to be present.

Mr. Van Dresar informed the board and the public of the purpose of the public hearing and its requirements under Chapter 36 of the Texas Water Code. Mr. Van Dresar stated that the proposed DFCs have been available for public review and comment in the district office beginning April 19, 2016 and that public comments will be received until July 20, 2016. He informed the board that no comments had been received in the office to date. Van Dresar stated that the public hearing was to accept any verbal comments from the public.

There was no public in attendance at the hearing and no public comments were received during the hearing.

Mr. Van Dresar and Mr. Donnelly advised the board on the composition of GMA12 and stated that Fayette County was the smallest district in both GMA 12 and GMA 15.

Mr. Hayek asked about the 77 foot drawdown in the Yegua Jackson. Mr. Donnelly and Mr. Van Dresar stated that the drawdown was modeled based on projected use, growth, and demand. Mr. Hayek asked what the drawdown would be in 200 years. Mr. Donnelly discussed how groundwater modeling work and the factors considered when inputting data into the model.

A discussion ensued about property rights/water ownership, drawdown, and legal concerns.

Mr. Leer asked if the board need to take action regarding the public hearing. Mr. Van Dresar stated that the hearing was for receiving public comments and that all public comments would be compiled and submitted to GMA 12.

Mr. Van Dresar and Mr. Donnelly reviewed and discussed the proposed desired future condition for GMA 12 with the board.

There being no further comments or questions, Mr. Wick closed the public hearing at 8:52 a.m.

Leo Wick, Sr., President

Cynthia Rodibaugh, Secretary Treasurer

LOST PINES GROUNDWATER CONSERVATION DISTRICT
NOTICE OF PUBLIC HEARING
ON PROPOSED DESIRED FUTURE CONDITIONS

TIME, DATE AND LOCATION

The Board of Directors of the Lost Pines Groundwater Conservation District ("District") will conduct a hearing on proposed Desired Future Conditions for the District as follows:

Wednesday, July 20, 2016 – 7:00 p.m.
Bastrop City Hall
1311 Chestnut Street
Bastrop, Texas 78602

PROPOSED FUTURE CONDITIONS FOR THE DISTRICT:

The District is located in Groundwater Management Area 12 as designated by the Texas Water Development Board. The other groundwater conservation districts within Groundwater Management Area 12 are: Brazos Valley Groundwater Conservation District, Fayette County Groundwater Conservation District, Mid-East Texas Groundwater Conservation District, and Post Oak Savannah Groundwater Conservation District.

On April 15, 2006, the groundwater conservation districts within Groundwater Management Area 12 adopted a resolution establishing proposed desired future conditions for the following aquifers located within the District: Sparta, Queen City, Carrizo, Calvert Bluff, Simsboro, Hooper. The proposed desired future conditions for these aquifers are as follows:

PROPOSED DESIRED FUTURE CONDITIONS

Aquifer	Average aquifer drawdown measured from January 2000 through December 2069
Sparta	5 feet
Queen City	15 feet
Carrizo	62 feet
Calvert Bluff	100 feet
Simsboro	240 feet
Hooper	165 feet

COPIES OF RESOLUTION

The Resolution to Adopt Desired Future Conditions for Aquifers in Groundwater Management Area 12 and supporting materials are available for review and copying at the District offices, 908 Loop 230, Smithville, TX 78957, or at the District's website, www.lostpineswater.org.

ADDITIONAL INFORMATION

For additional information, please contact James Totten, District General Manager, at the District offices, 908 Loop 230, Smithville, TX 78957 or by calling 512-360-5088 or e-mailing lpgcd@lostpineswater.org.

WRITTEN AND ORAL COMMENTS

The District will accept written comments on the proposed desired future conditions filed before or at the hearing. In addition, the District will accept oral comments at the hearing. Written comments may be submitted to the District at the District offices 908 Loop 230, Smithville, TX 78957, or by e-mailing them to lpgcd@lostpineswater.org.

Persons with disabilities who plan to attend the public hearing and who may need auxiliary aids or services such as interpreters for persons who are deaf or hearing impaired, readers, large print, or Braille are requested to contact Peggy Campion, Assistant Secretary, at 512-360-5088 at least two (2) work days prior to the agenda, so that appropriate arrangements can be made. Persons who desire the assistance of an interpreter in conjunction with their oral presentation at this district agenda are requested to contact Peggy Campion, Assistant Secretary, at 512-360-5088 at least five (5) days prior to the agenda so that appropriate arrangements can be made.

Date: May 24, 2016

Peggy Campion
Assistant Secretary

<u>SUBJECT TO REVISIONS</u>
Lost Pines Groundwater Conservation District

Board of Directors Agenda Minutes

Wednesday, July 20, 2016

The Board of Directors convened at 7:00 p.m. in a meeting pursuant to public notice having been given, at Bastrop City Hall, Bastrop, Texas. The following members of the Board were present: President, Michael Talbot; Vice-President, Billy Sherrill; Secretary-Treasurer, Doug Prinz; Directors: Alice Darnell, David Fleming, Keith Hansberger, Larry Schatte, Clifton Seidel, Michael Simmang and Carl Steinbach.

Staff members present: Jim Totten, General Manager; Peggy Campion and Dana Goertz.

Consultants present: David Lein, Attorney and Robby Cook, Governmental Relations.

The following members of the public attended the meeting: see attachment one (1).

1. President Michael Talbot called the meeting to order.

2. Welcome and introductions.

3. *Public comments.* Hugh Brown, Lee County landowner, offered comments to the Board.

4. *Review and approval of the minutes of the June 15, 2016 regular Board meeting.* Director Hansberger moved to approve the minutes of the June 15, 2016 regular Board meeting. Director Darnell seconded the motion, which carried unanimously with Director Fleming abstaining.

5. *Public hearing regarding Desired Future Conditions proposed by Groundwater Management Area 12.* President Talbot called to order the public hearing regarding Desired Future Conditions proposed by Groundwater Management Area 12. The Board heard public comments from several members of the public. The Board also received written comments. Comments will be reported to Groundwater Management Area 12 at their next meeting. President Talbot closed the public hearing at 7:36 p.m.

6. *Consideration of and possible action on Desired Future Conditions proposed by Groundwater Management Area 12.* There was no action taken on this item.

7. *Consideration and possible action on application of Aqua Water Supply corporation for the renewal of the Operating Permit for Well No. 58 62 416 (S-8 Well).* Director Fleming recused himself from this agenda item. General Manager Totten explained to the Board that Aqua WSC has requested a renewal of this permit with no changes to be made. Director Hansberger moved to approve the renewal of the operating permit for Well No. 58 62 416 (S-8 Well). Secretary-Treasurer Prinz seconded the motion, which carried unanimously.

8. *Discussion and possible action regarding the process for filling the Board vacancy created by the retirement of Alice Darnell. The vacancy will not be filled at this meeting.* With the upcoming vacancy on the Board, President Talbot offered suggestions to the Lee County Board members in filling said vacancy.

9. *Consideration of the financial report for the period of June 1, 2016 through June 30, 2016.* General Manager Totten presented the financial report. Director Fleming moved to accept the financial report as presented. Director Steinbach seconded the motion, which carried unanimously.

10. *General Manager's Report.* President Talbot next recognized General Manager Totten for presentation of the General Manager's report.

11. *Discussion of Lost Pines Groundwater Conservation District Legislation, related legislation and/or activities occurring that affect or pertain to the District and Groundwater.* Robby Cook gave a legislative update to the Board.

12. *Consideration of conferences, meetings and educational opportunities Board members desire to attend.* There were none at this time.

13. *Consideration of agenda calendar and events.* The next regular meeting of the Board of Directors will be August 17, 2016 in Bastrop, Texas.

President Talbot adjourned the meeting at 7:56 p.m.

Approved:

Michael Talbot, President	Doug Prinz, Secretary-Treasurer

Mid-East Texas Groundwater Conservation District

101 W Main, Suite B22
P O Box 477
Madisonville, TX 77864
Phone: 936-348-3212
Fax: 936-348-3512
Email: david_metgcd@att.net
Website: www.mideasttexasgcd.com

NOTICE OF PUBLIC HEARING TO RECEIVE PUBLIC COMMENTS

PROPOSED DESIRED FUTURE CONDITIONS OF GROUNDWATER MANAGEMENT AREA 12

The Mid-East Texas Groundwater Conservation District (District) will hold a Public Hearing at 6:00 pm, June 28, 2016, at the Madison County Courthouse, JP Courtroom at 101 W Main, Madisonville Texas, for the purpose of receiving public comments on the proposed Desired Future Conditions for the area aquifers that were recently adopted by Groundwater Management Area 12 (GMA 12) under §36.108, Texas Water Code. GMA 12 includes the groundwater conservation districts as follows: Brazos Valley Groundwater Conservation District (GCD), Post Oak Savannah GCD, Lost Pines GCD, Fayette County GCD and Mid-East Texas GCD. The proposed Desired Future Conditions (DFC) and supporting materials for the area aquifers are available at the District's office at 101 W Main, Suite B22, Madisonville Texas, or on the District's website at www.mideasttexasgcd.com. Public comments will be accepted by the District through July 18, 2016 at the District's office, by mail, or email, or at the public hearing. For more information, please contact the District at 101 W Main, Suite B22, Madisonville Texas, or by mail at P O Box 477, Madisonville Texas 77864, by email at david_metgcd@att.net, by fax at 936-348-3512, or by phone at 936-348-3212.

David M. Bailey, Manager

June 8, 2016
Date

MINUTES
MID-EAST TEXAS GROUNDWATER CONSERVATION DISTRICT
DIRECTORS MEETING/PUBLIC HEARING
June 28, 2016, 6:00 PM
Madisonville, Texas

Members present:
John Fryer, President
George Holleman, Vice President
Elyse Schill, Director
Clark Osborne, Director
Jim Nash, Director
Matt Way, Director
John Alford, Director

Also present:
David Bailey, General Manager
Brandon Gastell

The Public Hearing portion of the meeting to receive public comments for the 2016 proposed Desired Future Conditions for aquifers managed by the District was called to order by Pres. Fryer at 6:00 pm.

After a brief description of the proposed Desired Future Conditions (DFC), the floor was open for public comments. No comments were offered. The Public Hearing portion of the meeting was adjourned at 6:02 pm.

The regular Board meeting portion of the meeting was then called to order by Pres. Fryer at 6:03 pm.

The minutes of the Directors Meeting held on April 26, 2016 were then reviewed. A motion was made by Dir. Osborne to approve the minutes as written. Motion was seconded by Dir. Alford and the motion passed unanimously.

The floor was open for public comments by Pres. Fryer. No comments were offered.

The next agenda item was to hear and consider public comments received during the Public Hearing portion of the meeting regarding the 2016 Proposed DFC's for the District. No comments were offered therefore no action was taken. The deadline for receiving written comments is July 18, 2016 therefore any comments received by that date will be summarized and provided by the District to Groundwater Management Area 12.

Next, the Board reviewed the District's Investment Policy in its entirety. After a review and upon a recommendation from the District's Investment Officer David Bailey, a motion was made to make no changes or amendments to the current Investment Policy. A motion to that effect was offered by Dir. Way with a second to that motion from Dir. Schill. The motion passed unanimously upon a called vote by Pres. Fryer.

The Board then reviewed and considered two (2) proposals for a web-based data management system for the District. The proposals submitted were from Collier Consulting, Inc. and Halff and Associates. After review and upon a recommendation by staff the Board voted to approve to accept the proposal offered by Halff and Associates pending a review by Greg Ellis, the District's attorney to ensure that the wording of the contract to Halff is in the best interest of the District. Once a review of the contract documents is completed by Mr. Ellis and he as cleared any legal issues associated with the documents, the Executive Committee will then convene to sign any necessary forms needed to enter into this agreement with Halff & Associates for a data-base management system for the District. A motion to this effect was offered by Dir. Alford and this motion was seconded by Dir. Way. Upon a called vote by Pres. Fryer, all present voted in the affirmative.

Manager's Report was then submitted by David Bailey, General Manager of District activities since April 26, 2016. Highlights of the report are listed below:

- Attendance as the voting member of Groundwater Management Area 12 at the Region H Water Planning Group meeting held in Conroe on May 4, 2016.
- Presentation provided to Madison County 7th graders at Ag Day sponsored by the Madison County Farm Bureau on May 13, 2016.
- Attended the Texas Alliance of Groundwater Districts regular meeting held in Austin on May 18-19, 2016.
- Completed a refresher course for Public Funds Investment Act training provided by the Texas Alliance of Groundwater Districts in Austin on May 18, 2016.
- Upcoming events: TAGD Finance Committee meeting via teleconference – 7/13/2016; Region H WPG meeting, Conroe – 8/3/2016; Deadline to receive written comments on 2016 proposed DFC's – 7/18/2016; 5th Annual Groundwater Summit sponsored by TAGD in San Marcos – 8/23-25/2016.
- Also provided to the Board was a Texas Commission of Environmental Quality (TCEQ) report of a groundwater contamination issue in Dew, Texas in Freestone County at a site owned by Dew Cemetery Association at 879 South Highway 75. Contaminates found at a sampling depth of 20 feet were gasoline (benzene). This site was previously used as a gas station and this contamination is likely from a leaking gasoline storage tank. This report was provided to the board for information purposes along with an updated report of a contamination issue found in shallow monitoring wells at Luminant's Big Brown Steam Electric Station in Freestone County. Contaminates found in two (2) monitoring wells there were selenium in one well and cadmium in another. Both contamination issues are now being investigated by TCEQ and remedies have been suggested.

The Board then reviewed the financial reports and agreed that the reports were in order and that all payments were justified. A listing of the bills approved for payment is attached. The bills and financial records as presented were approved with a motion by Dir. Schill. Motion was seconded by Vice Pres. Holleman and motion passed unanimously. In addition, a request was made to cancel the phone at the Centerville office to reduce costs as it is deemed to be not needed. This action will be taken as soon as the current contract term has expired.

The date, time and place of the next meeting were tentatively set for **Tuesday, August 16, 2016 at 6:00 PM in Centerville**.

With no further business the meeting was adjourned at 6:36 pm.

Minutes approved by the Board of Directors (date) August 16, 2016

Secretary

William Parten

Vice President

George Holleman

Post Oak Savannah Groundwater Conservation District

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

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

NOTICE OF PUBLIC HEARING TO RECEIVE PUBLIC COMMENTS

PROPOSED DESIRED FUTURE CONDITIONS OF GROUNDWATER MANAGEMENT AREA 12

The Post Oak Savannah Groundwater Conservation District (District) will hold a **Public Hearing** at **5:30 pm, July 12, 2016**, at the District's temporary office at 309 E Ave. C, Milano, Texas, for the purpose of receiving public comments on the proposed Desired Future Conditions for the area aquifers that were recently adopted by Groundwater Management Area 12 (GMA 12) under §36.108, Texas Water Code. GMA 12 includes the groundwater conservation districts as follows: Brazos Valley Groundwater Conservation District, Fayette County Groundwater Conservation District, Lost Pines Groundwater Conservation District, Mid-East Texas Groundwater Conservation District, and Post Oak Savannah Groundwater Conservation District. The proposed Desired Future Conditions and supporting materials for the area aquifers are available at the District's temporary office at 309 E Ave. C, Milano, Texas, or on the District's website at www.posgcd.org. Public comments will be accepted by the District through **July 18, 2016** at the District's temporary office, by mail, or email, or at the public hearing. For more information, please contact the District at 309 E. Avenue C, Milano, Texas, or by mail at P.O. Box 92, Milano, Texas, 76556, by email at admin@posgcd.org, by fax at 512-455-9909, or by phone at 512-455-9900.

Post Oak Savannah Groundwater Conservation District
Public Hearings and Board of Directors Meeting
POSGCD District Offices
309 East Avenue C
Milano, TX 76556
July 12, 2016 – 5:30 p.m.

MINUTES

Directors Present
Nathan Ausley
Kerry Starnes
Bob Ware
Steven Wise
Tommy Tietjen
Durwood Tucker
Bob Wilson
Lee Alford
Sidney Youngblood

Directors Absent
Jay Wilder

Staff Present
Gary Westbrook
Bobby Bazan
Elaine Gerren

Others Present	**Entity**
Barney Knight	Knight & Partners
Steve Young	Intera
Pat Riley	Blue Water Systems
Ross Cummings	Blue Water Systems
Mike Irlbeck	EPCOR Water
Becky Goetsch	Self
Gabbo Goetsch	Self
Rosa Lee Perry	Self
John W. Perry	Self
Kodi Sawin	Self
Donald Schuerman	Self
Mike Korneagy	Self
Melanie Jeul	Self
David McCleran	CTS America
Lauren Ice	SOS/Landowner Representative
Bill Graham	Rancher
Ronny Coleman	Rancher
Curtis Chubb	Landowner
Shawna Fitzsimmons	Sledge Law Group LLC
Pamela Hornby	Landowner
Judith McGeory	Farm & Ranch Freedom Alliance
Phyllis C. Waring	Self
Dave Barkermeyer	Milam County Judge
Sidney Zgabay	Self
Harry Jordan	Self

BOARD MEETING

1. **Call to Order and establish quorum**
   The meeting was called to order and a quorum established at 5:30 p.m. by Board President, Nathan Ausley.

2. **Public Hearings on Proposed Desired Future conditions for GMA 8**
   President Nathan Ausley opened the Public Hearing at 5:30 pm. Steve Young with Intera gave a summary of the proposed DFC's for the GMA 8. President Nathan Ausley asked for public comment. No public comment was heard. President Nathan Ausley closed the Public Hearing at 5:33 pm

3. **Public Hearings on Proposed Desired Future Conditions for GMA 12**
President Nathan Ausley opened the Public Hearing at 5:33 pm. Steve Young with Intera gave a summary of the proposed DFC's for the GMA 12. Curtis Chubb asked for clarification and explanation on DFC values. Dr. Young responded. Director Wise asked for clarification on the content of the proposed DFCs. Dr, Young responded. President Nathan Ausley asked for public comment. No public comment was heard. President Nathan Ausley closed the Public Hearing at 5:40 pm

4. **Public Hearings on Proposed Rules**
President Nathan Ausley opened the Public Hearings at 5:40 pm. Barney Knight with Knight & Partners commented that most of the proposed rule changes were due to changes in Chapter 36, with a few additions to this. GM Westbrook reported the District had exceeded posting requirements for these hearings, that proposed changes to the Rules had been available by request and on the District's website in excess of the required time, and offered a printed copy of the recommended amendments to anyone present. President Ausley noted all of these amendments had been covered and discussed at the Board's previous meeting May 10, 2016. President Nathan Ausley asked for public comment. No public comment was heard. President Nathan Ausley closed the Public Hearing at 5:41 pm

5. **Testimony before Senate Committee on Agriculture, Water and Rural Affairs of June 20,2016**
President Nathan Ausley opened item # 5 and stated there was a request to address the Board on this item. Ronnie Coleman, Milam county Landowner, voiced appreciation to the Board for the opportunity to address them with concerns, and introduced Lauren Ice, representing Milam/Burleson County Landowners. Ms. Ice said she was an attorney with Save Our Springs Alliance, and stated there were many landowners who were not happy with the testimony that General Manger Gary Westbrook had given before the Senate Committee on Agriculture, Water and Rural Affairs. Ms. Ice stated she desired to ask questions of the Board to receive answers. Mr. Knight stated this was not appropriate. President Ausley called the meeting to order and noted that Board members would hear Ms. Ice's comments, and then ask either her or Mr. Westbrook questions. He then asked Ms. Ice to continue. In her statements Ms. Ice stated Mr. Westbrook had explained the current process and how Modeled Available Groundwater (MAG) was used as a cap in Regional Water Planning, and he had lobbied the Senate Committee to change the MAG in favor of Water Marketers, and he had encouraged the Texas Water Development Board to change the way MAG is addressed and used in their rules which govern regional planning. She then stated Mr. Westbrook and the Board did not understand the importance of MAG in protection of the aquifers of the District. She then stated Mr. Westbrook explained to the Senate Committee how Post Oak Savannah works around the MAG and the MAG is the suggested maximum allowed for permitting for a GCD. Ms. Ice then criticized the Board for the District's reputation as, "approve all permits requested." She then stated the testimony of Mr. Westbrook is not the words of a general manager working to protect the aquifers of the District, and the group requests the Board dismiss him from his position.

President Ausley then recognized Judith McGeory, Milam County Landowner, who voiced her disagreement with the testimony that General Manger Gary Westbrook presented and stated that his comments represented the Board and that she felt that his testimony was not representative of the best interest of the citizens of Milam and Burleson counties.

President Ausley then recognized Dr. Steve Young of Intera, District hydrologist, who clarified how the MAG was derived and the role of MAG as a tool to be used for evaluations by GCD, but not as a cap for permitting. He then clarified the current role of MAG as a cap for planning at the regional planning groups.

President Ausley asked if any of the Board had questions for either Ms. Ice or Mr. Westbrook. Director Wise asked Mr. Westbrook for clarification about the use of MAG in his testimony. Mr.

Westbrook answered by quoting language of Chapter 36.1132(a) concerning the use of MAG in permitting decisions by a GCD. Ms. Ice argued this was not correct. Mr. Westbrook reminded he was invited specifically to testify on the issue of the Desired Future Condition process and the use of MAG in regional water planning, and to contrast how Post Oak Savannah utilized MAG in management of groundwater resources in the District. He then gave examples of issues which had arisen at the Brazos Region G during the latest round of planning, and noted these issues were happening across the state, which was the reason for the panel. He also noted there were other panels testifying that day on other aspects of issues in state water planning. He further stated his efforts were directed toward describing and explaining the issues incurred, and requesting that if any changes in use of MAG for regional planning were developed, it be referred back to either the affected GMA or GCD.

Barney Knight then commented that his understanding of Mr. Westbrook's testimony was that it was professional and well done. Generally stated, Mr. Westbrook simply encouraged work be done to resolve the conflict between how MAG is defined for planning purposes and how it is defined for management purposes. Knight mentioned it was unusual to require planning be done using one definition and the use of that plan be done using a different definition. He said that his understanding of Mr. Westbrook's comments was the inconsistency should be resolved and that such resolution should be made by the TWDB or other agency and preserve the local control and management of groundwater conservation.

President Ausley asked if any other Board members had questions. With no response, President Ausley moved to the next item on the agenda.

6. **Public Comment**

President Ausley asked for public comment.

Sydney Zgabay stated he was concerned because Alcoa was splitting their land into 3 parcels so that they can sell it and the water rights. He also stated that he wanted the larger wells in his area to be placed in strategic locations and not all so close together in one area.

Judith McGeory voiced concern that we will not be able to reach the desired future conditions and that maybe what the Board should do is redistribute the permits that are not being used.

Director Steven Wise voiced concern with the perception of those present that this Board does not care about the Citizens of Milam and Burleson Counties. He stated that every Member of the Board has a vested interest in these counties, and that the most important thing is the level of the aquifers, and not necessarily the MAG or amounts permitted. He also stated that it is not and has never been the Board's intention to drain the aquifers. He stated he had watched the general manager's testimony and did not see any lobbying.

Milam County Judge Dave Barkemeyer stated that the Directors are appointed according to the State Legislature Laws. He also stated that the directors have been rotated with the exception of Mr. Starnes who was on the original Board. He said he believed the Board's intentions are to preserve the aquifers of the District, and that the citizens of Milam county need to be careful how they proceed so as not destroy what we have, and loose local control, and to remember that the Legislature is often swayed by Metropolitan Areas.

Andrew Hovorak a Burleson County land owner voiced his concern and that he felt the Mr. Westbrook's testimony was an effort to lobby for and facilitate more water for Water Marketers. He also stated he did not want to see efforts which would lead to losing local control.

Ronnie Coleman said he felt the Board wanted to give away more water and that they did not represent the interest of the Milam and Burleson county landowners. He said actions speak louder than words, and water is needed for economic development of Milam County.

Mike Kornegay a Milam county landowner stating he did not hear a problem with Mr. Westbrook's testimony until the end, and then there was a lobbying effort to come up with more water for Region G. He reminded the Board the name of the District has conservation in it.

David McClaren stated he believes the Board is made up of great people, and it seems Mr. Westbrook does more speaking outside of the District and should do more speaking within the District. He stated the board should clarify what is appropriate for Mr. Westbrook to say when he represents the Board.

No further comment was offered.

7. Minutes of May 10, 2016 Board Meeting
A motion was made by Director Lee Alford to approve the minutes of the May 10, 2016 Board meeting with the exception of 2 Typographical errors being corrected. The motion was 2nd by Director Kerry Starnes. The motion passed unanimously.

8. Proposed Desired Future Conditions GMA 8
Board President Nathan Ausley opened item # 8. After discussion, a motion was made by President Nathan Ausley to adopt the Proposed Desired Future Conditions for GMA8. The motion was 2nd by Director Tommy Tietjen. The motion carried unanimously.

9. Proposed Desired Future Conditions GMA 12
Board President Nathan Ausley opened item # 9. After discussion, a motion was made by Director Tommy Tietjen to adopt the Desired Future Conditions for GMA12. The motion was 2nd by Director Durwood Tucker. The motion carried unanimously.

10. District Rules
Board President Nathan Ausley opened item # 10. After discussion, a motion was made by Director Bob Wilson to approve the recommended amendments to the District Rules as presented and posted. The motion was 2nd by Director Durwood Tucker. The motion carried unanimously.

11. Board Policies
Board President Nathan Ausley opened item # 11. GM Westbrook explained the need for the amendment having risen from an unforeseen addition to the Board Policies at the May 10, 2016 Board Meeting. After discussion, a motion was made by Director Tommy Tietjen to approve the Board Policies as presented. The motion was 2nd by Director Robert Ware. The motion carried unanimously.

12. Groundwater Conservation Grant Contract with HDU Services
General Manager Gary Westbrook commented that since there was language that had to be added to their Board Policies, there was a delay in getting this contract executed within the required 30 days. After discussion, a motion was made by President Nathan Ausley to waive the 30 day requirement and to accept their grant contract. The motion was 2nd by Director Durwood Tucker. The motion carried unanimously.

13. **Rescind and cancel the 2014 amendments of the following Historic Use Production Permits for which Holland Porter was listed as the Permittee: (a) Historic Certificate # POS-HUP-0204; (b) POS-HUP-0205; (c) POS-HUP-0206; and (d) POS-HUP-0207.**
GM Westbrook reviewed the facts at issue, and noted that all parties were in agreement this resolution was acceptable, and this could be handled by this and the next two agenda items. After discussion, a motion was made by Robert Ware to rescind and cancel the prior amendments made to these four listed permits. The motion was 2nd by director Kerry Starnes. The motion carried unanimously.

14. **Transfer and amend the following Historic Use Production Permits, as originally issued to Holland Porter, Permittee (a) Historic Certificate # POS-HUP-0204; (b) POS-HUP-0205; (c) POS-HUP-0206; and (d) POS-HUP-0207, to MSP/JHP Properties, Ltd. as the Permittee.**
After discussion, a motion was made by Director Robert Ware to amend these four listed permits to state the name of the Permittee as MSP/JHP Properties, LTD. The motion was 2nd by President Nathan Ausley. The motion carried unanimously.

15. **Rescind and terminate the following now expired permits issued to Anadarko E & P Onshore, LLC: (a) POS-O&G-0086; (b) POS-O&G-0087; (c) POS-O&G-0088; and (d) POS-O&G-0089.**
After discussion, a motion was made by Robert Ware to Rescind and terminate these four listed permits. The motion was 2nd by Director Tommy Tietjen. The motion carried unanimously.

16. **Negotiate and Execute Contract with EBCO Development for General Contractor services**
Director Robert Ware presented a review of the Building Committee work to date. He then outlined recommendations to the Board from the committee for the building remodel. Director Sidney Youngblood added information for the Board to consider. After discussion, Director Ware moved the Board approve EBCO Development as the District's General Contractor, and approve the contract with revisions for the remodel to total $ 233,718.00, and to add the amount of $ 24,565.00 for the concrete driveway in the front of the building, as described in the document. The motion was 2nd by Director Durwood Tucker. The motion carried unanimously. A motion was made by Director Bob Wilson to approve and include in the contract $ 7,000.00 for the crushed stone parking pad in the rear of the building. The motion was 2nd by Director Tommy Tietjen. The motion carried unanimously. It was estimated the remodel would start within 30 days and should be complete within 4 months.

17. **Texas Counties Districts Retirement System Plan**
GM Westbrook explained the requirement to renew this plan, and the recommendation from the District's Financial Officer, Steven Wise, to reduce the District's participation to the recommended rate necessary to bring the District participation back into balance with the amount needed at renewal. A motion was made by President Nathan Ausley to reduce our TCDRS participation back to the required amount, and renew the plan at the next renewal date. The motion was 2nd by Director Tommy Tietjen. The motion carried unanimously.

18. **Joint planning process and Desired Future Conditions (DFCs), groundwater resources in the District, and future process for evaluating District DFCs for Groundwater Management Area 12 (GMA 12) and Groundwater Management Area 8 (GMA 8)**
Director Steven Wise reviewed recent discussions with GM Westbrook concerning possible considerations of the District's management strategies. After discussion of possible studies to be reviewed, no action was taken.

19. Receive report from District Manager on recent District activities and take appropriate actions.

A. Permit applications filed with the District and Hearing Dates; Emergency Permits Granted
GM Westbrook reported no applications were filed which require a hearing.

B. Well Drilling activities: registrations, applications, completions, plugging, inspections
GM Westbrook reported 9 registrations, 11 new applications, 7 completions, 0 plugging, 2 Wells inspected since the last meeting..

C. Recent and future District presentations and activities

1. Lone Star Healthy Streams: Little River May 24, 2016
General Manager, Gary Westbrook advised the Board that he and Bobby Bazan, District Water Resource Management Specialist, provided discussion of the District's management at this meeting in Cameron, and Director Wise was present for their discussion.

2. Texas Alliance of Groundwater Districts quarterly meetings of May 18-19, 2106
General Manager Gary Westbrook reported he and that Bobby Bazan attended this meeting

3. Texas Aquifer Conference June 9, 2016
General Manager Gary Westbrook reported he and Bobby Bazan attended this meeting, and gave a brief description of the agenda items covered.

4. Milam and Burleson Counties Groundwater Summit of August 11, 2016
General Manager Gary Westbrook stated that the Summit would be from 9 to 4 and reviewed the itinerary, which had been e-mailed to the Directors. He also discussed the District's policy for sponsors and display space at the event.

5. Texas Alliance of Groundwater Districts Groundwater Summit of August 23-25. 2016
General Manager Gary Westbrook stated that he and Bobby Bazan would attend as well as Director Durwood Tucker and President Nathan Ausley

6. Milam County Ag in the Classroom
General Manager Gary Westbrook stated that Bobby Bazan presented to Approximately 320 students and this educational presentation was very informative and that the participation was excellent. Director Tucker was also in attendance and complimented Mr. Bazan as well.

7. District Education Programs
General Manager Gary Westbrook updated the Directors on recent education efforts and activities.

8. District Website
General Manager Gary Westbrook advised the Board the recent work on the website was complete.

20. Bills received, current financial status, Investment Officer Report.
After discussion, a motion was made by Director Kerry Starnes to approve payment of bills. The motion was 2nd by Director Sidney Youngblood. The motion passed unanimously.

21. Dates, locations, and times of future meetings.
President Ausley announced the next regularly scheduled meeting, if needed, would be August 9, 2016 at 5:30 pm located at the District Office.

22. Adjourn Board Meeting
President Ausley adjourned the meeting at 7:11 p.m.

THE ABOVE MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS OF THE POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT HELD ON JULY 12, 2016 WERE APPROVED AND ADOPTED BY THAT BOARD ON AUGUST 9, 2016.

Nathan Ausley, President

Attest:

Kerry Starnes, Secretary/Treasurer

Date 8/9/16

APPENDIX D

DOCUMENTATION OF GMA 12 BOUNDARY AMENDMENT IN BRAZOS VALLEY GCD

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cwh 12-16-2013
RECEIVED
12-16-2013
AmD 12-16-2013

Texas Water Development Board

P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

November 25, 2013

Mr. Alan M. Day
General Manager
Brazos Valley Groundwater Conservation District
P.O. Box 528
Hearne, Texas 77859

Re: Request to Amend Groundwater Management Area Boundaries

Dear Mr. Day,

We received your request dated September 10, 2013, to amend the boundaries of Groundwater Management Areas 12 and 14 pursuant to 31 Texas Administrative Code (TAC) §356.22. Based on staff technical and administrative review of the request and supporting documentation, I approve the request and direct my staff to make the necessary changes to the data files as described in TAC §356.21.

By copy of this letter, and in compliance with TAC §356.22(c), I am also informing the affected districts and the technical coordinators of both groundwater management areas of this action. Please contact Mr. Larry French (512-463-5067) of my staff if you have any questions regarding this action.

Sincerely,

Kevin Patteson
Executive Administrator

Cc: Kathy Turner Jones, Lone Star Groundwater Conservation District (GMA 14)
Gary Westbrook, Post Oak Savannah Groundwater Conservation District (GMA 12)
Monique Norman
Robert Mace, Ph.D., P.G.,
Larry French, P.G.

Alan Day

From:	Larry French <Larry.French@twdb.texas.gov>
Sent:	Tuesday, December 10, 2013 3:53 PM
To:	Alan Day
Cc:	Gary Westbrook (gwestbrook@posgcd.org); kjones@lonestargcd.org; norman.law@earthlink.net; Robert Mace
Subject:	TWDB Approval of GMA 14/12 Boundary Change Request
Attachments:	TWDB Approval of GMA 14-12 Boundary Change Request.pdf

Alan,

Please see attached letter of approval from the TWDB Executive Administrator concerning the request to adjust the boundary of GMA 12 and 14. The original is being mailed to you.

Please.let me know if you have any questions.

Larry

Larry French, P.G.

Director, Groundwater Resources Division

Texas Water Development Board

P.O. Box 13231
1700 North Congress Avenue
Austin, Texas 78711-3231
512-463-5067
larry.french@twdb.texas.gov
www.twdb.texas.gov/groundwater

Alan Day

From: Joe Reynolds <Joe.Reynolds@twdb.texas.gov>
Sent: Wednesday, September 18, 2013 4:21 PM
To: Alan Day
Cc: Larry French; Sandy Kaiser
Subject: GMA Boundary Amendment Request

Follow Up Flag: Follow up
Flag Status: Completed

Mr. Day,

I am the attorney assigned to review your request of September 10, 2013 to amend the boundaries of Groundwater Management Areas 12 and 14. I have forwarded your request to Larry French, Director of Groundwater Resources, for a technical review.

TWDB rules provide that, if the proposed change involves only an administrative adjustment or correction to the boundary data files that constitute the official description of the GMA boundaries, the executive administrator instructs TWDB staff to make the change and notify the districts. If the proposed change involves a substantive change to the boundaries of a groundwater management area, the request will be presented to the TWDB board for authorization to make the change through a rulemaking. Thus, the timing of any TWDB action will depend on how staff characterizes the requested change.

We will let you know as soon as we have a determination. If you have any questions, please feel free to contact Larry at 512.463.5067 or me at the number below.

Joe P. Reynolds
Attorney
Texas Water Development Board
Direct: 512.936.2414
Fax: 512.475.2053
Joe.reynolds@twdb.texas.gov

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(Please Print Clearly) Box 13231
Austin TX 78711
Robert Mace, Dr.
GMA12-14

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PS Form 153, January 2005

(See Reverse)

september 10, 2013

BRAZOS VALLEY GROUNDWATER
CONSERVATION DISTRICT
P.O. BOX 528 · HEARNE, TX 77859 · (979)279-9350 · FAX: (979)279-0035
WWW.BRAZOSVALLEYGCD.ORG

September 10, 2013

Dr. Robert Mace
Interim Executive Administrator
Texas Water Development Board
PO Box 13231
Austin, Texas 78711-3231

Dear Dr. Mace,

Enclosed is the required background documentation for the Brazos Valley Groundwater Conservation District's request to amend the boundaries of Groundwater Management Areas 12 and 14 pursuant to 31 Texas Administrative Code 356.22.

We appreciate your consideration of this request. Please contact me if you have any questions concerning this matter.

Best regards,

Alan M. Day
General Manager, BVGCD
979-279-9350 (Office)
817-774-6412 (Cell)
aday@brazosvalleygcd.org

MONIQUE NORMAN
ATTORNEY AT LAW

P.O. BOX 50245
AUSTIN, TEXAS 78763

512.459.9428
FAX 512.459.8671
NORMAN.LAW@EARTHLINK.NET

September 10, 2013

Dr. Robert Mace
Interim Executive Administrator
Texas Water Development Board
P.O. Box 13231
Austin, TX 78711-3231

Re: Request to Amend Groundwater Management Area Boundaries

Dear Dr. Mace:

The Brazos Valley Groundwater Conservation District submits this request to amend the boundaries of Groundwater Management Areas 12 and 14 pursuant to 31 Texas Administrative Code §356.22. The Brazos Valley GCD is made up of the entirety of Brazos and Robertson counties. Almost all of the Brazos Valley GCD is contained in Groundwater Management Area 12, except for the bottom tip of Brazos County, which is currently in Groundwater Management 14. The Brazos Valley GCD seeks to have its district entirely in GMA 12. All of the groundwater districts that comprise GMA 12 and GMA 14 have agreed to the requested boundary change.

Groundwater Management Area 12 includes all of the Brazos Valley GCD, except for approximately 19 square miles of the southeastern tip of Brazos County. According to LBG-Guyton Associates, the Brazos Valley GCD's hydrologists:

> the Catahoula Sandstone, the basal unit of the Gulf Coast Aquifer, occurs in the very southern part of Brazos County under about 1.3 percent of the Brazos Valley Groundwater Conservation District area that encompasses Brazos and Robertson Counties. The aquifer provides small amounts of water to a limited number of wells no greater than 250 feet deep. Its contribution to the overall groundwater supply within the Brazos Valley Groundwater Conservation District is de minimis. The Catahoula Sandstone is a groundwater supply of some significance in the counties to the south of Brazos County where the aquifer is deeper and can support wells with high pumping rates.

The Brazos Valley GCD does not have any permitted wells in that area. The geographic and hydrogeologic conditions require that Brazos County be wholly contained in GMA 12.

Please find enclosed the required resolutions and a copy of the related notice and minutes of the public meetings held to discuss and take action on the resolutions to amend the groundwater management area boundaries.

Sincerely,

Monique Norman

A RESOLUTION OF GROUNDWATER MANAGEMENT AREA 14 REGARDING THE REASSIGNMENT OF THE BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT IN BRAZOS COUNTY TO GMA 12

WHEREAS, groundwater conservation districts are charged by the Texas Legislature with providing for the conservation, preservation, protection, and prevention of waste of groundwater, and of groundwater resources under §36.0015, Tex. Water Code;

WHEREAS, groundwater conservation districts are required by §36.108 et seq., Tex. Water Code, to meet with the other groundwater districts within its Groundwater Management Areas, as appointed by the Texas Water Development board, for joint planning;

WHEREAS, not later than September 1, 2010, and every five years thereafter, the groundwater districts within Groundwater Management Area 14 ("GMA 14") are required to collectively establish desired future conditions for the relevant aquifers within GMA 14 using groundwater availability models and other data;

WHEREAS, the Brazos Valley Groundwater Conservation District ("BVGCD"), which consists of Brazos and Robertson counties, is entirely within Groundwater Management Area 12, except for a small land area in the southern tip of Brazos County that comprises only approximately 19 square miles that is in GMA 14, which is only 1.3 percent of BVGCD's land area.

WHEREAS, the Brazos Valley Groundwater Conservation District ("BVGCD") does not have any permitted wells in Brazos County in the GMA 14 designated area;

WHEREAS, according to LBG-Guyton Associates, BVGCD's hydrologists: the Catahoula Sandstone, the basal unit of the Gulf Coast Aquifer, occurs in the very southern part of Brazos County under about 1.3 percent of the Brazos Valley Groundwater Conservation District area that encompasses Brazos and Robertson Counties. The aquifer provides small amounts of water to a limited number of wells no greater than 250 feet deep. Its contribution to the overall groundwater supply within the Brazos Valley Groundwater Conservation District is de minimis. The Catahoula Sandstone is a groundwater supply of some significance in the counties to the south of Brazos County where the aquifer is deeper and can support wells with high pumping rates.

WHEREAS, the Brazos Valley Groundwater Conservation District requests that the Texas Water Development Board reassign the small part of BVGCD's district that is in GMA 14 to GMA 12; and

WHEREAS, the District finds no compelling hydrogeological reason for the Brazos Valley Groundwater Conservation District to be included in GMA 14.

NOW, THEREFORE, BE IT ORDERED BY GROUNDWATER MANAGEMENT AREA 14 THAT:

> **Groundwater Management Area 14 hereby supports the reassignment of the portion of the Brazos Valley Groundwater Conservation District in Brazos County that is currently in Groundwater Management Area 14 to Groundwater Management Area 12 by the Texas Water Development Board.**

PASSED AND APPROVED this 24th day of April, 2013.

GROUNDWATER MANAGEMENT AREA 14's DISTRICT REPRESENTATIVES:

Zach Holland

Bluebonnet Groundwater Conservation District

Brazoria County Groundwater Conservation District

Brazos Valley Groundwater Conservation District

Lone Star Groundwater Conservation District

Bill Jacobs

Lower Trinity Groundwater Conservation District

John M. Martin

Southeast Texas Groundwater Conservation District

APPENDIX E

SEPTEMBER 20, 2017 PRESENTATION "GMA 12 TWDB CLARIFICATIONS AND ASSUMPTIONS UPDATE "

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GMA 12

TWDB Clarifications and Assumptions Update

by

GMA 12 Consultant Team

September 20, 2017

TWDB Request

- On July 25 and September 11 the TWDB sent request for clarifications and assumptions for each of the three GAMs being used to calculate MAGs
- Six items for Carrizo-Wilcox/Queen City/Sparta
- Six items for Yegua-Jackson
- Five items for Brazos River Alluvium

Items 1 and 2

- Calculated drawdowns for the Simsboro and Hooper Aquifers were greater than specified variances for Lost Pines GCD
- Calculated drawdowns for the Carrizo and Sparta Aquifers were greater than the specified variances for Fayette County GCD

Lost Pines GCD

- Calculated drawdowns for Simsboro and Hooper exceeded specified variances of 5% (Simsboro) and 10% (Hooper)
- Required a reduction in pumpage in PS-10 to get LPGCD drawdowns within the specified variances
- New pumpage file is called PS-12
- No pumpage outside of LPGCD was changed
- Calculated drawdowns in other GCDs all remained within stated variances

Approved DFCs

GCD/County	Sparta	QC	Carrizo	Calvert	Simsboro	Hooper
Brazos Valley GCD	12	12	61	125	295	207
Fayette County GCD	47	64	110	--	--	--
Lost Pines GCD	5	15	62	100	240	165
Mid-East Texas GCD	5	2	80	90	138	125
ND Falls	--	--	--	--	-2	27
ND Limestone	--	--	--	11	50	50
ND Navarro	--	--	--	-1	3	3
ND Williamson	--	--	--	-11	47	69
Post Oak Savannah GCD	28	30	67	149	318	205

DFCs are in feet of drawdown from 2000 to 2069

TWDB Calculated Drawdowns

GCD/County	Sparta	QC	Carrizo	Calvert	Simsboro	Hooper
Brazos Valley GCD	12.5	12.5	60.5	125.6	295.9	208.5
Fayette County GCD	56.4	70.3	122.2	164.1	275.9	282.3
Lost Pines GCD	4.4	16.2	68.3	110.2	257.0	184.6
Mid-East Texas GCD	0.5	-3.2	80.6	89.9	138.2	125.6
ND Falls	--	--	--	--	-1.7	27.5
ND Limestone	--	--	--	11.1	50.6	53.2
ND Navarro	--	--	--	-0.8	3.3	2.7
ND Williamson	--	--	--	-11.0	47.0	68.7
Post Oak Savannah GCD	28.6	29.9	66.6	149.6	324.7	208.2

DFCs are in feet of drawdown from 2000 to 2069

Differences for LPGCD

- Simsboro DFC = 240 feet
- Simsboro drawdown = 257.0 feet
- Difference = 17 feet or 7.1%

- Hooper DFC = 165 feet
- Hooper drawdown = 184.6 feet
- Difference = 19.6 feet or 11.9%

Solution for LPGCD

- Pumpage in Simsboro and Hooper was reduced in order to reduce drawdowns so that they fell within specified variances
- Simsboro pumpage was reduced by 12% in the last decade of the simulation
- Hooper pumpage was reduced by 50% for the entire predictive portion of the simulation

Differences with PS-12 for LPGCD

- Simsboro DFC = 240 feet
- Simsboro drawdown = 250.7 feet
- Difference = 10.7 feet or 4.5%

- Hooper DFC = 165 feet
- Hooper drawdown = 181.1 feet
- Difference = 16.1 feet or 9.8%

LPGCD Summary

- Pumpage in LPGCD had to be reduced to meet stated variances
- Well file was sent to TWDB to confirm that the results all fell within stated variances
- MAGs for the Simsboro and Hooper will be reduced for the LPGCD

Fayette County GCD

- Calculated drawdowns for Sparta and Carrizo exceeded specified variance of 10%
- Reason for discrepancy was that the TWDB calculated drawdowns for these aquifers <u>only</u> within GMA 12
- Clarification in Attachment B of the DFC resolution will correct this issue

The Sparta, Queen City, and Carrizo aquifers are present and used in all GCDs within GMA 12. Therefore, all GCDs submitted DFCs for these aquifers. The Calvert Bluff, Simsboro, and Hooper aquifers are present in all GCDs but not used in Fayette County. Therefore, GMA 12 declared these aquifers not relevant for Fayette County, and Fayette County GCD did not submit a DFC for these aquifers. For the purpose of establishing DFCs, the Groundwater Availability Model (GAM) for the Queen City and Sparta Aquifers (Kelley and others, 2004) was used to determine the compatibility and physical possibility of the DFCs proposed by each GCD. Note that this GAM also includes the Carrizo-Wilcox Aquifer. The DFCs proposed by each GCD for these six aquifers are provided in **Table 2-1**, as well as the DFC adopted by GMA 12 as a whole. The DFC is based on the average drawdown from January 2000 through December 2069. Note that the DFCs for Fayette County GCD in the Sparta, Queen City, and Carrizo aquifers are for all of Fayette County, and not just the portion of Fayette County within GMA 12. This is because GMA 15 has declared these aquifers not relevant for Fayette County, and all joint groundwater planning for these aquifers is done through GMA 12.

GCD or County	Average Aquifer Drawdown (ft) measured from January 2000 through December 2069					
	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
Brazos Valley GCD	12	12	61	125	295	207
Fayette County GCD	47*	64*	110*	--	--	--
Lost Pines GCD	5	15	62	100	240	165
Mid-East Texas GCD	5	2	80	90	138	125
Post Oak Savannah GCD	28	30	67	149	318	205
Falls County	--	--	--	--	-2	27
Limestone County	--	--	--	11	50	50
Navarro County	--	--	--	-1	3	3
Williamson County	--	--	--	-11	47	69
GMA-12	*16*	*16*	*75*	*114*	*228*	*168*

* Fayette County GCD DFCs are for all of Fayette County.

DFCs are in feet of drawdown from 2000 to 2069

FCGCD Summary

- Clarification was made to allow FCGCD drawdowns to fall within stated variances
- TWDB required that this clarification be made in the DFC resolution

Remaining Items

- Remaining 15 items are clarifications

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APPENDIX F

MAY 28, 2015 PRESENTATION “GMA 12 AQUIFER USES AND CONDITIONS CONSIDERATION DISCUSSION”

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GMA 12

Aquifer Uses and Conditions Consideration Discussion

by

GMA 12 Consultant Team

TWC Section 36.108 (d)

- Before voting on the proposed desired future conditions … the districts shall consider:
  - **Aquifer uses and conditions**
  - Needs and strategies
  - Hydrologic conditions
  - Environmental impacts
  - Subsidence
  - Socioeconomic impacts
  - Private property rights
  - Feasibility
  - Anything else

TWC Section 36.108 (d-2)

- The desired future conditions … must provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater … in the management area.

Consideration 1

- Aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another.

Aquifers

- Carrizo-Wilcox (including Carrizo, Calvert Bluff, Simsboro, and Hooper)
- Queen City
- Sparta
- Yegua-Jackson
- Brazos River Alluvium
- Trinity

Aquifer Uses

- Includes the following per TWDB:
  - **Muncipal**- city-owned, districts, WSCs, or private utilities supplying residential, commercial (non-goods-producing businesses), and institutional, and non-surveyed municipal (rural domestic)
  - **Manufacturing**- process water use reported by large manufacturing plants
  - **Livestock**
  - **Irrigation**
  - **Mining**- includes water used in the mining of oil, gas, coal, sand, gravel, and other materials
  - **Steam-Electric**- consumptive use of water by large power generation plants

Estimated Groundwater Use

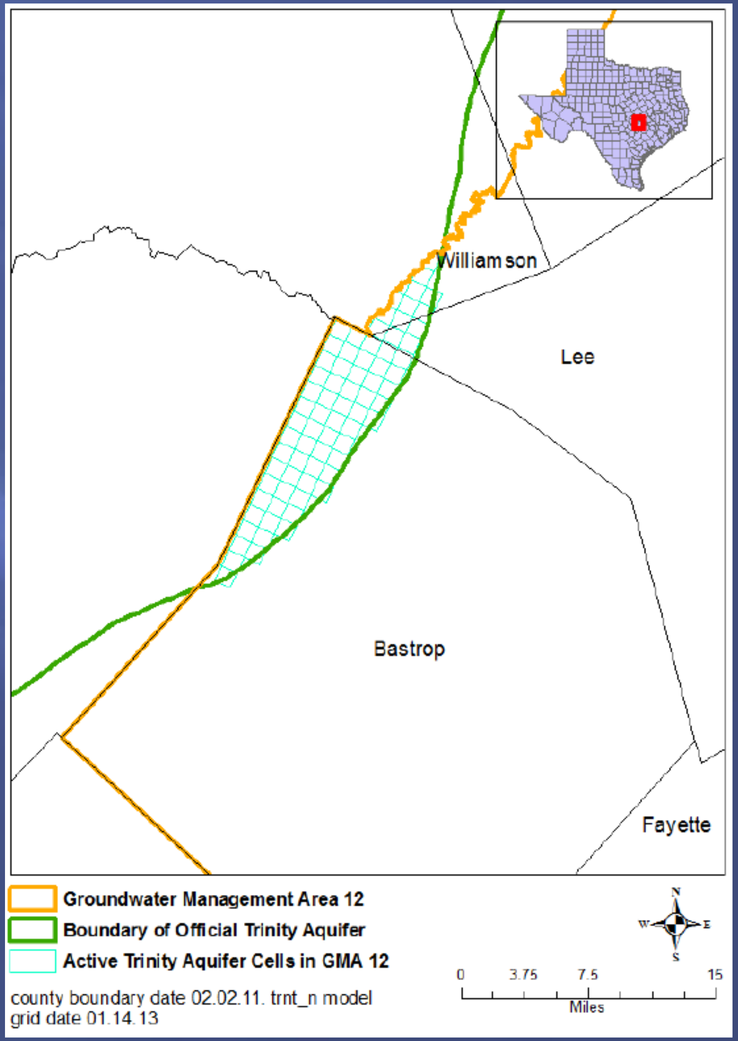
Estimated Historic Water Use Met With Groundwater					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	100%	75%	90%	100%	90%
Livestock	25%	30%	30%	10%	50%
Manufacturing	75%	45%	100%	0%	30%
Mining	100%	95+%	100%	50%	60%
Muncipal	100%	80%	95%	100%	100%
Steam-Electric Power	0%	0%	30%	0%	0%

2012 Reported Production

2012 Metered/Reported Groundwater Production (acre-feet)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Brazos River Alluvium	NA	17,000	90,814	NA	NA
Yegua-Jackson	0	700	1,707	78	579
Sparta	104	850	3,237	1,374	20
Queen City	110	300	685	417	0
Carrizo	3,444	1,400	810	2,038	0
Calvert Bluff	493	300	364	2,670	NA
Simsboro	16,980	13,000	59,538	1,074	NA
Hooper	0	700	1,086	2,614	NA
Carrizo-Wilcox	*20,917*	*15,400*	*61,798*	*8,397*	*0*
TOTAL	21,131	34,250	158,241	10,265	599

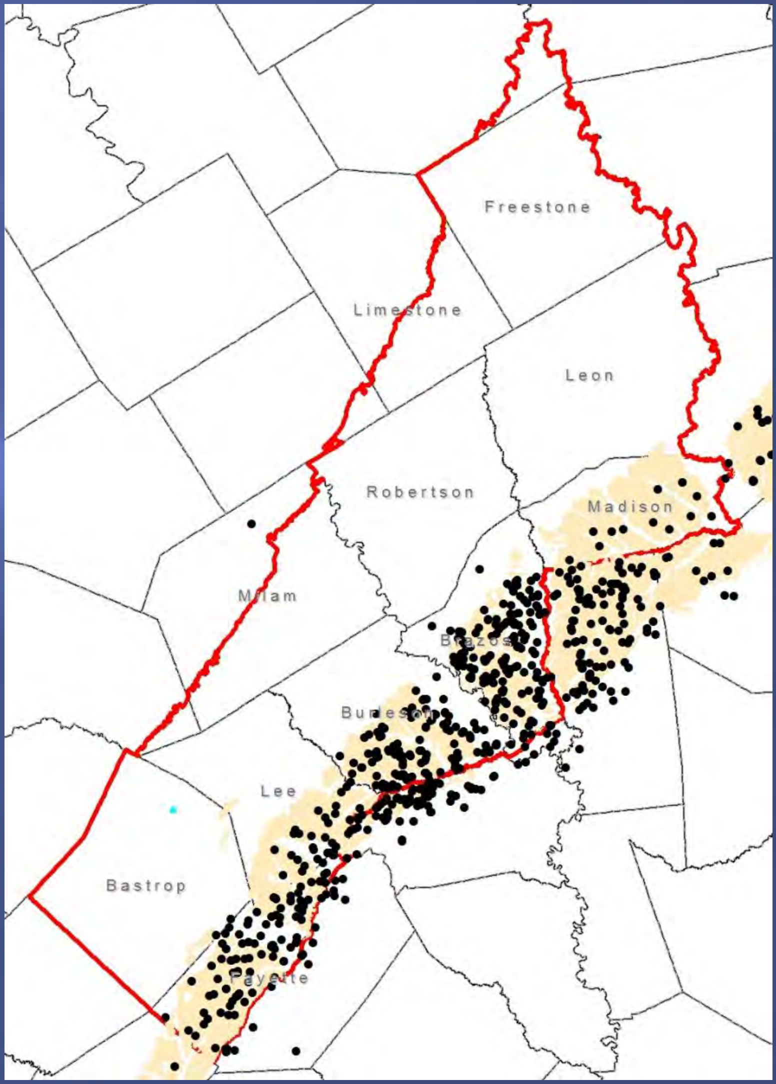
Trinity Aquifer

- Major Aquifer
- Present only in Bastrop, Lee, and Williamson Counties
- No historic use in GMA
- No known wells in GMA
- Very deep in GMA (>3,000 feet)
- Not relevant



Yegua-Jackson Aquifer

- Minor Aquifer
- Present across GMA 12
- Moderate historic use
- Numerous wells
- Wells tend to be shallow
- DFCs in 2010



Well data from TWDB groundwater database

Yegua-Jackson Uses

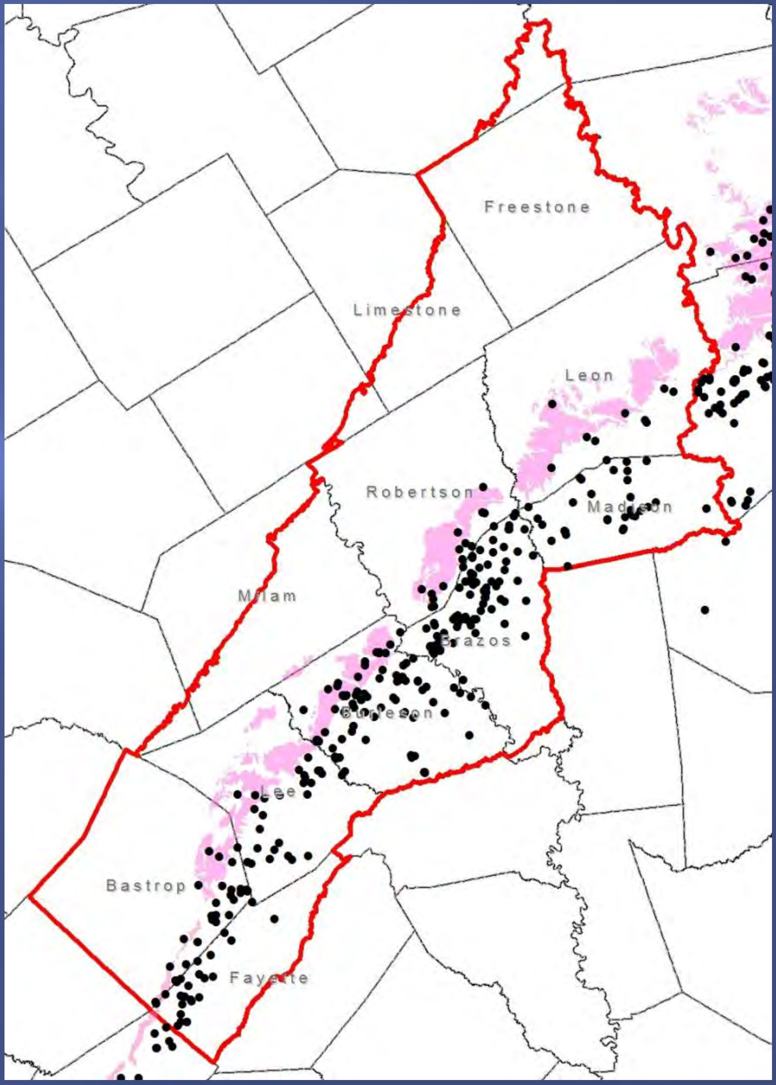
- Groundwater primarily produced from shallow wells
- Groundwater primarily used for domestic, irrigation and livestock purposes
- Some used for municipal, industrial, and oil and gas drilling
- Some significant users:
  - Several municipalities in Fayette County
  - Rig supply in Madison County
  - Golf course irrigation and some industrial use in BVGCD

Yegua-Jackson Uses

Approximate Yegua-Jackson Historic Groundwater Use (Percent)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	0%	20%	45%	0%	15%
Livestock	50%	10%	10%	5%	10%
Manufacturing	0%	0%	0%	0%	0%
Mining	0%	0%	0%	45%	0%
Muncipal	50%	60%	45%	50%	75%
Steam-Electric Power	0%	0%	<5%	0%	0%

Sparta Aquifer

- Minor Aquifer
- Present across GMA 12
- Low historic use
- Numerous wells
- Wells are shallow to moderately deep
- DFCs in 2010



Well data from TWDB groundwater database

Sparta Uses

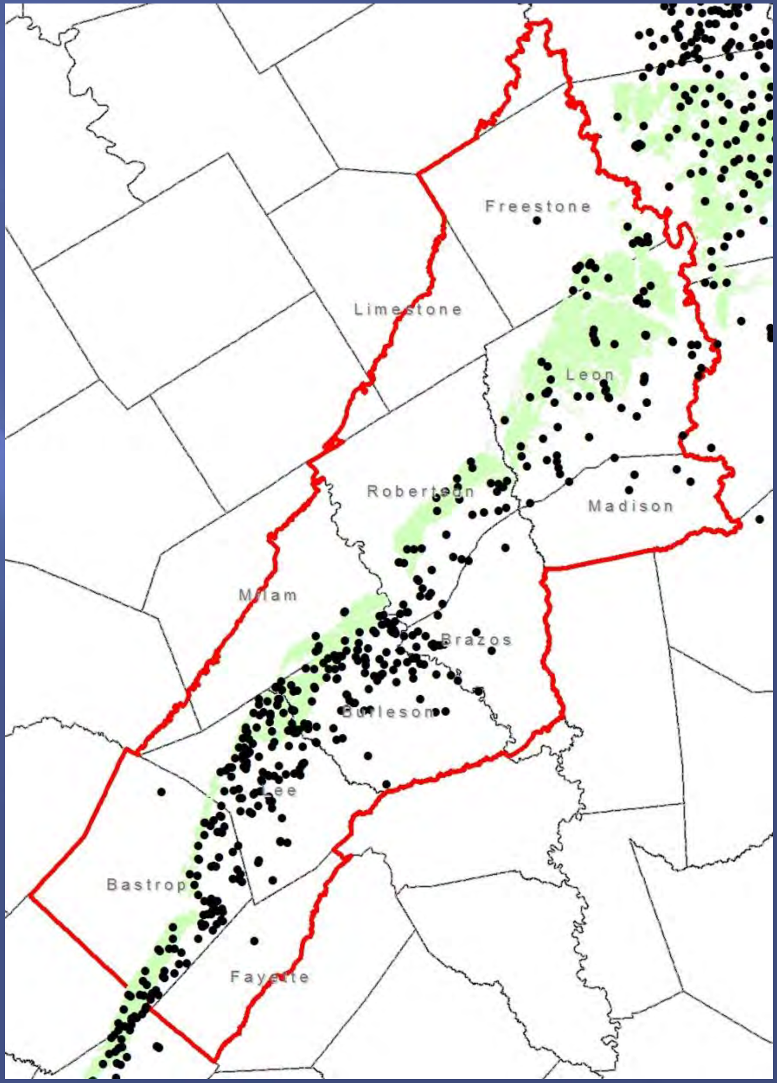
- Groundwater primarily produced from shallow to moderately deep wells (most <1000′, a few up to 2,000′)
- Groundwater primarily used for municipal, domestic, and livestock
- Some used for industrial, irrigation, and oil and gas well drilling
- Some significant users:
  - City of Madisonville
  - WSCs and municipal use in Brazos, Lee Counties

Sparta Uses

Approximate Sparta Historic Groundwater Use (Percent)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	45%	40%	10%	<5%	40%
Livestock	10%	5%	5%	<5%	10%
Manufacturing	0%	5%	0%	0%	0%
Mining	0%	0%	0%	0%	0%
Muncipal	45%	40%	80%	95+%	50%
Steam-Electric Power	0%	0%	<5%	0%	0%

Queen City Aquifer

- Minor Aquifer
- Present across GMA 12
- Low to moderate historic use
- Numerous wells
- Wells are shallow to moderately deep
- DFCs in 2010



Well data from TWDB groundwater database

Queen City Uses

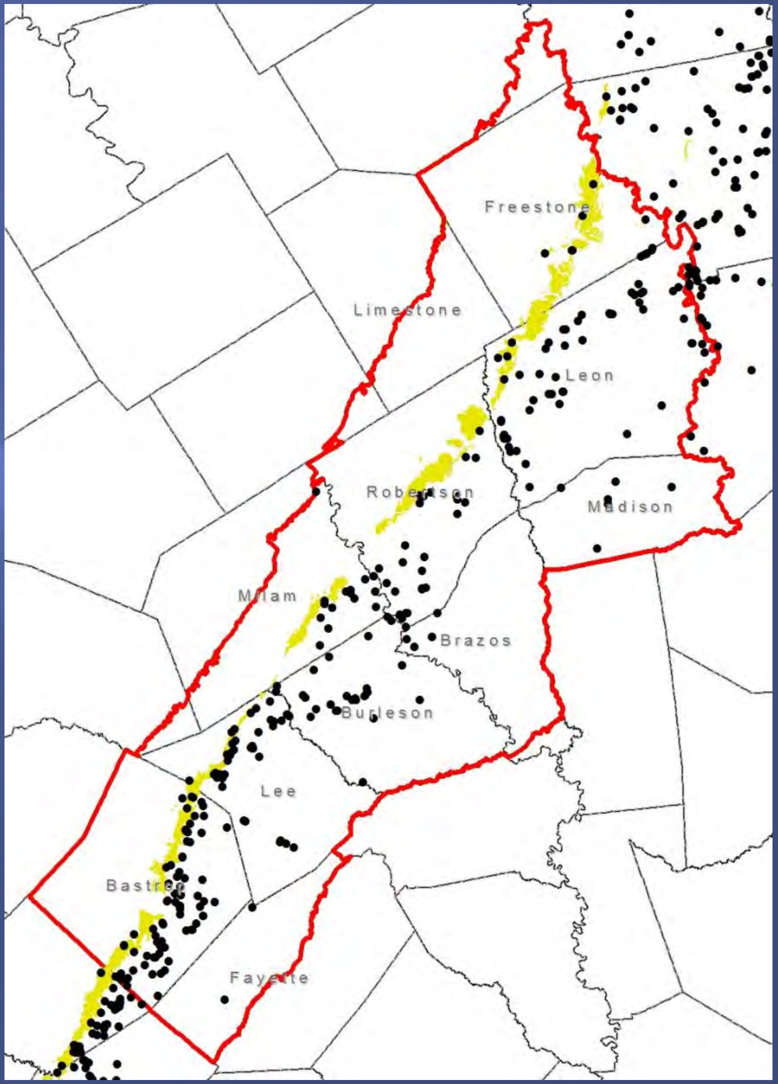
- Groundwater primarily produced from shallow to moderately deep wells (most <1000′, a few up to 2,000′)
- Groundwater primarily used for irrigation, domestic, and livestock
- Some used for municipal
- Some significant users:
  - Rural WSCs in METGCD
  - Town of Lincoln,
  - Landowners for livestock and domestic purposes

Queen City Uses

Approximate Queen City Historic Groundwater Use (Percent)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	60%	5%	75%	0%	5%
Livestock	15%	5%	10%	5%	5%
Manufacturing	0%	5%	0%	10%	0%
Mining	0%	0%	0%	0%	0%
Muncipal	25%	70%	15%	85%	90%
Steam-Electric Power	0%	0%	<5%	0%	0%

Carrizo Aquifer

- Part of Carrizo-Wilcox, which is a major aquifer
- Present across GMA 12
- Moderate historic use
- Moderate number of wells
- Wells can be deep
- DFCs in 2010



Well data from TWDB groundwater database

Carrizo Uses

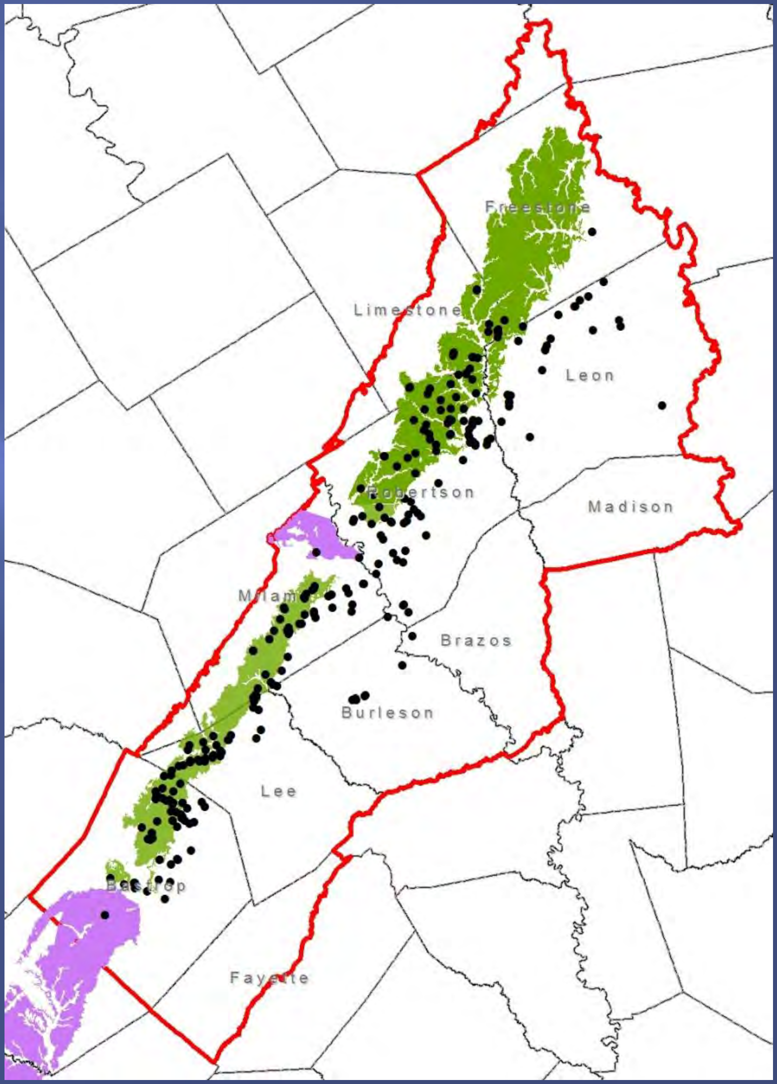
- Wells up to about 2,000 feet in depth
- Groundwater primarily used for municipal, domestic, and livestock
- Some used for irrigation
- Some significant users:
  - Cities of Giddings, Smithville,
  - Aqua WSC, Lee County WSC
  - TDCJ Ferguson unit (~1350 acft/yr)
  - Rural WSCs (~300 acft/yr)
  - Texas A&M University

Carrizo-Wilcox Uses

Approximate Carrizo-Wilcox Historic Groundwater Use (Percent)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	10%	<5%	25%	10%	95+%
Livestock	<5%	<5%	<5%	5%	0%
Manufacturing	<5%	5%	<5%	10%	0%
Mining	<1%	55%	10%	10%	0%
Muncipal	80-85%	20%	55%	65%	0%*
Steam-Electric Power	0%	0%	5%	0%	0%

Calvert Bluff Aquifer

- Part of Carrizo-Wilcox, which is a major aquifer
- Present across GMA 12
- Moderate historic use
- Moderate number of wells
- Most wells are shallow
- DFCs in 2010



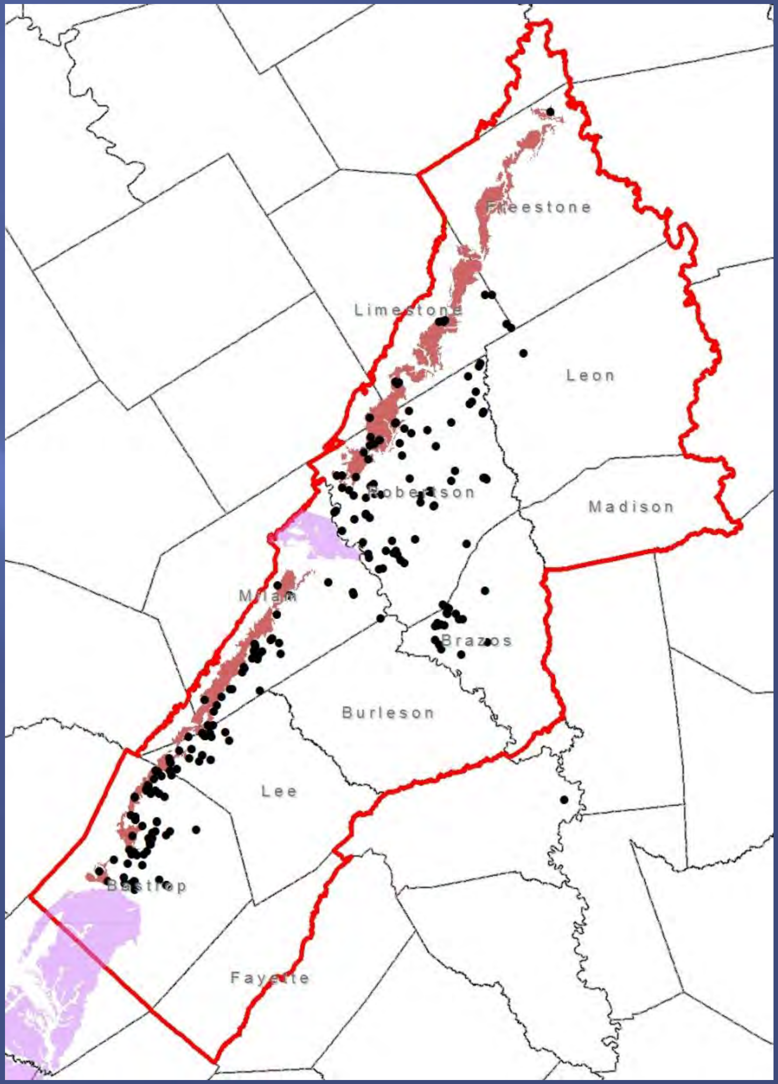
Well data from TWDB groundwater database

Calvert Bluff Uses

- Groundwater mostly produced from shallow wells (<800 feet)
- Groundwater primarily used for livestock and domestic purposes
- Some used for municipal, oil and gas drilling
- Some significant users:
  - Bastrop County WCID#2, numerous METGCD WSCs,
  - Nucor Steel (600 acft/yr)
  - Land and livestock owners

Simsboro Aquifer

- Part of Carrizo-Wilcox, which is a major aquifer
- Present across GMA 12
- Significant historic use
- Moderate number of wells
- Wells can be very deep
- DFCs in 2010



Well data from TWDB groundwater database

Simsboro Uses

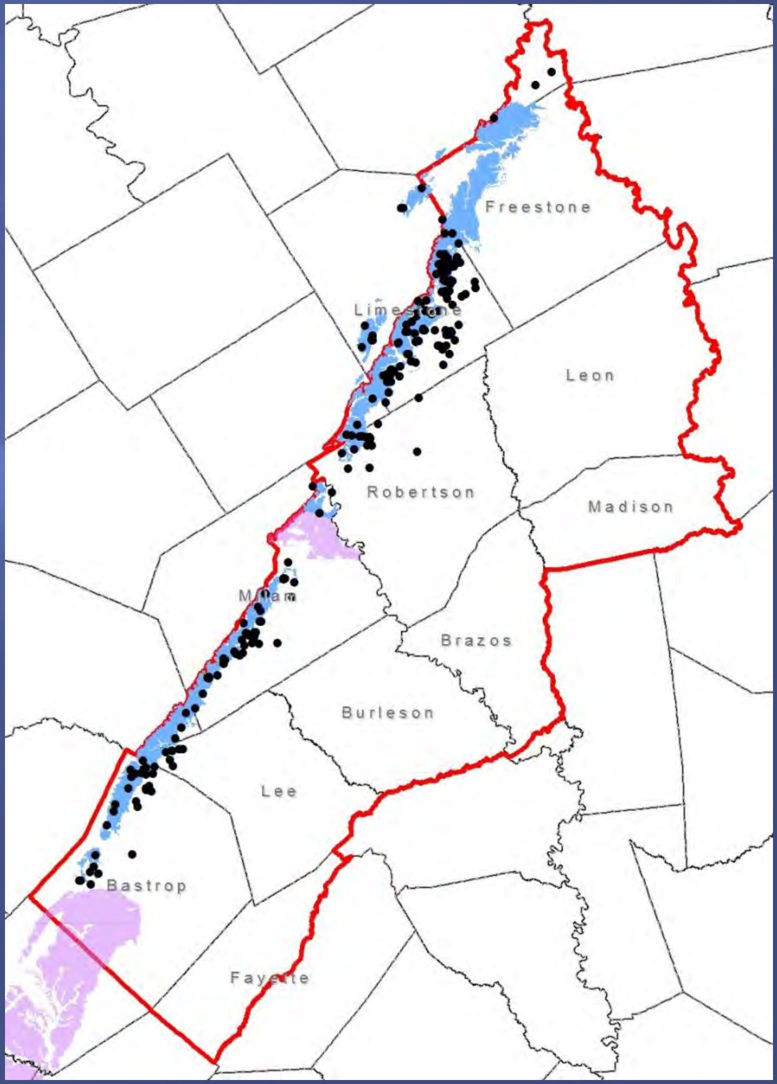
- Groundwater produced from wells up to 3,000 feet deep
- Groundwater primarily used for municipal, and mine depressuring
- Some used for livestock, industrial, and irrigation

Simsboro Uses

- Some significant users:
  - Manville WSC, Aqua WSC, several METGCD WSCs
  - LCRA, Forestar
  - Cities of Bryan/College Station, Elgin
  - Texas A&M University
  - NRG Texas Power LLC
  - Landowners
  - Two lignite coal mines

Hooper Aquifer

- Part of Carrizo-Wilcox, which is a major aquifer
- Present across GMA 12
- Low historic use
- Moderate number of wells
- Wells are shallow
- DFCs in 2010



Well data from TWDB groundwater database

Hooper Uses

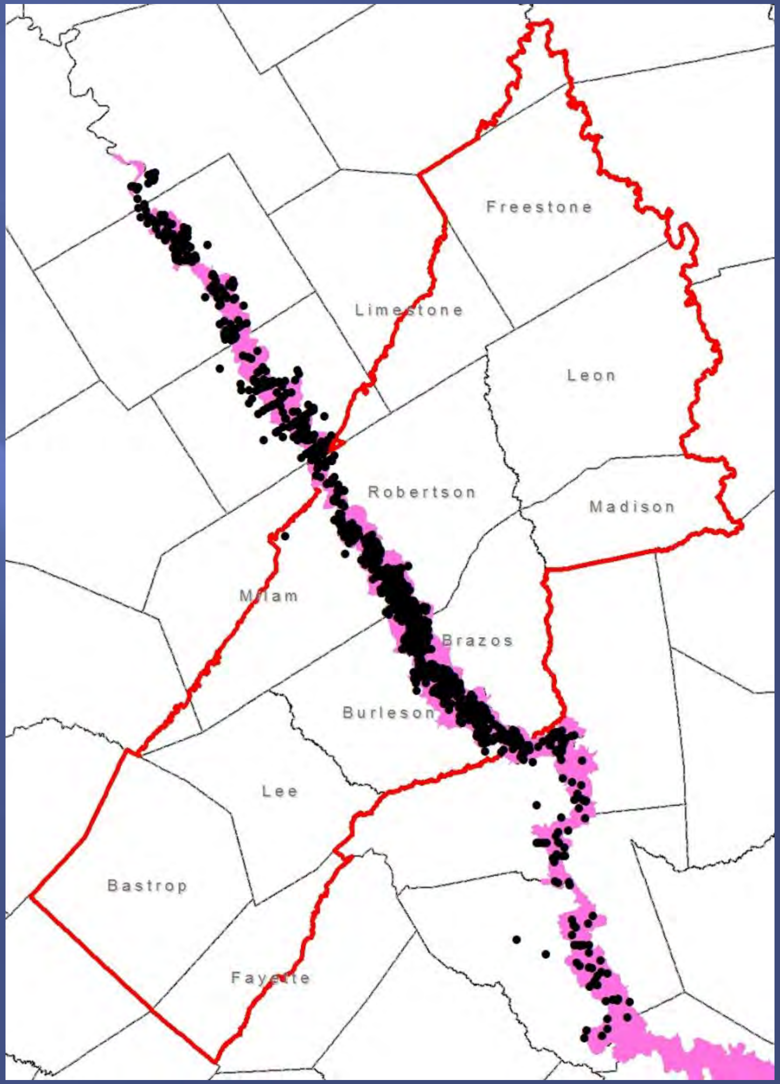
- Groundwater primarily produced from shallow wells- most <500 feet deep
- Groundwater primarily used for domestic and livestock purposes
- Some used for power generation, muncipal purposes
- Some significant users:
  - Cities of Fairfield, Teague,
  - TDCJ Boyd Unit
  - City of Bremond in Robertson County

Carrizo-Wilcox Uses

Approximate Carrizo-Wilcox Historic Groundwater Use (Percent)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	10%	<5%	25%	10%	95+%
Livestock	<5%	<5%	<5%	5%	0%
Manufacturing	<5%	5%	<5%	10%	0%
Mining	<1%	55%	10%	10%	0%
Muncipal	80-85%	20%	55%	65%	0%*
Steam-Electric Power	0%	0%	5%	0%	0%

Brazos River Alluvium Aquifer

- Minor Aquifer
- Localized in GMA 12
- Moderate historic use
- Numerous wells
- Wells are very shallow
- DFCs in 2010



Well data from TWDB groundwater database

Brazos River Alluvium Uses

- Groundwater primarily produced from very shallow wells (<100′)
- Groundwater primarily almost exclusively used for irrigation in the Brazos River Bottom
  - Crops
    - Corn
    - Cotton
    - Soybeans
    - Hay
    - Grain sorghum
- Small amount of domestic and livestock use

Brazos River Alluvium Uses

Approximate Brazos River Alluvium Historic Groundwater Use (Percent)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	NA	100%	95+%	NA	NA
Livestock	NA	0%	<5%	NA	NA
Manufacturing	NA	0%	0%	NA	NA
Mining	NA	0%	0%	NA	NA
Muncipal	NA	0%	0%	NA	NA
Steam-Electric Power	NA	0%	0%	NA	NA

Summary

- GMA 12 relies heavily on groundwater for all uses
- Over 50% of groundwater used for municipal purposes in most of the GMA (other than Brazos River Alluvium)

Estimated Historic Water Use Met With Groundwater					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Irrigation	100%	75%	90%	100%	90%
Livestock	25%	30%	30%	10%	50%
Manufacturing	75%	45%	100%	0%	30%
Mining	100%	95+%	100%	50%	60%
Muncipal	100%	80%	95%	100%	100%
Steam-Electric Power	0%	0%	30%	0%	0%

Summary

- In much of the GMA, most groundwater production is from the Carrizo-Wilcox, especially the Simsboro

2012 Metered/Reported Groundwater Production (acre-feet)					
	Lost Pines GCD	Post Oak Savannah GCD	Brazos Valley GCD	Mid-East Texas GCD	Fayette County GCD
Brazos River Alluvium	NA	17,000	90,814	NA	NA
Yegua-Jackson	0	700	1,707	78	579
Sparta	104	850	3,237	1,374	20
Queen City	110	300	685	417	0
Carrizo	3,444	1,400	810	2,038	0
Calvert Bluff	493	300	364	2,670	NA
Simsboro	16,980	13,000	59,538	1,074	NA
Hooper	0	700	1,086	2,614	NA
Carrizo-Wilcox	20,917	15,400	61,798	8,397	0
TOTAL	21,131	34,250	158,241	10,265	599

QUESTIONS?

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APPENDIX G

JUNE 25, 2015 PRESENTATION “GMA 12: NEEDS AND STRATEGIES”

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GMA-12: Needs and Strategies

Presented By:
GMA 12 Consultant Team

June 25, 2015

TWC Section 36.108 (d)

Before voting on the proposed desired future conditions … the districts shall consider:

- Aquifer uses and conditions
- **Needs and strategies**
- Hydrologic conditions
- Environmental impacts
- Subsidence
- Socioeconomic impacts
- Private property rights
- Feasibility
- Anything else

Approach

- Obtained from TWDB 2012 State Water Plan Database
  - Supply – WUGSupply table
  - Demand – WUGNetDemand table
  - Surplus/Need – WUGNeedsSurplus table
  - Availability – SRCAvailability table
- Obtained from Water Management Strategy Table Provided by the TWDB[a]
  - Water Management Strategies
- Obtained from GCDs
  - Permit Data

(a) Spreadsheet 140306 SA DB12 WMS Data.xlsx obtained from Sabrina Anderson at the TWDB on April 18, 2014.

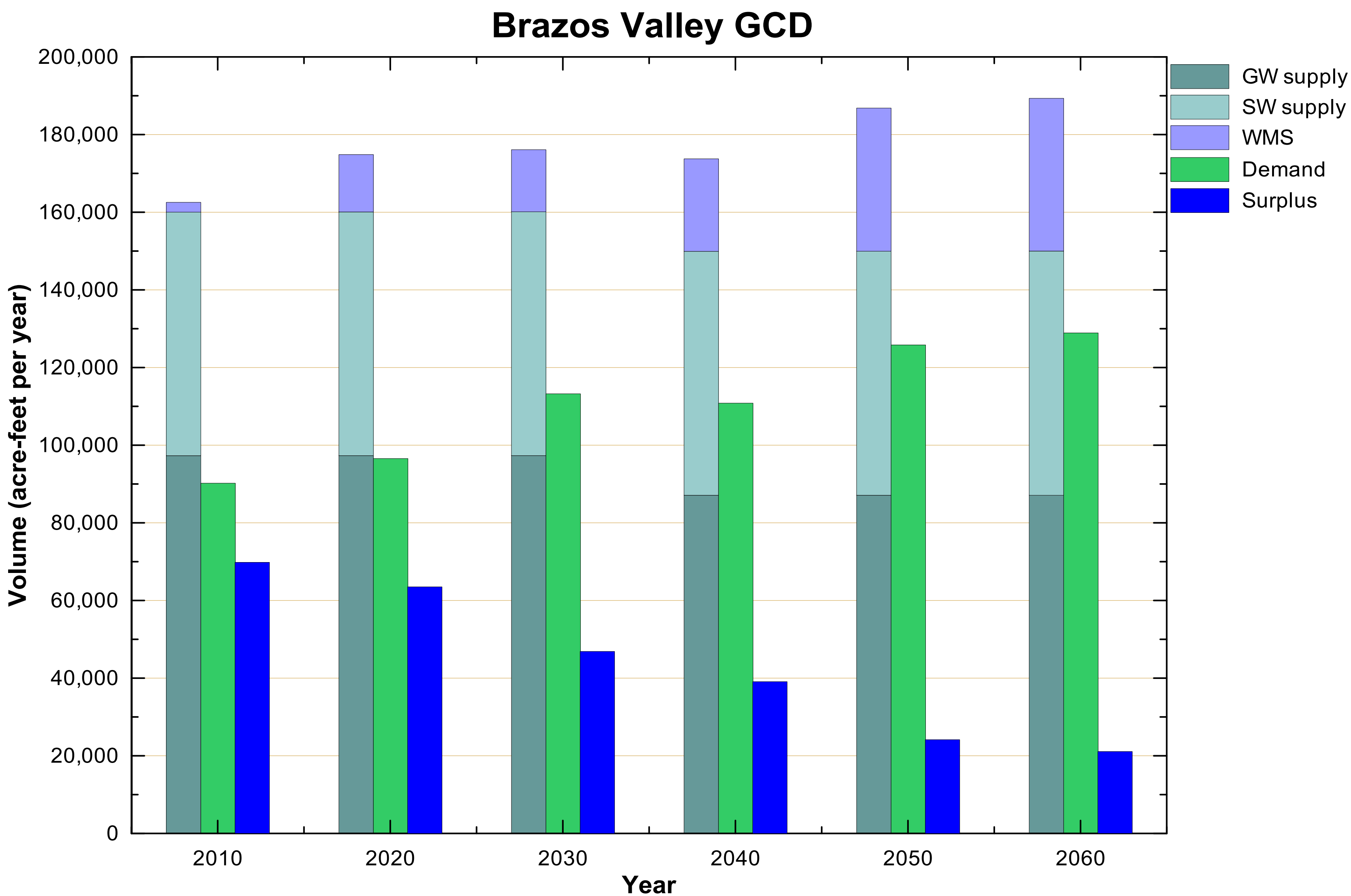
Approach

- Water Use Category Assignments
  - Used category consistent with WUG given in the 2012 SWP
    - Irrigation
    - Livestock
    - Manufacturing
    - Mining
    - Steam Electric Power
    - County-Other
  - Assigned category of Municipal
    - City WUGs
    - Water supply WUGs
- All values reported in acre-feet per year (AFY)

Definitions

- Supply
  - The amount of water that can be produced with current permits, current contracts, and existing infrastructure during drought
- Demand (Net)
  - Demand of the WUG during a drought after plumbing code savings are subtracted
- Surplus/Need
  - Difference between supply and demand
- Water Management Strategies
  - Water supply projects designed to meet needs for additional water supplies during drought
  - Some are associated with demand reduction or making supplies physically or legally available to users
- Availability
  - Maximum amount of water available during a drought, regardless of whether the supply is physically or legally available

Brazos Valley GCD - Supply/Demand/Surplus



Brazos Valley GCD – Supply/Demand/Surplus

	2010	2020	2030	2040	2050	2060
SUPPLY - Groundwater & Surface Water						
County-Other	2,228	2,228	2,228	2,228	2,228	2,228
Irrigation	38,044	38,085	38,128	38,170	38,212	38,254
Livestock	2,540	2,540	2,540	2,540	2,540	2,540
Manufacturing	17,360	17,360	17,360	17,360	17,360	17,360
Mining	10,341	10,341	10,341	119	118	117
Municipal	55,095	55,105	55,110	55,114	55,114	55,114
Steam Electric Power	34,420	34,412	34,404	34,396	34,387	34,379
Total Supply	***160,028***	***160,071***	***160,111***	***149,927***	***149,959***	***149,992***
DEMAND						
County-Other	1,375	1,289	1,202	1,126	1,035	1,006
Irrigation	22,759	22,286	21,525	20,791	20,085	19,403
Livestock	2,540	2,540	2,540	2,540	2,540	2,540
Manufacturing	401	466	530	596	656	712
Mining	10,327	10,328	10,329	108	108	107
Municipal	36,491	41,277	45,600	48,855	52,962	54,426
Steam Electric Power	16,315	18,370	31,507	36,815	48,421	50,712
Total Demand	*90,208*	*96,556*	*113,233*	*110,831*	*125,807*	*128,906*
SURPLUS/NEED						
County-Other	853	939	1,026	1,102	1,193	1,222
Irrigation	15,285	15,799	16,603	17,379	18,127	18,851
Livestock	0	0	0	0	0	0
Manufacturing	16,959	16,894	16,830	16,764	16,704	16,648
Mining	14	13	12	11	10	10
Municipal	18,604	13,828	9,510	6,259	2,152	688
Steam Electric Power	18,105	16,042	2,897	-2,419	-14,034	-16,333
Total Surplus/Need	***69,820***	***63,515***	***46,878***	***39,096***	***24,152***	***21,086***

Brazos Valley GCD – Supply/Demand/Surplus

Brazos Valley GCD	2010	2020	2030	2040	2050	2060
Groundwater Supply - All Categories						
BRAZOS RIVER ALLUVIUM AQUIFER	12,146	12,146	12,146	12,146	12,146	12,146
CARRIZO-WILCOX AQUIFER	78,476	78,486	78,491	68,273	68,272	68,271
QUEEN CITY AQUIFER	299	299	299	299	299	299
SPARTA AQUIFER	6,374	6,374	6,374	6,374	6,374	6,374
TRINITY AQUIFER	5	5	5	5	5	5
Groundwater Supply Total	*97,300*	*97,310*	*97,315*	*87,097*	*87,096*	*87,095*
Surface Water Supply - All Categories						
BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	43,870	43,885	43,901	43,916	43,931	43,946
BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	13,482	13,523	13,566	13,608	13,650	13,692
BRAZOS RIVER COMBINED RUN-OF-RIVER MINING	9	9	9	9	9	9
BRAZOS RIVER COMBINED RUN-OF-RIVER STEAM ELECTRIC POWER	1	1	1	1	1	1
DANSBY POWER PLANT/BRYAN UTILITIES LAKE/RESERVOIR	85	85	85	85	85	85
LIVESTOCK LOCAL SUPPLY	2,540	2,540	2,540	2,540	2,540	2,540
TWIN OAK LAKE/RESERVOIR	2,741	2,718	2,694	2,671	2,647	2,624
Surface Water Supply Total	*62,728*	*62,761*	*62,796*	*62,830*	*62,863*	*62,897*
TOTAL SUPPLY - All Categories	**160,028**	**160,071**	**160,111**	**149,927**	**149,959**	**149,992**
TOTAL DEMAND - All Categories	**90,208**	**96,556**	**113,233**	**110,831**	**125,807**	**128,906**
TOTAL SURPLUS/NEED - All Categories	**69,820**	**63,515**	**46,878**	**39,096**	**24,152**	**21,086**

Brazos Valley GCD - Water Management Strategies

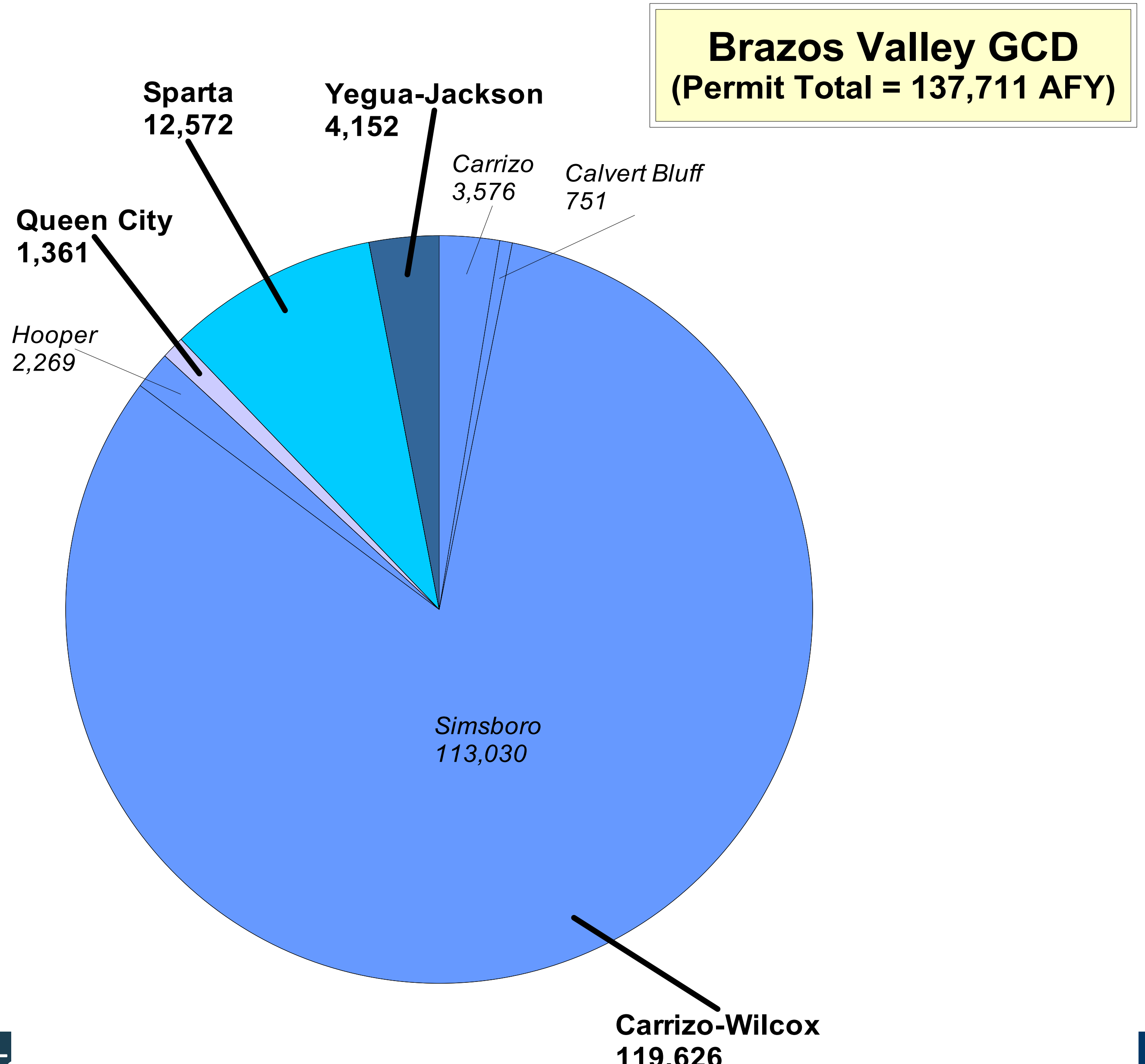
	2010	2020	2030	2040	2050	2060
Groundwater WMS - All Categories						
CARRIZO-WILCOX AQUIFER	1,500	1,500	1,500	4,500	4,500	4,500
Surface Water WMS - All Categories						
BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	0	0	0	2,500	2,500	2,500
Conservation WMS - All Categories						
CONSERVATION	1,019	2,272	3,498	3,723	4,639	4,954
Direct Reuse WMS - All Categories						
DIRECT REUSE	0	11,000	11,000	13,103	25,231	27,396
TOTAL WMS - All Categories	**2,519**	**14,772**	**15,998**	**23,826**	**36,870**	**39,350**
TOTAL SUPPLY + WMS - All Categories	**162,547**	**174,843**	**176,109**	**173,753**	**186,829**	**189,342**

	2010	2020	2030	2040	2050	2060
Water Management Strategy						
County-Other	-	-	-	-	-	-
Irrigation	-	-	-	-	-	-
Livestock	-	-	-	-	-	-
Manufacturing	-	-	-	-	-	-
Mining	-	-	-	-	-	-
Municipal	2,045	2,878	2,820	8,489	9,188	9,349
Steam Electric Power	*474*	*11,894*	*13,178*	*15,337*	*27,682*	*30,001*
Total WMS	***2,519***	***14,772***	***15,998***	***23,826***	***36,870***	***39,350***

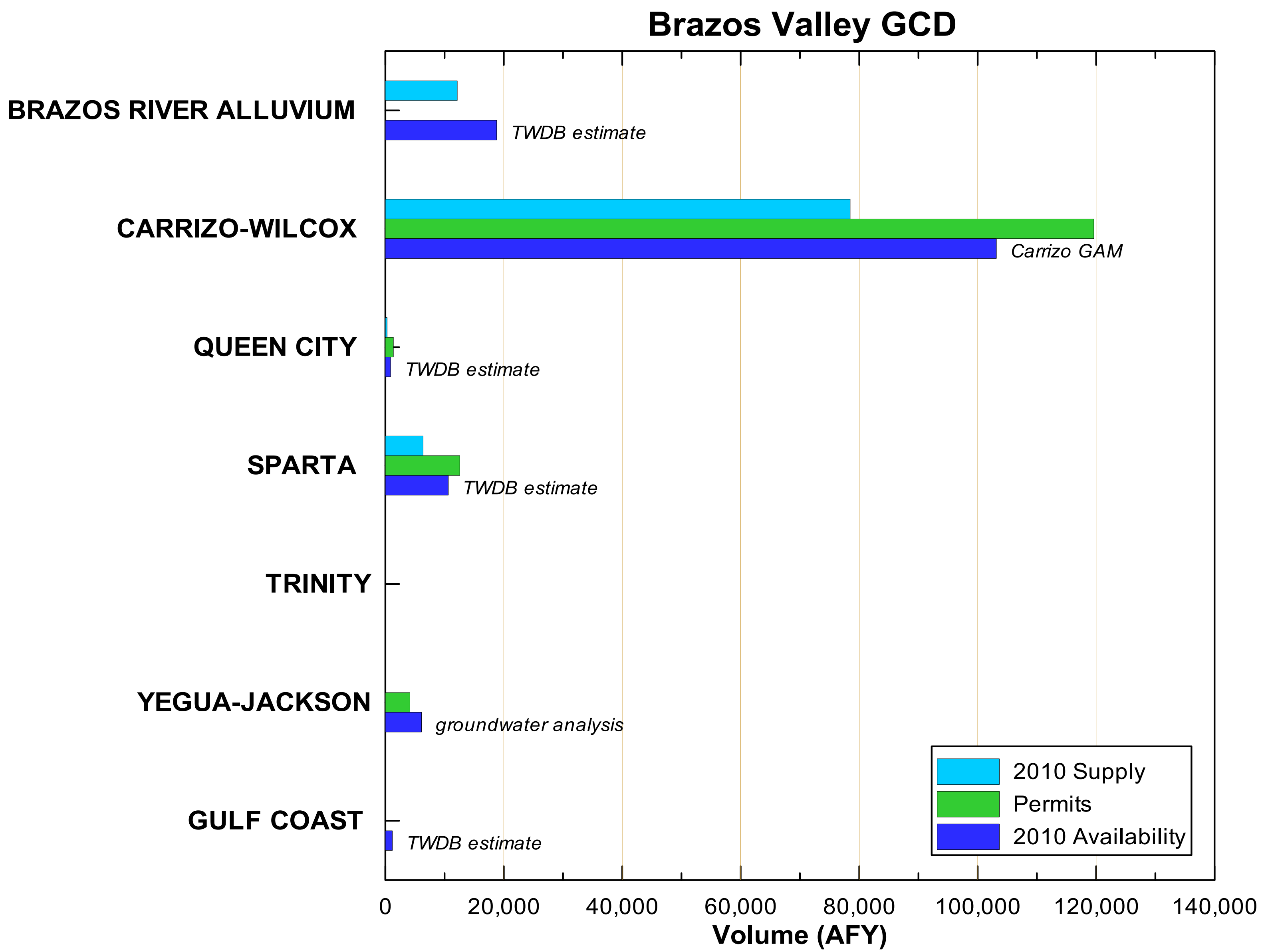
Brazos Valley GCD - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
BRYAN	MUNICIPAL WATER CONSERVATION	CONSERVATION	BRAZOS	BRAZOS	0	0	0	0	122	248
BRYAN	WASTEWATER REUSE	REUSE	BRAZOS	BRAZOS	0	0	0	0	605	605
COLLEGE STATION	MUNICIPAL WATER CONSERVATION	CONSERVATION	BRAZOS	BRAZOS	545	1,378	1,320	1,177	1,149	1,184
COLLEGE STATION	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING)	GROUNDWATER	BRAZOS	BRAZOS	0	0	0	3,000	3,000	3,000
COLLEGE STATION	WASTEWATER REUSE	REUSE	BRAZOS	BRAZOS	0	0	0	312	312	312
STEAM ELECTRIC POWER, GRIMES	WASTEWATER REUSE	REUSE	BRAZOS	GRIMES	0	11,000	11,000	11,000	11,000	11,000
WICKSON CREEK SUD	PURCHASE WATER FROM CITY OF BRYAN	GROUNDWATER	BRAZOS	BRAZOS	900	900	900	900	900	900
WICKSON CREEK SUD	PURCHASE WATER FROM CITY OF BRYAN	GROUNDWATER	BRAZOS	GRIMES	600	600	600	600	600	600
COLLEGE STATION	BRA SYSTEM OPERATIONS PERMIT	SURFACE WATER	RESERVOIR	BRAZOS	0	0	0	2,500	2,500	2,500
STEAM ELECTRIC POWER, ROBERTSON	STEAM-ELECTRIC CONSERVATION	CONSERVATION	ROBERTSON	ROBERTSON	474	894	2,178	2,546	3,368	3,522
STEAM ELECTRIC POWER, ROBERTSON	WASTEWATER REUSE	REUSE	ROBERTSON	ROBERTSON	0	0	0	1,791	13,314	15,479
TOTAL					**2,519**	**14,772**	**15,998**	**23,826**	**36,870**	**39,350**

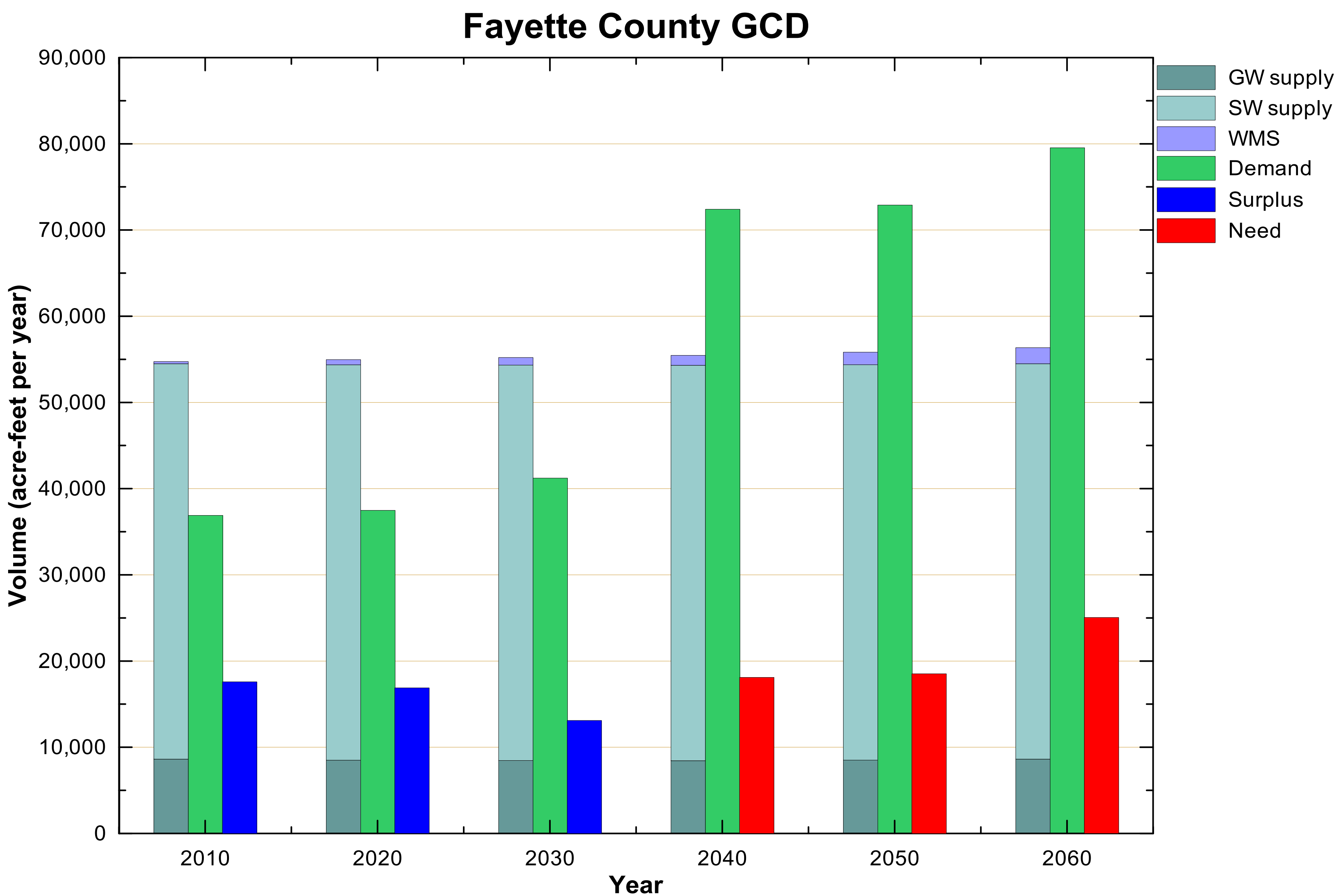
Brazos Valley GCD - Permits



Brazos Valley GCD - Supply & Permits



Fayette County GCD - Supply/Demand/ Surplus-Needs



Fayette County GCD - Supply/Demand/ Surplus-Needs

	2010	2020	2030	2040	2050	2060
SUPPLY - Groundwater & Surface Water						
County-Other	738	562	454	367	358	358
Irrigation	1,185	1,185	1,185	1,185	1,185	1,185
Livestock	3,663	3,663	3,663	3,663	3,663	3,663
Manufacturing	160	160	160	160	160	160
Mining	606	589	571	565	564	564
Municipal	5,267	5,340	5,429	5,498	5,577	5,690
Steam Electric Power	42,868	42,868	42,868	42,868	42,868	42,868
Total Supply	***54,487***	***54,367***	***54,330***	***54,306***	***54,375***	***54,488***
DEMAND						
County-Other	680	436	285	184	122	82
Irrigation	739	692	648	606	568	533
Livestock	2,397	2,397	2,397	2,397	2,397	2,397
Manufacturing	205	230	254	277	297	322
Mining	42	42	42	42	42	42
Municipal	3,210	3,981	4,594	5,060	5,629	6,413
Steam Electric Power	29,622	29,702	33,002	63,843	63,843	69,753
Total Demand	***36,895***	***37,480***	***41,222***	***72,409***	***72,898***	***79,542***
SURPLUS/NEED						
County-Other	58	126	169	183	236	276
Irrigation	446	493	537	579	617	652
Livestock	1,266	1,266	1,266	1,266	1,266	1,266
Manufacturing	-45	-70	-94	-117	-137	-162
Mining	564	547	529	523	522	522
Municipal	2,057	1,359	835	438	-52	-723
Steam Electric Power	13,246	13,166	9,866	-20,975	-20,975	-26,885
Total Surplus/Need	***17,592***	***16,887***	***13,108***	***-18,103***	***-18,523***	***-25,054***

Fayette County GCD - Supply/Demand/ Surplus-Needs

Fayette County GCD	2010	2020	2030	2040	2050	2060
Groundwater Supply - All Categories						
CARRIZO-WILCOX AQUIFER	380	453	542	611	690	803
GULF COAST AQUIFER	2,954	2,761	2,635	2,542	2,532	2,532
QUEEN CITY AQUIFER	1,059	1,059	1,059	1,059	1,059	1,059
SPARTA AQUIFER	3,869	3,869	3,869	3,869	3,869	3,869
YEGUA-JACKSON AQUIFER	359	359	359	359	359	359
Groundwater Supply Total	*8,621*	*8,501*	*8,464*	*8,440*	*8,509*	*8,622*
Surface Water Supply - All Categories						
COLORADO RIVER COMBINED RUN-OF-RIVER IRRIGATION	534	534	534	534	534	534
COLORADO RIVER RUN-OF-RIVER	1,267	1,267	1,267	1,267	1,267	1,267
HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	41,703	41,703	41,703	41,703	41,703	41,703
LIVESTOCK LOCAL SUPPLY	2,362	2,362	2,362	2,362	2,362	2,362
Surface Water Supply Total	*45,866*	*45,866*	*45,866*	*45,866*	*45,866*	*45,866*
TOTAL SUPPLY - All Categories	**54,487**	**54,367**	**54,330**	**54,306**	**54,375**	**54,488**
TOTAL DEMAND - All Categories	**36,895**	**37,480**	**41,222**	**72,409**	**72,898**	**79,542**
TOTAL SURPLUS/NEED - All Categories	**17,592**	**16,887**	**13,108**	**-18,103**	**-18,523**	**-25,054**

Fayette County GCD - Water Management Strategies

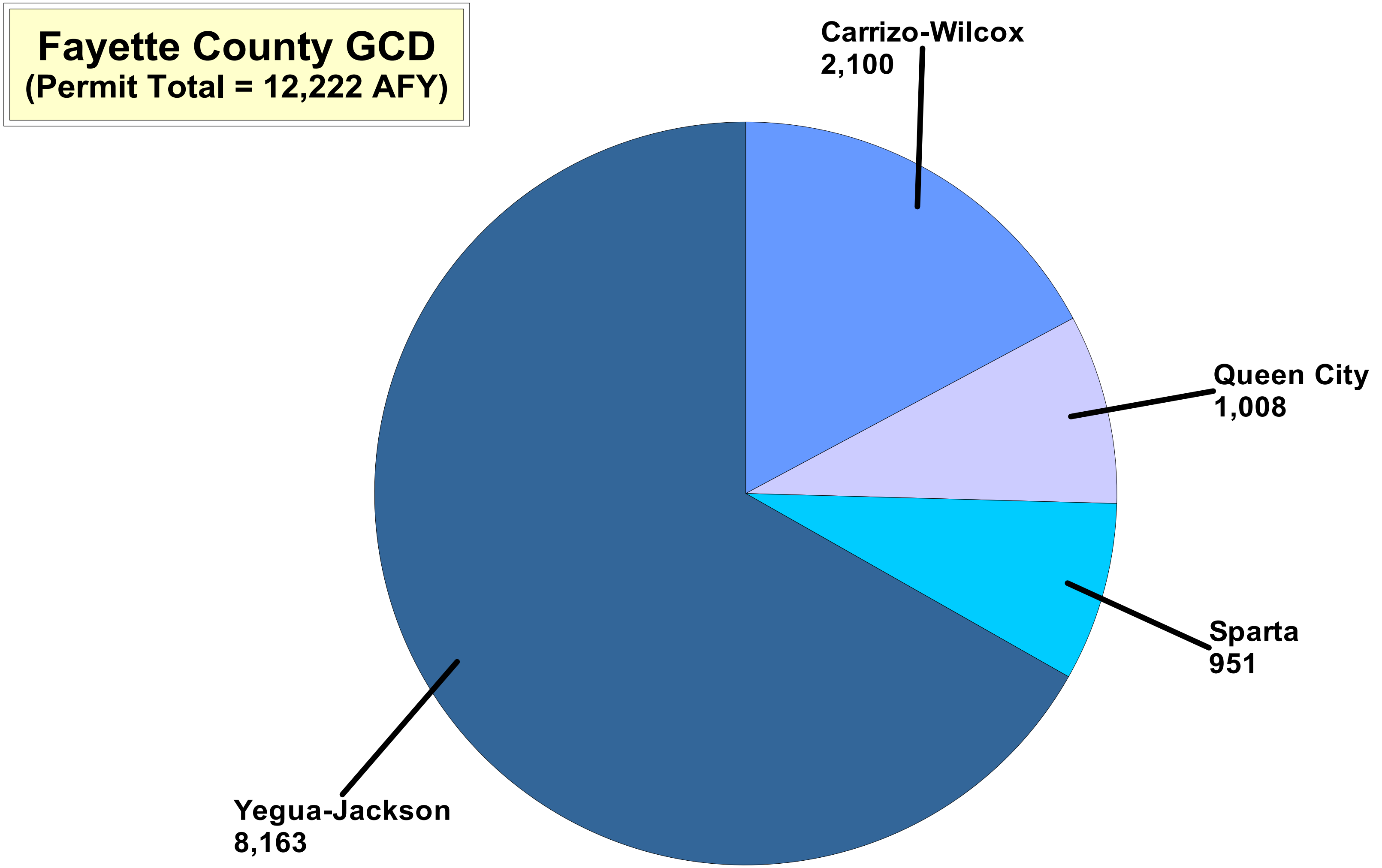
	2010	2020	2030	2040	2050	2060
Groundwater WMS - All Categories						
GULF COAST AQUIFER	0	261	495	553	588	632
SPARTA AQUIFER	188	208	129	129	129	129
YEGUA-JACKSON AQUIFER	0	0	0	0	0	9
OTHER AQUIFER	22	22	101	313	570	911
Conservation WMS - All Categories						
CONSERVATION	43	104	157	159	167	184
TOTAL WMS - All Categories	**253**	**595**	**882**	**1,154**	**1,454**	**1,865**
TOTAL SUPPLY + WMS - All Categories	**54,740**	**54,962**	**55,212**	**55,460**	**55,829**	**56,353**

	2010	2020	2030	2040	2050	2060
Water Management Strategy						
County-Other	123	120	19	32	25	16
Irrigation	20	18	16	14	12	10
Livestock	22	22	22	22	22	22
Manufacturing	45	70	94	117	137	162
Mining	0	4	22	28	29	29
Municipal	43	361	709	941	1,229	1,626
Steam Electric Power	-	-	-	-	-	-
Total WMS	***253***	***595***	***882***	***1,154***	***1,454***	***1,865***

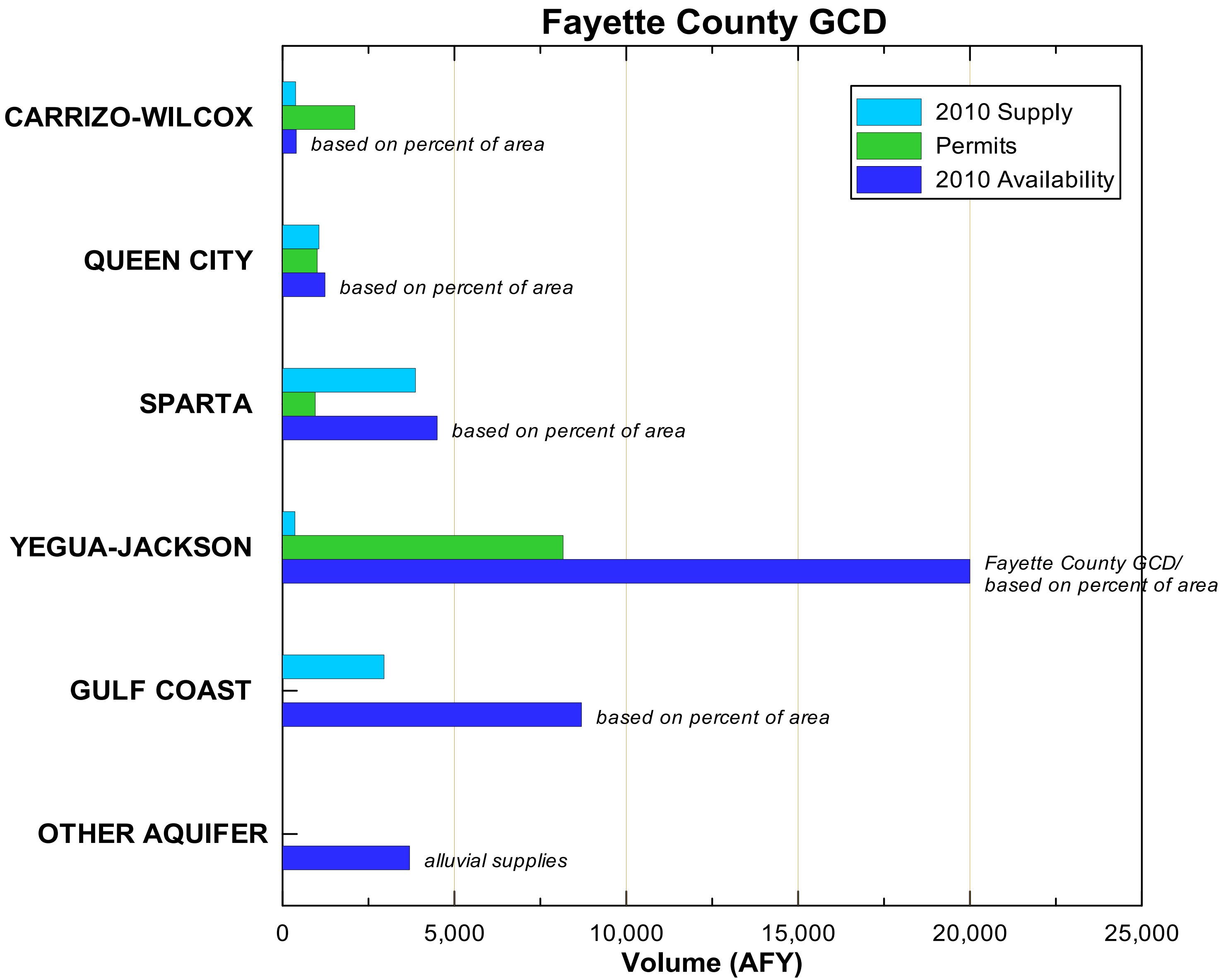
Fayette County GCD - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
COUNTY-OTHER, FAYETTE	EXPANSION OF GULF COAST AQUIFER - GULF COAST AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	0	0	0	32	25	16
COUNTY-OTHER, FAYETTE	EXPANSION OF SPARTA AQUIFER - SPARTA AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	123	120	19	0	0	0
FAYETTE WSC	DEVELOPMENT OF OTHER AQUIFER - OTHER AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	0	0	79	291	548	889
FAYETTE WSC	EXPANSION OF GULF COAST AQUIFER - GULF COAST AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	0	236	428	428	428	428
FAYETTE WSC	EXPANSION OF GULF COAST AQUIFER - GULF COAST AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	0	21	45	63	86	116
IRRIGATION, FAYETTE	EXPANSION OF SPARTA AQUIFER - SPARTA AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	20	18	16	14	12	10
LIVESTOCK, FAYETTE	DEVELOPMENT OF OTHER AQUIFER - OTHER AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	22	22	22	22	22	22
MANUFACTURING, FAYETTE	EXPANSION OF GULF COAST AQUIFER - GULF COAST AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	0	0	0	2	20	43
MANUFACTURING, FAYETTE	EXPANSION OF SPARTA AQUIFER - SPARTA AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	45	70	94	115	117	119
MINING, FAYETTE	EXPANSION OF GULF COAST AQUIFER - GULF COAST AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	0	4	22	28	29	29
SCHULENBURG	EXPANSION OF YEGUA-JACKSON AQUIFER - YEGUA-JACKSON AQUIFER	GROUNDWATER	FAYETTE	FAYETTE	0	0	0	0	0	9
SCHULENBURG	MUNICIPAL CONSERVATION - CONSERVATION	CONSERVATION	FAYETTE	FAYETTE	43	104	157	159	167	184
TOTAL					**253**	**595**	**882**	**1,154**	**1,454**	**1,865**

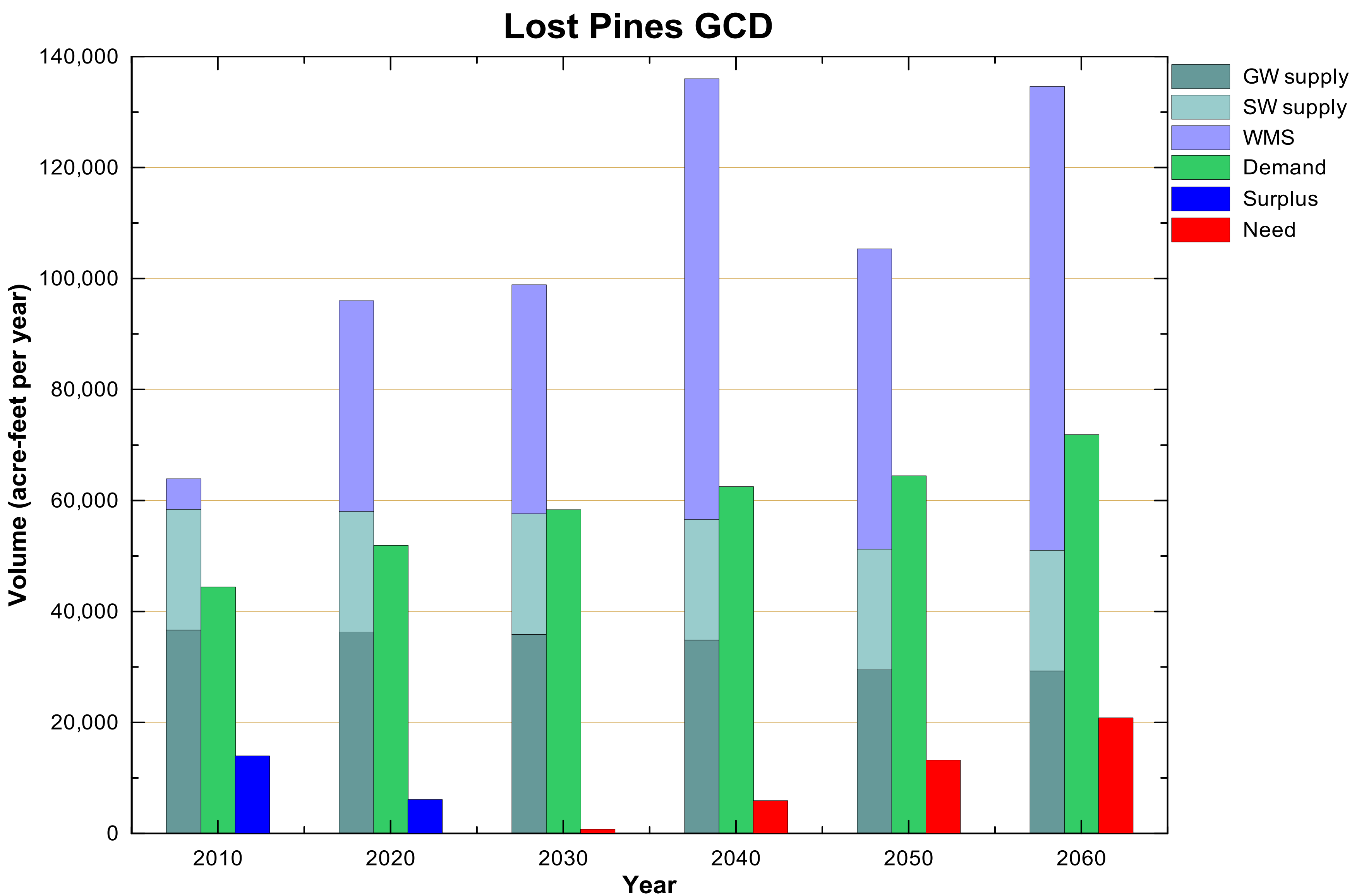
Fayette County GCD – Permits



Fayette County GCD - Supply/Permits/ Availability



Lost Pines GCD – Supply/Demand/Surplus-Needs



Lost Pines GCD – Supply/Demand/Surplus-Needs

	2010	2020	2030	2040	2050	2060
SUPPLY - Groundwater & Surface Water						
County-Other	3,775	3,590	3,315	3,131	3,143	3,143
Irrigation	2,571	2,571	2,571	2,571	2,571	2,571
Livestock	8,301	8,301	8,301	8,301	8,301	8,301
Manufacturing	104	112	120	130	141	141
Mining	6,275	6,273	6,272	5,570	134	135
Municipal	20,645	20,457	20,301	20,175	20,208	20,021
Steam Electric Power	16,720	16,720	16,720	16,720	16,720	16,720
Total Supply	***58,391***	***58,024***	***57,600***	***56,598***	***51,218***	***51,032***
DEMAND						
County-Other	2,850	3,843	4,769	6,184	7,341	8,766
Irrigation	2,550	2,323	2,117	1,939	1,776	1,632
Livestock	3,069	3,069	3,069	3,069	3,069	3,069
Manufacturing	105	125	145	166	186	201
Mining	10,483	10,485	10,486	5,487	51	52
Municipal	13,357	18,061	21,767	27,658	32,528	38,649
Steam Electric Power	12,000	14,000	16,000	18,000	19,500	19,500
Total Demand	***44,414***	***51,906***	***58,353***	***62,503***	***64,451***	***71,869***
SURPLUS/NEED						
County-Other	925	-253	-1,454	-3,053	-4,198	-5,623
Irrigation	21	248	454	632	795	939
Livestock	5,232	5,232	5,232	5,232	5,232	5,232
Manufacturing	-1	-13	-25	-36	-45	-60
Mining	-4,208	-4,212	-4,214	83	83	83
Municipal	7,288	2,396	-1,466	-7,483	-12,320	-18,628
Steam Electric Power	4,720	2,720	720	-1,280	-2,780	-2,780
Total Surplus/Need	***13,977***	***6,118***	***-753***	***-5,905***	***-13,233***	***-20,837***

Lost Pines GCD – Supply/Demand/Surplus-Needs

Lost Pines GCD	2010	2020	2030	2040	2050	2060
Groundwater Supply - All Categories						
CARRIZO-WILCOX AQUIFER	26,557	26,184	25,750	25,434	20,030	19,779
EDWARDS-BFZ AQUIFER	28	35	42	52	60	71
QUEEN CITY AQUIFER	2,395	2,395	2,395	2,186	2,185	2,186
SPARTA AQUIFER	5,500	5,500	5,500	5,007	5,007	5,007
YEGUA-JACKSON AQUIFER	198	198	198	198	198	198
OTHER AQUIFER	1,968	1,969	1,973	1,979	1,994	2,047
Groundwater Supply Total	*36,646*	*36,281*	*35,858*	*34,856*	*29,474*	*29,288*
Surface Water Supply - All Categories						
BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	181	181	181	181	181	181
COLORADO RIVER COMBINED RUN-OF-RIVER IRRIGATION	750	750	750	750	750	750
HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	18,354	18,354	18,354	18,354	18,354	18,354
LIVESTOCK LOCAL SUPPLY	2,402	2,402	2,402	2,402	2,402	2,402
OTHER LOCAL SUPPLY	58	56	55	55	57	57
Surface Water Supply Total	*21,745*	*21,743*	*21,742*	*21,742*	*21,744*	*21,744*
TOTAL SUPPLY - All Categories	**58,391**	**58,024**	**57,600**	**56,598**	**51,218**	**51,032**
TOTAL DEMAND - All Categories	**44,414**	**51,906**	**58,353**	**62,503**	**64,451**	**71,869**
TOTAL SURPLUS/NEED - All Categories	**13,977**	**6,118**	**-753**	**-5,905**	**-13,233**	**-20,837**

Lost Pines GCD – Water Management Strategies

	2010	2020	2030	2040	2050	2060
Groundwater WMS - All Categories						
CARRIZO-WILCOX AQUIFER	5,156	37,024	39,685	74,911	50,988	75,152
QUEEN CITY AQUIFER	119	50	40	24	31	597
OTHER AQUIFER	0	416	777	2,017	1,366	2,814
Conservation WMS - All Categories						
CONSERVATION	262	475	795	2465	1746	3572
Drought Management - All Categories						
DROUGHT MANAGEMENT	0	0	0	0	0	1,451
TOTAL WMS - All Categories	**5,537**	**37,965**	**41,297**	**79,417**	**54,131**	**83,586**
TOTAL SUPPLY + WMS - All Categories	**63,928**	**95,989**	**98,897**	**136,015**	**105,349**	**134,618**

	2010	2020	2030	2040	2050	2060
Water Management Strategy						
County-Other	0	1,649	2,968	4,618	5,861	7,362
Irrigation	119	50	40	31	24	17
Livestock						
Manufacturing	8	6,050	6,812	7,552	8,187	9,082
Mining	4,293	4,297	4,298	0	0	0
Municipal	1,117	25,919	27,179	41,930	65,345	67,125
Steam Electric Power	-	-	-	-	-	-
Total WMS	***5,537***	***37,965***	***41,297***	***54,131***	***79,417***	***83,586***

Lost Pines GCD – Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
AQUA WSC	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	0	602	3,709	6,109	7,850
AQUA WSC	ADDITIONAL MUNICIPAL CONSERVATION - CONSERVATION	CONSERVATION	BASTROP	BASTROP	0	0	0	122	396	908
AQUA WSC	DROUGHT MANAGEMENT - DROUGHT MANAGEMENT	DROUGHT MANAGEMENT	BASTROP	BASTROP	0	0	0	0	0	898
BASTROP	MUNICIPAL CONSERVATION - CONSERVATION	CONSERVATION	BASTROP	BASTROP	146	396	755	1,224	1,438	1,728
BASTROP	EXPANSION OF OTHER AQUIFER - OTHER AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	416	777	1,366	2,017	2,814
BASTROP COUNTY WCID #2	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	0	0	0	0	144
COUNTY-OTHER, BASTROP	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	663	1,879	3,037	2,922	3,700
COUNTY-OTHER, BASTROP	DEVELOPMENT OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	0	0	0	975	1,230
COUNTY-OTHER, BASTROP	DEVELOPMENT OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	0	0	0	0	16
COUNTY-OTHER, BASTROP	ADDITIONAL MUNICIPAL CONSERVATION - CONSERVATION	CONSERVATION	BASTROP	BASTROP	0	0	0	400	631	936
ELGIN	MUNICIPAL CONSERVATION - CONSERVATION	CONSERVATION	BASTROP	BASTROP	91	79	40	0	0	0
ELGIN	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	525	1,136	2,033	2,734	400
ELGIN	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	TRAVIS	0	0	0	0	1	3
ELGIN	DROUGHT MANAGEMENT - DROUGHT MANAGEMENT	DROUGHT MANAGEMENT	BASTROP	BASTROP	0	0	0	0	0	265
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	COMAL	0	20,732	15,826	9,046	5,338	1,282
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	COMAL	0	10	17	23	30	37

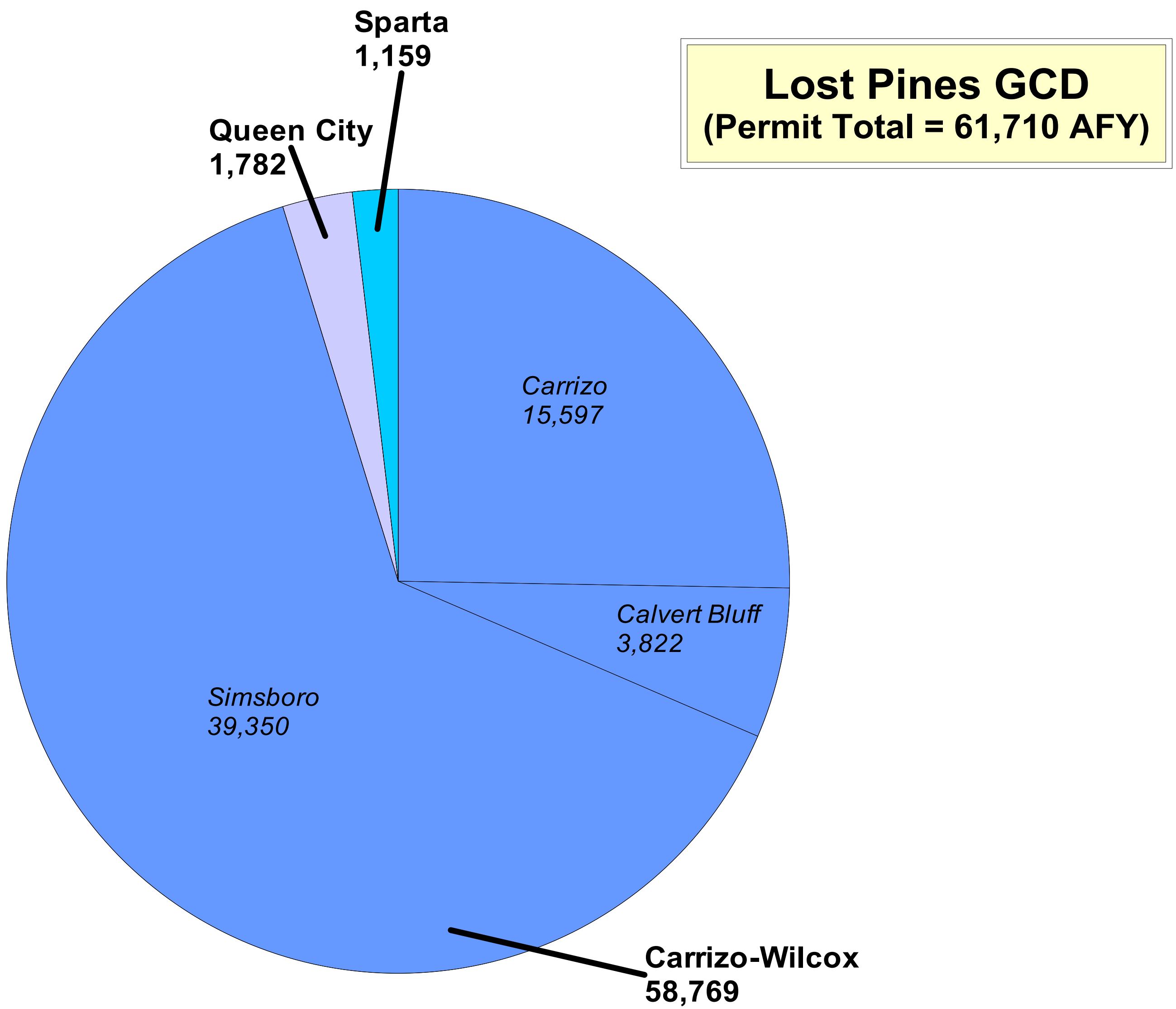
Lost Pines GCD – Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	COMAL	0	1,332	2,111	2,887	3,693	4,558
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	COMAL	0	0	129	2,198	4,466	6,769
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	COMAL	0	986	1,089	1,181	1,181	1,181
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	COMAL	0	6,033	6,784	7,514	8,141	9,022
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	COMAL	0	780	3,660	6,511	6,511	6,511
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	GUADALUPE	0	127	384	640	640	640
IRRIGATION, BASTROP	EXPANSION OF QUEEN CITY AQUIFER - QUEEN CITY AQUIFER	GROUNDWATER	BASTROP	BASTROP	40	40	40	31	24	17
IRRIGATION, BASTROP	EXPANSION OF QUEEN CITY AQUIFER - QUEEN CITY AQUIFER	GROUNDWATER	BASTROP	BASTROP	58	0	0	0	0	0
IRRIGATION, BASTROP	TEMPORARY DROUGHT PERIOD USE OF QUEEN CITY AQUIFER - QUEEN CITY AQUIFER	GROUNDWATER	BASTROP	BASTROP	21	10	0	0	0	0
LOWER COLORADO RIVER AUTHORITY	AQUIFER STORAGE AND RECOVERY - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	TRAVIS	0	0	0	10,000	10,000	10,000
MANUFACTURING, BASTROP	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	7	17	25	32	44
MANUFACTURING, BASTROP	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	8	10	11	13	14	16
MINING, BASTROP	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	4,293	4,297	4,298	0	0	0
POLONIA WSC	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	2	7	16	23	30
SMITHVILLE	MUNICIPAL CONSERVATION - CONSERVATION	CONSERVATION	BASTROP	BASTROP	25	0	0	0	0	0

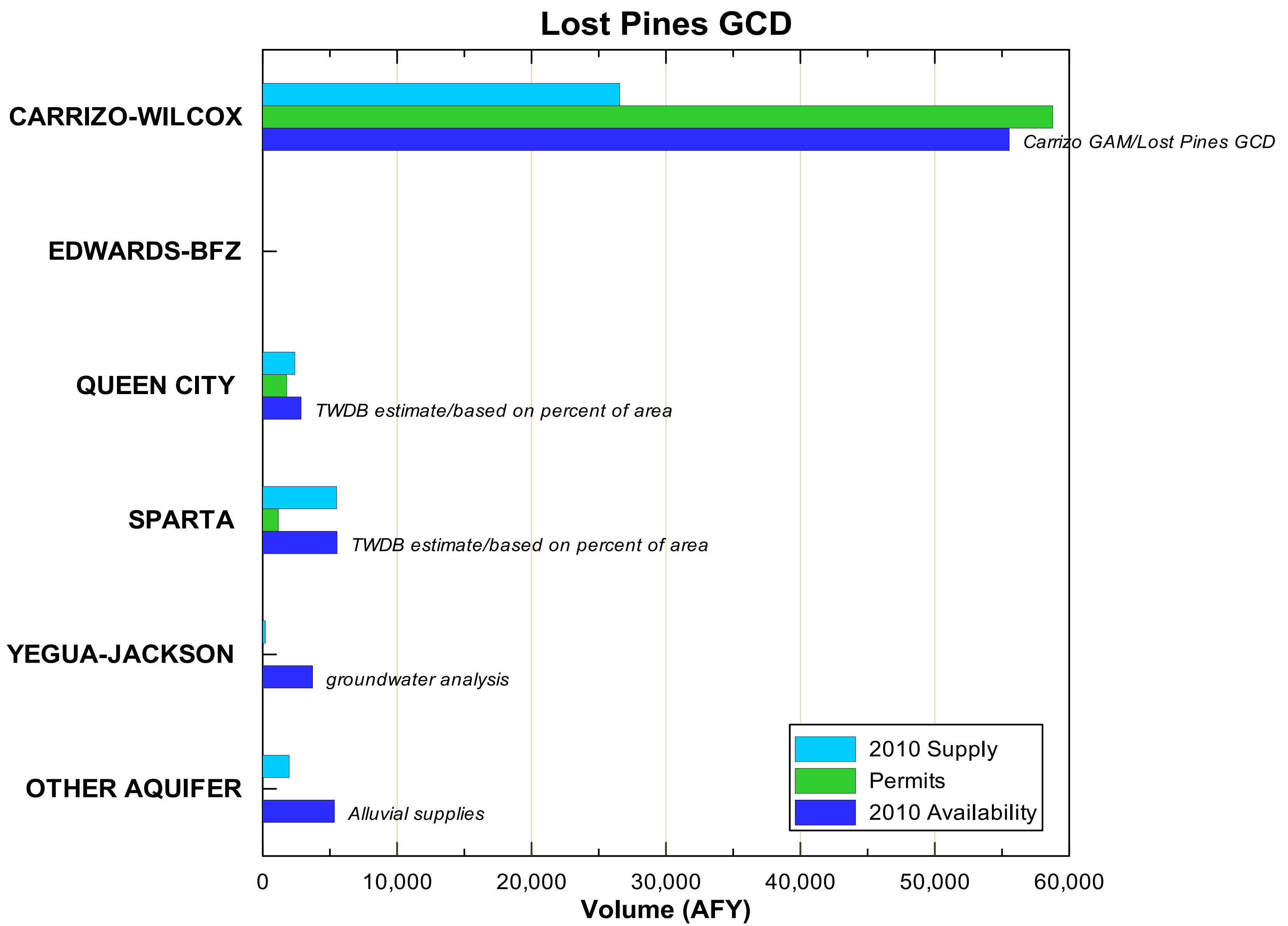
Lost Pines GCD – Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
SMITHVILLE	EXPANSION OF CARRIZO-WILCOX AQUIFER - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BASTROP	BASTROP	49	311	526	946	1,115	733
SMITHVILLE	DROUGHT MANAGEMENT - DROUGHT MANAGEMENT	DROUGHT MANAGEMENT	BASTROP	BASTROP	0	0	0	0	0	288
SMITHVILLE	DEVELOPMENT OF QUEEN CITY AQUIFER - QUEEN CITY AQUIFER	GROUNDWATER	BASTROP	BASTROP	0	0	0	0	0	580
AQUA WSC	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEE	LEE	0	388	373	355	336	315
AQUA WSC	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEE	WILLIAMSON	0	15	30	48	67	88
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEE	COMAL	0	0	0	0	16,415	12,709
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEE	COMAL	0	0	0	0	152	299
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEE	COMAL	0	0	0	0	2,927	6,175
GUADALUPE BLANCO RIVER AUTHORITY	GBRA SIMSBORO PROJECT (OVERDRAFT) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEE	GUADALUPE	0	0	0	0	283	594
LEE COUNTY WSC	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEE	LEE	806	806	806	806	806	806
TOTAL					**5,537**	**37,965**	**41,297**	**54,131**	**79,417**	**83,586**

Lost Pines GCD – Permits



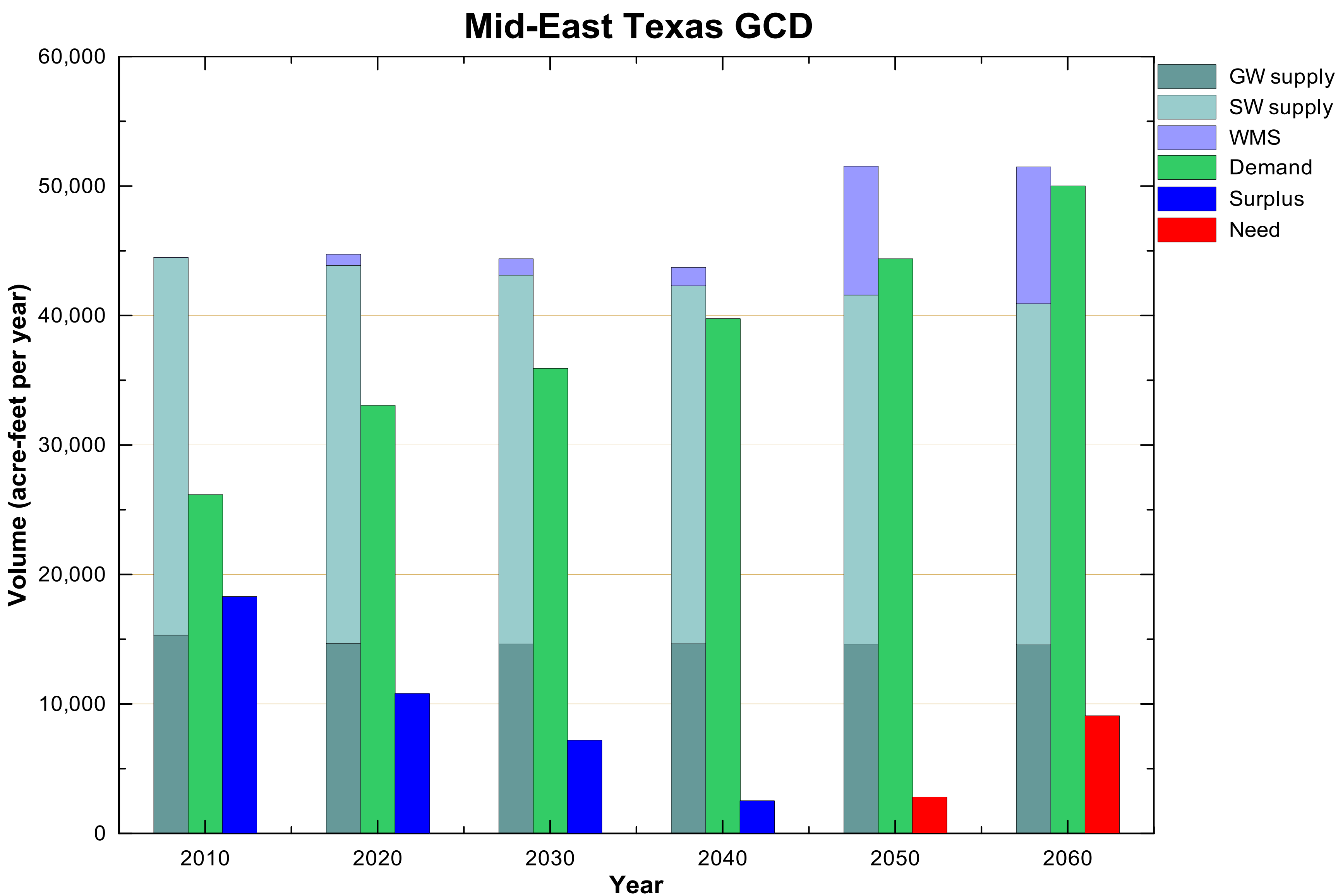
Lost Pines GCD – Supply/Permits/Availability



Lost Pines GCD – Water Export

- Water exported from LPGCD, not included in demands
  - Manville WSC - ~2,500 acre-feet/year
  - Aqua WSC - ~600 acre-feet/year
  - City of Elgin - ~100 acre-feet/year
  - Lee County WSC - ~100 acre-feet/year
  - Forestar - 12,000 acre-feet/year
  - End Op- ______ acre-feet/year

Mid-East Texas GCD - Supply/Demand/ Surplus-Needs



Mid-East Texas GCD - Supply/Demand/ Surplus-Needs

	2010	2020	2030	2040	2050	2060
SUPPLY - Groundwater & Surface Water						
County-Other	3,518	3,536	3,506	3,522	3,484	3,423
Irrigation	686	686	686	686	686	686
Livestock	4,243	4,243	4,243	4,243	4,243	4,243
Manufacturing	974	974	974	974	974	974
Mining	1,741	1,688	1,659	1,633	1,608	1,588
Municipal	4,966	4,406	4,406	4,406	4,406	4,406
Steam Electric Power	28,337	28,337	27,641	26,829	26,181	25,596
Total Supply	***44,465***	***43,870***	***43,115***	***42,293***	***41,582***	***40,916***
DEMAND						
County-Other	3,076	3,176	3,210	3,181	3,186	3,230
Irrigation	569	569	569	569	569	569
Livestock	3,969	3,969	3,969	3,969	3,969	3,969
Manufacturing	974	1,131	1,283	1,436	1,574	1,711
Mining	1,657	1,614	1,591	1,571	1,552	1,537
Municipal	3,753	4,387	4,773	5,040	5,306	5,595
Steam Electric Power	12,173	18,210	20,524	23,999	28,234	33,398
Total Demand	***26,171***	***33,056***	***35,919***	***39,765***	***44,390***	***50,009***
SURPLUS/NEED						
County-Other	442	360	296	341	298	193
Irrigation	117	117	117	117	117	117
Livestock	274	274	274	274	274	274
Manufacturing	0	-157	-309	-462	-600	-737
Mining	84	74	68	62	56	51
Municipal	1,213	19	-367	-634	-900	-1,189
Steam Electric Power	16,164	10,127	7,117	2,830	-2,053	-7,802
Total Surplus/Need	***18,294***	***10,814***	***7,196***	***2,528***	***-2,808***	***-9,093***

Mid-East Texas GCD - Supply/Demand/ Surplus-Needs

Mid-East Texas GCD	2010	2020	2030	2040	2050	2060
Groundwater Supply - All Categories						
CARRIZO-WILCOX AQUIFER	12,010	11,400	11,371	11,345	11,320	11,269
QUEEN CITY AQUIFER	478	479	479	479	479	479
SPARTA AQUIFER	2,441	2,408	2,391	2,441	2,441	2,441
OTHER AQUIFER	382	384	384	383	379	379
Groundwater Supply Total	**15,311**	**14,671**	**14,625**	**14,648**	**14,619**	**14,568**
Surface Water Supply - All Categories						
FAIRFIELD LAKE/RESERVOIR	870	870	870	870	870	870
LIVESTOCK LOCAL SUPPLY	1,043	1,043	1,043	1,043	1,043	1,043
LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	20,000	20,000	20,000	20,000	20,000	20,000
TEAGUE CITY LAKE/RESERVOIR	0	0	0	0	0	0
TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	87	87	87	87	87	87
TRINITY RIVER RUN-OF-RIVER MUNICIPAL	41	41	41	41	41	41
TRWD LAKE/RESERVOIR SYSTEM	6,993	7,038	6,329	5,484	4,802	4,187
WORTHAM LAKE/RESERVOIR	0	0	0	0	0	0
OTHER LOCAL SUPPLY	120	120	120	120	120	120
Surface Water Supply Total	**29,154**	**29,199**	**28,490**	**27,645**	**26,963**	**26,348**
TOTAL SUPPLY - All Categories	**44,465**	**43,870**	**43,115**	**42,293**	**41,582**	**40,916**
TOTAL DEMAND - All Categories	**26,171**	**33,056**	**35,919**	**39,765**	**44,390**	**50,009**
TOTAL SURPLUS/NEED - All Categories	**18,294**	**10,814**	**7,196**	**2,528**	**-2,808**	**-9,093**

Mid-East Texas GCD - Water Management Strategies

	2010	2020	2030	2040	2050	2060
Groundwater WMS - All Categories						
CARRIZO-WILCOX AQUIFER	0	444	757	836	880	1,030
QUEEN CITY AQUIFER	0	17	14	13	16	25
SPARTA AQUIFER	0	45	71	97	206	303
Surface Water WMS - All Categories						
RICHLAND CHAMBERS LAKE/RESERVOIR NON-SYSTEM PORTION	0	0	0	0	0	0
TOLEDO BEND LAKE/RESERVOIR	0	0	0	0	1,582	1,879
Conservation WMS - All Categories						
MUNICIPAL CONSERVATION	42	349	433	479	508	563
Reuse WMS - All Categories						
INDIRECT REUSE	0	0	0	0	6,760	6,760
TOTAL WMS - All Categories	**42**	**855**	**1,275**	**1,425**	**9,952**	**10,560**
TOTAL SUPPLY + WMS - All Categories	**44,507**	**44,725**	**44,390**	**43,718**	**51,534**	**51,476**

	2010	2020	2030	2040	2050	2060
Water Management Strategy						
County-Other	14	250	333	271	282	370
Irrigation	0	0	0	0	0	0
Livestock	0	0	0	0	0	0
Manufacturing	0	157	309	462	600	737
Mining	0	0	0	0	0	0
Municipal	28	448	633	692	2,310	2,693
Steam Electric Power	*0*	*0*	*0*	*0*	*6,760*	*6,760*
Total WMS	***42***	***855***	***1,275***	***1,425***	***9,952***	***10,560***

Mid-East Texas GCD - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
COUNTY-OTHER, FREESTONE	MUNICIPAL CONSERVATION-BASIC	CONSERVATION	FREESTONE	FREESTONE	2	7	10	11	11	12
COUNTY-OTHER, FREESTONE	MUNICIPAL CONSERVATION-BASIC	CONSERVATION	FREESTONE	FREESTONE	12	40	54	58	61	65
FAIRFIELD	MUNICIPAL CONSERVATION-BASIC	CONSERVATION	FREESTONE	FREESTONE	7	24	37	73	95	116
FAIRFIELD	MUNICIPAL CONSERVATION-EXPANDED	CONSERVATION	FREESTONE	FREESTONE	0	0	0	3	4	4
FLO COMMUNITY WSC	MUNICIPAL CONSERVATION-BASIC	CONSERVATION	FREESTONE	FREESTONE	0	1	2	2	2	2
TEAGUE	MUNICIPAL CONSERVATION-BASIC	CONSERVATION	FREESTONE	FREESTONE	2	9	12	15	17	20
TEAGUE	MUNICIPAL CONSERVATION-BASIC	CONSERVATION	FREESTONE	FREESTONE	4	13	19	23	27	31
TRINITY RIVER AUTHORITY	TRA FREESTONE COUNTY REUSE	REUSE	FREESTONE	FREESTONE	0	0	0	0	6,760	6,760
WORTHAM	MUNICIPAL CONSERVATION-BASIC	CONSERVATION	FREESTONE	FREESTONE	14	38	49	58	68	78
BUFFALO	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	36	53	49	44	47
BUFFALO	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	21	22	22	22	22
CENTERVILLE	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	14	21	18	16	17
CENTERVILLE	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	11	12	11	11	11
COUNTY-OTHER, LEON	EXPANDED USE OF GW - SPARTA AQUIFER	GROUNDWATER	LEON	LEON	0	7	8	5	3	4
COUNTY-OTHER, LEON	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	7	8	5	3	4
COUNTY-OTHER, LEON	EXPANDED USE OF GW - QUEEN CITY AQUIFER	GROUNDWATER	LEON	LEON	0	6	8	5	2	3
COUNTY-OTHER, LEON	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	21	26	17	10	13
COUNTY-OTHER, LEON	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	20	24	15	8	11
COUNTY-OTHER, LEON	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	21	23	17	10	13

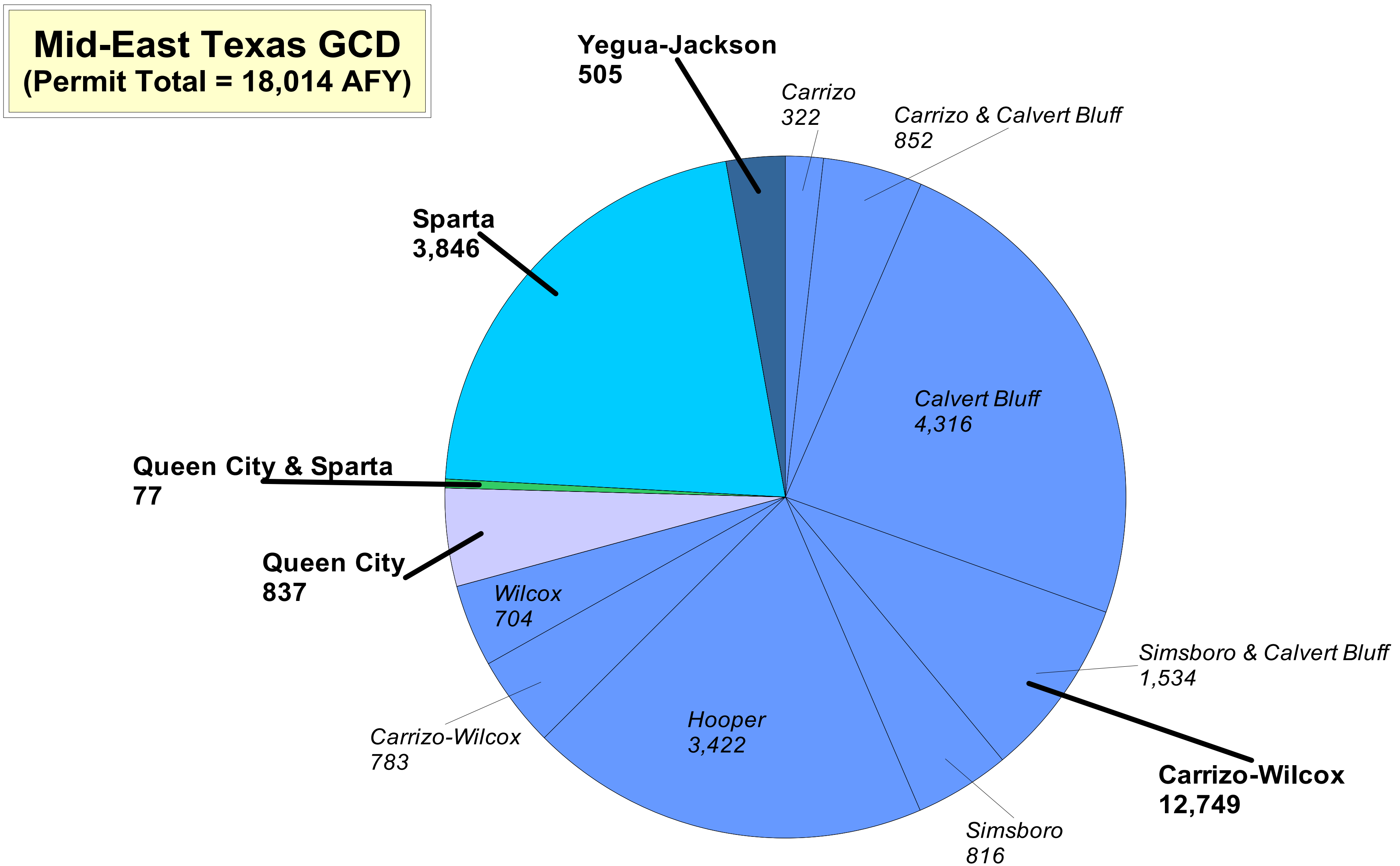
Mid-East Texas GCD - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
FLO COMMUNITY WSC	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	107	160	156	141	149
FLO COMMUNITY WSC	MUNICIPAL CONSERVATION - MEDIUM WUG	CONSERVATION	LEON	LEON	0	31	34	34	33	34
JEWETT	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	26	41	40	37	39
JEWETT	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	9	13	13	12	13
JEWETT	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	10	11	11	10	11
JEWETT	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	3	4	4	3	4
MANUFACTURING, LEON	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	128	148	145	202	201
MANUFACTURING, LEON	EXPANDED USE OF GW - QUEEN CITY AQUIFER	GROUNDWATER	LEON	LEON	0	0	0	0	0	8
MANUFACTURING, LEON	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	0	105	234	291	390
NORMANGEE	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	11	16	14	13	14
NORMANGEE	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LEON	LEON	0	4	7	6	5	6
NORMANGEE	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	6	7	7	7	7
NORMANGEE	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	LEON	LEON	0	3	3	3	3	3
COUNTY-OTHER, MADISON	EXPANDED USE OF GW - QUEEN CITY AQUIFER	GROUNDWATER	MADISON	MADISON	0	11	6	4	9	9
COUNTY-OTHER, MADISON	EXPANDED USE OF GW - SPARTA AQUIFER	GROUNDWATER	MADISON	MADISON	0	0	0	8	91	156

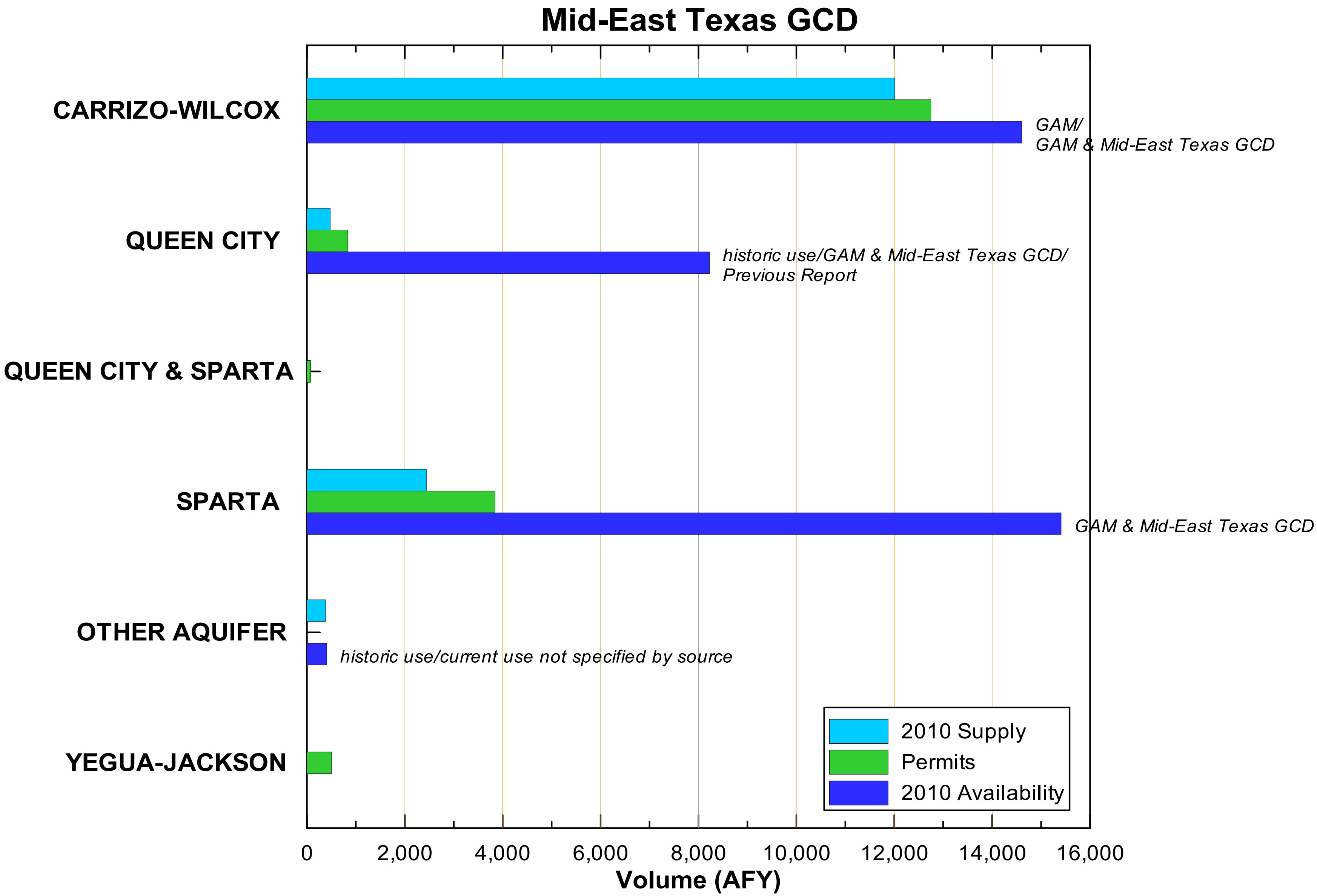
Mid-East Texas GCD - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
COUNTY-OTHER, MADISON	EXPANDED USE OF GW - SPARTA AQUIFER	GROUNDWATER	MADISON	MADISON	0	4	7	9	12	16
COUNTY-OTHER, MADISON	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	MADISON	MADISON	0	50	100	57	0	0
COUNTY-OTHER, MADISON	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	MADISON	MADISON	0	52	53	54	55	57
COUNTY-OTHER, MADISON	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	MADISON	MADISON	0	4	6	6	7	7
MADISONVILLE	EXPANDED USE OF GW - SPARTA AQUIFER	GROUNDWATER	MADISON	MADISON	0	34	56	75	100	127
MADISONVILLE	MUNICIPAL CONSERVATION - MEDIUM WUG	CONSERVATION	MADISON	MADISON	0	34	50	51	53	54
MANUFACTURING, MADISON	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	MADISON	MADISON	0	0	41	68	61	61
MANUFACTURING, MADISON	EXPANDED USE OF GW - QUEEN CITY AQUIFER	GROUNDWATER	MADISON	MADISON	0	0	0	4	5	5
MANUFACTURING, MADISON	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	MADISON	MADISON	0	29	15	11	41	72
NORMANGEE	EXPANDED USE OF GW - CARRIZO-WILCOX AQUIFER	GROUNDWATER	MADISON	MADISON	0	2	3	3	4	4
NORMANGEE	MUNICIPAL CONSERVATION - SMALL WUG	CONSERVATION	MADISON	MADISON	1	1	1	1	1	1
TARRANT REGIONAL WD	TOLEDO BEND PROJECT - TOLEDO BEND LAKE/RESERVOIR	SURFACE WATER	RESERVOIR	FREESTONE	0	0	0	0	44	57
TARRANT REGIONAL WD	TOLEDO BEND PROJECT - TOLEDO BEND LAKE/RESERVOIR	SURFACE WATER	RESERVOIR	FREESTONE	0	0	0	0	1,538	1,822
TOTAL					**42**	**855**	**1,275**	**1,425**	**9,952**	**10,560**

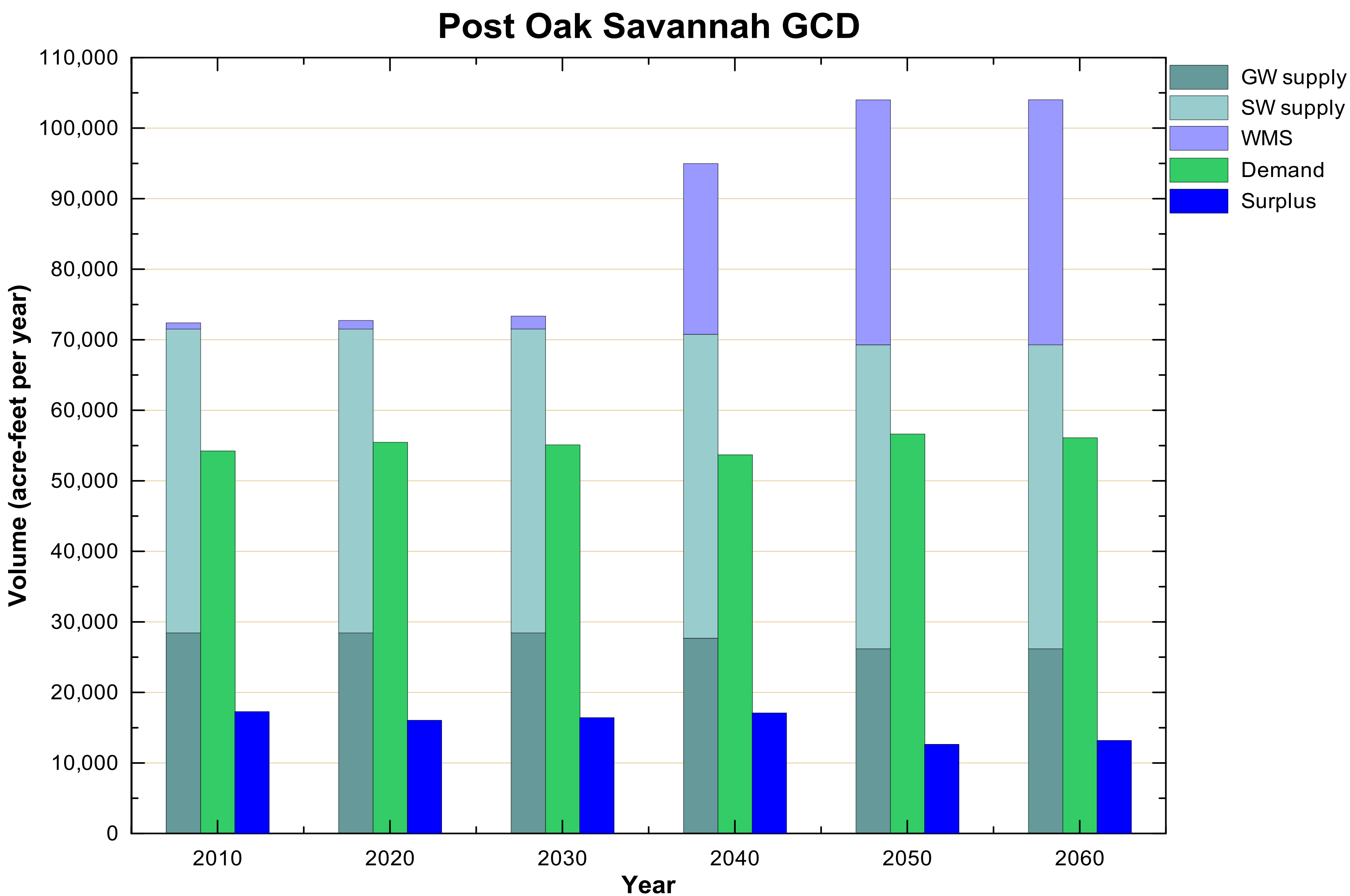
Mid-East Texas GCD – Permits



Mid-East Texas GCD - Supply/Permits/ Availability



Post Oak Savannah GCD - Supply/Demand Surplus



Post Oak Savannah GCD - Supply/Demand Surplus

	2010	2020	2030	2040	2050	2060
SUPPLY - Groundwater & Surface Water						
County-Other	2,328	2,328	2,328	2,334	2,334	2,334
Irrigation	27,525	27,530	27,534	27,547	27,552	27,556
Livestock	3,201	3,201	3,201	3,201	3,201	3,201
Manufacturing	10,534	10,534	10,534	10,628	10,628	10,628
Mining	3,959	3,959	3,959	3,029	1,529	1,529
Municipal	9,962	9,962	9,962	10,031	10,031	10,031
Steam Electric Power	14,000	14,000	14,000	14,000	14,000	14,000
Total Supply	***71,509***	***71,514***	***71,518***	***70,770***	***69,275***	***69,279***
DEMAND						
County-Other	1,540	1,554	1,560	1,556	1,561	1,586
Irrigation	19,852	19,101	18,385	17,743	17,035	16,357
Livestock	3,201	3,201	3,201	3,201	3,201	3,201
Manufacturing	7,016	8,483	8,520	8,557	10,140	10,170
Mining	4,025	4,024	4,024	3,024	1,524	1,524
Municipal	6,096	6,600	6,907	7,098	7,174	7,264
Steam Electric Power	12,500	12,500	12,500	12,500	16,000	16,000
Total Demand	***54,230***	***55,463***	***55,097***	***53,679***	***56,635***	***56,102***
SURPLUS/NEED						
County-Other	788	774	768	778	773	748
Irrigation	7,673	8,429	9,149	9,804	10,517	11,199
Livestock	0	0	0	0	0	0
Manufacturing	3,518	2,051	2,014	2,071	488	458
Mining	-66	-65	-65	5	5	5
Municipal	3,866	3,362	3,055	2,933	2,857	2,767
Steam Electric Power	1,500	1,500	1,500	1,500	-2,000	-2,000
Total Surplus/Need	***17,279***	***16,051***	***16,421***	***17,091***	***12,640***	***13,177***

Post Oak Savannah GCD - Supply/Demand Surplus

Post Oak Savannah GCD	2010	2020	2030	2040	2050	2060
Groundwater Supply - All Categories						
BRAZOS RIVER ALLUVIUM AQUIFER	9,400	9,400	9,400	9,400	9,400	9,400
CARRIZO-WILCOX AQUIFER	17,555	17,555	17,555	16,802	15,302	15,302
QUEEN CITY AQUIFER	293	293	293	293	293	293
SPARTA AQUIFER	1,049	1,049	1,049	1,049	1,049	1,049
TRINITY AQUIFER	106	106	106	106	106	106
YEGUA-JACKSON AQUIFER	29	29	29	29	29	29
Groundwater Supply Total	*28,432*	*28,432*	*28,432*	*27,679*	*26,179*	*26,179*
Surface Water Supply - All Categories						
ALCOA LAKE/RESERVOIR	14,000	14,000	14,000	14,000	14,000	14,000
BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	4,692	4,692	4,691	4,692	4,692	4,692
BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	17,641	17,646	17,650	17,654	17,659	17,663
BRAZOS RIVER COMBINED RUN-OF-RIVER MANUFACTURING	751	751	752	752	752	752
BRAZOS RIVER RUN-OF-RIVER	2,792	2,792	2,792	2,792	2,792	2,792
LIVESTOCK LOCAL SUPPLY	3,201	3,201	3,201	3,201	3,201	3,201
Surface Water Supply Total	*43,077*	*43,082*	*43,086*	*43,091*	*43,096*	*43,100*
TOTAL SUPPLY - All Categories	**71,509**	**71,514**	**71,518**	**70,770**	**69,275**	**69,279**
TOTAL DEMAND - All Categories	**54,230**	**55,463**	**55,097**	**53,679**	**56,635**	**56,102**
TOTAL SURPLUS/NEED - All Categories	**17,279**	**16,051**	**16,421**	**17,091**	**12,640**	**13,177**

Post Oak Savannah GCD - Water Management Strategies

	2010	2020	2030	2040	2050	2060
Groundwater WMS - All Categories						
CARRIZO-WILCOX AQUIFER	500	500	800	23,145	33,411	33,411
Surface Water WMS - All Categories						
BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	14	100	156	192	206	218
Conservation WMS - All Categories						
CONSERVATION	375	625	875	875	1,120	1,120
TOTAL WMS - All Categories	**889**	**1,225**	**1,831**	**24,212**	**34,737**	**34,749**
TOTAL SUPPLY + WMS - All Categories	**72,398**	**72,739**	**73,349**	**94,982**	**104,012**	**104,028**

	2010	2020	2030	2040	2050	2060
Water Management Strategy						
County-Other	0	0	0	0	1,072	1,785
Irrigation	-	-	-	-	-	-
Livestock	-	-	-	-	-	-
Manufacturing	-	-	-	-	-	-
Mining	100	100	100	0	0	0
Municipal	414	500	856	23,337	30,932	30,231
Steam Electric Power	*375*	*625*	*875*	*875*	*2,733*	*2,733*
Total WMS	***889***	***1,225***	***1,831***	***24,212***	***34,737***	***34,749***

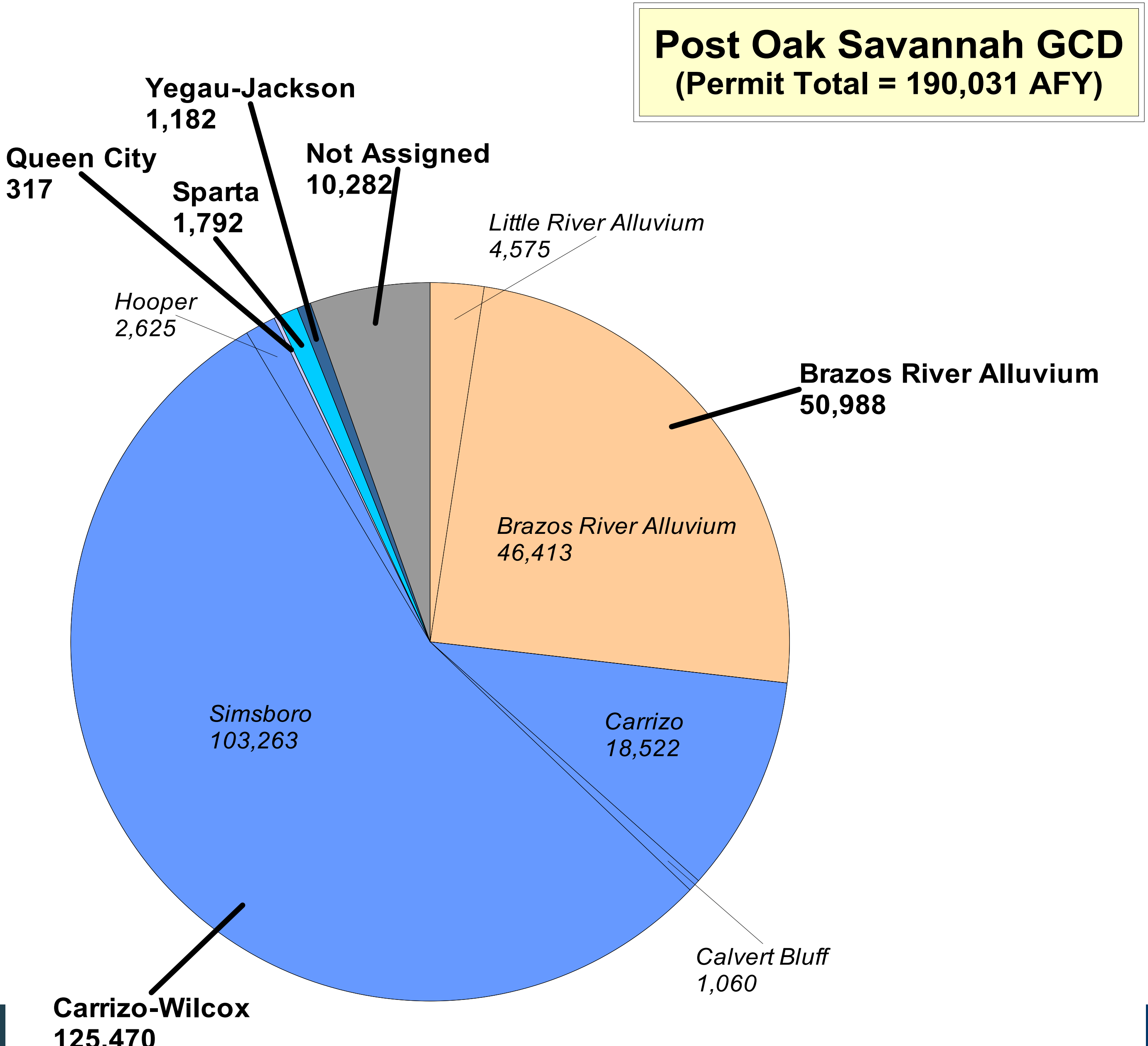
Post Oak Savannah GCD - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source	Recipient	2010	2020	2030	2040	2050	2060
BRAZOS RIVER AUTHORITY	GROUNDWATER/SURFACE WATER CONJUNCTIVE USE (LAKE GRANGER AUGMENTATION) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	MCLENNAN	0	0	0	0	5,144	4,431
BRAZOS RIVER AUTHORITY	GROUNDWATER/SURFACE WATER CONJUNCTIVE USE (LAKE GRANGER AUGMENTATION) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	WILLIAMSON	0	0	0	22,445	22,445	22,445
BRAZOS RIVER AUTHORITY	GROUNDWATER/SURFACE WATER CONJUNCTIVE USE (LAKE GRANGER AUGMENTATION) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	WILLIAMSON	0	0	0	0	1,115	1,115
BRAZOS RIVER AUTHORITY	GROUNDWATER/SURFACE WATER CONJUNCTIVE USE (LAKE GRANGER AUGMENTATION) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	WILLIAMSON	0	0	0	0	1,072	1,785
BRAZOS RIVER AUTHORITY	GROUNDWATER/SURFACE WATER CONJUNCTIVE USE (LAKE GRANGER AUGMENTATION) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	WILLIAMSON	0	0	0	0	1,056	1,056
SOUTHWEST MILAM WSC	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	BURLESON	0	4	10	15	18	22
SOUTHWEST MILAM WSC	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	LEE	0	5	11	15	19	23
SOUTHWEST MILAM WSC	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	MILAM	143	308	407	458	484	508
SOUTHWEST MILAM WSC	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	BURLESON	WILLIAMSON	257	83	272	212	445	413

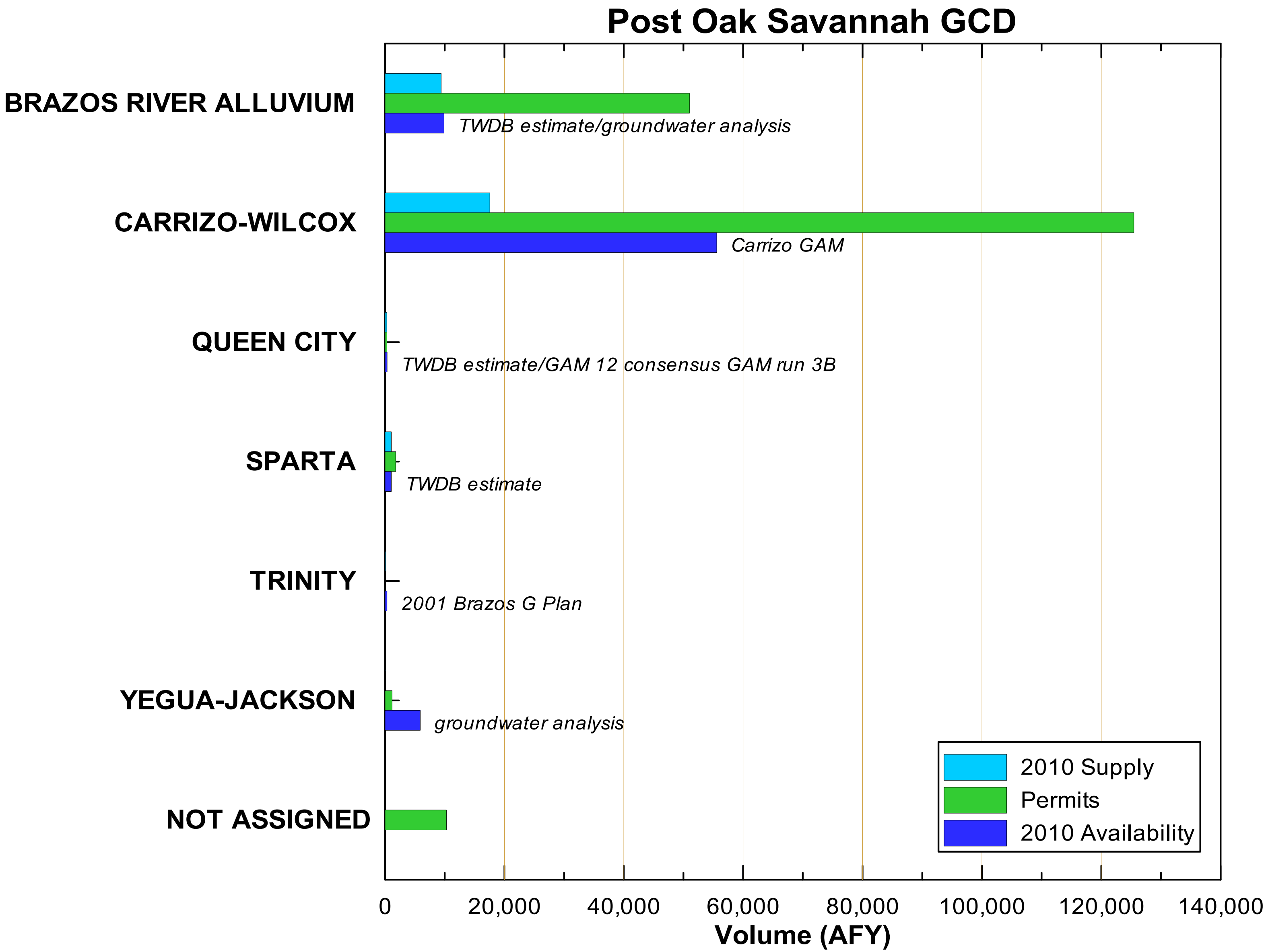
Post Oak Savannah GCD - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
MINING, MILAM	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	MILAM	MILAM	100	100	100	0	0	0
STEAM ELECTRIC POWER, MILAM	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	MILAM	MILAM	0	0	0	0	1,613	1,613
STEAM ELECTRIC POWER, MILAM	STEAM-ELECTRIC CONSERVATION - CONSERVATION	CONSERVATION	MILAM	MILAM	375	625	875	875	1,120	1,120
BELL-MILAM FALLS WSC	VOLUNTARY REDISTRIBUTION - BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	SURFACE WATER	RESERVOIR	MILAM	7	50	78	96	103	109
CENTRAL TEXAS WSC	BRA SUPPLY THROUGH THE EWCRWTS - BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	SURFACE WATER	RESERVOIR	MILAM	7	50	78	96	103	109
TOTAL					**889**	**1,225**	**1,831**	**24,212**	**34,737**	**34,749**

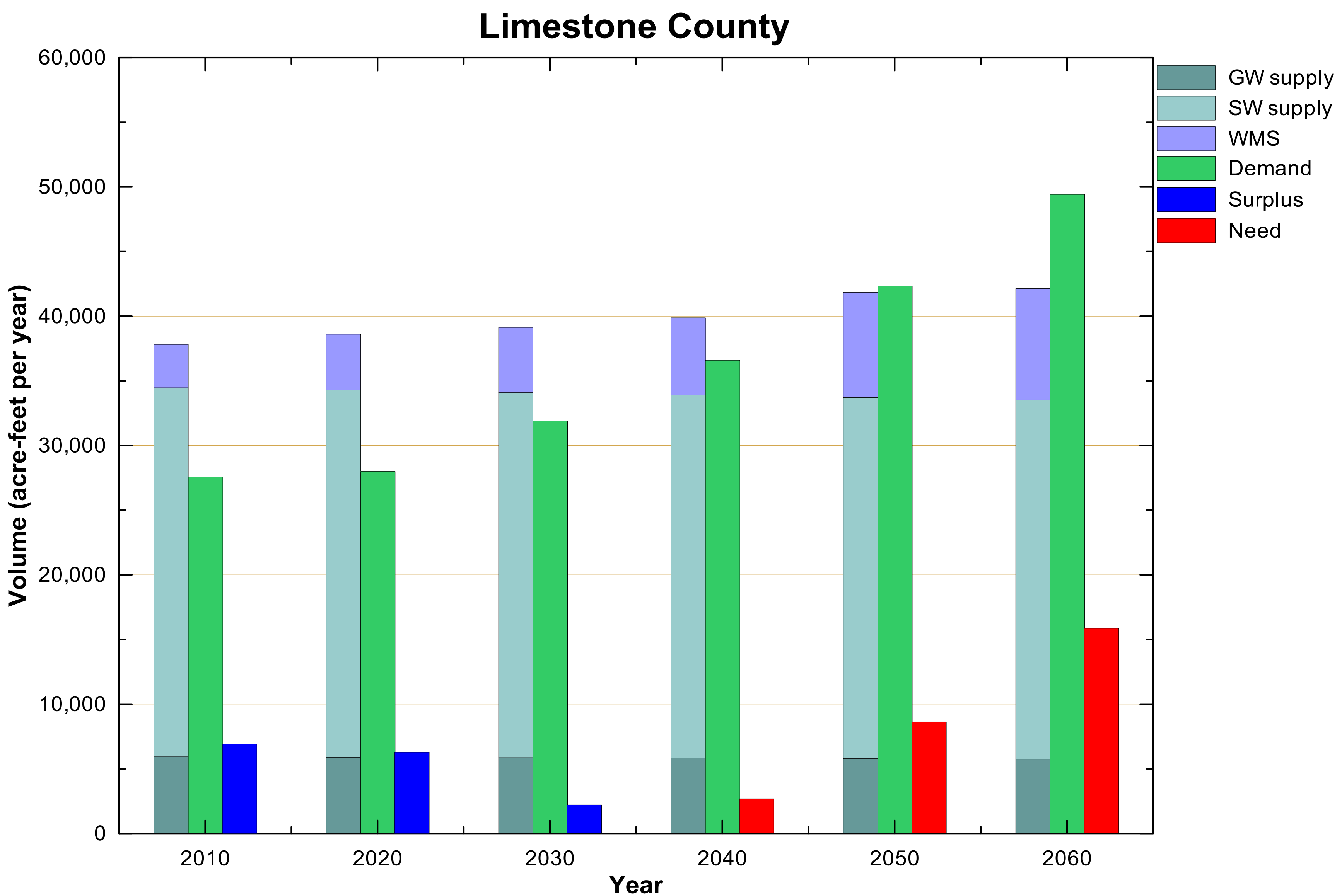
Post Oak Savannah GCD – Permits



Post Oak Savannah GCD – Supply/Permits/ Availability



Limestone County - Supply/Demand/ Surplus-Needs



Limestone County - Supply/Demand/ Surplus-Needs

	2010	2020	2030	2040	2050	2060
SUPPLY - Groundwater & Surface Water						
County-Other	1,552	1,518	1,485	1,451	1,418	1,384
Irrigation	-	-	-	-	-	-
Livestock	1,487	1,487	1,487	1,487	1,487	1,487
Manufacturing	30	25	19	14	8	3
Mining	1,168	1,168	1,168	1,168	1,168	1,168
Municipal	3,429	3,420	3,411	3,402	3,393	3,384
Steam Electric Power	26,803	26,664	26,524	26,384	26,245	26,105
Total Supply	***34,469***	***34,282***	***34,094***	***33,906***	***33,719***	***33,531***
DEMAND						
County-Other	828	765	703	642	594	551
Irrigation	-	-	-	-	-	-
Livestock	1,487	1,487	1,487	1,487	1,487	1,487
Manufacturing	48	53	58	63	67	72
Mining	380	387	392	396	400	403
Municipal	2,485	2,703	2,828	2,924	3,044	3,224
Steam Electric Power	22,332	22,598	26,420	31,079	36,758	43,681
Total Demand	***27,560***	***27,993***	***31,888***	***36,591***	***42,350***	***49,418***
SURPLUS/NEED						
County-Other	724	753	782	809	824	833
Irrigation	-	-	-	-	-	-
Livestock	0	0	0	0	0	0
Manufacturing	-18	-28	-39	-49	-59	-69
Mining	788	781	776	772	768	765
Municipal	944	717	583	478	349	160
Steam Electric Power	4,471	4,066	104	-4,695	-10,513	-17,576
Total Surplus/Need	***6,909***	***6,289***	***2,206***	***-2,685***	***-8,631***	***-15,887***

Limestone County - Supply/Demand/ Surplus-Needs

Limestone County	2010	2020	2030	2040	2050	2060
Groundwater Supply - All Categories						
CARRIZO-WILCOX AQUIFER	5,691	5,657	5,624	5,590	5,557	5,523
TRINITY AQUIFER	237	237	237	237	237	237
Groundwater Supply Total	*5,928*	*5,894*	*5,861*	*5,827*	*5,794*	*5,760*
Surface Water Supply - All Categories						
BRAZOS RIVER AUTHORITY MAIN STEM LAKE/RESERVOIR SYSTEM	25,735	25,596	25,456	25,316	25,177	25,037
LIVESTOCK LOCAL SUPPLY	1,487	1,487	1,487	1,487	1,487	1,487
MEXIA LAKE/RESERVOIR	199	185	170	156	141	127
NAVASOTA RIVER RUN-OF-RIVER	1,120	1,120	1,120	1,120	1,120	1,120
Surface Water Supply Total	*28,541*	*28,388*	*28,233*	*28,079*	*27,925*	*27,771*
TOTAL SUPPLY - All Categories	**34,469**	**34,282**	**34,094**	**33,906**	**33,719**	**33,531**
TOTAL DEMAND - All Categories	**27,560**	**27,993**	**31,888**	**36,591**	**42,350**	**49,418**
TOTAL SURPLUS/NEED - All Categories	**6,909**	**6,289**	**2,206**	**-2,685**	**-8,631**	**-15,887**

Limestone County - Water Management Strategies

	2010	2020	2030	2040	2050	2060
Groundwater WMS - All Categories						
CARRIZO-WILCOX AQUIFER	2,675	3,175	3,175	3,775	3,775	3,775
Surface Water WMS - All Categories						
GROESBECK OFF-CHANNEL LAKE/RESERVOIR	0	0	0	0	1755	1755
RICHLAND CHAMBERS LAKE/RESERVOIR NON-SYSTEM PORTION	0	7	6	18	16	15
Conservation WMS - All Categories						
CONSERVATION	675	1,142	1,860	2,185	2,582	3,067
TOTAL WMS - All Categories	**3,350**	**4,324**	**5,041**	**5,978**	**8,128**	**8,612**
TOTAL SUPPLY + WMS - All Categories	**37,819**	**38,606**	**39,135**	**39,884**	**41,847**	**42,143**

	2010	2020	2030	2040	2050	2060
Water Management Strategy						
County-Other	-	-	-	-	-	-
Irrigation	-	-	-	-	-	-
Livestock	-	-	-	-	-	-
Manufacturing	76	78	79	79	80	80
Mining	-	-	-	-	-	-
Municipal	2,604	3,116	3,113	3,723	5,475	5,474
Steam Electric Power	*670*	*1,130*	*1,849*	*2,176*	*2,573*	*3,058*
Total WMS	***3,350***	***4,324***	***5,041***	***5,978***	***8,128***	***8,612***

Limestone County - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
BISTONE MWSD	LIMESTONE COUNTY CARRIZO-WILCOX AQUIFER DEVELOPMENT - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	223	498	275	651	426	203
BISTONE MWSD	LIMESTONE COUNTY CARRIZO-WILCOX AQUIFER DEVELOPMENT - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	10	11	12	13	14	15
BISTONE MWSD	LIMESTONE COUNTY CARRIZO-WILCOX AQUIFER DEVELOPMENT - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	82	90	99	107	115	123
BISTONE MWSD	LIMESTONE COUNTY CARRIZO-WILCOX AQUIFER DEVELOPMENT - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	12	13	14	15	17	18
BISTONE MWSD	LIMESTONE COUNTY CARRIZO-WILCOX AQUIFER DEVELOPMENT - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	329	362	394	426	459	491
BISTONE MWSD	LIMESTONE COUNTY CARRIZO-WILCOX AQUIFER DEVELOPMENT - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	922	1,013	1,103	1,194	1,285	1,375
BISTONE MWSD	LIMESTONE COUNTY CARRIZO-WILCOX AQUIFER DEVELOPMENT - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	922	1,013	1,103	1,194	1,284	1,375
BISTONE MWSD	MUNICIPAL WATER CONSERVATION - CONSERVATION	CONSERVATION	LIMESTONE	LIMESTONE	4	9	7	5	4	4
KOSSE	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	100	100	100	100	100	100

Limestone County - Water Management Strategies

Sponsor Entity	Water Management Strategy	Type	Source County	Recipient County	2010	2020	2030	2040	2050	2060
MANUFACTURING, LIMESTONE	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	60	60	60	60	60	60
MANUFACTURING, LIMESTONE	ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING) - CARRIZO-WILCOX AQUIFER	GROUNDWATER	LIMESTONE	LIMESTONE	15	15	15	15	15	15
MANUFACTURING, LIMESTONE	MANUFACTURING WATER CONSERVATION - CONSERVATION	CONSERVATION	LIMESTONE	LIMESTONE	1	3	4	4	5	5
STEAM ELECTRIC POWER, LIMESTONE	STEAM-ELECTRIC CONSERVATION - CONSERVATION	CONSERVATION	LIMESTONE	LIMESTONE	670	1,130	1,849	2,176	2,573	3,058
CORSICANA	WATER TREATMENT PLANT - EXPANSION - RICHLAND CHAMBERS LAKE/RESERVOIR NON-SYSTEM PORTION	SURFACE WATER	RESERVOIR	LIMESTONE	0	7	6	18	16	15
GROESBECK	CITY OF GROESBECK OFF-CHANNEL RESERVOIR - GROESBECK OFF-CHANNEL LAKE/RESERVOIR	SURFACE WATER	RESERVOIR	LIMESTONE	0	0	0	0	1,755	1,755
TOTAL					**3,350**	**4,324**	**5,041**	**5,978**	**8,128**	**8,612**

Management Strategy Types - All

Water Management Strategy	Brazos Valley GCD	Fayette County GCD	Lost Pines GCD	Mid-East Texas GCD	Post Oak Savannah GCD	Limestone County
BRA SUPPLY THROUGH THE EWCRWTS					x	
BRA SYSTEM OPERATIONS PERMIT	x					
CITY OF GROESBECK OFF-CHANNEL RESERVOIR						x
AQUIFER STORAGE AND RECOVERY - CARRIZO-WILCOX AQUIFER			x			
ADDITIONAL CARRIZO AQUIFER DEVELOPMENT (INCLUDES OVERDRAFTING)	x		x		x	x
DEVELOPMENT OF CARRIZO-WILCOX AQUIFER			x			x
EXPANDED USE OF CARRIZO-WILCOX AQUIFER			x	x		
DEVELOPMENT OF QUEEN CITY AQUIFER			x			
EXPANDED USE OF QUEEN CITY AQUIFER			x	x		
EXPANDED USE OF SPARTA AQUIFER		x		x		
EXPANSION OF GULF COAST AQUIFER		x				
EXPANSION OF YEGUE-JACKSON AQUIFER		x				
DEVELOPMENT OF OTHER AQUIFER		x				
EXPANSION OF OTHER AQUIFER			x			
DROUGHT MANAGEMENT			x			
GBRA SIMSBORO PROJECT (OVERDRAFT)			x			
GROUNDWATER/SURFACE WATER CONJUNCTIVE USE (LAKE GRANGER AUGMENTATION/ CARRIZO-WILCOX AQUIFER)					x	
CONSERVATION			x			
MANUFACTURING CONSERVATION						x
MUNICIPAL CONSERVATION	x	x	x	x		x
STEAM ELECTRIC CONSERVATION	x				x	x
PURCHASE WATER FROM CITY OF BRYAN	x					
REUSE				x		
REUSE	x					
TEMPORARY DROUGHT PERIOD USE OF QUEEN CITY AQUIFER			x			
TOLEDO BEND PROJECT				x		
VOLUNTARY REDISTRIBUTION (BRAZOS RIVER AUTHORITY)					x	
WATER TREATMENT PLANT EXPANSION (RICHLAND CHAMBERS RESERVOIR)						x


Questions?

APPENDIX H

TERS FOR GMA 12 (GAM TASK 12-035)

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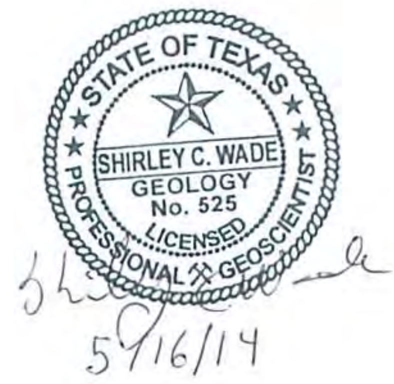
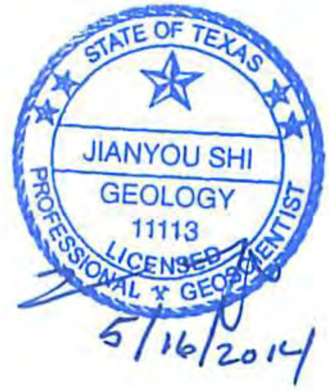
GAM TASK 13-035 VERSION 2: TOTAL ESTIMATED RECOVERABLE STORAGE FOR AQUIFERS IN GROUNDWATER MANAGEMENT AREA 12

by Shirley Wade, Ph.D., P.G. and Jerry Shi, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
(512) 936-0883
May 16, 2014





The seals appearing on this document were authorized by Shirley C. Wade, P.G. 525, and Jianyou (Jerry) Shi, P.G. 11113 on May 16, 2014.

The total estimated recoverable storage in this report was calculated as follows: the Trinity Aquifer (Jerry Shi), and the Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, Gulf Coast, and Brazos River Alluvium aquifers (Shirley Wade).

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GAM Task 13-035 Version 2: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 12

by Shirley Wade, Ph.D., P.G. and Jerry Shi, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
(512) 936-0883
May 16, 2014

EXECUTIVE SUMMARY:

Texas Water Code, §36.108 (d) (Texas Water Code, 2011) states that, before voting on the proposed desired future conditions for a relevant aquifer within a groundwater management area, the groundwater conservation districts shall consider the total estimated recoverable storage as provided by the executive administrator of the Texas Water Development Board (TWDB) along with other factors listed in §36.108(d). Texas Administrative Code Rule §356.10 (Texas Administrative Code, 2011) defines the total estimated recoverable storage as the estimated amount of groundwater within an aquifer that accounts for recovery scenarios that range between 25 percent and 75 percent of the porosity-adjusted aquifer volume.

This report discusses the methods, assumptions, and results of an analysis to estimate the total recoverable storage for the Trinity, Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, Brazos River Alluvium, and Gulf Coast aquifers within Groundwater Management Area 12. Tables 1 through 14 summarize the total estimated recoverable storage required by the statute. Figures 2 through 8 indicate the official extent of the aquifers in Groundwater Management Area 12 used to estimate the total recoverable storage. Tables 15 through 22 summarize total estimated recoverable storage for the Carrizo-Wilcox Aquifer by model layer, as requested by the coordinator for Groundwater Management Area 12.

On November 25, 2013, the TWDB Executive Administrator approved a boundary change between Groundwater Management Areas 12 and 14. That boundary change consisted of removing a small portion of Brazos County from Groundwater Management Area 14 and assigning it to Groundwater Management Area 12 such that Brazos County is now completely within Groundwater Management Area 12. This report (version 2) reflects those changes.

Updates to this report from version 1 include, (1) addition of total estimated recoverable storage volumes for the Gulf Coast Aquifer System, (2) updates to total estimated recoverable storage volumes for the Brazos River Alluvium Aquifer, and (3) updates to all maps showing the boundary of Groundwater Management Area 12.

DEFINITION OF TOTAL ESTIMATED RECOVERABLE STORAGE:

The total estimated recoverable storage is defined as the estimated amount of groundwater within an aquifer that accounts for recovery scenarios that range between 25 percent and 75 percent of the porosity-adjusted aquifer volume. In other words, we assume that only 25 to 75 percent of groundwater held within an aquifer can be removed by pumping.

The total recoverable storage was estimated for the portion of the aquifer within Groundwater Management Area 12 that lies within the official lateral aquifer boundaries as delineated by George and others (2011). Total estimated recoverable storage values may include a mixture of water quality types, including fresh, brackish, and saline groundwater, because the available data and the existing groundwater availability models do not permit the differentiation between different water quality types. The total estimated recoverable storage values do not take into account the effects of land surface subsidence, degradation of water quality, or any changes to surface water-groundwater interaction that may occur as the result of extracting groundwater from the aquifer.

METHODS:

To estimate the total recoverable storage of an aquifer, we first calculated the total storage in an aquifer within the official aquifer boundary. The total storage is the volume of groundwater removed by pumping that completely drains the aquifer.

Aquifers can be either unconfined or confined (Figure 1). A well screened in an unconfined aquifer will have a water level equal to the water level outside the well or in the aquifer. Thus, unconfined aquifers have water levels within the aquifers. A confined aquifer is bounded by low permeable geologic units at the top and bottom, and the aquifer is under hydraulic pressure above the ambient atmospheric pressure. The water level at a well screened in a confined aquifer will be above the top of the aquifer. As a result, calculation of total storage is also different between unconfined and confined aquifers. For an unconfined aquifer, the total storage is equal to the volume of groundwater removed by pumping that makes the water level fall to the aquifer bottom. For a confined aquifer, the total storage contains two parts. The first part is the groundwater released from the aquifer when the water level falls from above the top of the aquifer to the top of the aquifer. The reduction of hydraulic pressure in the aquifer by pumping causes expansion of groundwater and deformation of aquifer solids. The aquifer is still fully saturated to this point. The second part, just like unconfined aquifer, is the groundwater released from the aquifer when the water level falls from the top to the bottom of the aquifer. Given the same aquifer area and water level drop, the amount of water released in the second part is much greater than the first part. The difference is quantified by two parameters: storativity related to confined aquifers and specific yield related to unconfined aquifers. For example, storativity values range from 10^{-5} to 10^{-3} for most confined aquifers, while the specific yield values can be 0.01 to 0.3 for most unconfined aquifers. The equations for calculating the total storage are presented below:

- for unconfined aquifers

$$Total\ Storage\ = V_{drained} = Area \times S_y \times (Water\ Level - Bottom)$$

- for confined aquifers

$$Total\ Storage\ = V_{confined} + V_{drained}$$

  - confined part

$$V_{confined} = \ Area \times [\ S \times (Water\ Level - Top)]$$

or

$$V_{confined} = \ Area \times [\ S_s\ \times (\mathrm{Top} - \mathrm{Bottom}) \times (Water\ Level - Top)]$$

  - unconfined part

$$V_{drained} = \ Area \times \left[S_y \times (Top - Bottom)\right]$$

where:

- $V_{drained}$ = storage volume due to water draining from the formation (acre-feet)
- $V_{confined}$ = storage volume due to elastic properties of the aquifer and water(acre-feet)
- *Area* = area of aquifer (acre)

- *Water Level* = groundwater elevation (feet above mean sea level)
- *Top* = elevation of aquifer top (feet above mean sea level)
- *Bottom* = elevation of aquifer bottom (feet above mean sea level)
- S_y = specific yield (no units)
- S_s = specific storage (1/feet)
- S = storativity or storage coefficient (no units)

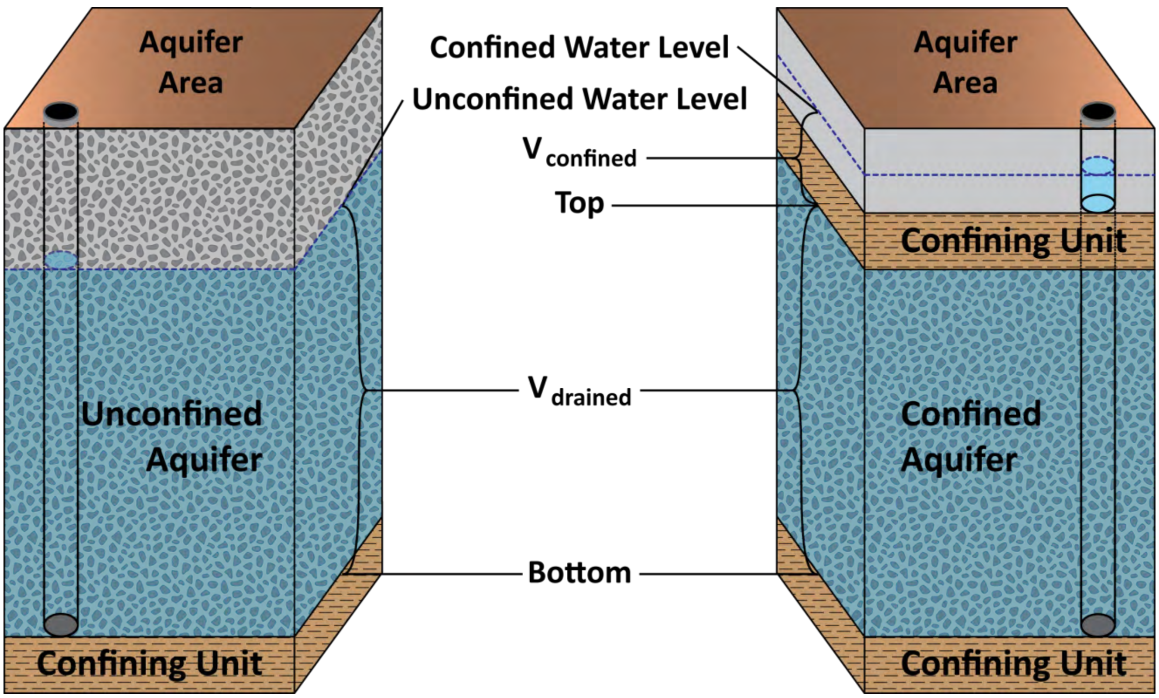

FIGURE 1. SCHEMATIC GRAPH SHOWING THE DIFFERENCE BETWEEN UNCONFINED AND CONFINED AQUIFERS.

As presented in the equations, calculation of the total storage requires data, such as aquifer top, aquifer bottom, aquifer storage properties, and water level. For the Trinity, Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Gulf Coast aquifers we extracted this information from existing groundwater availability model input and output files on a cell-by-cell basis.

For the Brazos River Alluvium Aquifer, which does not yet have a groundwater availability model, we used an analytical approach. For each county, ArcMAP™ was used to estimate the Brazos River Alluvium Aquifer thickness (assuming base of the alluvium and land surface) and average water table depth. Average Brazos River Alluvium Aquifer saturated thickness for each county was then calculated from average thickness minus average water table depth. Finally we estimated the total storage of the Brazos River Alluvium Aquifer from average saturated thickness multiplied with area and an assumed specific yield value.

The recoverable storage for each of the aquifers listed above was the product of its total storage and an estimated factor ranging from 25 percent to 75 percent.

PARAMETERS AND ASSUMPTIONS:

Trinity Aquifer

- We used version 1.01 of the groundwater availability model for the northern part of the Trinity Aquifer and the Woodbine Aquifer to estimate the total recoverable storage for the Trinity Aquifer. The Woodbine Aquifer is not present in Groundwater Management Area 12. See Bené and others (2004) for assumptions and limitations of the groundwater availability model.
- This groundwater availability model includes seven layers which generally represent the Woodbine Aquifer (Layer 1), the Washita and Fredericksburg Confining Unit (Layer 2), the Paluxy Aquifer Unit of the Trinity Aquifer (Layer 3), the Glen Rose Confining Unit of the Trinity Aquifer (Layer 4), the Hensell Sand Aquifer Unit of the Trinity Aquifer (Layer 5), the Twin Mountains Confining Units of the Trinity Aquifer (Layer 6), and the Hosston Aquifer Unit of the Trinity Aquifer (Layer 7). To develop the estimates for the total estimated recoverable storage, we used Layers 3 through 7 (the Trinity Aquifer).
- The down-dip boundary of the model is considered the Luling-Mexia-Talco Fault Zone, which probably allows minimal groundwater flow across the fault zone (Bené and others, 2004). The groundwater in the official extent of the northern portion of the Trinity Aquifer aquifers ranges from fresh to moderately saline (brackish) in composition (Bené and others, 2004).

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used version 2.02 of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers to estimate the total recoverable storage for the Carrizo-Wilcox, Queen City, and Sparta aquifers. 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 which generally represent the Sparta Aquifer (Layer 1), the Weches Confining Unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Confining Unit (Layer 4), the Carrizo Formation (Layer 5), the Upper Wilcox Formation or Calvert Bluff Formation (Layer 6), the Middle Wilcox Formation or Simsboro Formation (Layer 7), and the Lower Wilcox Formation or Hooper Formation (Layer 8). To develop the estimates for the total estimated recoverable storage, we used Layer 1 (Sparta Aquifer), Layer 3 (Queen City Aquifer), and Layers 5 through 8 (Carrizo-Wilcox Aquifer system).
- The down-dip boundary of the model is based on the location of the Wilcox Growth Fault Zone, which is considered to be a barrier to flow (Kelley and others, 2004). This boundary is relatively deep and in the portion of the aquifer that is characterized as brackish to saline; consequently, the model includes parts of the formation beyond potable portions of the aquifer (Dutton and others, 2003). The groundwater in the official extent of the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004).

Yegua-Jackson Aquifer and the Catahoula Formation portion of the Gulf Coast Aquifer System

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer to estimate the total recoverable storage of the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.
- This groundwater availability model includes five layers which represent the outcrop section for the Yegua-Jackson Aquifer and the Catahoula Formation and other younger overlying units (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5). To develop the estimates for the total estimated recoverable storage in the Yegua-Jackson Aquifer, we used layers

1 through 5; however, we only used model cells in Layer 1 that represent the outcrop area of the Yegua-Jackson Aquifer.

- The down-dip boundary for the Yegua-Jackson Aquifer in this model was set to approximately coincide with the extent of the available geologic data, well beyond any active portion (groundwater use) of the aquifer (Deeds and others, 2010). Consequently, the model extends into zones of brackish and saline groundwater. The groundwater in the official extent of the Yegua-Jackson Aquifer ranges from fresh to brackish in composition (Deeds and others, 2010).

Gulf Coast Aquifer System

- We used version 3.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer system for this analysis. See Kasmarek (2013) for assumptions and limitations of the model.
- The model has four layers which represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville confining unit (Layer 3), and the Jasper Aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer (Layer 4).
- The southeastern boundary of flow in each hydrogeologic unit of the model was set at the down-dip limit of freshwater (up to 10,000 milligrams per liter of total dissolved solids; Kasmarek, 2013).

Brazos River Alluvium Aquifer

- The Brazos River Alluvium Aquifer is under water table conditions in most places (George and others, 2011).
- The thickness of the Brazos River Alluvium Aquifer is based on a U.S. Geological Survey electromagnetic and resistivity imaging project (Shah and others, 2007).
- Water levels are from the TWDB groundwater database http://www.twdb.texas.gov/groundwater/data/gwdbrpt.asp accessed in July 2013. The three latest years of water level data were used to estimate the average water table depth for each county.
- We used a specific yield value of 0.15 from Cronin and others (1967).

RESULTS:

Tables 1 through 14 summarize the total estimated recoverable storage required by statute. Tables 15 through 22 in Appendix A summarize the total estimated recoverable storage for the formations making up the Carrizo-Wilcox Aquifer: the Hooper, the Simsboro, the Calvert Bluff, and the Carrizo formations. The county and groundwater conservation district total storage estimates are rounded to two significant digits. Figures 2 through 7 indicate the extent of the groundwater availability models in Groundwater Management Area 12 for the Trinity, Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Gulf Coast aquifers from which the storage information was extracted. Figure 8 indicates the extent of the Brazos River Alluvium Aquifer in Groundwater Management Area 12 used to estimate the total recoverable storage. Figures 9 through 12 in Appendix A indicate the extent of the groundwater availability model for the central portion of the Carrizo-Wilcox Aquifer from which the storage information for the Hooper, Simsboro, Calvert Bluff, and Carrizo formations was extracted.

TABLE 1. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE TRINITY AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	9,000,000	2,250,000	6,750,000
Lee	500,000	125,000	375,000
Williamson	1,600,000	400,000	1,200,000
Total	**11,100,000**	**2,775,000**	**8,325,000**

TABLE 2. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[1] FOR THE TRINITY AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	1,600,000	400,000	1,200,000
Lost Pines GCD	9,500,000	2,375,000	7,125,000
Total	**11,100,000**	**2,775,000**	**8,325,000**

[1] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

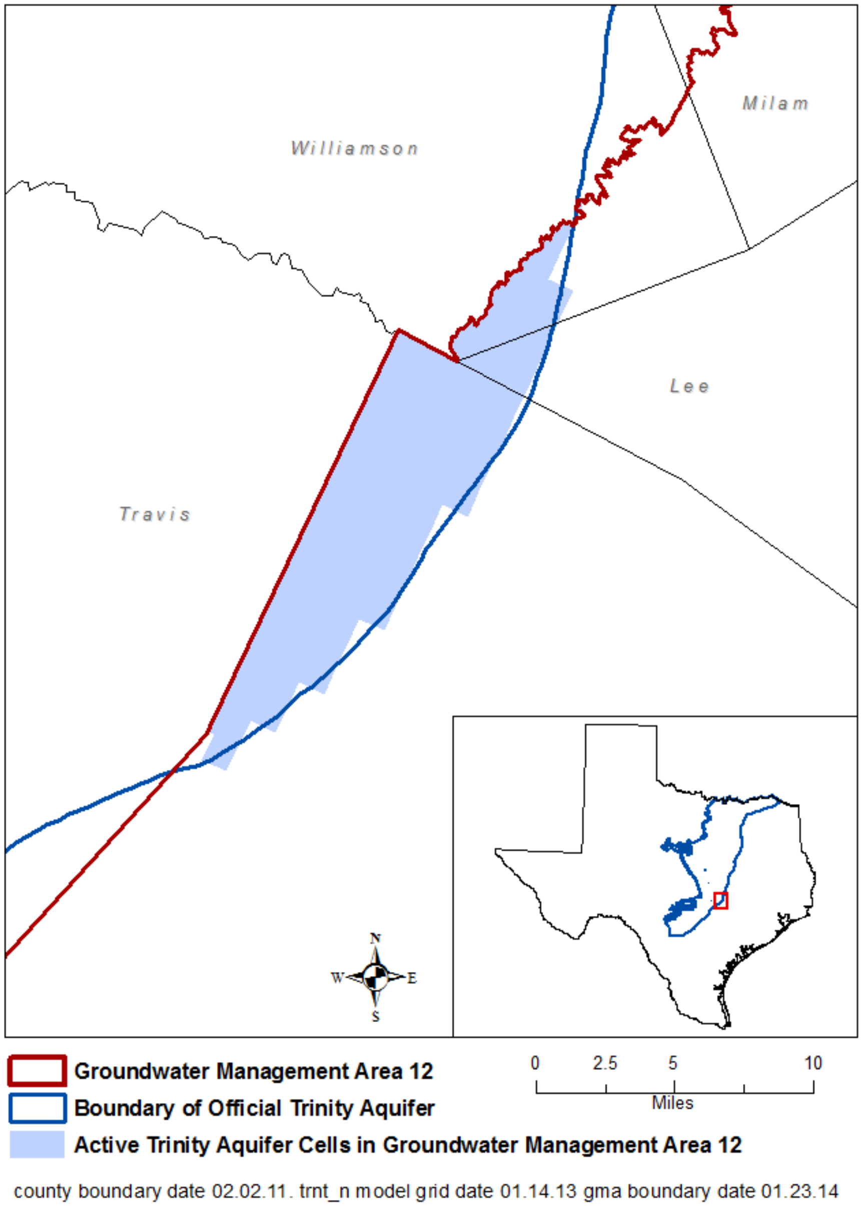

FIGURE 2. AREA OF THE TRINITY AQUIFER USED TO ESTIMATE TOTAL RECOVERABLE STORAGE (TABLES 1 AND 2) WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 3. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE CARRIZO-WILCOX AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	98,000,000	24,500,000	73,500,000
Brazos	69,000,000	17,250,000	51,750,000
Burleson	120,000,000	30,000,000	90,000,000
Falls	820,000	205,000	615,000
Fayette	95,000,000	23,750,000	71,250,000
Freestone	46,000,000	11,500,000	34,500,000
Lee	130,000,000	32,500,000	97,500,000
Leon	180,000,000	45,000,000	135,000,000
Limestone	12,000,000	3,000,000	9,000,000
Madison	110,000,000	27,500,000	82,500,000
Milam	47,000,000	11,750,000	35,250,000
Navarro	1,000,000	250,000	750,000
Robertson	110,000,000	27,500,000	82,500,000
Williamson	500,000	125,000	375,000
Total	1,019,320,000	254,830,000	764,490,000

TABLE 4. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT [2] FOR THE CARRIZO-WILCOX AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	14,000,000	3,500,000	10,500,000
Brazos Valley GCD	180,000,000	45,000,000	135,000,000
Fayette County GCD	95,000,000	23,750,000	71,250,000
Lost Pines GCD	220,000,000	55,000,000	165,000,000
Mid-East Texas GCD	340,000,000	85,000,000	255,000,000
Post Oak Savannah GCD	170,000,000	42,500,000	127,500,000
Total	1,019,000,000	254,750,000	764,250,000

[2] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

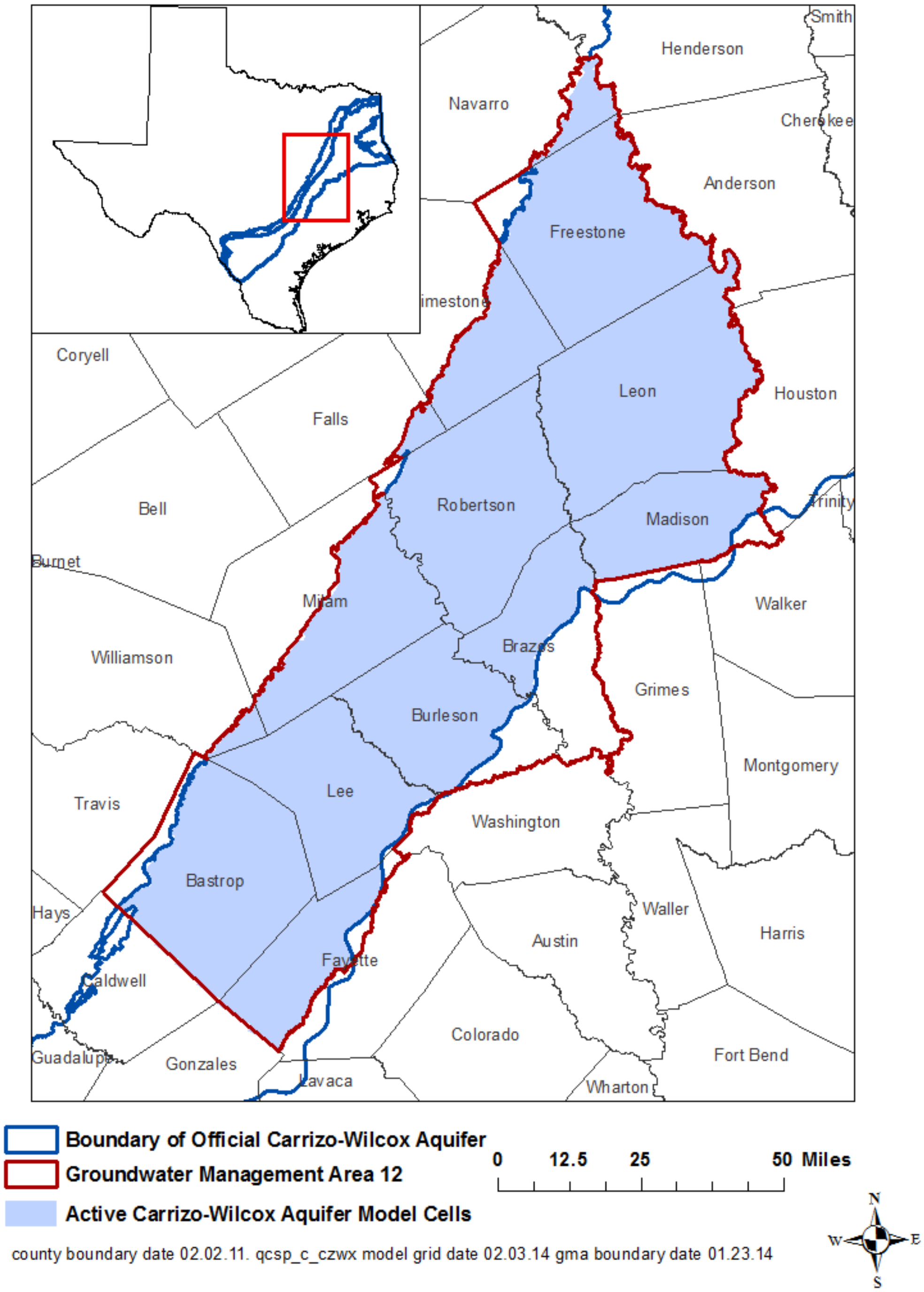

FIGURE 3. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE CARRIZO-WILCOX AQUIFER (TABLES 3 AND 4) WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 5. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE QUEEN CITY AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	9,500,000	2,375,000	7,125,000
Brazos	25,000,000	6,250,000	18,750,000
Burleson	29,000,000	7,250,000	21,750,000
Fayette	19,000,000	4,750,000	14,250,000
Freestone	290,000	72,500	217,500
Lee	23,000,000	5,750,000	17,250,000
Leon	25,000,000	6,250,000	18,750,000
Madison	20,000,000	5,000,000	15,000,000
Milam	650,000	162,500	487,500
Robertson	8,800,000	2,200,000	6,600,000
Total	160,240,000	40,060,000	120,180,000

TABLE 6. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[3] FOR THE QUEEN CITY AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Brazos Valley GCD	34,000,000	8,500,000	25,500,000
Fayette County GCD	19,000,000	4,750,000	14,250,000
Lost Pines GCD	32,000,000	8,000,000	24,000,000
Mid-East Texas GCD	45,000,000	11,250,000	33,750,000
Post Oak Savannah GCD	30,000,000	7,500,000	22,500,000
Total	160,000,000	40,000,000	120,000,000

[3] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

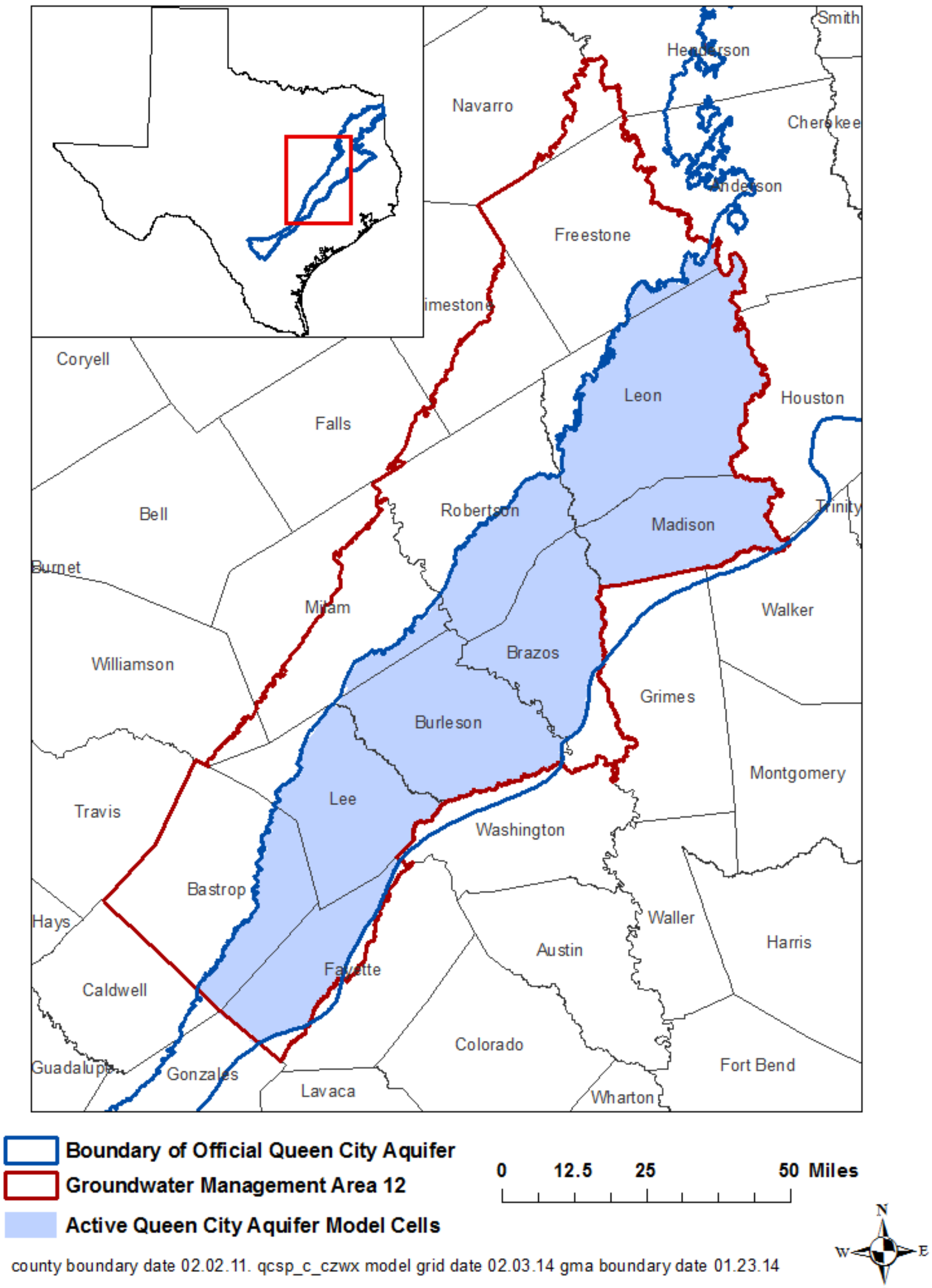

FIGURE 4. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE QUEEN CITY AQUIFER (TABLES 5 AND 6) WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 7. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE SPARTA AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	***Total Storage (acre-feet)***	***25 percent of Total Storage (acre-feet)***	***75 percent of Total Storage (acre-feet)***
Bastrop	2,500,000	625,000	1,875,000
Brazos	17,000,000	4,250,000	12,750,000
Burleson	16,000,000	4,000,000	12,000,000
Fayette	12,000,000	3,000,000	9,000,000
Lee	10,000,000	2,500,000	7,500,000
Leon	4,600,000	1,150,000	3,450,000
Madison	16,000,000	4,000,000	12,000,000
Robertson	1,300,000	325,000	975,000
Total	79,400,000	19,850,000	59,550,000

TABLE 8. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[4] FOR THE SPARTA AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Brazos Valley GCD	18,000,000	4,500,000	13,500,000
Fayette County GCD	12,000,000	3,000,000	9,000,000
Lost Pines GCD	13,000,000	3,250,000	9,750,000
Mid-East Texas GCD	21,000,000	5,250,000	15,750,000
Post Oak Savannah GCD	16,000,000	4,000,000	12,000,000
Total	80,000,000	20,000,000	60,000,000

[4] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

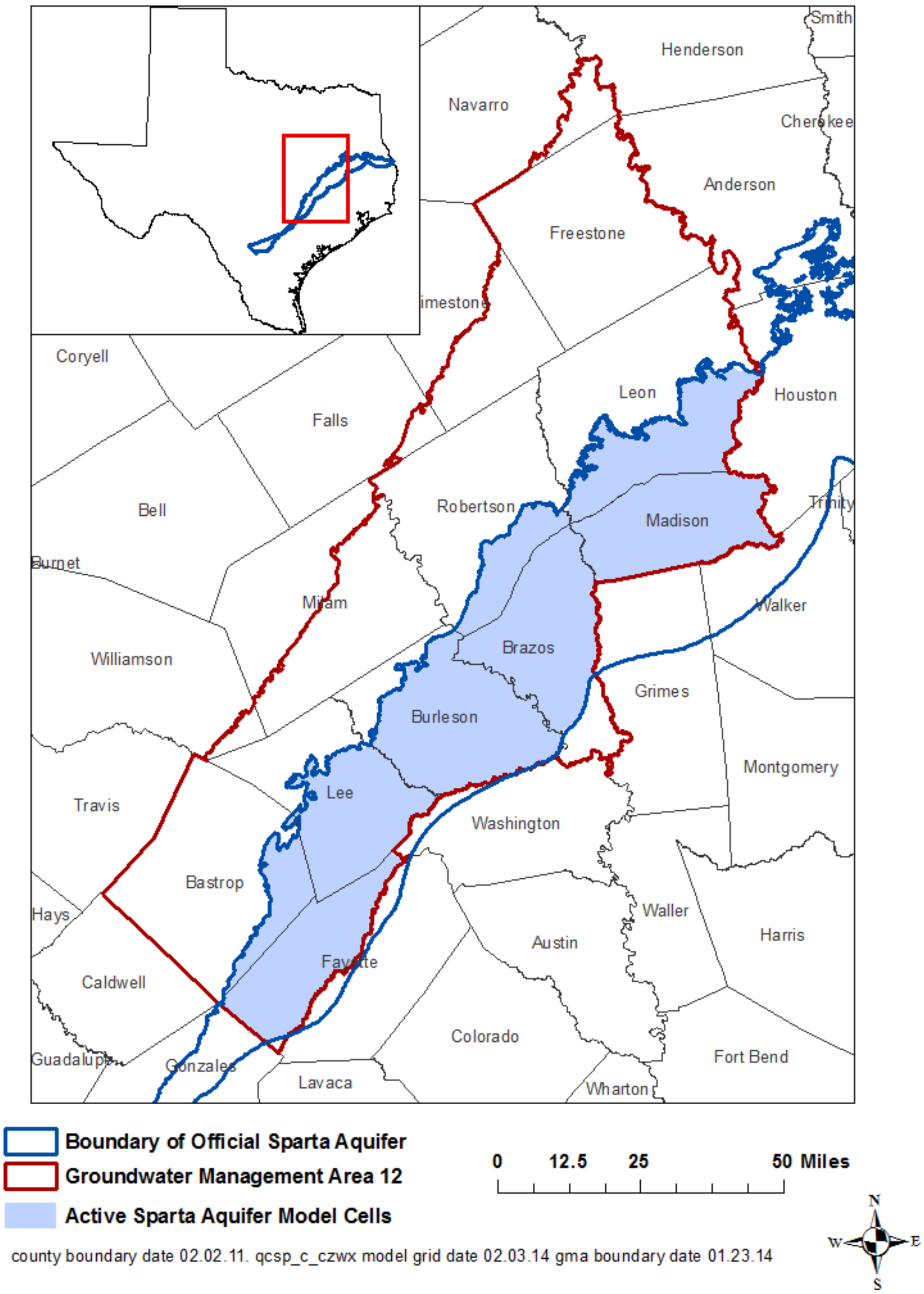

FIGURE 5. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE SPARTA AQUIFER (TABLES 7 AND 8) WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 9. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE YEGUA-JACKSON AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	290,000	72,500	217,500
Brazos	30,000,000	7,500,000	22,500,000
Burleson	27,000,000	6,750,000	20,250,000
Fayette	27,000,000	6,750,000	20,250,000
Lee	10,000,000	2,500,000	7,500,000
Leon	76,000	19,000	57,000
Madison	15,000,000	3,750,000	11,250,000
Total	109,366,000	27,341,500	82,024,500

TABLE 10. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[5] FOR THE YEGUA-JACKSON AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25percent of Total Storage (acre-feet)*	*75percent of Total Storage (acre-feet)*
Brazos Valley GCD	30,000,000	7,500,000	22,500,000
Fayette County GCD	27,000,000	6,750,000	20,250,000
Lost Pines GCD	10,000,000	2,500,000	7,500,000
Mid-East Texas GCD	15,000,000	3,750,000	11,250,000
Post Oak Savannah GCD	27,000,000	6,750,000	20,250,000
Total	109,000,000	27,250,000	81,750,000

[5] The total estimated recoverable storages values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

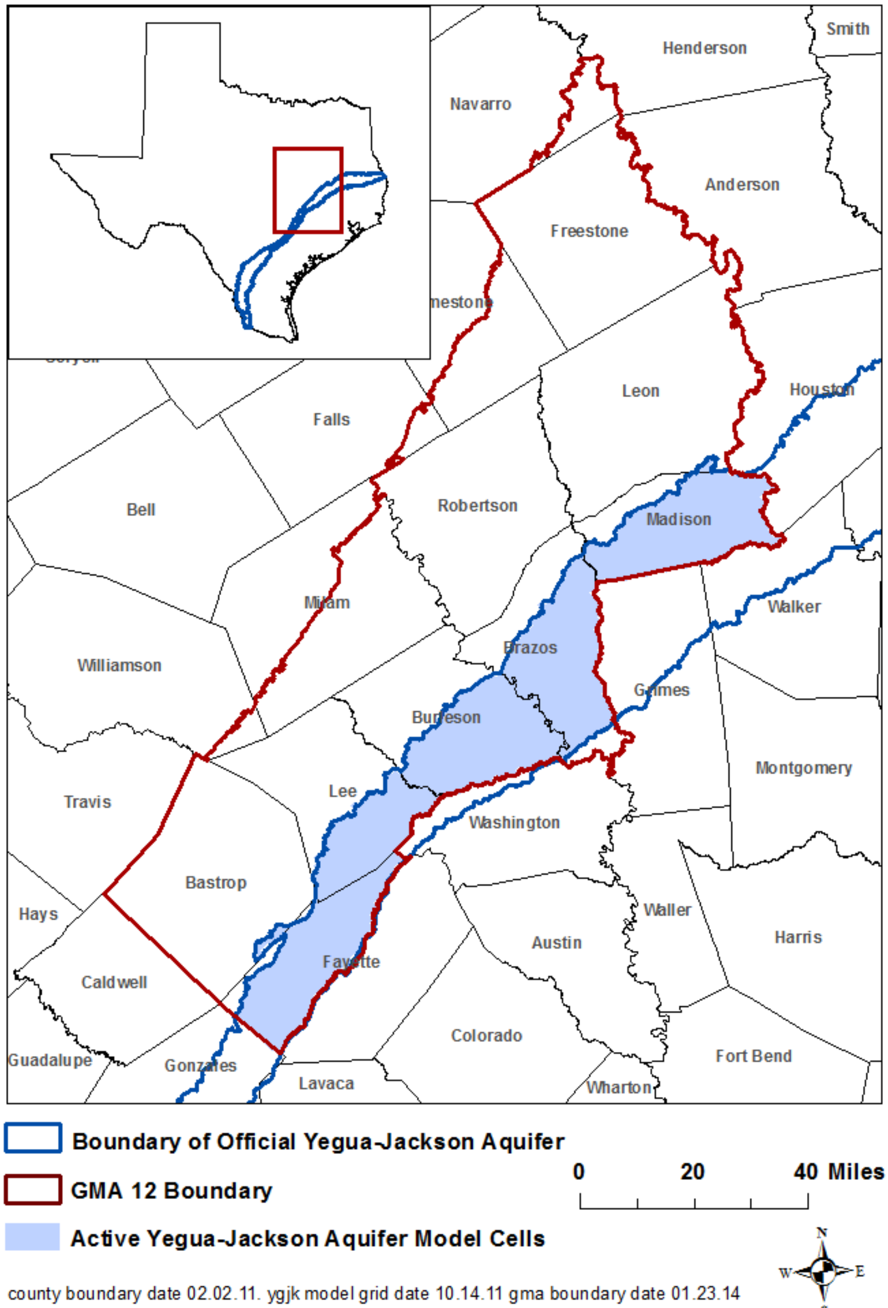

FIGURE 6. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER USED TO ESTIMATE TOTAL RECOVERABLE STORAGE (TABLES 9 AND 10) FOR THE YEGUA-JACKSON AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 11. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE GULF COAST AQUIFER SYSTEM WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Brazos	450,000	112,500	337,500
Total	450,000	112,500	337,500

TABLE 12. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[6] FOR THE GULF COAST AQUIFER SYSTEM WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25percent of Total Storage (acre-feet)*	*75percent of Total Storage (acre-feet)*
Brazos Valley GCD	450,000	112,500	337,500
Total	450,000	112,500	337,500

[6] The total estimated recoverable storages values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

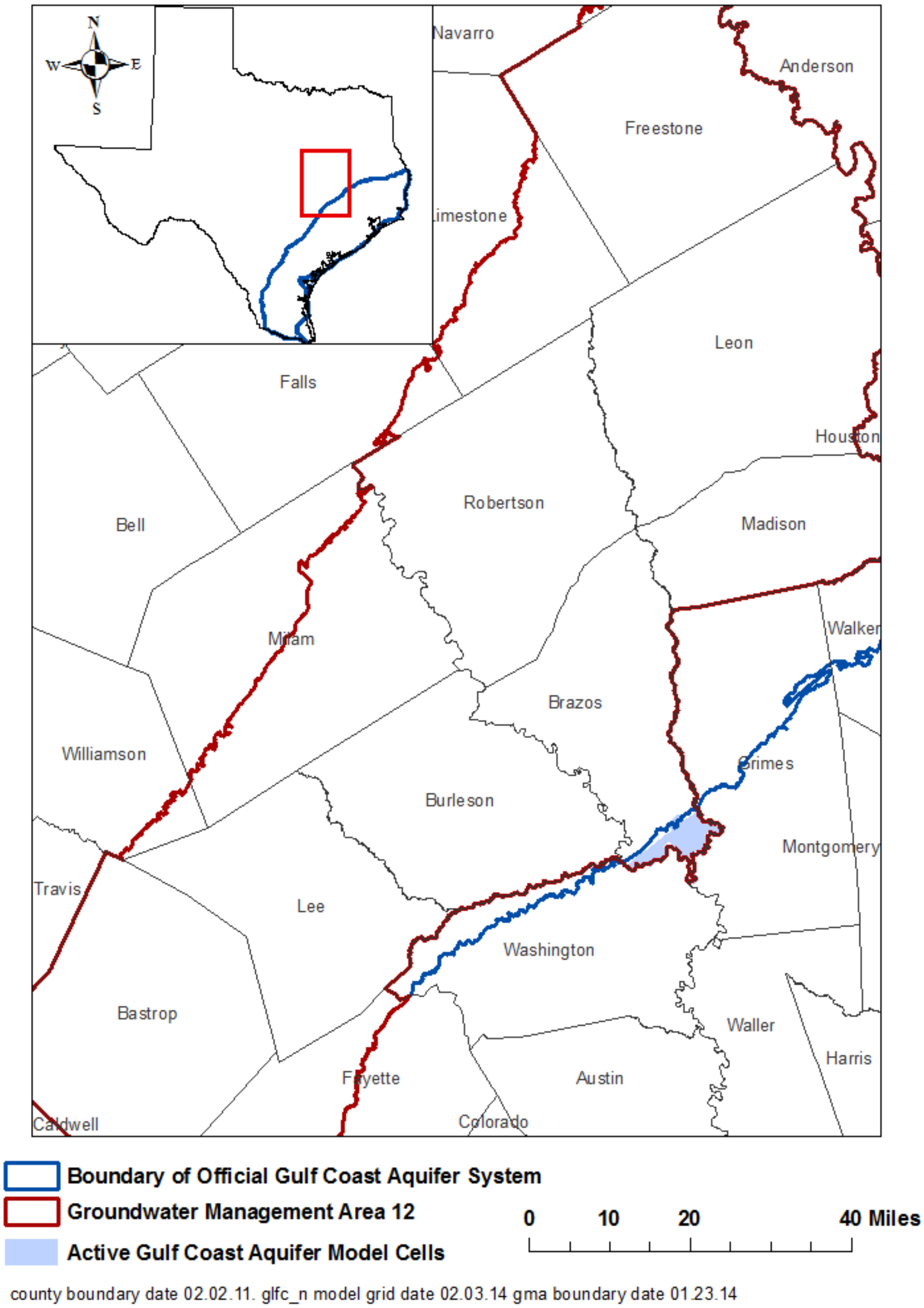

FIGURE 7. AREA USED TO ESTIMATE TOTAL RECOVERABLE STORAGE (TABLES 11 AND 12) FOR THE GULF COAST AQUIFER SYSTEM WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 13. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE BRAZOS RIVER ALLUVIUM AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Brazos	290,000	72,500	217,500
Burleson	450,000	112,500	337,500
Falls	140	35	105
Milam	28,000	7,000	21,000
Robertson	270,000	67,500	202,500
Total	1,038,140	259,535	778,605

TABLE 14. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[7] FOR THE BRAZOS RIVER ALLUVIUM AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25percent of Total Storage (acre-feet)*	*75percent of Total Storage (acre-feet)*
No district	140	35	105
Brazos Valley GCD	560,000	140,000	420,000
Post Oak Savannah GCD	480,000	120,000	360,000
Total	1,040,140	260,035	780,105

[7] The total estimated recoverable storages values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

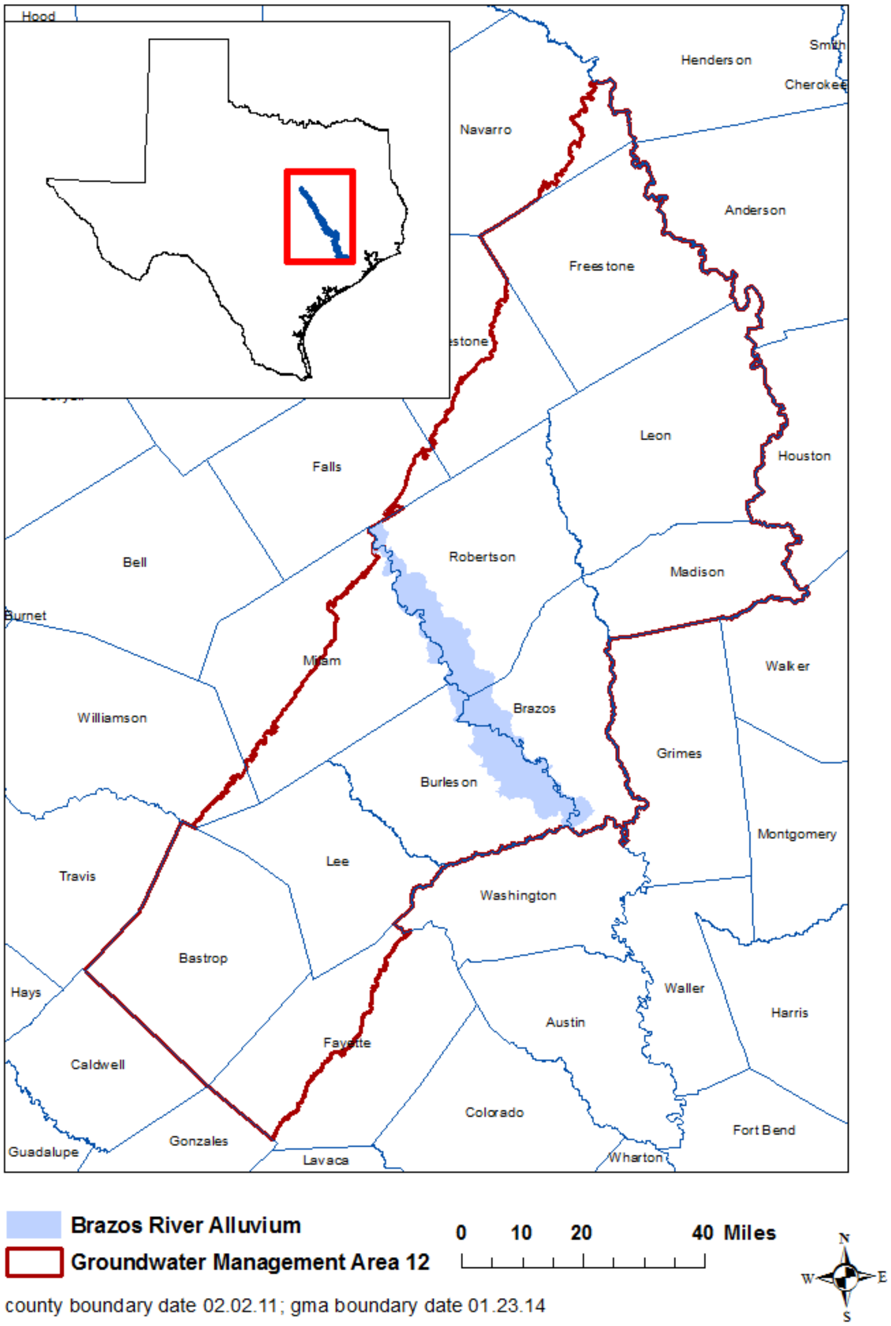

FIGURE 8. AREA USED TO ESTIMATE TOTAL RECOVERABLE STORAGE (TABLES 13 AND 14) FOR THE BRAZOS RIVER ALLUVIUM AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 12.

LIMITATIONS

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

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

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.

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APPENDIX A Total Estimated Recoverable Storage for the Hooper, Simsboro, Calvert Bluff, and Carrizo Formations of the Carrizo-Wilcox Aquifer

TABLE 15. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE HOOPER FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	35,000,000	8,750,000	26,250,000
Brazos	18,000,000	4,500,000	13,500,000
Burleson	30,000,000	7,500,000	22,500,000
Falls	760,000	190,000	570,000
Fayette	25,000,000	6,250,000	18,750,000
Freestone	17,000,000	4,250,000	12,750,000
Lee	34,000,000	8,500,000	25,500,000
Leon	42,000,000	10,500,000	31,500,000
Limestone	7,200,000	1,800,000	5,400,000
Madison	32,000,000	8,000,000	24,000,000
Milam	15,000,000	3,750,000	11,250,000
Navarro	850,000	212,500	637,500
Robertson	31,000,000	7,750,000	23,250,000
Williamson	450,000	112,500	337,500
Total	288,260,000	72,065,000	216,195,000

TABLE 16. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[8] FOR THE HOOPER FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	9,300,000	2,325,000	6,975,000
Brazos Valley GCD	49,000,000	12,250,000	36,750,000
Fayette County GCD	25,000,000	6,250,000	18,750,000
Lost Pines GCD	68,000,000	17,000,000	51,000,000
Mid-East Texas GCD	92,000,000	23,000,000	69,000,000
Post Oak Savannah GCD	45,000,000	11,250,000	33,750,000
Total	288,300,000	72,075,000	216,225,000

[8] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

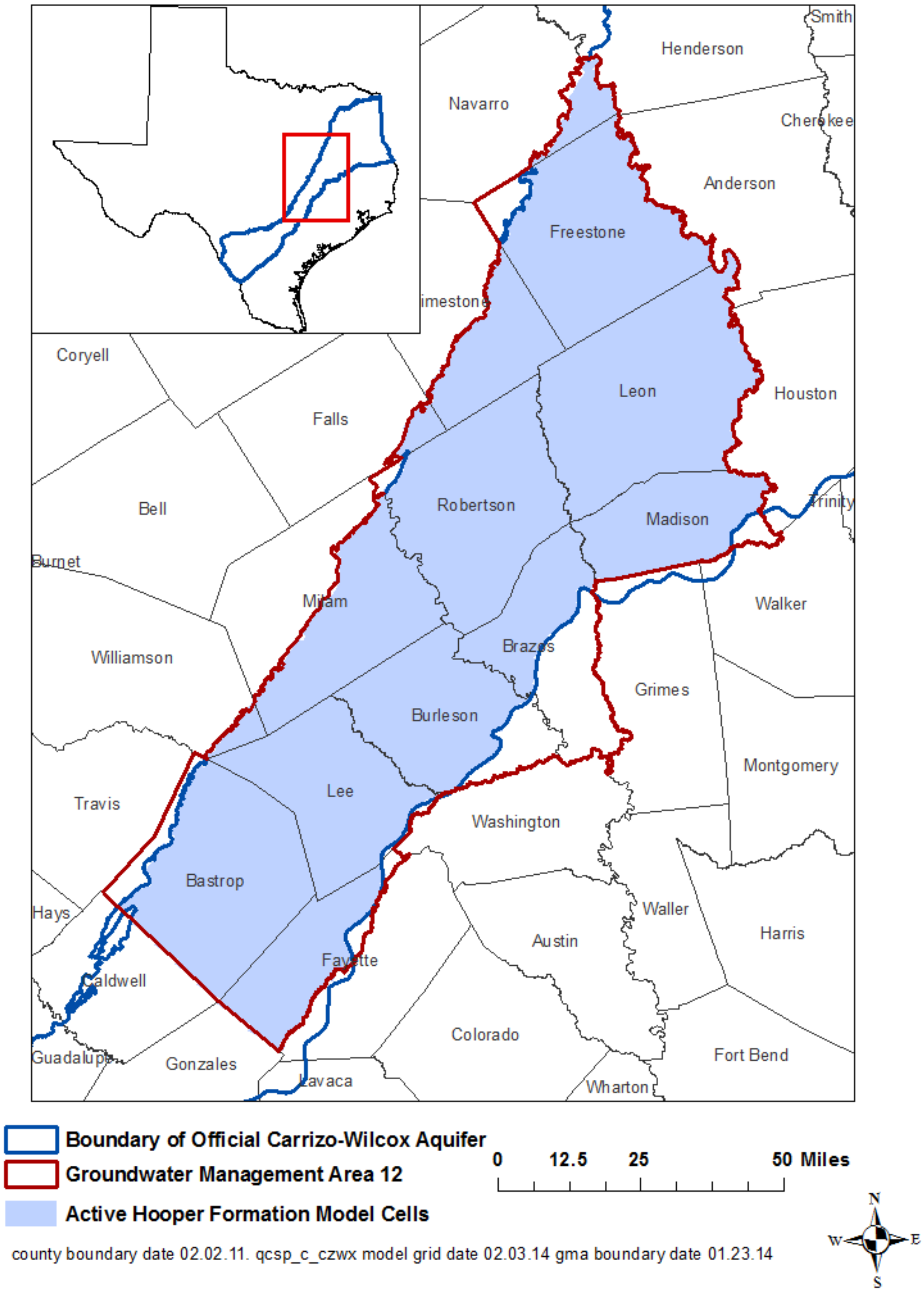

FIGURE 9. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE HOOPER FORMATION (TABLES 15 AND 16) WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 17. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE SIMSBORO FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	18,000,000	4,500,000	13,500,000
Brazos	19,000,000	4,750,000	14,250,000
Burleson	30,000,000	7,500,000	22,500,000
Falls	66,000	16,500	49,500
Fayette	14,000,000	3,500,000	10,500,000
Freestone	9,600,000	2,400,000	7,200,000
Lee	28,000,000	7,000,000	21,000,000
Leon	35,000,000	8,750,000	26,250,000
Limestone	3,100,000	775,000	2,325,000
Madison	19,000,000	4,750,000	14,250,000
Milam	17,000,000	4,250,000	12,750,000
Navarro	140,000	35,000	105,000
Robertson	36,000,000	9,000,000	27,000,000
Williamson	49,000	12,250	36,750
Total	228,955,000	57,238,750	171,716,250

TABLE 18. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[9] FOR THE SIMSBORO FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	3,400,000	850,000	2,550,000
Brazos Valley GCD	55,000,000	13,750,000	41,250,000
Fayette County GCD	14,000,000	3,500,000	10,500,000
Lost Pines GCD	46,000,000	11,500,000	34,500,000
Mid-East Texas GCD	64,000,000	16,000,000	48,000,000
Post Oak Savannah GCD	47,000,000	11,750,000	35,250,000
Total	229,400,000	57,350,000	172,050,000

[9] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

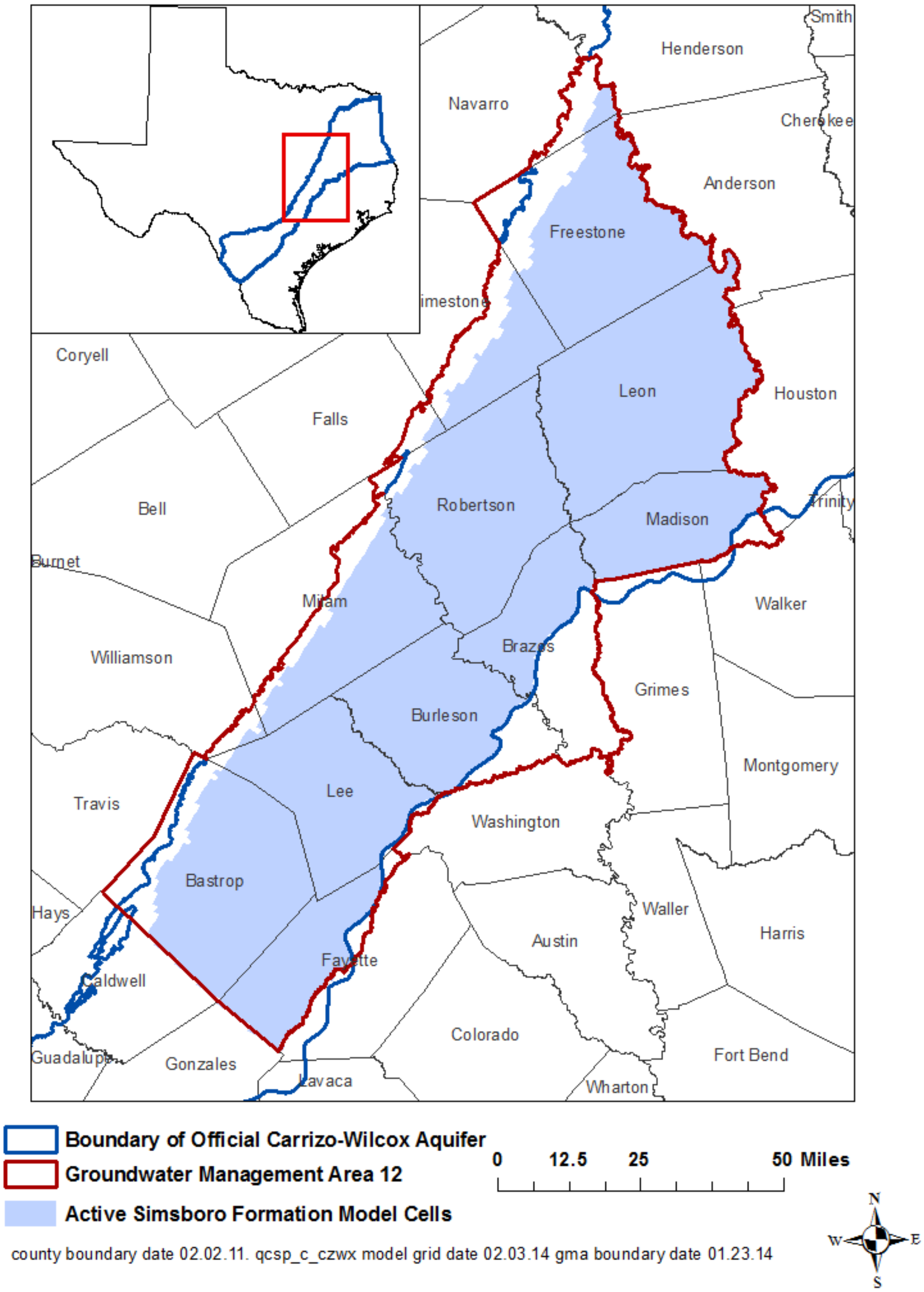

FIGURE 10. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE SIMSBORO FORMATION (TABLES 17 AND 18) WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 19. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE CALVERT BLUFF FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	33,000,000	8,250,000	24,750,000
Brazos	22,000,000	5,500,000	16,500,000
Burleson	40,000,000	10,000,000	30,000,000
Falls	0	0	0
Fayette	36,000,000	9,000,000	27,000,000
Freestone	17,000,000	4,250,000	12,750,000
Lee	43,000,000	10,750,000	32,250,000
Leon	81,000,000	20,250,000	60,750,000
Limestone	1,300,000	325,000	975,000
Madison	51,000,000	12,750,000	38,250,000
Milam	12,000,000	3,000,000	9,000,000
Navarro	39,000	9,750	29,250
Robertson	32,000,000	8,000,000	24,000,000
Williamson	1,800	450	1,350
Total	368,340,800	92,085,200	276,255,600

TABLE 20. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[10] FOR THE CALVERT BLUFF FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	1,400,000	350,000	1,050,000
Brazos Valley GCD	54,000,000	13,500,000	40,500,000
Fayette County GCD	36,000,000	9,000,000	27,000,000
Lost Pines GCD	77,000,000	19,250,000	57,750,000
Mid-East Texas GCD	150,000,000	37,500,000	112,500,000
Post Oak Savannah GCD	52,000,000	13,000,000	39,000,000
Total	370,400,000	92,600,000	277,800,000

[10] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

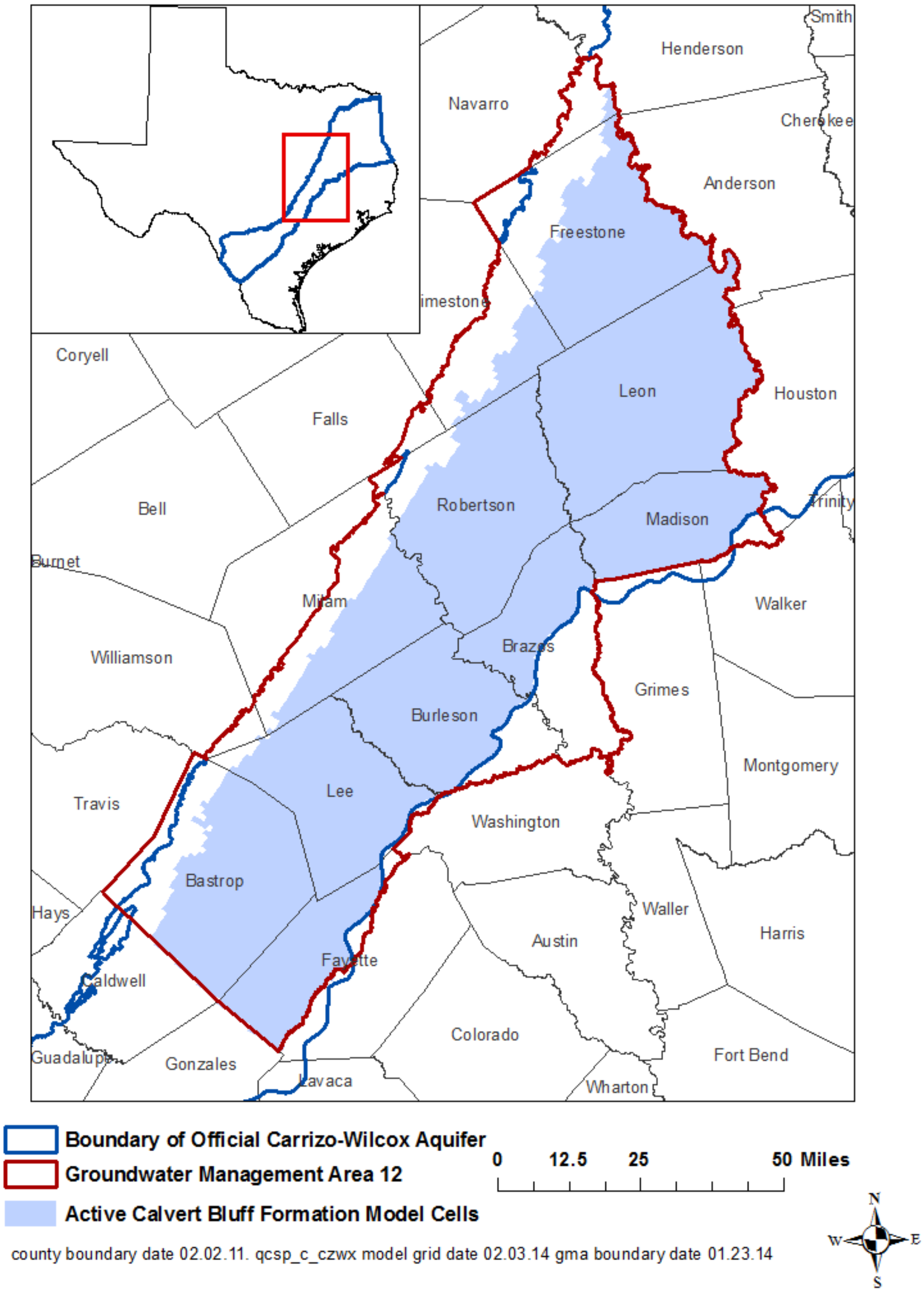

FIGURE 11.EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE CALVERT BLUFF FORMATION (TABLES 19 AND 20) WITHIN GROUNDWATER MANAGEMENT AREA 12.

TABLE 21. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE CARRIZO FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. COUNTY TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	12,000,000	3,000,000	9,000,000
Brazos	9,800,000	2,450,000	7,350,000
Burleson	21,000,000	5,250,000	15,750,000
Falls	0	0	0
Fayette	20,000,000	5,000,000	15,000,000
Freestone	2,000,000	500,000	1,500,000
Lee	21,000,000	5,250,000	15,750,000
Leon	20,000,000	5,000,000	15,000,000
Limestone	0	0	0
Madison	9,500,000	2,375,000	7,125,000
Milam	2,900,000	725,000	2,175,000
Navarro	0	0	0
Robertson	9,500,000	2,375,000	7,125,000
Williamson	0	0	0
Total	127,700,000	31,925,000	95,775,000

TABLE 22. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT[11] FOR THE CARRIZO FORMATION WITHIN GROUNDWATER MANAGEMENT AREA 12. GROUNDWATER CONSERVATION DISTRICT TOTAL ESTIMATES ARE ROUNDED TO TWO SIGNIFICANT DIGITS.

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	0	0	0
Brazos Valley GCD	19,000,000	4,750,000	14,250,000
Fayette County GCD	20,000,000	5,000,000	15,000,000
Lost Pines GCD	33,000,000	8,250,000	24,750,000
Mid-East Texas GCD	31,000,000	7,750,000	23,250,000
Post Oak Savannah GCD	23,000,000	5,750,000	17,250,000
Total	126,000,000	31,500,000	94,500,000

[11] The total estimated recoverable storage values by groundwater conservation district and county for an aquifer may not be the same because the numbers have been rounded to two significant digits.

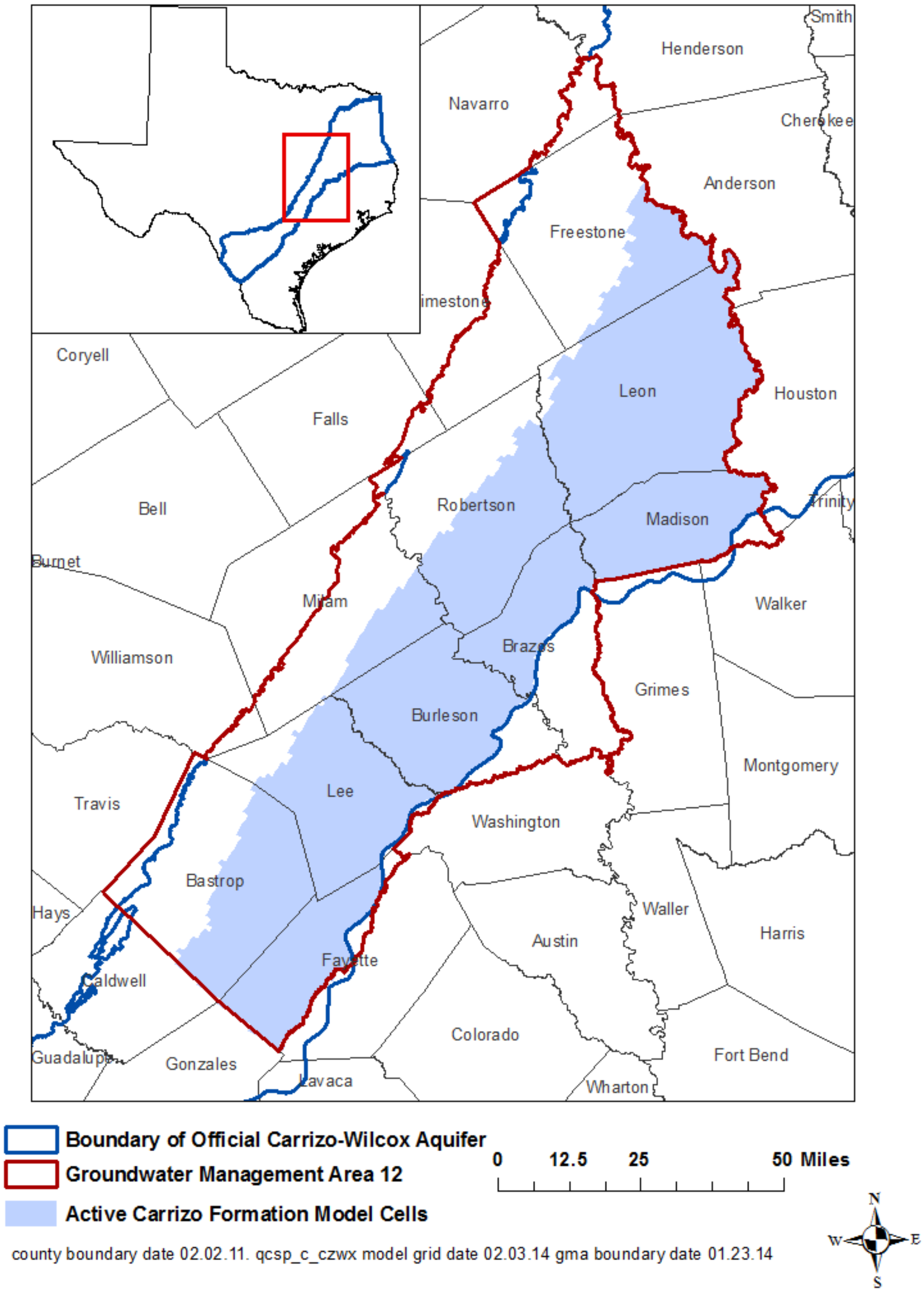

FIGURE 12.EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE CARRIZO FORMATION (TABLES 21 AND 22) WITHIN GROUNDWATER MANAGEMENT AREA 12.

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APPENDIX I

GAM RUN 13-002 FOR FAYETTE COUNTY GCD

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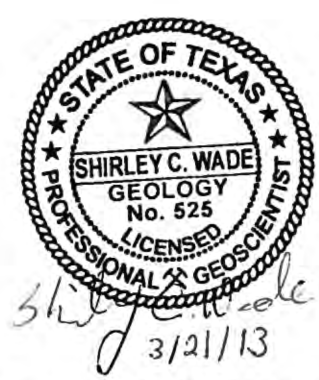
GAM Run 13-002: Fayette County Groundwater Conservation District Management Plan

by Shirley Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-0883
March 21, 2013



The seal appearing on this document was authorized by Shirley Wade, P.G. 525 on March 21, 2013.

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GAM RUN 13-002: FAYETTE COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Shirley Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 936-0883
March 21, 2013

EXECUTIVE SUMMARY:

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

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

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

The groundwater management plan for the Fayette County Groundwater Conservation District should be adopted by the district on or before October 9, 2013 and submitted to the executive administrator of the TWDB on or before November 8, 2013. The current management plan for the Fayette County Groundwater Conservation District expires on January 7, 2014.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability models for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers, the central portion of the Gulf Coast Aquifer, and the Yegua-Jackson Aquifer. Tables 1 through 5 summarize the groundwater availability model data required by the statute, and Figures 1 through 5 show the area of the model from which the values in the table was extracted. This model run replaces the results of GAM Run 08-35. GAM Run 13-002 meets current standards set after the release of GAM Run 08-35 including a refinement of using the extent of the official aquifer boundaries within the district. If after review of the figures, Fayette County Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately. Per statute TWDB is required to provide the districts with data from the official groundwater availability models; however, the TWDB has also approved, for planning purposes, the fully penetrating alternative model for the central portion of the Gulf Coast Aquifer that can have water budget information extracted for the district. Please contact the author of this report if a comparison report using this model is desired.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models for the Carrizo-Wilcox, Queen City, and Sparta aquifers, the central portion of the Gulf Coast Aquifer, and the Yegua-Jackson Aquifer were run for this analysis. Fayette County Groundwater Conservation District Water budgets for the historical model periods were extracted using ZONEBUDGET Version 3.01 (Harbaugh, 2009) The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used version 2.02 of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Dutton and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- This groundwater availability model includes eight layers which generally represent the Sparta Aquifer (Layer 1), the Weches Confining Unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Confining Unit (Layer 4), the Carrizo Aquifer (Layer 5), the Upper Wilcox or Calvert Bluff Formation (Layer 6), the Middle Wilcox or Simsboro Formation (Layer 7), and the Lower Wilcox or Hooper Formation (Layer 8). Individual water budgets for the District were determined for the Sparta Aquifer (Layer 1), the Queen City Aquifer (Layer 3), and the Carrizo-Wilcox Aquifer (Layer 5 through Layer 8 collectively).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

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

Gulf Coast Aquifer

- Version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer was used for this analysis. See Chowdhury and others (2004) and Waterstone and others (2003) for assumptions and limitations of the groundwater availability model.

- The model for the central portion of the Gulf Coast Aquifer assumes partially penetrating wells in the Evangeline Aquifer due to a lack of data for aquifer properties in the deeper, lower section of the aquifer.

- This groundwater availability model includes four layers, which generally represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer including parts of the Catahoula Formation (Layer 4).

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

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.

- This groundwater availability model includes five layers which represent the outcrop section for the Yegua-Jackson Aquifer and younger overlying units (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).

- An overall water budget for the District was determined for the Yegua-Jackson Aquifer (Layer 1 through Layer 5 collectively for the portions of the model that represent the Yegua Jackson Aquifer).

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

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model runs in the district, as shown in Tables 1 through 5.

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

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

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

- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer. In some cases this flow term includes lateral flow between the official aquifer and adjacent portions of the same hydrogeologic units which are not part of the official aquifer and may contain brackish water.

The information needed for the District’s management plan is summarized in Tables 1 through 5. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (Figures 1 through 5).

TABLE 1: SUMMARIZED INFORMATION FOR THE SPARTA AQUIFER THAT IS NEEDED FOR THE FAYETTE COUNTY GROUNDWATER CONSERVATION DISTRICT’S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	379
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	514
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	178
Estimated net annual volume of flow between each aquifer in the district	From the Sparta Aquifer into younger overlying units	1,656
	From the Weches Formation confining unit into the Sparta Aquifer	1,534
	From Sparta Aquifer to brackish Sparta	38

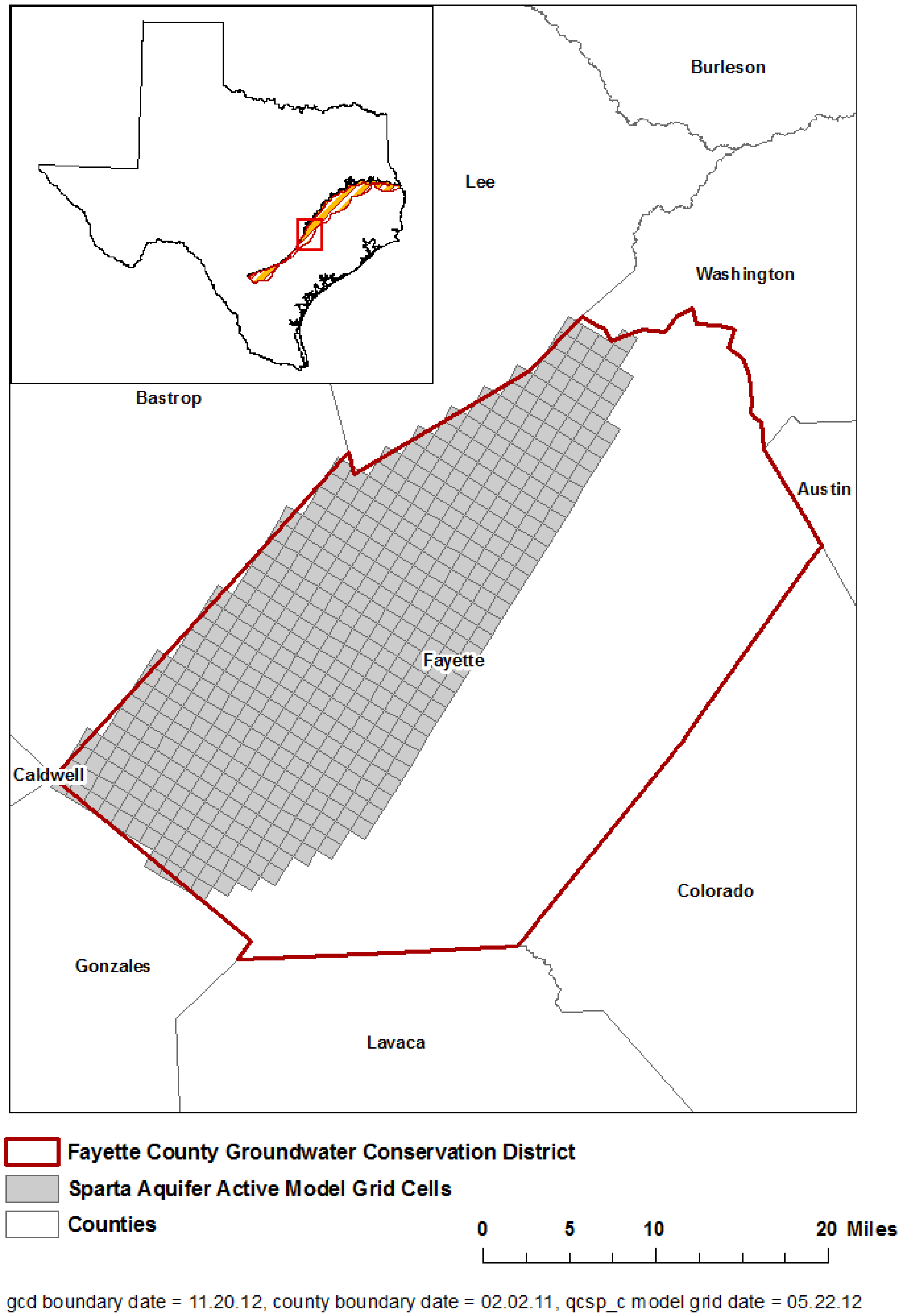

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE SPARTA AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER THAT IS NEEDED FOR THE FAYETTE COUNTY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	1,935
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	499
Estimated net annual volume of flow between each aquifer in the district	From the Queen City Aquifer into the Weches Formation confining unit.	1,430
	From the Reklaw Formation confining unit into the Queen City Aquifer	198
	From the Queen City Aquifer to the brackish Queen City	87

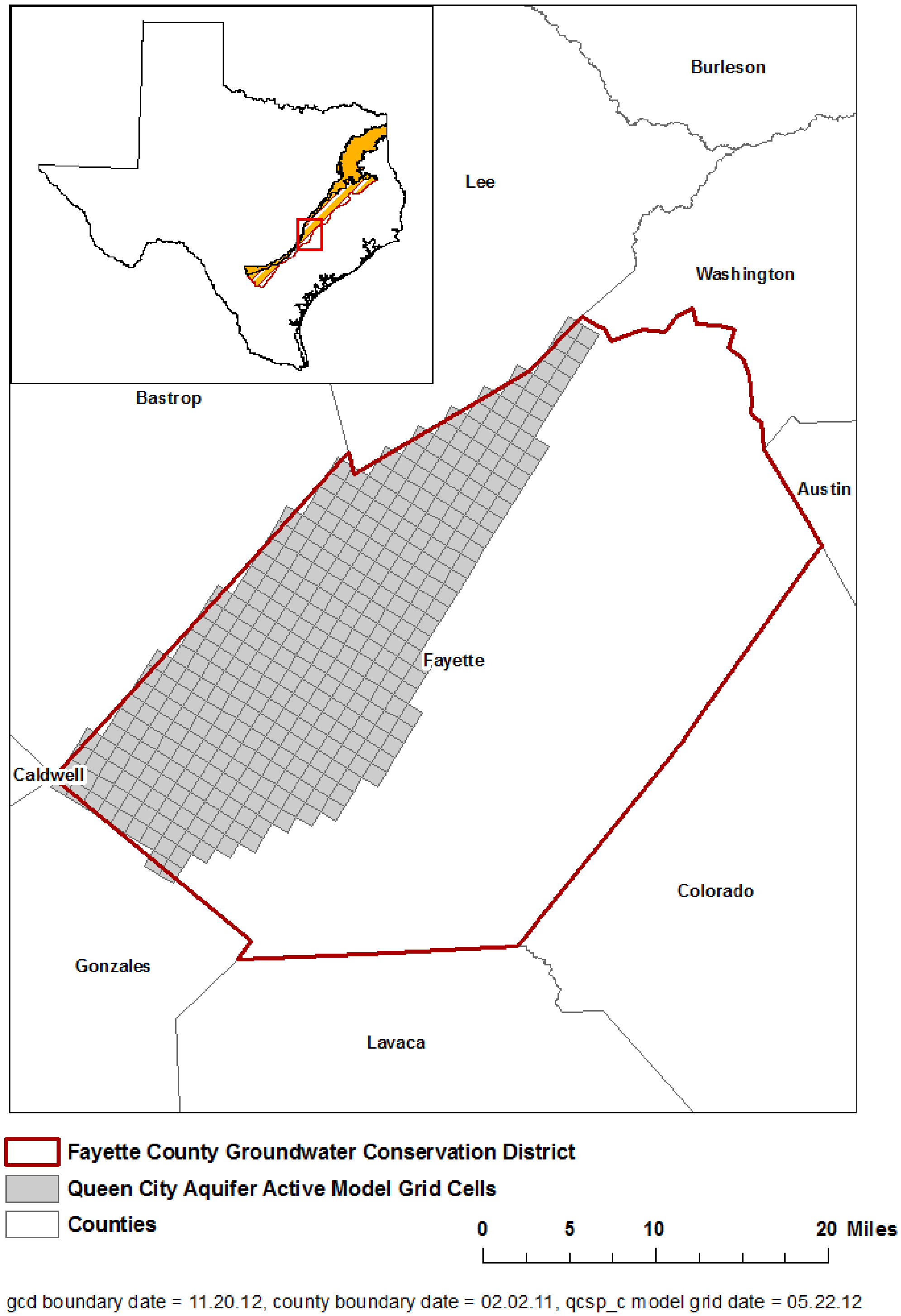

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE QUEEN CITY AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 3: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR THE FAYETTE COUNTY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	7,134
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	2,966
Estimated net annual volume of flow between each aquifer in the district	From the Carrizo-Wilcox Aquifer into the Reklaw confining unit.	231
	From the Carrizo-Wilcox Aquifer to the brackish Carrizo-Wilcox	4,115

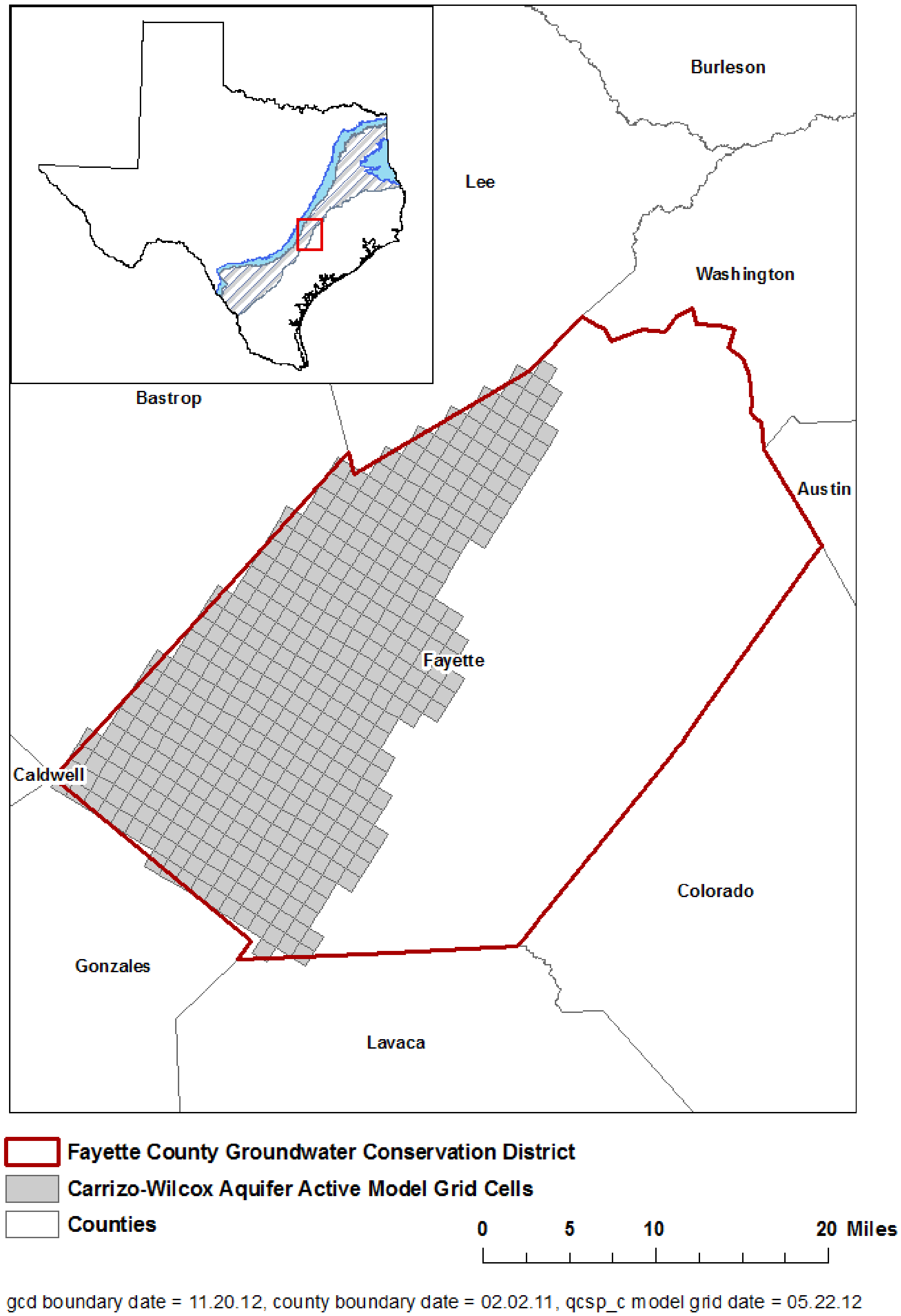

FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE CARRIZO-WILCOX AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 4: SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER THAT IS NEEDED FOR THE FAYETTE COUNTY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer	1,955
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Gulf Coast Aquifer	982
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer	279
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer	1,375
Estimated net annual volume of flow between each aquifer in the district	From the Gulf Coast Aquifer into underlying units	599[1]

1) Estimated from the groundwater availability model for the Yegua-Jackson Aquifer

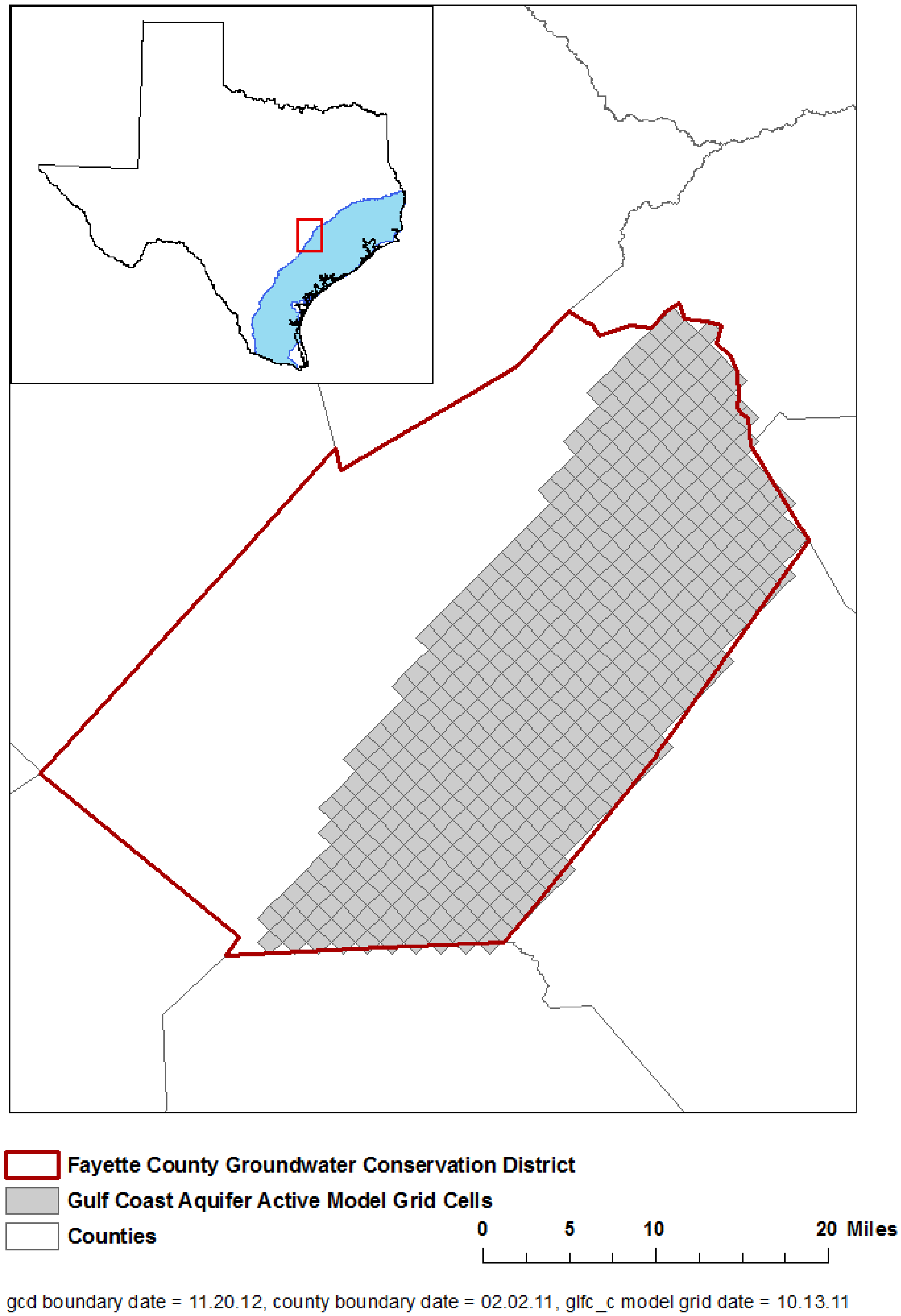

FIGURE 4: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE GULF COAST AQUIFER FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED (THE GULF COAST AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 5: SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER THAT IS NEEDED FOR THE FAYETTE COUNTY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	47,304
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	59,160
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	9,849
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	6,492
Estimated net annual volume of flow between each aquifer in the district	From Yegua-Jackson Aquifer to brackish Yegua-Jackson	728
	From the Catahoula and overlying units into the Yegua-Jackson Aquifer	599

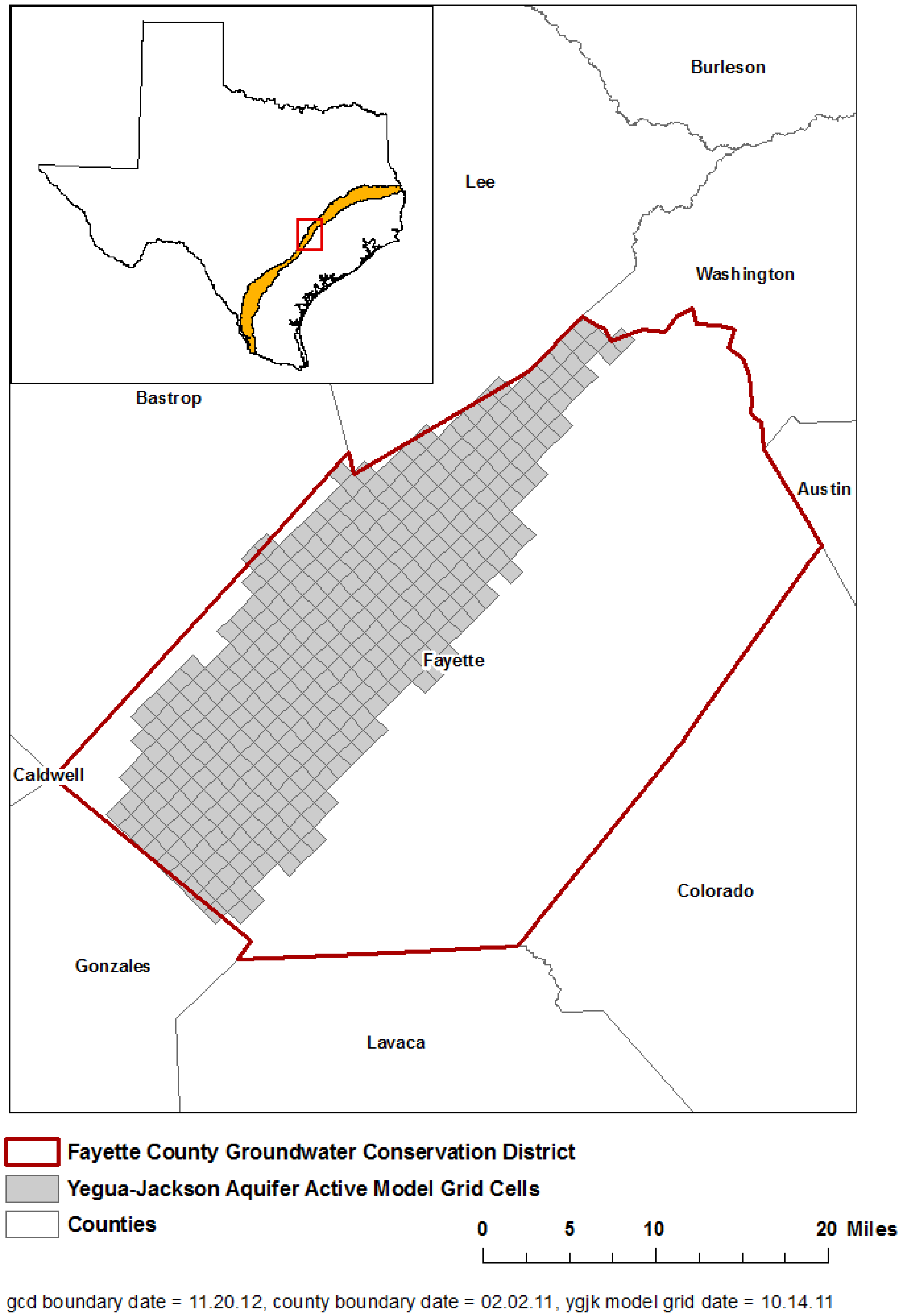

FIGURE 5: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 5 WAS EXTRACTED (THE YEGUA-JACKSON AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS

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

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

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

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

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

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APPENDIX J

GAM RUN 10-014 FOR LOST PINES GCD

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GAM Run 10-014

By Mohammad Masud Hassan P.E.
Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3337
May 28, 2010

Mohammad Masud Hassan is a Hydrologist in the Groundwater Availability Modeling Section and is responsible for the work performed. The seal appearing on this document was authorized by Mohammad Masud Hassan, P.E.95699 on May 28, 2010.

STATE OF TEXAS
MOHAMMAD M. HASSAN
95699
LICENSED
PROFESSIONAL ENGINEER

6/9/10

EXECUTIVE SUMMARY:

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

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

The purpose of this model run is to provide information to Lost Pines Groundwater Conservation District for its groundwater management plan. The groundwater management plan for the Lost Pines Groundwater Conservation District was due for approval by the Executive Administrator of the Texas Water Development Board before February 15, 2010.

This report discusses the method, assumptions, and results from model runs using the groundwater availability models for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers, the northern part of the Trinity Aquifer, and the Yegua-Jackson Aquifer. This report replaces GAM Run 08-89 (Aschenbach, 2009) due to the release of the groundwater availability model for the Yegua-Jackson Aquifer in May of 2010. Tables 1 through 5 summarizes the groundwater availability model data required by the statute, and figures 1 through 5 shows the area of each model from which the values in Tables were extracted.

METHODS:

We ran the groundwater availability models for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers, and the northern part of the Trinity Aquifer and (1) extracted water budgets for each year of the 1980 through 1999 period and (2) averaged the annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower).

We ran the groundwater availability model for Yegua-Jackson Aquifer and (1) extracted water budgets for each year of the 1980 through 1997 period and (2) averaged the annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district for the portions of the Yegua-Jackson Aquifer located within the district.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used Version 2.01 of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Dutton and others (2003) and Bené and others (2004) for assumptions and limitations of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- This groundwater availability model includes eight layers, representing (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).

- Information extracted and summarized for layer 1 represents the Sparta Aquifer, layer 3 represents the Queen City Aquifer, and layers 5 to 8 were summarized and reported for the Carrizo-Wilcox Aquifer.

- The root mean square error (a measure of the difference between simulated and actual 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). These root mean square errors are between four and eleven percent of the range of measured water levels (Kelley and others, 2004).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output.

Trinity Aquifer

- We used version 1.01 of the groundwater availability model for the northern section of the Trinity Aquifer. See Bené and others (2004) for assumptions and limitations of the model.

- The northern section of the Trinity Aquifer model includes seven layers representing:

    1. the Woodbine Aquifer (Layer 1),
    2. the Washita and Fredericksburg Confining Unit (Layer 2),
    3. the Paluxy Aquifer (Layer 3),
    4. the Glen Rose Confining Unit (Layer 4),
    5. the Hensell Aquifer (Layer 5),
    6. the Pearsall/Cow Creek/Hammett/Sligo Confining Unit (Layer 6), and
    7. the Hosston Aquifer (Layer 7).

- Information extracted and summarized for layers 2 to 7 were assumed to represent the Trinity Aquifer.

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the four main aquifers in the model (Woodbine, Paluxy, Hensell, and Hosston) for the calibration and verification time periods (1980 through 1999) ranged from approximately 37 to 75 feet. The root mean squared error was less than ten percent of the maximum change in water levels across the model (Bené and others, 2004).

- The evapotranspiration package of the groundwater availability model was used to represent evaporation, transpiration, springs, seeps, and discharge to streams not modeled by the streamflow-routing package as described in Bené and others (2004).

- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output.

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the western section of the Yegua-Jackson Aquifer. See Kelley and others (2010) for assumptions and limitations of the model.

- The Yegua-Jackson Aquifer model includes five layers representing:
  1. outcrop section for the Yegua-Jackson Aquifer and younger overlying units,
  2. the upper portion of the Jackson Group,
  3. the lower portion of the Jackson Group,
  4. the upper portion of the Yegua Group, and
  5. the lower portion of the Yegua Group.

- Information was extracted and summarized for portions of layer 1 that represent the Yegua-Jackson as well as layers 2 to 5.

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the four main aquifers in the model (Jackson Group, Upper Yagua and Lower Yagua) for the transient calibration period (1980 through 1997) ranged from approximately 31 to23 feet. The root mean squared error was about ten percent (or less) of the maximum change in water levels across the model (Deeds and others, 2010).

- The recharge used for the model run represents average recharge as described in Deeds and others (2010).

- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output.

- The model results presented in this report were extracted from all areas of the model representing the units comprising the Yegua-Jackson Aquifer. For this reason, the reported values may reflect water of quality ranging from fresh to brackish and saline. This is especially true for the subcrop portions of the aquifer in the northeastern part of the District.

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model run (1980 through 1999 for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers, and the northern part of the Trinity Aquifer and 1980 through 1997 for the Yegua-Jackson Aquifer) in the district, as shown in Table 1 through Table 5. The components of the modified budgets shown in Tables include:

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

- Surface water outflow—This is the total water exiting the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).

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

- Flow between aquifers—This describes the vertical flow, or leakage, between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

The information needed for the district's management plan is summarized in tables 1 through 5. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as district or county boundaries, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (see figures 1 to 5).

As depicted by Bené and others (2004) and Kelley and others (2004), groundwater in the Trinity Aquifer and the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to saline. The reported values in this report for flow terms include fresh (less than 1,000 milligrams per liter total dissolved solids), brackish (1,000 to 10,000 milligrams per liter total dissolved solids), and saline (greater than 10,000 milligrams per liter total dissolved solids) groundwater.

Table 1: Sparta Aquifer's summarized information required for the Lost Pines Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. Reported flow estimates include both fresh and brackish waters present in the aquifers.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	10,142
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	4,564
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	1,299
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	733
Estimated net annual volume of flow between each aquifer in the district	Weches Confining Unit into the Sparta Aquifer	970

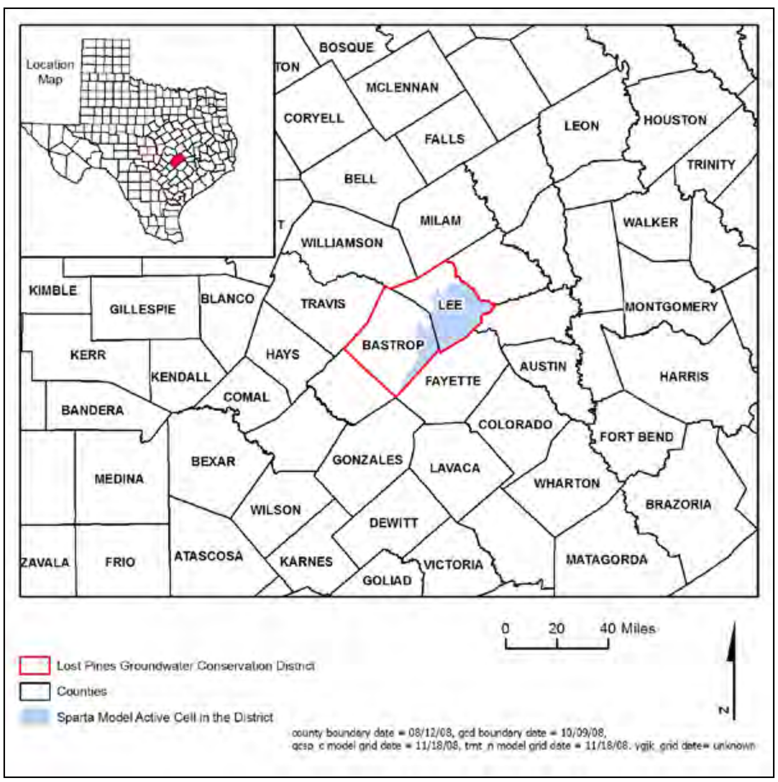

Figure 1: Area of the groundwater availability model for the Sparta Aquifer from which the information in Table 1 was extracted (the aquifer extent within the Lost Pines Groundwater Conservation District boundary).

Table 2: Queen City Aquifer's summarized information required for the Lost Pines Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. Reported flow estimates include both fresh and brackish waters present in the aquifers.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	7,256
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	5,488
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	670
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	3,354
Estimated net annual volume of flow between each aquifer in the district	Queen City Aquifer into the Weches Confining Unit	946
	Queen City Aquifer into the Reklaw Confining Unit	179

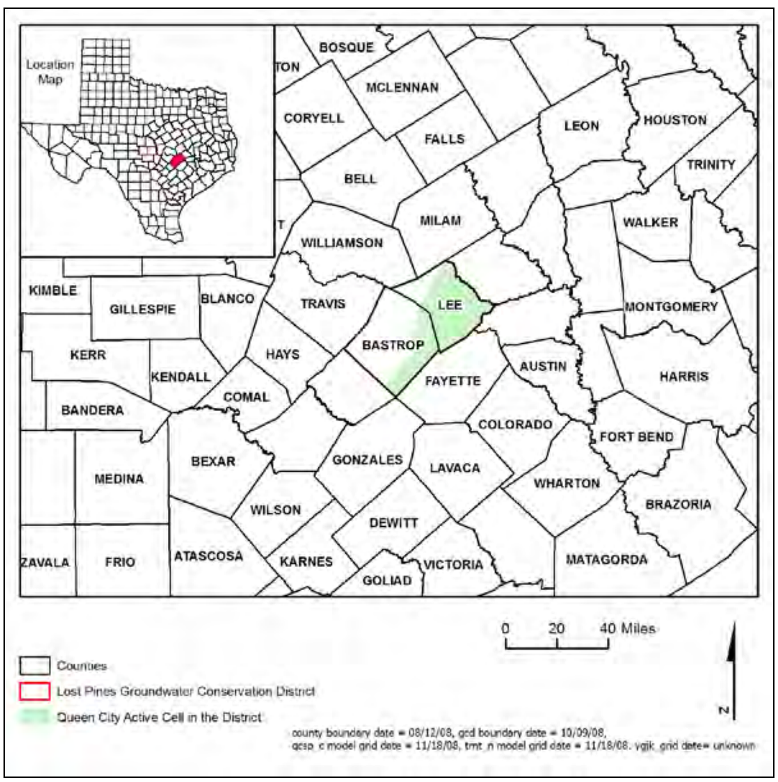

Figure 2: Area of the groundwater availability model for the Queen City Aquifer from which the information in Table 2 was extracted (the aquifer extent within the Lost Pines Groundwater Conservation District boundary).

Table 3: Carrizo-Wilcox Aquifer's summarized information required for the Lost Pines Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. Reported flow estimates include both fresh and brackish waters present in the aquifers.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	29,604
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	32,780
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	14,023
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	19,713
Estimated net annual volume of flow between each aquifer in the district	Reklaw Confining Unit into the Carrizo-Wilcox Aquifer	1,309

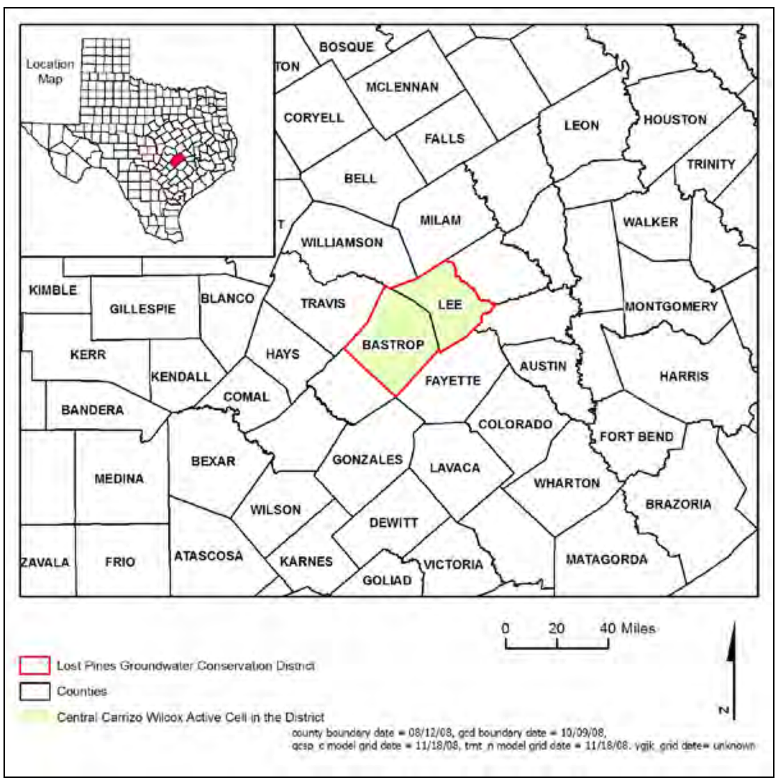

Figure 3: Area of the groundwater availability model for the Carrizo-Wilcox Aquifer from which the information in Table 3 was extracted (the aquifer extent within the Lost Pines Groundwater Conservation District boundary).

Table 4: Trinity Aquifer's summarized information required for the Lost Pines Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. Reported flow estimates include both fresh and brackish waters present in the aquifers.

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	517
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	661
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not Applicable

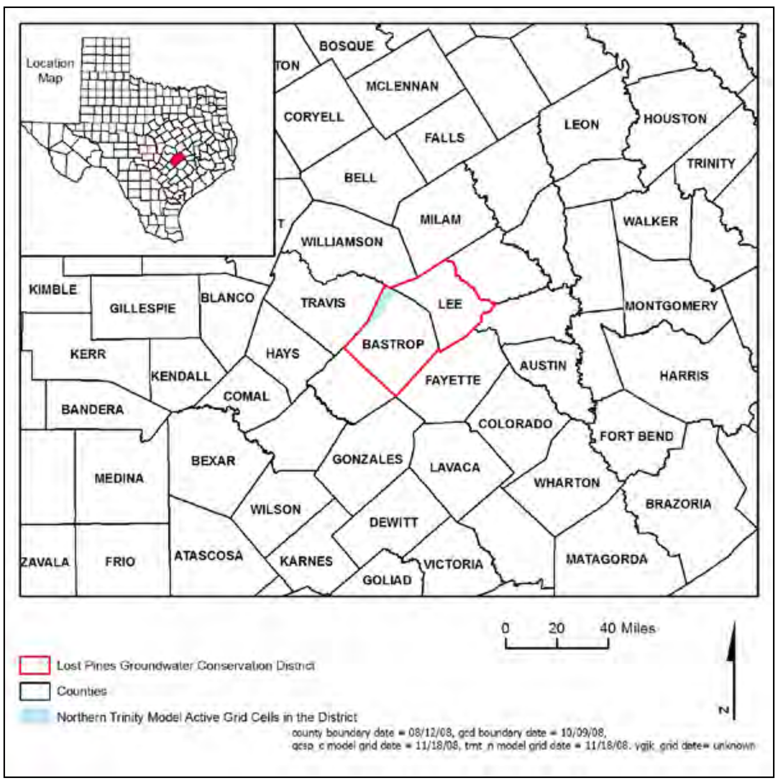

Figure 4: Area of the groundwater availability model for the Trinity Aquifer from which the information in Table 4 was extracted (the aquifer extent within the Lost Pines Groundwater Conservation District boundary).

Table 5: Yegua-Jackson Aquifer's summarized information required for the Lost Pines Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. Reported flow estimates include both fresh and brackish waters present in the aquifers.

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	38,859
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	35,780
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	5,883
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	10,155
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

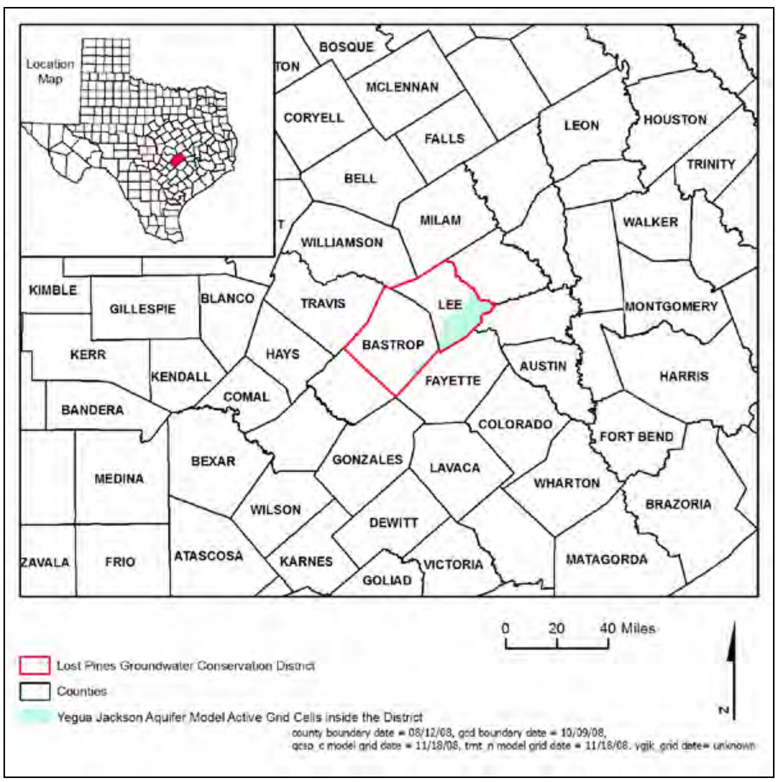

Figure 5: Area of the groundwater availability model for the Yegua-Jackson Aquifer from which the information in Table 5 was extracted (the aquifer extent within the Lost Pines Groundwater Conservation District boundary).

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APPENDIX K

GAM RUN 10-029 FOR POST OAK SAVANNAH GCD

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GAM Run 10-029

by Eric Aschenbach
Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-1708
January 4, 2011

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Eric Aschenbach under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on January 4, 2011.

EXECUTIVE SUMMARY:

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

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

The purpose of this report is to provide information to Post Oak Savannah Groundwater Conservation District for its groundwater management plan. The groundwater management plan for Post Oak Savannah Groundwater Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before July 24, 2011.

This report discusses the method, assumptions, and results from model runs using the groundwater availability models for the northern part of the Trinity Aquifer; the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers; and the Yegua Jackson Aquifer. Tables 1 through 8 summarize the groundwater availability model data required by the statute, and figures 1 through 8 show the area of each model from which the values in the respective tables were extracted. If after review of the figures, Post Oak Savannah Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately.

The Brazos River Alluvium Aquifer also underlies the Post Oak Savannah Groundwater Conservation District. However, a groundwater availability model for this minor aquifer has not been completed at this time. If the district would like information for the Brazos River Alluvium Aquifer, they may request it from the Groundwater Technical Assistance Section of the Texas Water Development Board.

METHODS:

The groundwater availability model for the northern part of the Trinity Aquifer (1980 through 1999); the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (1980 through 1999); and the Yegua-Jackson Aquifer (1980 through 1997) were run for this analysis. Water budgets for each year of the transient model period were extracted and the average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Trinity Aquifer

- Version 1.01 of the groundwater availability model for the northern section of the Trinity Aquifer was used for this analysis. See Bené and others (2004) for assumptions and limitations of the model.

- The northern part of the Trinity Aquifer model includes seven layers, which generally correspond to:

  1. the Woodbine Aquifer,
  2. the Washita and Fredericksburg Confining Unit,
  3. the Paluxy Aquifer,
  4. the Glen Rose Confining Unit,
  5. the Hensell Aquifer,
  6. the Pearsall/Cow Creek/Hammett/Sligo Confining Unit, and
  7. the Hosston Aquifer.

  Layer 1 is not present in the district. Out of the remaining layers listed above, an overall water budget for the district was determined for the Trinity Aquifer (Layer 2 through Layer 7, collectively).

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the four main aquifers in the model (Woodbine, Paluxy, Hensell, and Hosston) for the calibration and verification time periods (1980 through 1999) ranged from approximately 37 to 75 feet. The root mean squared error was less than ten percent of the maximum change in water levels across the model (Bené and others, 2004).

- The evapotranspiration package of the groundwater availability model was used to represent evaporation, transpiration, springs, seeps, and discharge to streams not modeled by the streamflow-routing package as described in Bené and others (2004).

- As depicted by Bené and others (2004) and LBG-Guyton Associates (2003), groundwater in the Trinity Aquifer within the Post Oak Savannah Groundwater Conservation District is predominantly brackish (1,000 to 10,000 milligrams per liter total dissolved solids).

- Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) was used as the interface to process model output.

Carrizo-Wilcox, Queen City, and Sparta aquifers

- Version 2.01 of the groundwater availability model for the central part 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 for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

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

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

Out of the eight layers listed above, individual water budgets for the district were determined for the Sparta Aquifer (Layer 1), the Queen City Aquifer (Layer 3), and each layer of the Carrizo-Wilcox Aquifer (Layer 5 through Layer 8).

- The root mean square error (a measure of the difference between simulated and actual 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 to 1990) and 24, 33, 32, and 43 feet for the same aquifers, respectively, in the verification period (1991 to 1999) (Kelley and others, 2004). These root mean square errors are between four and eleven percent of the range of measured water levels (Kelley and others, 2004).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

- Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) was used as the interface to process model output.

Yegua-Jackson Aquifer

- Version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer was used for this analysis. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.

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

  1. outcrop section for the Yegua-Jackson Aquifer and younger overlying units,
  2. the upper portion of the Jackson Group,
  3. the lower portion of the Jackson Group,
  4. the upper portion of the Yegua Group, and
  5. the lower portion of the Yegua Group.

  An overall water budget for the district was determined for the Yegua-Jackson Aquifer (Layer 1 through Layer 5, collectively for the portions that represent the Yegua-Jackson Aquifer).

- As reported in Deeds and others (2010), the mean absolute errors (a measure of the difference between simulated and measured water levels during model calibration) for the Jackson Group (combined upper and lower Jackson units), Upper Yegua, and Lower Yegua portions of the Yegua-Jackson Aquifer for the historical-calibration period of the model are 31.1, 23.9, and 24.5 feet, respectively. These represent 10.3, 5.7 and 6.3 percent of the hydraulic head drop across each model area, respectively.

- Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) was used as the interface to process model output.

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model runs in the district, as shown in tables 1 through 8. The components of the modified budget shown in tables 1 through 8 include:

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

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

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

- Flow between aquifers—The vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

The information needed for the District’s management plan is summarized in tables 1 through 8. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as district or county boundaries, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (see figures 1 through 8).

Table 1: Summarized information for the Trinity Aquifer that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows include brackish waters.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	423
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	678
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

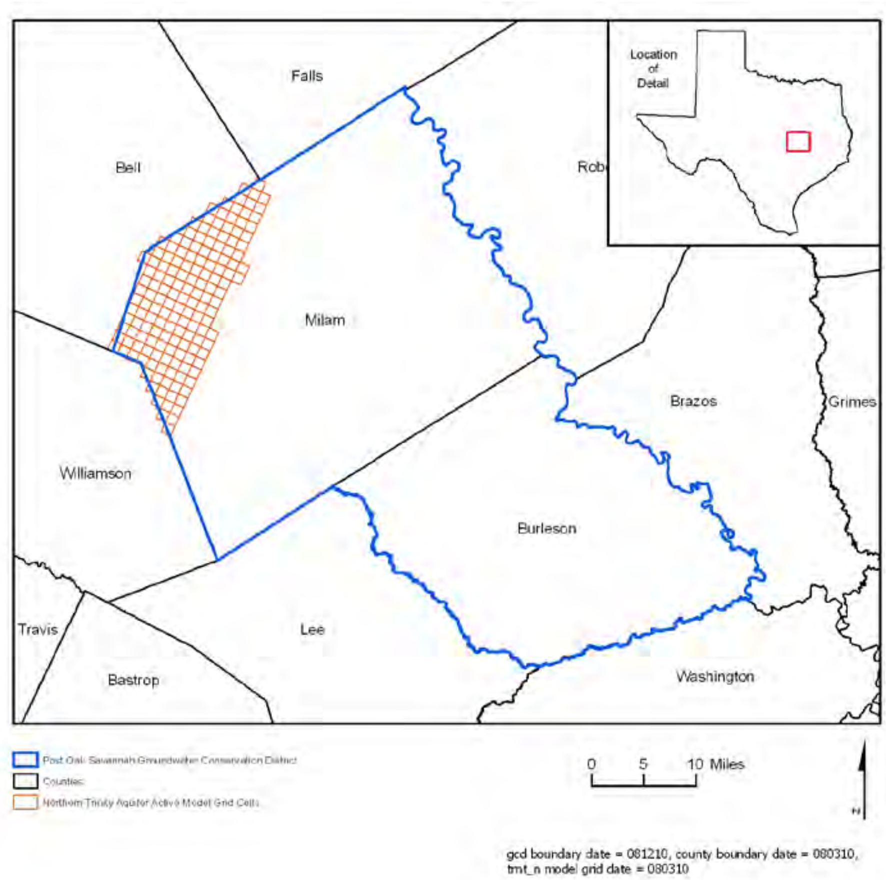

Figure 1: Area of the groundwater availability model for the northern portion of the Trinity Aquifer from which the information in Table 1 was extracted (the aquifer extent within the district boundary).

Table 2: Summarized information for the Sparta Aquifer that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows may include fresh and brackish waters.

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	7,424
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	4,807
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	739
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	1,226
Estimated net annual volume of flow between each aquifer in the district	Weches Confining Unit and adjacent underlying areas into the Sparta Aquifer	1,569

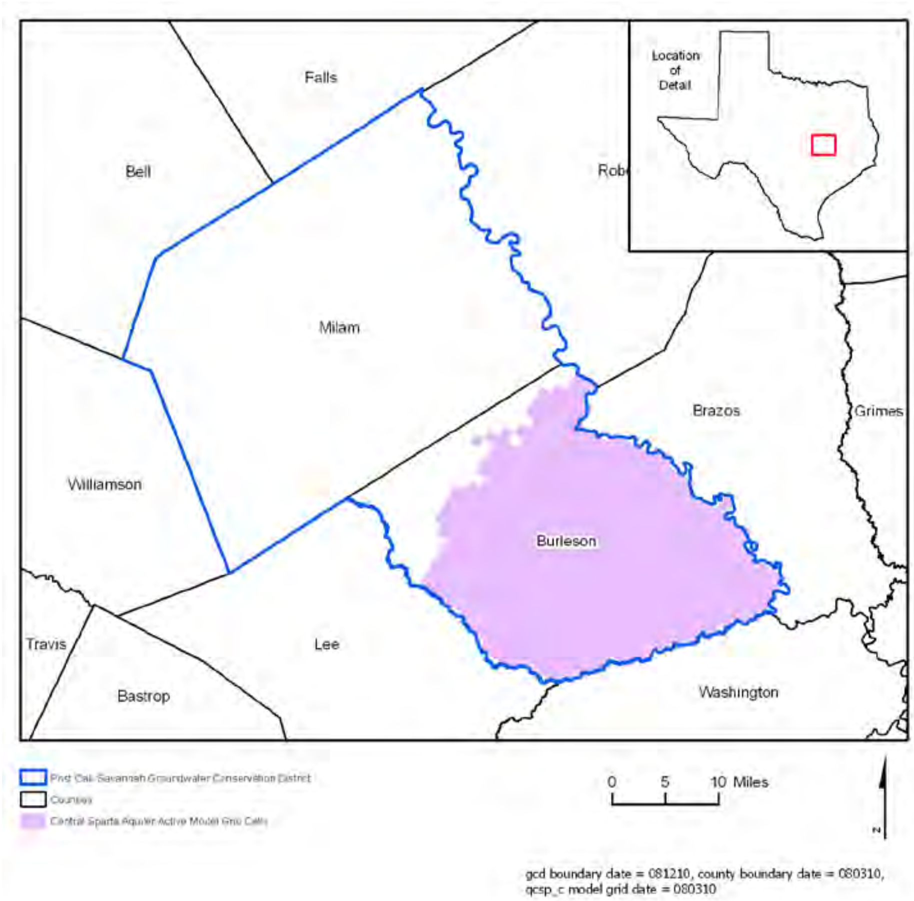

Figure 2: Area of the groundwater availability model for the Sparta Aquifer from which the information in Table 2 was extracted (the aquifer extent within the district boundary).

Table 3: Summarized information for the Queen City Aquifer that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows may include fresh and brackish waters.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	8,812
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	12,028
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	1,316
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	947
Estimated net annual volume of flow between each aquifer in the district	Queen City Aquifer into the overlying Weches Confining Unit	1,435
	Reklaw Confining Unit and adjacent underlying areas into the Queen City Aquifer	861

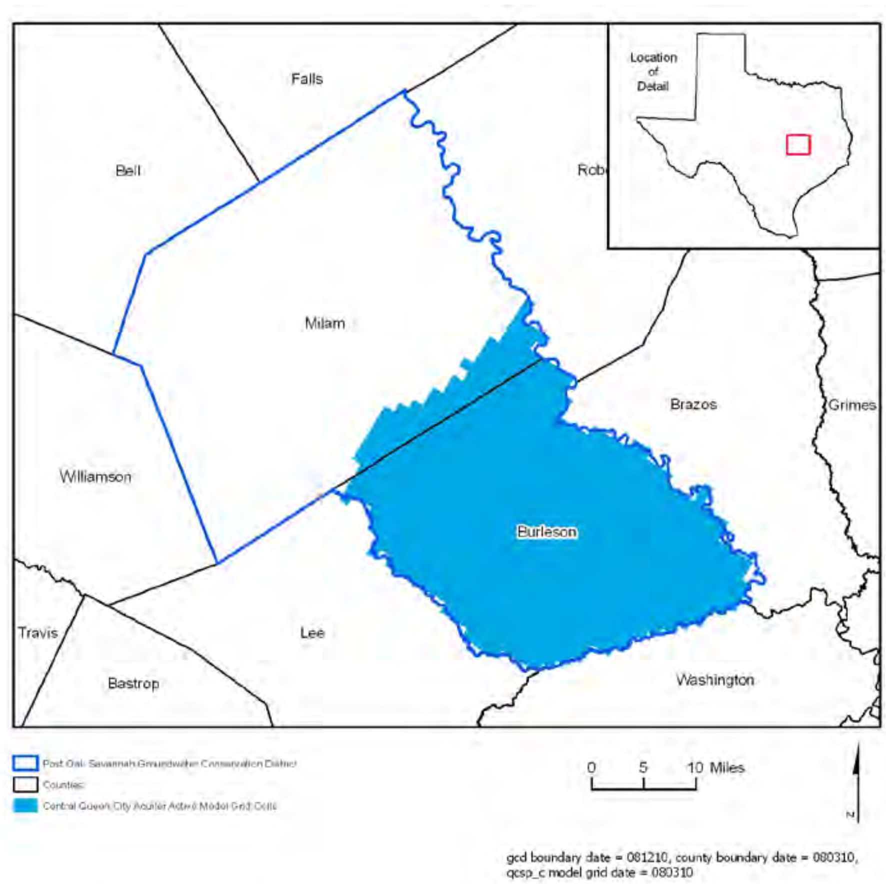

Figure 3: Area of the groundwater availability model for the southern portion of the Queen City Aquifer from which the information in Table 3 was extracted (the aquifer extent within the district boundary).

Table 4: Summarized information for the Carrizo Aquifer that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows may include fresh and brackish waters.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo Aquifer	4,018
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo Aquifer	1,964
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo Aquifer	3,810
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo Aquifer	2,424
Estimated net annual volume of flow between each aquifer in the district	Carrizo Aquifer into the overlying Reklaw Confining Unit	233
	Carrizo Aquifer into the underlying Upper Wilcox Aquifer (Calvert Bluff Formation)	317

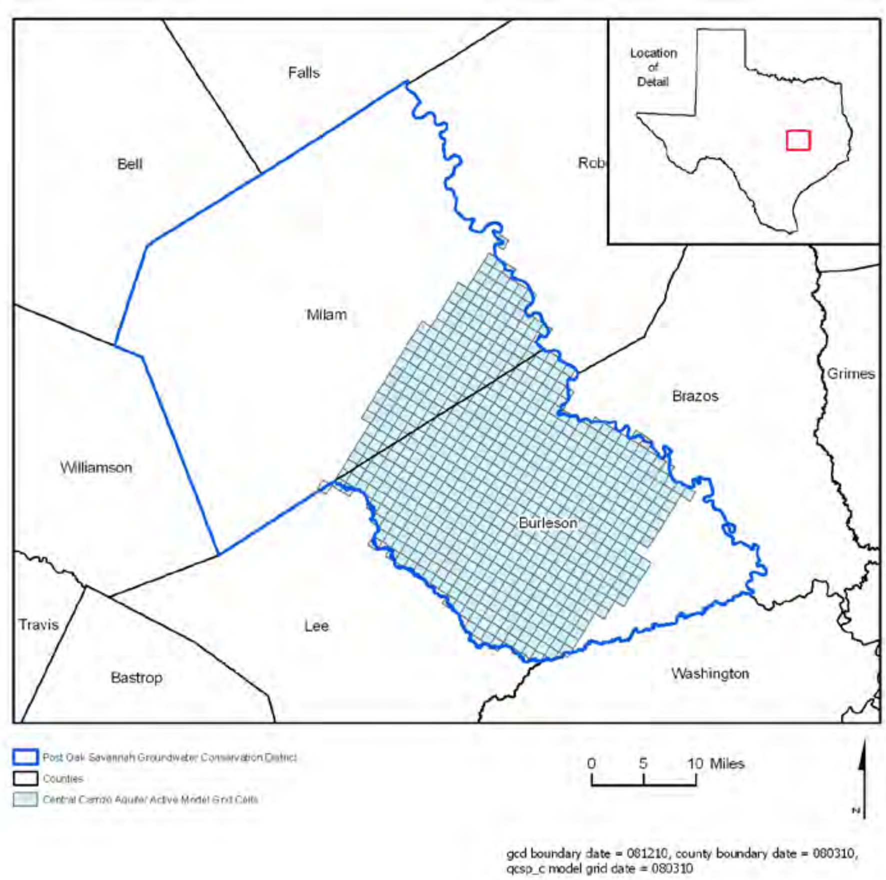

Figure 4: Area of the groundwater availability model for the Carrizo Aquifer from which the information in Table 4 was extracted (the aquifer extent within the district boundary).

Table 5: Summarized information for the Upper Wilcox Aquifer (Calvert Bluff Formation) that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows may include fresh and brackish waters.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Upper Wilcox Aquifer (Calvert Bluff Formation)	7,330
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Upper Wilcox Aquifer (Calvert Bluff Formation)	7,995
Estimated annual volume of flow into the district within each aquifer in the district	Upper Wilcox Aquifer (Calvert Bluff Formation)	2,416
Estimated annual volume of flow out of the district within each aquifer in the district	Upper Wilcox Aquifer (Calvert Bluff Formation)	2,000
Estimated net annual volume of flow between each aquifer in the district	Carrizo Aquifer into the underlying Upper Wilcox Aquifer (Calvert Bluff Formation)	317
	Upper Wilcox Aquifer (Calvert Bluff Formation) into the underlying Middle Wilcox Aquifer (Simsboro Formation)	3,451

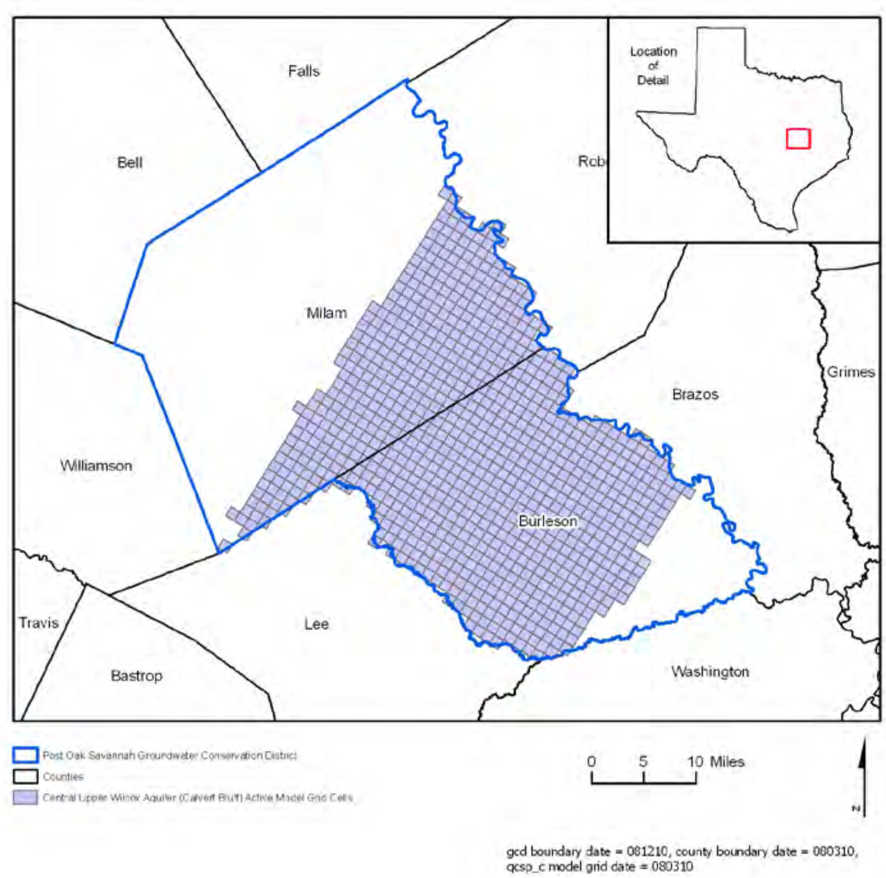

Figure 5: Area of the groundwater availability model for the Upper Wilcox Aquifer (Calvert Bluff Formation) from which the information in Table 5 was extracted (the aquifer extent within the district boundary).

Table 6: Summarized information for the Middle Wilcox Aquifer (Simsboro Formation) that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows may include fresh and brackish waters.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Middle Wilcox Aquifer (Simsboro Formation)	12,540
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Middle Wilcox Aquifer (Simsboro Formation)	18,827
Estimated annual volume of flow into the district within each aquifer in the district	Middle Wilcox Aquifer (Simsboro Formation)	10,804
Estimated annual volume of flow out of the district within each aquifer in the district	Middle Wilcox Aquifer (Simsboro Formation)	18,025
Estimated net annual volume of flow between each aquifer in the district	Upper Wilcox Aquifer (Calvert Bluff Formation) into the underlying Middle Wilcox Aquifer (Simsboro Formation)	3,451
	Lower Wilcox Aquifer (Hooper Formation) into the overlying Middle Wilcox Aquifer (Simsboro Formation)	1,537

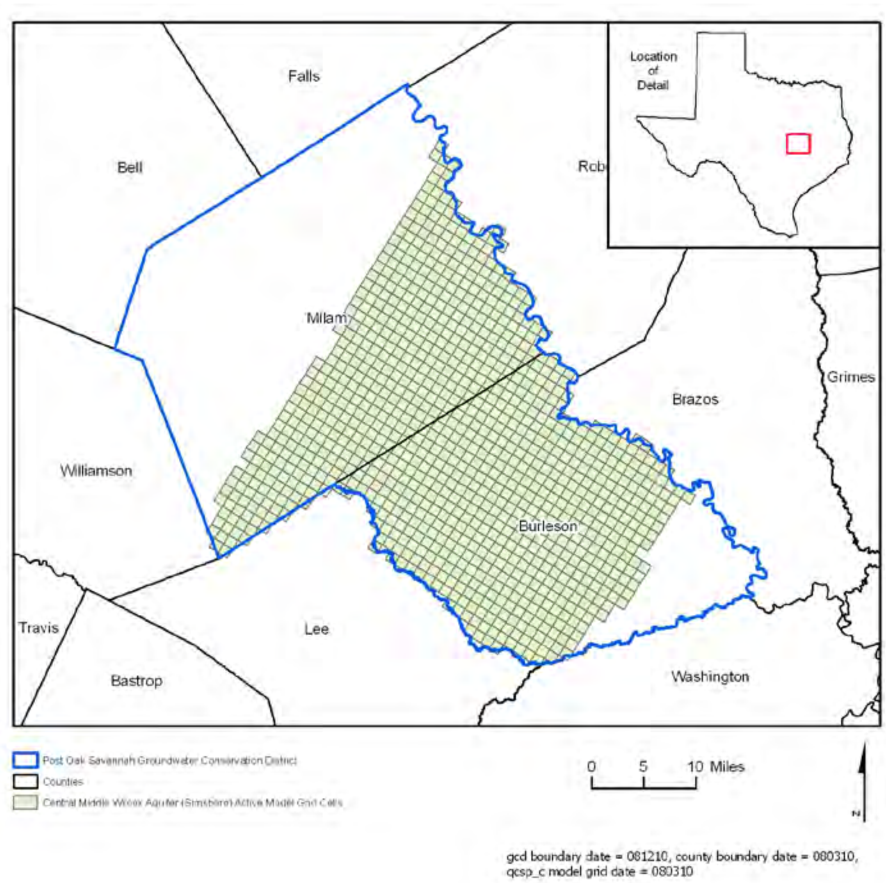

Figure 6: Area of the groundwater availability model for the Middle Wilcox Aquifer (Simsboro Formation) from which the information in Table 6 was extracted (the aquifer extent within the district boundary).

Table 7: Summarized information for the Lower Wilcox Aquifer (Hooper Formation) that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot. These flows may include fresh and brackish waters.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Lower Wilcox Aquifer (Hooper Formation)	2,391
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Lower Wilcox Aquifer (Hooper Formation)	1,748
Estimated annual volume of flow into the district within each aquifer in the district	Lower Wilcox Aquifer (Hooper Formation)	3,572
Estimated annual volume of flow out of the district within each aquifer in the district	Lower Wilcox Aquifer (Hooper Formation)	3,232
Estimated net annual volume of flow between each aquifer in the district	Lower Wilcox Aquifer (Hooper Formation) into the overlying Middle Wilcox Aquifer (Simsboro Formation)	1,537

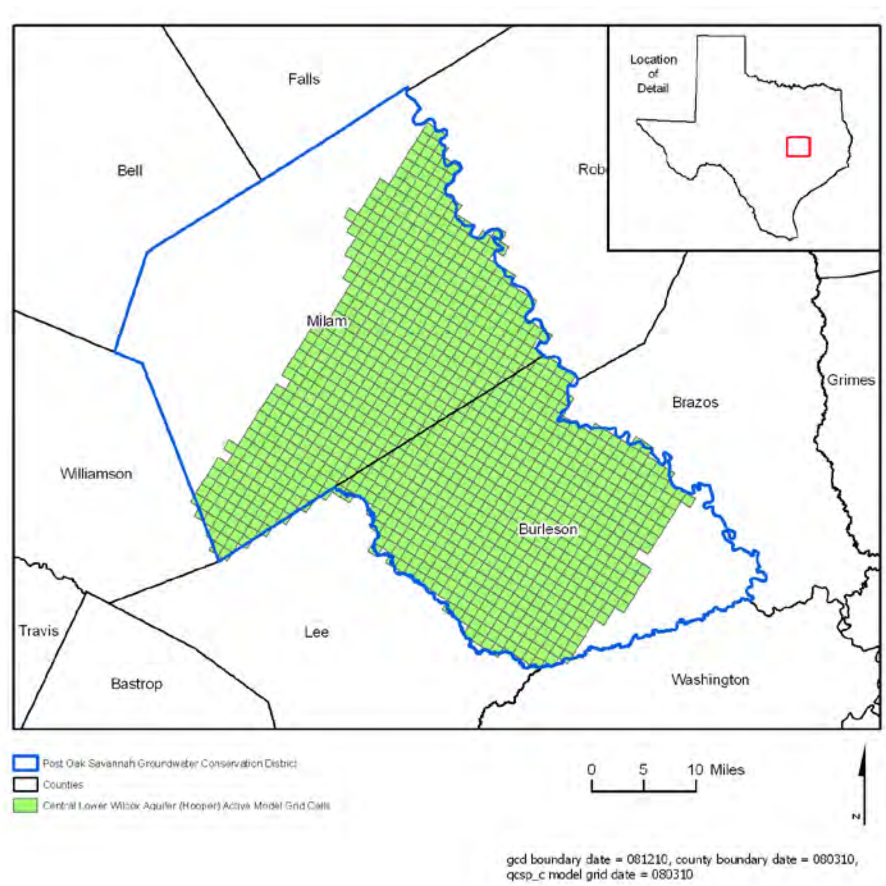

Figure 7: Area of the groundwater availability model for the Lower Wilcox Aquifer (Hooper Formation) from which the information in Table 7 was extracted (the aquifer extent within the district boundary).

Table 8: Summarized information for the Yegua-Jackson Aquifer that is needed for Post Oak Savannah Groundwater Conservation District's groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	22,459
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	13,923
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	4,436
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	8,017
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

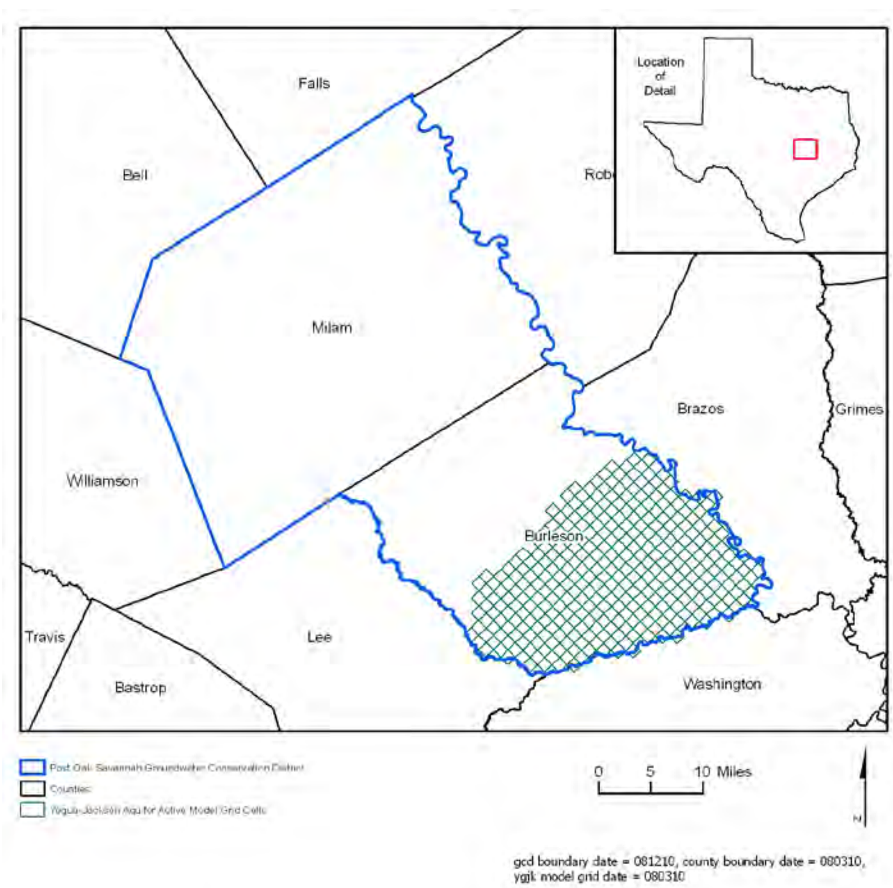

Figure 8: Area of the groundwater availability model for the Yegua-Jackson Aquifer from which the information in Table 8 was extracted (the aquifer extent within the district boundary).

REFERENCES:

Bené, J., Harden, B., O'Rourke, D., Donnelly, A., and Yelderman, J., 2004, Northern Trinity/Woodbine Groundwater Availability Model: contract report to the Texas Water Development Board by R.W. Harden and Associates, 391 p., http://www.twdb.state.tx.us/gam/trnt_n/trnt_n.htm.

Deeds, N.E., Yan, T., Singh, A., Jones, T.L., Kelley, V.A., Knox, P.R., Young, S.C., 2010, Groundwater availability model for the Yegua-Jackson Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc., 582 p., http://www.twdb.state.tx.us/gam/ygjk/ygjk.htm.

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LBG-Guyton Associates, 2003, Brackish Groundwater Manual for Texas Regional Water Planning Groups: contract report to the Texas Water Development Board, 188 p., http://www.twdb.state.tx.us/RWPG/rpgm_rpts/2001483395.pdf.

APPENDIX L

GAM RUN 14-005 FOR BRAZOS VALLEY GCD

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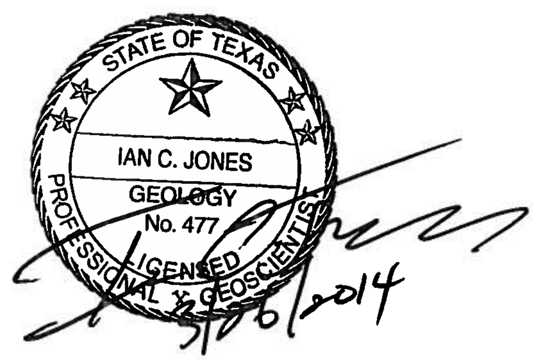
GAM Run 14-005: Brazos Valley Groundwater Conservation District Management Plan

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
March 26, 2014



The seal appearing on this document was authorized by Ian C. Jones, P.G. 455 on March 26, 2014.

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GAM RUN 14-005: BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
March 26, 2014

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2011), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

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

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

The groundwater management plan for Brazos Valley Groundwater Conservation District should be adopted by the district on or before March 9, 2015 and submitted to the executive administrator of the TWDB on or before April 8, 2015. The current management plan for Brazos Valley Groundwater Conservation District expires on June 7, 2015.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability models for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers, and the Gulf Coast Aquifer System. This model run replaces the results of GAM Run 10-013 (Wade and Aschenbach, 2011). GAM Run 14-005 meets current standards set after the release of GAM Run 10-013 including use of the official aquifer boundaries within the district rather than the entire active area of the model within the district. This GAM Run also includes results from the recently updated groundwater availability model for the northern portion of the Gulf Coast Aquifer System (Kasmarek, 2013). Tables 1 through 5 summarize the groundwater availability model data required by statute, and Figures 1 through 5 show the area of the models from which the values in the tables were extracted. If after review of the figures, Brazos Valley Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB immediately.

Although the Brazos River Alluvium Aquifer occurs within the Brazos Valley Groundwater Conservation District, a groundwater availability model for this aquifer has not been developed at this time. If the district would like information for the Brazos River Alluvium Aquifer, the district may request it from the Groundwater Technical Assistance Section of the TWDB.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers, the Yegua-Jackson Aquifer, and the northern portion of the Gulf Coast Aquifer System were run for this analysis. Water budgets for Brazos Valley Groundwater Conservation District were extracted for the historical model periods (1980-2000 for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers, 1980-1997 for the Yegua-Jackson Aquifer, and 1980-2009 for the northern portion of the Gulf Coast Aquifer System) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portion of each aquifer located within the district is summarized in this report.

The groundwater availability model for the northern portion of the Gulf Coast Aquifer System uses MODFLOW's General-Head Boundary Package to simulate groundwater recharge and groundwater-surface water interaction. The general-head boundary was assigned over the outcrop areas of the aquifer. To estimate groundwater recharge and groundwater-surface water interaction separately, we assumed groundwater recharge to be inflow through the general-head boundary while discharge from the aquifer to surface water bodies was assumed to be outflow through the general-head boundary. We then calculated the water budget of these zones using ZONEBUDGET Version 3.01 (Harbaugh, 2009).

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used version 2.02 of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Dutton and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- This groundwater availability model includes eight layers which generally represent the Sparta Aquifer (Layer 1), the Weches Formation confining unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Formation confining unit (Layer 4), the Carrizo Formation (Layer 5), the Calvert Bluff Formation (Layer 6), the Simsboro Formation (Layer 7), and the Hooper Formation (Layer 8). Individual water budgets for the district were determined for the Sparta Aquifer (Layer 1), the Queen City Aquifer (Layer 3), and the Carrizo-Wilcox Aquifer (Layer 5 through Layer 8, collectively).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

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

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.

- This groundwater availability model includes five layers which represent the outcrop of the Yegua-Jackson Aquifer and younger overlying units—the Catahoula Formation (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).

- An overall water budget for the district was determined for the Yegua-Jackson Aquifer (Layer 1 through Layer 5, collectively, for the portions of the model that represent the Yegua-Jackson Aquifer). In separate water budget calculations we calculated groundwater flow between the Catahoula Formation and the underlying Yegua-Jackson Aquifer.

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

Gulf Coast Aquifer System

- We used version 3.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer System for this analysis. See Kasmarek (2013) for assumptions and limitations of the model.

- The model has four layers which represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer (Layer 4).

- Water budgets for the district were determined for the Gulf Coast Aquifer System (Layers 1 through 4).

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

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the respective aquifers located within the district and averaged over the duration of the calibration and verification portion of the model run in the district, as shown in Tables 1 through 5.

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

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

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

- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

The information needed for the district’s management plan is summarized in Tables 1 through 5. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (Figures 1 through 5).

TABLE 1: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	26,906
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	16,869
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	17,840
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	10,051
Estimated net annual volume of flow between each aquifer in the district	To the Carrizo-Wilcox Aquifer from the Reklaw Formation confining unit	62
	To the Carrizo-Wilcox Aquifer from the down-dip portions of the equivalent formations	10,962

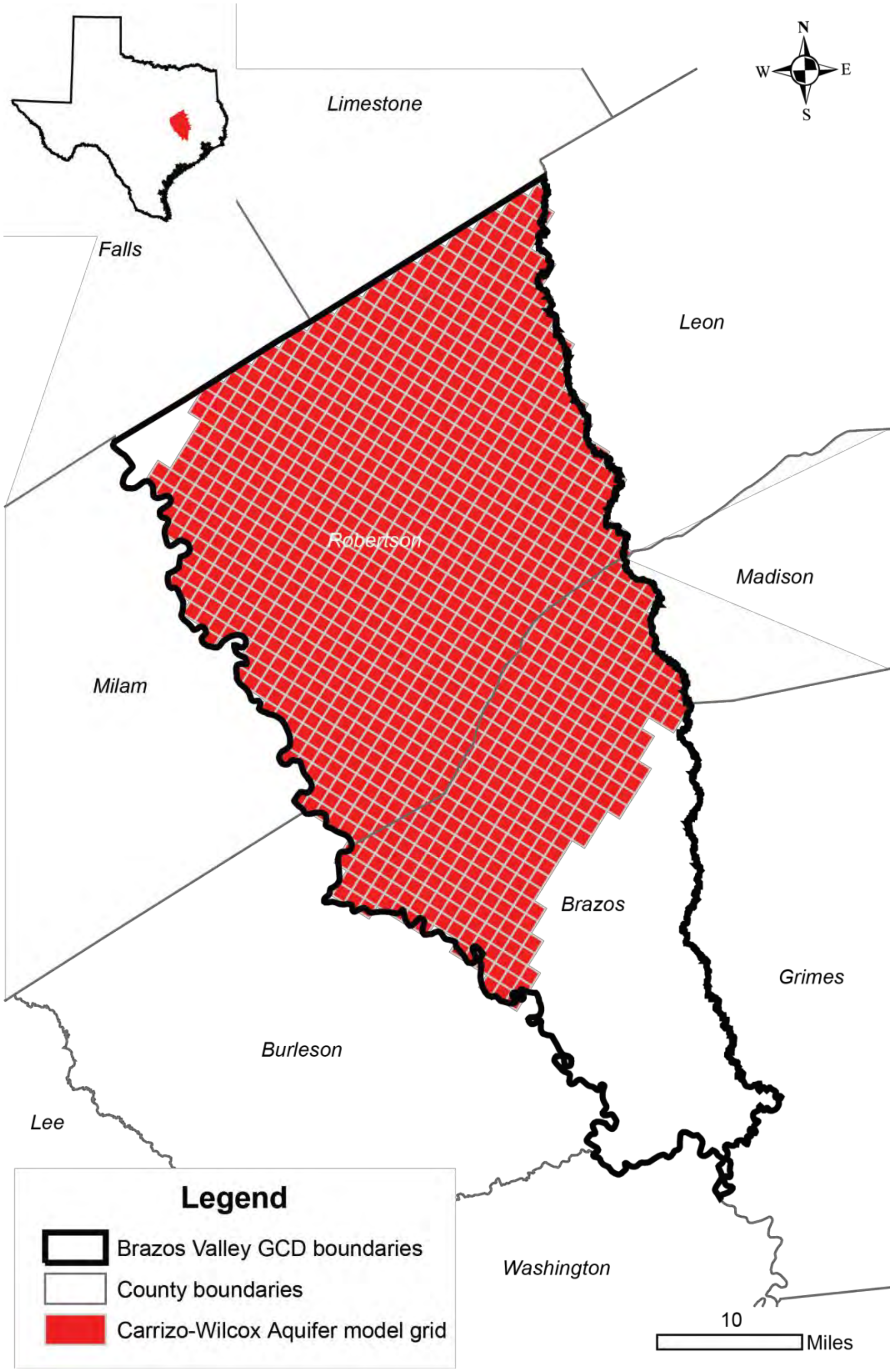

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CARRIZO-WILCOX AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE CARRIZO-WILCOX AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER THAT IS NEEDED FOR BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	6,091
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	11,902
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	1,865
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	815
Estimated net annual volume of flow between each aquifer in the district	To the Queen City Aquifer from the Weches Formation confining unit	209
	To the Queen City Aquifer from the Reklaw Formation confining unit	148
	From the Queen City Aquifer to the down-dip portion of the Queen City Formation	83

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE QUEEN CITY AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE QUEEN CITY AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 3: SUMMARIZED INFORMATION FOR THE SPARTA AQUIFER THAT IS NEEDED FOR BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	9,970
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	1,861
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	617
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	496
Estimated net annual volume of flow between each aquifer in the district	To the Sparta Aquifer from overlying stratigraphic units	714
	From the Sparta Aquifer to the Weches Formation confining unit	599
	From the Sparta Aquifer to the down-dip portion of the Sparta Formation	76

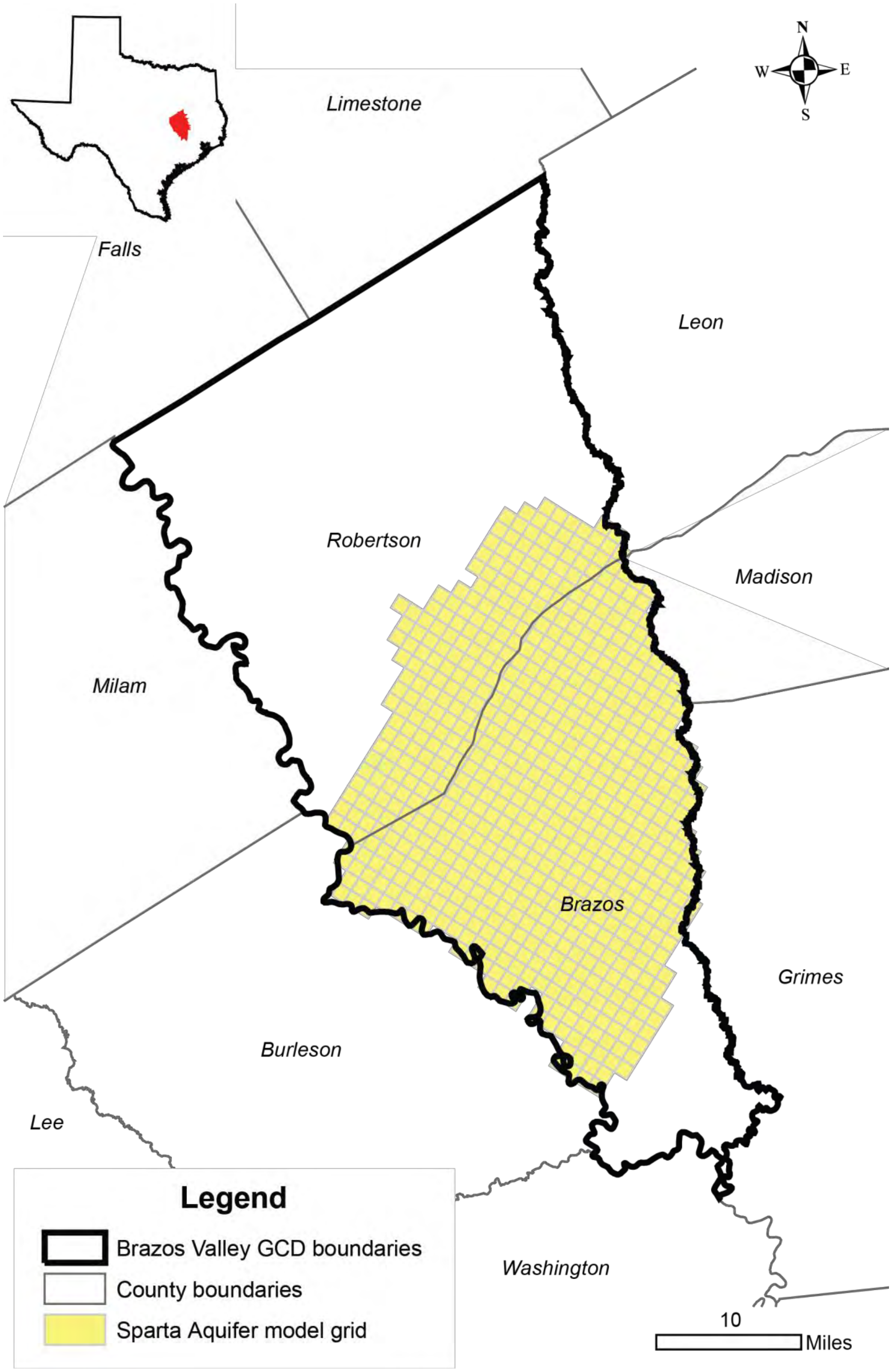

FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SPARTA AQUIFER FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE SPARTA AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 4: SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER THAT IS NEEDED FOR BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	26,512
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	39,287
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	12,029
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	9,921
Estimated net annual volume of flow between each aquifer in the district	To the Yegua-Jackson Aquifer from the confined portion of the Yegua and Jackson groups	178

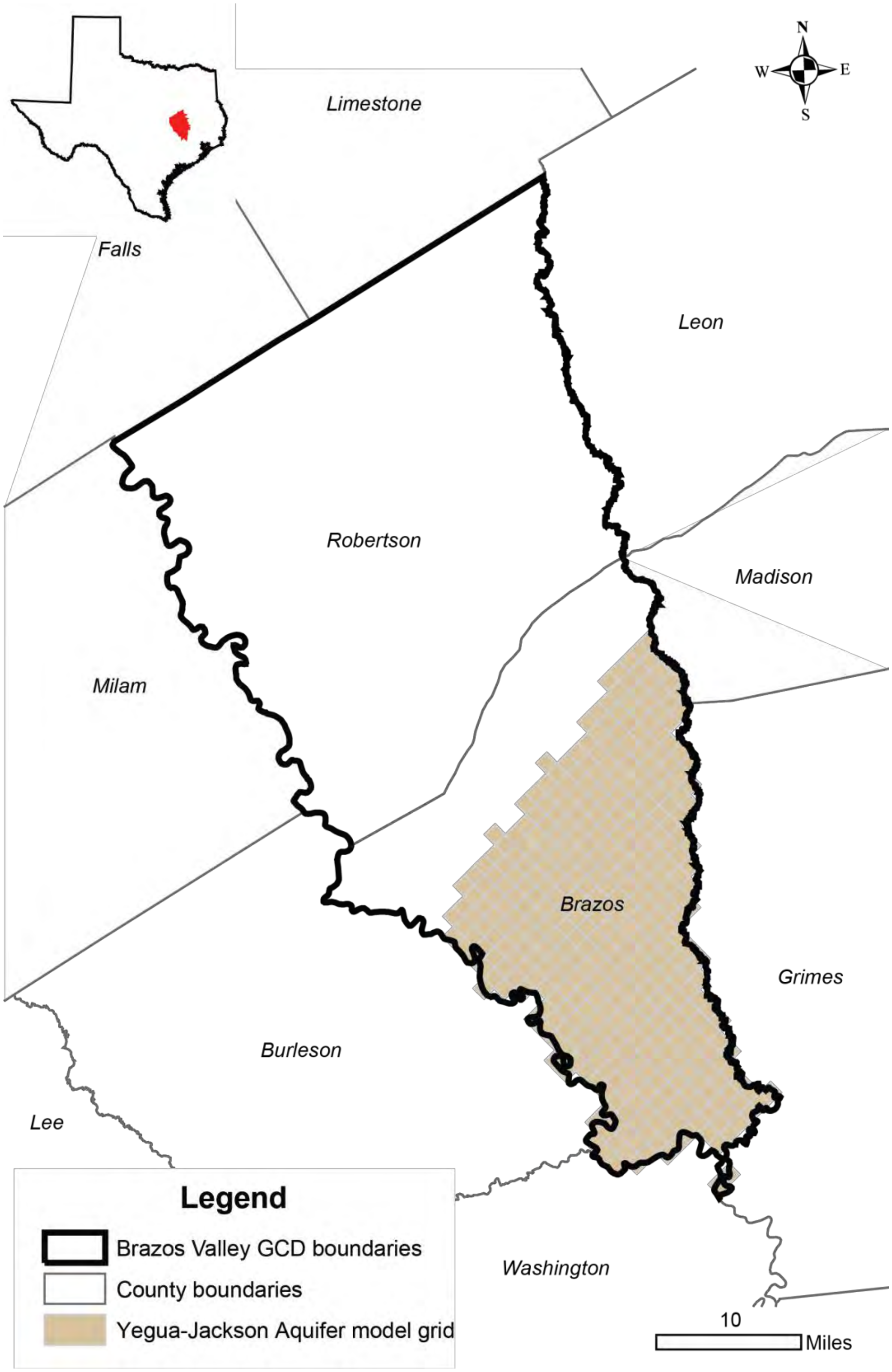

FIGURE 4: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED (THE YEGUA-JACKSON AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 5: SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	40
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Gulf Coast Aquifer System	255
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	332
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	48
Estimated net annual volume of flow between each aquifer in the district	To the Gulf Coast Aquifer System from the confined portion of the Yegua and Jackson groups [1]	423

[1] Calculated using the groundwater availability model for the Yegua-Jackson Aquifer.

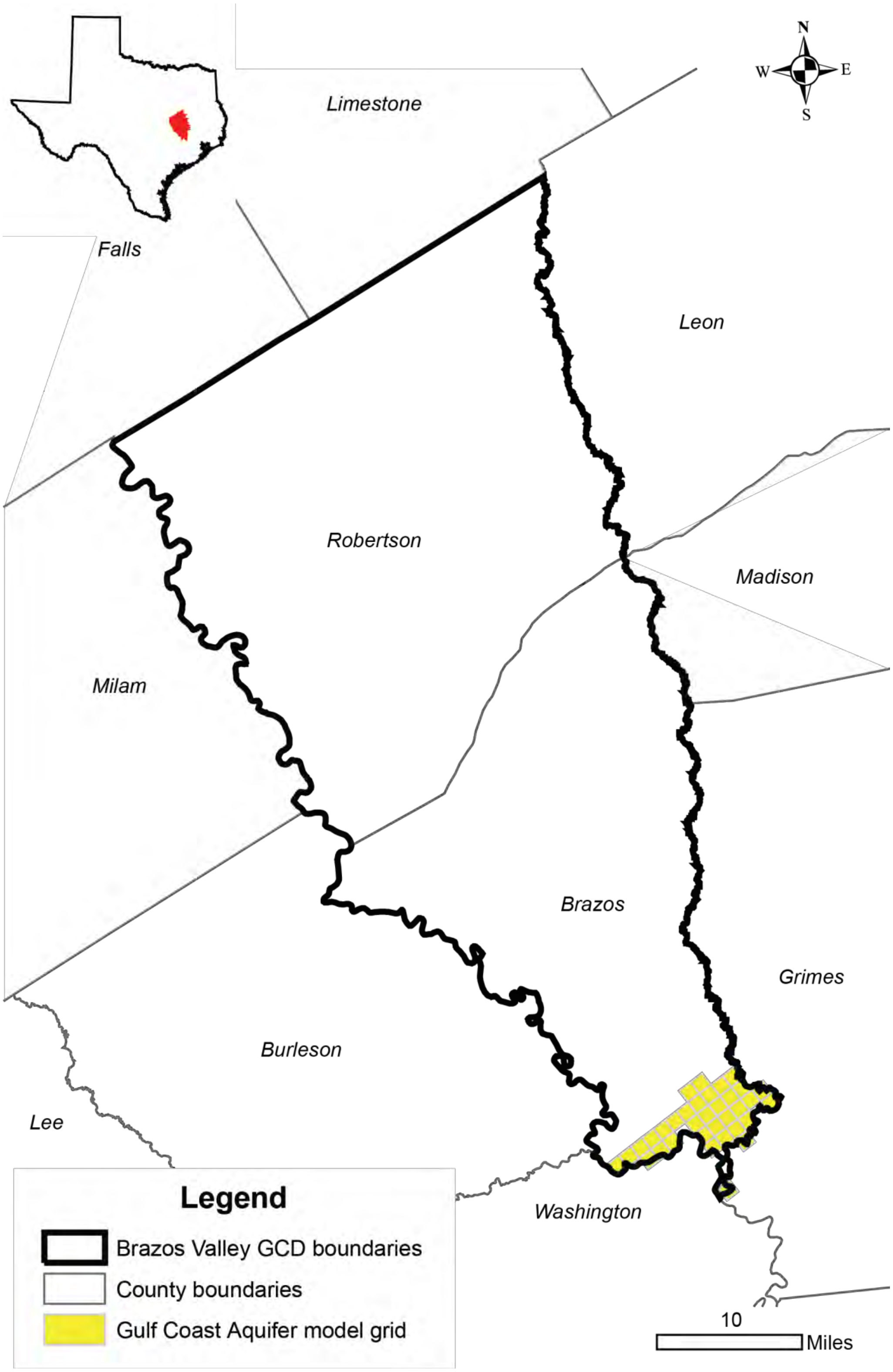

FIGURE 5: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 5 WAS EXTRACTED (THE GULF COAST AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS:

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

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

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

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

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

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APPENDIX M

GAM RUN 13-024 FOR MID-EAST TEXAS GCD

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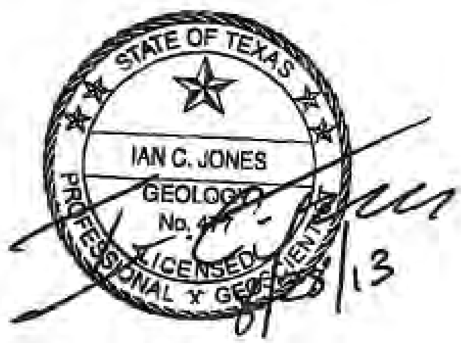
GAM Run 13-024: Mid-East Texas Groundwater Conservation District Management Plan

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
August 28, 2013



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GAM RUN 13-024: MID-EAST TEXAS GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Ian C. Jones, Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-6641
August 28, 2013

EXECUTIVE SUMMARY:

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

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

This report (Part 2 of a two-part package of information from the TWDB to Mid-East Texas Groundwater Conservation District) fulfills the requirements noted above. Part 1 of the two-part package is the Historical Water Use/State Water Plan data report. The District should have received, or will receive, this data report from the TWDB Groundwater Technical Assistance Section. Questions about the data report should be directed to Mr. Stephen Allen, Stephen.Allen@twdb.texas.gov or (512) 463-7317.

The groundwater management plan for the Mid-East Texas Groundwater Conservation District should be adopted by the district on or before July 1, 2014 and submitted to the executive administrator of the TWDB on or before July 31, 2014. The current management plan for the Mid-East Texas Groundwater Conservation District expires on September 29, 2014.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability models for the central portions of the Carrizo-Wilcox, Queen City, and Sparta aquifers (version 2.02) and the Yegua-Jackson Aquifer (version 1.01) (Kelley and others, 2004; Deeds and others, 2010). Tables 1 through 4 summarize the groundwater availability model data required by the statute, and Figures 1 through 4 show the areas of the models from which the values in the tables were extracted. This model run replaces the results of GAM Run 08-077 (Aschenbach, 2009). GAM Run 13-024 meets current standards set after the release of Gam Run 08-077 including a refinement of using the extent of the official aquifer boundaries within the district. If after review of the figures, Mid-East Texas Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models for the central portions of the Carrizo-Wilcox, Queen City, and Sparta aquifers and the Yegua-Jackson Aquifer were run for this analysis. Mid-East Texas Groundwater Conservation District water budgets for the historical model periods were extracted using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used version 2.02 of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Dutton and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- This groundwater availability model includes eight layers which generally represent the Sparta Aquifer (Layer 1), the Weches Confining Unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Confining Unit (Layer 4), the Carrizo Aquifer (Layer 5), the Upper Wilcox or Calvert Bluff Formation (Layer 6), the Middle Wilcox or Simsboro Formation (Layer 7), and the Lower Wilcox or Hooper Formation (Layer 8). Individual water budgets for the District were determined for the Sparta Aquifer (Layer 1), the Queen City Aquifer (Layer 3), and the Carrizo-Wilcox Aquifer (Layer 5 through Layer 8 collectively).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

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

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.

- This groundwater availability model includes five layers which represent the outcrop section for the Yegua-Jackson Aquifer and younger overlying units (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).

- An overall water budget for the District was determined for the Yegua-Jackson Aquifer (Layer 1 through Layer 5 collectively for the portions of the model that represent the Yegua-Jackson Aquifer).

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

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the model results for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model runs in the district, as shown in Tables 1 through 4.

- Precipitation recharge—The areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
- Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).
- Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.
- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

The information needed for the District’s management plan is summarized in Tables 1 through 4. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

TABLE 1: SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER THAT IS NEEDED FOR THE MID-EAST TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the groundwater resources within the district	Yegua-Jackson Aquifer	31,137
Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers	Yegua-Jackson Aquifer	46,448
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	16,334
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	11,401
Estimated net annual volume of flow between each aquifer in the district	Yegua-Jackson Aquifer	0[1]

[1] The model assumptions include no groundwater flow between the Yegua-Jackson Aquifer and underlying stratigraphic units.

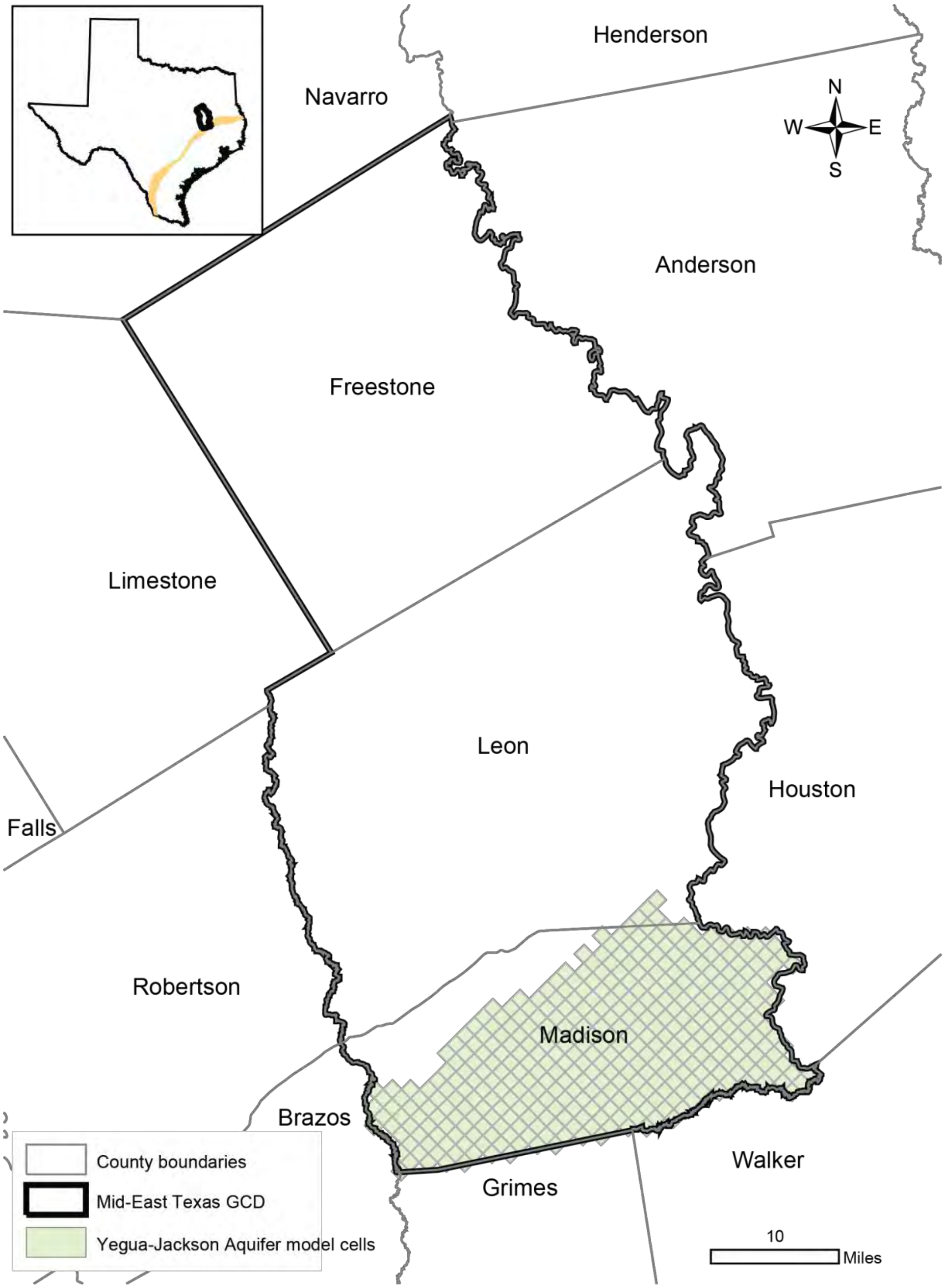

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED. ONLY THE CELLS REPRESENTING THE YEGUA-JACKSON AQUIFER WITHIN THE DISTRICT BOUNDARIES ARE SHOWN.

TABLE 2: SUMMARIZED INFORMATION FOR THE SPARTA AQUIFER THAT IS NEEDED FOR THE MID-EAST TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

<table>
<tr><th>Management Plan requirement</th><th>Aquifer or confining unit</th><th>Results</th></tr>
<tr><td>Estimated annual amount of recharge from precipitation to the groundwater resources within the district</td><td>Sparta Aquifer</td><td>15,100</td></tr>
<tr><td>Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers</td><td>Sparta Aquifer</td><td>3,702</td></tr>
<tr><td>Estimated annual volume of flow into the district within each aquifer in the district</td><td>Sparta Aquifer</td><td>1,135</td></tr>
<tr><td>Estimated annual volume of flow out of the district within each aquifer in the district</td><td>Sparta Aquifer</td><td>914</td></tr>
<tr><td rowspan="3">Estimated net annual volume of flow between each aquifer in the district</td><td>From the Sparta Aquifer to overlying stratigraphic Unit</td><td>445</td></tr>
<tr><td>From the Sparta Aquifer to the Weches Confining Unit</td><td>1,121</td></tr>
<tr><td>From the Sparta Aquifer to down-dip parts of the Sparta Formation</td><td>86</td></tr>
</table>

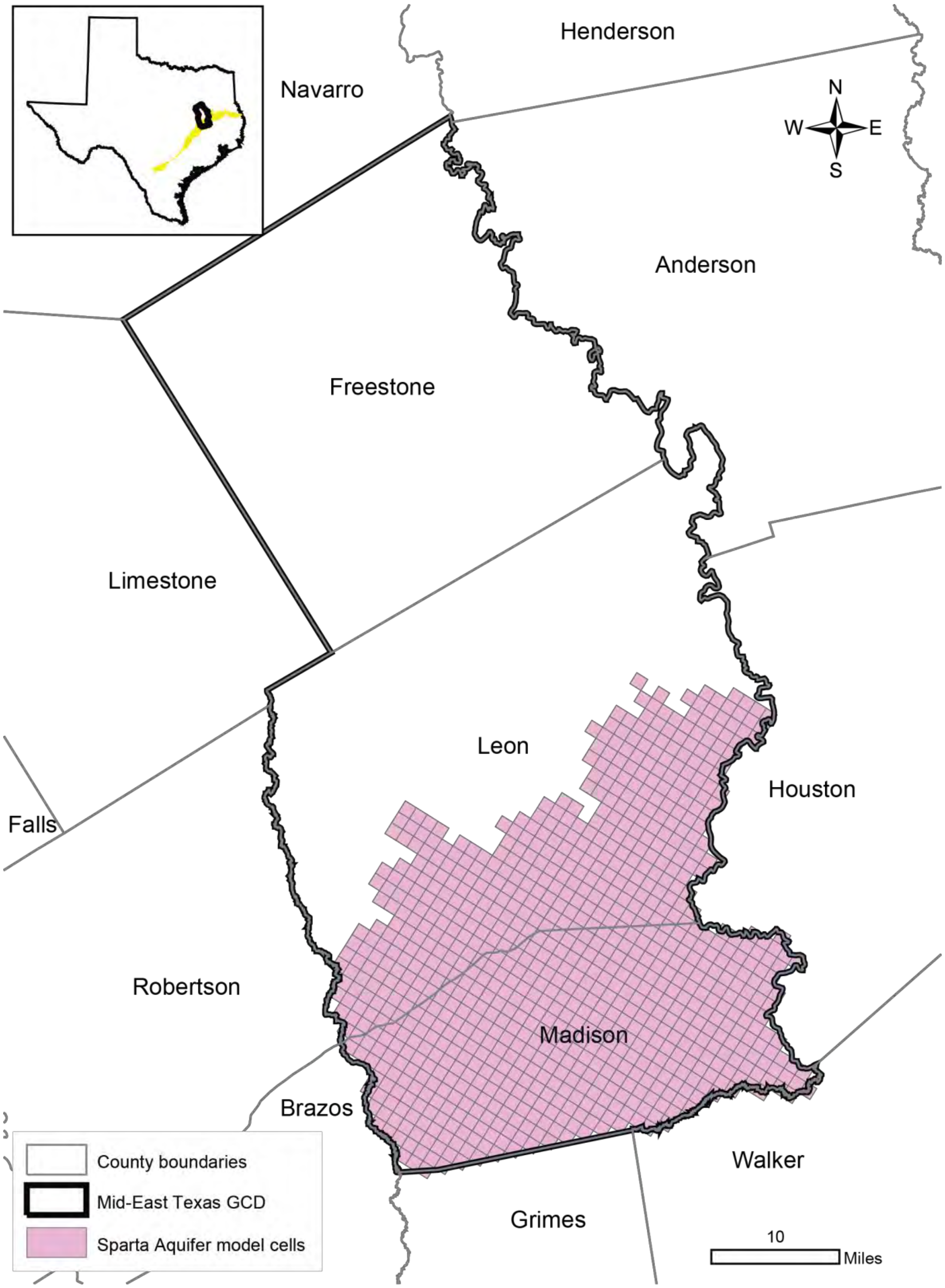

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SPARTA AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED. ONLY THE CELLS REPRESENTING THE SPARTA AQUIFER WITHIN THE DISTRICT BOUNDARIES ARE SHOWN.

TABLE 3: SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER THAT IS NEEDED FOR THE MID-EAST TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the groundwater resources within the district	Queen City Aquifer	26,645
Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers	Queen City Aquifer	16,399
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	2,000
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	2,294
Estimated net annual volume of flow between each aquifer in the district	To the Queen City Aquifer from the Weches Confining Unit	2,126
	To the Queen City Aquifer from the Reklaw Confining Unit	150
	From the Queen City Aquifer to down-dip parts of the Queen City Formation	130

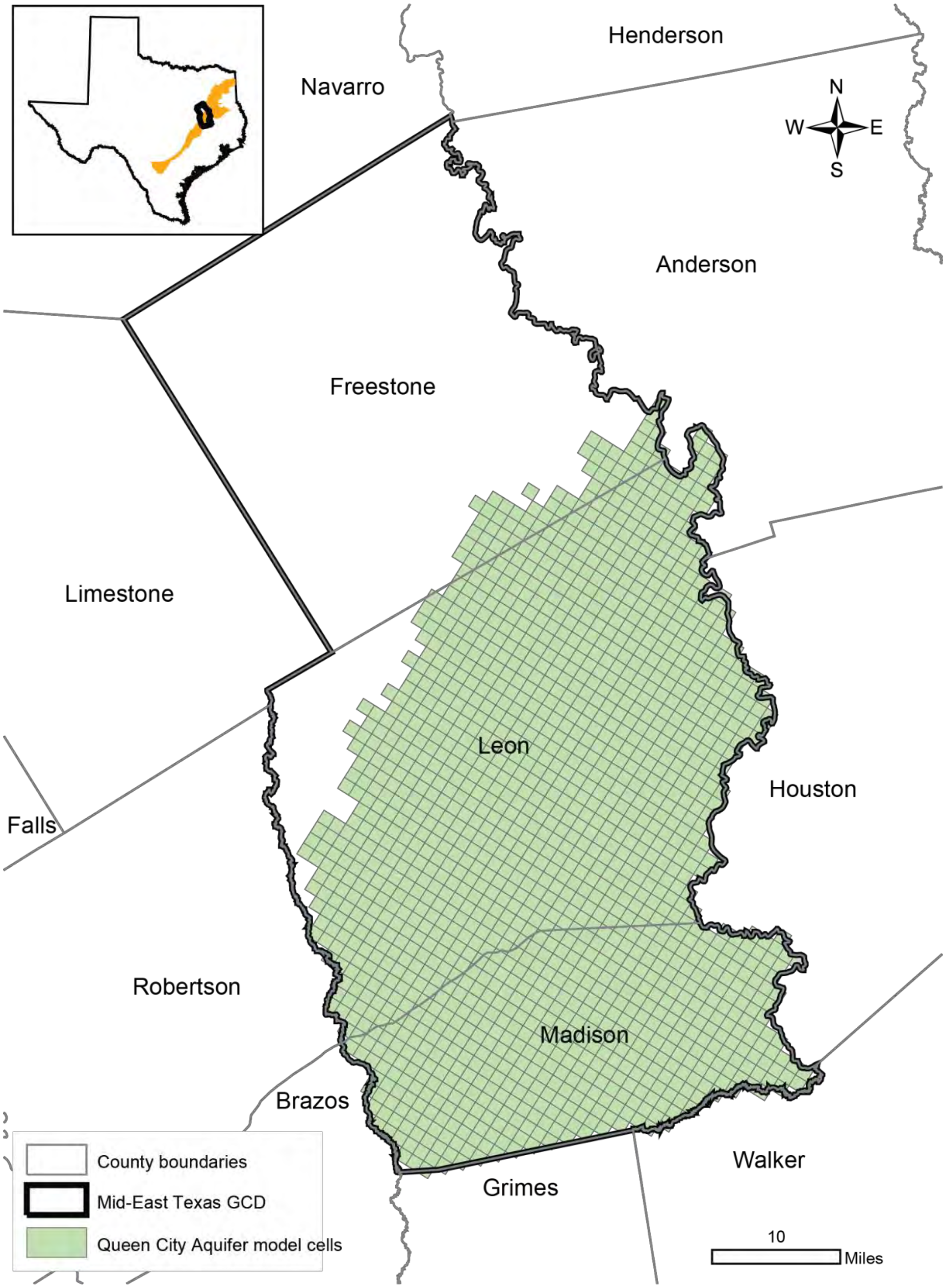

FIGURE 3: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE QUEEN CITY AQUIFER FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED. ONLY THE CELLS REPRESENTING THE QUEEN CITY AQUIFER WITHIN THE DISTRICT BOUNDARIES ARE SHOWN.

TABLE 4: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR THE MID-EAST TEXAS GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the groundwater resources within the district	Carrizo-Wilcox Aquifer	48,603
Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	35,855
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	10,474
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	21,365
Estimated net annual volume of flow between each aquifer in the district	To the Carrizo-Wilcox Aquifer from the Reklaw Confining Unit	29
	To the Carrizo-Wilcox Aquifer from down-dip stratigraphic units	4,184

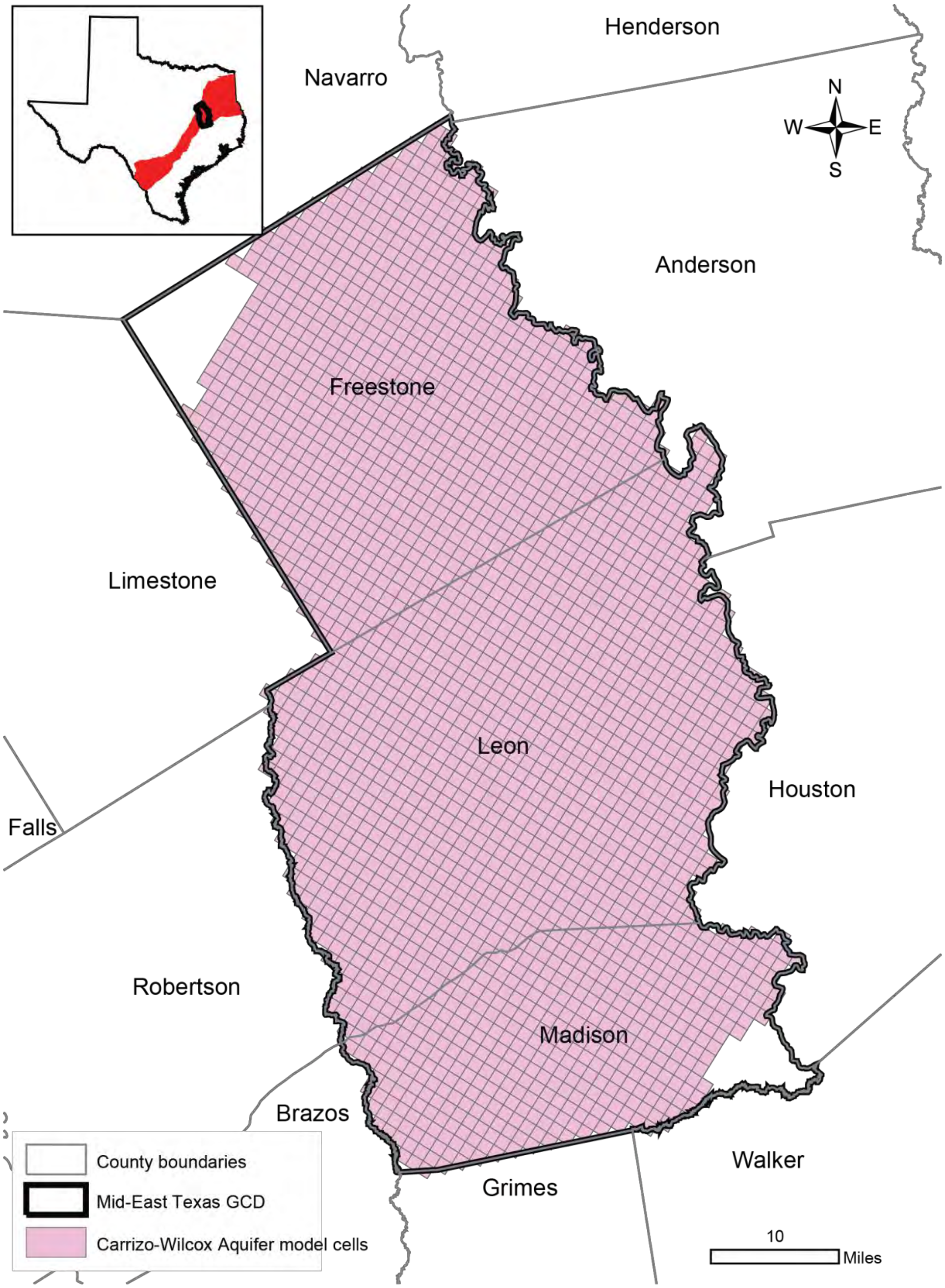

FIGURE 4: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CARRIZO-WILCOX AQUIFER FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED. ONLY THE CELLS REPRESENTING THE CARRIZO-WILCOX AQUIFER WITHIN THE DISTRICT BOUNDARIES ARE SHOWN.

LIMITATIONS

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

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

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

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

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

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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., http://www.twdb.texas.gov/groundwater/models/gam/qcsp/qcsp.asp.

National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

APPENDIX N

MAY 28, 2015 PRESENTATION “GMA 12: HYDROLOGICAL CONDITIONS CONSIDERATION DISCUSSION”

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GMA 12

Hydrological Conditions Consideration Discussion

by

GMA 12 Consultant Team

TWC Section 36.108 (d)

- Before voting on the proposed desired future conditions … the districts shall consider:
  - Aquifer uses and conditions
  - Needs and strategies
  - **Hydrologic conditions**
  - Environmental impacts
  - Subsidence
  - Socioeconomic impacts
  - Private property rights
  - Feasibility
  - Anything else

TWC Section 36.108 (d-2)

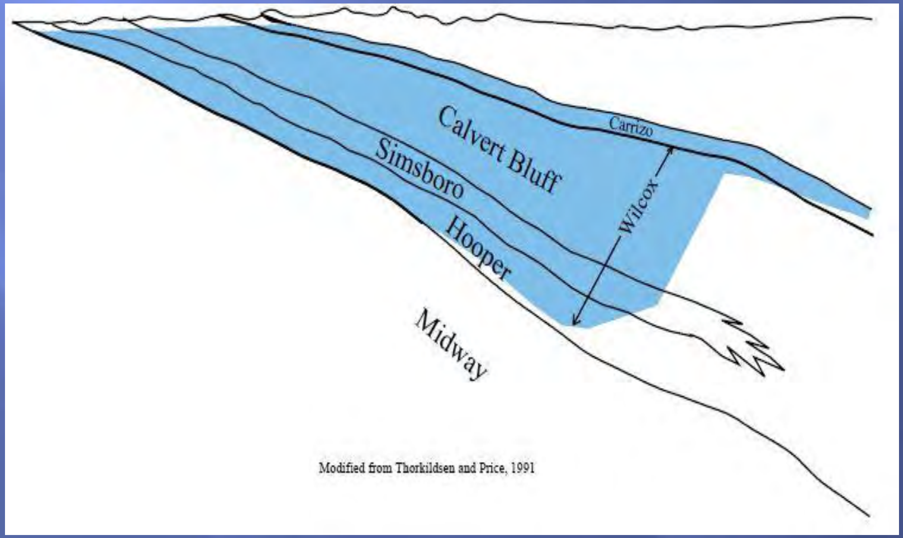
- The desired future conditions … must provide a <u>balance</u> between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater … in the management area.

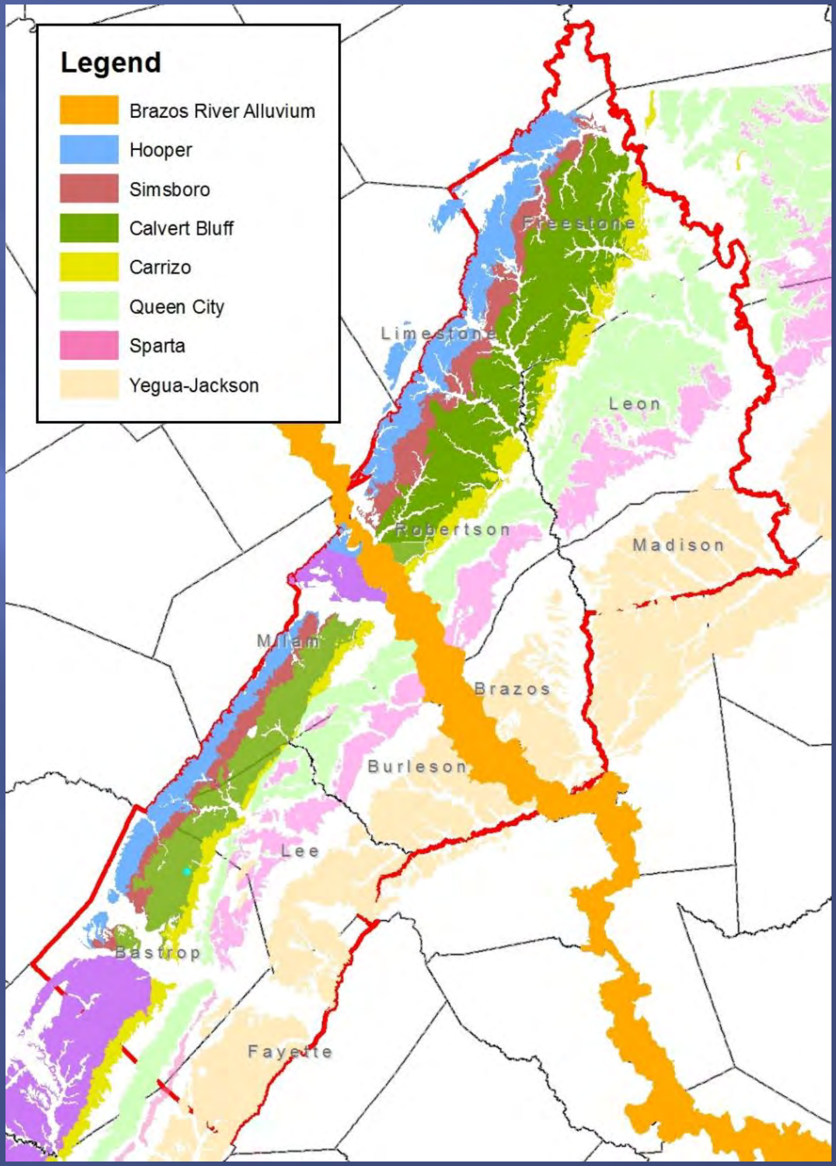
Consideration 3

- Describe the hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge

Hydrological Conditions

- Aquifers outcrop from SW to NE
- Dip towards the coast



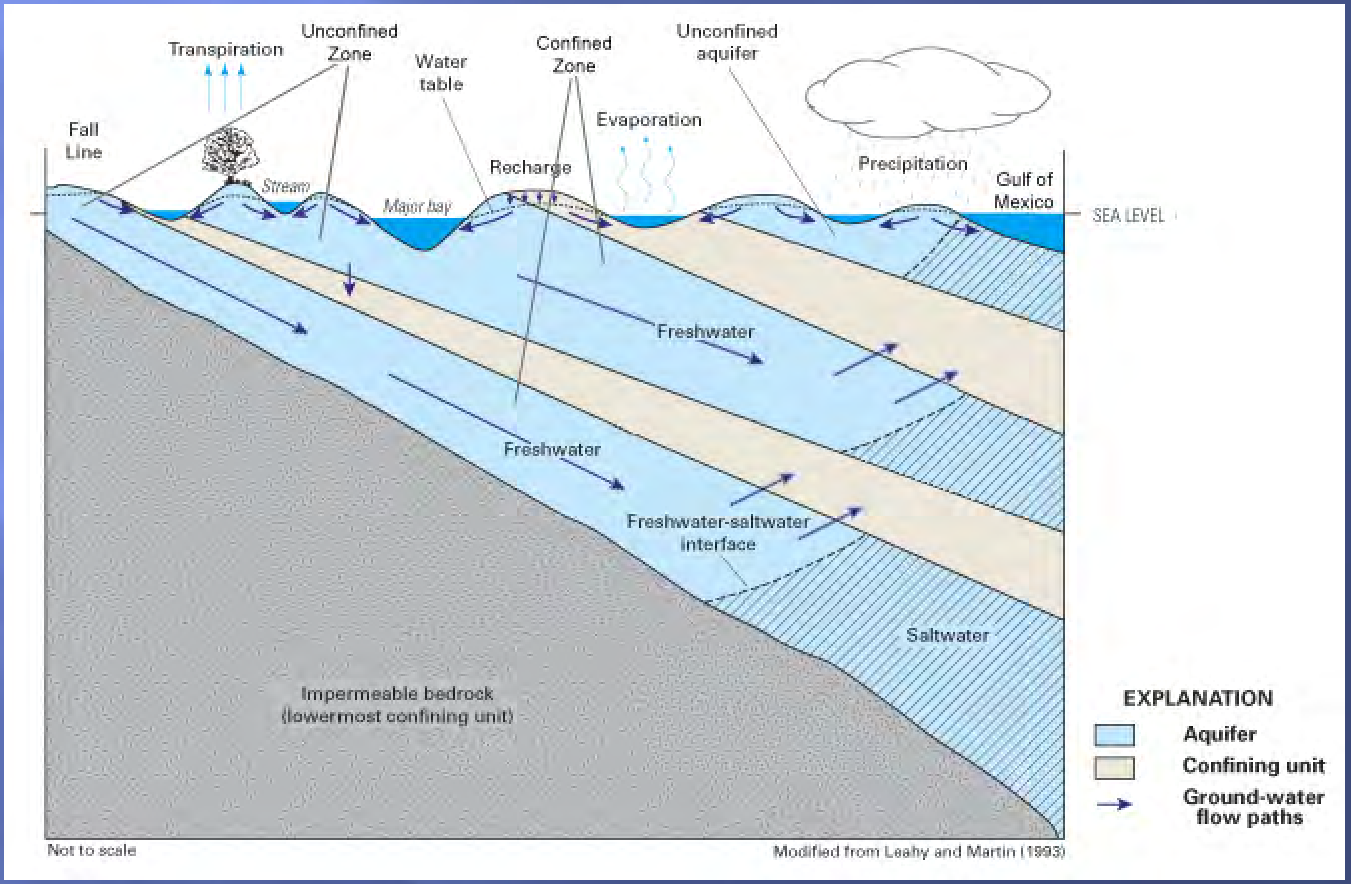


Hydrological Conditions

- Unconfined in outcrop, confined downdip
- Most pumpage and large projects are in the confined section
- Faults!!!!!

Hydrological Conditions

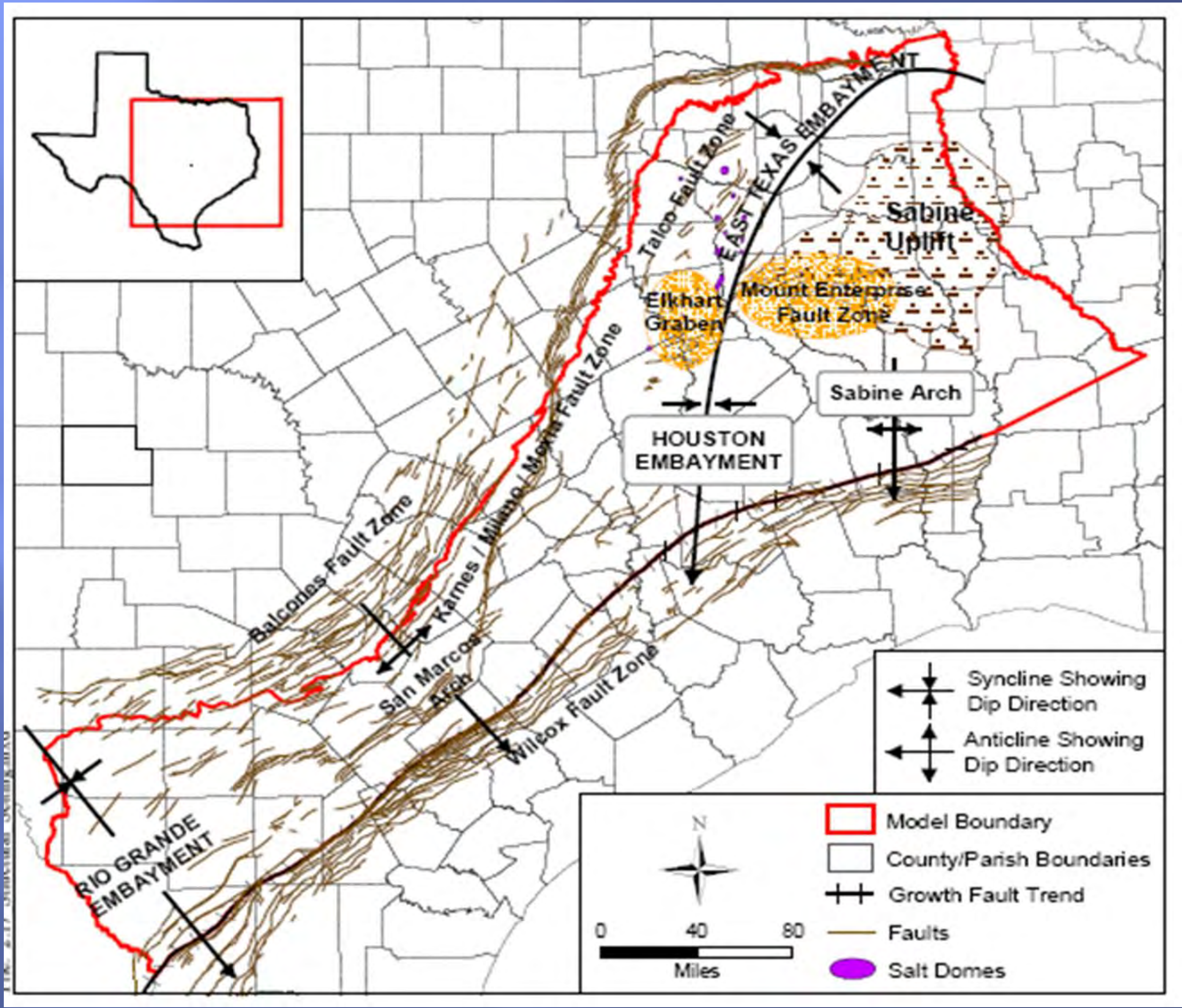
- Unconfined in outcrop, confined downdip



Faults

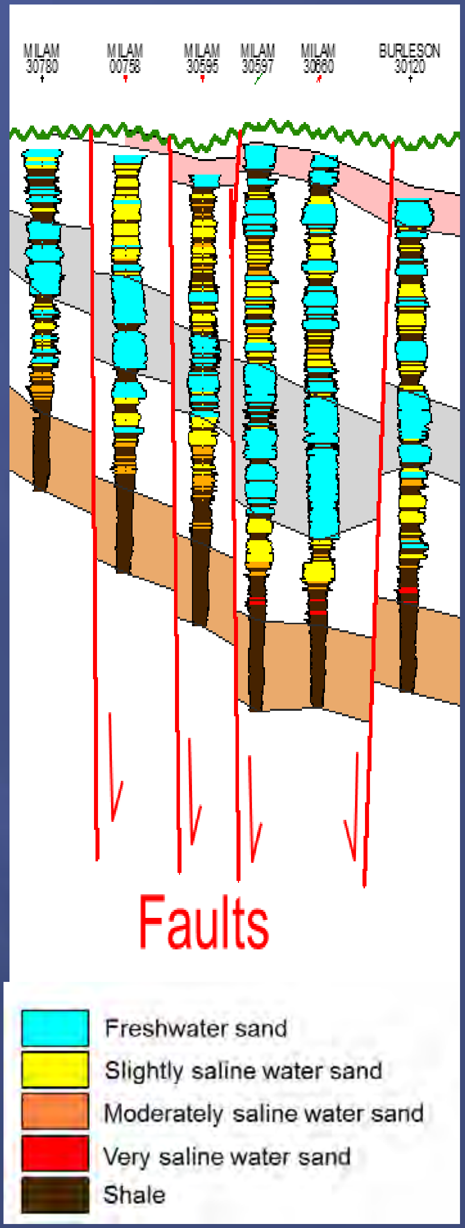
- Impact of faulting on groundwater flow in much of GMA 12 is an important consideration
- Many of the faults included in the GAM are "sealing" faults, allowing little water to move across them
- Unsure of real impact of faults on groundwater flow
- Impact of faults on the flow system is about to be re-evaluated in an updated GAM

Major Fault Zones

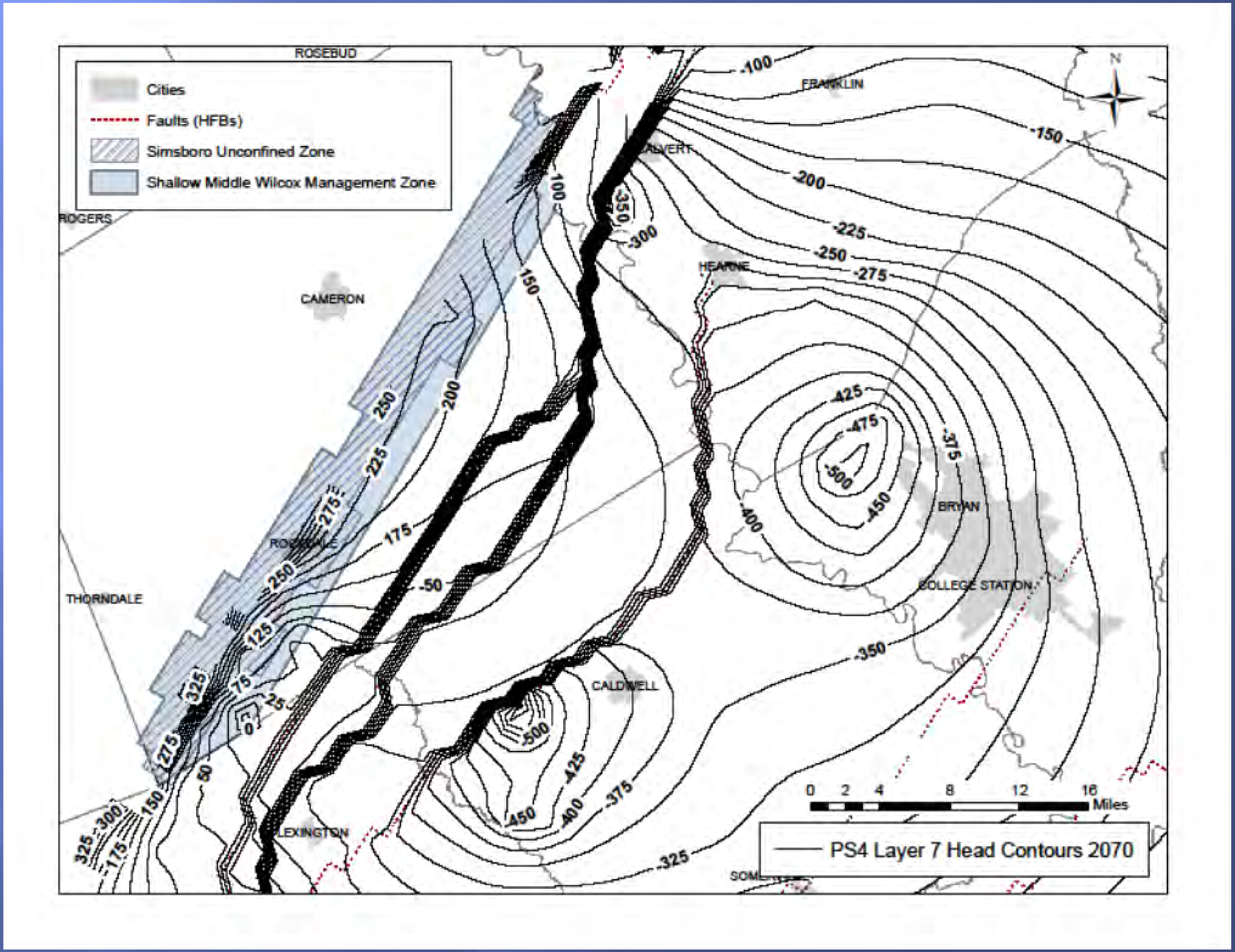


Impact of Faults on Groundwater Flow

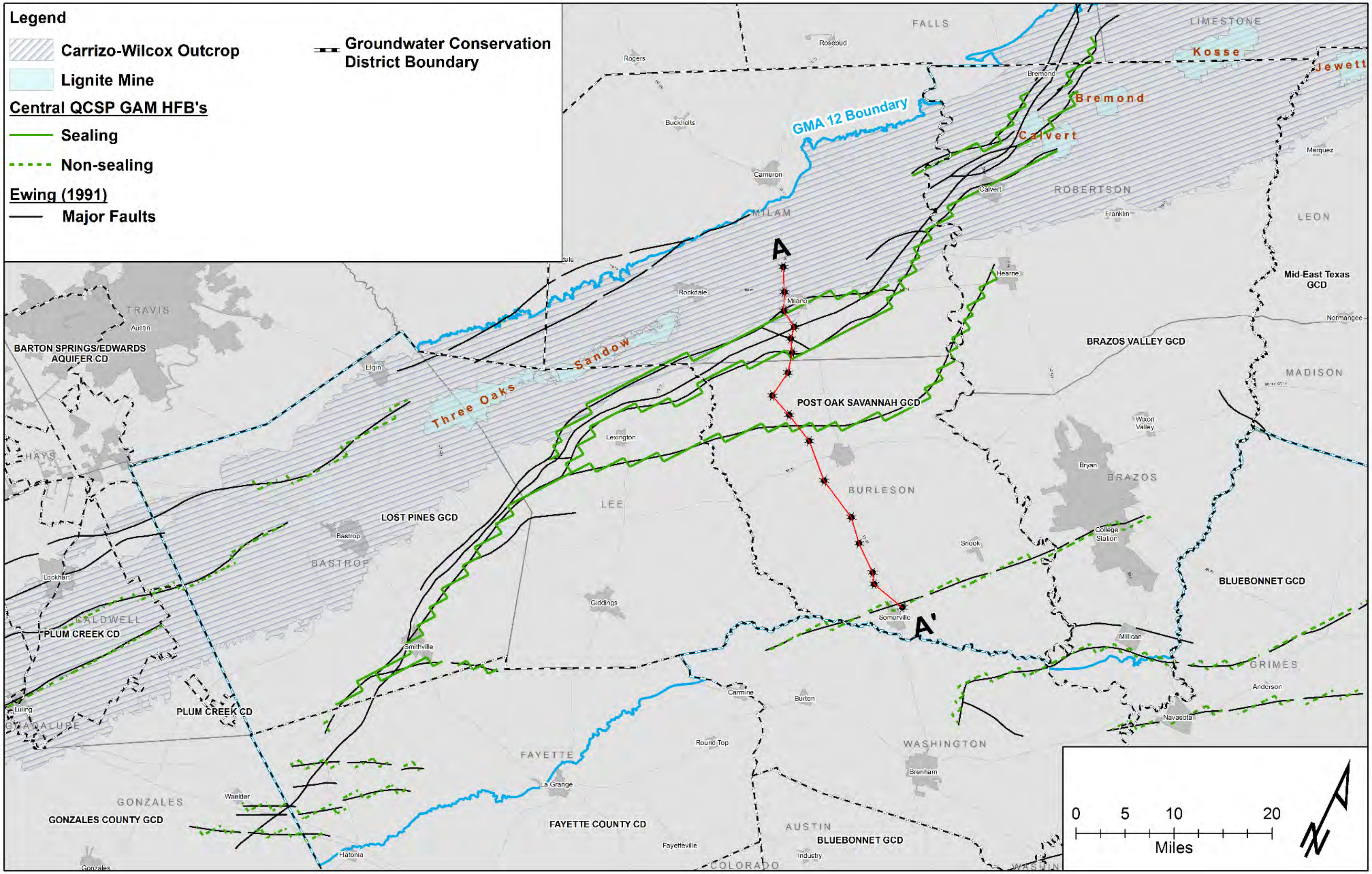
- Mexia-Talco Fault Zone created after sediments for Sparta, Queen City, and Carrizo-Wilcox Aquifers had been deposited
- Sediment thicknesses should be comparable on both sides of a fault
- Existing GAM classifies fault as either
  - Sealing (major impedance to groundwater flow)
  - Non-sealing (minor impact on groundwater flows)



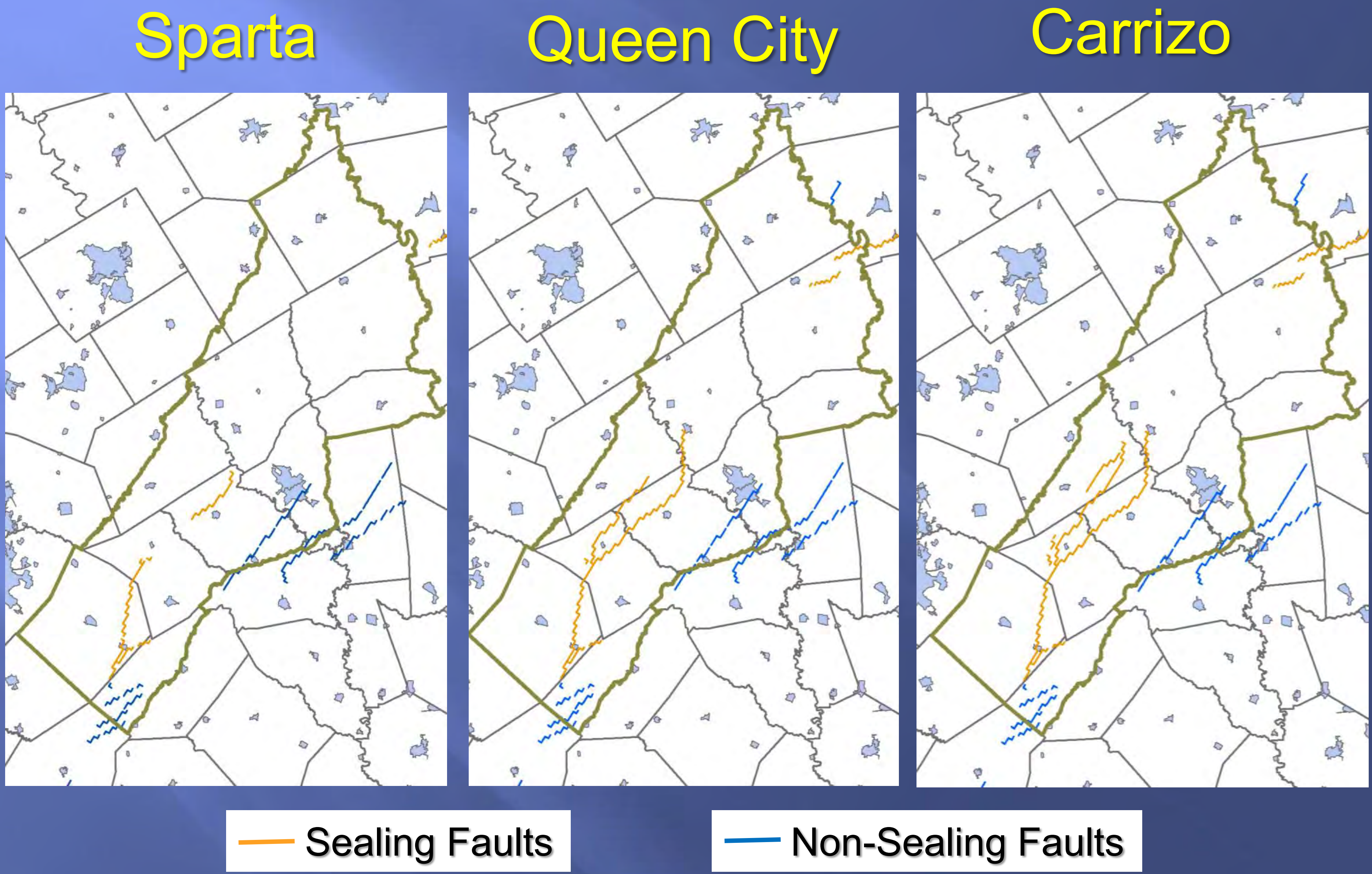
Effects of Sealing Faults



Comparison of Simsboro Faults in Ewing (1991) and in GAM

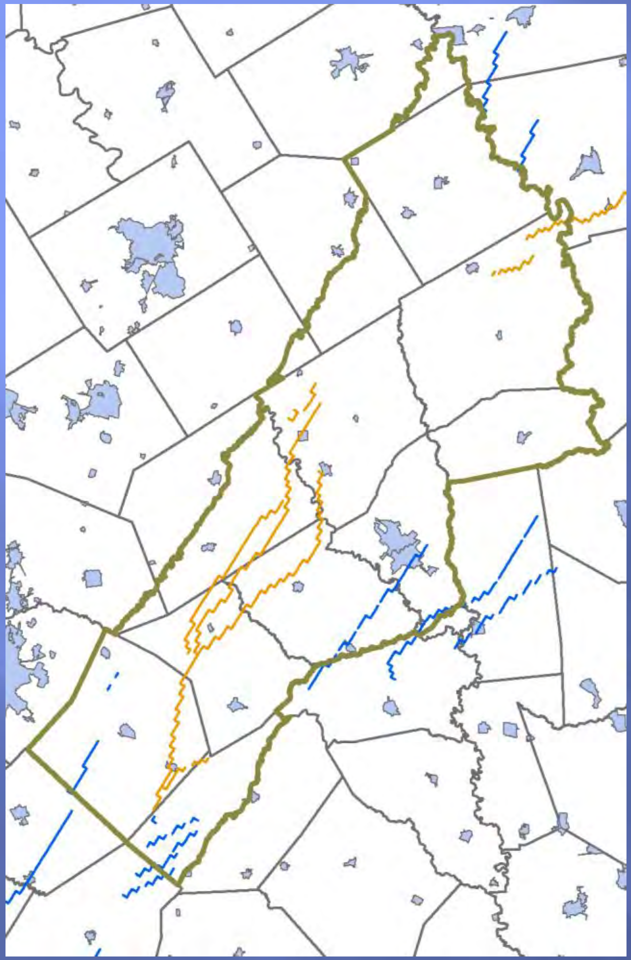


Fault Locations in GAM

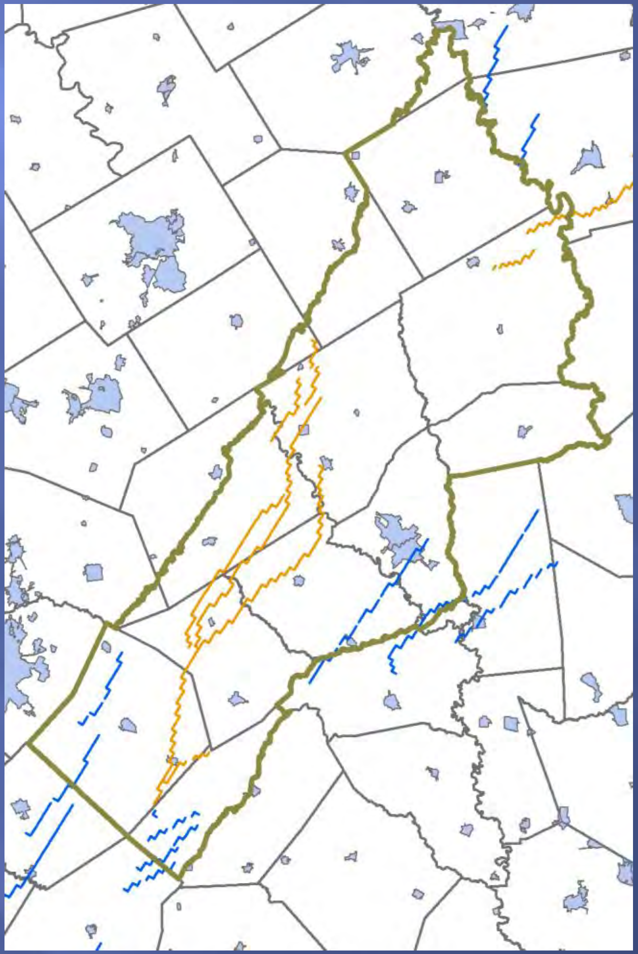


Fault Locations in GAM

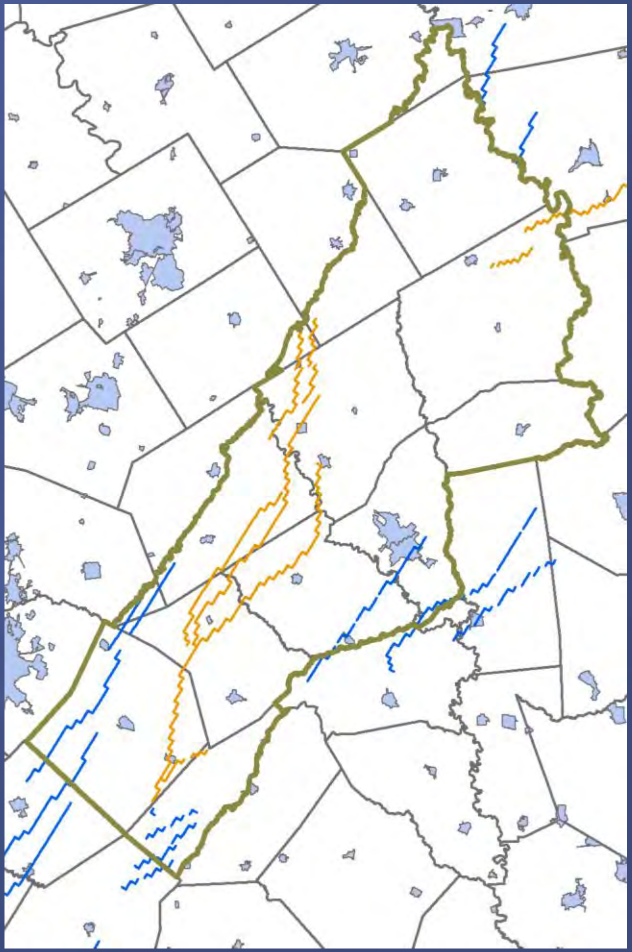
Calvert Bluff



Simsboro



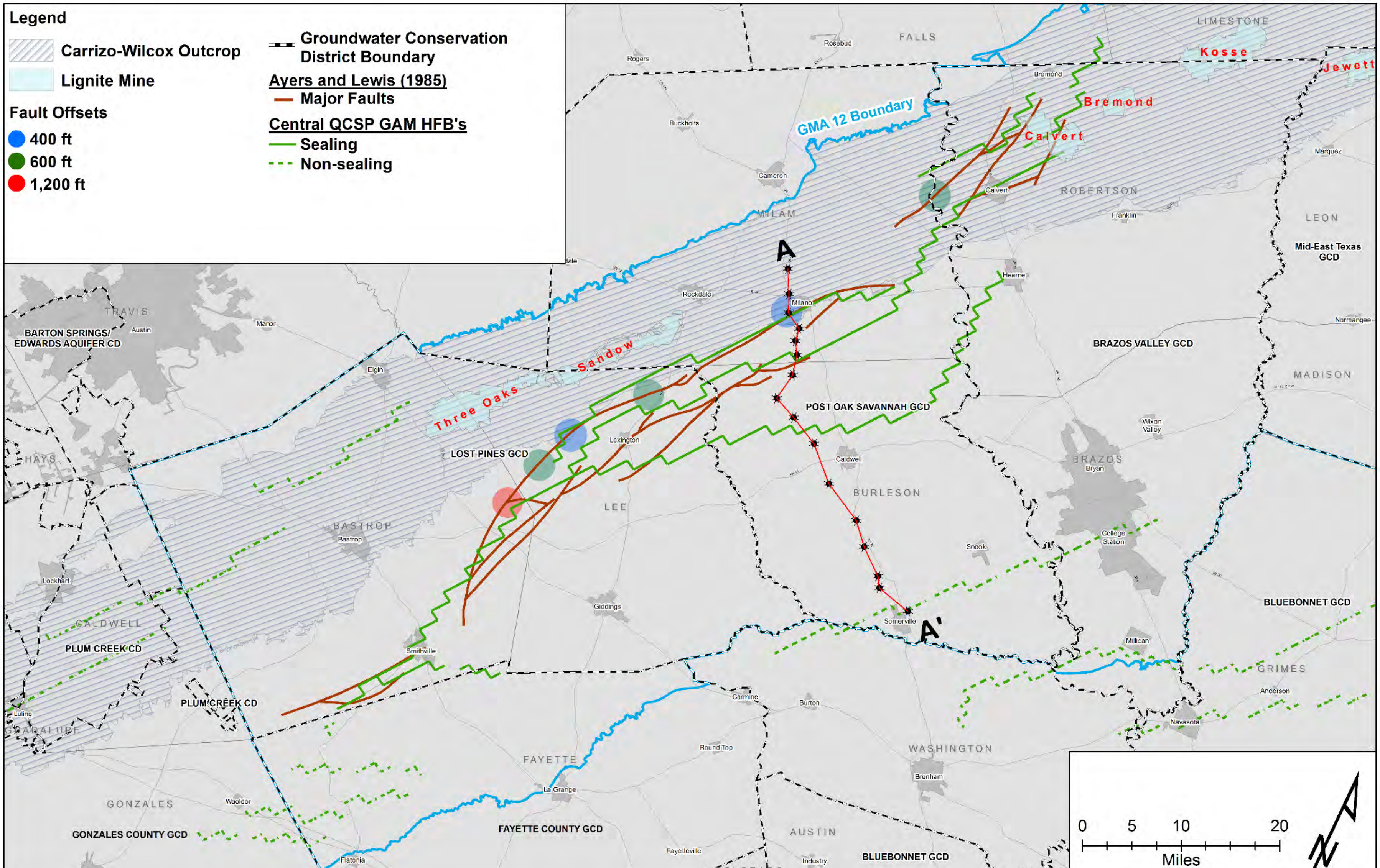
Hooper



Sealing Faults

Non-Sealing Faults

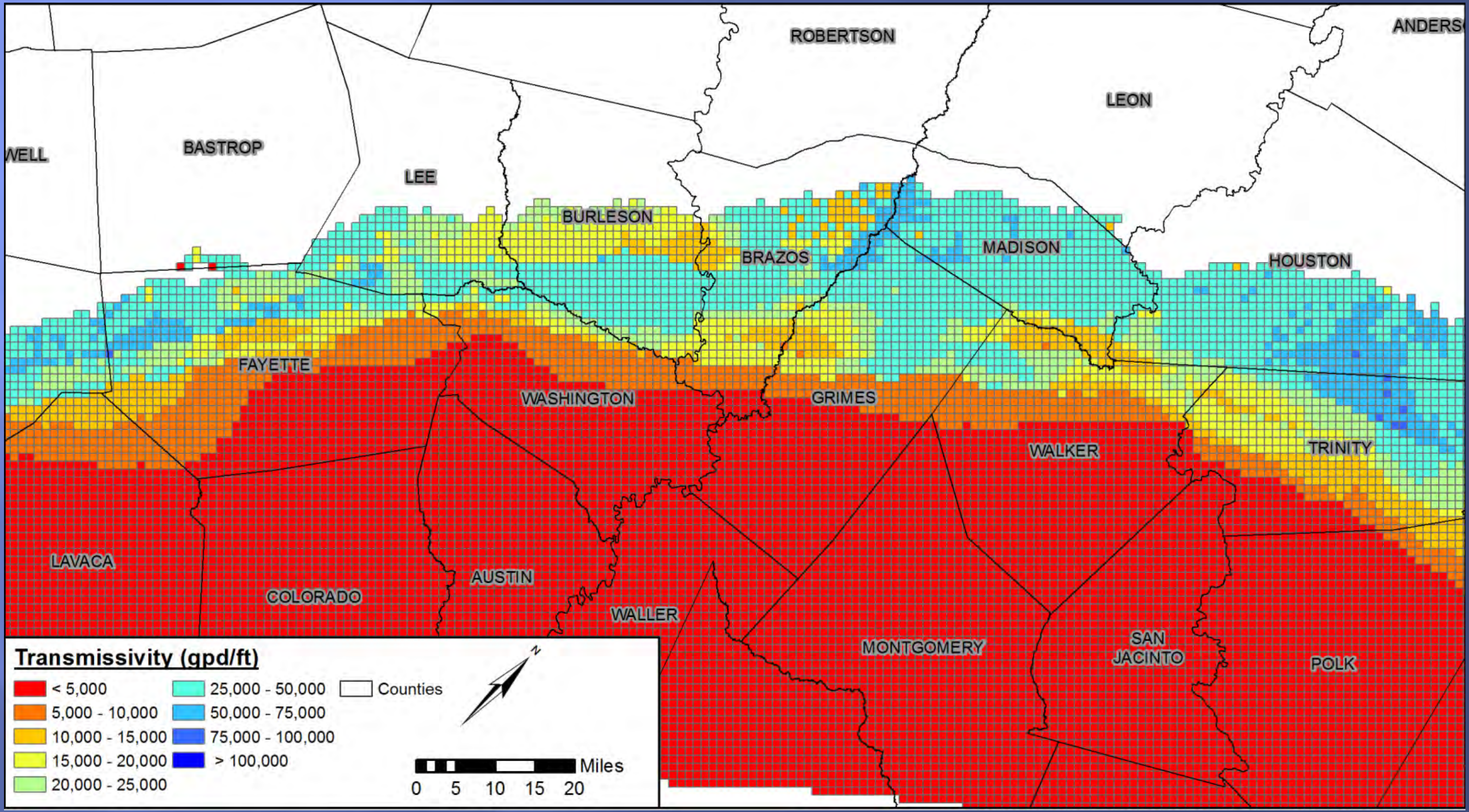
Comparison of Simsboro Faults in Ayers (1985) and in QCSP GAM



Yegua-Jackson Conditions

- Water is produced from the Yegua Formation and the Jackson Group, generally treat these together as one aquifer unit
- Groundwater primarily produced from shallow wells, most <1000'
- Variable water quality due to composition of sediments in the formations
- Fairly consistent aquifer conditions across the extent of the aquifer within GMA 12
- Not a highly productive aquifer anywhere within GMA 12

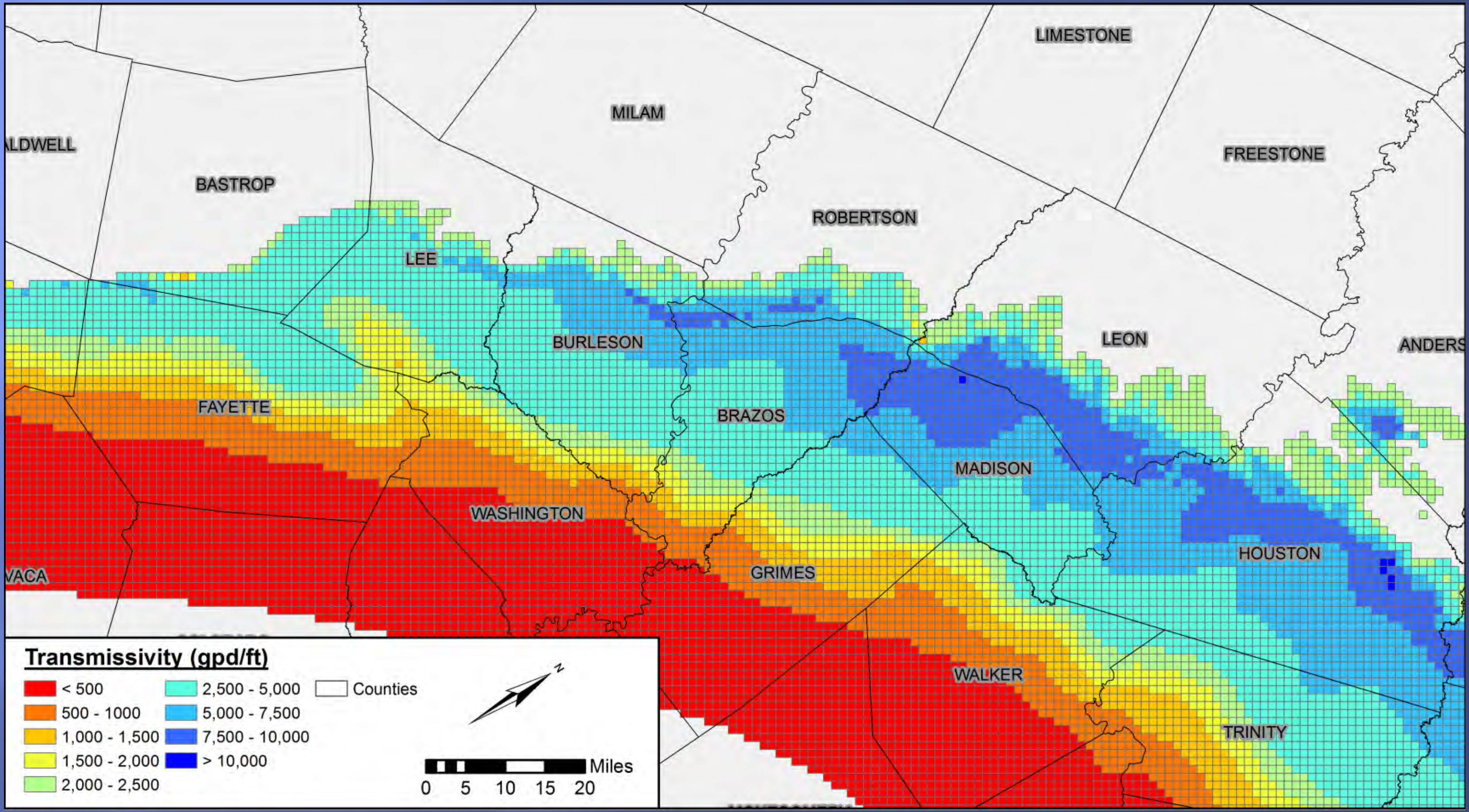
Yegua-Jackson Transmissivity



Sparta Conditions

- Water is produced from the Sparta Formation of the Clairborne Group
- Sand-rich formation interbedded with silt and clay
- Groundwater primarily produced from shallow to moderately deep wells (most <1000′, a few up to 2,000′)
- Water quality usually fresh in and near outcrop, deteriorates downdip
- More prolific towards the northeastern portions of GMA 12
- Can produce small to moderate quantities of water in GMA 12

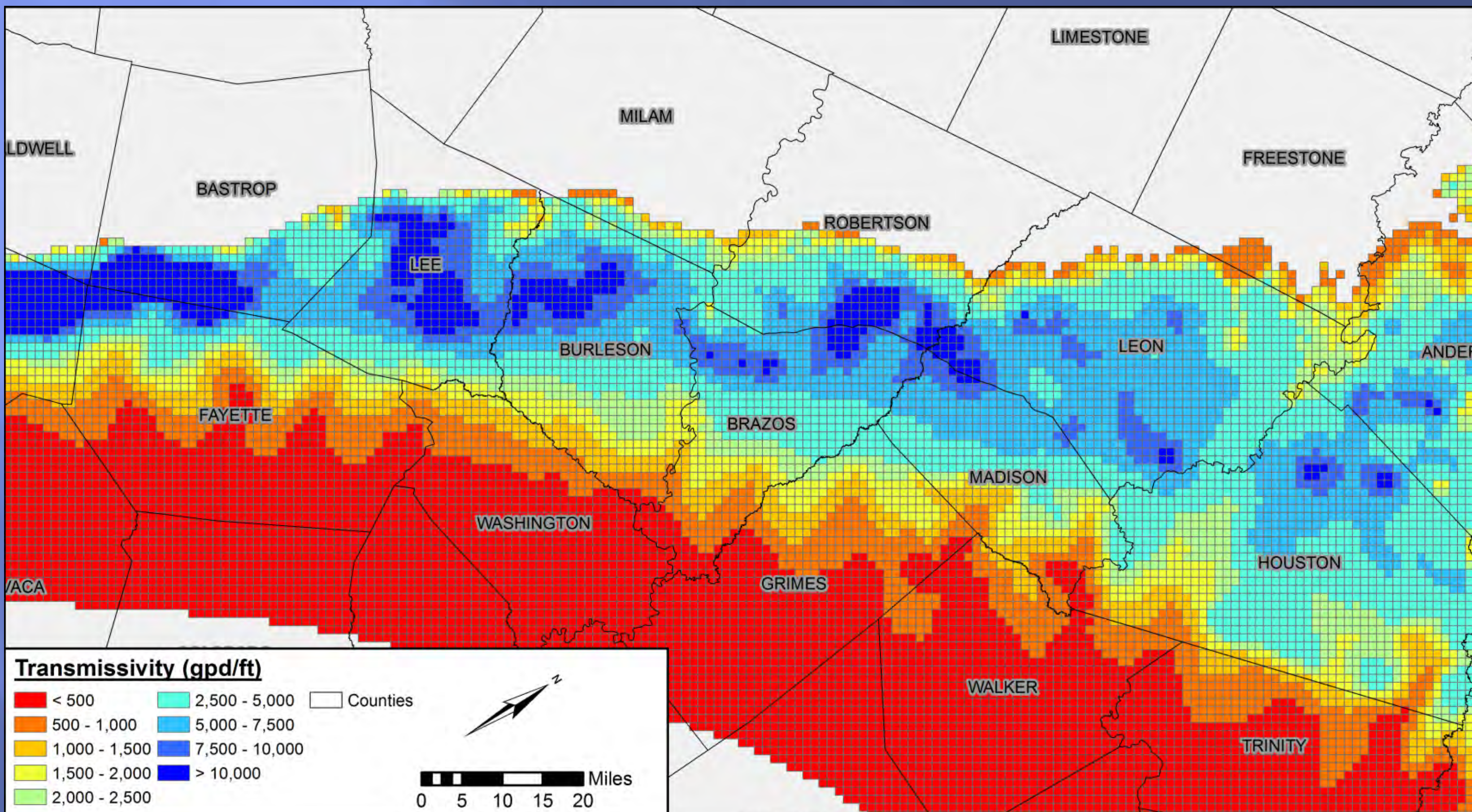
Sparta Transmissivity



Queen City Conditions

- Water is produced from the Queen City Formation
- Water stored in sand, loosely cemented sandstone, and interbedded clay
- Water quality generally fresh, deteriorates downdip
- Fairly consistent aquifer conditions across the extent of the aquifer within GMA 12
- Can produce small to moderate quantities of water in GMA 12

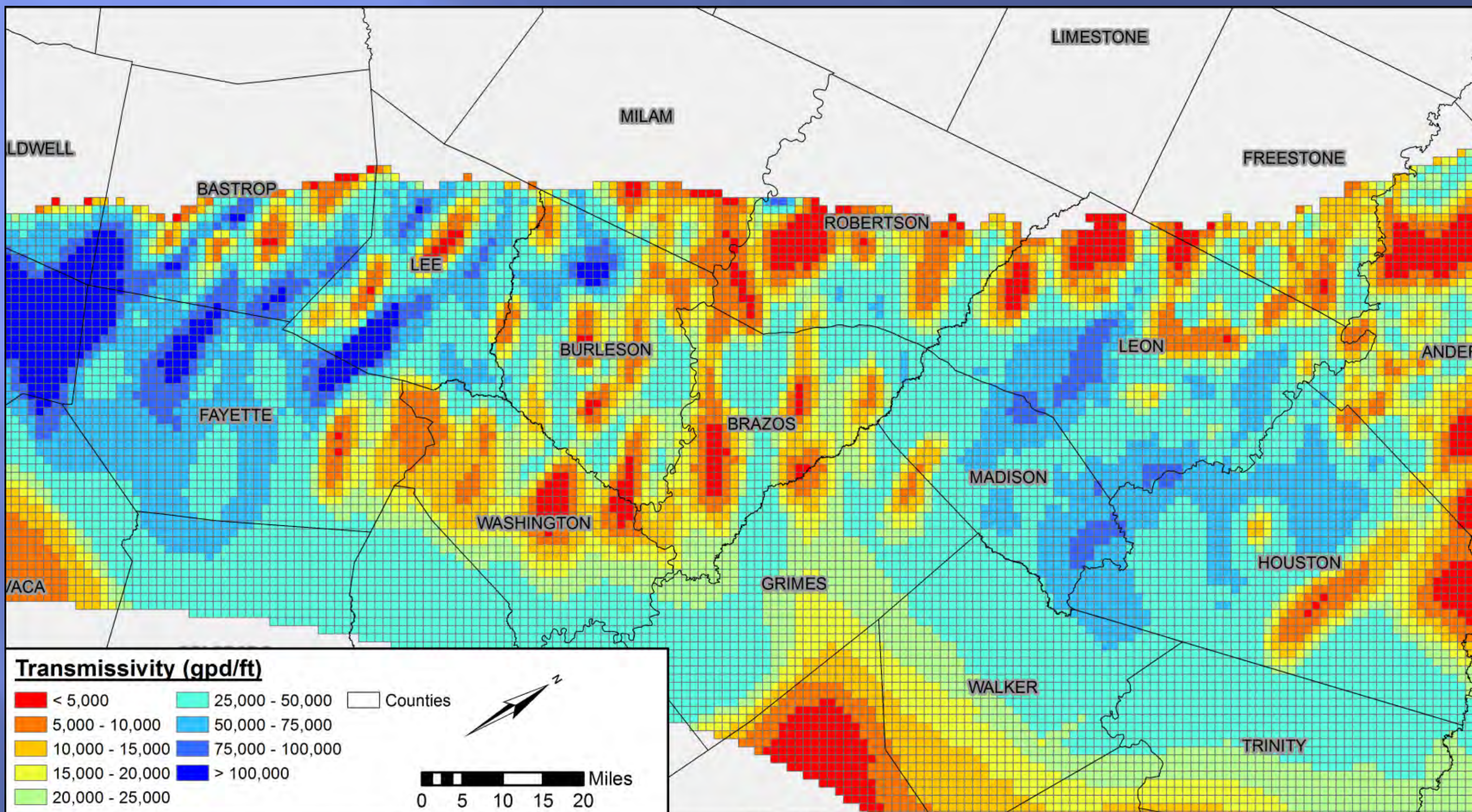
Queen City Transmissivity



Carrizo Conditions

- Water is produced from the Carrizo Formation, which is hydrologically connected to Wilcox and thus referred to as the Carrizo-Wilcox Aquifer
- Sand-rich formation interbedded with silt and clay. Sand thicknesses 100-200 feet and more laterally continuous.
- Water quality generally fresh, deteriorates downdip
- Becomes more prolific to the southeast, especially in GMA 13.
- Can be a very productive aquifer within GMA 12. Extremely productive aquifer in GMA 13.

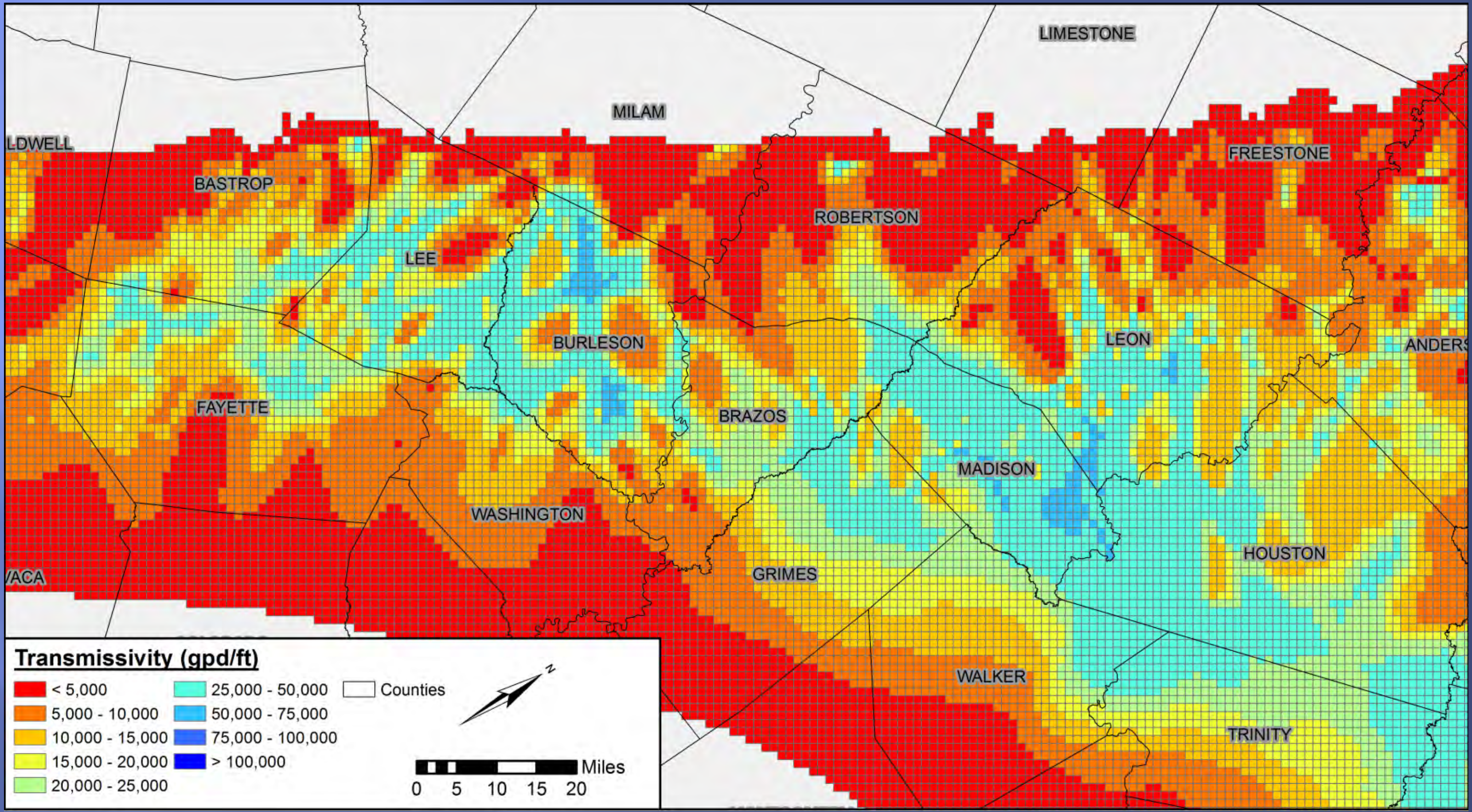
Carrizo Transmissivity



Calvert Bluff Conditions

- Water is produced from the Calvert Bluff Formation of the Wilcox Group
- Consists mostly of lower permeability clays and lignites. Sands, where present, can be productive. Very thick formation.
- Water quality usually fresh in and near outcrop, deteriorates downdip
- Fairly consistent across the GMA
- Can produce low to moderate quantities of water in GMA 12

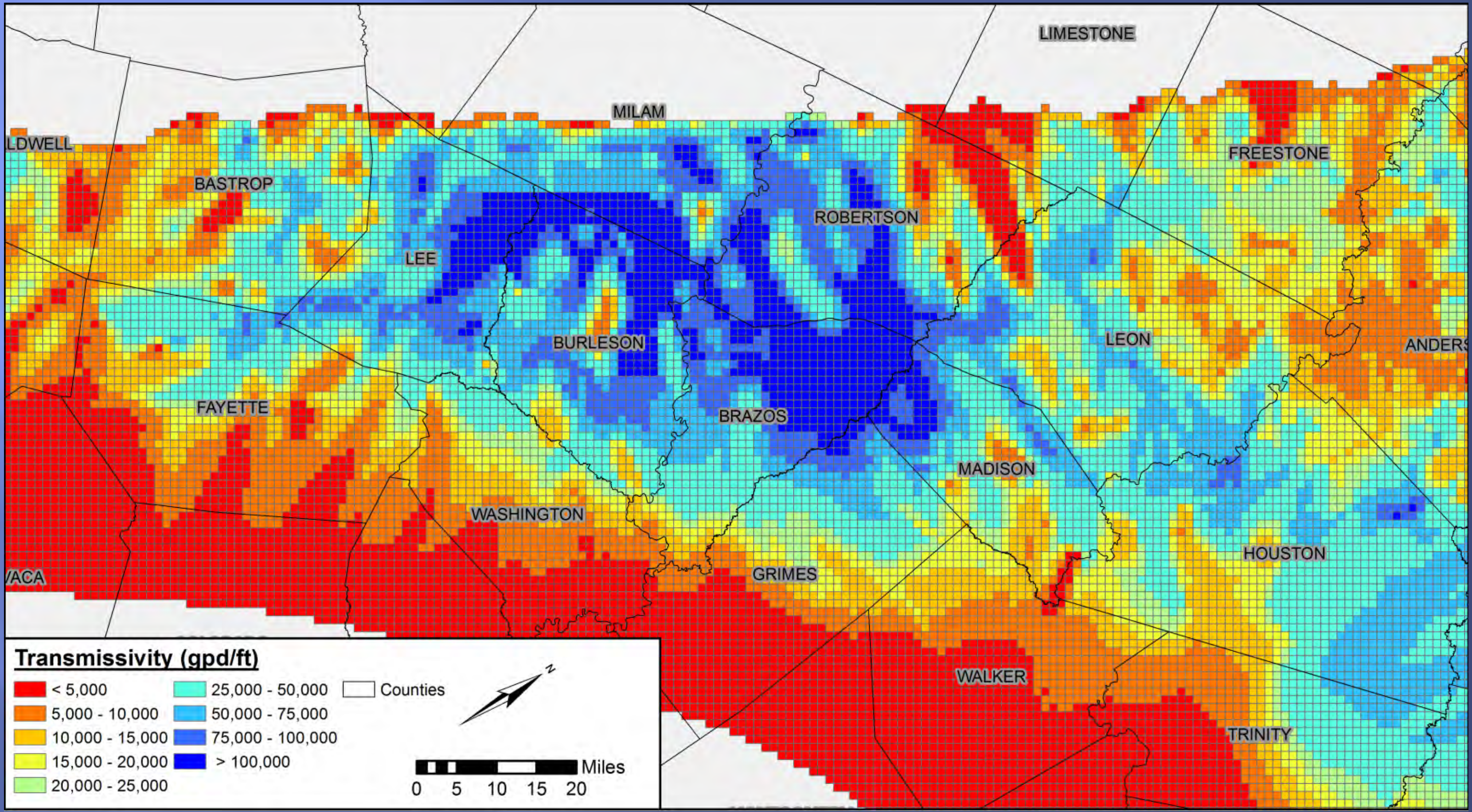
Calvert Bluff Transmissivity



Simsboro Conditions

- Water is produced from the Simsboro Formation of the Wilcox Group
- Predominantly sand-rich formation. Can have more than 500 feet of sandstone. Thick sands extend well downdip, make up 80% of the formation
- Defined as a separate unit in most of the GMA
- Water quality generally fresh, deteriorates farther downdip
- More productive in the central portion of the GMA
- Extremely productive aquifer within GMA 12

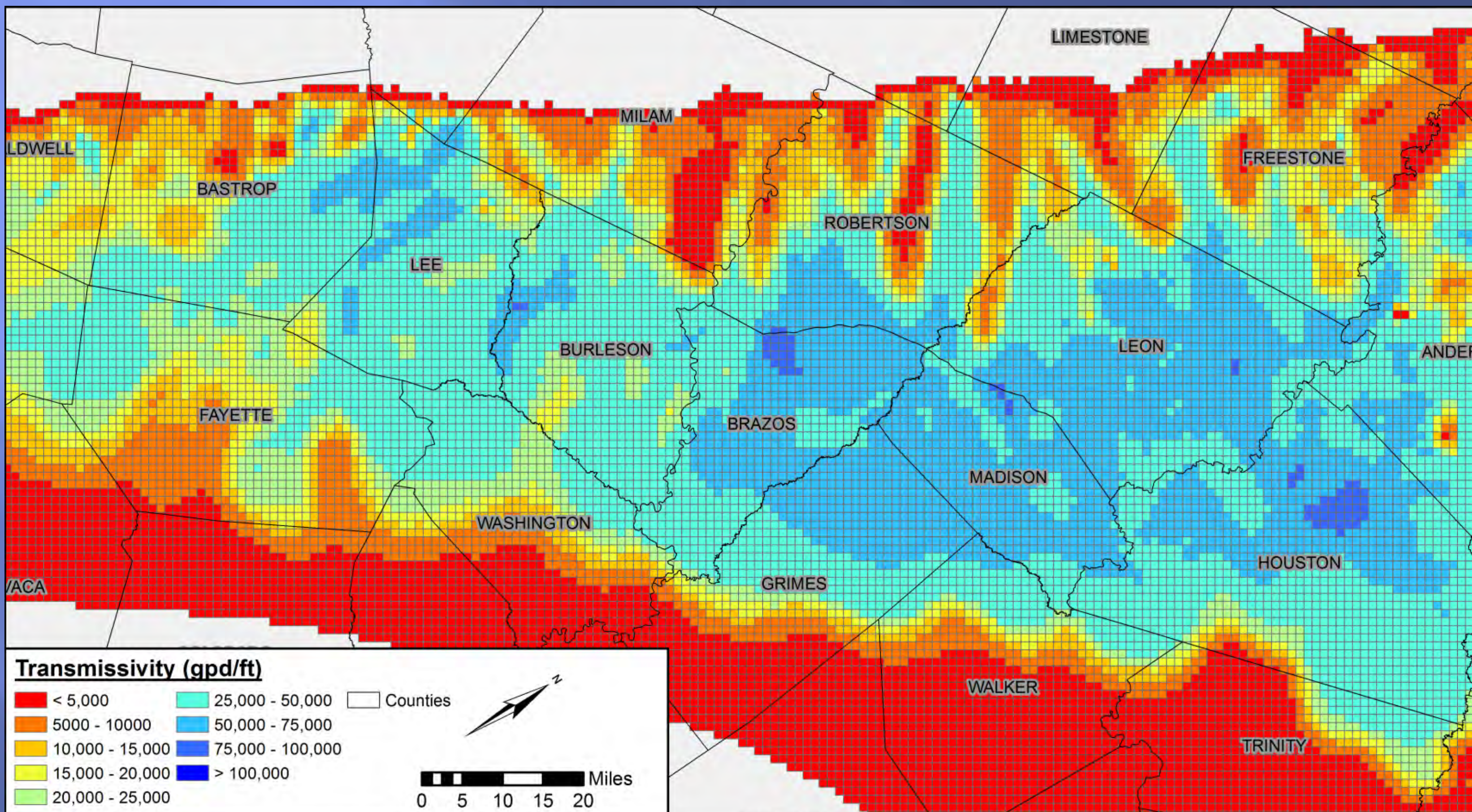
Simsboro Transmissivity



Hooper Conditions

- Water is produced from the Hooper Formation of the Wilcox Group
- Made up of interbedded shales and sandstones with minor amounts of lignite, generally 20-40% sand, can be higher locally. Sand thicknesses thin to near zero in most of the downdip areas.
- Water quality usually fresh in and near outcrop, deteriorates downdip
- Not a highly productive aquifer in most areas of GMA 12

Hooper Transmissivity



Brazos River Alluvium Conditions

- Water is produced from the alluvium deposited by the Brazos River
- Wells are very shallow (<100 feet)
- Water quality usually fresh, some pockets of poorer quality water
- Fairly consistent aquifer conditions across the extent of the aquifer within GMA 12
- Can be fairly productive

Total Estimated Recoverable Storage (TERS)

- Required to be evaluated as part of the DFC process
- Provided by the TWDB in GAM Task 13-035 report dated August 30, 2013
- “Recoverable” is defined as the estimated amount of groundwater that accounts for recovery scenarios that range from 25% to 75% of the total storage
- Total storage = L x W x H x Storage coefficient

Total Estimated Recoverable Storage (TERS)

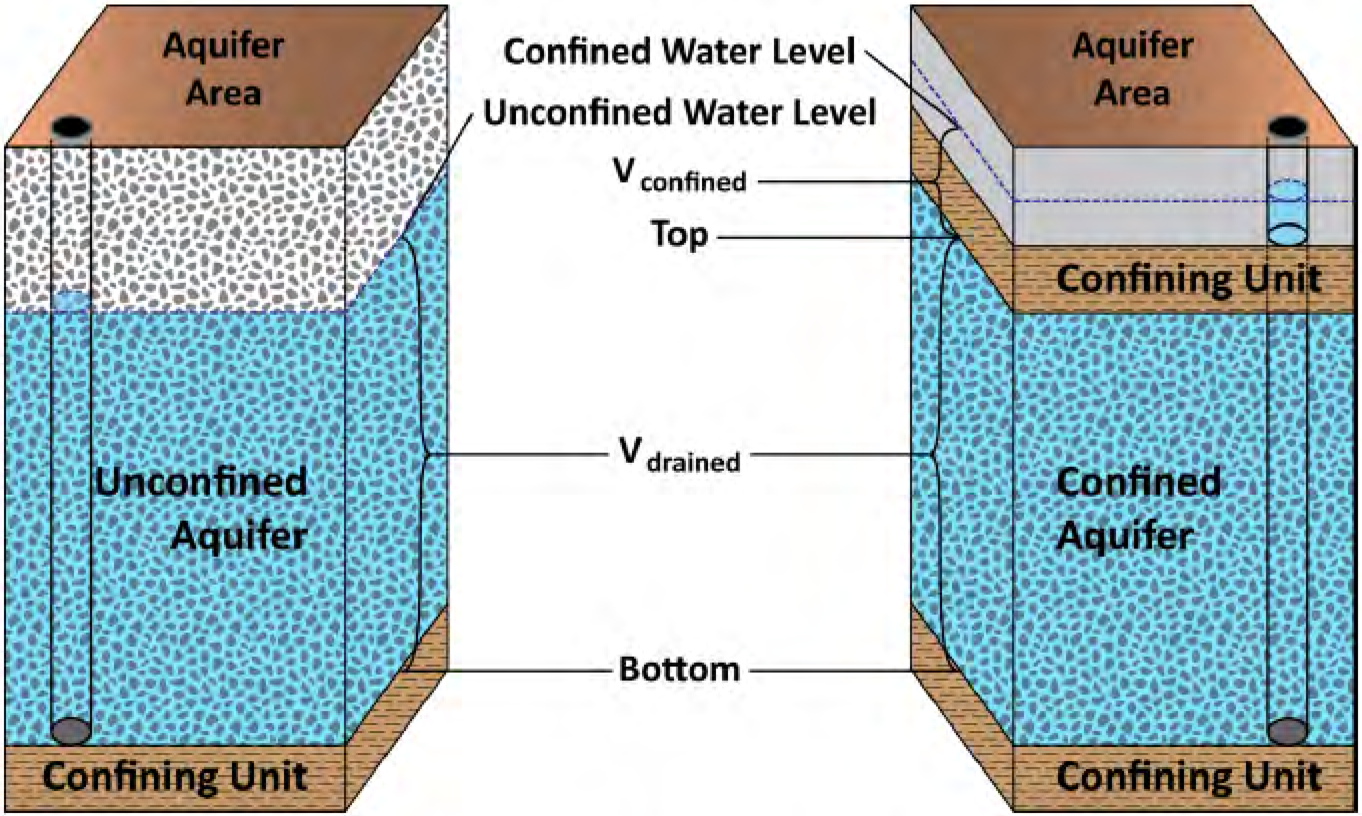


FIGURE 1. SCHEMATIC GRAPH SHOWING THE DIFFERENCE BETWEEN UNCONFINED AND CONFINED AQUIFERS.

Total Estimated Recoverable Storage (TERS)

- Does not account for water quality
- Estimates have been restricted based on the "official" aquifer extents per the TWDB
- Does not account for subsidence potential
- Does not account for impact on surface water

Total Estimated Recoverable Storage (TERS)

- Solely based on how much water is present and how much can be pumped out based on TWDB definition of 25% to 75%
- One-size-fits-all definition of “recoverable”. How much is actually recoverable may actually vary based on aquifer type
- Vast majority of water is in unconfined storage

Trinity Aquifer TERS

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	9,000,000	2,250,000	6,750,000
Lee	500,000	125,000	375,000
Williamson	1,600,000	400,000	1,200,000
Total	**11,100,000**	**2,775,000**	**8,325,000**

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Trinity Aquifer TERS

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	1,600,000	400,000	1,200,000
Lost Pines GCD	9,500,000	2,375,000	7,125,000
Total	**11,100,000**	**2,775,000**	**8,325,000**

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Carrizo-Wilcox Aquifer TERS

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	98,000,000	24,500,000	73,500,000
Brazos	69,000,000	17,250,000	51,750,000
Burleson	120,000,000	30,000,000	90,000,000
Falls	820,000	205,000	615,000
Fayette	95,000,000	23,750,000	71,250,000
Freestone	46,000,000	11,500,000	34,500,000
Lee	130,000,000	32,500,000	97,500,000
Leon	180,000,000	45,000,000	135,000,000
Limestone	12,000,000	3,000,000	9,000,000
Madison	110,000,000	27,500,000	82,500,000
Milam	47,000,000	11,750,000	35,250,000
Navarro	1,000,000	250,000	750,000
Robertson	110,000,000	27,500,000	82,500,000
Williamson	500,000	125,000	375,000
Total	1,019,320,000	254,830,000	764,490,000

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Carrizo-Wilcox Aquifer TERS

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
No District	14,000,000	3,500,000	10,500,000
Brazos Valley GCD	180,000,000	45,000,000	135,000,000
Fayette County GCD	95,000,000	23,750,000	71,250,000
Lost Pines GCD	220,000,000	55,000,000	165,000,000
Mid-East Texas GCD	340,000,000	85,000,000	255,000,000
Post Oak Savannah GCD	170,000,000	42,500,000	127,500,000
Total	1,019,000,000	254,750,000	764,250,000

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Queen City Aquifer TERS

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	9,500,000	2,375,000	7,125,000
Brazos	25,000,000	6,250,000	18,750,000
Burleson	29,000,000	7,250,000	21,750,000
Fayette	19,000,000	4,750,000	14,250,000
Freestone	290,000	72,500	217,500
Lee	23,000,000	5,750,000	17,250,000
Leon	25,000,000	6,250,000	18,750,000
Madison	20,000,000	5,000,000	15,000,000
Milam	650,000	162,500	487,500
Robertson	8,800,000	2,200,000	6,600,000
Total	160,240,000	40,060,000	120,180,000

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Queen City Aquifer TERS

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Brazos Valley GCD	34,000,000	8,500,000	25,500,000
Fayette County GCD	19,000,000	4,750,000	14,250,000
Lost Pines GCD	32,000,000	8,000,000	24,000,000
Mid-East Texas GCD	45,000,000	11,250,000	33,750,000
Post Oak Savannah GCD	30,000,000	7,500,000	22,500,000
Total	160,000,000	40,000,000	120,000,000

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Sparta Aquifer TERS

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	2,500,000	625,000	1,875,000
Brazos	17,000,000	4,250,000	12,750,000
Burleson	16,000,000	4,000,000	12,000,000
Fayette	12,000,000	3,000,000	9,000,000
Lee	10,000,000	2,500,000	7,500,000
Leon	4,600,000	1,150,000	3,450,000
Madison	16,000,000	4,000,000	12,000,000
Robertson	1,300,000	325,000	975,000
Total	79,400,000	19,850,000	59,550,000

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Sparta Aquifer TERS

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Brazos Valley GCD	18,000,000	4,500,000	13,500,000
Fayette County GCD	12,000,000	3,000,000	9,000,000
Lost Pines GCD	13,000,000	3,250,000	9,750,000
Mid-East Texas GCD	21,000,000	5,250,000	15,750,000
Post Oak Savannah GCD	16,000,000	4,000,000	12,000,000
Total	80,000,000	20,000,000	60,000,000

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Yegua-Jackson Aquifer TERS

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Bastrop	290,000	72,500	217,500
Brazos	30,000,000	7,500,000	22,500,000
Burleson	27,000,000	6,750,000	20,250,000
Fayette	27,000,000	6,750,000	20,250,000
Lee	10,000,000	2,500,000	7,500,000
Leon	76,000	19,000	57,000
Madison	15,000,000	3,750,000	11,250,000
Total	109,366,000	27,341,500	82,024,500

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Yegua-Jackson Aquifer TERS

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25percent of Total Storage (acre-feet)*	*75percent of Total Storage (acre-feet)*
Brazos Valley GCD	30,000,000	7,500,000	22,500,000
Fayette County GCD	27,000,000	6,750,000	20,250,000
Lost Pines GCD	10,000,000	2,500,000	7,500,000
Mid-East Texas GCD	15,000,000	3,750,000	11,250,000
Post Oak Savannah GCD	27,000,000	6,750,000	20,250,000
Total	109,000,000	27,250,000	81,750,000

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Brazos River Alluvium Aquifer TERS

County	*Total Storage (acre-feet)*	*25 percent of Total Storage (acre-feet)*	*75 percent of Total Storage (acre-feet)*
Brazos	180,000	45,000	135,000
Burleson	450,000	112,500	337,500
Falls	140	35	105
Milam	28,000	7,000	21,000
Robertson	270,000	67,500	202,500
Total	928,140	232,035	696,105

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Brazos River Alluvium Aquifer TERS

Groundwater Conservation District (GCD)	*Total Storage (acre-feet)*	*25percent of Total Storage (acre-feet)*	*75percent of Total Storage (acre-feet)*
No district	140	35	105
Brazos Valley GCD	450,000	112,500	337,500
Post Oak Savannah GCD	480,000	120,000	360,000
Total	930,140	232,535	697,605

Source: TWDB GAM Task 13-035 Report (Wade and Shi, 2013)

Annual Recharge, Inflows, and Discharge

- Required to be evaluated as part of the DFC process
- Provided by the TWDB in GAM Run reports in support of management plan development
- Fayette County GCD = GAM Run 13-002
- Lost Pines GCD = GAM Run 10-014
- Post Oak Savannah GCD = GAM Run 10-029
- Brazos Valley GCD = GAM Run 14-005
- Mid-East Texas GCD = GAM Run 13-024
- No values for Brazos River Alluvium

Fayette County GCD Sparta Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	379
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	514
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	178
Estimated net annual volume of flow between each aquifer in the district	From the Sparta Aquifer into younger overlying units	1,656
	From the Weches Formation confining unit into the Sparta Aquifer	1,534
	From Sparta Aquifer to brackish Sparta	38

Units are in acre-feet per year

Fayette County GCD
Queen City Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	1,935
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	499
Estimated net annual volume of flow between each aquifer in the district	From the Queen City Aquifer into the Weches Formation confining unit.	1,430
	From the Reklaw Formation confining unit into the Queen City Aquifer	198
	From the Queen City Aquifer to the brackish Queen City	87

Units are in acre-feet per year

Fayette County GCD Carrizo-Wilcox Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	7,134
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	2,966
Estimated net annual volume of flow between each aquifer in the district	From the Carrizo-Wilcox Aquifer into the Reklaw confining unit.	231
	From the Carrizo-Wilcox Aquifer to the brackish Carrizo-Wilcox	4,115

Units are in acre-feet per year

Fayette County GCD Yegua-Jackson Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	47,304
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	59,160
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	9,849
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	6,492
Estimated net annual volume of flow between each aquifer in the district	From Yegua-Jackson Aquifer to brackish Yegua-Jackson	728
	From the Catahoula and overlying units into the Yegua-Jackson Aquifer	599

Units are in acre-feet per year

Lost Pines GCD
Sparta Aquifer

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	10,142
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	4,564
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	1,299
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	733
Estimated net annual volume of flow between each aquifer in the district	Weches Confining Unit into the Sparta Aquifer	970

Units are in acre-feet per year

Lost Pines GCD
Queen City Aquifer

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	7,256
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	5,488
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	670
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	3,354
Estimated net annual volume of flow between each aquifer in the district	Queen City Aquifer into the Weches Confining Unit	946
	Queen City Aquifer into the Reklaw Confining Unit	179

Units are in acre-feet per year

Lost Pines GCD Carrizo-Wilcox Aquifer

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	29,604
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	32,780
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	14,023
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	19,713
Estimated net annual volume of flow between each aquifer in the district	Reklaw Confining Unit into the Carrizo-Wilcox Aquifer	1,309

Units are in acre-feet per year

Lost Pines GCD Trinity Aquifer

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	517
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	661
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not Applicable

Units are in acre-feet per year

Lost Pines GCD
Yegua-Jackson Aquifer

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	38,859
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	35,780
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	5,883
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	10,155
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

Units are in acre-feet per year

Post-Oak Savannah GCD Trinity Aquifer

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Trinity Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	423
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	678
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

Units are in acre-feet per year

Post-Oak Savannah GCD Sparta Aquifer

Management Plan requirement	Aquifer	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	7,424
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	4,807
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	739
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	1,226
Estimated net annual volume of flow between each aquifer in the district	Weches Confining Unit and adjacent underlying areas into the Sparta Aquifer	1,569

Units are in acre-feet per year

Post-Oak Savannah GCD Queen City Aquifer

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	8,812
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	12,028
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	1,316
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	947
Estimated net annual volume of flow between each aquifer in the district	Queen City Aquifer into the overlying Weches Confining Unit	1,435
	Reklaw Confining Unit and adjacent underlying areas into the Queen City Aquifer	861

Units are in acre-feet per year

Post-Oak Savannah GCD Carrizo Formation

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo Aquifer	4,018
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo Aquifer	1,964
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo Aquifer	3,810
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo Aquifer	2,424
Estimated net annual volume of flow between each aquifer in the district	Carrizo Aquifer into the overlying Reklaw Confining Unit	233
	Carrizo Aquifer into the underlying Upper Wilcox Aquifer (Calvert Bluff Formation)	317

Units are in acre-feet per year

Post-Oak Savannah GCD Calvert Bluff Formation

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Upper Wilcox Aquifer (Calvert Bluff Formation)	7,330
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Upper Wilcox Aquifer (Calvert Bluff Formation)	7,995
Estimated annual volume of flow into the district within each aquifer in the district	Upper Wilcox Aquifer (Calvert Bluff Formation)	2,416
Estimated annual volume of flow out of the district within each aquifer in the district	Upper Wilcox Aquifer (Calvert Bluff Formation)	2,000
Estimated net annual volume of flow between each aquifer in the district	Carrizo Aquifer into the underlying Upper Wilcox Aquifer (Calvert Bluff Formation)	317
	Upper Wilcox Aquifer (Calvert Bluff Formation) into the underlying Middle Wilcox Aquifer (Simsboro Formation)	3,451

Units are in acre-feet per year

Post-Oak Savannah GCD Simsboro Formation

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Middle Wilcox Aquifer (Simsboro Formation)	12,540
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Middle Wilcox Aquifer (Simsboro Formation)	18,827
Estimated annual volume of flow into the district within each aquifer in the district	Middle Wilcox Aquifer (Simsboro Formation)	10,804
Estimated annual volume of flow out of the district within each aquifer in the district	Middle Wilcox Aquifer (Simsboro Formation)	18,025
Estimated net annual volume of flow between each aquifer in the district	Upper Wilcox Aquifer (Calvert Bluff Formation) into the underlying Middle Wilcox Aquifer (Simsboro Formation)	3,451
	Lower Wilcox Aquifer (Hooper Formation) into the overlying Middle Wilcox Aquifer (Simsboro Formation)	1,537

Units are in acre-feet per year

Post-Oak Savannah GCD Hooper Formation

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Lower Wilcox Aquifer (Hooper Formation)	2,391
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Lower Wilcox Aquifer (Hooper Formation)	1,748
Estimated annual volume of flow into the district within each aquifer in the district	Lower Wilcox Aquifer (Hooper Formation)	3,572
Estimated annual volume of flow out of the district within each aquifer in the district	Lower Wilcox Aquifer (Hooper Formation)	3,232
Estimated net annual volume of flow between each aquifer in the district	Lower Wilcox Aquifer (Hooper Formation) into the overlying Middle Wilcox Aquifer (Simsboro Formation)	1,537

Units are in acre-feet per year

Post-Oak Savannah GCD Yegua-Jackson Aquifer

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	22,459
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	13,923
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	4,436
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	8,017
Estimated net annual volume of flow between each aquifer in the district	Not applicable	Not applicable

Units are in acre-feet per year

Brazos Valley GCD Carrizo-Wilcox Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	26,906
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	16,869
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	17,840
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	10,051
Estimated net annual volume of flow between each aquifer in the district	To the Carrizo-Wilcox Aquifer from the Reklaw Formation confining unit	62
	To the Carrizo-Wilcox Aquifer from the down-dip portions of the equivalent formations	10,962

Units are in acre-feet per year

Brazos Valley GCD Queen City Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	6,091
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	11,902
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	1,865
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	815
Estimated net annual volume of flow between each aquifer in the district	To the Queen City Aquifer from the Weches Formation confining unit	209
	To the Queen City Aquifer from the Reklaw Formation confining unit	148
	From the Queen City Aquifer to the down-dip portion of the Queen City Formation	83

Units are in acre-feet per year

Brazos Valley GCD Sparta Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	9,970
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	1,861
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	617
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	496
Estimated net annual volume of flow between each aquifer in the district	To the Sparta Aquifer from overlying stratigraphic units	714
	From the Sparta Aquifer to the Weches Formation confining unit	599
	From the Sparta Aquifer to the down-dip portion of the Sparta Formation	76

Units are in acre-feet per year

Brazos Valley GCD Yegua-Jackson Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	26,512
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	39,287
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	12,029
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	9,921
Estimated net annual volume of flow between each aquifer in the district	To the Yegua-Jackson Aquifer from the confined portion of the Yegua and Jackson groups	178

Units are in acre-feet per year

Mid-East Texas GCD
Yegua-Jackson Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the groundwater resources within the district	Yegua-Jackson Aquifer	31,137
Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers	Yegua-Jackson Aquifer	46,448
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	16,334
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	11,401
Estimated net annual volume of flow between each aquifer in the district	Yegua-Jackson Aquifer	0[1]

Units are in acre-feet per year

Mid-East Texas GCD Sparta Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the groundwater resources within the district	Sparta Aquifer	15,100
Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers	Sparta Aquifer	3,702
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	1,135
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	914
Estimated net annual volume of flow between each aquifer in the district	From the Sparta Aquifer to overlying stratigraphic Unit	445
	From the Sparta Aquifer to the Weches Confining Unit	1,121
	From the Sparta Aquifer to down-dip parts of the Sparta Formation	86

Units are in acre-feet per year

Mid-East Texas GCD
Queen City Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the groundwater resources within the district	Queen City Aquifer	26,645
Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers	Queen City Aquifer	16,399
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	2,000
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	2,294
Estimated net annual volume of flow between each aquifer in the district	To the Queen City Aquifer from the Weches Confining Unit	2,126
	To the Queen City Aquifer from the Reklaw Confining Unit	150
	From the Queen City Aquifer to down-dip parts of the Queen City Formation	130

Units are in acre-feet per year

Mid-East Texas GCD Carrizo-Wilcox Aquifer

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the groundwater resources within the district	Carrizo-Wilcox Aquifer	48,603
Estimated annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	35,855
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	10,474
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	21,365
Estimated net annual volume of flow between each aquifer in the district	To the Carrizo-Wilcox Aquifer from the Reklaw Confining Unit	29
	To the Carrizo-Wilcox Aquifer from down-dip stratigraphic units	4,184

Units are in acre-feet per year

PS-4 Budgets

- Current simulation PS-4 is an "anticipated use" model run
- Budgets extracted from results for 2070
- Important to note that storage is part of the budget as a source of water. Removing water from storage means water levels are declining.

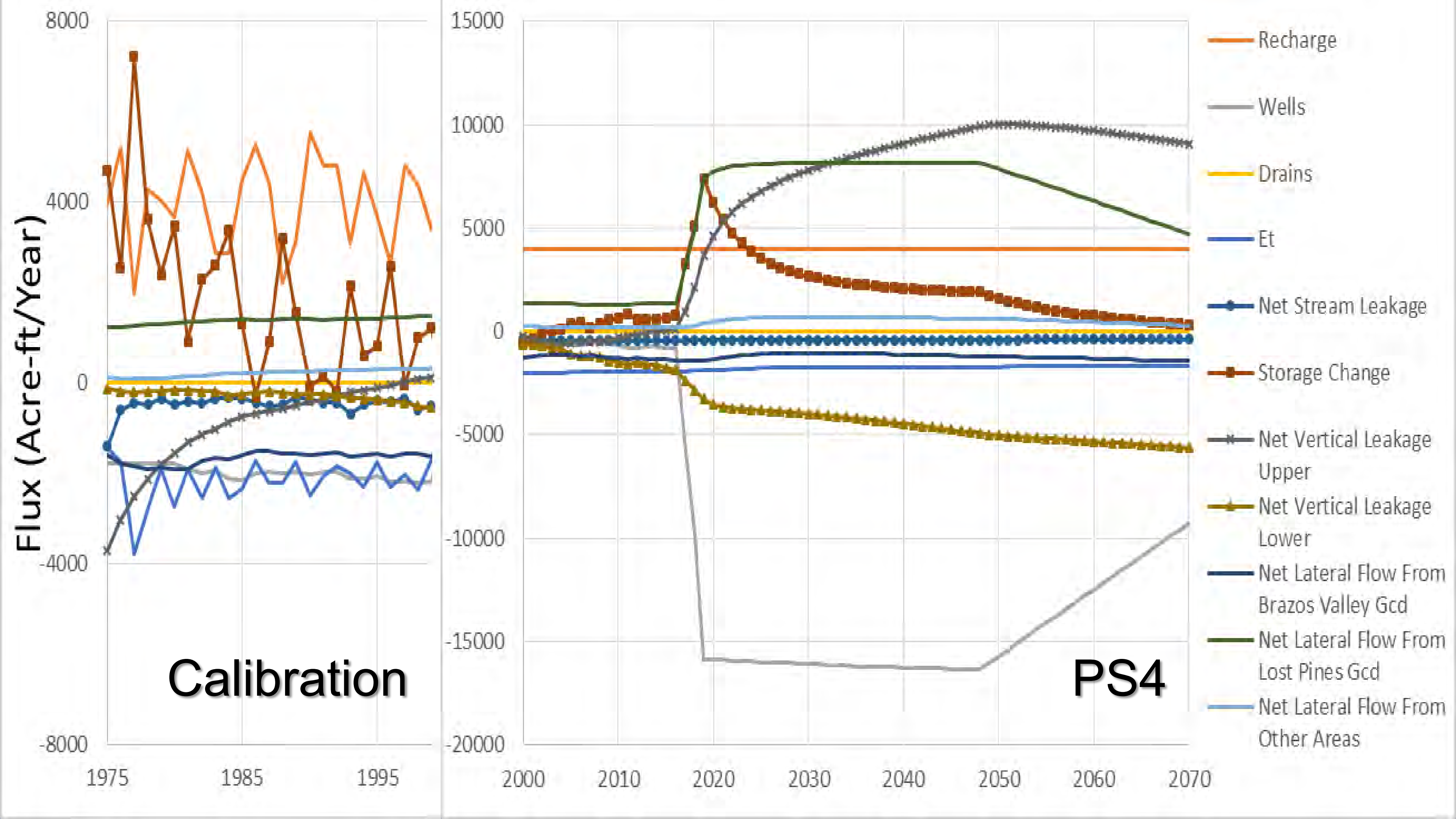
Water Budget Charts for GMA 12 GCDs

- Five GMA 12 GCDs
- Charts for Carrizo and Simsboro Aquifers and for all eight model layers
- 1975 – 1999 based on GAM model report
- 2000 to 2070 based on PS 4 simulation
- Water Budget Calculations performed using a version of the USGS code Zone Budget

POSGCD: Carrizo

\+ Aquifer Gains

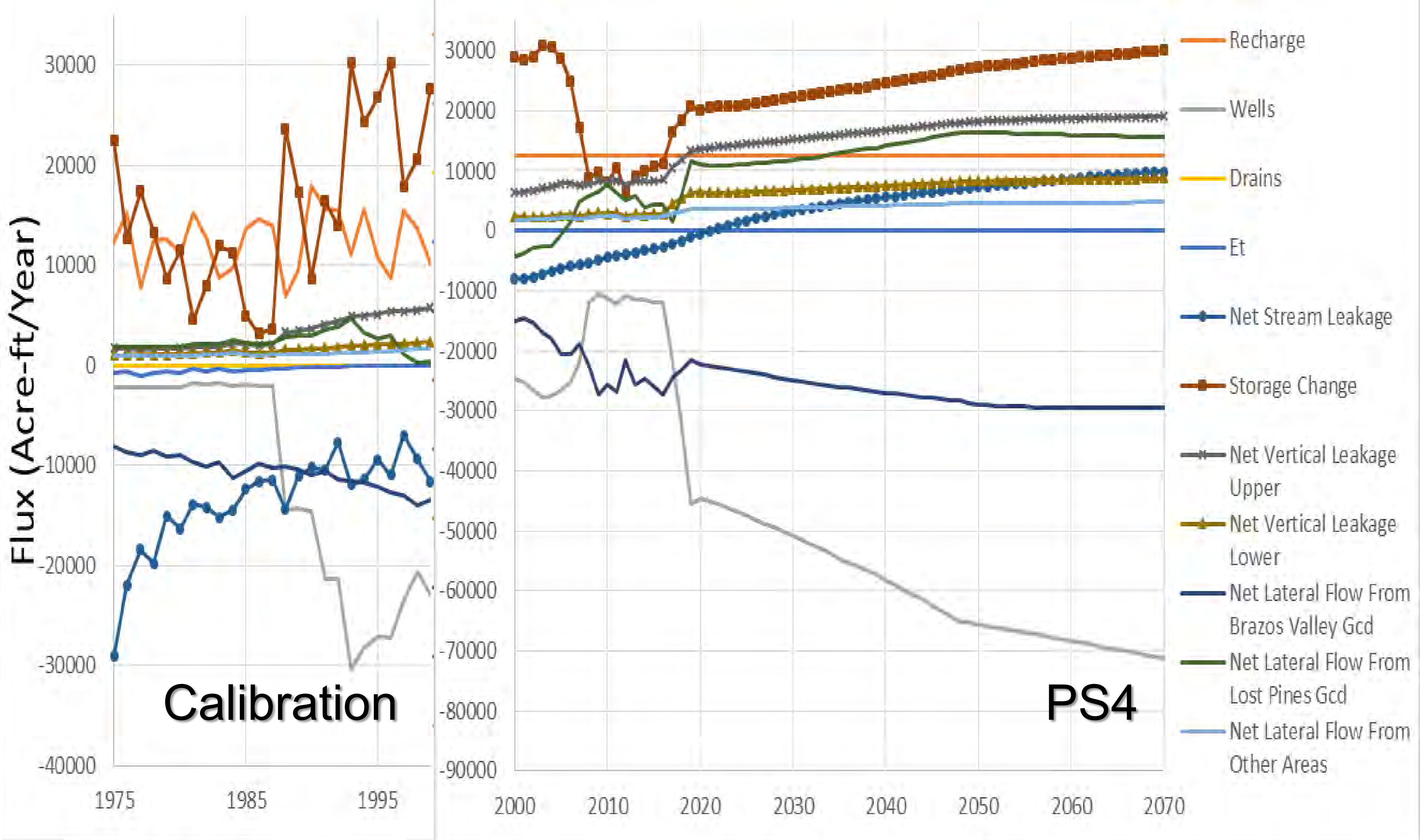
\- Aquifer Losses



POSGCD: Simsboro

+ Aquifer Gains

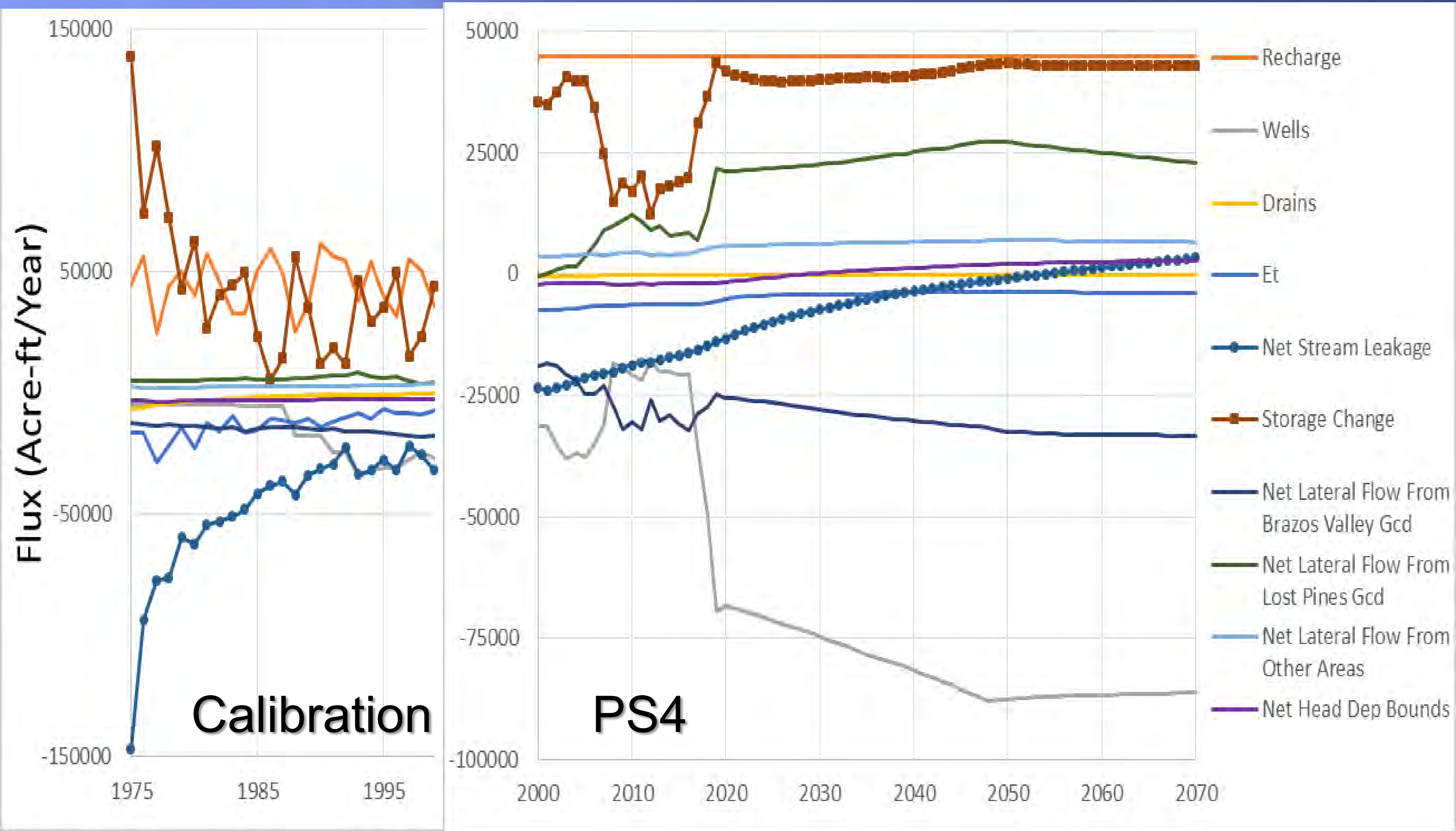
- Aquifer Losses



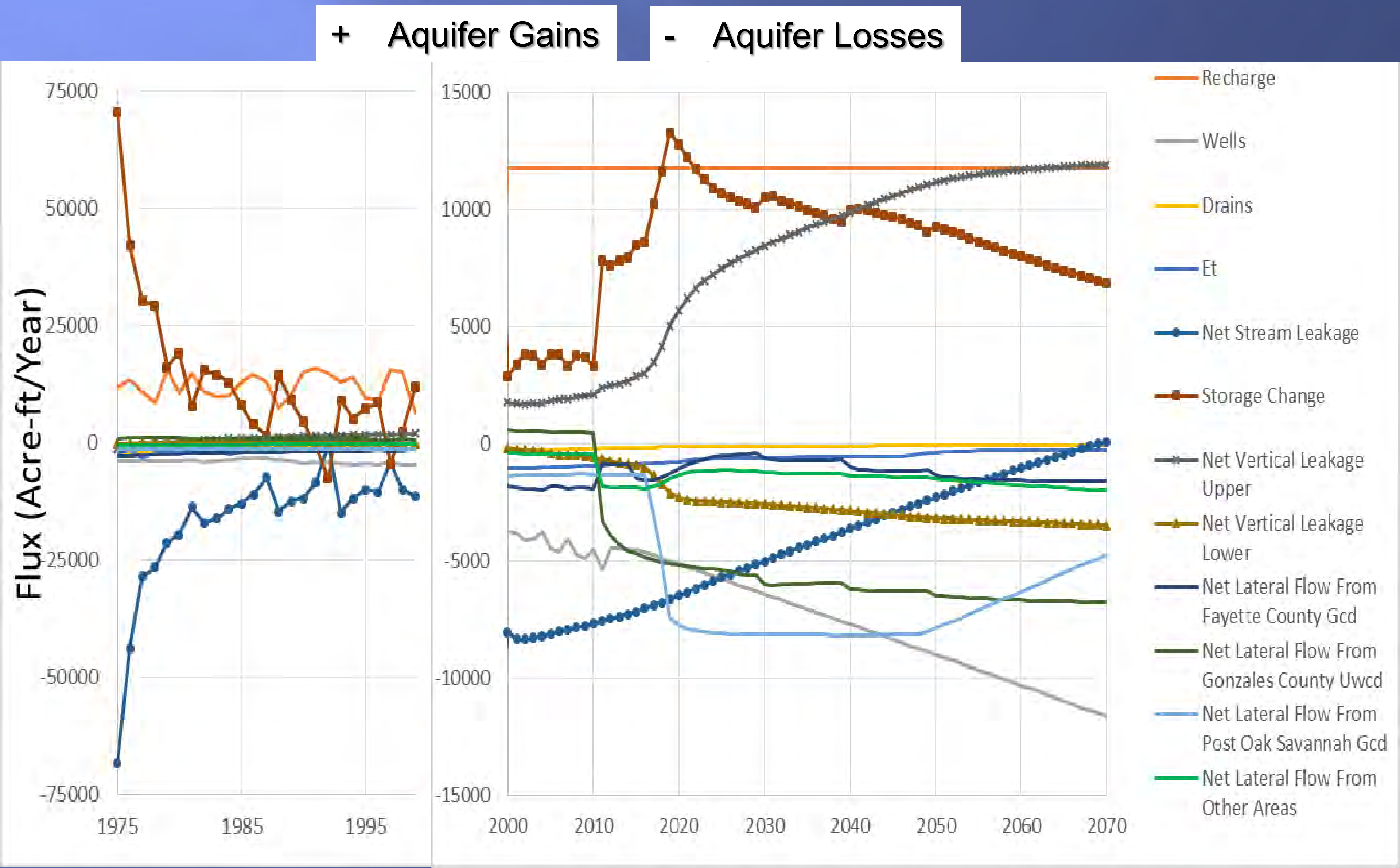
POSGCD: Overall

+ Aquifer Gains

- Aquifer Losses

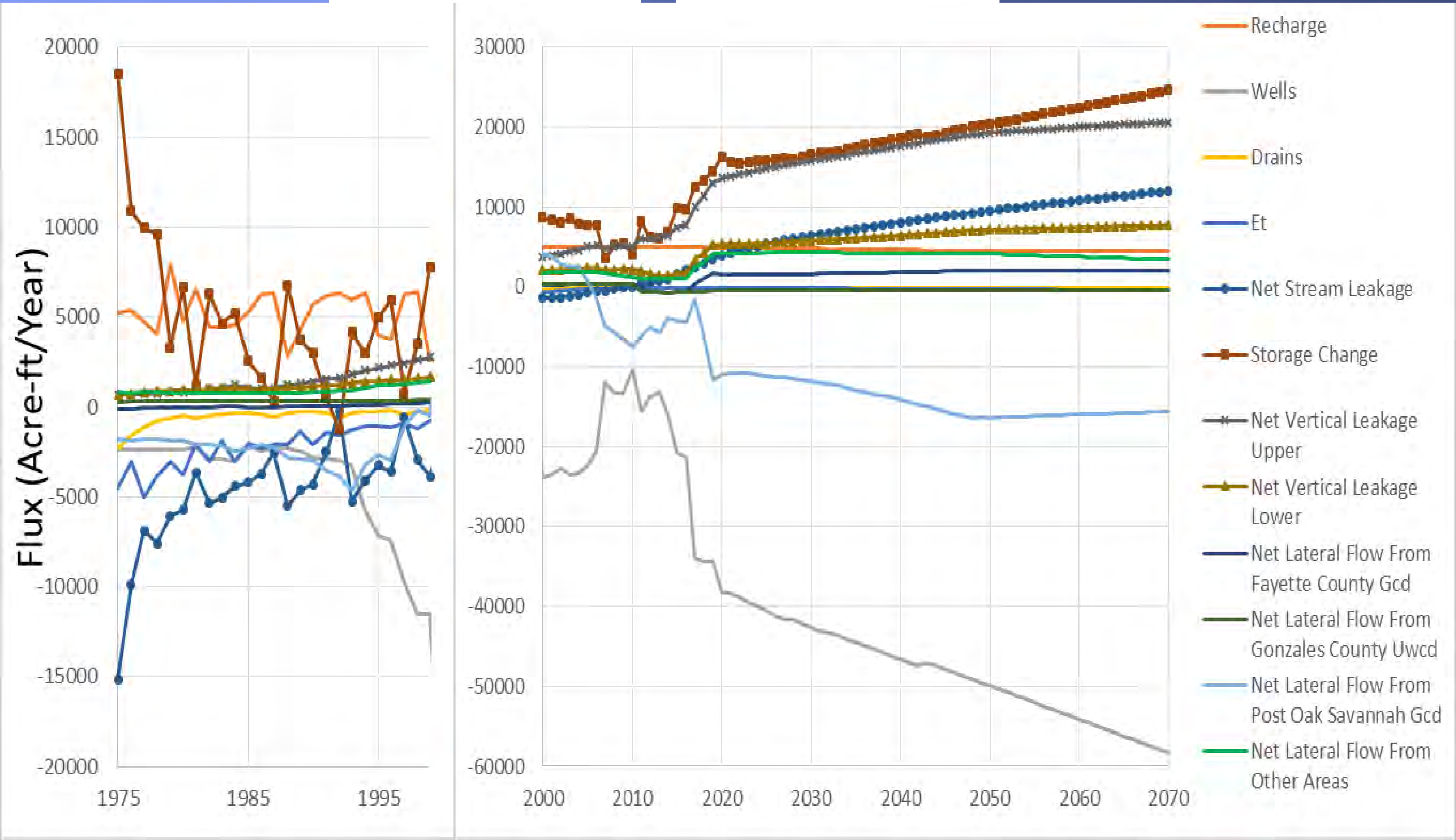


Lost Pines GCD: Carrizo



Lost Pines GCD: Simsboro

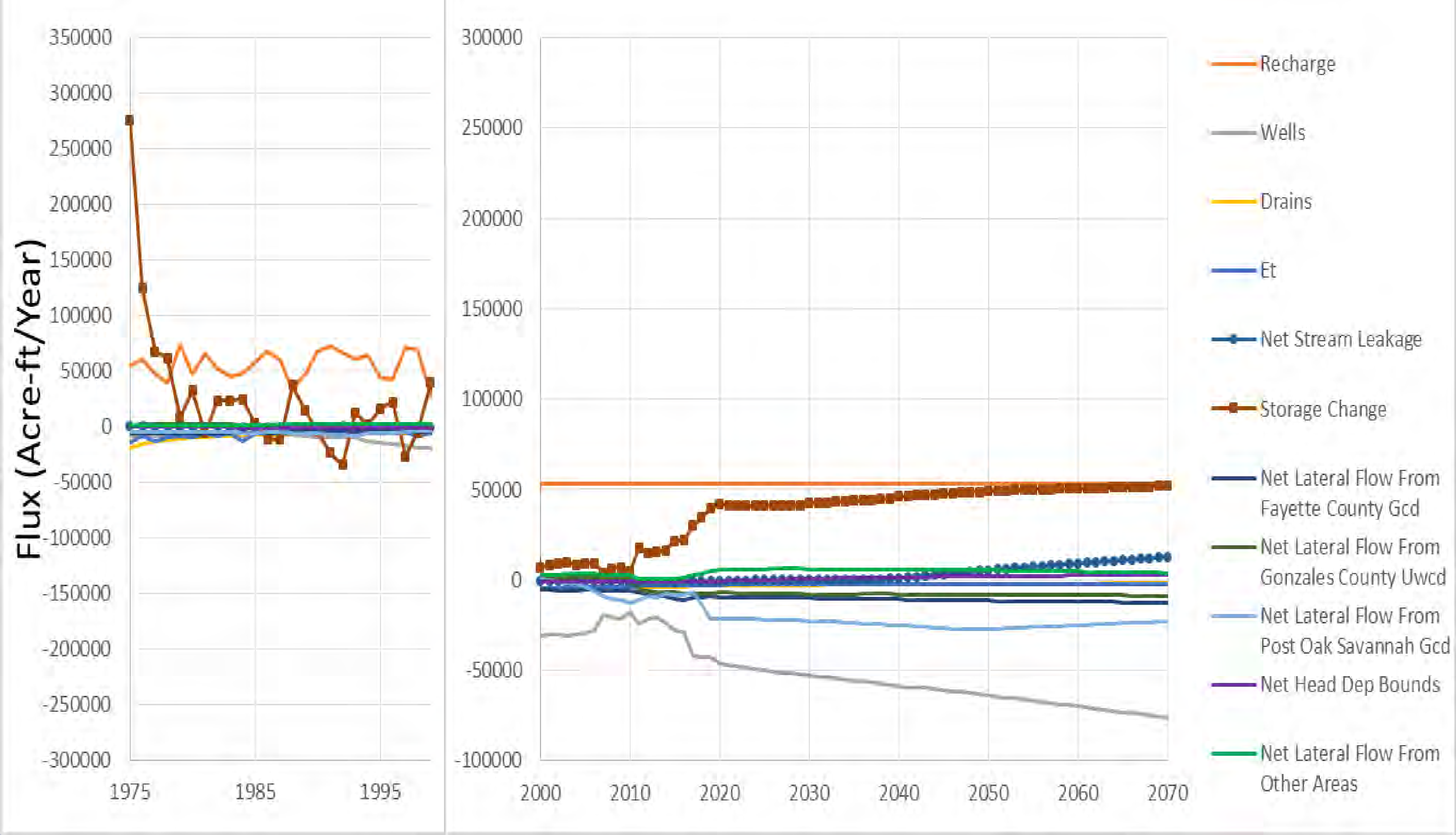
+ Aquifer Gains - Aquifer Losses



Lost Pines GCD: Overall

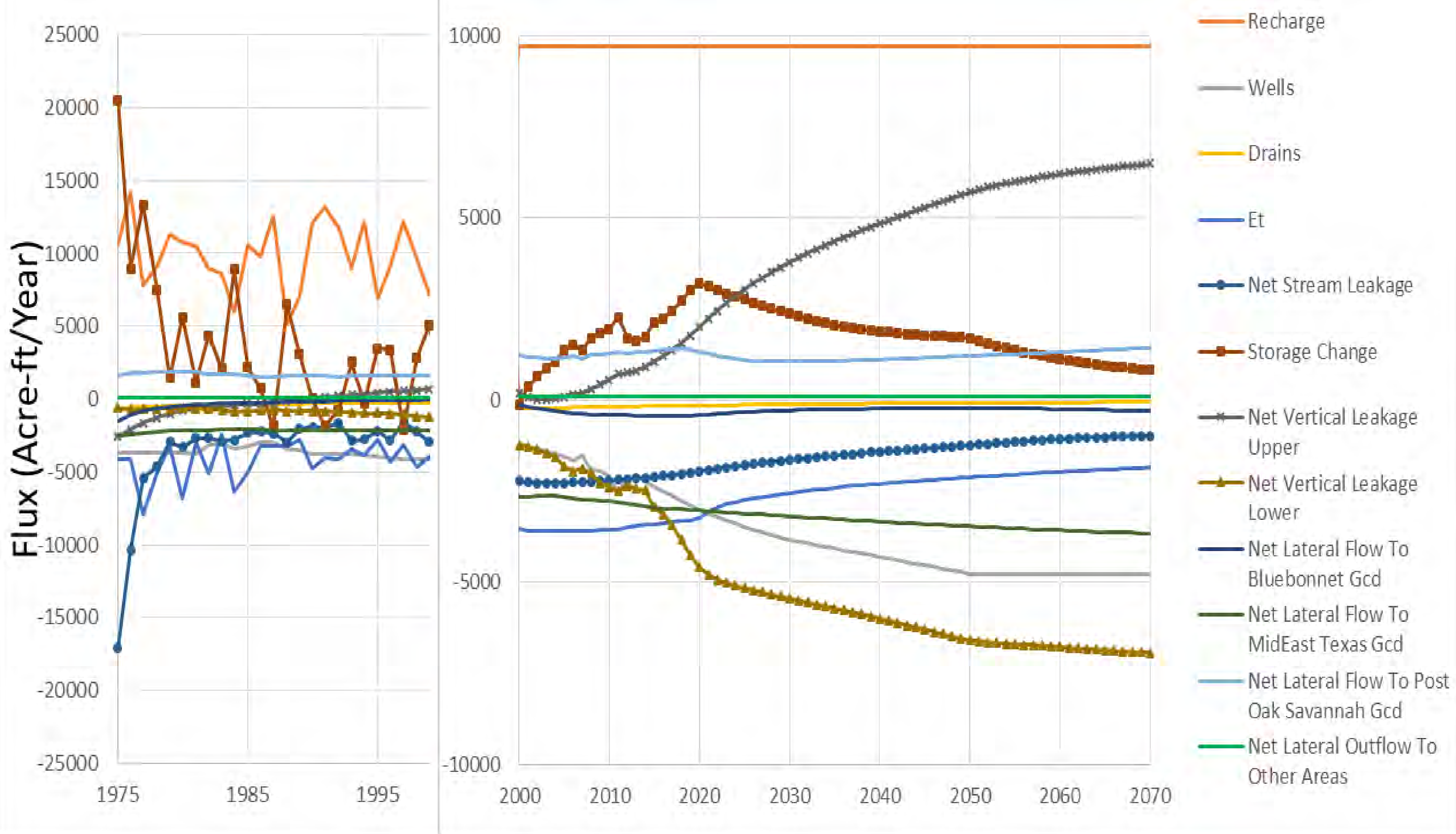
+ Aquifer Gains

- Aquifer Losses



Brazos Valley GCD: Carrizo

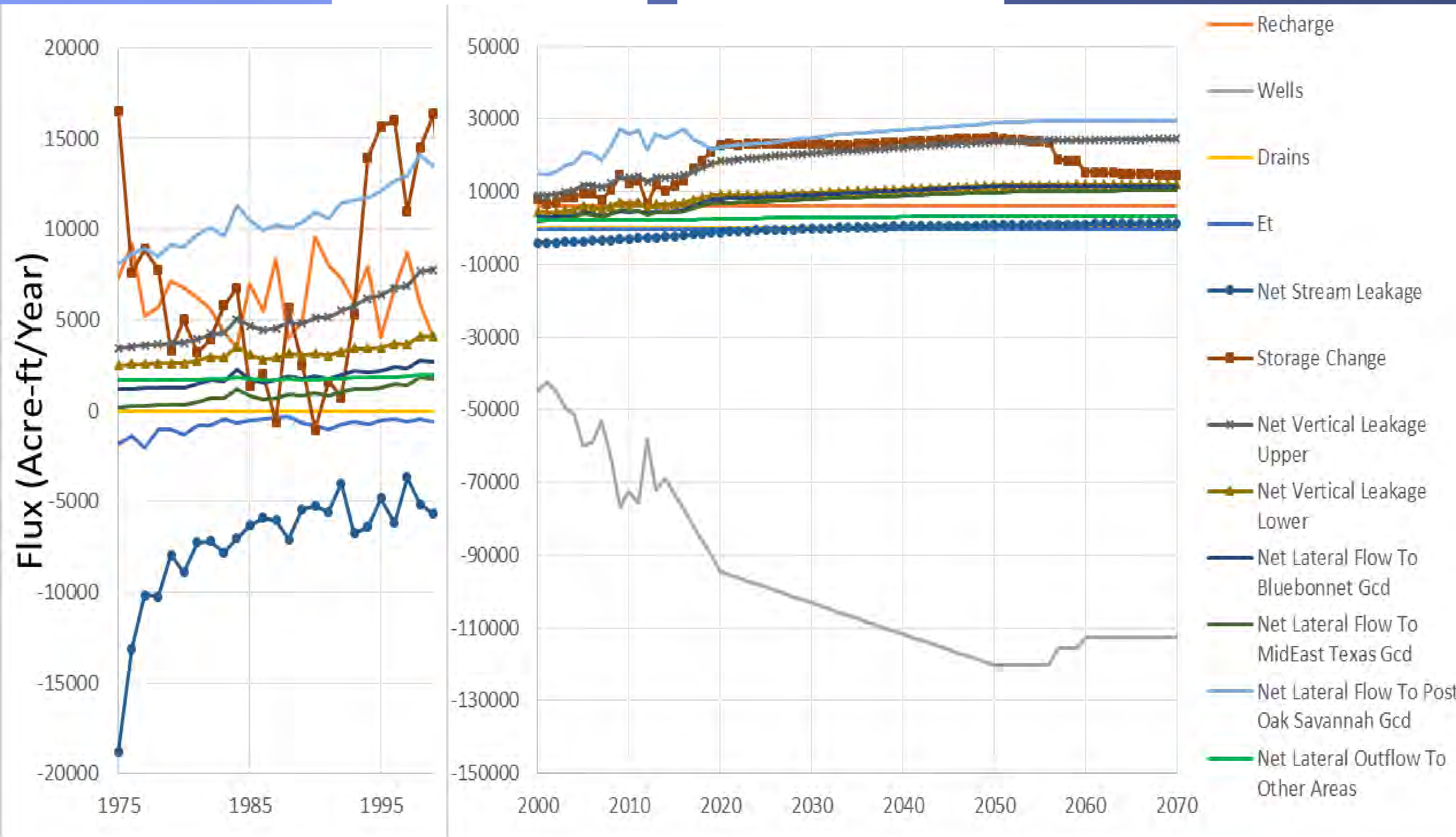
+ Aquifer Gains | - Aquifer Losses



Brazos Valley GCD: Simsboro

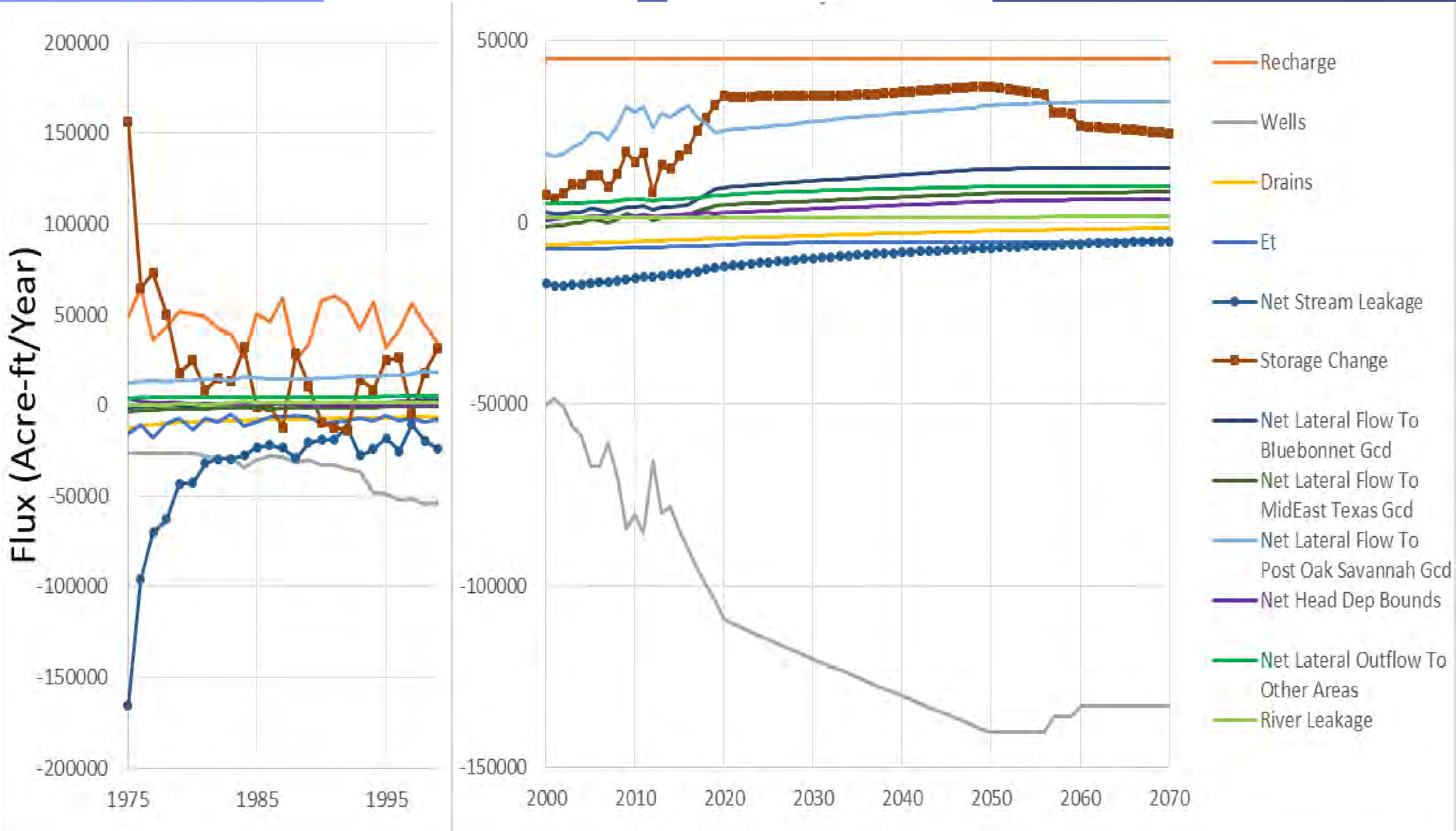
+ Aquifer Gains

- Aquifer Losses



Brazos Valley GCD: Overall

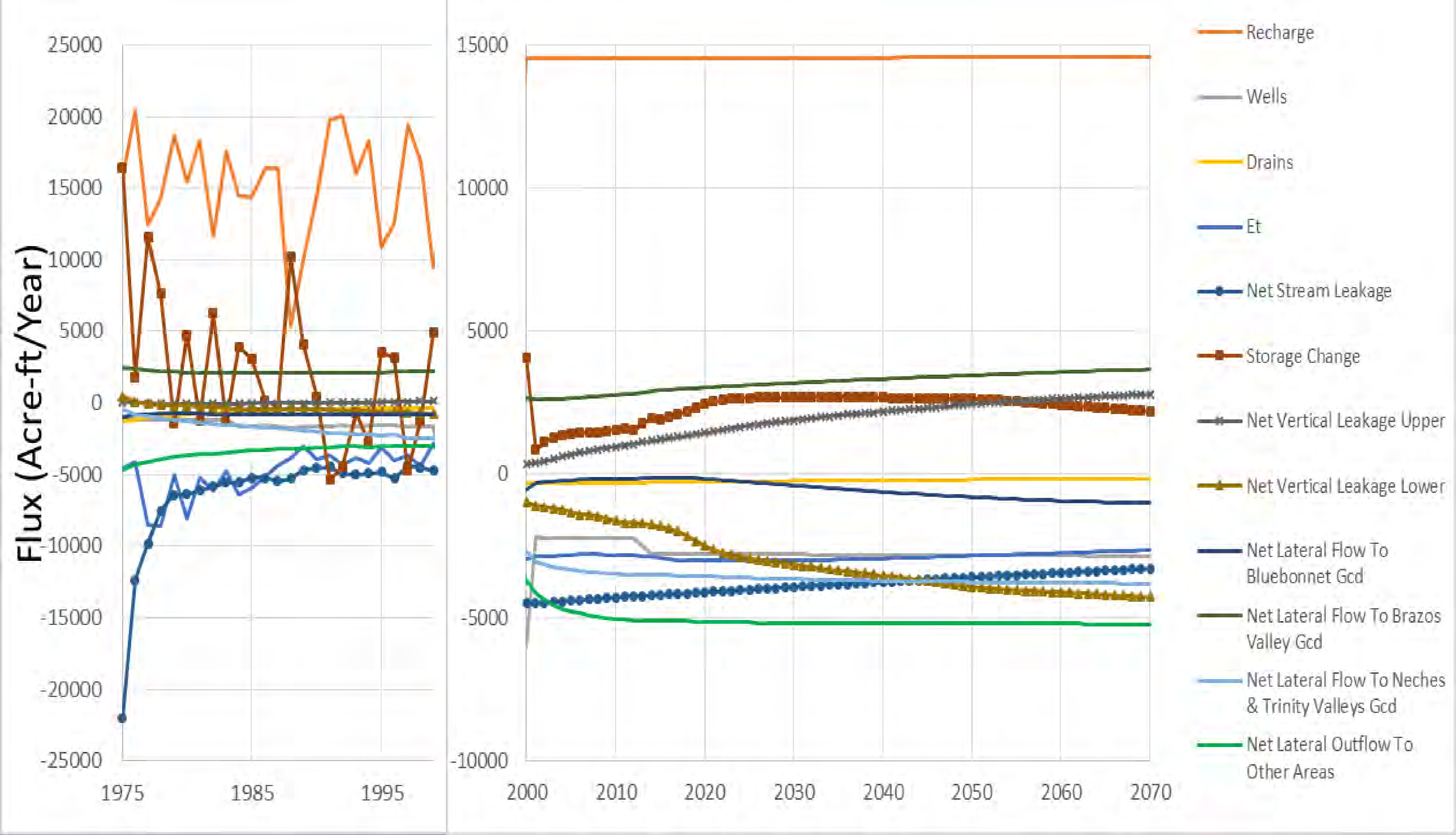
+ Aquifer Gains
- Aquifer Losses



Mid-east Texas GCD: Carrizo

+ Aquifer Gains

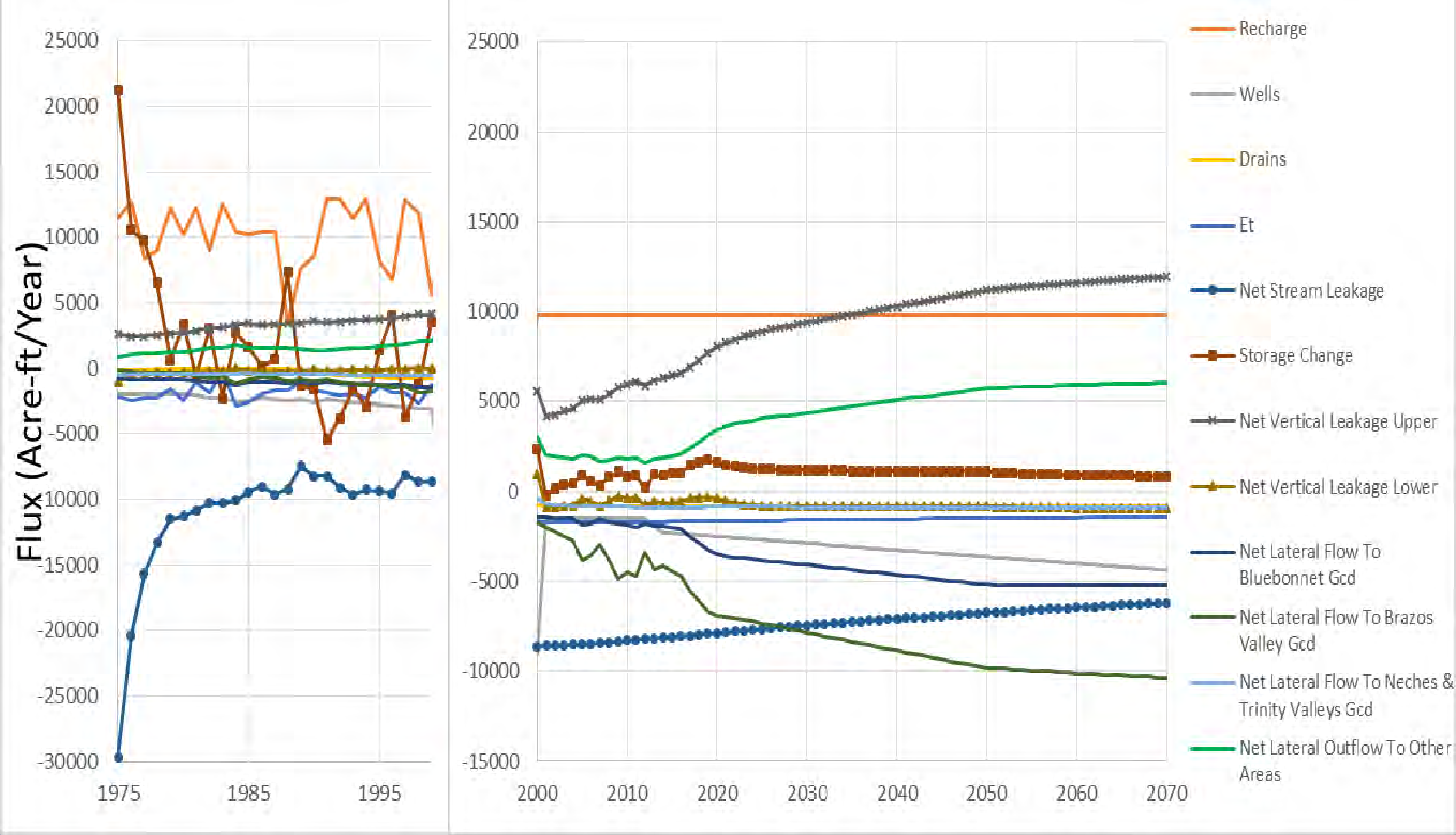
- Aquifer Losses



Mid-east Texas GCD: Simsboro

+ Aquifer Gains

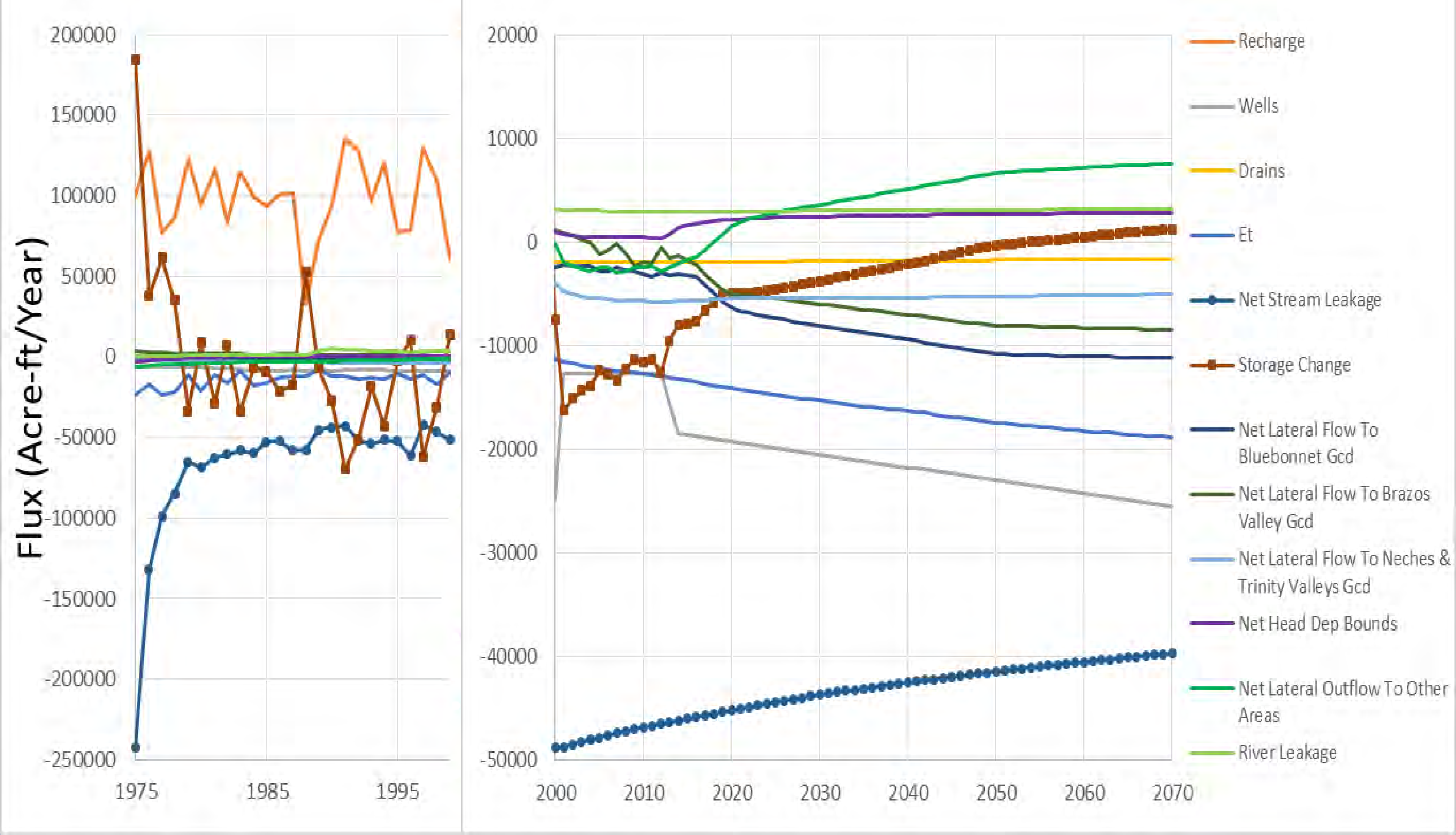
- Aquifer Losses



Mid-east Texas GCD: Overall

+ Aquifer Gains

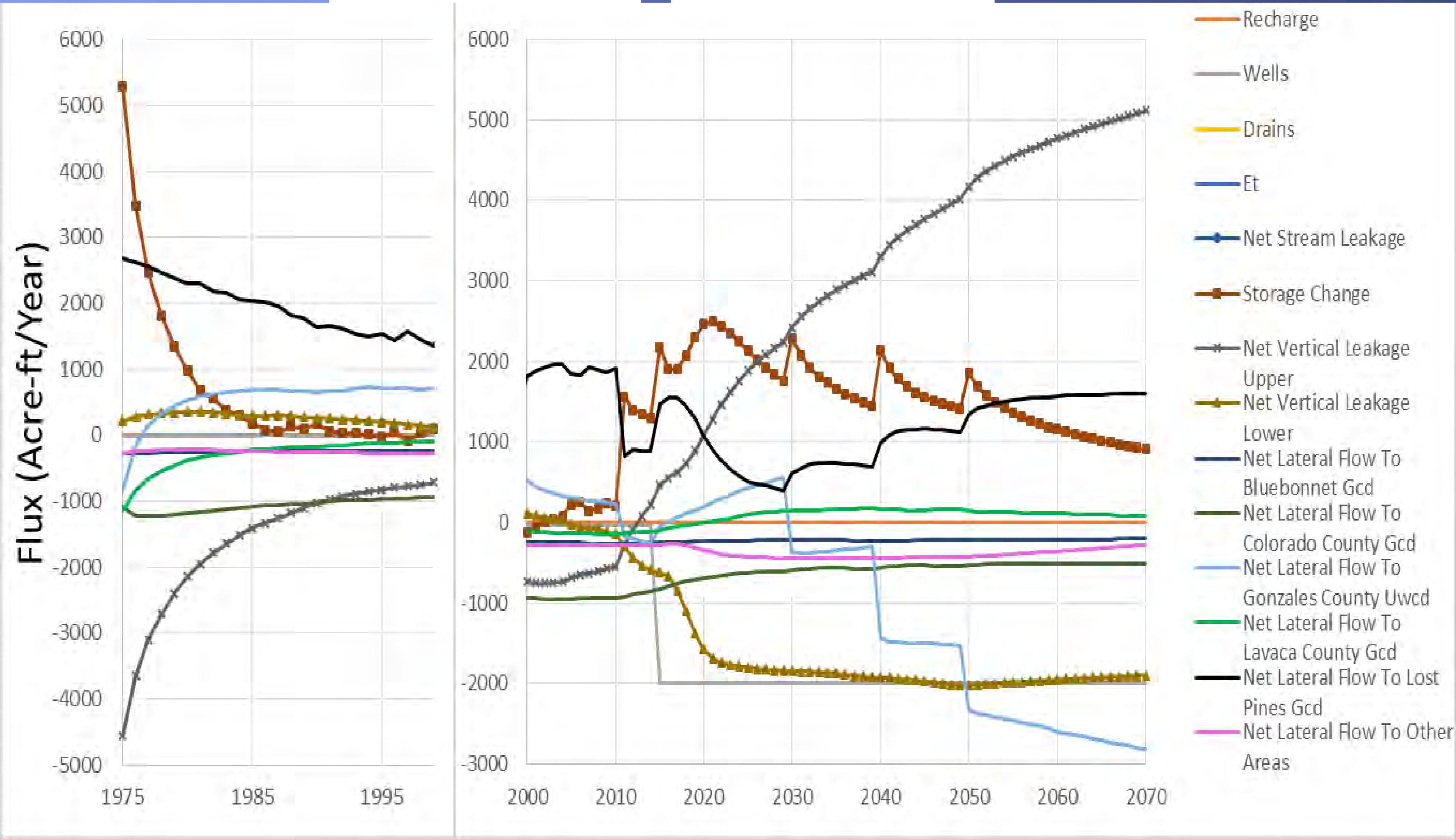
- Aquifer Losses



Fayette County GCD: Carrizo

+ Aquifer Gains

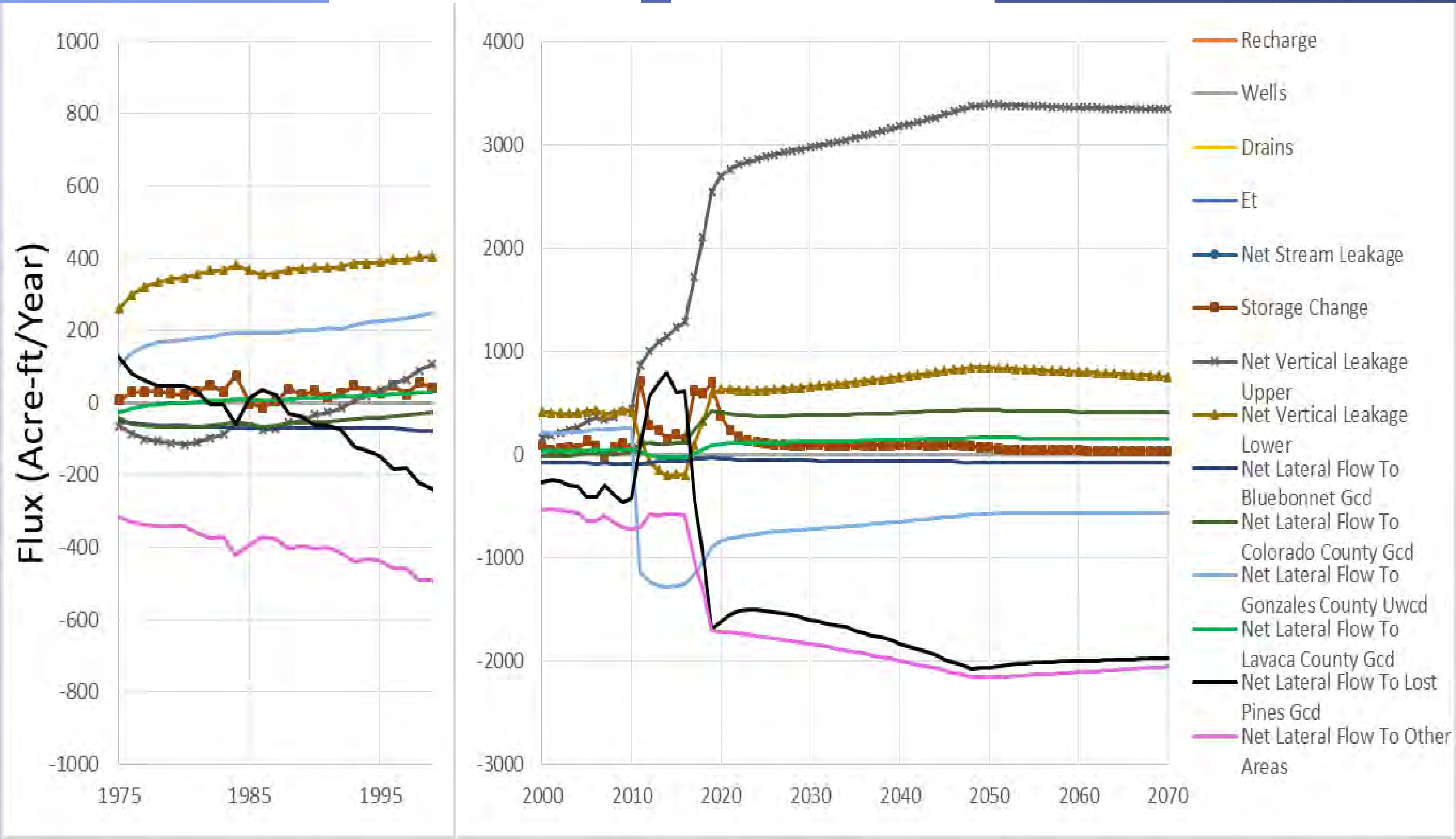
- Aquifer Losses



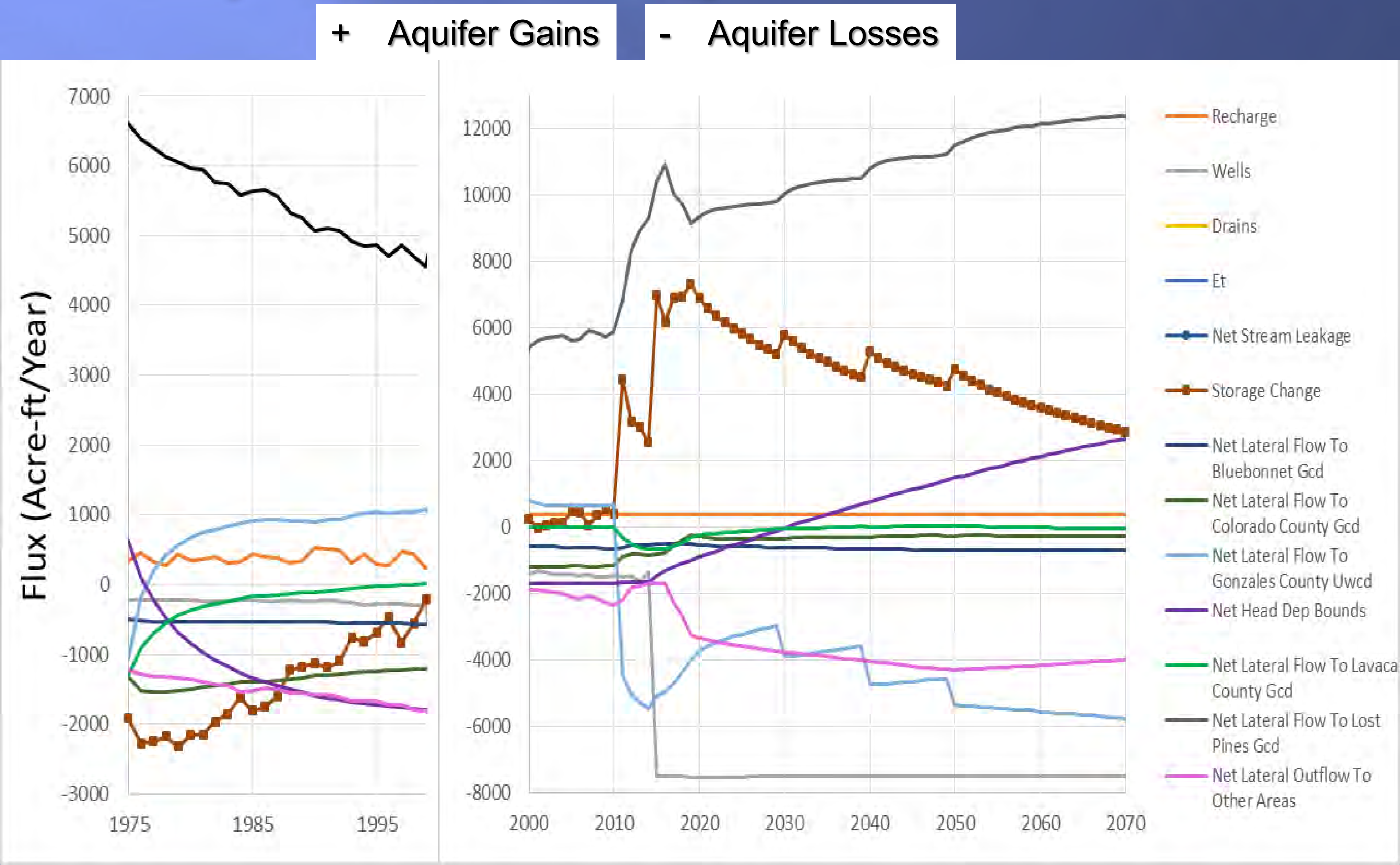
Fayette County GCD: Simsboro

+ Aquifer Gains

- Aquifer Losses



Fayette County GCD: Overall



QUESTIONS?

APPENDIX O

AUGUST 13, 2015 PRESENTATION "GMA-12: ENVIRONMENTAL IMPACT CONSIDERATIONS"

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PRESENTATION TO GMA-12: Environmental Impact Considerations

By consultants for the:
Brazos Valley GCD (LBG-Guyton Associates)
Fayette County GCD (Daniel B. Stephens & Associates)
Lost Pines GCD (Daniel B. Stephens & Associates)
Mid-East Texas GCD (Matt Uliana, independent consultant)
Post Oak Savannah GCD (INTERA, Inc.)

Presented By:
Steve Young

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

August 13, 2015

APPROACH

- Introduction to Groundwater Flow System
- Measured GW/SW Interaction
- Measured Spring Flow
- Overview of GMA 12 Aquifers and Their Numerical Representation
- QCSP GAM Simulated GW/SW Exchange
- QCSP GAM Simulated Spring Flow
- Summary of Key Environmental Issues

INTRODUCTION TO GROUNDWATER FLOW SYSTEMS

- Definition of Terms
- Groundwater Flow Zones and Flow Paths

DEFINITION OF UNSATURATED AND SATURATED GROUNDWATER ZONES

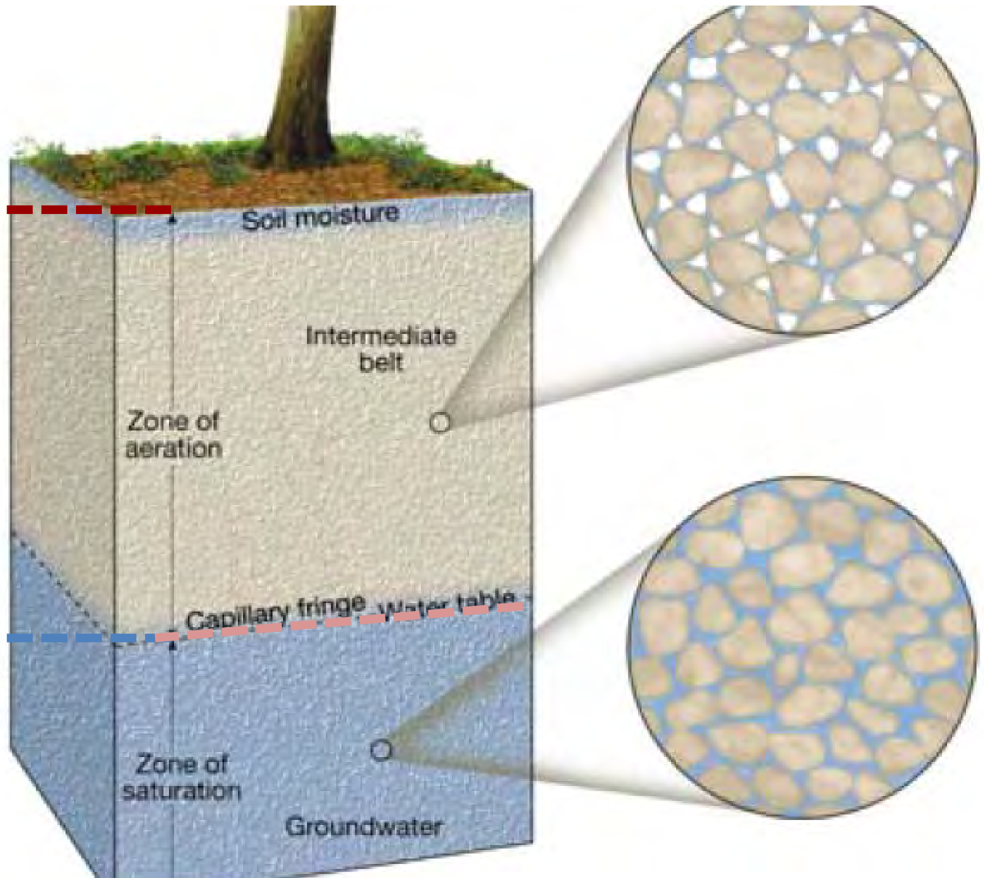
- **The unsaturated zone is beneath land surface where pore spaces are partially filled with water and air.**
- **The saturated zone is beneath a water table where pore spaces are filled with water.**

Ground Surface

Pore spaces are occupied by air and soil moisture

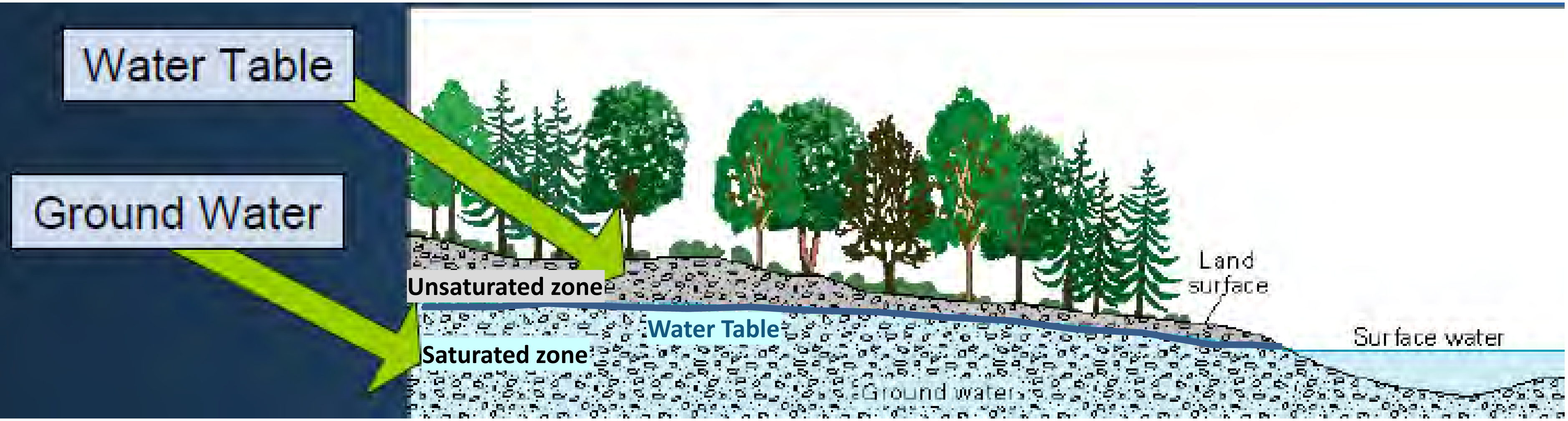
Water Table

Porosity is occupied by groundwater

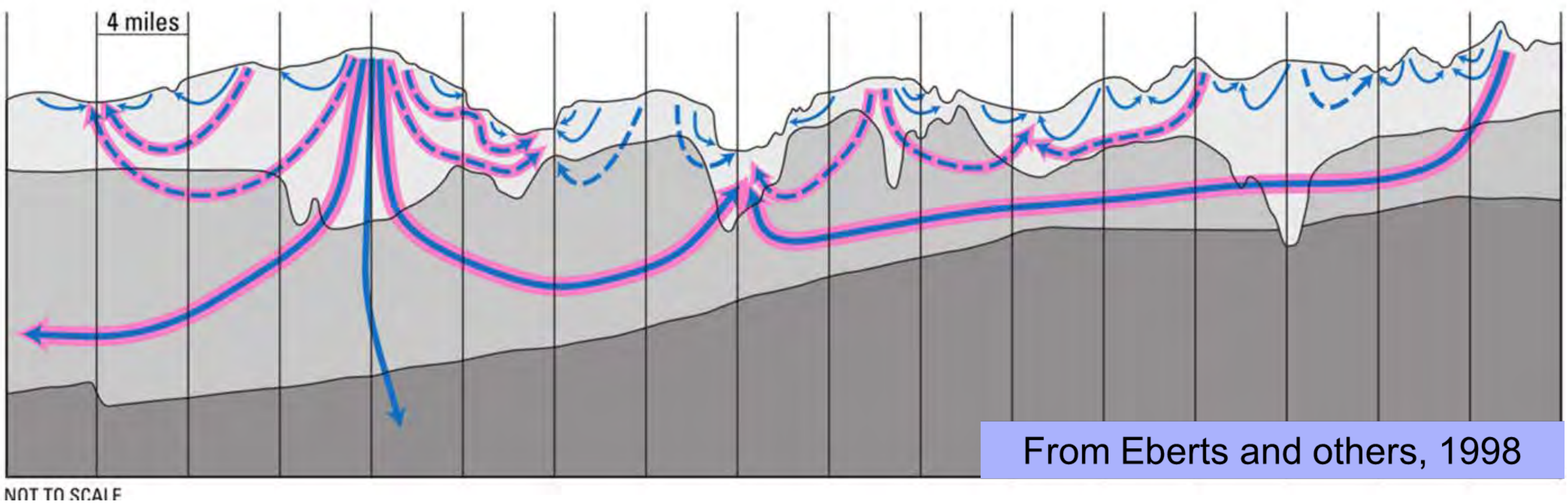


DEFINITION OF A WATER TABLE

- A water table is where the saturated zone meets the unsaturated zone
- A water table occurs where the groundwater is under atmospheric pressure
- Water table is the upper boundary of the shallow groundwater flow zone; it contains the groundwater that supports spring flow and interacts with rivers and lakes



HEIRARCHY OF GROUNDWATER FLOW SYSTEMS



Local ground-water flow path

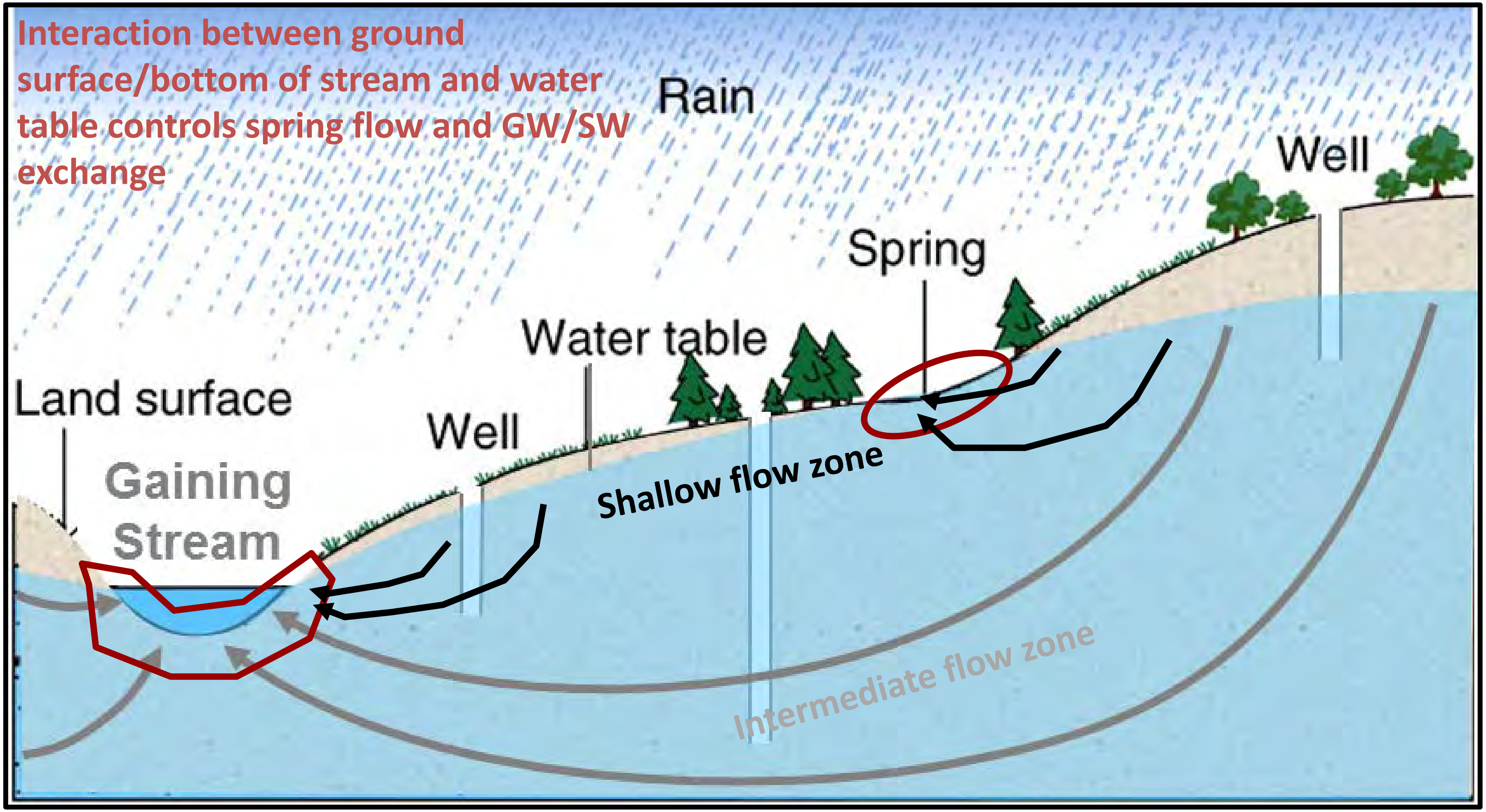
Intermediate ground-water flow path

Regional ground-water flow path

Indicates flow simulated by the regional ground-water flow model constructed for this investigation

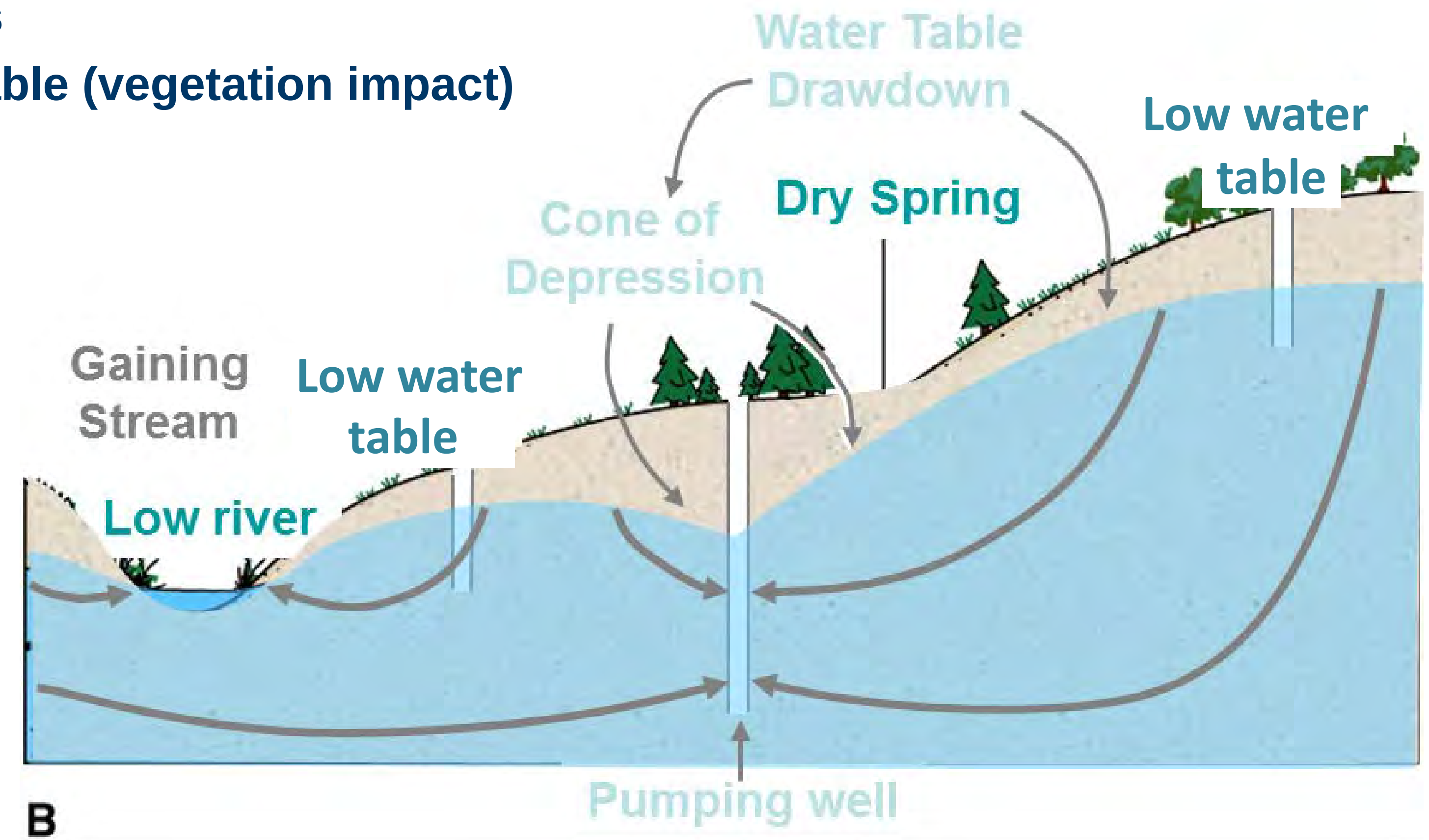
Note: Most GAMs and regional groundwater flow models do not have the vertical resolution in their layering to represent local flow paths.

LOCATION OF GW-SW INTERACTION AND SPRINGS

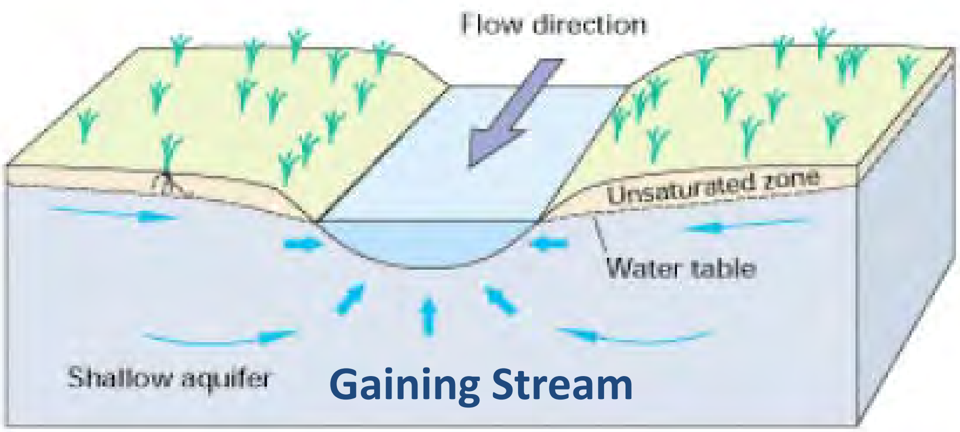


ENVIRONMENTAL CONCERNS ASSOCIATED WITH PUMPING

- Reduced flows to rivers
- Withdrawal from rivers (losing streams)
- Reduced spring flows
- Dried springs
- Low Water Table (vegetation impact)



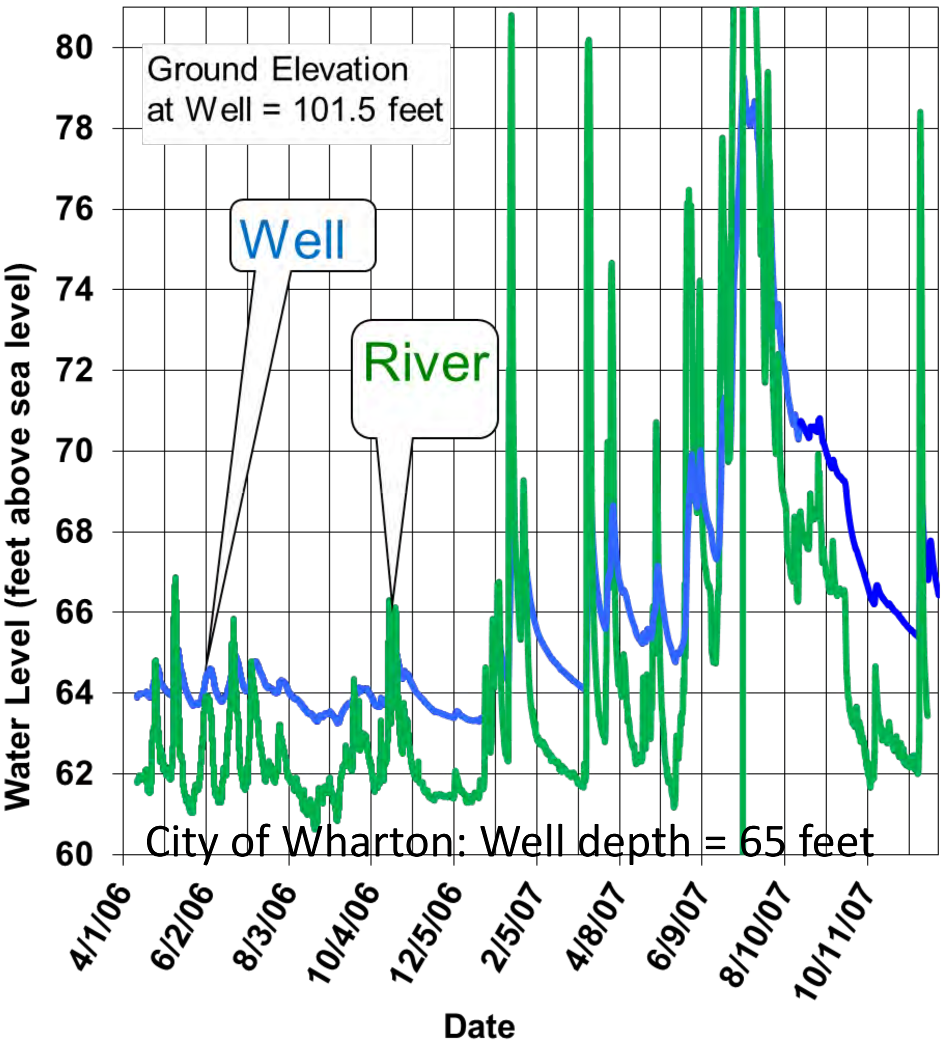
GAINING AND LOSING STREAMS

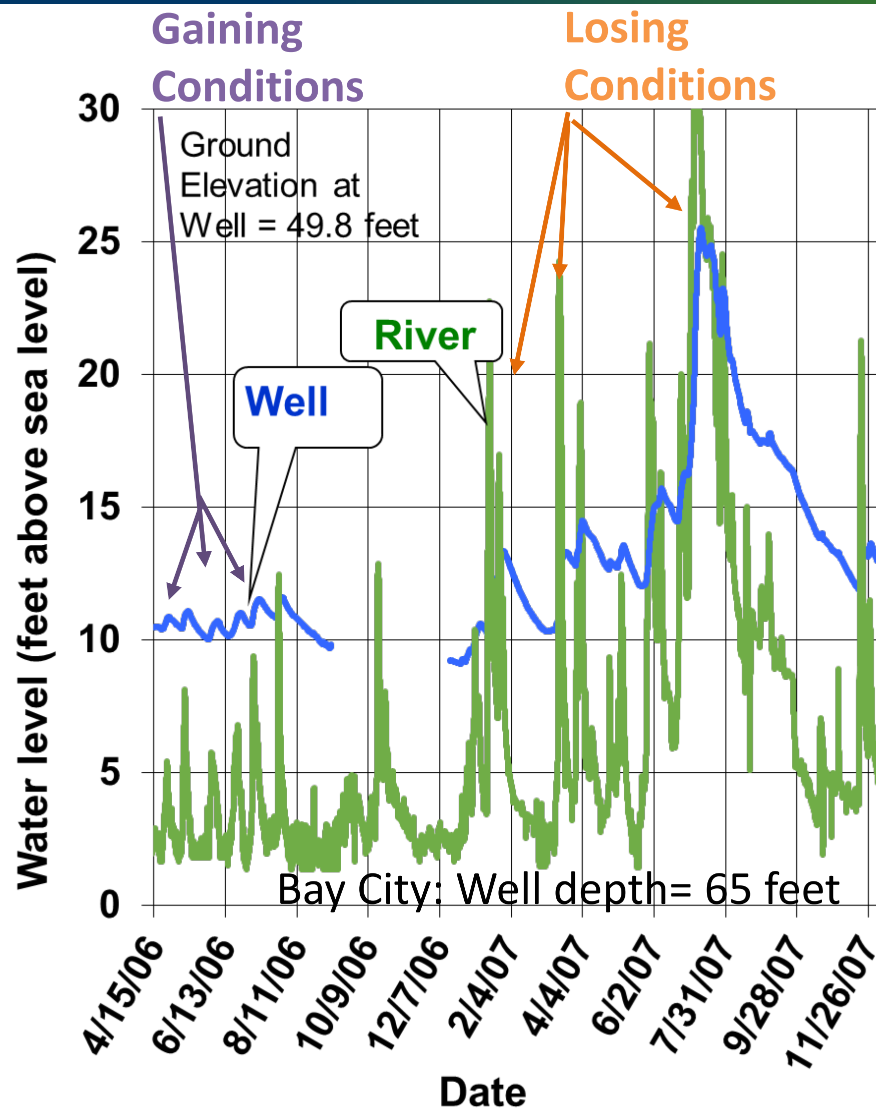


USGS Circular 1186, 1999

- Gaining:
  - Net discharge of groundwater to surface water "base flow"
- Losing:
  - Net discharge of surface water to groundwater "recharge"

COMPARISON OF COLORADO RIVER LEVELS AND WATER LEVEL IN SHALLOW WELLS:





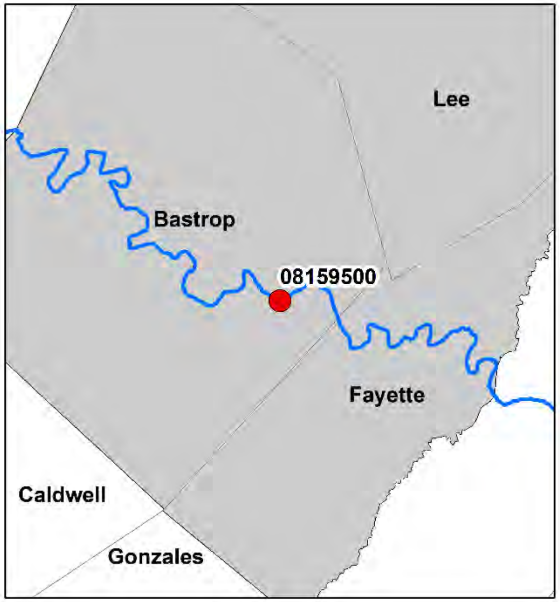
INTRO TO GW SYSTEM: SUMMARY POINTS

- Basin-scale groundwater systems have a shallow, intermediate and deep flow system
- Most regional groundwater computer models do not have sufficient vertical layering to represent a shallow flow system accurately
- The water table is the upper boundary of the shallow flow system
- Spring flow and GW/SW exchange occurs primarily where the ground surface or bottom of a stream intersects the water table

MEASURED GW/SW EXCHANGE

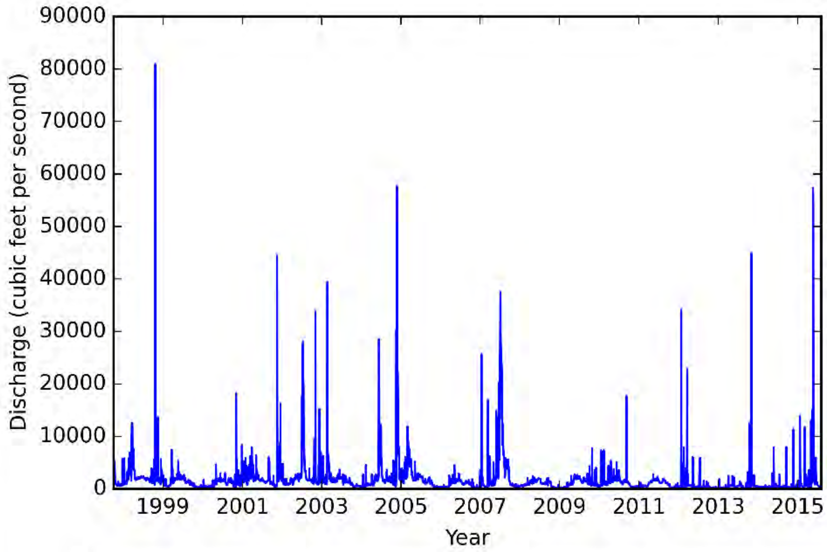
- River Gage Hydrograph
- Approaches to Measuring GW/SW Exchange
  - Gain/Loss Study
  - Hydrograph Separation
- Groundwater Contribution to River Baseflows
  - Colorado River
  - Streams in POSGCD
  - Brazos River

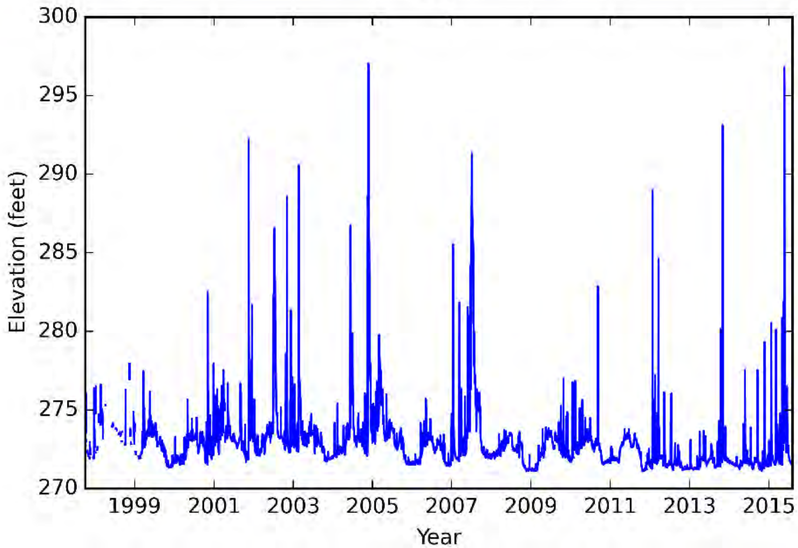
STREAM DATA FROM THE COLORADO RIVER



Example Gage on Colorado River

10 CFS = 7,240 AFY

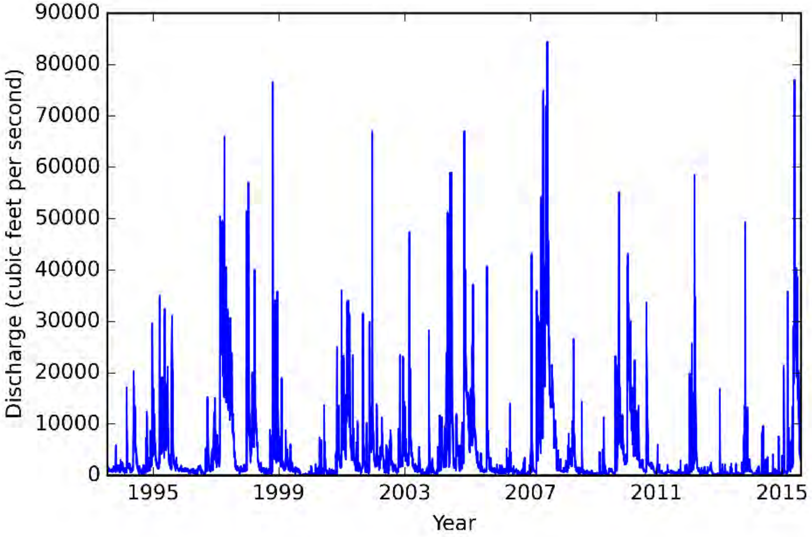


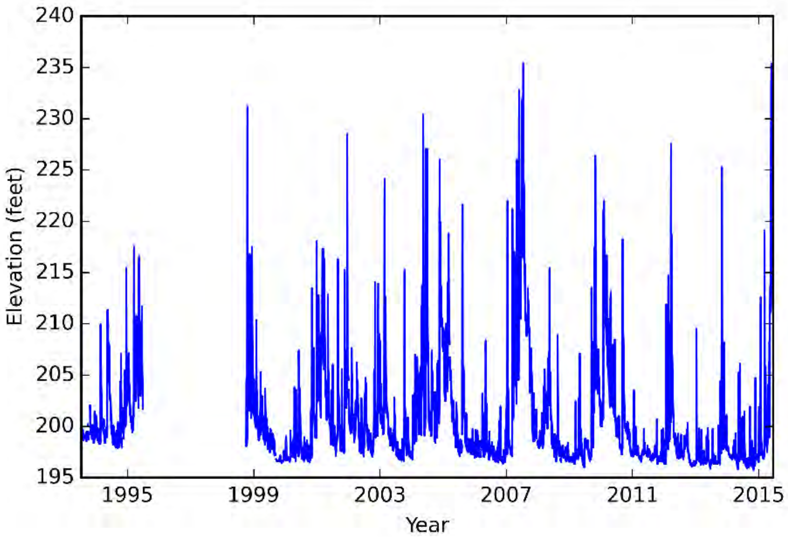


STREAM DATA FROM THE BRAZOS RIVER

Example Gage on Brazos River

10 CFS = 7,240 AFY



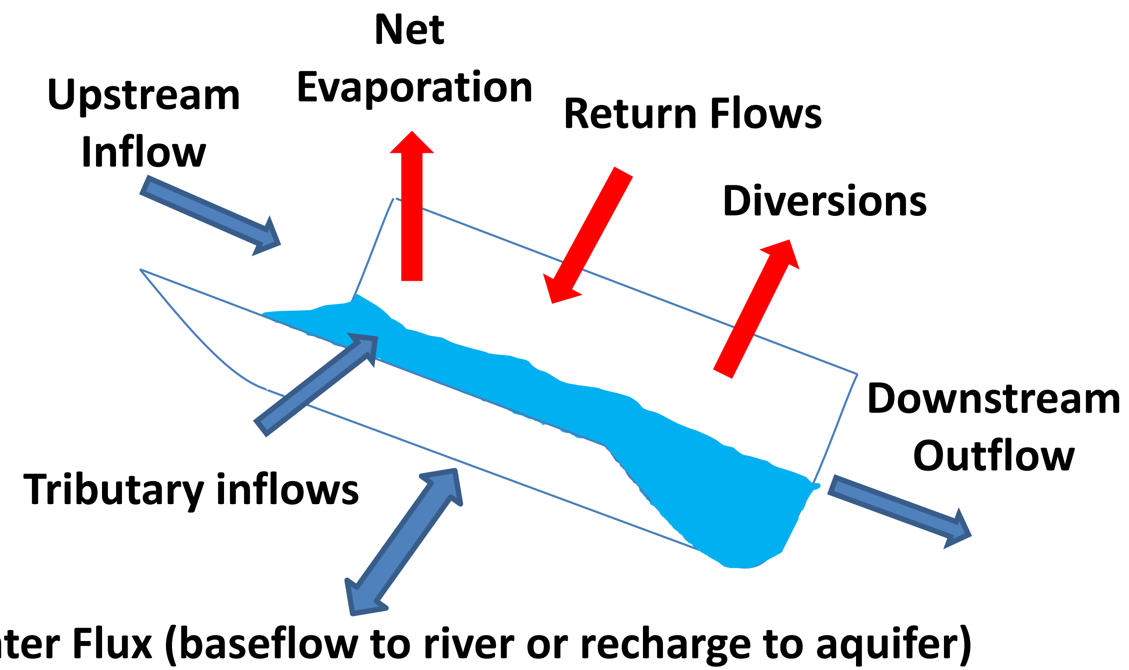


COMMON METHODS TO EVALUATE SURFACE-GROUNDWATER INTERACTION

- Stream Gain/Loss Study
  - Measure flow in stream at several locations at one time
  - Perform a water balance that should account for diversions or returns
- Hydrograph Separation
  - Measure stage (discharge) in stream at a single location (hydrograph) over a large time period
  - Separate flow into event flow (runoff) and a base flow component

STREAM GAIN/LOSS STUDY

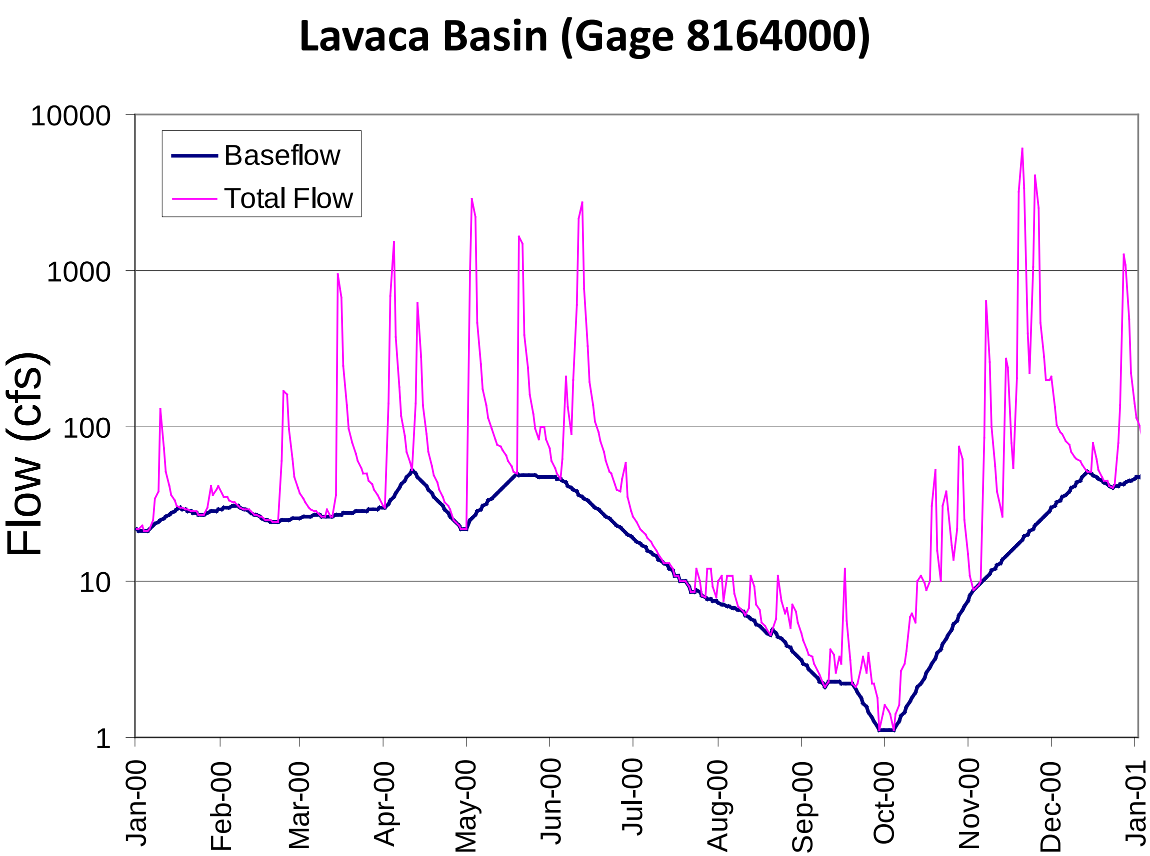
Groundwater Flux = Downstream River Flow
+ River Outflows (ET, diversions)
– Upstream River Flow
– River Inflows (tributaries, return flows)



HYDROGRAPH SEPARATION APPROACHES

- Groundwater Models: TWDB GAM Program
  - Identifies GW component of river flow
  - Attempts to separate river discharge into runoff and baseflow component
- Surface Water Models: TCEQ Instream Flow Program
  - Does not identify GW component of river flow
  - Attempts to separate river discharge into five flow stream categories

TWDB GAM PROGRAM: BASEFLOW SEPARATION USING DATA FROM A SINGLE RIVER GAGE



10 CFS = 7,240 AFY

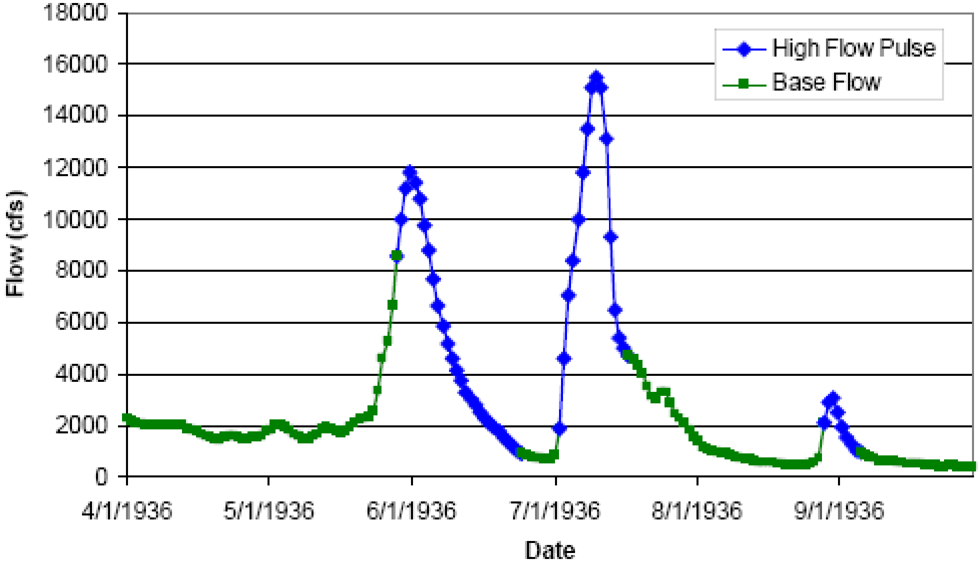
- **Event Flow**
  - Runoff from precipitation events
  - Reservoir releases
- **Base Flow**
  - Groundwater discharge
  - Reservoir releases
  - Return flows
  - Bank flows
  - Seasonal variations
- **Computer Program**
  - Base Flow Index (BFI)
  - Calculates ratio of baseflow to runoff

TCEQ INSTREAM FLOW PROGRAM

- Perform statistical analysis of flow data to identify one of five river flow regimes per day using a computer program
  - Indicators of Hydrological Alterations (IHA)
  - Hydrology-based Environmental Flow Regime (HEFR)

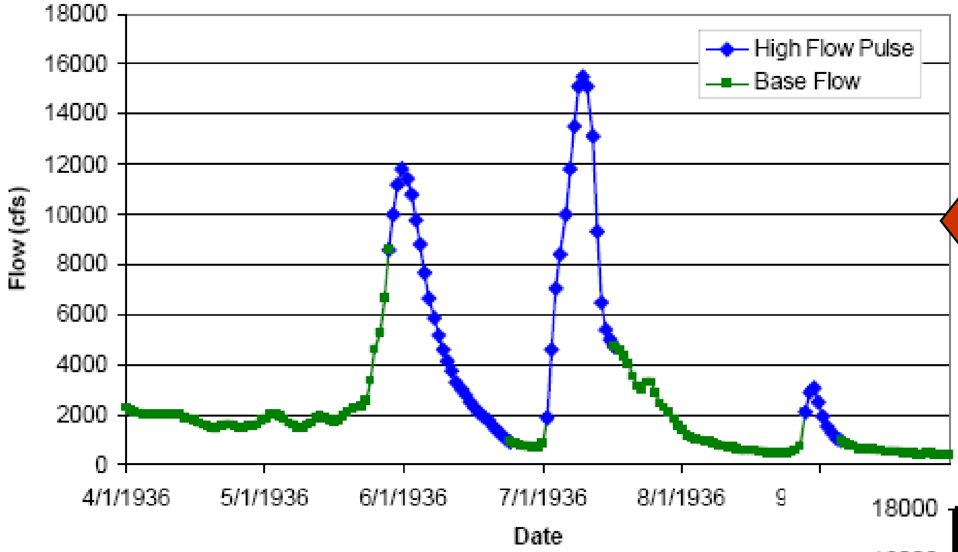
- Source of river water is not a factor in determining flow regimes

- Groundwater could be an important component of subsistence and critical flow regimes in some basins



Regime	Hydrologic Condition
Overbank Flows	NA
High-Pulse Flows	Wet
	Average
	Dry
Base Flows	Wet
	Average
	Dry
Subsistence Flows	Subsistence
Critical Flows	Critical

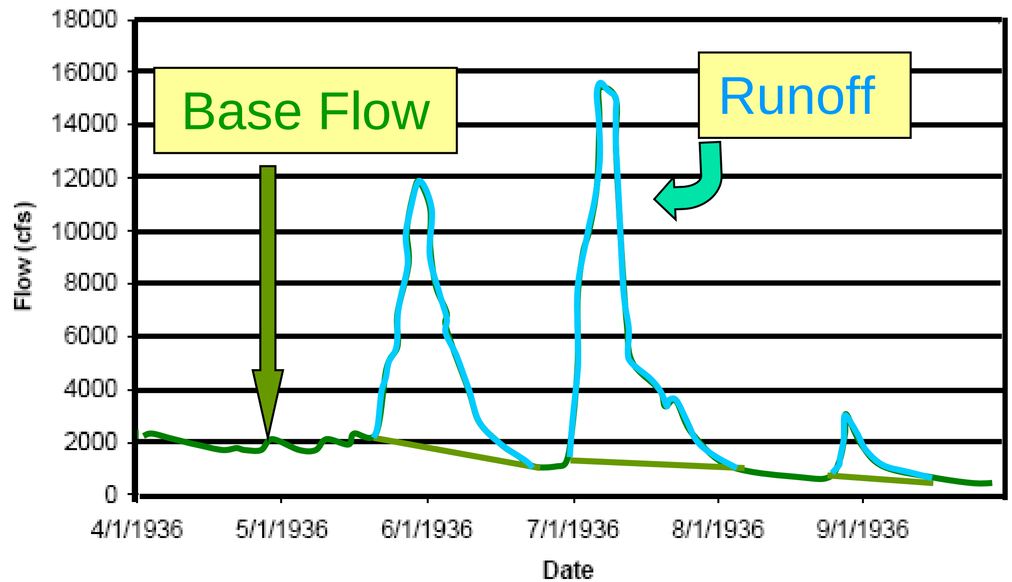
DIFFERENCE BETWEEN HYDROGRAPH SEPARATION



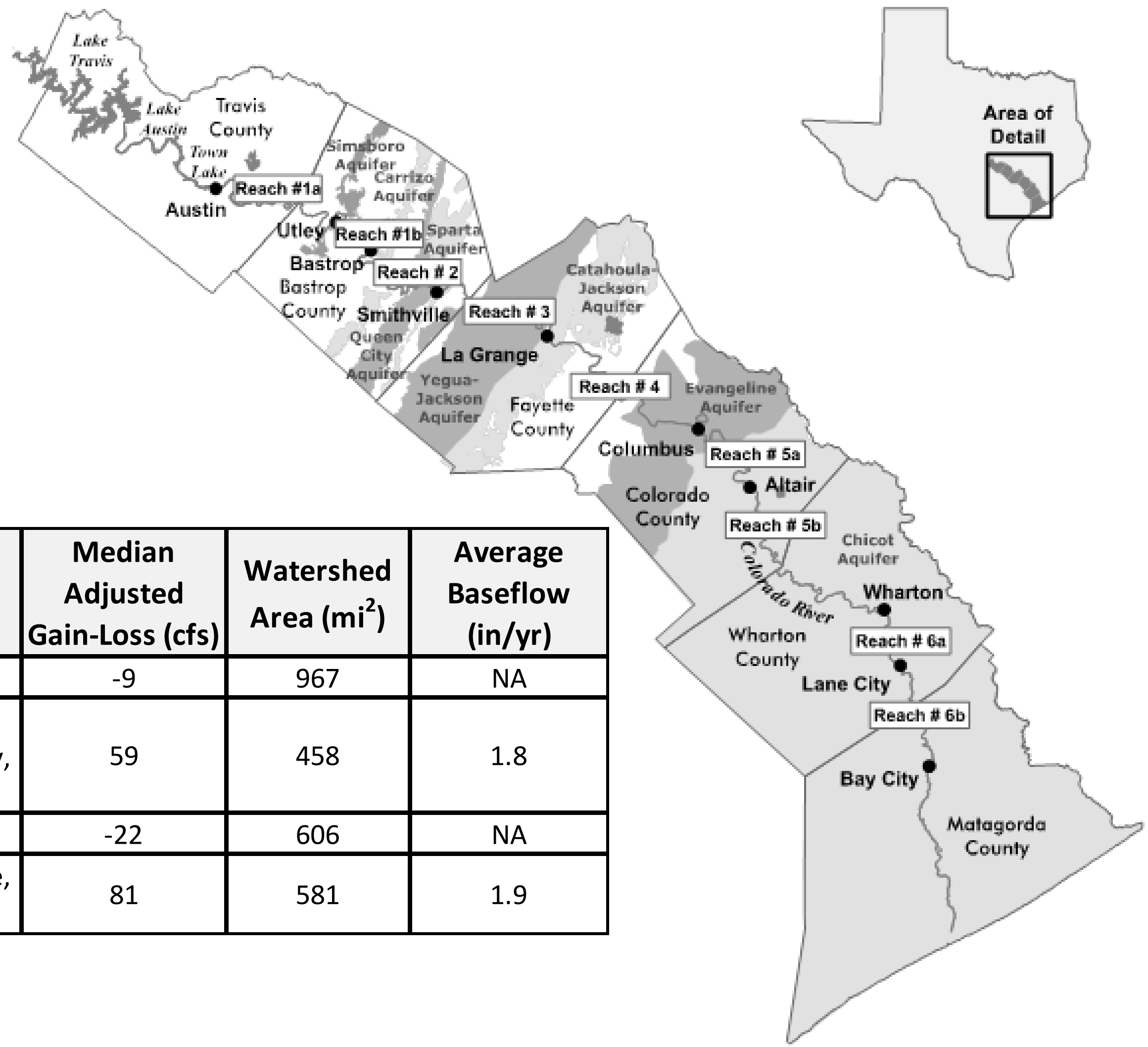
TCEQ hydrograph separation segregates hydrograph into different flow regimes – one for each day

Does not attempt to segregate groundwater discharge

Groundwater hydrograph separation segregates hydrograph into groundwater discharge and runoff



COLORADO RIVER GAIN-LOSS STUDY (SAUNDERS, 2006)*

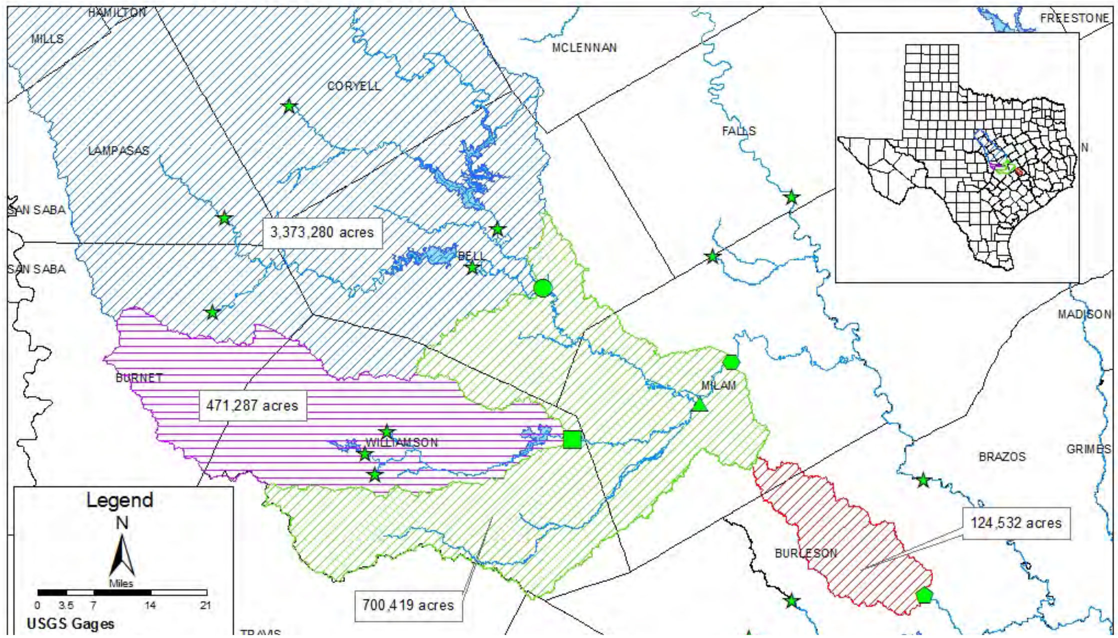


Description	River Mile Length (mi)	Water-bearing units	Median Adjusted Gain-Loss (cfs)	Watershed Area (mi^2)	Average Baseflow (in/yr)
Austin-Bastrop	54	Simsboro	-9	967	NA
Bastrop-Smithville	25	Calvert Bluff, Carrizo, Queen City, Sparta	59	458	1.8
Smithville-LaGrange	36	Yegua-Jackson	-22	606	NA
LaGrange-Columbus	41	Catahoula, Oakville, Goliad	81	581	1.9

10 CFS = 7,240 AFY

*** Based on 1999 and 2005 data**

GAIN-LOSS STUDY IN VICINITY POSGCD

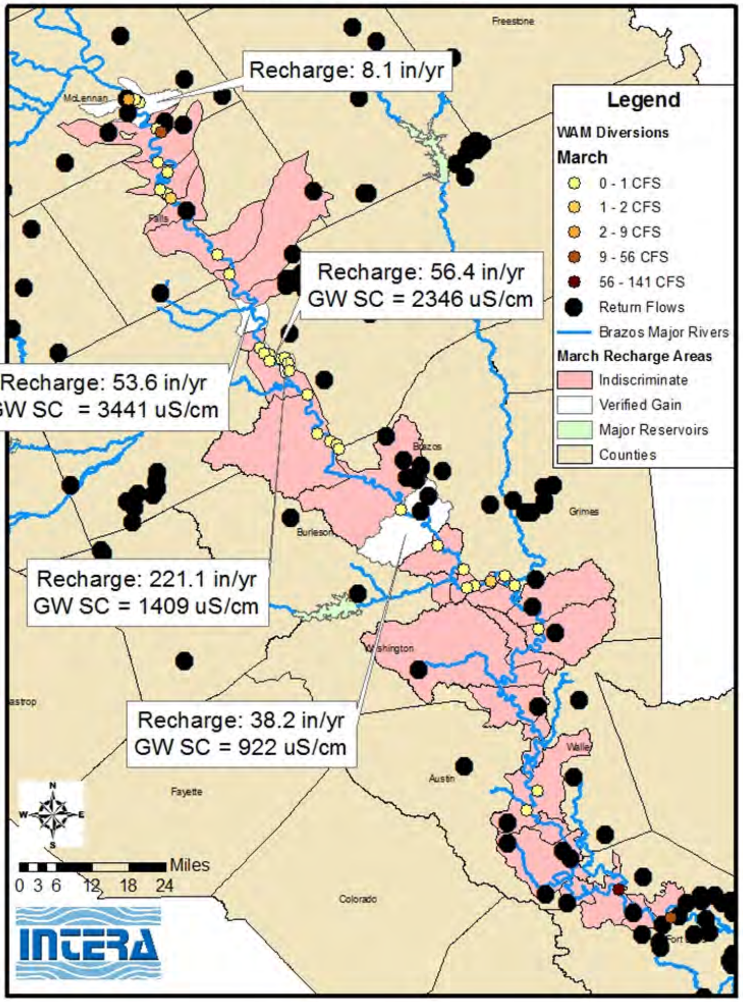


Gage #	Gage Name	Area (acre)	Avg. Precip. (in/yr)	Avg. Runoff (in/yr)	Avg. Baseflow (in/yr)	% Precip. as Baseflow
08110100	Davidson Ck nr Lyons, TX	124532	40.39	5.10	0.23	0.57%
08104500	Little Rv nr Little River, TX	3373280	32.43	3.02	1.62	4.99%
08105700	San Gabriel Rv at Laneport, TX	471287	34.56	4.82	1.39	4.01%
08106350	Little Rv nr Rockdale, TX	633128	Insufficient Data			
08106500	Little Rv nr Cameron, TX	700419	35.43	3.59	2.01	5.68%

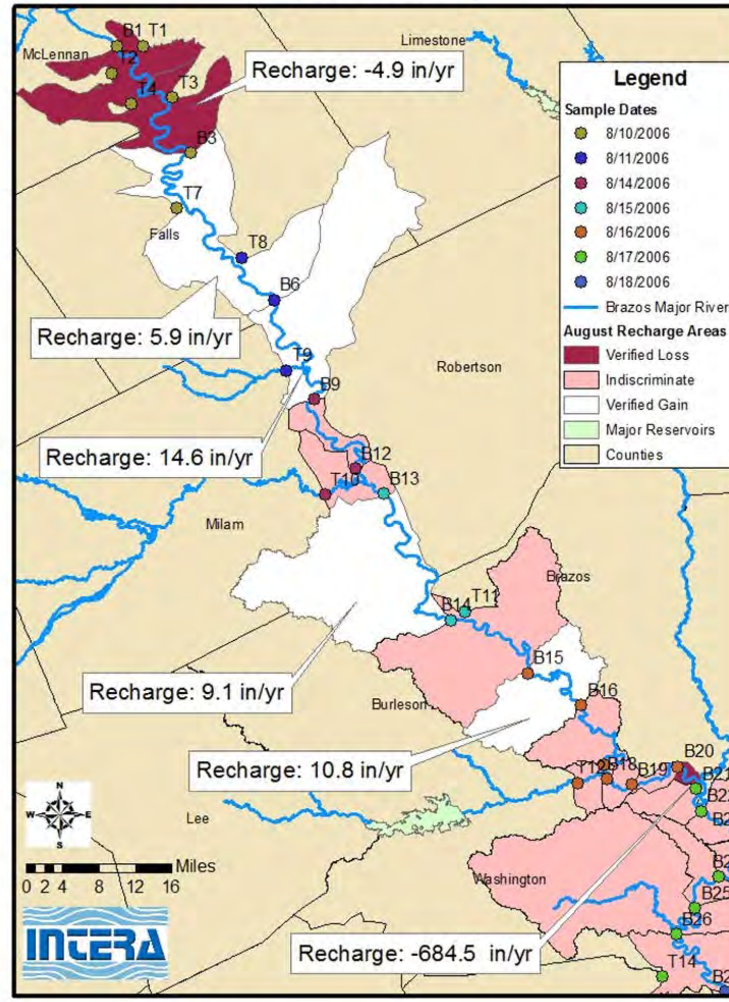
April 5, 2011

ANALYSIS OF STREAM GAINS FROM (TURCO, 2007)

March Recharge

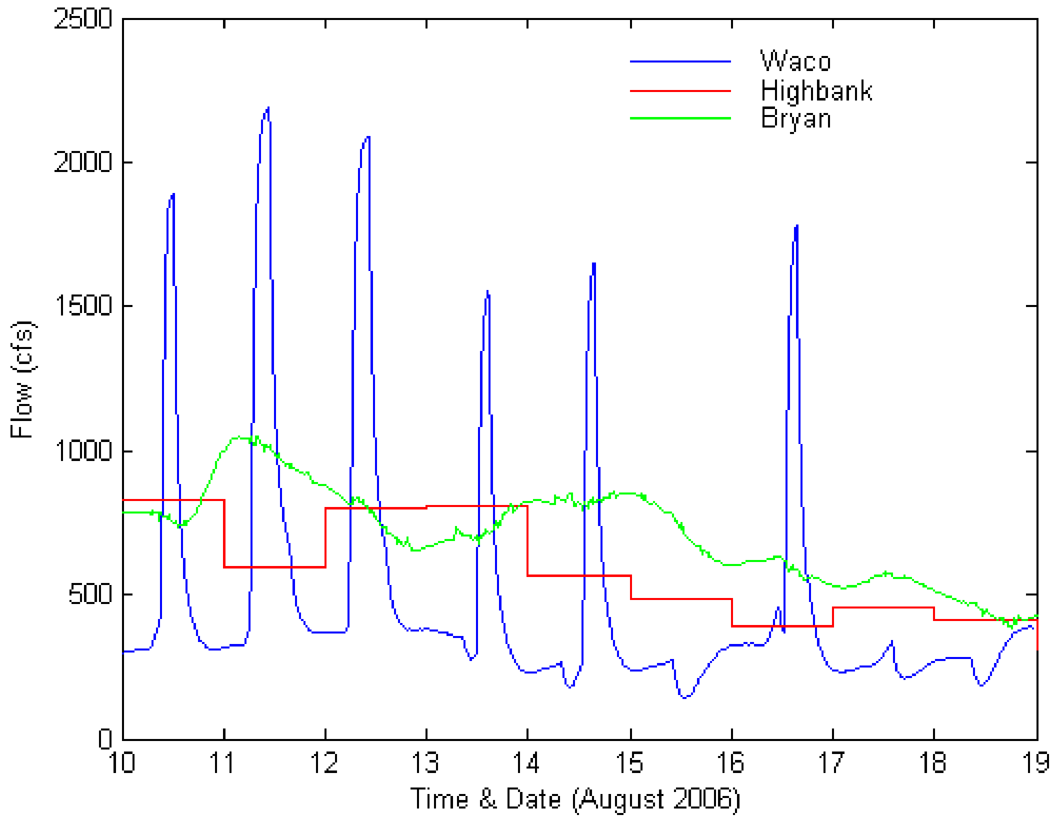


August Recharge



POTENTIAL PROBLEMS OF BRAZOS RIVER GAIN-LOSS STUDY (TURCO, 2007)

- Gain-loss studies performed when river flow was not steady and uniform
- Pulsing river flow was not considered as part of data collection or analysis
- Data analysis did not properly consider diversion and return flows



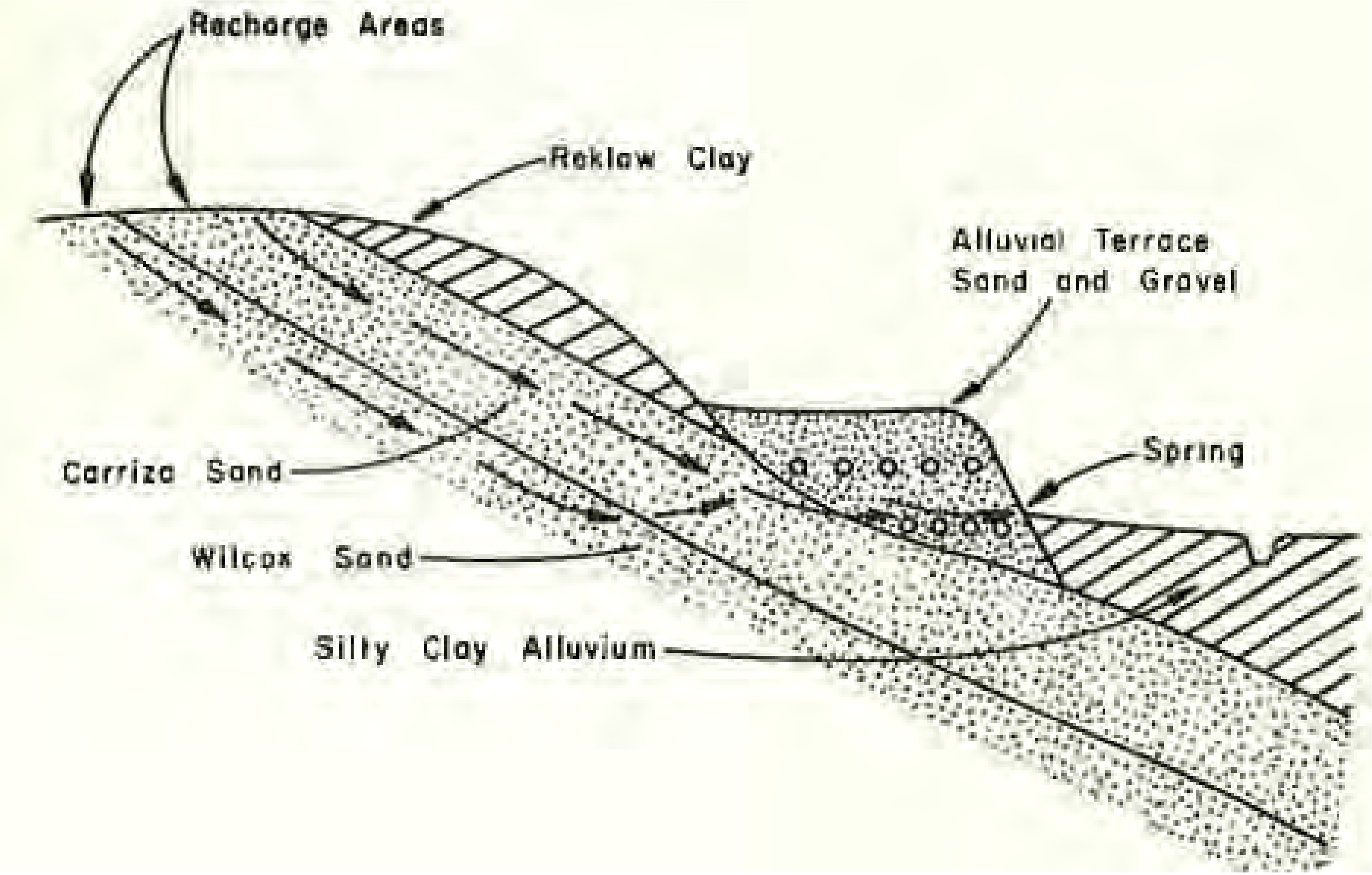
MEASURED GW/SW EXCHANGE: SUMMARY POINTS

- Stream flows in Colorado and Brazos River have a large temporal variability component
- Geohydrologist and surface water hydrologist have different approaches for evaluation river gage hydrographs
- Stream gain-loss studies should be performed during well controlled, steady-flow conditions
- High quality stream gain-loss studies are difficult to conduct and relatively few good studies exist
- Brazos River gain-loss study should be used with caution because it has not been properly adjusted for return flow, diversions, and unsteady flow effects
- Stream studies can be used to obtain lower estimates of recharge across a watershed

MEASURED SPRING FLOW

- Spring Mechanics
  - Regional Aquifer
  - Perched Aquifer
  - Required Conditions
- Review of Literature Regarding Springs
  - Location
  - Discharge Rates

SPRINGS AND SEEPS

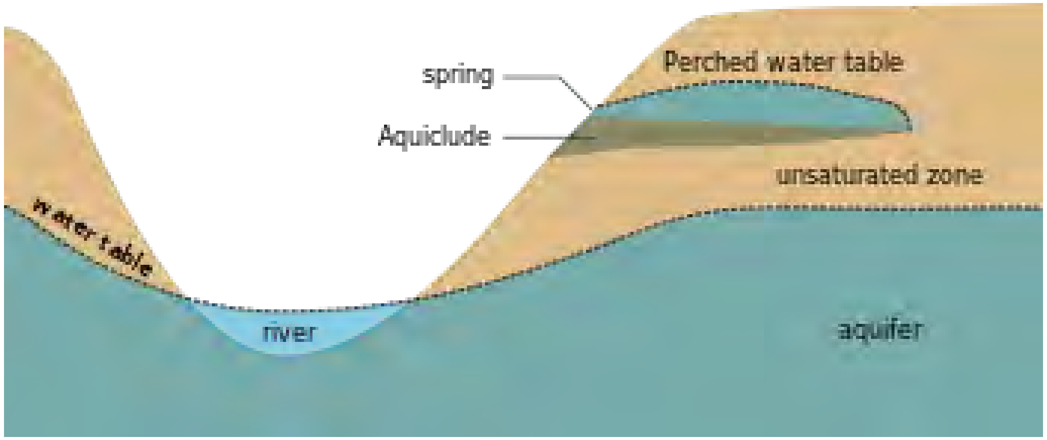


Schematic of a spring in Carrizo-Wilcox sand and terrace sand and gravel (1981, Brune)

PERCHED WATER TABLE

A perched water table is a water-bearing unit that occurs above the regional water table, in the unsaturated zone where there is an impermeable layer of sediment (aquiclude) above the main water table/aquifer.

If a perched aquifer's flow intersects the earth's dry surface, at a valley wall for example, the water is discharged as a spring



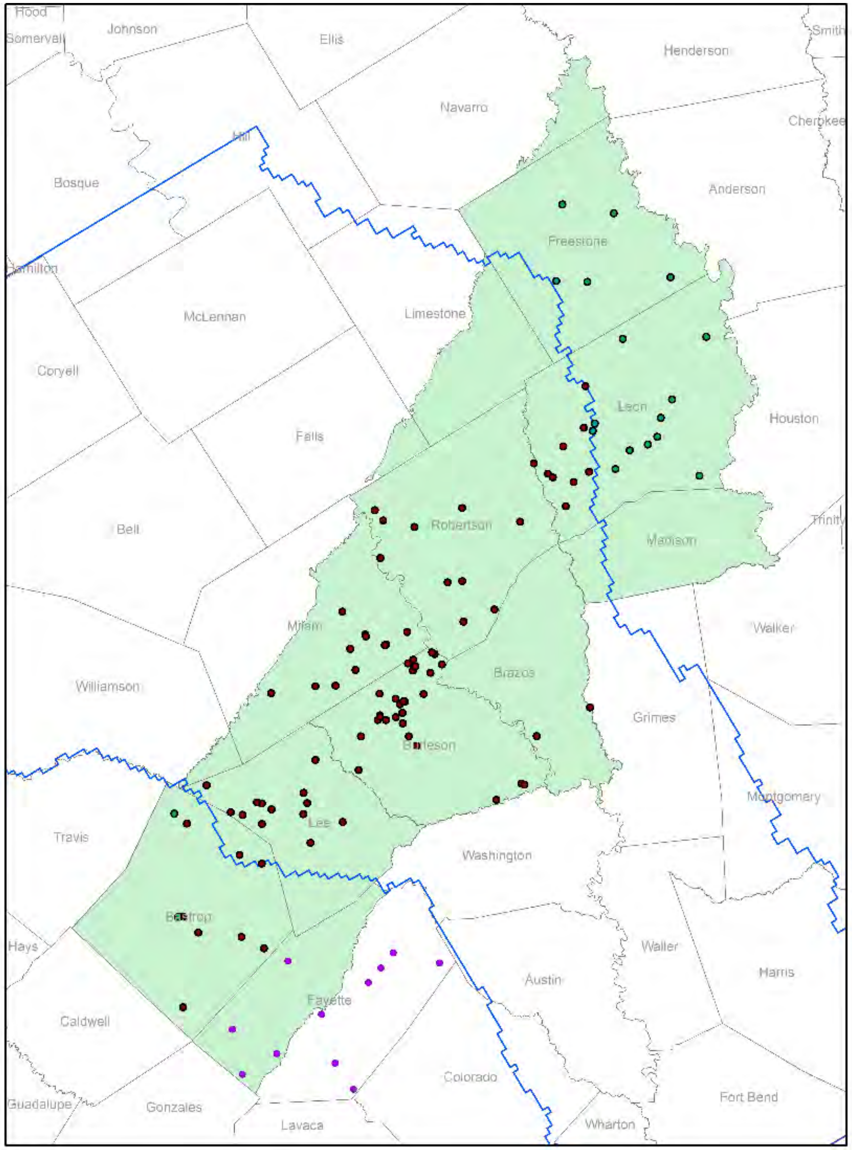
Schematic of a spring connected to a perched water table (2015,https://en.wikipedia.org/wiki/Water_table)

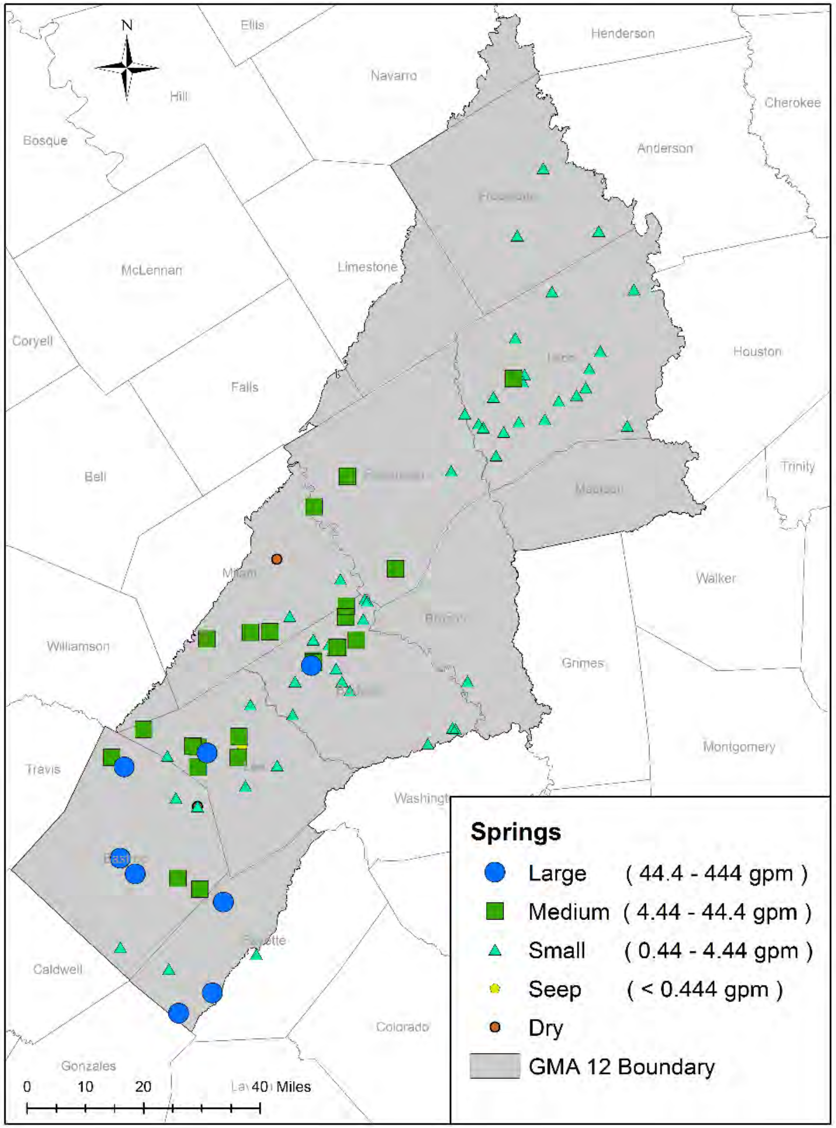
REQUIREMENTS FOR A SPRING TO OCCUR IN THE GEOLOGICAL FORMATIONS IN GMA 12

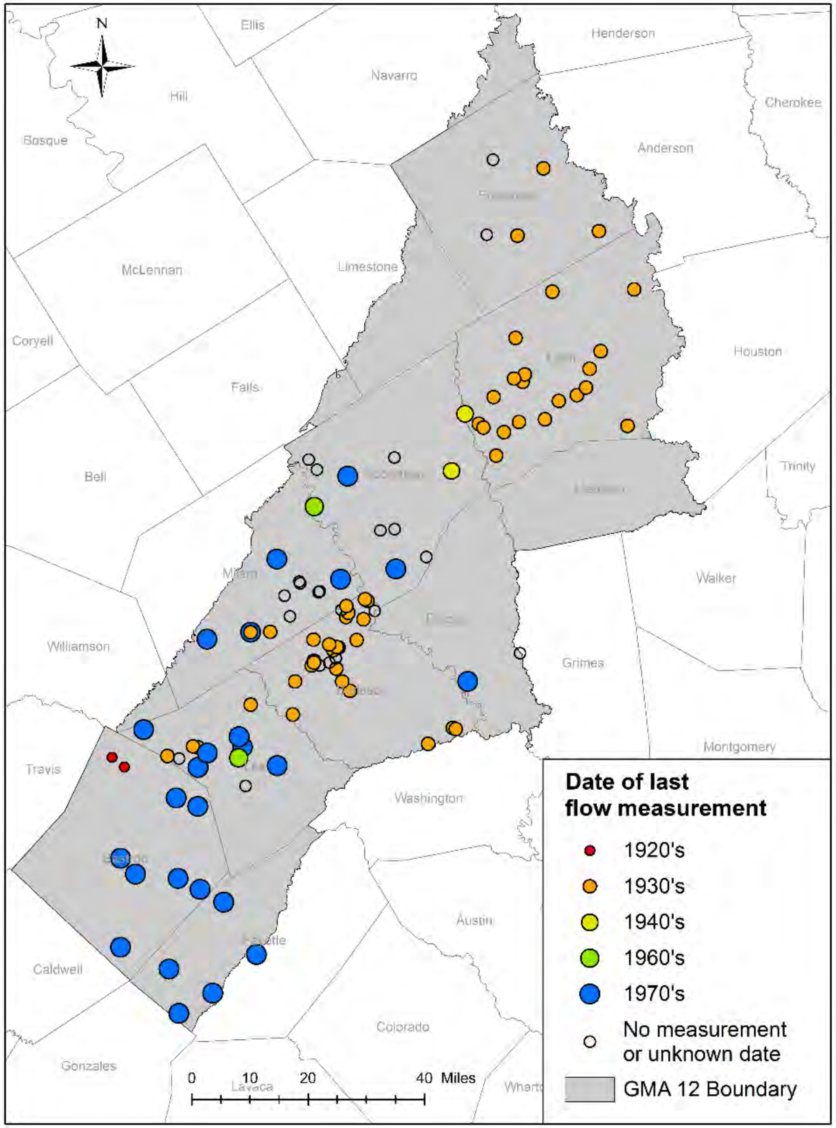
- Aquifer to deliver water to a spring
- Sufficiently large recharge area
- Sufficient hydraulic pressure gradient between recharge and discharge area to cause flow
- Water table intersected by ground surface

IDENTIFIED SPRING IN GMA 12

- Sources
  - Springs of Texas, Volume 1 (2002, Brune)
  - Database of historically documented springs and spring flow measurements in Texas(2003, Heitmuller and Reece)
  - TWDB Groundwater Database (March, 2014)




N
Ellis
Henderson
Navarro
Hill
Cherokee
Bosque
Anderson
McLennan
Limestone
Coryell
Houston
Falls
Bell
Trinity
Walker
Milam
Williamson
Grimes
Montgomery
Travis
Washington
Caldwell
Colorado
Gonzales
Springs
Large (44.4 - 444 gpm)
Medium (4.44 - 44.4 gpm)
Small (0.44 - 4.44 gpm)
Seep (< 0.444 gpm)
Dry
GMA 12 Boundary
0 10 20 40 Miles


N
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Anderson
McLennan
Limestone
Coryell
Houston
Falls
Bell
Trinity
Walker
Milam
Williamson
Grimes
Montgomery
Travis
Washington
Austin
Caldwell
Colorado
Gonzales
Date of last flow measurement
1920's
1930's
1940's
1960's
1970's
No measurement or unknown date
GMA 12 Boundary
0 10 20 40 Miles

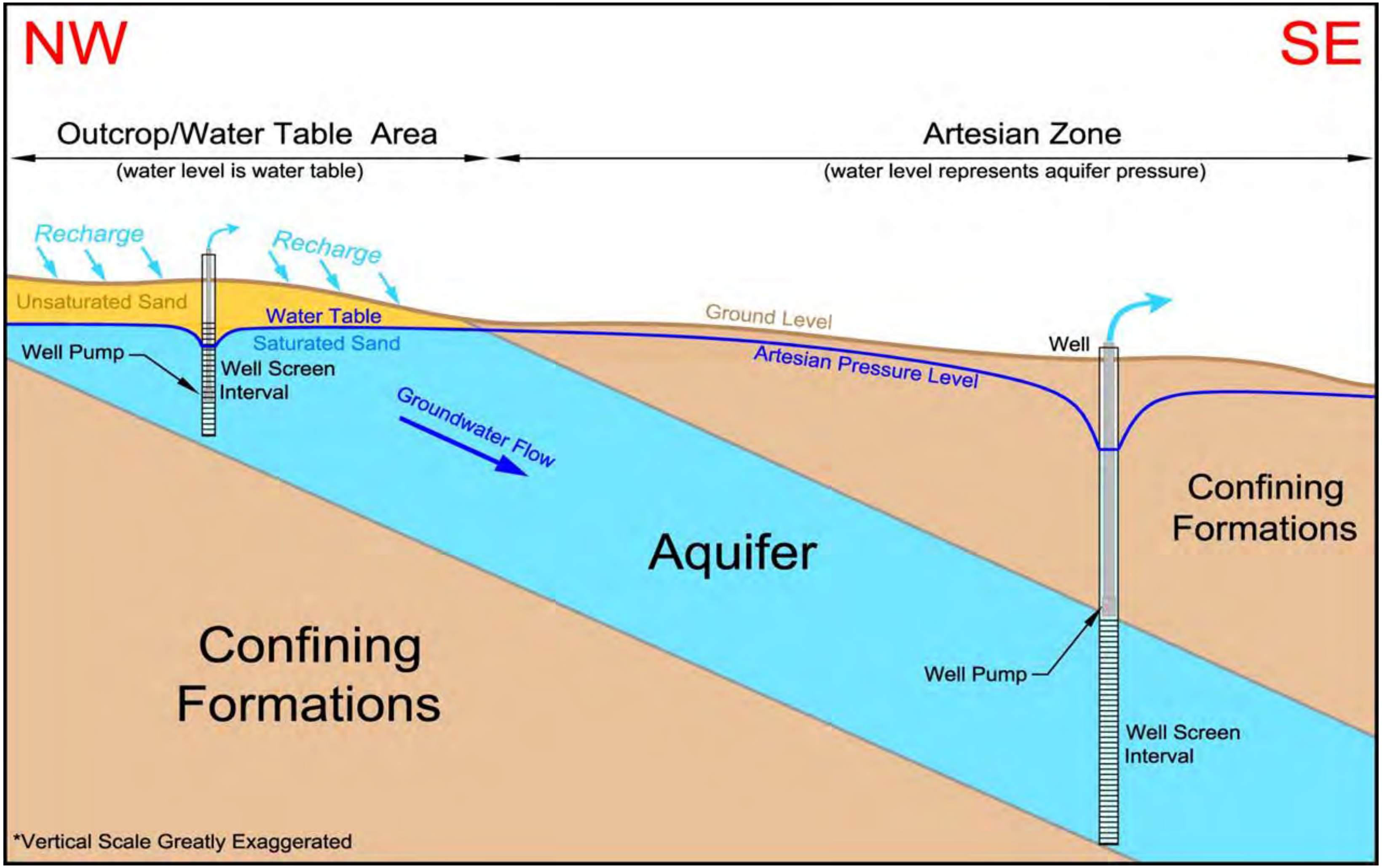
MEASURED SPRING FLOW: SUMMARY POINTS

- Springs are typically controlled by localized site-specific topographic, hydrologic, and geological conditions
- Perched and regional water tables can be a source of springs
- Extremely limited spring flow data collected since 1970s

OVERVIEW OF GMA 12 AQUIFERS AND THEIR NUMERICAL REPRESENTATION IN THE GAM

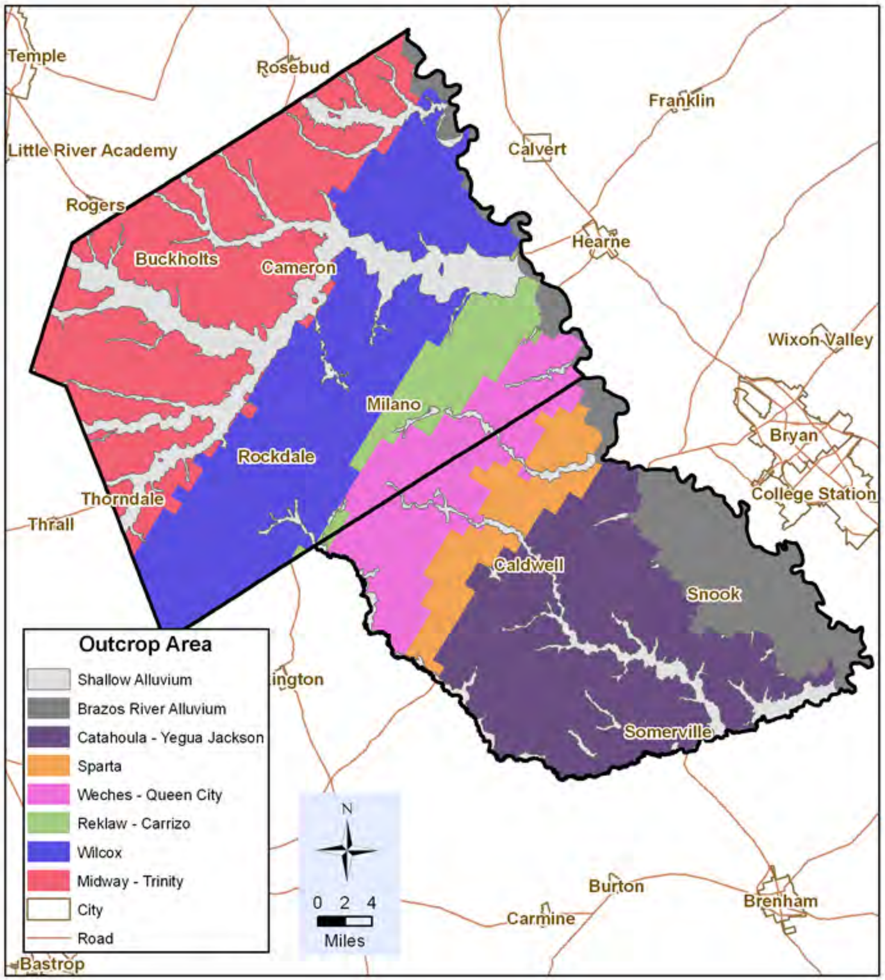
- Aquifer Outcrop
- Vertical Hydraulic Gradients
- Potential Problems with Developing Numerical grids for Models
- Summary Points

SCHEMATIC OF DIPPING AQUIFER

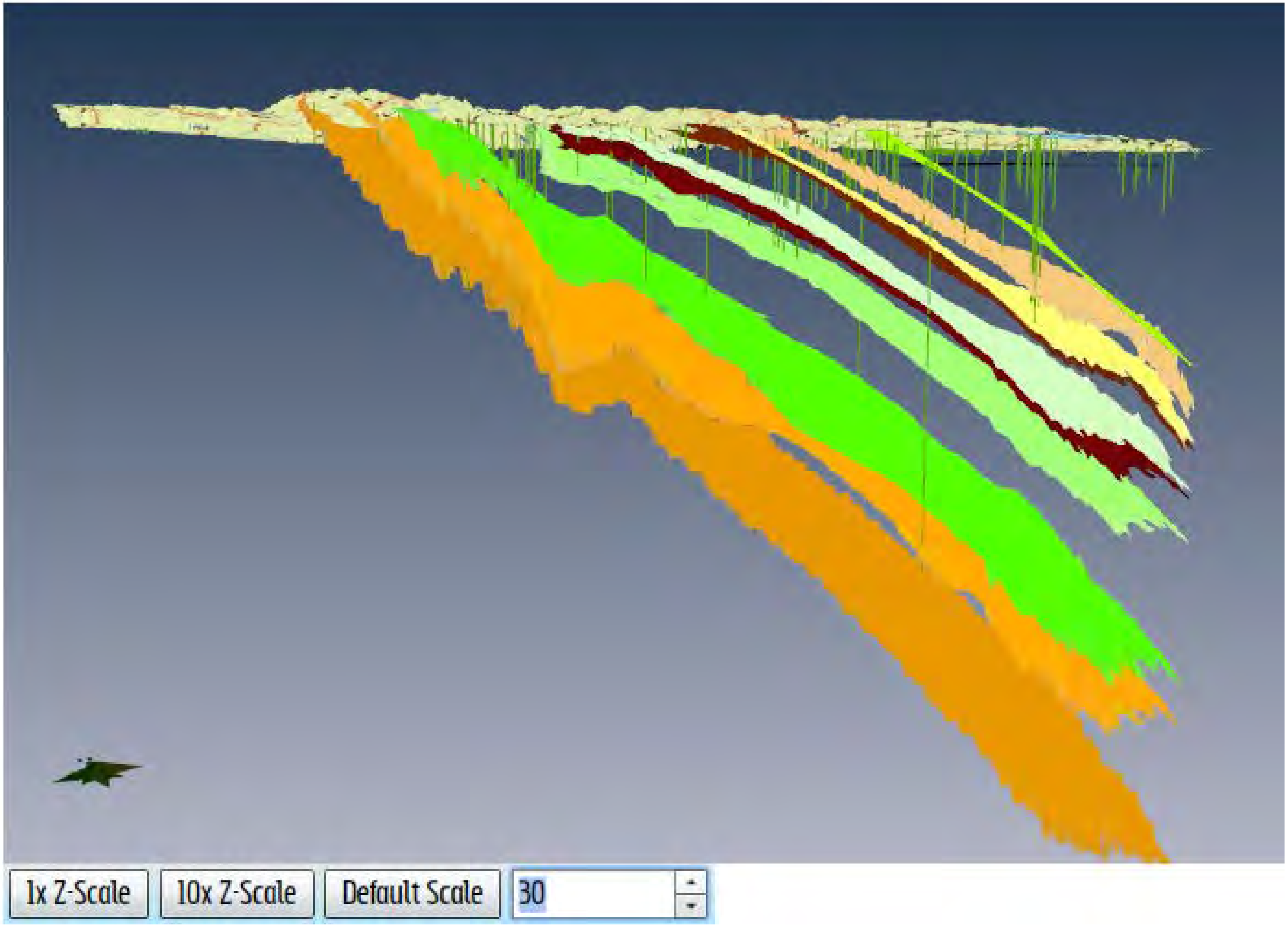


Slide provided by Harden & Associates

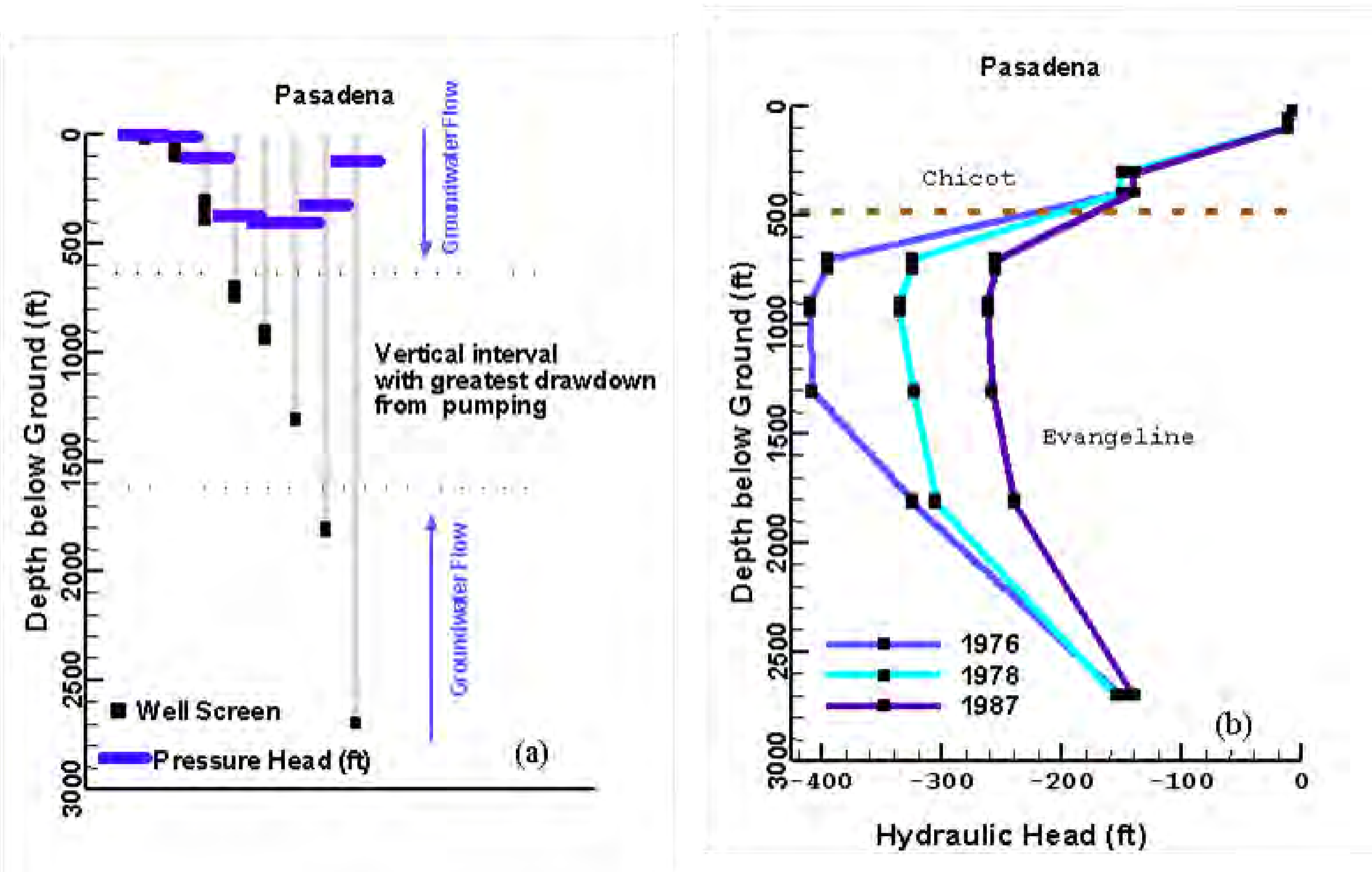
FOOTPRINT OF AQUIFER OUTCROPS



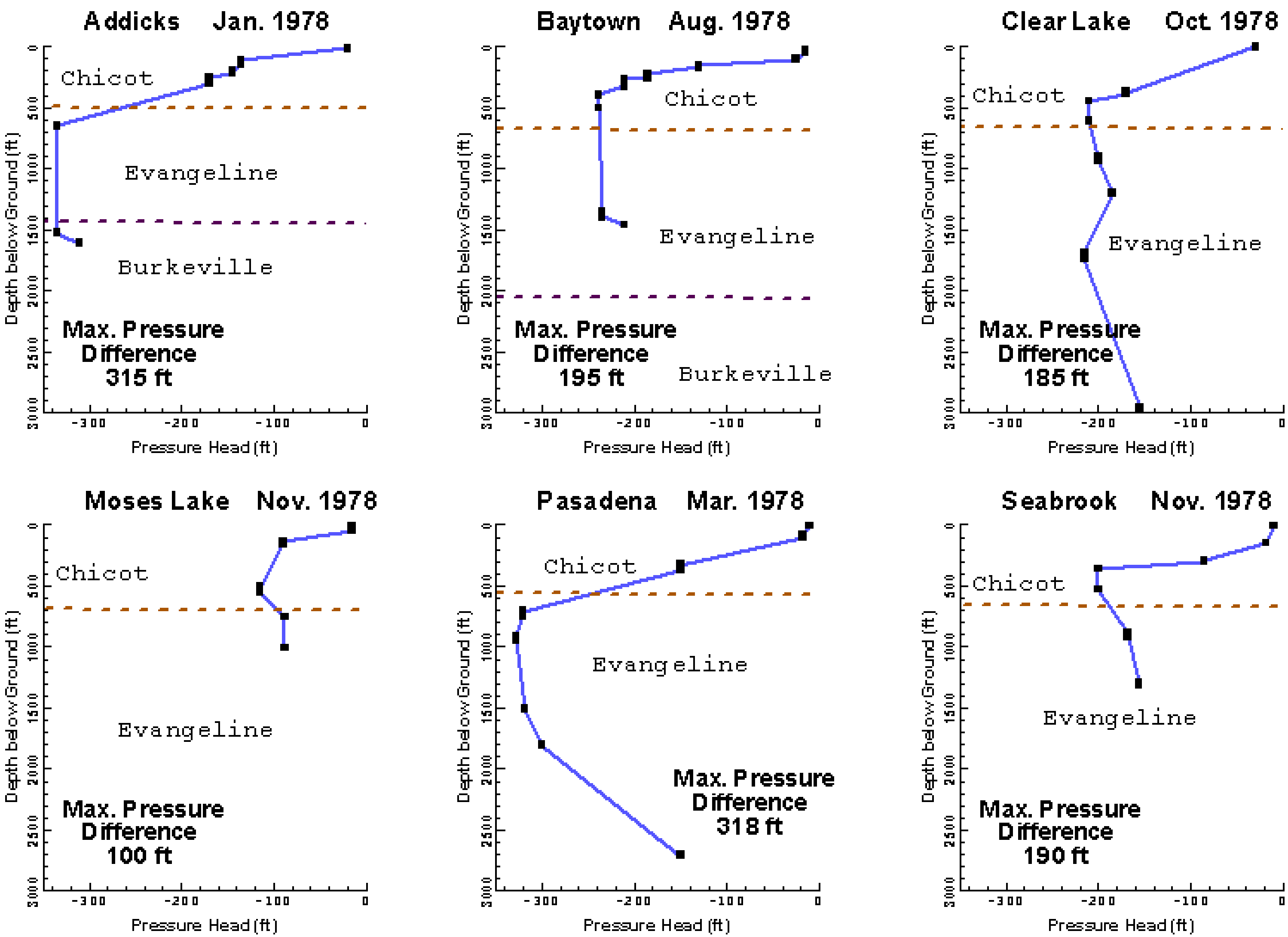
VERTICAL CROSS-SECTION THROUGH MILAM AND BURLESON COUNTIES



WATER LEVELS FROM CLUSTER MONITORING WELLS IN HARRIS COUNTY

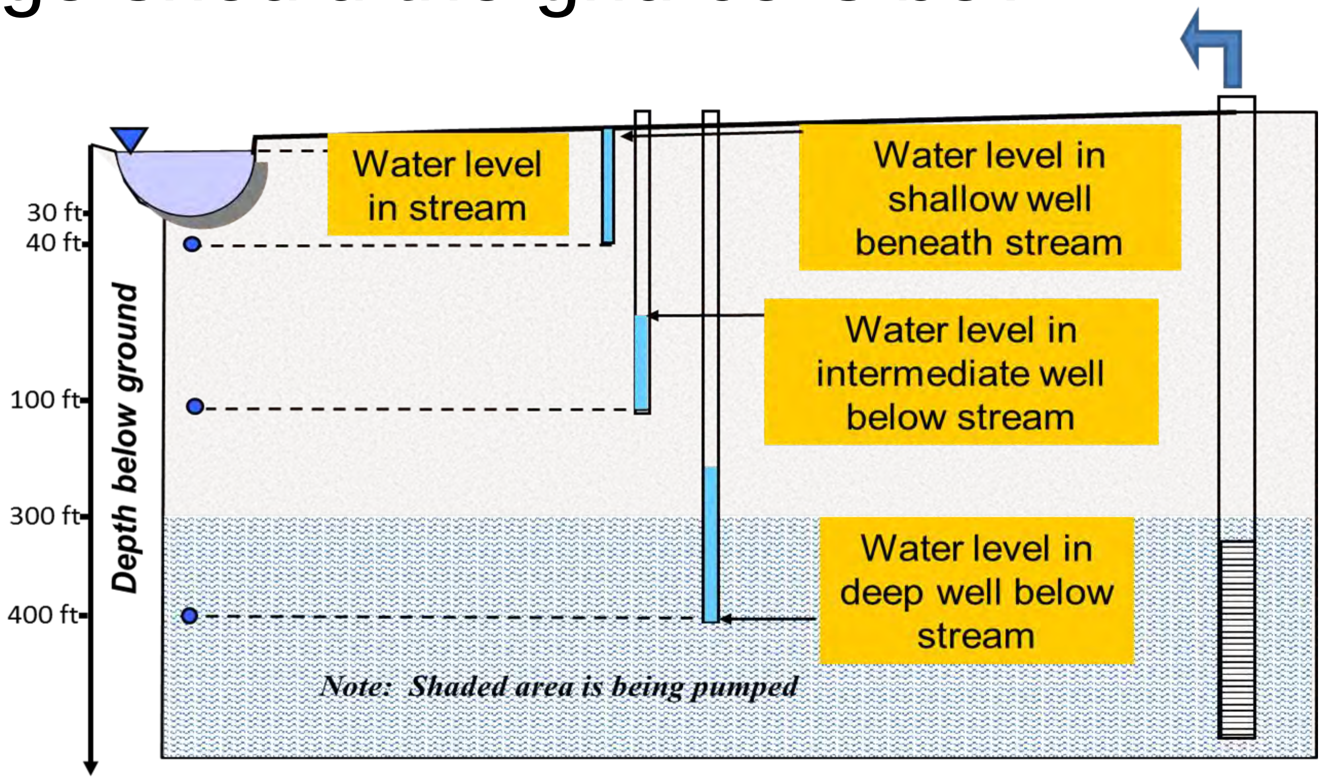


WATER LEVELS FROM STAGED MONITORING WELLS IN HARRIS COUNTY (CONT.)



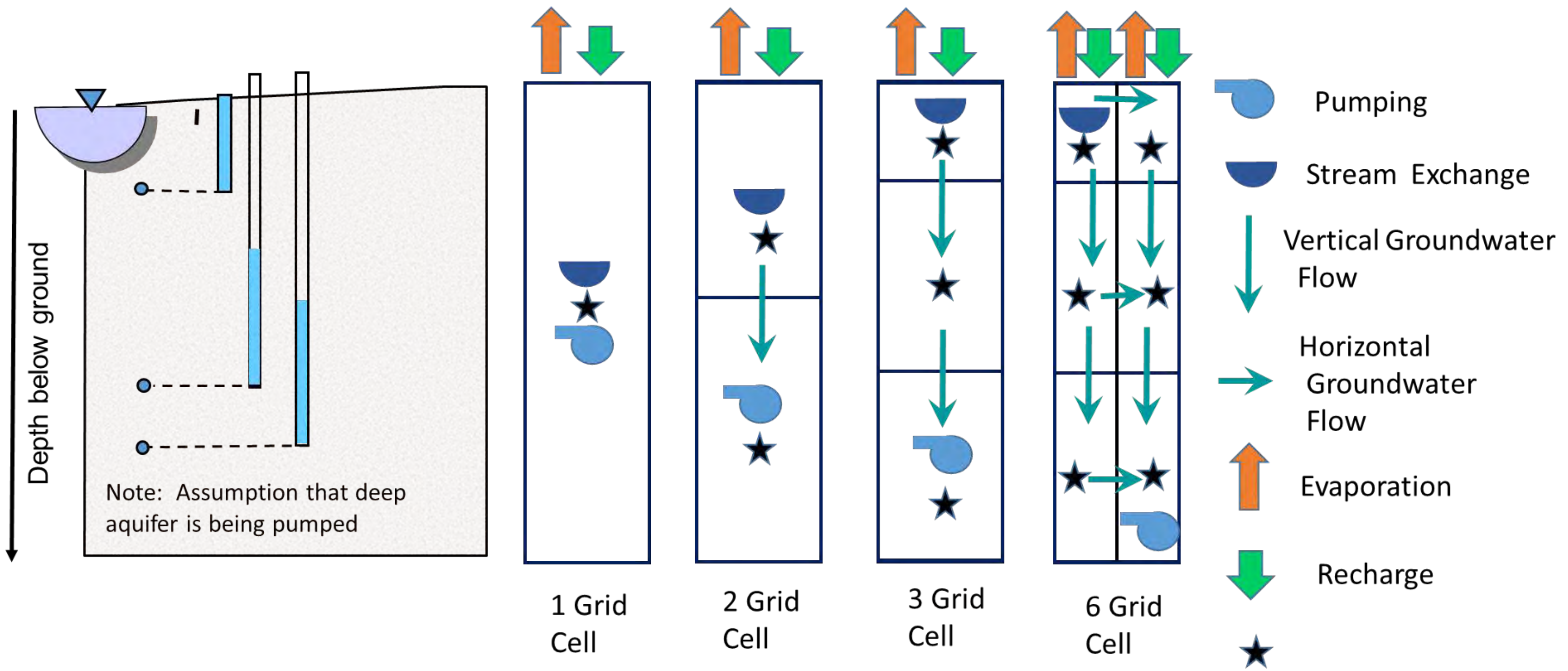
FUNDAMENTAL PROBLEM WITH DEVELOPING REGIONAL MODEL TO ADDRESS LOCAL ISSUES

- Where shallow water level is different from deep water level near a river– how thick and large should the grid cells be?

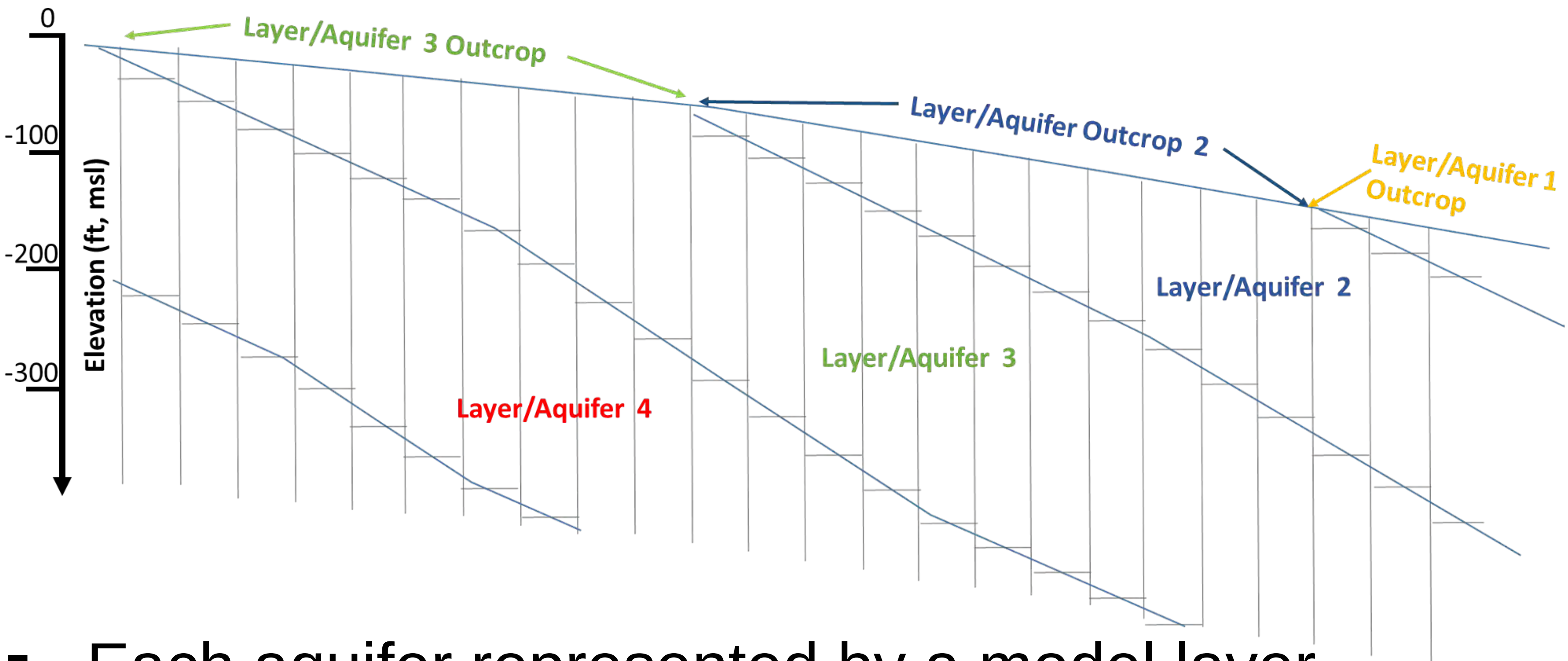


FUNDAMENTAL PROBLEM WITH DEVELOPING REGIONAL MODEL TO ADDRESS LOCAL ISSUES

- Some options for grid cell construction near a stream. Which options provides the best option for representing shallow flow paths? Which options requires the most effort and data to create?

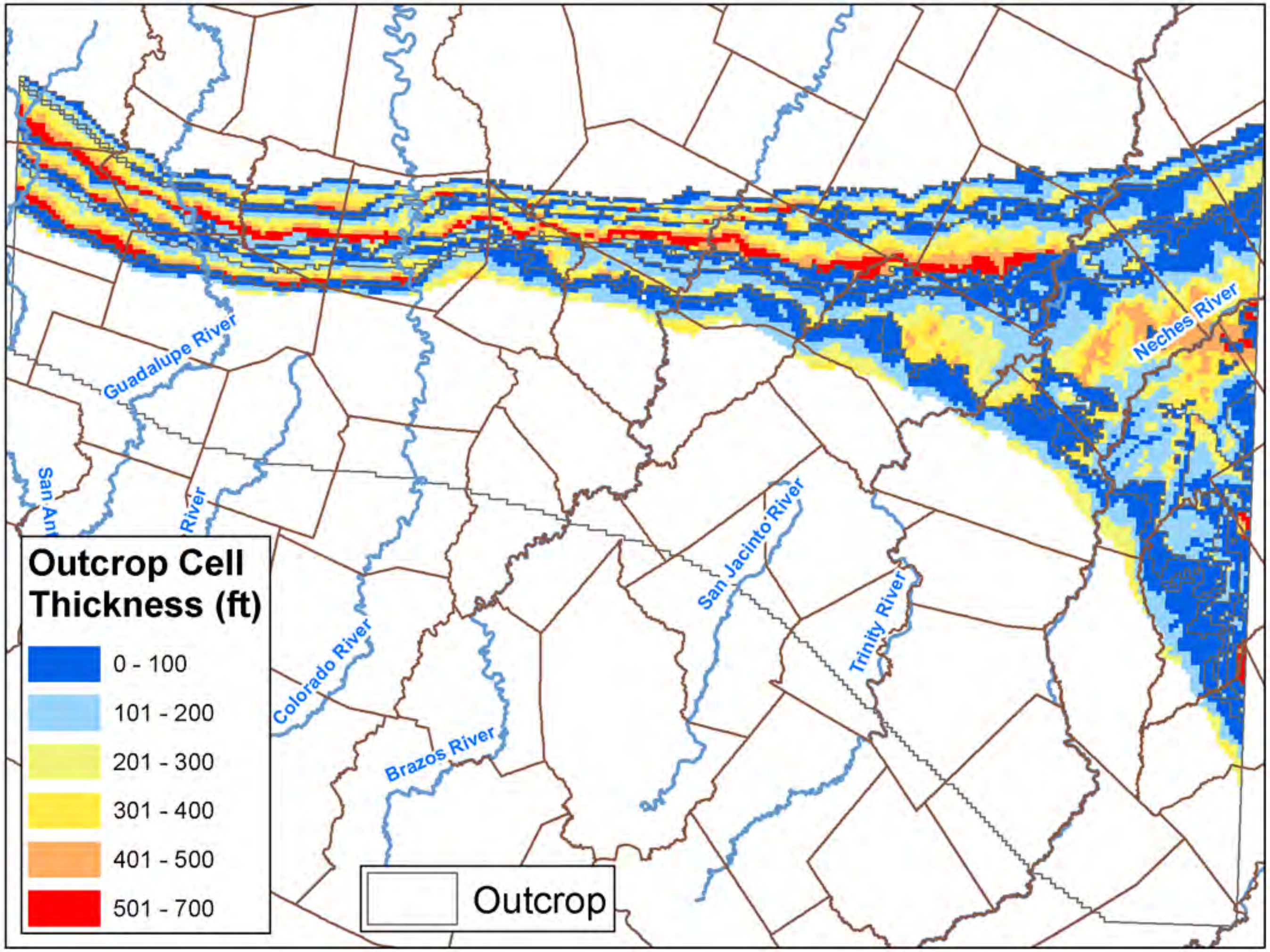


A GENERIC APROACH TO DEVELOPING A REGIONAL GROUNDWATER MODEL



- Each aquifer represented by a model layer
- Along an outcrop, the grid cells get thicker
- Where the grid cells are thick, the model loses ability to represent a shallow groundwater flow paths

THICKNESS OF GRID CELL REPRESENTING OUTCROP AND WATER LEVEL ELEVATION



AQUIFER AND GAM GRID CONSTRUCTION: SUMMARY POINTS

- The GMA 12 aquifers are dipping and therefore include both an unconfined (outcrop) and confined component
- Where there is pumping, there will be large vertical hydraulic gradients, so model layering is an important design criterion
- Spring flows and GW/SW exchange are largely controlled by the water table the outcrop
- The GAM has numerous grid cells representing the outcrop that are over 300 feet thick
- Thick grid cells in the outcrop can lead to problems with accurately simulating spring flows and GW/SW interactions
- Arbitrary decreases in grid sizes does not necessarily improve a model performance but a well designed numerical grid can have a major important in how well a model can perform

SPARTA/QUEEN CITY/CARRIZO-WILCOX GAM SIMULATED GW/SW EXCHANGE

- Representation of Streams and Springs
- Simulated GW/SW Exchange
- Summary Points

REPRESENTATION OF STREAMS

MODFLOW Stream Package

- Located only in aquifer outcrops
- Assigned a stream water level that changes annually
- GW/SW exchange based on difference between aquifer and stream interaction

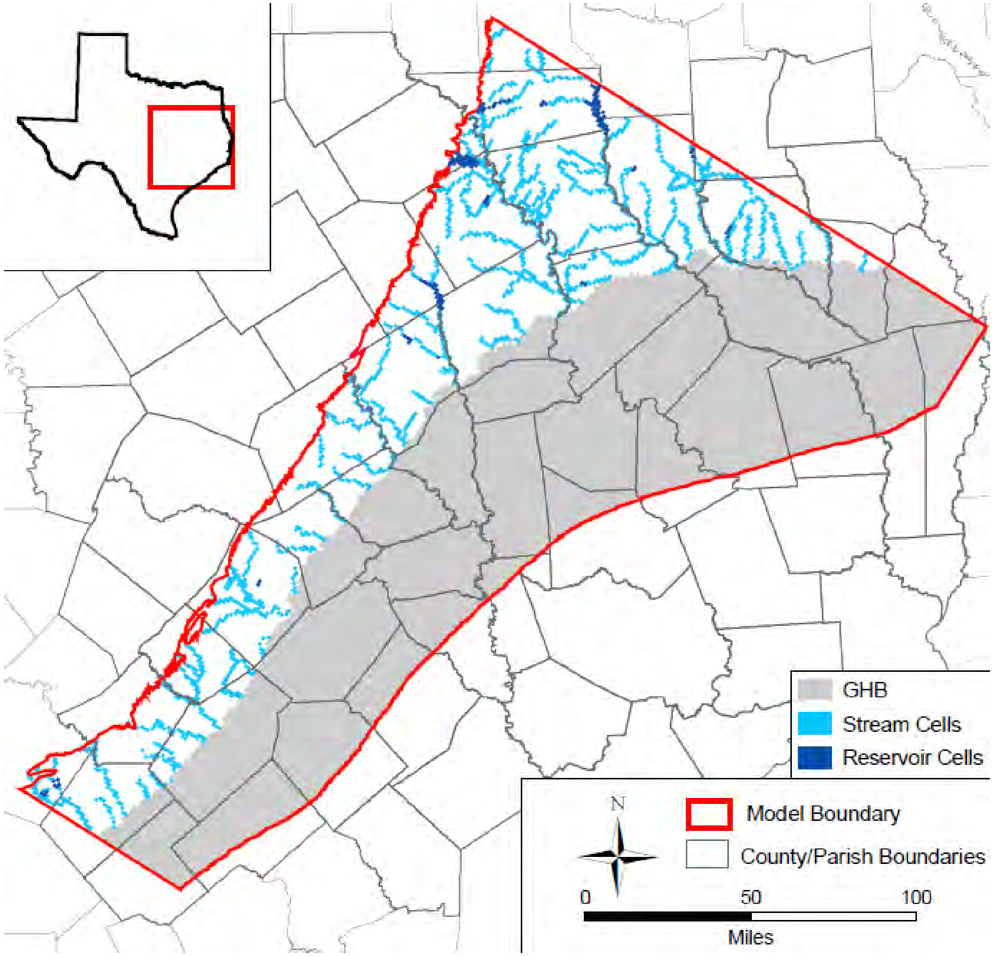
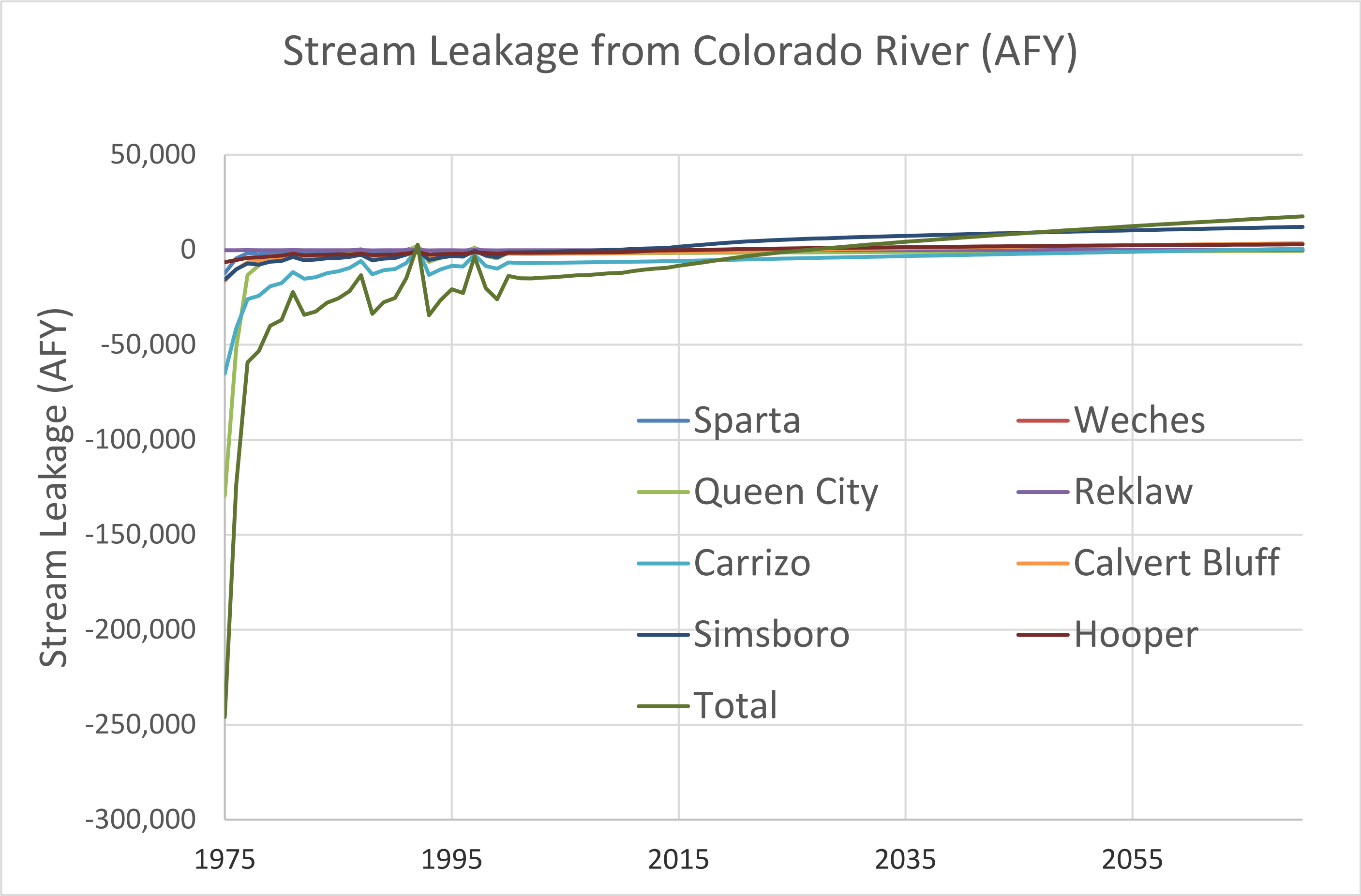


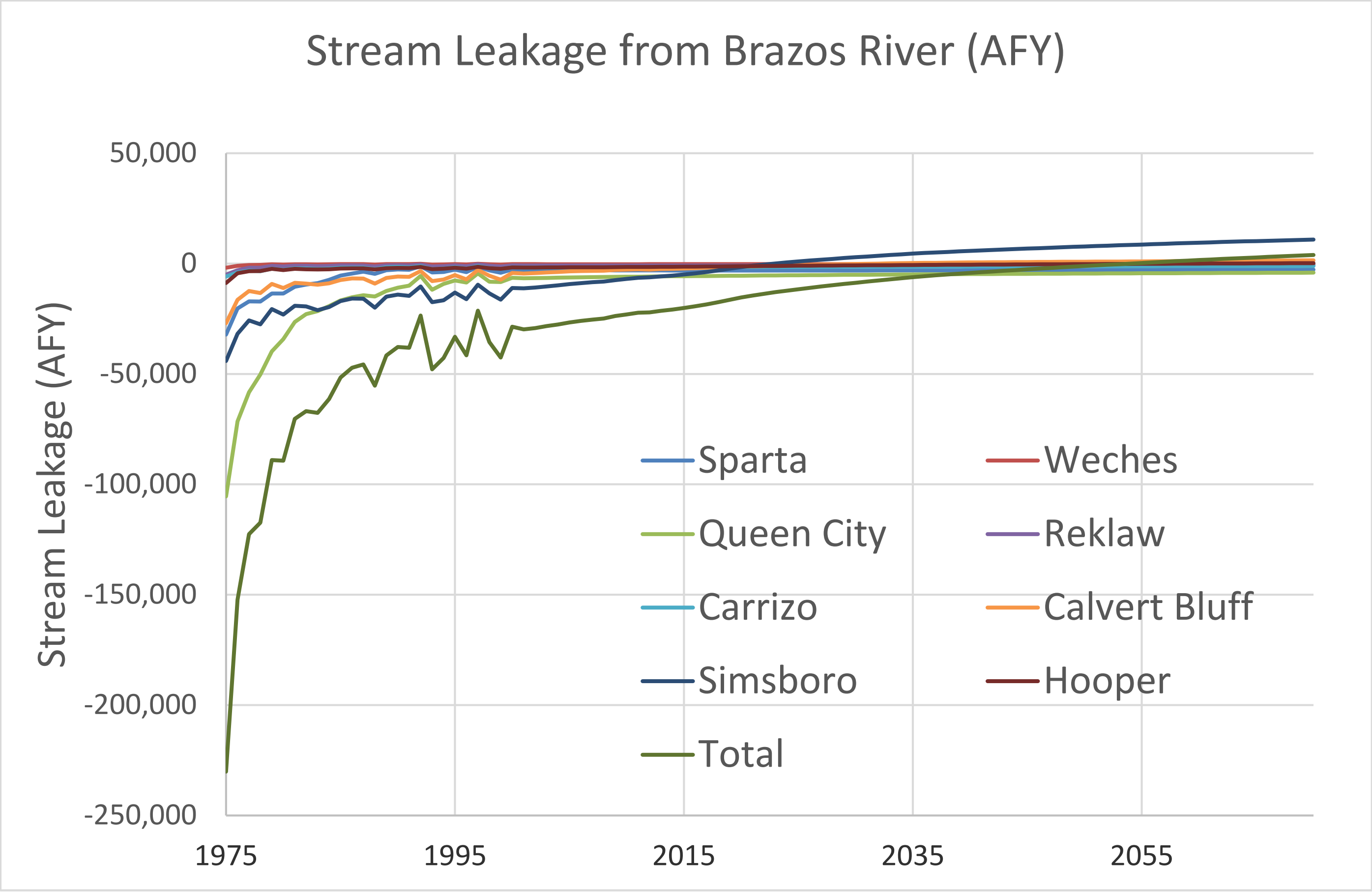
Figure from Kelley and others (2004)

SIMULATED GW/SW EXCHANGE: COLORADO RIVER & TRIBUTARIES



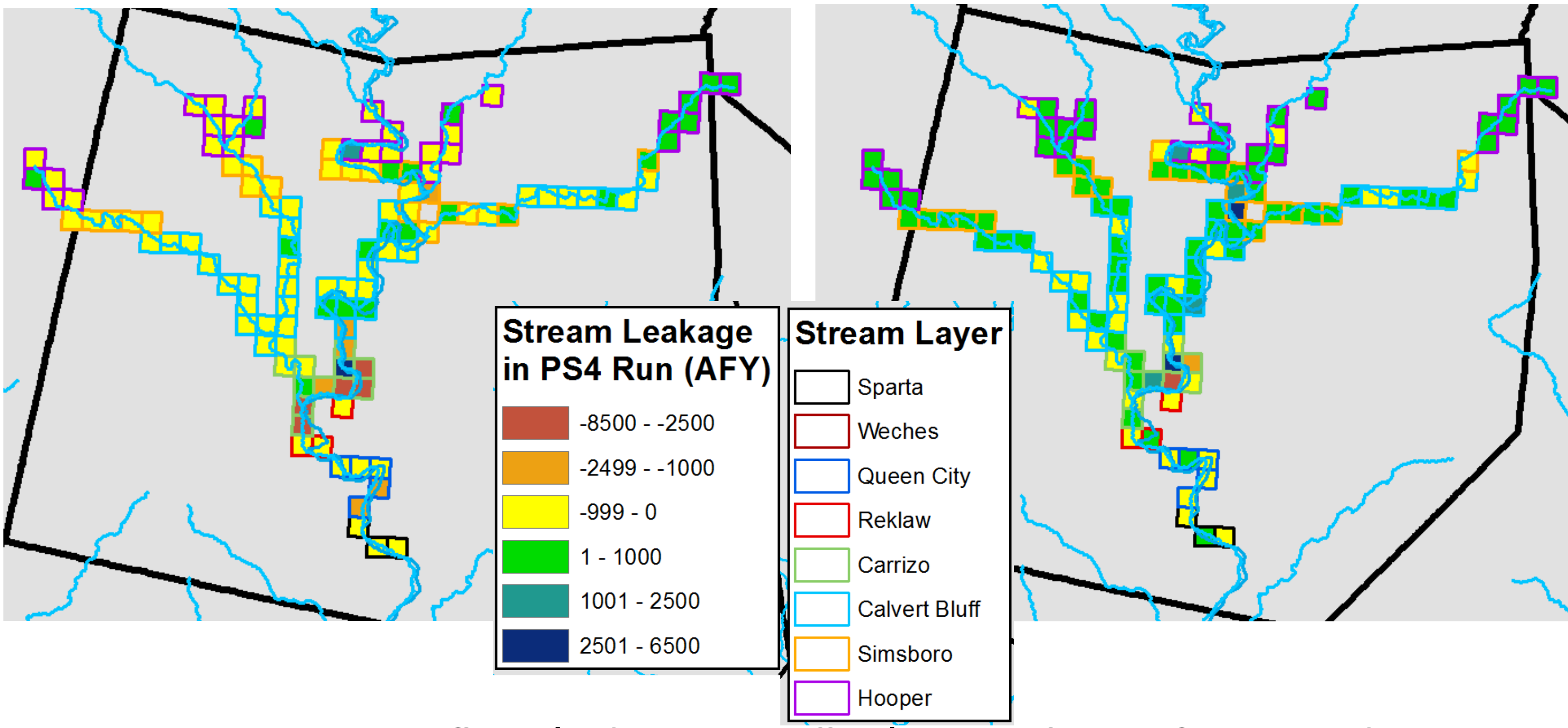
Note: Negative flows means the aquifer is providing groundwater to the stream – so stream is gaining.

SIMULATED GW-SW EXCHANGE: BRAZOS RIVER AND TRIBUTARIES



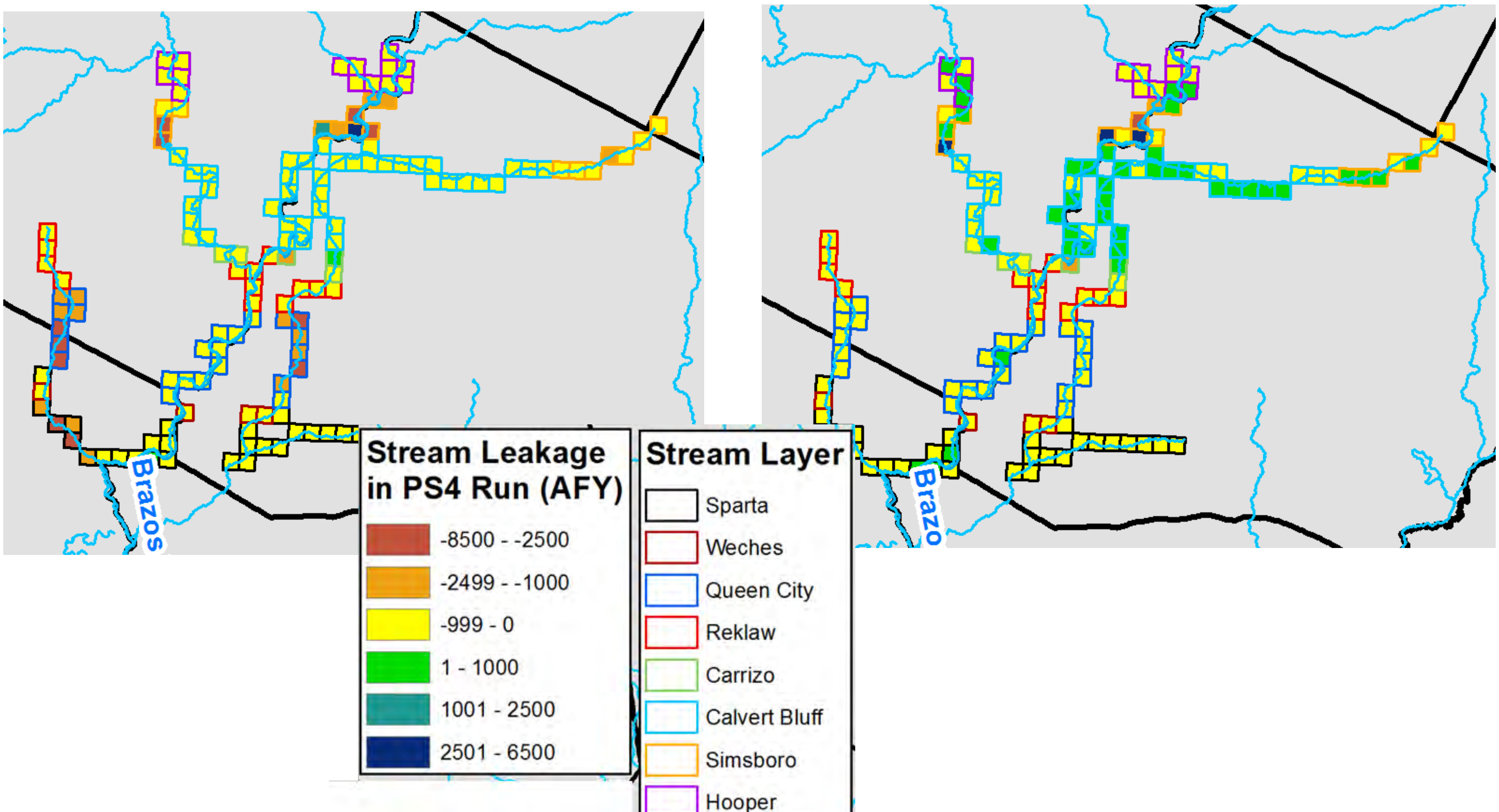
Note: Negative flows means the aquifer is providing groundwater to the stream – so stream is gaining.

LOCATION OF GAINING AND LOSING STREAM CELLS (1980 & 2070) FOR COLORADO RIVER



Note: Negative flows (red, orange, yellow) means the aquifer is providing groundwater to the stream – so stream is gaining. Positive flows (greens and blues) means the aquifer if receiving water from the stream – so stream is losing.

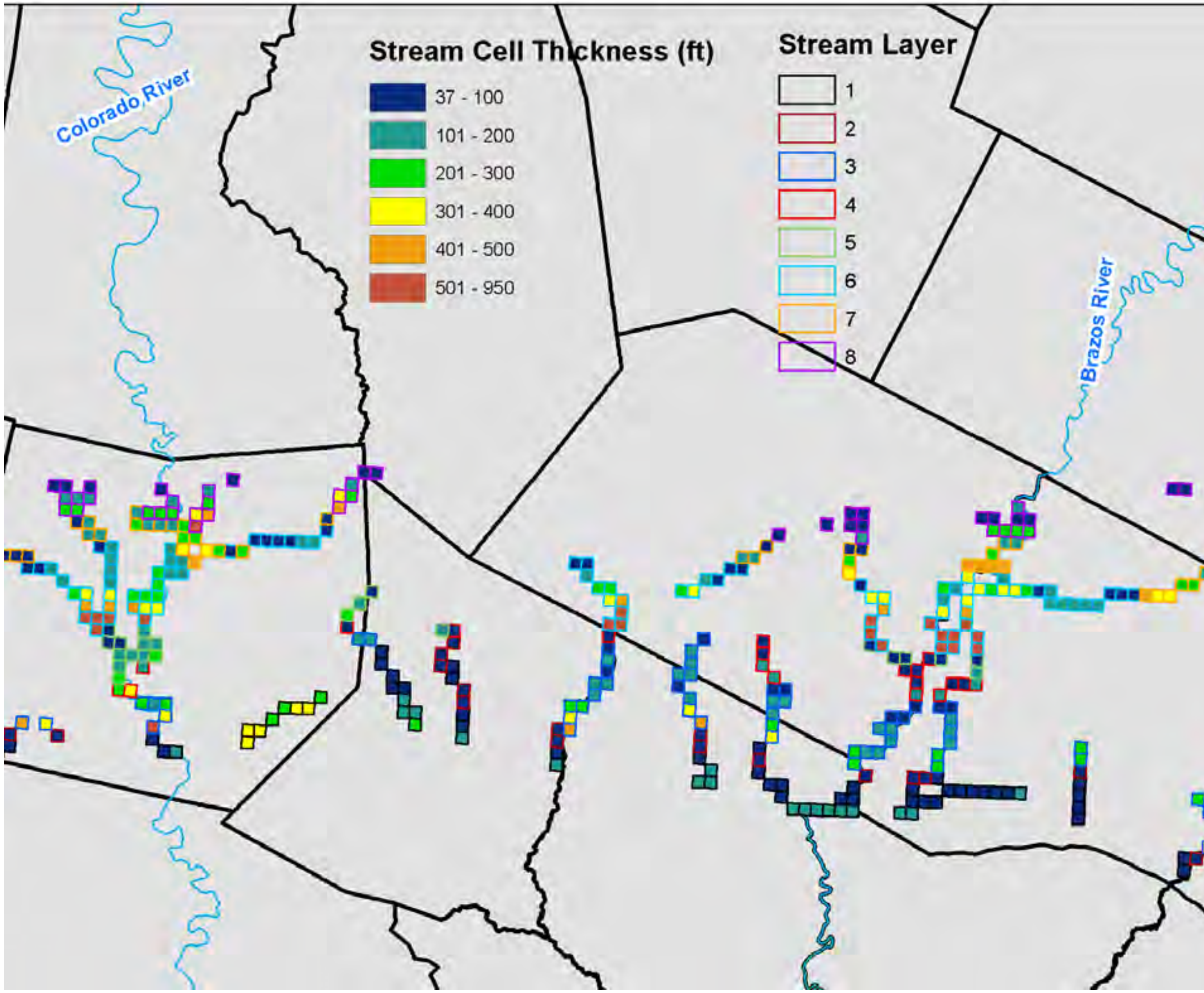
LOCATION OF GAINING AND LOSING STREAM CELLS (1980) FOR BRAZOS RIVER



Note: Negative flows (red, orange, yellow) means the aquifer is providing groundwater to the stream – so stream is gaining. Positive flows (greens and blues) means the aquifer if receiving water from the stream – so stream is losing.

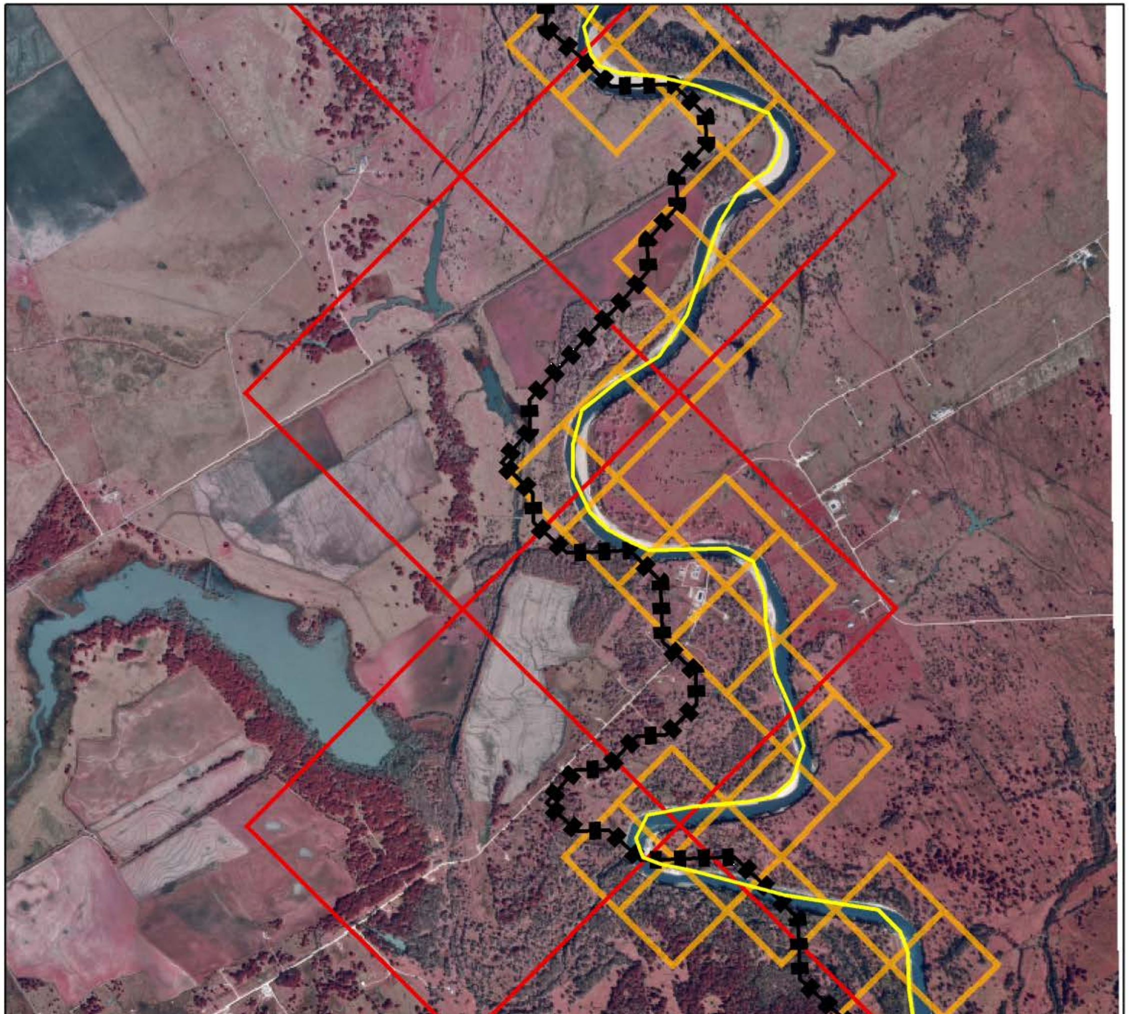
POTENTIAL PROBLEM WITH REPRESENTING GW/SW INTERACTION IS THICKNESS OF GRID CELL

- Numerous grid cells have thicknesses > 200 feet
- Thick grid cells prevents model from simulation shallow groundwater flow zone
- If “deep” pumping occurs in a thick grid cell, river acts as a source of recharge for aquifer
- Because of model grid construction, there is a question if the losses are an artifact of the thick grids



POTENTIAL PROBLEM WITH REPRESENTING GW-SW INTERACTION IS BOTH THICKNESS AND SIZE OF GRID CELL

Example is Lower Colorado River



GAM 1 mile by 1 mile grid

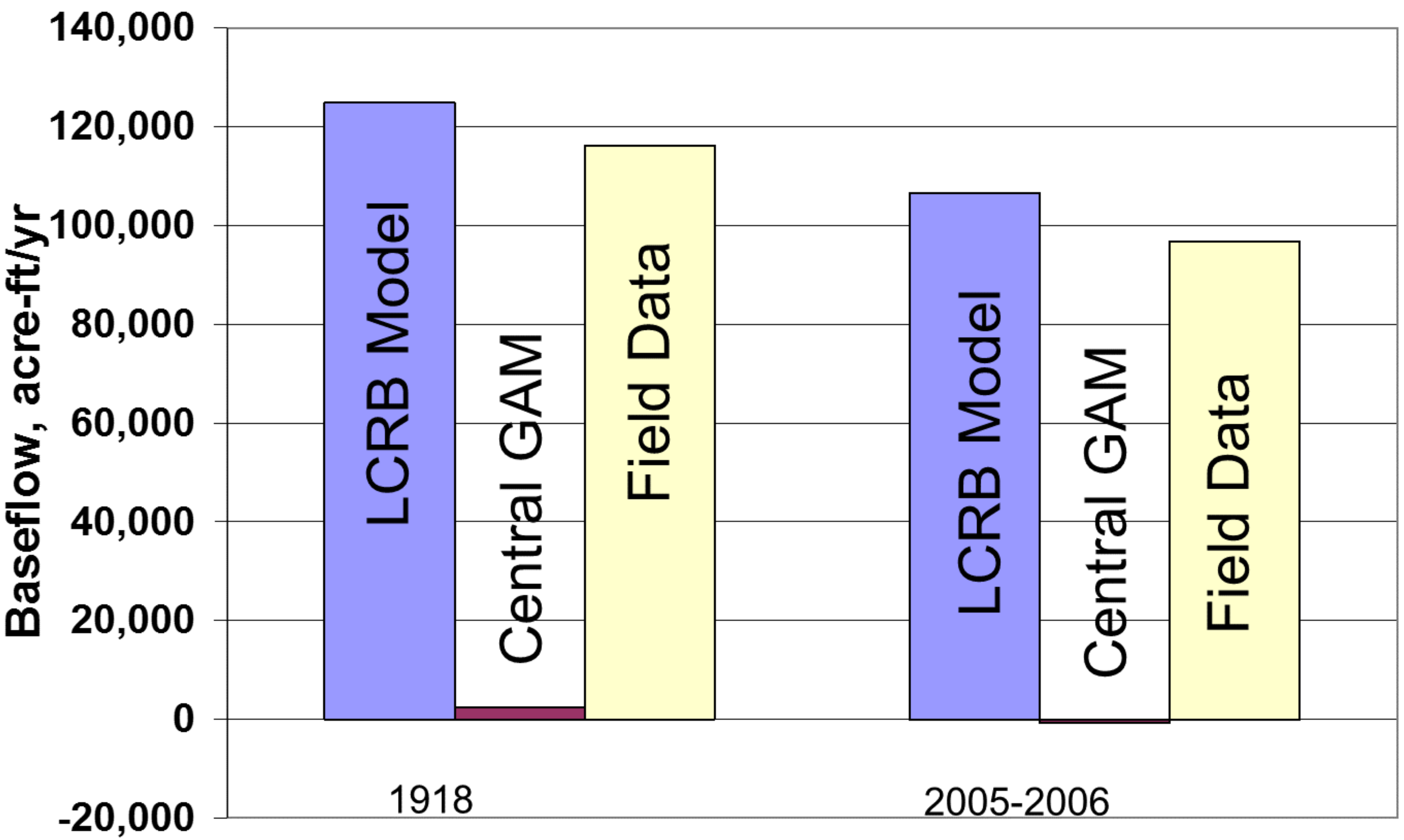
LSWP 0.25 mile by 0.25 mile grid

EPA RF1

National Hydrography Database

Note: Grid size affects the location of river to wells

EXAMPLE OF IMPROVED PREDICTION OF GW/SW INTERACTION BY REFINING GRID CELL SIZES



COMPARISON OF NUMERICAL GRID BETWEEN THE LCRB MODEL AND THE CENTRAL GULF COAST GAM

Chicot Aquifer

- GAM = 1 layer with thickness up to 1000 ft
- LCRB = 4 layers with shallow 50 to 100 ft thick

GAM (1 layer)

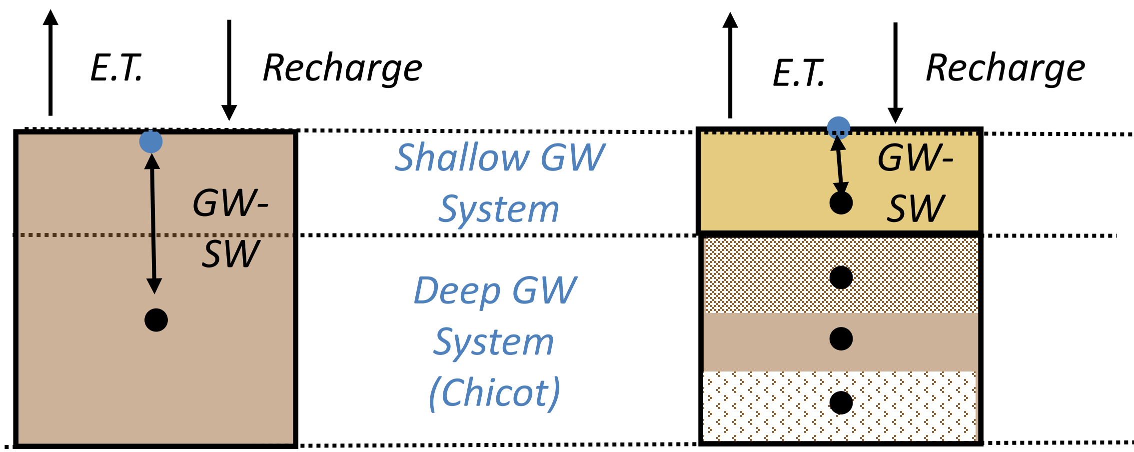
- one hydraulic head value
- all same aquifer property
- all wells intersect the entire layer thickness

LCRB (4 layer)

- four hydraulic head value
- four unit with different aquifer properties
- wells located in 1 to 4 layers

Central Gulf Coast GAM

LCRB Model



One cell total

R, ET, and GW-SW process interact directly with deep system

Four cells total

R, ET, and GW-SW processes interact directly with shallow system

QSCP GW-SW INTERACTIONS: SUMMARY POINTS

- Many grid cells in aquifer outcrop are too thick to represent a shallow flow system accurately
- Modeling in Gulf Coast demonstrates the importance of modeling a shallow groundwater system
- Because of model grid construction, there is a question of what portions of the predicted pumping impacts on river are an artifact of the model construction
- 1-mile by 1-mile grid cell size inhibits accurate assignment of river locations and elevations
- Little data for representative estimates of GW/SW exchange to help model development
- Large flow (~250,000 AFY) in 1975 from aquifers into rivers raises a few questions

SPARTA/QUEEN CITY/CARRIZO-WILCOX GAM SIMULATED SPRING FLOW

- Representation of Springs
- Simulated Spring Flow
- Summary Points

REPRESENTATION OF SPRINGS AWAY FROM STREAMS

MODFLOW Drain Package

- Located only in aquifer outcrops
- Assigned an elevation based on topographic low
- Spring flow based on difference between aquifer and drain elevation

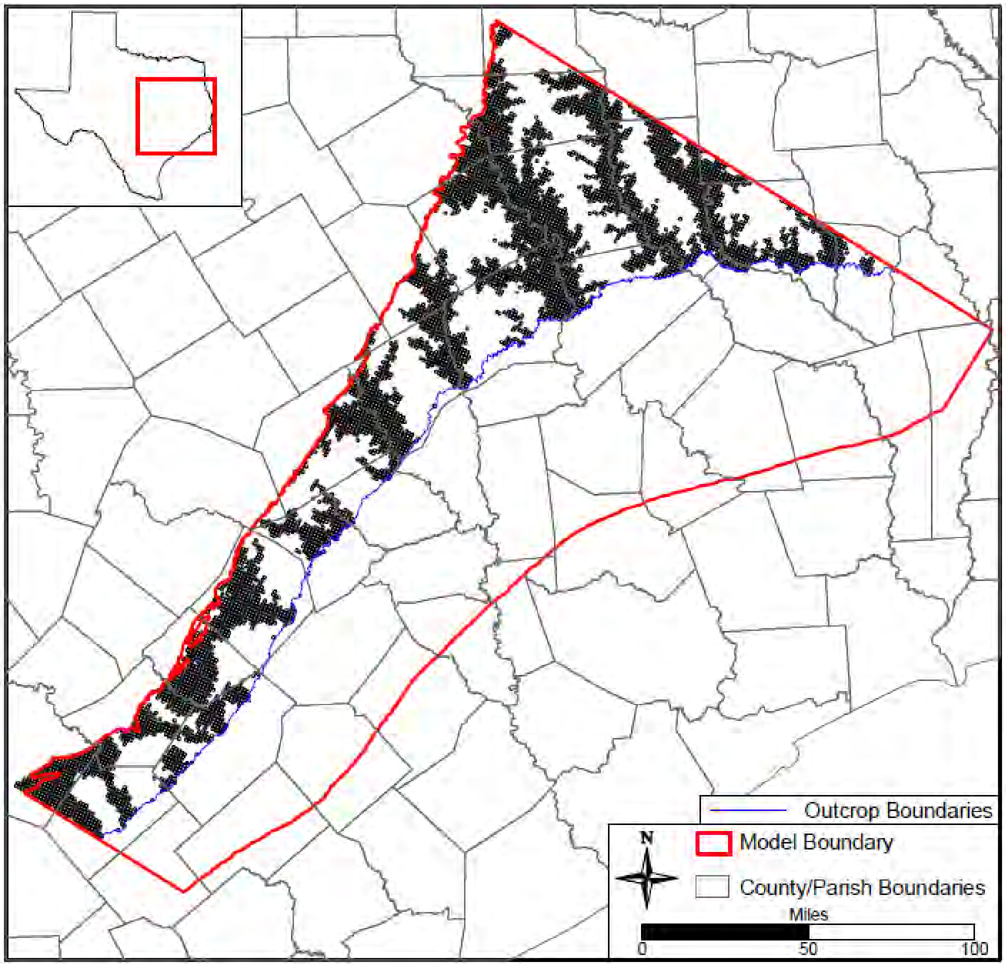
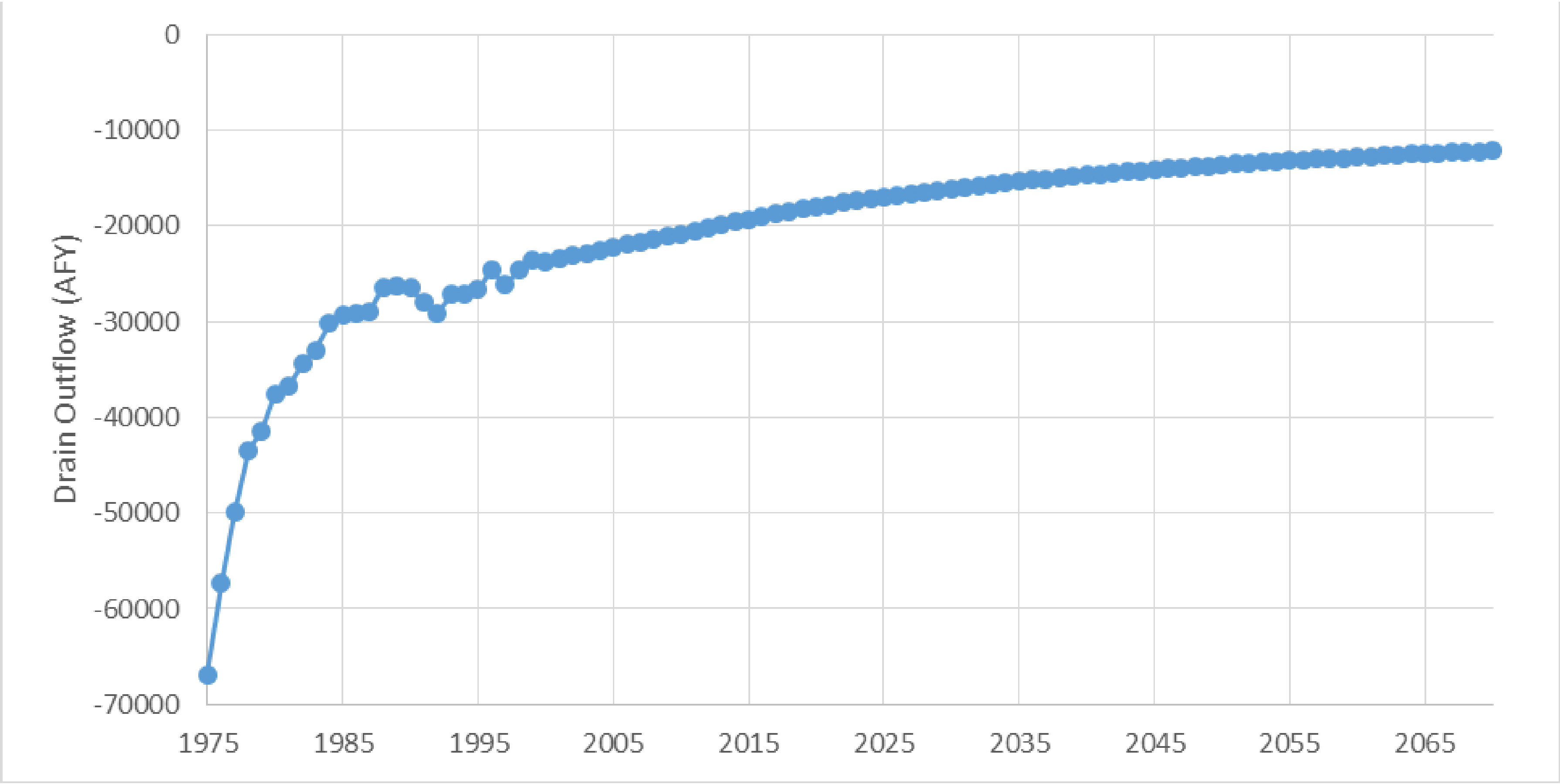


Figure from Kelley and others (2004)

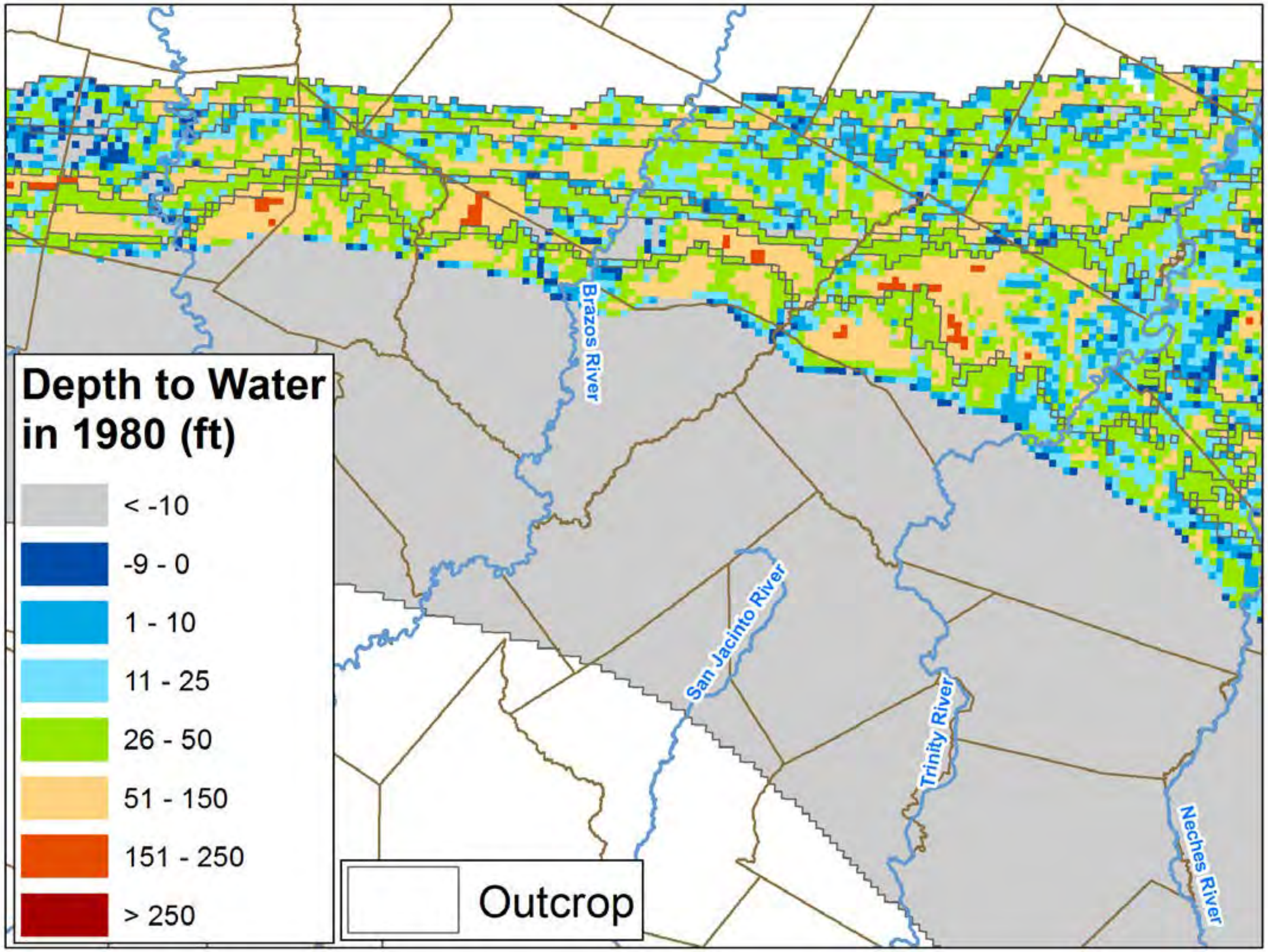
SIMULATED GROUNDWATER FLOW FROM DRAINS



Drain flow represents about 0.3% of water balance for GMA 12

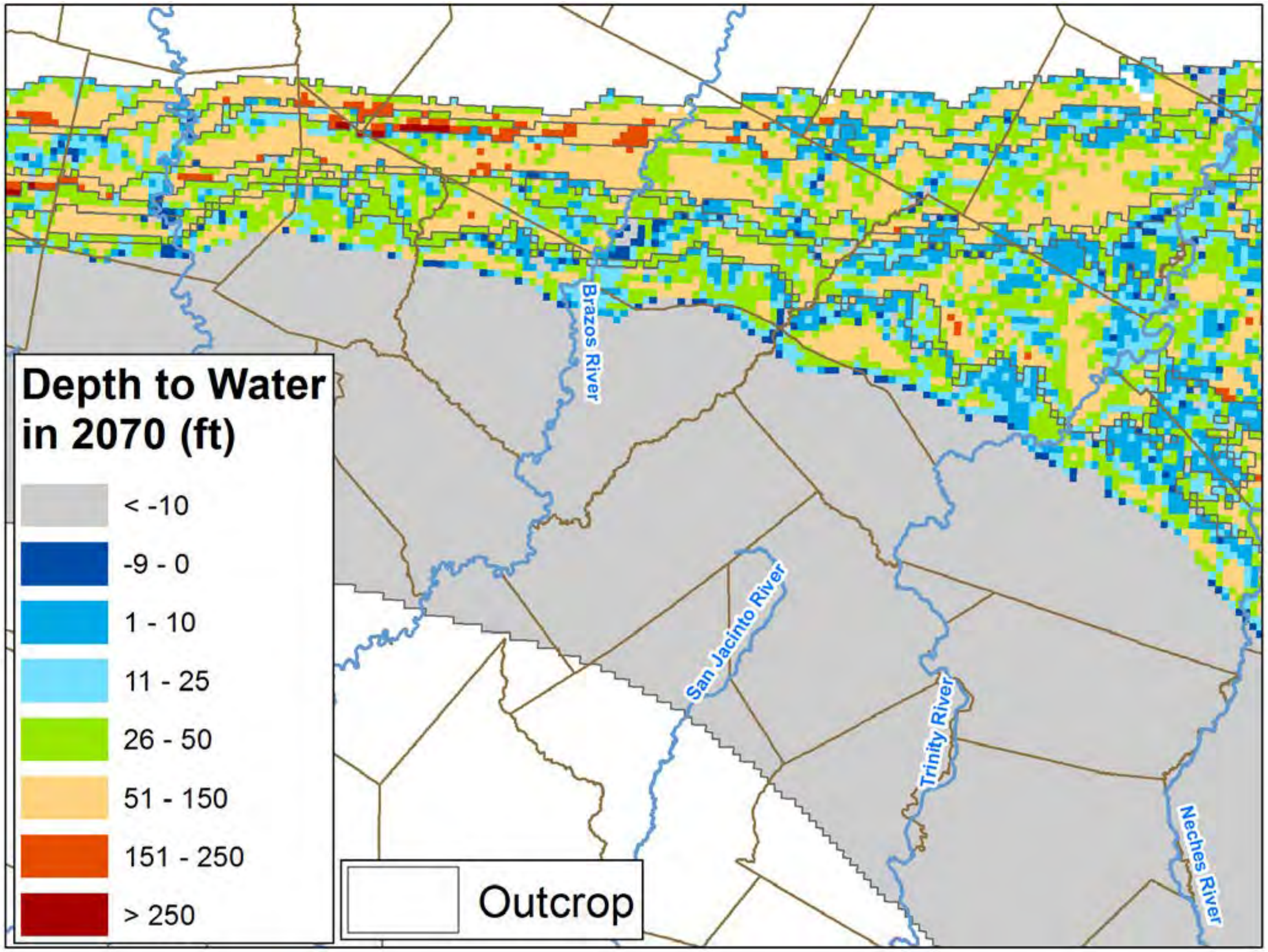
Assumed that all drains represent springs. Modelers may have used drains to limit recharge rates.

SIMULATED DEPTH TO WATER TABLE IN THE AQUIFER OUTCROP (1980)



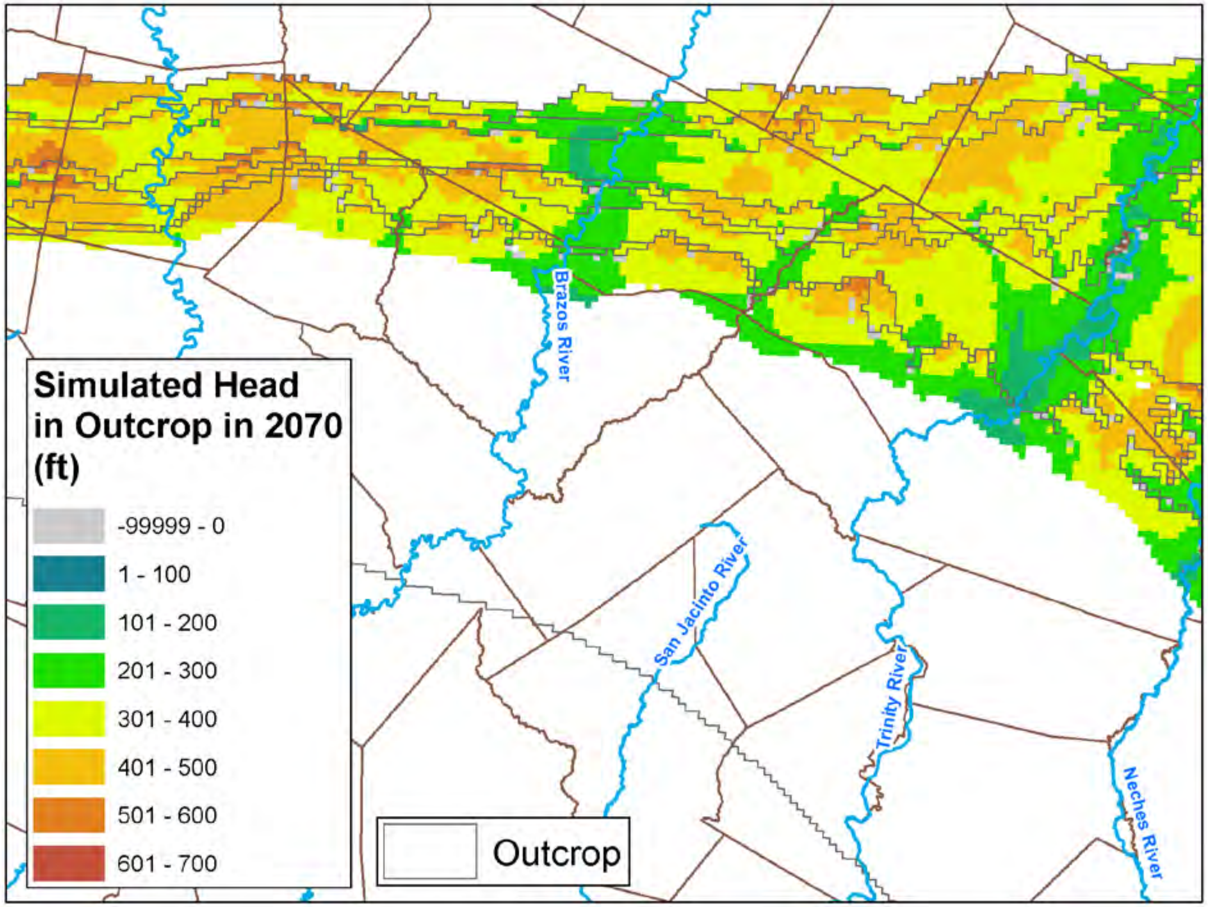
Note: In down-dip reaches of some of the aquifer outcrops, the depth to the water table exceeds 150 feet in 1980

SIMULATED DEPTH TO WATER TABLE IN THE AQUIFER OUTCROP (2070)



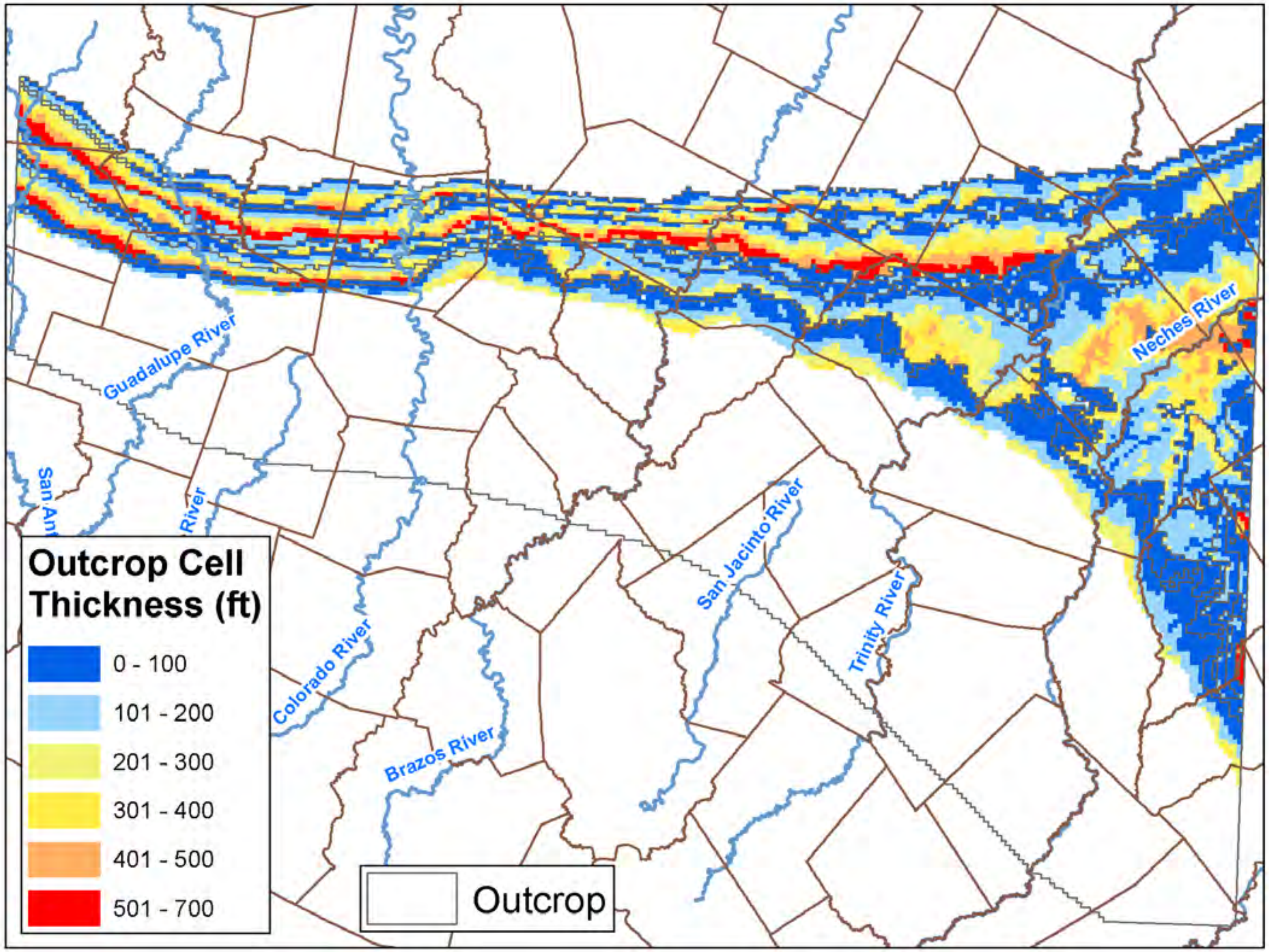
Note: In down-dip reaches of much of the Simsboro outcrop, the depth to the water table exceeds 150 feet in 2070

SIMULATED WATER TABLE (FT, MSL) IN THE AQUIFER OUTCROP (2070)



Note: In the aquifer outcrop, there is strong correlation between the model layering and outcrop location and the water table elevation

THICKNESS OF GRID CELL REPRESENTING OUTCROP AND WATER LEVEL ELEVATION



QSCP SPRING FLOW: SUMMARY POINTS

- Spring flow is estimated to be about 70,000 AFY in 1975 and 20,000 AFY in 2010
- Future pumping in PS4 run will reduce spring flow to 12,000 AFY in 2010
- No springs identified in GMA 12 that are tied to endangered species
- Many grid cells in the aquifer outcrop are too thick to represent a shallow flow system
- Thick grid cells in the aquifer outcrop area have the potential to cause spring flow to be under predicted where pumping occurs near the spring
- There is insufficient field data to evaluate the accuracy of the GAM to predict the impact of pumping of spring flow

SUMMARY OF KEY ENVIRONMENTAL ISSUES

SUMMARY OF KEY ENVIRONMENTAL ISSUES

- Spring Flow and GW-Stream Exchange are potentially important environmental issues
- Accurate prediction of pumping impacts on spring flow and river flow requires accurate predictions of a shallow groundwater system, including a water table
- The QSCP GAM is not a good simulator of water tables or shallow groundwater flow systems because of thick grid cells in the aquifer outcrop

SUMMARY OF KEY ENVIRONMENTAL ISSUES

- Collection of representative stream gain-loss data is expensive. Very limited good gain-loss data exists in GMA 12
- Brazos River gain-loss study should be used with caution because it has not been properly adjusted for return flow, diversions, and unsteady flow effects
- LCRA gain-loss study should also be used with care because it was measured during low flow conditions and it not likely representative of other flow conditions

SUMMARY OF KEY ENVIRONMENTAL ISSUES

- TCEQ Environmental Instream Flow program is set up to protect the health of the Colorado and Brazos Rivers
- River authorities are currently managing in-stream flows in Colorado and Brazos rivers
- Groundwater flow into streams can be an important contributor for helping river authorities maintain critical or subsistence flows
- Springs' flows are poorly documented; no substantial flow measurements done since 1970s


Consultants for the
Brazos Valley GCD (LBG-Guyton Associates)
Fayette County GCD (Daniel B. Stephens & Associates)
Lost Pines GCD (Daniel B. Stephens & Associates)
Mid-East Texas GCD (Matt Uliana, independent consultant)
Post Oak Savannah GCD (INTERA, Inc.)

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APPENDIX P

AUGUST 13, 2015 PRESENTATION “GMA 12 SOCIOECONOMIC IMPACTS CONSIDERATIONS”

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GMA12 SOCIOECONOMIC IMPACTS CONSIDERATIONS

Presented
by

GMA 12 Consultant Team

August 13, 2015

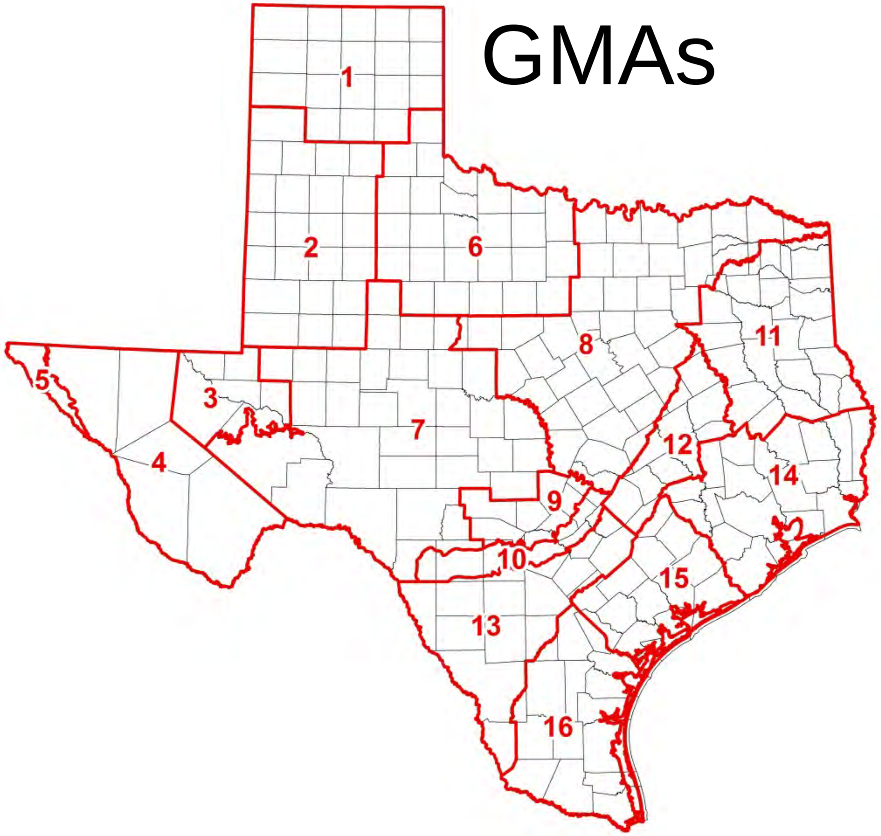
TWC Section 36.108 (d)

- Before voting on proposed desired future conditions . . . the district shall consider:
  - Aquifer uses and conditions
  - Needs and strategies
  - Hydrogeologic conditions
  - Environmental impacts
  - Subsidence
  - **Socioeconomic impacts**
  - Private Property rights
  - Feasibility
  - Anything else

Today’s Consideration

- TWC Section 36.108 (d) (6) – socioeconomic impacts reasonably expected to occur

GMAs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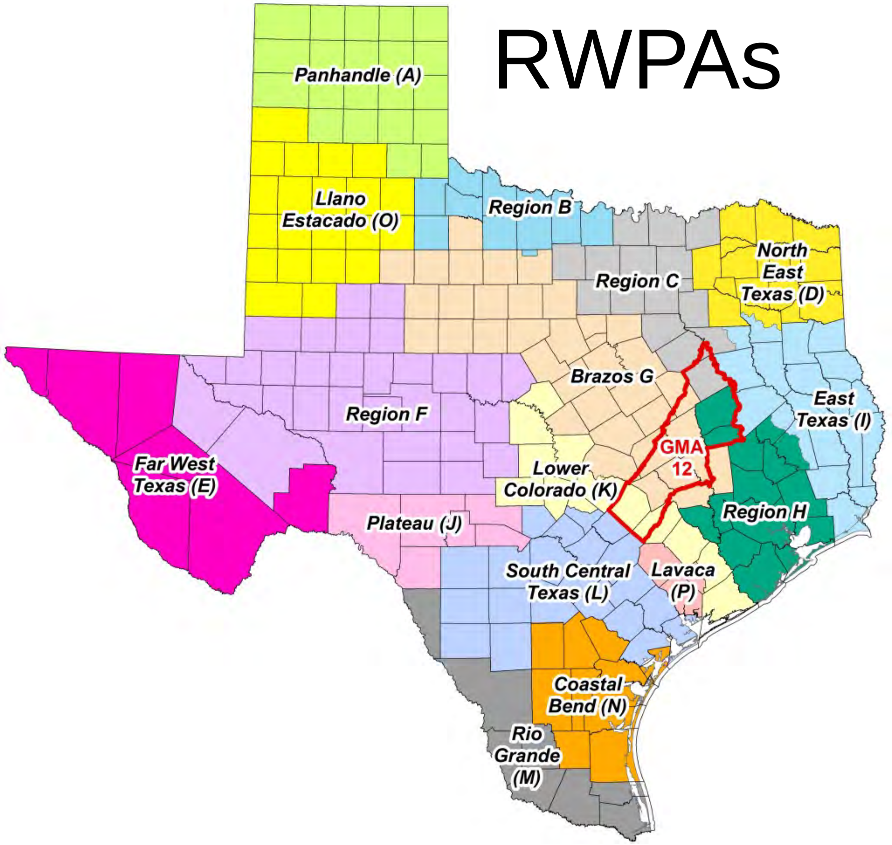
RWPAs


Panhandle (A)
Llano Estacado (O)
Region B
Region C
North East Texas (D)
Brazos G
East Texas (I)
Region F
Far West Texas (E)
GMA 12
Lower Colorado (K)
Region H
Plateau (J)
South Central Texas (L)
Lavaca (P)
Coastal Bend (N)
Rio Grande (M)

Socioeconomic Impacts and Water Planning in Texas – A Brief History

- Texas Water Code Chapter 16.051 (a) the board shall prepare, develop, formulate, and adopt a comprehensive state water plan that …shall provide for…further economic development (companion provision in TWC Chapter 16.053 (a, b) for regional water plans).
- Texas Administrative Code (TAC), Title 31, Chapter 357.7 (4)(A) states, *"The executive administrator shall provide available technical assistance to the regional water planning groups, upon request, on water supply and demand analysis, including methods to evaluate the social and economic impacts of not meeting needs."*

Socioeconomic Impacts and Water Planning in Texas – A Brief History (cont.)

- TAC, Title 31, Chapter 357.40 (a) RWPs shall include a quantitate description of the socioeconomic impacts of not meeting the identified water needs pursuant to §357.33 (c) of this title (relating to Needs Analysis: Comparison of Water Supplies and Demands).

Socioeconomic Impacts Analysis

- Executed by TWDB at request of RWPGs
- Uses water supply needs from Regional Water Plan
- Analysis attempts to measure the impacts in the event that water user groups do not meet their identified water supply needs associated with normal and drought conditions
- Multiple impacts examined
  - Sales, income and tax revenue
  - Jobs
  - Population
  - School enrollment
- Results of analysis are incorporated into final Regional Water Plan

Socioeconomic impact of not meeting water supply needs vs. impact of proposed desired future conditions

- Regional Water Planning (from TWDB)
  - Generate Input-Output Models combined with Social Accounting Models (IO/SAM) and develop economic baselines. Utilizes IMPLAN (Impact for Planning Analysis) software.
    - Economic baseline developed for counties, planning regions, and the state based on variables for 528 economic sectors as follows:

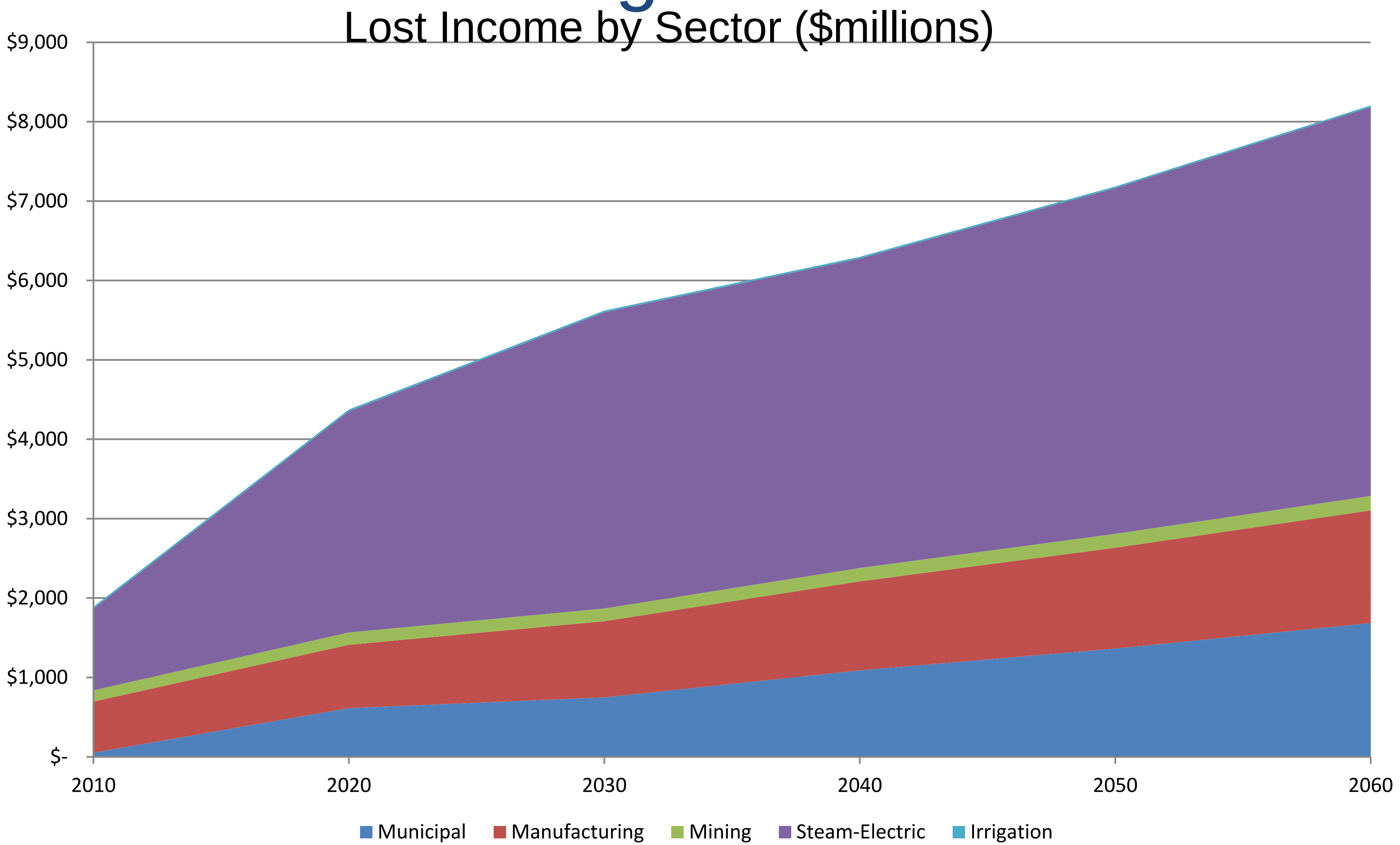
Socioeconomic impact of not meeting water supply needs vs. impact of proposed desired future conditions

- Output – total production of goods and services measured by gross sales revenues
- Final sales – sales to end user in Texas (a region) and exports out of region
- Employment – number of full and part-time jobs required by a given industry
- Regional income – total payroll cost paid by industries, corporate income, rental income, and interest payments
- Business taxes – sales, excise, fees, licenses and other taxes paid during normal operations

Socioeconomic impact of not meeting water supply needs vs. impact of proposed desired future conditions

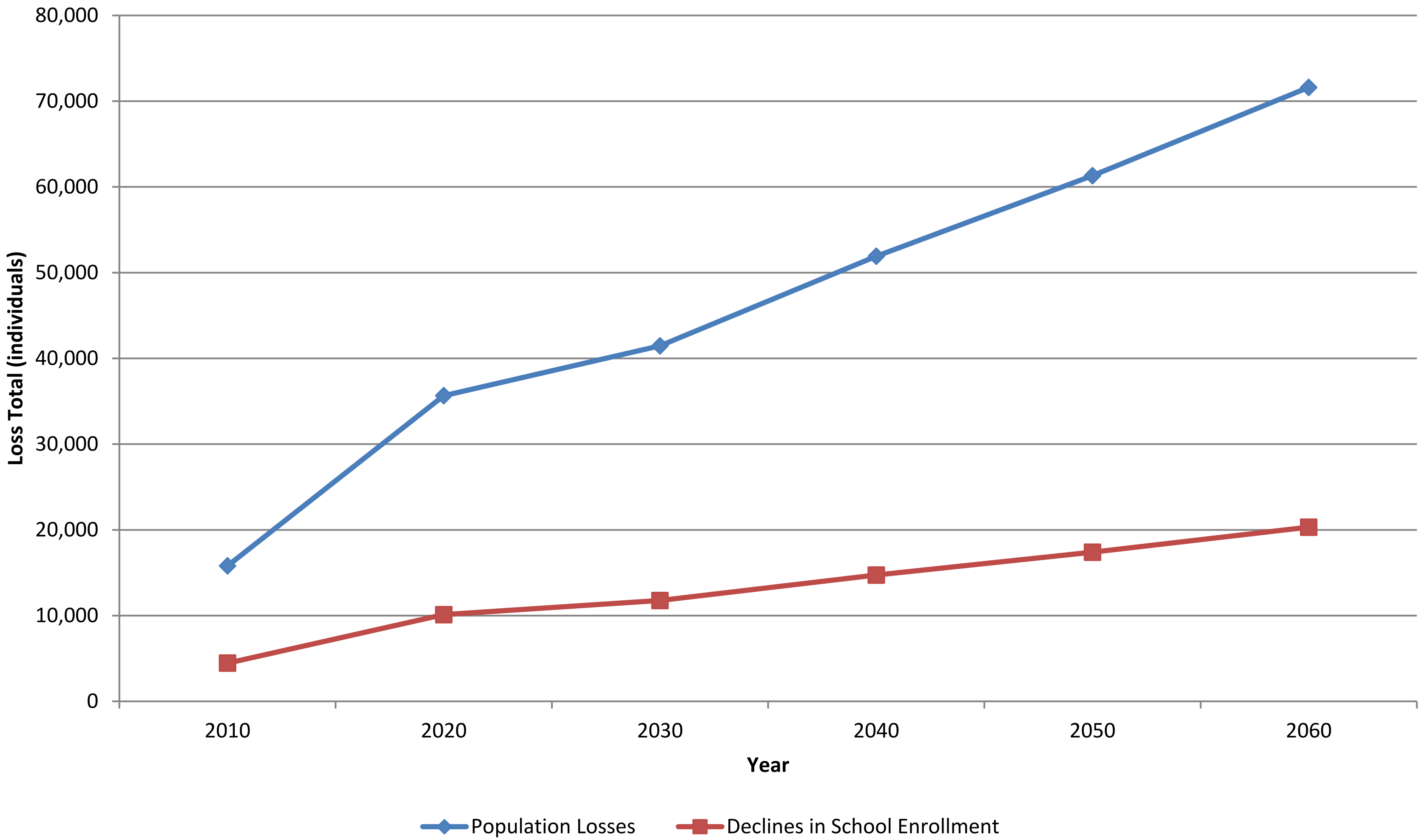
- Regional Water Planning (from TWDB – cont.)
  - Estimate direct and indirect impacts to business, industry and agriculture
  - Impact associated with domestic water usage
- While useful for planning purposes, socioeconomic impacts developed for regional water planning do not represent a benefit-cost analysis
- Analysis is executed for water user groups with needs for additional water supply.

Socioeconomic Impacts Analysis – 2011 Brazos G Regional Water Plan



For full analysis, see TWDB correspondence to Dale Spurgin from Stuart Norvell dated May 17, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Brazos G Regional Water Plan."

Social Impacts of Water Shortages in Region G



For full analysis, see TWDB correspondence to Dale Spurgin from Stuart Norvell dated May 17, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Brazos G Regional Water Plan."

Examples of Impacts by County for the Brazos G Regional Water Planning Area

BRAZOS COUNTY ($millions)	2010	2020	2030	2040	2050	2060
Bryan						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.26
Lost utility revenues	$0.00	$0.00	$0.00	$0.00	$0.00	$0.62
College Station						
Monetary value of domestic water shortages	$0.00	$0.00	$0.06	$2.18	$5.41	$7.24
Lost utility revenues	$0.00	$0.00	$0.13	$4.22	$9.35	$11.15
Wickson Creek SUD						
Monetary value of domestic water shortages	$0.04	$2.05	$4.26	$12.26	$16.05	$20.69
Lost income from reduced commercial business activity	$0.00	$0.00	$0.00	$2.14	$3.17	$3.57
Lost jobs due to reduced commercial business activity	0	0	0	67	100	113
Lost state and local taxes from reduced commercial business activity	$0.00	$1.00	$0.00	$0.30	$0.45	$0.51
Lost utility revenues	$0.06	$0.70	$1.20	$1.64	$2.20	$2.39

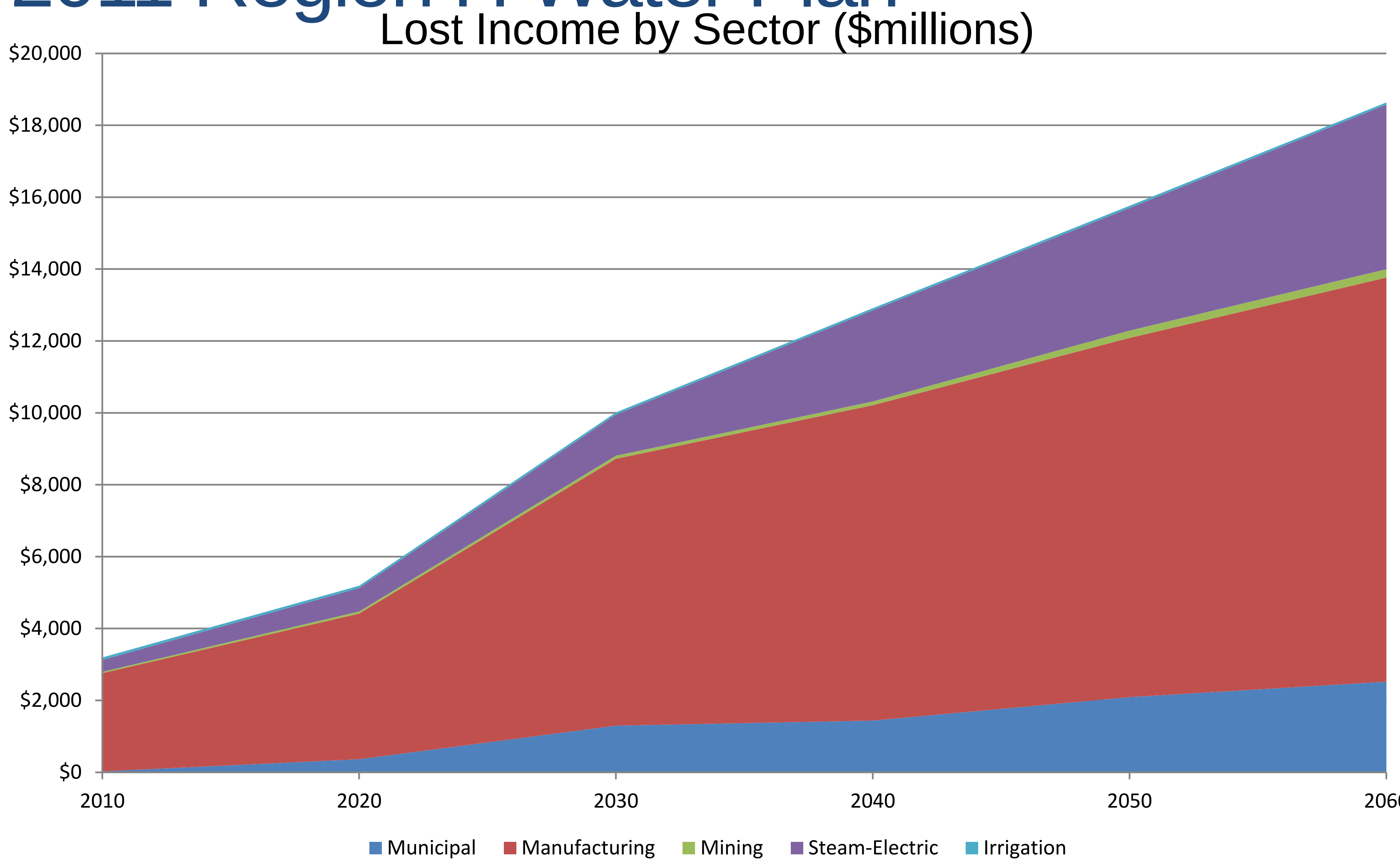
For full analysis, see TWDB correspondence to Dale Spurgin from Stuart Norvell dated May 17, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Brazos G Regional Water Plan."

Examples of Impacts by County for the Brazos G Regional Water Planning Area (cont.)

MILAM COUNTY ($millions)	2010	2020	2030	2040	2050	2060
Bell Milam Falls WSC						
Monetary value of domestic water shortages	$0.02	$0.08	$0.17	$0.27	$1.06	$1.42
Lost utility revenues	$0.01	$0.10	$0.15	$0.19	$0.20	$0.22
Southwest Milam WSC						
Monetary value of domestic water shortages	$0.17	$0.55	$0.83	$0.93	$0.99	$4.19
Lost utility revenues	$0.28	$0.61	$0.81	$0.91	$0.96	$1.01
Steam-electric						
Lost income due to reduced electrical generation	$0.00	$0.00	$0.00	$0.00	$18.36	$18.36
Lost state and local business tax revenues due to reduced electrical generation	$0.00	$0.00	$0.00	$0.00	$2.63	$2.63
Lost jobs due to reduced electrical generation	0	0	0	0	62	62

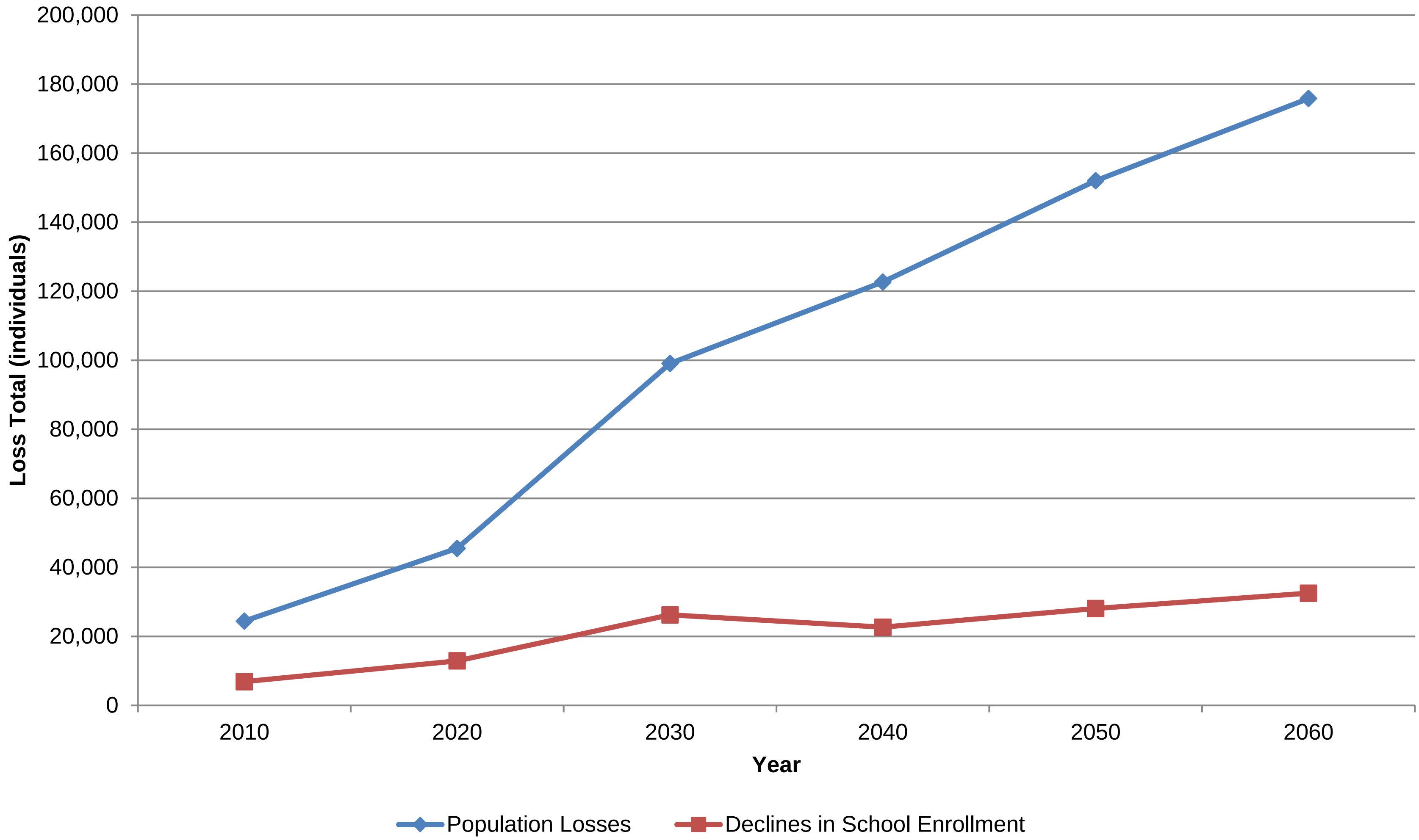
For full analysis, see TWDB correspondence to Dale Spurgin from Stuart Norvell dated May 17, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Brazos G Regional Water Plan."

Socioeconomic Impacts Analysis – 2011 Region H Water Plan



For full analysis, see TWDB correspondence to the Honorable Mark Evans from Stuart Norvell dated May 19, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Region H Regional Water Plan."

Social Impacts of Water Shortages in Region H



For full analysis, see TWDB correspondence to the Honorable Mark Evans from Stuart Norvell dated May 19, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Region H Regional Water Plan."

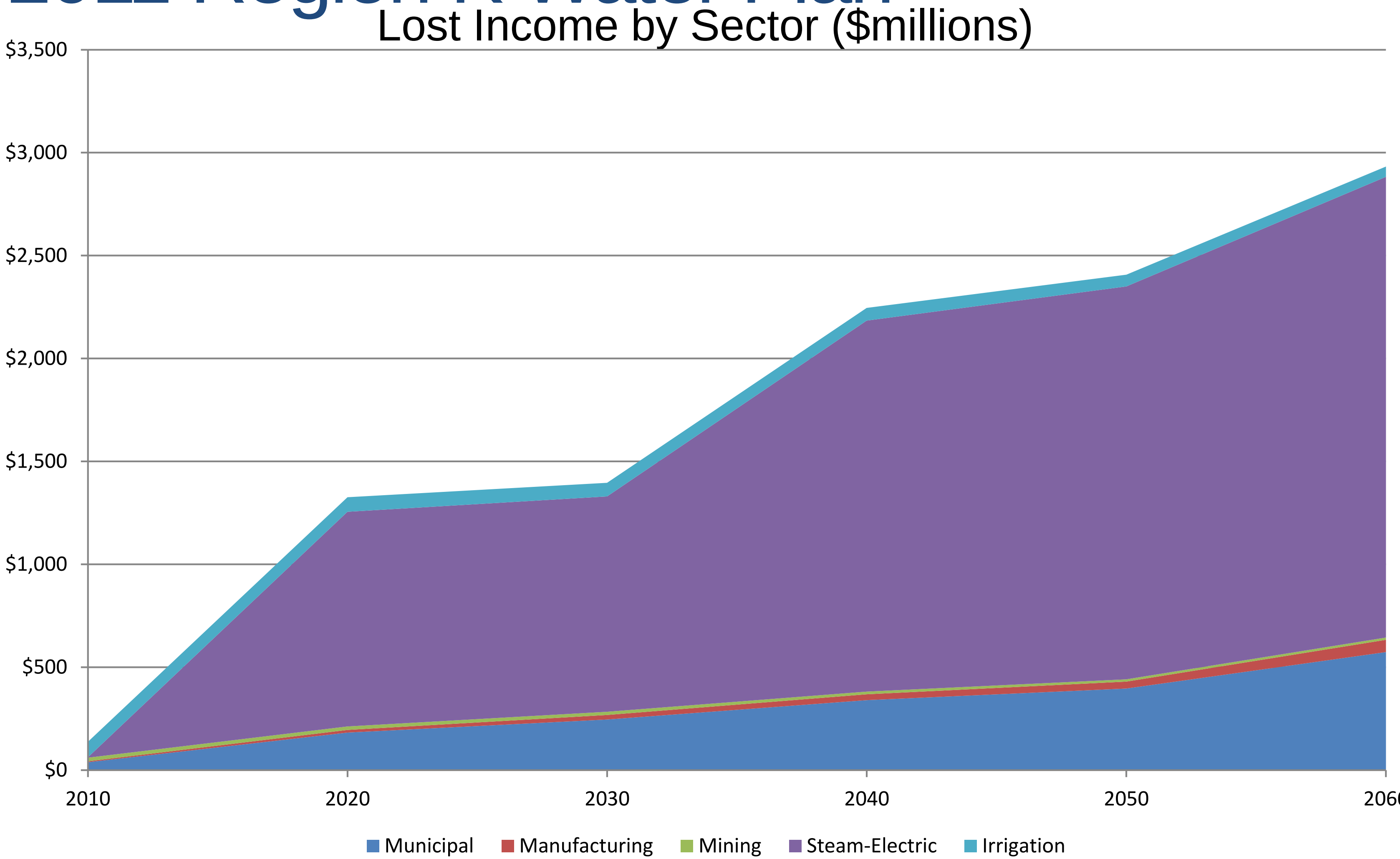
Examples of Impacts of Water Shortages in Municipal and Manufacturing Sectors in Region H

MUNICIPAL	2010	2020	2030	2040	2050	2060
Leon County						
Monetary value of domestic water shortages	$0.00	$0.06	$0.07	$0.03	$0.01	$0.02
Madison County						
Monetary value of domestic water shortages	$0.00	$0.06	$0.12	$0.08	$0.11	$0.21

MANUFACTURING	2010	2020	2030	2040	2050	2060
Leon County						
Reduced income from reduced manufacturing output	$0.00	$10.18	$20.12	$60.27	$78.40	$95.25
Reduced business taxes from reduced manufacturing output	$0.00	$0.62	$1.22	$3.66	$4.76	$5.78
Reduced jobs from reduced manufacturing output	0	51	101	304	395	480
Madison County						
Reduced income from reduced manufacturing activity	$0.00	$0.52	$1.00	$1.48	$1.91	$4.93
Reduced business taxes from reduced manufacturing activity	$0.00	$0.02	$0.04	$0.07	$0.09	$0.22
Reduced jobs from reduced manufacturing activity	0	6	12	18	23	59

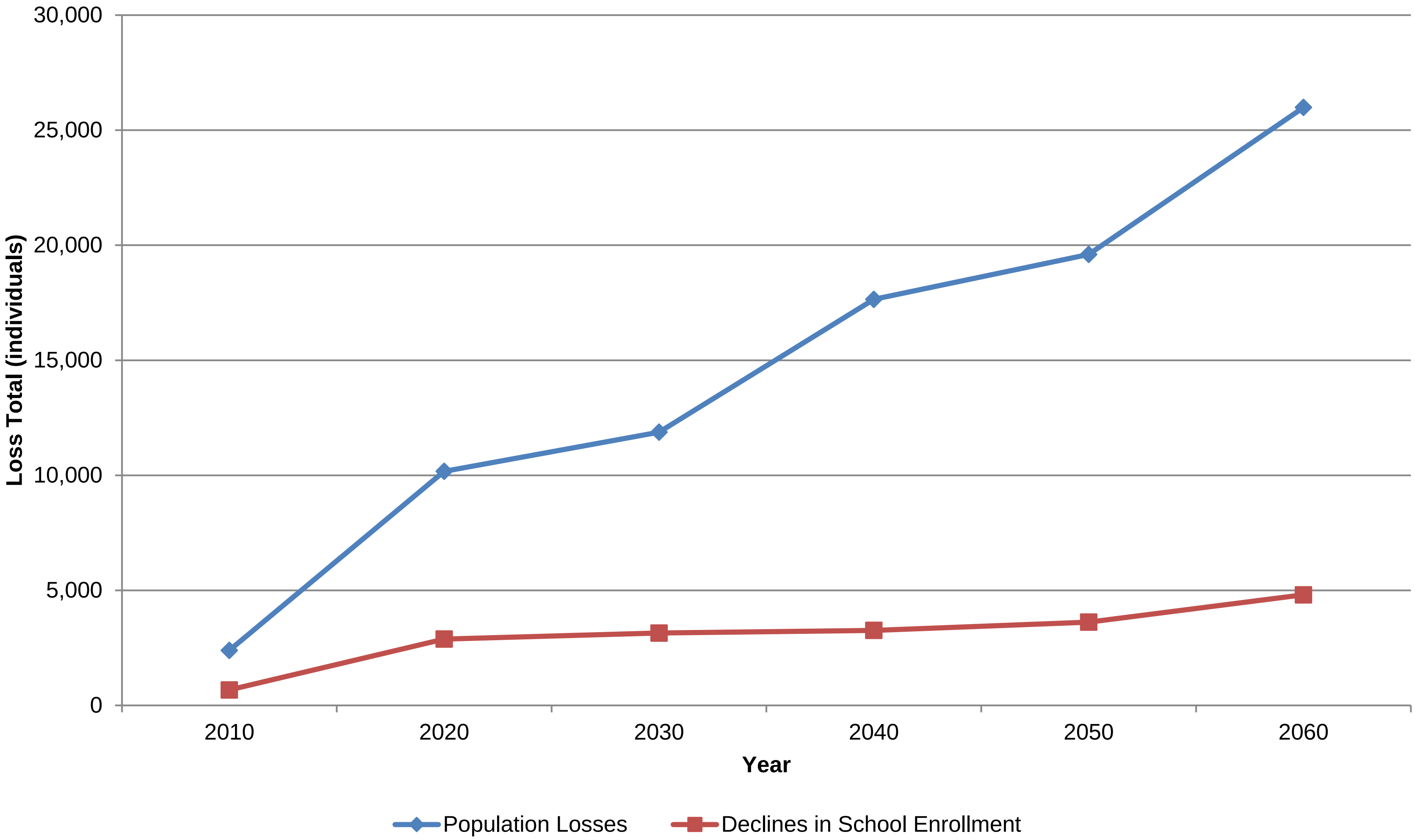
For full analysis, see TWDB correspondence to the Honorable Mark Evans from Stuart Norvell dated May 19, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Region H Regional Water Plan."

Socioeconomic Impacts Analysis – 2011 Region K Water Plan



For full analysis, see TWDB report by Stuart Novell dated May 2010, titled "Socioeconomic Impacts of Projected Water Shortages for the Lower Colorado Regional Water Planning Area (Region K)".

Social Impacts of Water Shortages in Region K



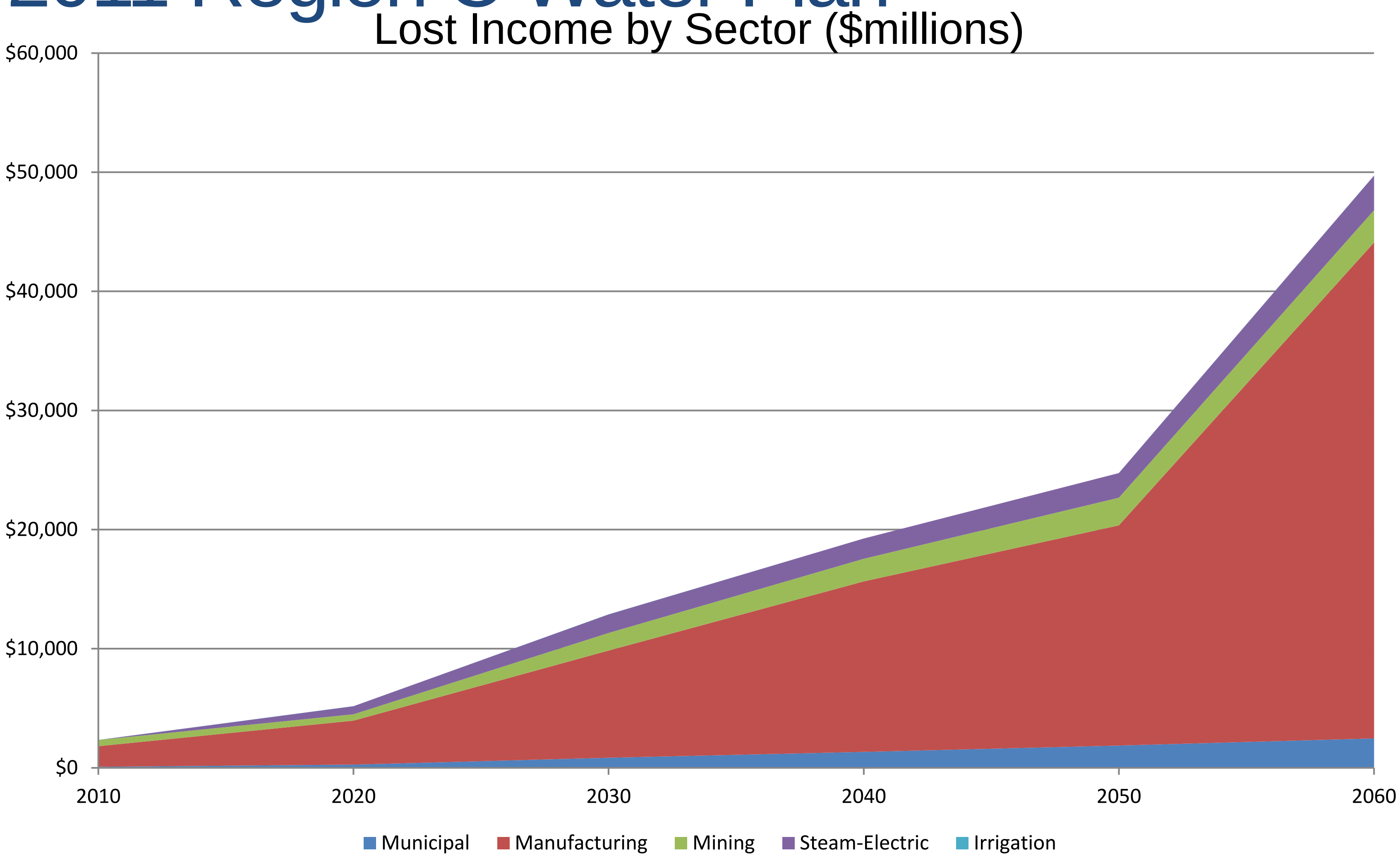
For full analysis, see TWDB report by Stuart Novell dated May 2010, titled "Socioeconomic Impacts of Projected Water Shortages for the Lower Colorado Regional Water Planning Area (Region K)".

Examples of Economic Impacts of Reduced Municipal Supply in Region K

($millions)	2010	2020	2030	2040	2050	2060
Aqua WSC						
Monetary value of domestic water shortages	$0.00	$0.00	$0.62	$26.11	$75.35	$142.24
Lost income from reduced commerical business activity	$0.00	$0.00	$0.00	$0.00	$0.00	$52.86
Lost jobs due to reduced commericial business activity	0	0	0	0	0	1176
Lost state and local taxes from reduced commercial business activity	$0.00	$0.00	$0.00	$0.00	$0.00	$5.63
Lost utility revenues	$0.00	$0.00	$1.10	$6.79	$11.39	$17.24
Austin						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$27.42	$69.83
Lost utility revenues	$0.00	$0.00	$0.00	$0.00	$46.14	$95.28
Barton Creek West						
Monetary value of domestic water shortages	$0.07	$0.07	$0.06	$0.05	$0.05	$0.05
Lost utility revenues	$0.10	$0.10	$0.09	$0.09	$0.09	$0.09
Bastrop						
Monetary value of domestic water shortages	$0.08	$0.50	$3.04	$4.26	$7.73	$13.76
Lost income from reduced commerical business activity	$0.00	$0.00	$0.00	$16.21	$24.16	$68.28
Lost jobs due to reduced commericial business activity	0	0	0	361	537	1519
Lost state and local taxes from reduced commercial business activity	$0.00	$0.00	$0.00	$1.72	$2.57	$7.27
Lost utility revenues	$0.12	$1.49	$2.81	$4.74	$6.33	$8.32
Bastrop County WCID #2						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.18
Lost utility revenues	$0.00	$0.00	$0.00	$0.00	$0.00	$0.29
Bee Cave Village						
Monetary value of domestic water shortages	$19.27	$24.02	$28.74	$32.96	$36.04	$39.16
Lost income from reduced commerical business activity	$28.34	$36.37	$44.33	$51.44	$56.65	$61.92
Lost jobs due to reduced commericial business activity	457	586	715	829	913	998
Lost state and local taxes from reduced commercial business activity	$2.55	$3.27	$3.99	$4.63	$5.10	$5.57
Lost utility revenues	$1.85	$2.32	$2.78	$3.20	$3.50	$3.81

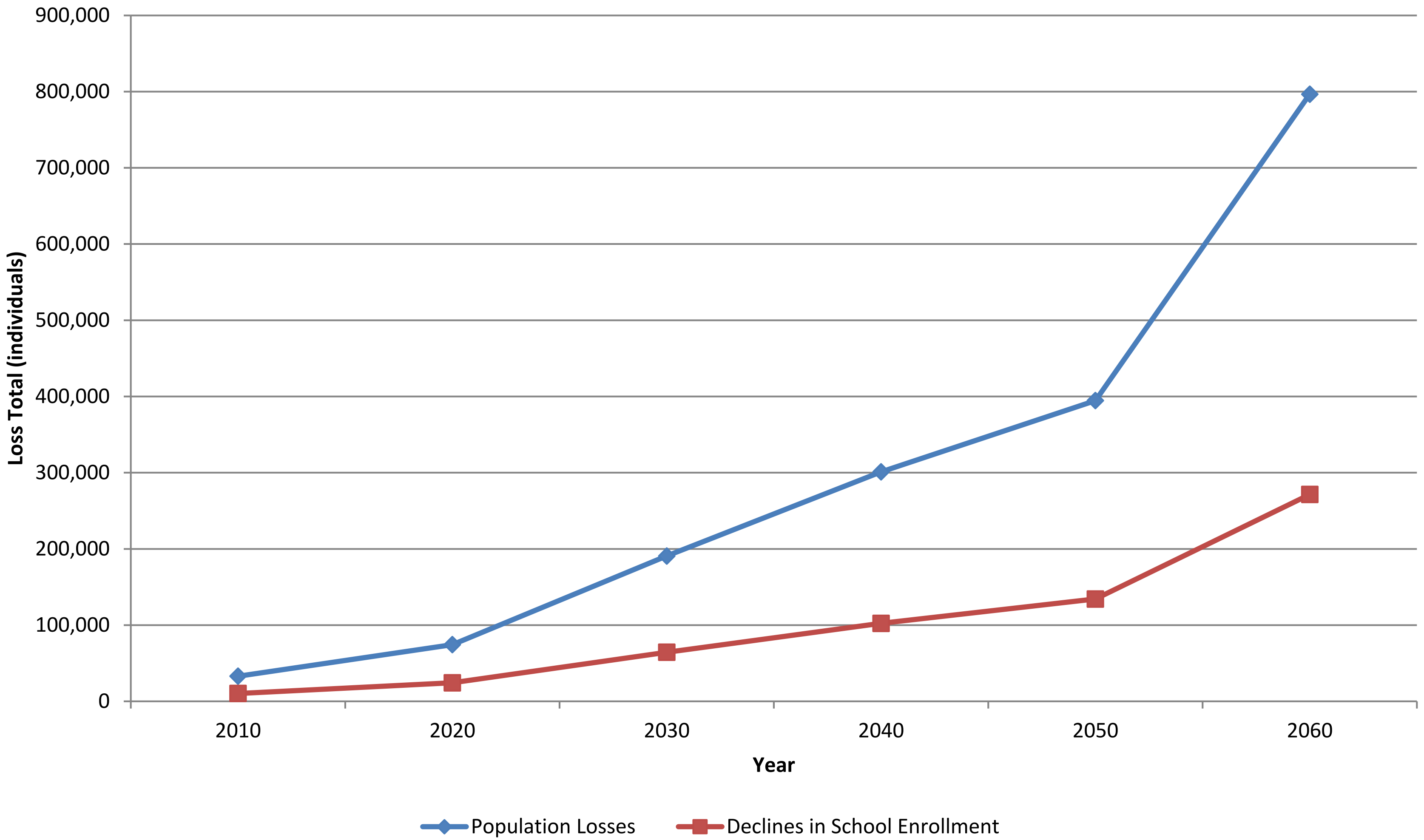
For full analysis, see TWDB report by Stuart Novell dated May 2010, titled "Socioeconomic Impacts of Projected Water Shortages for the Lower Colorado Regional Water Planning Area (Region K)".

Socioeconomic Impacts Analysis – 2011 Region C Water Plan



For full analysis, see TWDB report by Stuart Novell Revised September 1, 2010, titled "Economic Impacts of Projected Water Shortages for the Region C Regional Water Planning Area".

Social Impacts of Water Shortages in Region C



For full analysis, see TWDB report by Stuart Novell Revised September 1, 2010, titled "Economic Impacts of Projected Water Shortages for the Region C Regional Water Planning Area".

Examples of Economic Impacts of Reduced Steam-Electric & Municipal Supply in Region C

	2010	2020	2030	2040	2050	2060
Steam-Electric ($millions)						
Freestone County						
Reduced income from reduced electrical generation	$0.00	$0.00	$0.00	$0.00	$64.62	$187.54
Reduced business taxes from reduced electrical generation	$0.00	$0.00	$0.00	$0.00	$9.28	$26.92
Reduced jobs due to reduced electrical generation	0	0	0	0	220	638
Municipal ($millions)						
Fairfield						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.01	$0.21	$0.47
Lost utility revenues	$0.00	$0.00	$0.00	$0.02	$0.47	$0.83

For full analysis, see TWDB report by Stuart Novell Revised September 1, 2010, titled "Economic Impacts of Projected Water Shortages for the Region C Regional Water Planning Area".

Potential Socioeconomic Impact of Proposed DFCs

During the first round of joint-planning (2005-2010), the TWDB adopted rules to describe what is to be considered in the petition process. With the passage of Senate Bill 660 in 2011, these rules were repealed.

Potential Socioeconomic Impact of Proposed DFCs (cont.)

- TWC Chapter 36.108(d) and (d)(6) states, “the districts shall consider groundwater availability models and other data or information for the management area and shall propose for adoption desired future conditions for the relevant aquifers within the management area. Before voting on the proposed desired future conditions of the aquifers…the districts shall consider **socioeconomic impacts reasonably expected to occur**;”
- Proposed DFCs are quantitative descriptions of specific times (decadal) of groundwater resources in a management area.
- This requirement was added to the requirements of joint planning with the passage of Senate Bill 660 in 2011.

Potential Socioeconomic Impact of Proposed DFCs (cont.)

- From a qualitative perspective, both positive and negative socioeconomic impacts may potentially result from implementation of proposed DFCs.
  - Proposed DFCs may require conversion of part or all of a supply to an alternative supply or supplies, which may have increased costs associated with infrastructure, operation and maintenance.
  - Proposed DFCs may reduce/ eliminate the costs of lowering pumps and either constructing or deepening wells.
  - Proposed DFCs should help ensure a long-term supply for an area.

Potential Socioeconomic Impact of Proposed DFCs (cont.)

- Proposed DFCs may serve to sustain/enhance economic growth due to assurances provided by diversified water portfolio.
- Alternative to proposed DFCs may result in short-term reduction in utility rates due to reduction in cost of water management strategy implementation.
- Alternatives to proposed DFCs may result in significant but unquantified production costs due to transition from confined to unconfined conditions in part of aquifer or continuing lower water levels in wells.
- Alternative to proposed DFCs may result in a reduced groundwater supply being available on a long-term basis.


Questions
Thank you!

Potential Socioeconomic Impact of Proposed DFCs (cont. – note, these rules were repealed with passage of SB 660 in 2011

1. the adopted desired future conditions are physically possible and the consideration given groundwater use;
2. the socio-economic impacts reasonably expected to occur;
3. the environmental impacts including, but not limited to, impacts to spring flow or interaction between groundwater and surface water;
4. the state's policy and legislative directives;
5. the impact on private property rights
6. the reasonable and prudent development of the state's groundwater resources; and
7. any other information relevant to the specific desired future condition.

Region H Distribution of Impacts by Major River Basin

	2010	2020	2030	2040	2050	2060
Trinity						
Irrigation	18%	19%	21%	23%	24%	24%
Manufacturing	0%	1%	1%	1%	1%	1%
Mining	72%	64%	59%	60%	59%	59%
Municipal	2%	1%	1%	1%	1%	1%
Steam-electric	0%	10%	11%	12%	11%	9%

For full analysis, see TWDB correspondence to the Honorable Mark Evans from Stuart Norvell dated May 19, 2010, titled "Socioeconomic impact analysis of not meeting water needs for the 2011 Region H Regional Water Plan."

APPENDIX Q

JUNE 25, 2015 PRESENTATION "GROUNDWATER MANAGEMENT AREA 12: CONSIDERATION OF THE IMPACT ON THE INTERESTS AND RIGHTS IN PRIVATE PROPERTY IN THE ADOPTION OF DESIRED FUTURE CONDITIONS OF AQUIFERS"

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Groundwater Management Area 12: Consideration of the Impact on the Interests and Rights in Private Property in the Adoption of Desired Future Conditions of Aquifers

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Required DFC considerations in Section 36.108(c):

(d) …the districts shall consider groundwater availability models and other data or information for the management area and shall propose for adoption desired future conditions for the relevant aquifers within the management area. Before voting on the proposed desired future conditions of the aquifers under Subsection (d-2), the districts shall consider:

(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, 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;

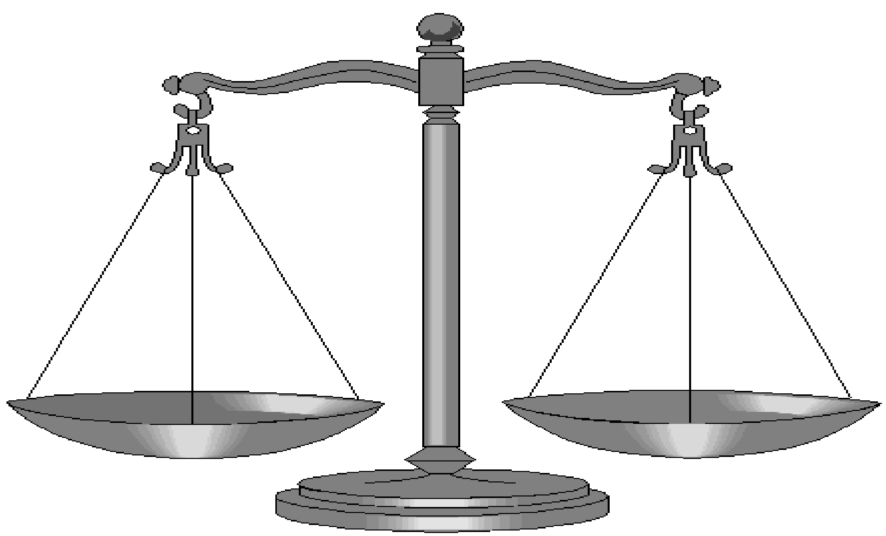
(7) the impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under Section 36.002;

(8) the feasibility of achieving the desired future condition; and

(9) any other information relevant to the specific desired future conditions.

(d-2) The desired future conditions proposed under Subsection (d) must 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. This subsection does not prohibit the establishment of desired future conditions that provide for the reasonable long-term management of groundwater resources consistent with the management goals under Section 36.1071(a).

GMA 12's consideration of the impact of proposed DFCs on the interests and rights in private property, is one of many considerations that the GMA must make in developing a DFC that **provides a balance between the highest practicable level of groundwater production and the conservation.**



In the first round of DFCs, the impact of the DFC on private property was one of TWDB's considerations to determine if the DFC was reasonable.

Since then, Texas has further defined groundwater property rights—in both statute and case law.

And amended §36.108 to require an Explanatory Report that documents the nine considerations, including the "impact on the interests and rights in private property."

Explanatory Report Required

GMAs are required to document their consideration of the §36.108(d) factors (including impacts on private property) in an explanatory report that will be given to the TWDB with the proposed DFCs submittal package.

Under 36.109(d-3) the explanatory report shall:

(1) identify each desired future condition;

(2) provide the policy and technical justifications for each desired future condition;

(3) include documentation that the factors under Subsection (d) were considered by the districts and a discussion of how the adopted desired future conditions impact each factor;

(4) list other desired future condition options considered, if any, and the reasons why those options were not adopted; and

(5) discuss reasons why recommendations made by advisory committees and relevant public comments received by the districts were or were not incorporated into the desired future conditions.

In 2011, the 82nd Texas Legislature modified groundwater law by redefining the ownership of groundwater:

Sec. 36.002. OWNERSHIP OF GROUNDWATER. (a) The legislature recognizes that a landowner owns the groundwater below the surface of the landowner's land as real property.

(b) The groundwater ownership and rights described by this section[~~:~~][~~(1)~~] entitle the landowner, including a landowner's lessees, heirs, or assigns, to:

(1) drill for and produce the groundwater below the surface of real property, subject to Subsection (d), without causing waste or malicious drainage of other property or negligently causing subsidence; and

(2) have any other right recognized under common law.

(b-1) The groundwater ownership and rights described by this section do [~~, but does~~] not:

(1) entitle a landowner, including a landowner's lessees, heirs, or assigns, to the right to capture a specific amount of groundwater below the surface of that landowner's land; or [~~and~~]

(2) [~~do not~~] affect the existence of common law defenses or other defenses to liability under the rule of capture.

(c) Nothing in this code shall be construed as granting the authority to deprive or divest a landowner, including a landowner's lessees, heirs, or assigns, of the groundwater ownership and rights described by this section.

Sec. 36.002. OWNERSHIP OF GROUNDWATER.

(d) This section does not:

(1) prohibit a district from limiting or prohibiting the drilling of a well by a landowner for failure or inability to comply with minimum well spacing or tract size requirements adopted by the district;

(2) affect the ability of a district to regulate groundwater production as authorized under Section 36.113, 36.116, or 36.122 or otherwise under this chapter or a special law governing a district; or

(3) require that a rule adopted by a district allocate to each landowner a proportionate share of available groundwater for production from the aquifer based on the number of acres owned by the landowner.

In 2012, the Texas Supreme Court affirmed the Texas Legislature's recognition of groundwater as a real property right in the case of The Edwards Aquifer Authority v. Burrell Day and Joel McDaniel.

- The Texas Supreme Court ruled that, under both the common law and the Section 36.002 of the Texas Water Code, a landowner owns the groundwater under his land "in place" as a property right that cannot be taken for public use without adequate compensation guaranteed by the Takings Clause of the Texas Constitution.

- The State is empowered to regulate groundwater production.

- Regulation is essential to groundwater conservation and use.

What does this change in groundwater ownership law mean?

- Texas now recognizes both Rule of Capture and groundwater ownership as a real property right.
- Therefore, landowners have a statutory right to pump groundwater; although not a correlative right to pump a specific amount of groundwater.
- The tort preclusion aspects of Rule of Capture remain as they do in common law. Therefore, you cannot sue your neighbor for pumping your well dry in most circumstances.
- Recognizes that owners of groundwater rights must comply with groundwater district regulations if they are within the boundaries of a groundwater conservation district.
- Opens the door for a groundwater rights owner to challenge a groundwater district's regulations and/or permits based on constitutional regulatory takings grounds.
- Lawyers can stop fighting over if groundwater is a property right and start fight over how much regulation constitutes a takings.

Consideration of Potential DFC Impacts

- "Considerations" analyze how property rights could be impacted.

- Impacts ≠ takings in this process

  - *this is NOT a takings impact analysis*

- A GMA must consider the rights of all owners of private property, including all owners of groundwater within the GMA. All interests, whether they favor highest practicable use or conservation, have property rights under the law.

- Impacts may be viewed as both restricting and enhancing property rights.

- Rules adopted by a District to achieve a DFC may have a potential impact on property rights

Major GMA 12 Interests in Groundwater Rights

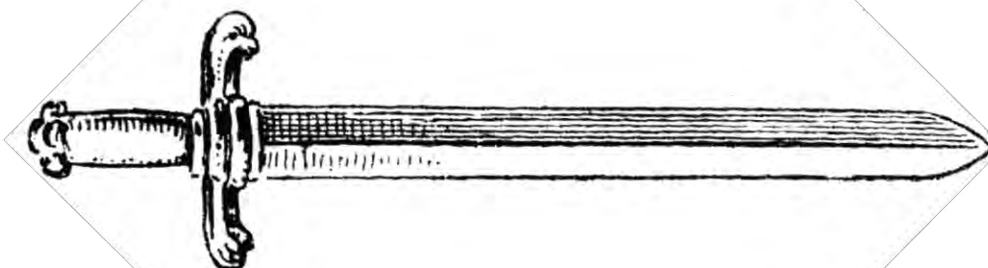
Highest Practicable Use

- Interests and rights that are benefitted or enhanced by the present use of groundwater.
- Interests and rights that are benefitted or enhanced by the use of groundwater in the near future.
- Interests and rights that are benefitted or enhanced by the ability to use groundwater over the long-term.
- Interests and rights that are benefitted or enhanced by leaving a significant amount of groundwater in place.

Conservation

How DFCs May Impact Interests in Real Property Including Groundwater

- A DFC that allows for lower aquifer levels could favorably impact property interests identified on the "highest practicable use" in the balance; while negatively impacting interests identified as "conservation"



- A DFC that aims for a higher aquifer levels could favorably impact property interests identified as "conservation" in the balance; while negatively impacting interests identified as "highest practicable use"

Potential Impacts by District Rules to Achieve DFCs

Existing Rules that implement DFCs adopted by GMA 12 in 2010 impact or affect private property rights by setting well spacing requirements and production limits.

Spacing Requirements impact where well owners can drill wells. Spacing requirements also impact neighboring property right holders by reducing interference between wells.

Production limitations currently exist in GMA 12 districts. These Rules are designed to prolong the groundwater supply and reduce drainage of surrounding groundwater rights.

Potential impacts on property rights of DFCs favoring "highest practicable production":

- lenient production restrictions that allow existing users to produce more groundwater with less acreage.
- may allow groundwater supply and levels to meet needs.
- may endanger water supply and needs of future users.
- increased production may increase drainage of groundwater from neighboring landowners.

Potential impacts on property rights of DFCs favoring conservation, preservation, protection and recharging:

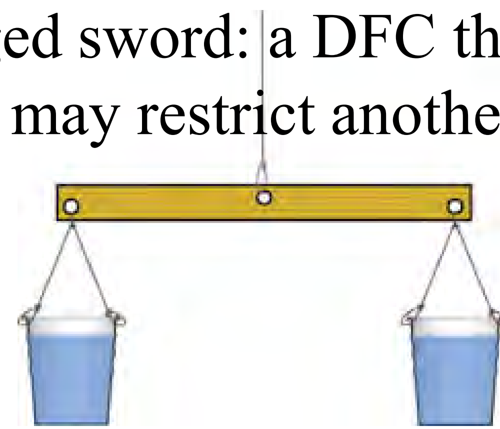
- increased production limits may require existing users to reduce groundwater production or acquire additional groundwater rights.
- may extend groundwater supply and levels to meet future needs.
- may extend the productive life of the aquifer.
- may minimize interference between groundwater right owners.

Takeaway?

- Consideration of impact on Private Property Rights is one of many factors that have to be weighed to provide a balance between the highest practicable level of groundwater production and the conservation to provide for the reasonable long-term management of groundwater resources

- An impact does not mean a taking

- Impacts are a double-edged sword: a DFC that may benefit one property right owner may restrict another…hence the balancing act.



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APPENDIX R

AUGUST 13, 2015 PRESENTATION "PRESENTATION TO GMA-12: FEASIBILITY OF A DFC"

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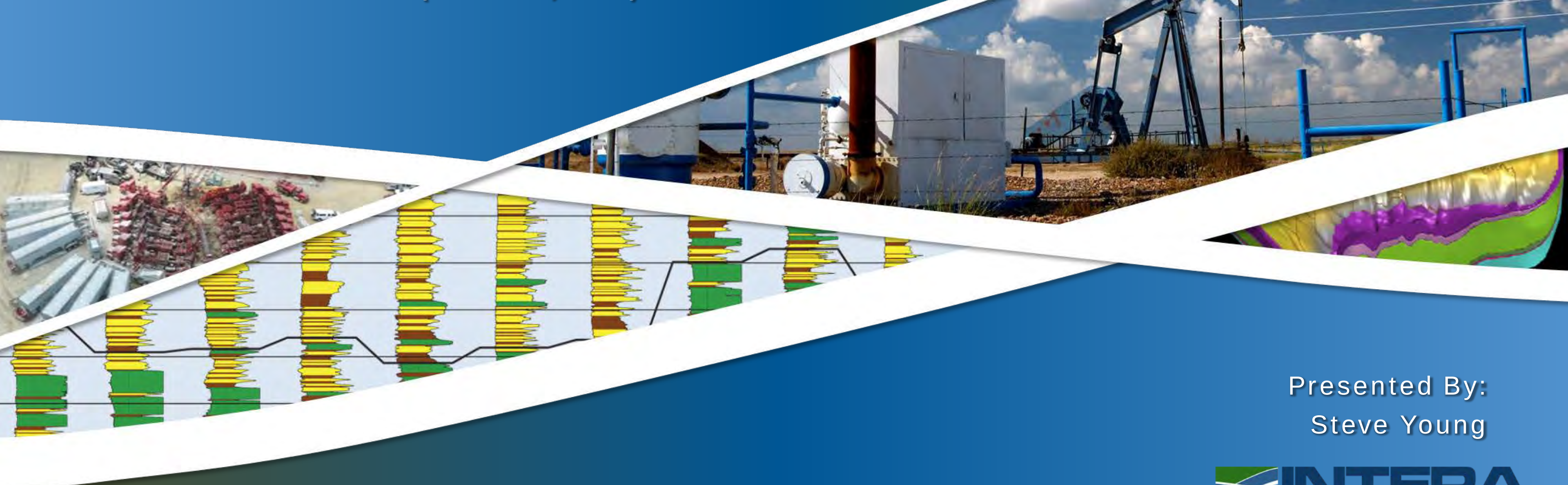
PRESENTATION TO GMA-12: FEASIBILITY OF A DFC

By consultants for the:
Brazos Valley GCD (LBG-Guyton Associates)
Fayette County GCD (Daniel B. Stephens & Associates)
Lost Pines GCD (Daniel B. Stephens & Associates)
Mid-East Texas GCD (Matt Uliana, independent consultant)
Post Oak Savannah GCD (INTERA, Inc.)



Presented By:
Steve Young
INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

August 13, 2015

TWC Section 36.108 (d)

- Before voting on the proposed desired future conditions … the districts shall consider:
  - Aquifer uses and conditions
  - Needs and strategies
  - Hydrologic conditions
  - Environmental impacts
  - Subsidence
  - Socioeconomic impacts
  - Private property rights
  - **Feasibility**
  - Anything else

CONSIDERATIONS FOR FEASIBILITY OF A DFC

- Conceptual Consideration
  - Conditions Needed to be Physically Possible
  - Likelihood of Being Physically Possible
  - Impacts of Pumping outside of a GCD on the DFC for that GCD

- Practical Consideration
  - What type of demonstration is needed to show feasibility of DFCs
  - What approaches are available to support a demonstration

GMA 12 PREVIOUS JOINT PLANNING CYCLE FOR SPARTA, QUEEN CITY, AND CARRIZO-WILCOX DFCs

Based on the principle of using the GAM as a joint planning tool and the fact that the GAM predictions contain uncertainty, GMA 12 considered the DFCs to be compatible and physically possible if the difference between modeled drawdown results for model Run 12_7B and the DFC drawdown targets **were within 5 feet or 5 percent** of the DFC drawdown targets. Factors considered for determining tolerance criteria include:

- model calibration results and statistics,
- information used to calibrate the GAM,
- aquifer and recharge information collected since the GAM was developed,
- sensitivity of the GAM calibration and GAM predictions to changes in the model parameters, and
- range of uncertainty in the model parameters including historical and future pumping, and temporal variation in recharge distribution and magnitude.

MODEL CALIBRATION AND STATISTICS FOR HYDRAULIC HEADS

Calibration Statistics Using Hydraulic Heads from the TWDB database for the Period from 1980 to 2000

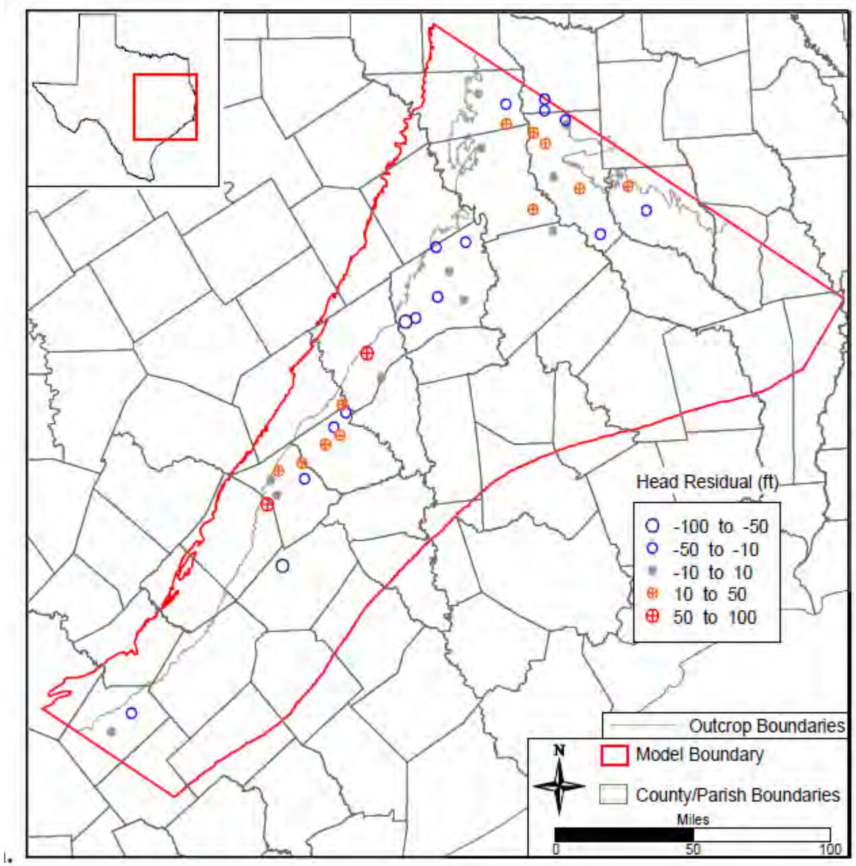
Model Layer	Aquifer	Root-Mean Square Error	# Wells	# Points
1	Sparta	23.8	63	689
3	Queen City	31.2	84	1010
5	Carrizo	28	90	1804
6	Calvert Bluff	49.7	20	309
7	Simsboro	35.9	22	358
8	Hooper	85.2	12	187

Calibration Statistics Provided by QCSP GAM Report (Kelley and others, 2004) for 1990 and 1999

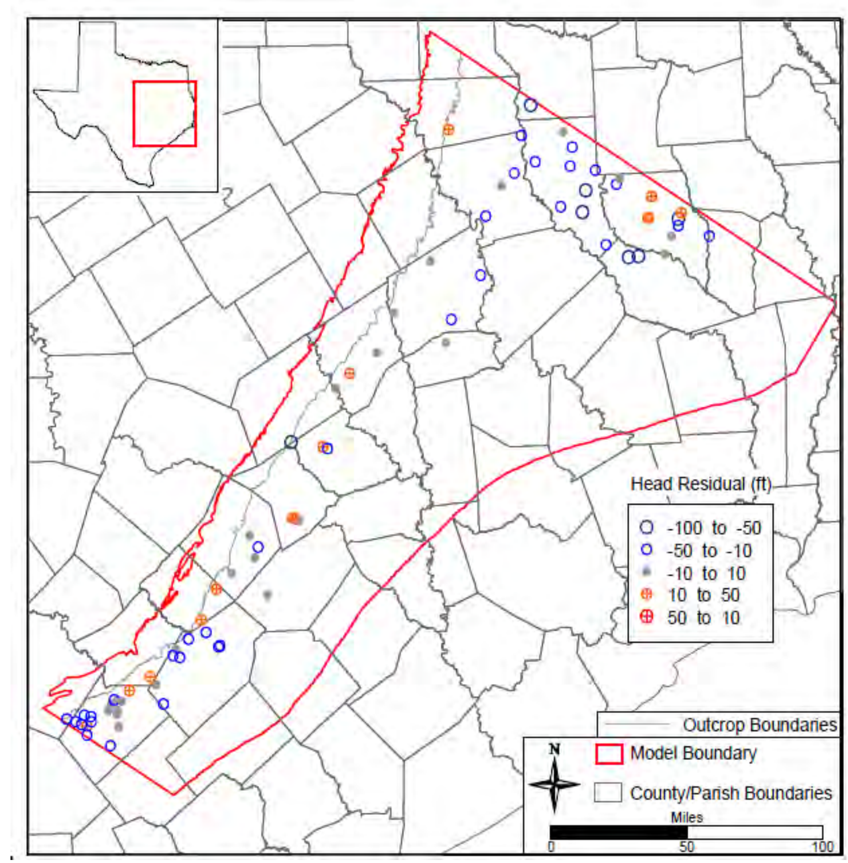
Model Layer	Aquifer	1990		1999	
		Root-Mean Square Error	# Well/ # Points	Root-Mean Square Error	# Well/ # Points
1	Sparta	22	36	18.4	30
3	Queen City	26.5	62	24.1	40
5	Carrizo	36.3	115	23.8	80
7	Simsboro	30.8	42	31.3	32

MODEL CALIBRATION AND STATISTICS FOR HYDRAULIC HEADS (con't)

Queen City - 1999



Carrizo - 1999



Head Residual = Modeled Head – Measured Head

QUALITY & QUANTITY OF INFORMATION USED TO DEVELOP AND CALIBRATION GAM

- Aquifer hydraulic properties
- Recharge magnitudes and patterns
- Temporal and spatial distribution of pumping rates
- Distribution of hydraulic head measurements
- Representativeness of hydraulic head measurements in pumping wells
- Groundwater – Surface Water interaction

NON-UNIQUENESS CALIBRATED MODELS

- Model calibration focuses on adjusting aquifer parameters to achieve acceptable fit to measured or estimated hydraulic heads
- Set of model parameters (aquifer properties, recharge, etc.,) used to calibrate model are not unique
- Selection of alternative sets of equally plausible model parameters can be used to generate a set of different model outcomes that defines the uncertainty in the model

SENSITIVITY OF THE GAM CALIBRATION AND GAM PREDICTIONS TO CHANGES FAULTS: DFC SIMULATION

Summary of Calibration Statistics Calculated from a Measurement File Generated from the TWDB database for the Period from 1980 to 2000

Model Layer	Aquifer	RMSE (ft)		# Wells	# Points
		Faults Included	Faults Excluded		
1	Sparta	23.8	24.7	63	689
3	Queen City	31.2	30.7	84	1010
5	Carrizo	28.0	28.9	90	1804
6	Calvert Bluff	49.7	49.3	20	309
7	Simsboro	35.9	29.9	22	358
8	Hooper	85.2	86.1	13	187

SENSITIVITY OF THE GAM CALIBRATION AND GAM PREDICTIONS TO CHANGES FAULTS: DFC SIMULATION

Comparison of Predicted Drawdown between 2000 and 2060 for Run12_7a for the Condition of Inclusion of the Faults and of the Exclusion of the Faults

Groundwater Conservation District	Fault Assumption	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
Brazos Valley	Faults	13.7	12.3	47.9	108.8	269.1	175.6
	No Faults	12.3	10.1	37.1	77.6	188.5	121.0
	Difference	1.4	2.2	10.9	31.2	**80.6**	**54.6**
Fayette County	Faults	58.9	58.7	59.6	126.5	219.6	171.7
	No Faults	52.9	51.3	47.9	92.5	155.8	125.2
	Difference	**6.1**	**7.3**	**11.7**	33.9	63.7	46.5
Lost Pines	Faults	3.7	12.7	47.2	94.4	236.2	133.4
	No Faults	1.3	9.4	41.8	69.4	184.0	102.5
	Difference	2.5	3.2	5.5	25.0	52.2	30.9
Mid-East Texas	Faults	0.4	-3.2	52.5	66.9	113.3	95.4
	No Faults	0.3	-3.4	45.3	52.4	84.7	69.6
	Difference	0.2	0.3	7.3	14.5	28.5	25.8
Post Oak Savannah	Faults	27.5	27.9	60.8	135.9	296.6	177.6
	No Faults	24.2	22.5	53.1	96.3	225.2	132.6
	Difference	3.4	5.4	7.7	**39.6**	71.4	45.0

PROPOSED APPROACH FOR EVALUATING FEASIBILITY OF DFC

- Similar Approach to 2010 Joint Planning Approach
  - Calculate differences between adopted DFC and simulated DFCs based on pumping file
  - Evaluate differences relative to estimated uncertainties and errors in model predictions
  - Criteria will be vary with among aquifers


Consultants for the
Brazos Valley GCD (LBG-Guyton Associates)
Fayette County GCD (Daniel B. Stephens & Associates)
Lost Pines GCD (Daniel B. Stephens & Associates)
Mid-East Texas GCD (Matt Uliana, independent consultant)
Post Oak Savannah GCD (INTERA, Inc.)

APPENDIX S

GMA 12'S RESPONSES TO COMMENTS FOR BRAZOS VALLEY GCD

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Public Comments regarding 2010-2070 Desired Future Condition (DFC) "drawdowns" assigned to the BVGCD aquifers.

July 8, 2016

I applaud the pause in the Carrizo-Wilcox Group groundwater availability predictions that would exceed the annual 2060 MAG levels for most aquifers. It is my understanding that more comprehensive analysis of these aquifers' water budgets; i.e. their hydrologic data, human demands, and our ecological/environmental systems' needs, will be more reliably represented in the new GAM runs. This pause appeases the public concerns regarding Predictive Scenario-4 proposed DFCs, but the "questionable" data, "uncertain" demands, and inadequate environmental/socioeconomic measurements still makes any calculation of "safe" drawdowns problematic. The fact remains that the datasets included in these models are only as good as the actual data collected and the assumptions made according to the best science available.

As a layman, it is very difficult to attend all of the meetings. It is even harder to understand presentation slides without context or explanation. So, I may be completely off base with my comments. But, it is my understanding that "sustainable yield" of an aquifer requires a tabulation of its recharge, discharge and storage capacity plus <u>a clear understanding of the undesirable condition(s) that signal(s) enough is enough</u>. We seem to just mollify the DFC numbers *at-will* by "ramping-up" to meet the population growth and/or other contractual demands, kicking the can further down the road. These increasing human demands will definitely worsen drawdowns, but do we truly know the groundwater extraction limits to ensure "sustainable yields" for future generations. At some point there has to be a finite determination of the "beginning water level" and the "point (or level) of no return." Then our water planning will have real groundwater-surface parameters and the DFC guidelines become meaningful as compared to monitored well water levels.

As for Brazos Valley GCD (BVGCD), progress in developing methodologies to improve data collection has been developed. However, these address only the manual how-to issues of taking artesian head readings in a consistent manner. My concern is still the selection of wells used to

Cathy Lazarus, 11685 FM 2159, Calvert, Texas 77837
979-814-0733

monitor our groundwater resources and the resulting effects of excessive discharge on each aquifer within the areal boundaries of Robertson County. If it is impractical to monitor all wells, then there should be an effort to select a statistical sample that represents each aquifer's underground conformation.

As stated in previous critiques, I am still concerned that the BVGCD is not aggressively addressing *"other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water"* as it relates to the Brazos River Basin. Many known aquifer-reaches along the Brazos River in Robertson and Brazos counties contribute to the natural recharge and discharge of our aquifers. The WAM has eliminated Brazos River monitoring points in northern Robertson County. Why? The GMA-12's new GAM study has included specific goals of investigating and quantifying the Lower Colorado River Basin's groundwater – surface water interactions. Why would the Brazos River Basin not have similar study criteria? I realize the alluvium aquifers are different, but there are still significant interactions between the other major aquifers and the Brazos River that must be investigated and protected to assure a healthy balance. When there is talk of off-channel reservoirs pumping thousands of acre-feet of "pulse-flow" from the Brazos River, the District must at least ask the question, "How will this affect our groundwater?" When an OCR site is plotted over a significant part of an aquifer's recharge zone; certainly, one must ask how this might have adverse hydrologic and ecological impacts.

I am concerned the Hooper Aquifer's projected annual pumping is above the 2060 MAG assignments. The response to the question of why has been because the previous DFC/MAG calculations were woefully understated based on "what we are seeing." Is this based on the same data that has been deemed questionable or needs better science? I would feel better about this significant "recalculation" if there was a narrative that explained exactly why the Hooper wells are surprisingly stable and/or the reason(s) for these unexpected results? Perhaps these wells may not be the best wells to monitor the Hooper's health should deeper, brackish wells are permitted for oil/gas use.

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979-814-0733

When decisions are made that seem to make the DFCs fit what we would like to see versus what the data may or may not yield, I lose confidence in the District/ GMA-12's reporting and decision-making.

Again, I may be way off in my perceptions of what the GAM-12's DFC for 2000-2070 mean. As a member of the public, perhaps if I am misreading the information provided, the public information and education requirements of the GAM-12 are inadequate to explain their decision-making so the public has a better understanding. Just to declare a public meeting and provide charts without narratives is confusing to the general public.

Thank you for this opportunity to share my concerns.

	Aquifer	BVGCD 2010 DFCs 2000-2059		BVGCD 2016 proposed DFCs 2000-2069	BVGCD 2060 MAG (allowed annual pumping in acft)		BVGCD 2070 projected annual pumping in acft	2060 MAG GMA12 total pumping	2070 GMA12 projected pumping in acft
	Sparta	15	↓	12	7923	↑	9019	23597	↑24317
	Queen City	12	=	12	529	↑	1200	3708	↑ 6701
Carrizo-Wilcox Group	Carrizo	47	↑	61	5496	≈	5494	36695	↑41173
	Calvert Bluff	106	↑	125	1755	≈	1758	10690	10696
	Simsboro	270	↑	295	96185	≈	96187	189105	189119
	Hooper	170	↑	207	316	↑	2001	8157	↑14624
	Yegua	70	=	70					
	Jackson	110	↑	114					
	Yegua-Jackson			65	7071				
	BRA – RC			30%					
	BRA - Brazos			40%					

Six times original MAG

DFC Comments - July 8. 2016
Cathy Lazarus, 11685 FM 2159, Calvert, Texas 77837
979-814-0733

Response to Comments Received Regarding the GMA 12 Planning Effort

Commenter: City of Bryan

Comment 1: The comment is regarding the requirements of groundwater conservation districts (GCDs) to utilize "best available science" as the overall arching principal for many GCDs in the development of the groundwater management area (GMA) water planning process. The conclusion is that the distribution of current pumping in Brazos and Robertson counties in the PS6 simulation is outdated and incorrect information.

> ***Response:*** *The pumping amounts and distribution in the PS6 simulation through 2010 are based on the best available data. The distribution of the pumping after 2010 in the PS6 pumping file was modified for certain parts of the Brazos Valley Groundwater Conservation District (BVGCD). The new pumpage file (PS10) did not change the proposed desired future conditions (DFCs).*

Comment 2: The comment is regarding pumping and the PS6 simulation for the period 2011 through 2015, when actual pumping in northern Brazos County was greater than the amount represented in the simulation for the Simsboro Aquifer.

> ***Response:*** *It was a decision by GMA 12 to utilize projections of future pumping from 2011 to 2070, with limited modification, as contained in a similar pumping file developed for the 2010 GMA planning cycle. The pumping file was modified to develop a pumping file PS10 that included a greater amount of municipal pumping from the Simsboro Aquifer between 2011 and 2015 in the northern part of Brazos County than actually occurred during that period.*

Comment 3: A series of comments that include requested revisions to the PS6 information are summarized as follows.

a. Modify the simulated pumping at the City of Bryan well field to reflect the reported pumping values from 2011 to 2015 and to also reflect anticipated growth in pumping to meet demands within the planning cycle of 2016 to 2070.
   Response: *See response to Comment 2. The pumping file also was modified to contain a greater amount of pumping from the Simsboro Aquifer in the northern part of Brazos County from 2016 thru 2039.*

b. Remove pumping in the southern part of Robertson County, apparently associated with the City of Bryan.

   Response: *The pumping from the Simsboro Aquifer in the southern part of Robertson County was intended for Robertson County and was redistributed in areas of western Robertson County in the PS10 pumping file where greater amounts of pumping have occurred. This redistribution of pumping did not affect the proposed desired future conditions (DFCs).*

c. Modify the simulated pumping at the Skiles Family Partnership to reflect the reported values in 2011 to 2015 and the permitted amount after that year.

   Response: *The permitted amount of pumping from the Simsboro Aquifer has been pumped in past years by the Partnership and will continue to be represented in the model from 2011 forward.*

d. Reduce the amount of predicted pumping at the Calvert (Walnut Creek) Mine so that the overall modeled available groundwater (MAG) for the BVGCD remains the same, but there is a resulting 8,700 ac-ft/yr increase in the MAG in Brazos County and a commensurate decrease in Robertson County.

   Response: *Some of the estimated amount of future pumping from the Simsboro Aquifer in the Calvert (Walnut Creek) Mine area was redistributed in the PS10 pumping file to other areas in Robertson County where greater amounts of pumping were estimated to occur, providing an improved representation of pumping in those areas. This redistribution of pumpage did not affect the proposed desired future conditions (DFCs). Calvert (Walnut Creek) Mine pumping was therefore not reassigned to Brazos County.*

Commenter: Cathy Lazarus

Comment 4: The comment is regarding the MAG for the Hooper Aquifer that was set at 316 ac-ft/yr for the GMA 12 planning cycle in 2010 and is set at 2,001 ac-ft/yr for the GMA 12 planning cycle for 2016. Why the increase in the MAG?

> ***Response:*** *Pumping amounts reported to the BVGCD showed that pumping was substantially over 316 ac-ft/yr and that this pumping was resulting in very modest amounts of well static water-level decline. Based on these results and considering the projected utilization of groundwater produced by the Hooper Aquifer in the northern part of Roberson County, the DFC for the Hooper Aquifer was increased to accommodate a higher MAG. Well water-level*

monitoring of the response of the Hooper Aquifer has occurred and will continue in the future. The comment does not affect the proposed DFC in PS10 for the Hooper Aquifer.

CITY OF BRYAN
The Good Life, Texas Style.

July 18, 2016

Via e-mail

Mr. Bill Harris
President, Brazos Valley Water Conservation District
1112 West 3rd St.
Hearne, TX 77859

Re: City of Bryan comments on proposed Desired Future Conditions

Dear Mr. Harris,

Pursuant to the notice published by the Brazos Valley Groundwater Conservation District (BVGCD) inviting public comments on the proposed Desired Future Conditions (DFC) through July 18, 2016, I am submitting to you the enclosed technical memo prepared and sealed by Mr. Bill Mullican P.G. on behalf of the City of Bryan. This memo constitutes Bryan's comments, suggested revisions, and the basis for those revisions. Because of the potential for the DFCs to adversely affect the property interests of the City of Bryan, we appreciate the opportunity to provide these comments to you and request that they be considered in developing the final DFC's. We would be glad to answer any questions you have concerning our comments.

Sincerely,

Jayson Barfknecht

Jayson Barfknecht, Ph.D., P.E.
Public Works Director

Cc: Brazos Valley Groundwater District Board of Directors.
Mr. Alan Day, General Manager. BVGCD

TBPE Firm No. F-3043

Memorandum

To: *Jayson Barfnecht, Director of Utilities, City of Bryan*

From: *William F. Mullican, III, P.G.*

Date: *July 18, 2016*

STATE OF TEXAS
WILLIAM F MULLICAN, III
GEOLOGY
No 10
LICENSED
PROFESSIONAL GEOSCIENTIST

Willi F Mullican
7/18/2016

Subject: *Technical review of proposed desired future conditions for Simsboro Aquifer in Brazos Valley Groundwater Conservation District adopted by Groundwater Management Area 12*

This technical memorandum presents a series of technical comments and requested revisions on the proposed Desired Future Conditions (DFCs), adopted by District Representatives in Groundwater Management Area 12 (GMA 12), specific to the area under the jurisdiction of the Brazos Valley Groundwater Conservation District (BVGCD). These comments and requested revisions have been prepared for your consideration and possible submission to the BVGCD Board of Directors, pursuant to BVGCD's notice inviting comment through July 18. In this technical comment and suggested revision letter, the following are discussed:

- Focus of City of Bryan's review,
- Discussion of use of "best available science,"
- Issues with distribution and amount of historic, current, and future pumping included in GMA 12 predictive simulation, referred to as PS6,
- Impact of incorrect distribution of current pumping in PS6 on cities in BVGCD,
- Modeling results utilizing PS6 in all areas of GMA 14 except for BVGCD, where corrections were made to major pumping centers, and
- Requested revisions.

Focus of City of Bryan's review

The focus of this technical review is on the Simsboro Aquifer, the distribution and rates or volume of pumping utilized in PS6 (the pumping scenario used by BVGCD is developing its DFC proposal), and current conditions in the BVGCD. Two primary outcomes that result from the joint-planning process as prescribed in Texas Water Code Section 36.108 (d) are DFCs and estimates of Modeled Available Groundwater (MAG). While we understand that the official estimates of MAG for all relevant aquifers in GMA 12 will not be produced by the Texas Water Development Board (TWDB) until after final adoption of the DFCs, the practical reality is that the locations and rates of pumping prescribed by the District Representatives in PS6 for all relevant aquifers of the Carrizo-Wilcox Aquifer System also represent the ultimate estimates of MAG (to be produced by the TWDB) for each aquifer. Due to the ramifications that estimates of MAG now has on regional water planning, the Texas State Water Plan, and funding opportunities from the State Water Implementation Fund for Texas (SWIFT), administered by the TWDB, the distribution, rates, and timing of estimates of MAG are of critical concern to the City of Bryan, and thus are the focus of this technical review.

Use of "best available science" in GMA 12 joint-planning process

During the 84th Texas Legislature, House Bill 200 was passed and signed into law by Governor Abbott on June 19, 2015. House Bill 200, in part, amends Texas Water Code Section 36.0015 as follows:

> Sec. 36.0015. PURPOSE. <u>(a) In this section, "best available science" means conclusions that are logically and reasonably derived using statistical or quantitative data, techniques, analyses, and studies that are publicly available to reviewing scientists and can be employed to address a specific scientific question.</u>
>
> (b) In order to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions, consistent with the objectives of Section 59, Article XVI, Texas Constitution, groundwater conservation districts may be created as provided by this chapter. Groundwater conservation districts created as provided by this chapter are the state's preferred method of groundwater management <u>in order to protect property rights, balance the conservation and development of groundwater to meet the needs of this state, and use the best available science in the conservation and development of groundwater</u> through rules developed, adopted, and promulgated by a district in accordance with the provisions of this chapter.

This requirement for GCDs to utilize "best available science," although a new provision in the Texas Water Code, is certainly a standard that has been assumed to be an overarching principle for many GCDs prior to the passage of House Bill 200. As documented below, however, it is clear that when distributing current pumping in Brazos and Robertson counties in PS6, outdated and incorrect pumping information, both the location of current pumping and the rate of pumping, was utilized, rather than the readily available information obtained from the BVGCD during our review efforts. As such, it seems clear that in the execution of PS6 and derivation of the resulting proposed DFCs, the best science available to the District Representatives in GMA 12 was not utilized. This failure to utilize the best available science will become even more clear during the preparation of the explanatory report required by Texas Water Code Section 36.108 (d-3).

A review of the TWDB's <u>Desired Future Condition Submission Packet Checklist - Groundwater Availability Model Administrative Elements</u> (located at http://www.twdb.texas.gov/groundwater/docs/DesiredFutureConditions-TWDB_Checklist_for_Submittals_Explanatory_Reports_and_Model_Files.pdf) clearly highlights that failure to utilize current, up-to-date information, including current pumping information, with a focus on the transition from the calibration period to the predictive period, will be important during the determination of administrative completeness by the TWDB. It is our understanding that if clearly identified flaws in pumping data is utilized in the modeling efforts of a GMA, then the modeling results may be deemed as administratively incomplete by the TWDB. As such, we believe it would be best for the BVGCD to request that GMA 12 District Representatives make the revisions recommended through this technical report to the pumping input files in order to ensure that the best available science is utilized.

Issues with distribution and amount of historic, current, and future pumping included in GMA 12 predictive simulation, referred to as PS6

The following analysis is based on the foundational premise of water resources planning and groundwater availability modeling that the more accurately observed/measured conditions are expressed in a groundwater availability model at the beginning of the predictive simulation, the better the predictive results will be in the end of the simulation (all other variables being the same). In other words, if one starts out a predictive simulation with significant (recognized or unrecognized) errors in the beginning of a predictive simulation, then the magnitude of error in subsequent results will be exacerbated.

In order to initiate this review, a copy of the pumping input file for PS6 was requested and obtained. In addition, copies of all reported Simsboro Aquifer pumping from 2008 – 2015 in the BVGCD were obtained, analyzed, and summarized. It is critical to establish and understand the correlation/relationship that exists between the PS6 pumping input file and the estimates of MAG (that will ultimately be provided by the TWDB). Simply put, the two sets of pumping estimates, (1) the PS6 pumping input file and (2) the estimates of MAG are, in fact, the same numbers. As such, any errors or mischaracterization of pumping in the pumping input file will also result in errors in the official estimates of MAG produced by the TWDB. It is noted that the BVGCD reported groundwater use estimates do not provide a specific breakdown by county for the location of pumping. Therefore, as part of this analysis, an additional dataset identifying well name and latitude and longitude, but not reported production, was obtained from the BVGCD and then correlated with reported groundwater production data to determine if reported pumping was located in Brazos County or Robertson County (Note – Annual BVGCD production reports do not include well locations. This absence of datasets that provide direct correlation between reported production and specific location, either by county or latitude/longitude, was confirmed by both the BVGCD and their consultant).

A summary of reported pumping (provided by BVGCD and located using the additional data obtained for this analysis), and volume of pumping utilized in PS6 for the Simsboro Aquifer within the BVGCD from 2011 – 2015 (provided by GMA 12 representative Gary Westbrook), is provided below in **Table 1**. Based on a comparison of these data, the following issues are quickly identified. First, pumping allocated in PS6 for Brazos County, on average, from 2011 – 2015, is 2,711 acre-feet per year <u>less than</u> what BVGCD is recording/reporting as actual pumping for the same time period. It is noted that actual pumping reported by BVGCD does not include exempt use, whereas the pumping input file utilized in PS6 is required by law to include exempt use. As such, the actual delta between actual pumping, on average, from 2011 – 2015, is greater than the 2,711 acre feet recorded in **Table 1**. Conversely, pumping allocated in PS6 for Robertson County, on average, from 2011 – 2015, is 15,005 acre-feet per year <u>more than</u> what BVGCD is recording/reporting as actual pumping for the same time period. As part of our analysis of these numbers, it was observed that BVGCD reported pumping volumes from 2011-2015 do not include pumping from the Calvert Mine, located in Robertson County. It is assumed that this is because groundwater production for surface mining activities permitted by the Texas Railroad Commission (RRC) is exempt from GCD regulation (see Texas Water Code Section 36.117). **Table 2** includes reported annual groundwater production from the Simsboro Aquifer at the Calvert Mine (Permit No. 27G), located in Robertson County. From 2011 – 2014, the average production reported from the Simsboro Aquifer at the Calvert Mine is 5,088 acre-feet per year. As such, the combination of reported use (from the BVGCD) and exempt use from the Calvert Mine, as reported by the RRC, is approximately 31,319 acre-feet per year from 2011 – 2015 in Robertson County. Therefore an adjusted comparison is that the pumping allocated in PS6 for Robertson County, on average, from 2011 – 2015, is 9,917 acre-feet per year more than what the BVGCD and RRC are recording/reporting as actual pumping for the same time period. In summary, for the period from 2011 – 2015, pumping from the Simsboro Aquifer allocated in PS6 is 2,711 acre-feet per year **<u>less than</u>** actual reported pumping in Brazos County, whereas pumping from the Simsboro Aquifer allocated in PS6 is 9,917 acre-feet per year **<u>more than</u>** actual reported pumping in Robertson County. The result of these discrepancies is that predictions of declines in artesian pressure in the Simsboro Aquifer predicted by PS6 will inherently be less than actual declines in Brazos County and more than actual declines in Robertson County, under the assumption that pumping centers remain in the same locations.

Table 1 Estimates of reported pumping from the Simsboro Aquifer in the BVGCD from reported use and GMA 12 PS6 GAM predictive simulation

		Reported			PS6			Difference		
Year	**Aquifer**	**Brazos**	**Robertson**	**Total**	**Brazos**	**Robertson**	**Total**	**Brazos**	**Robertson**	**Total**
2011	Simsboro	39,143	28,416	67,558	31,117	41,123	72,240	8,026	-12,708	-4,682
2012	Simsboro	34,018	19,405	53,423	31,561	41,183	72,743	2,457	-21,778	-19,320
2013	Simsboro	35,528	28,730	64,258	32,005	41,232	73,237	3,523	-12,502	-8,979
2014	Simsboro	33,112	29,788	62,899	32,449	41,291	73,741	662	-11,504	-10,841
2015	Simsboro	31,778	24,818	56,595	32,894	41,351	74,245	-1,116	-16,533	-17,649
	Average	**34,716**	**26,231**	**60,947**	**32,005**	**41,236**	**73,241**	2,711	-15,005	-12,294

Table 2 Reported annual groundwater production from the Simsboro Aquifer for Calvert Mine, Permit No. 27G; located in Robertson County

Year	Production from Simsboro Aquifer (AFY)
2011	7,076
2012	6,387
2013	3,838
2014	3,051
2015	Not reported
Average	5,088

In addition to reviewing the differences in the volumes of actual pumping versus pumping used in PS6 on a county-by-county basis, another analysis was conducted to evaluate the locations of reported pumping versus location of pumping utilized in PS6 by GMA 12. In **Figures 1** and **2** below, the location and volume of pumping from the Simsboro Aquifer for 2011 and 2015 are illustrated. A close examination of these two maps documents three primary issues regarding the location and volume of pumping in BVGCD between actual reported pumping and simulated pumping used in PS6 by GMA 12. First, there are two areas of pumping in southern Robertson County (illustrated as individual square mile model cells colored orange) that are assumed to be associated with municipal production for Brazos County, and in particular for the City of Bryan. However, currently the City of Bryan does not have any groundwater production located in Robertson County. As such, to more accurately reflect what already is a matter of record, this production in southern Robertson County in a modified PS6 should be relocated to the general area of the current City of Bryan wellfield. Next, there is a very large amount of production in PS6 in Robertson County in the area of the Calvert Mine in PS6 that is not supported by any reported water use, either from the BVGCD or the RRC. Even accounting for reported water use at the Calvert Mine, the location and volume of pumping is not supported by any reported production, and this is confirmed by the number of high volume cells in the area with no well locations documented. Finally, there is a major discrepancy between reported groundwater use and groundwater pumping included in PS6 in the area of the Skiles Family Partnership. In both **Figure 1** and **2**, no pumping has been assigned to the cells in PS6 where the Skiles Family Partnership wells are located. However, actual reported production from the Skiles Family Partnership wells for the same time period represent approximately 20,000 acre feet per year of production from the Simsboro Aquifer. As a result, due to the location of the Skiles Family Partnership wells being farther from the Simsboro Aquifer outcrop, one could reasonably anticipate that if the actual production were to be moved from the Calvert Mine area, where no current production is occurring, to the actual location of this production in the Skiles Family Partnership area, then the predicted drawdowns will be greater than those currently reported from PS6, due to the more-downdip location of the Skiles Family Partnership wells.

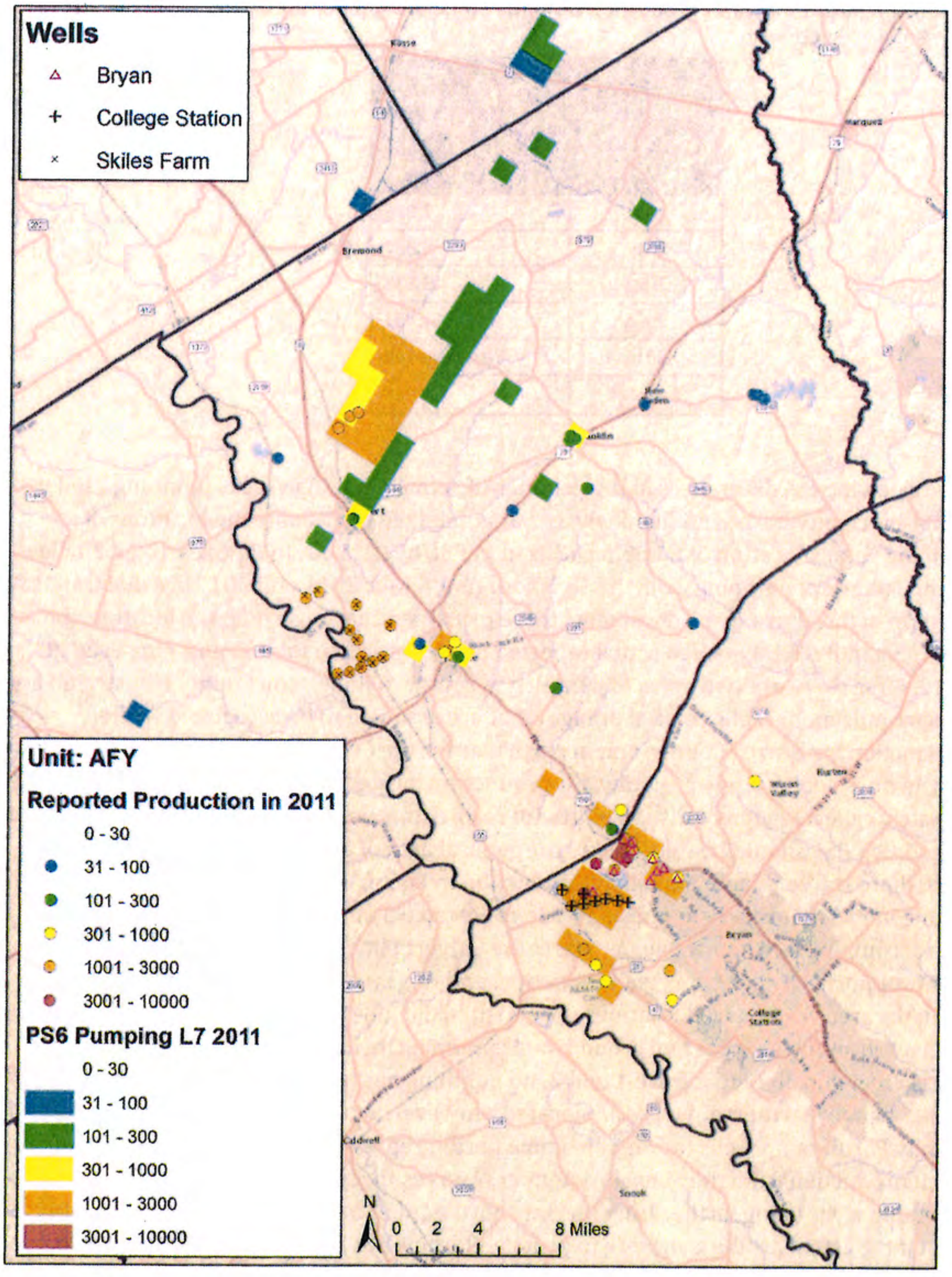

Figure 1. Map comparing location and annual volume of reported and simulated groundwater production from the Simsboro Aquifer in BVGCD in 2011. Reported production compiled from BVGCD reported water production data. PS6 pumping extracted from PS6 pumping input file.

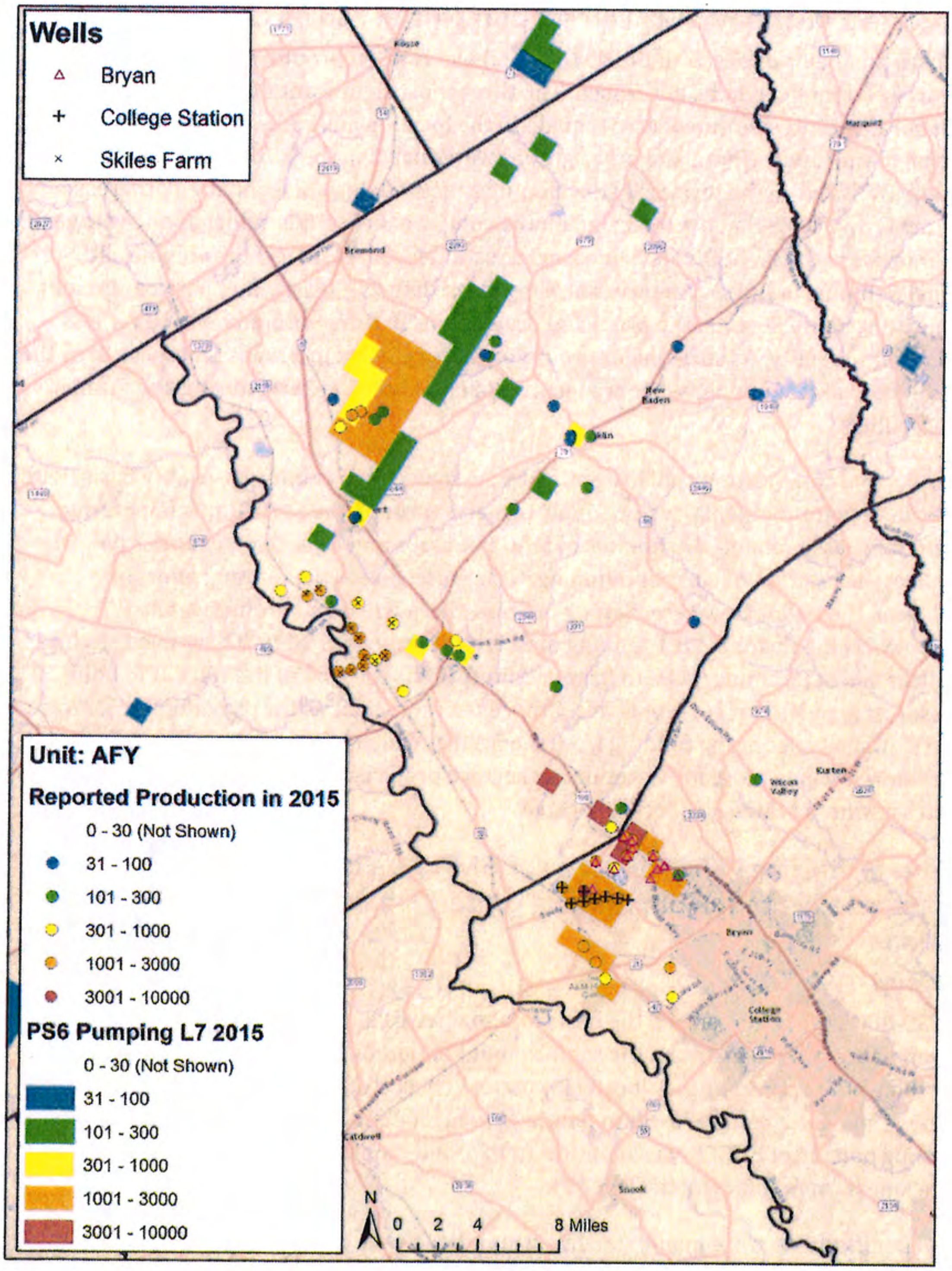

Figure 2. Map comparing location and annual volume of reported and simulated groundwater production from the Simsboro Aquifer in BVGCD in 2015. Reported production compiled from BVGCD reported water production data. PS6 pumping extracted from PS6 pumping input file.

Impact of incorrect distribution of current pumping in PS6 on cities in BVGCD

In summary, there are major issues with the distribution and rates of production used in PS6 by GMA 12 in the BVGCD that need to be addressed. The three most significant discrepancies are discussed in detail above. Resolution of errors made in the location and rates of production utilized in PS6 are critical to the City of Bryan and other groundwater users in the BVGCD for two primary reasons. First, the BVGCD is in the process of developing a methodology of evaluating progress made towards achieving DFCs that is predicated on the comparison of DFCs, which is an average of predicted water levels in the BVGCD versus measured water levels. As such, if the volume and location of actual pumping in Brazos County is already more than 2,500 acre-feet per year greater than the volume utilized in PS6, then the predicted drawdowns in Brazos County will be far less than what will occur in reality. As such, major groundwater producers in Brazos County such as the City of Bryan will be evaluated under what are incorrect and punitive criteria during any future regulatory proceedings.

Also, due to the current ramifications of MAG estimates, assigned on a county-by-county basis, with respect to state funding for municipal water supply projects through the SWIFT, it is imperative that at a minimum the assignment of estimates of MAG in Brazos and Robertson counties be realigned to reflect the location of current pumping. Otherwise, due to the limiting effect of estimates of MAG on the regional water planning process, there will be no groundwater development projects eligible for SWIFT funding in Brazos County until 2040. There needs to be a significant reallocation of pumping/MAG to Brazos County if it is the goal of the BVGCD to hold district-wide estimates of MAG at current levels. Otherwise, municipal water providers in Brazos County will have difficulty accessing funding from the SWIFT, which translates to citizens in the BVGCD being required to pay more for water infrastructure projects and upgrades than citizens residing in districts where MAG is properly allocated.

Modeling results utilizing PS6 in all areas of GMA 12 except for BVGCD, where corrections were made to major pumping centers – a modified PS6 "PS6_mod" DFC simulation

Simulation Setup

The GMA-12 PS6 DFC simulation formed the basis for what we refer to as "PS6_mod". The goal of the modified simulation was to maintain the same amount of pumping in BVGCD as in PS6, but to change where some of the pumping was located to better reflect BVGCD reported use records, City of Bryan pumping, and anticipated growth in pumping to meet demands within the region. PS6_mod pumping outside of BVGCD was identical to PS6, and modifications were made only to pumping in the Simsboro Aquifer (model layer 7).

Three primary modifications were made, starting in simulated year 2011:

1. City of Bryan pumping was modified to reflect reported production (based on BVGCD records) from 2011 to 2015. City of Bryan pumping from 2016 through 2070 was modified to reflect the estimates in the 2016 Region G Regional Water Plan. This modification included removing pumping in Robertson County that represented a hypothetical City of

Bryan wellfield near the county line, as discussed previously. Future pumping was distributed among the City of Bryan permitted wells based on their relative permitted amounts.

2. Skiles Family Partnership pumping was added for 2011-2070. For 2011 through 2015, reported pumping totals were used. From 2016 – 2070, the full permitted amount was used. The pumping was distributed to the permitted wells based on average yields from 2011-2015.

3. Pumping in the area of the Calvert Mine was reduced such that the total pumping in BVGCD was kept the same between PS6 and PS6_mod, given the changes described in #1 and #2. The pumping in the Calvert Mine area in PS6 was approximately 27,000 AFY from 2011 – 2014, and decreased to about 23,000 AFY by 2070. As discussed previously, this amount is considerably higher than water use reported to the RRC. RRC records indicate that reported pumping at the Calvert mine ranged from 7,000 – 8,000 AFY from 2000 to 2010, and averaged 5,088 AFY from 2011-2014. In PS6_mod, Calvert Mine pumping ranges from about 8,000 AFY in 2016 to 3,000 AFY in 2070.

Figure 3 shows the cell by cell pumping in PS6_mod in 2015 for the Simsboro Aquifer, for comparison to Figure 2, which shows the cell by cell pumping in 2015 for the original PS6 simulation. Note that simulated pumping now occurs at the Skiles Family Partnership wellfield, while less pumping occurs at the Calvert mine. Additionally, the pumping near the Brazos/Robertson county line, north of the City of Bryan that is not shown in BVGCD's records of reported pumping has been removed.

Figure 4 shows a temporal comparison between the simulated pumping in Robertson and Brazos counties for PS6 versus PS6_mod. Compared to PS6, PS6_mod pumping in Brazos County increases 8,700 acre-feet per year by 2070, while the pumping in Robertson County decreases 8,700 AFY by 2070.

Simulation Results

Figure 5 shows a comparison of the simulated head in the Simsboro Aquifer (model layer 7) between PS6 and PS6_mod in year 2070. The addition of pumping in the Skiles Family Partnership wells increases drawdown at that location, while the decreased pumping at the location of the Calvert Mine results in higher water levels at that location compared to PS6. The average drawdown in Robertson County increases by 14 feet in PS6 Mod compared to PS6. This increase in drawdown occurs despite an overall decrease in simulated pumping in the county. This result is partially due to the proximity of the outcrop to the mine, compared to the Skiles Family Partnership wells, and partially due to the simulated faulting in the area. As seen in Figure 5, there are many simulated faults in the area that act as barriers to flow. The actual sealing nature of these faults has been the subject of considerable discussion in GMA-12, and is currently being studied as part of an update to the groundwater model. In the case of PS6_mod, the simulated faults bracket the location of the Skiles Family Partnership wells, and cause an enhanced increase in drawdown due to the prevention of flow from the northwest and southeast.

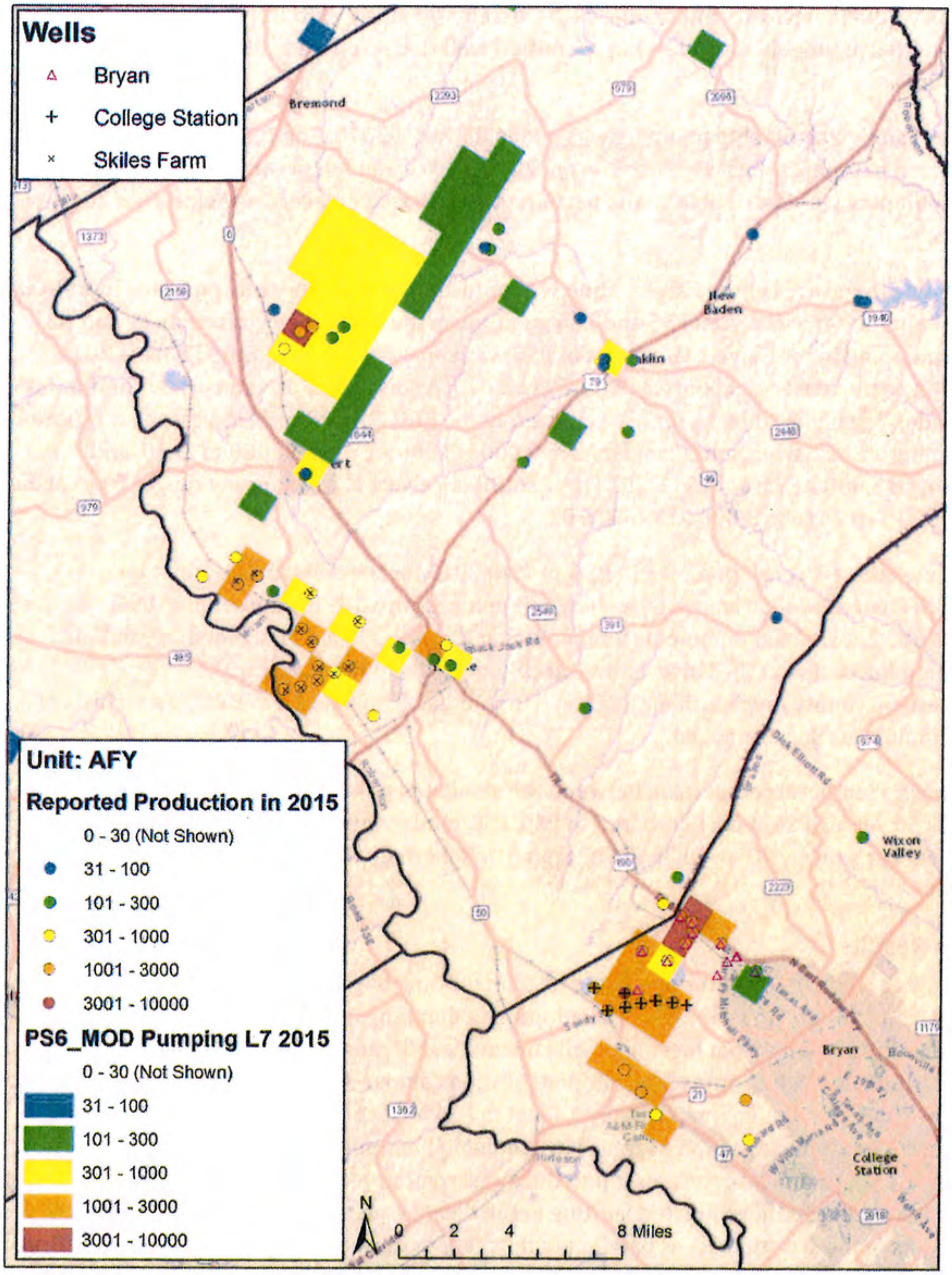

Figure 3. Map comparing location and annual volume of reported and modified simulated groundwater production from the Simsboro Aquifer in BVGCD in 2015. Reported production compiled from BVGCD reported water production data. PS6_mod pumping extracted from PS6_mod pumping input file.

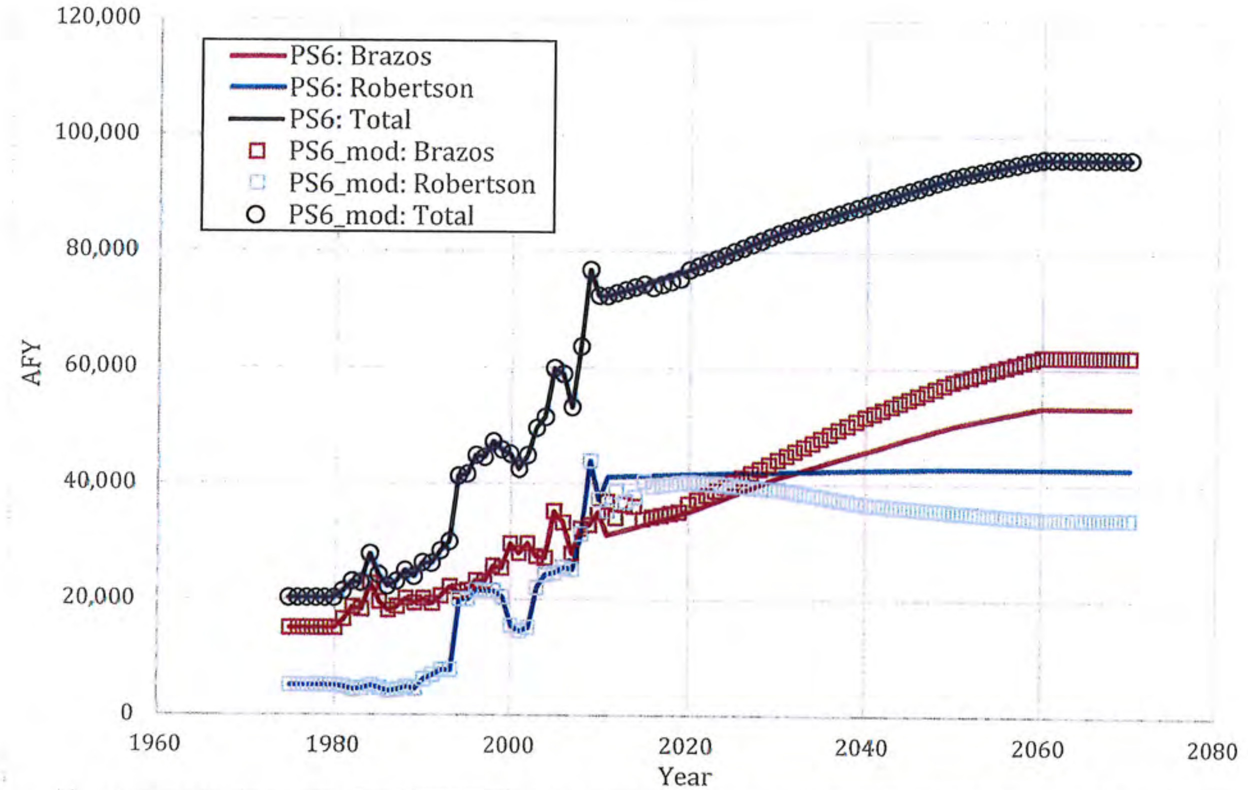

Figure 4 Simulated Simsboro pumping in PS6 and PS6_mod for Brazos and Robertson counties

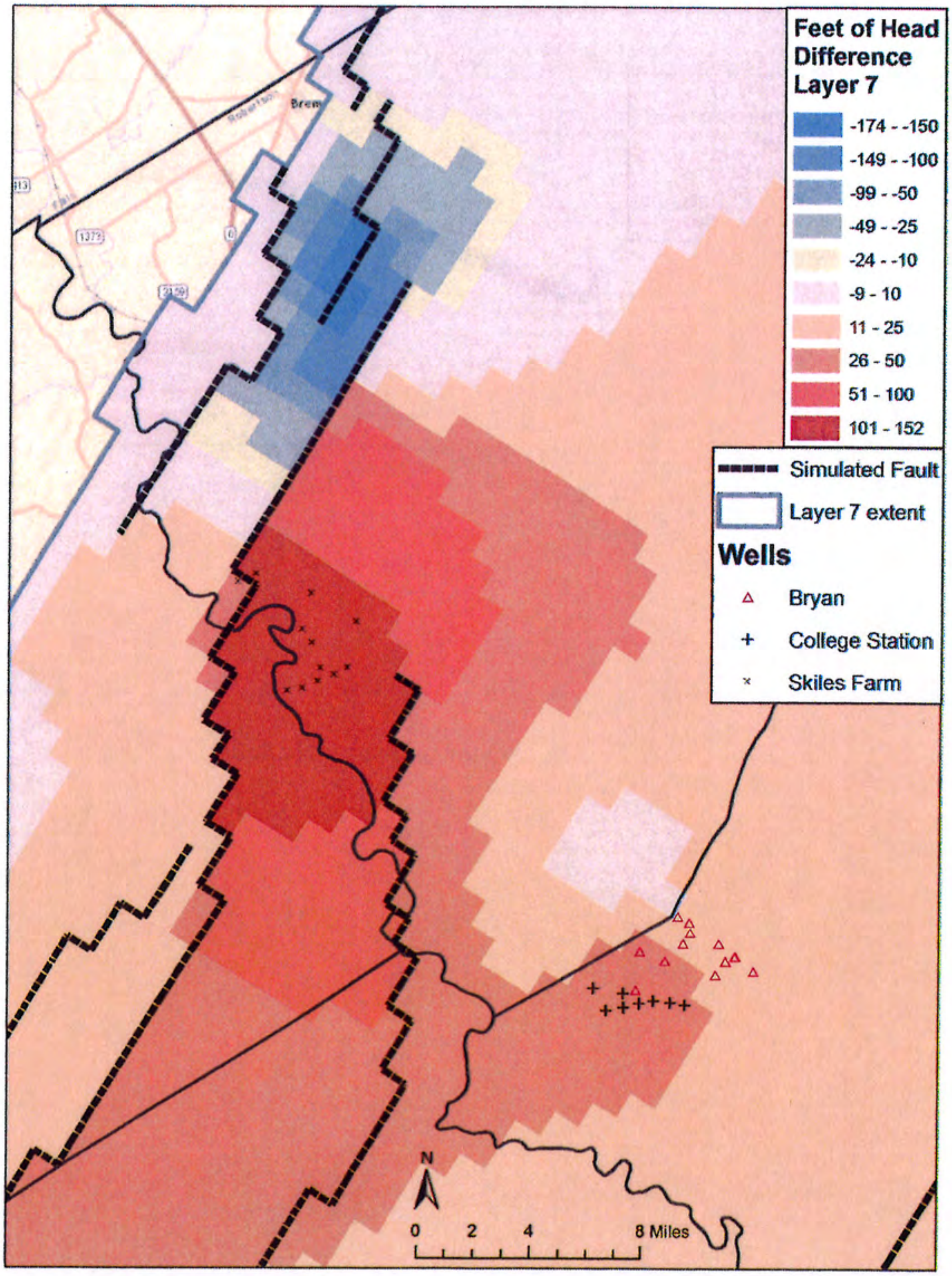

Figure 5. Map showing the difference between simulated Simsboro Aquifer heads in PS6 and PS6_mod in 2070. The values represent the difference between PS6 and PS6_mod, so that negative values indicate higher heads (less drawdown) in PS6_mod, while positive values indicate more drawdown in PS6_mod.

The simulated average drawdown in Brazos County increases by 18 feet due to the increased pumping at the City of Bryan wells in Brazos County. The combined average increase in Simsboro Aquifer drawdown in BVGCD for PS6_mod compared to PS6 is 16 feet.

Requested revisions

As a result of this review and analysis of the DFCs proposed by GMA 12 for the Simsboro Aquifer in the BVGCD, the City of Bryan respectfully requests the BVGCD consider the following changes for submission to the District Representatives of GMA 12 for their consideration. This request is based on the foundational principle of DFCs, as stated in Texas Water Code Section 36.1083 (b), that adopted DFCs are to be reasonable. The proposed DFCs for the Simsboro Aquifer in BVGCD, for the reasons stated above, are not based on best available science, do not reflect current pumping conditions, and as such, are not reasonable.

1. Modify the simulated pumping at the City of Bryan wellfield in Brazos County to reflect the reported values from 2011-2015, and to reflect anticipated growth in pumping to meet demands within the region from 2016-2070.

2. Remove the pumping in Robertson County apparently associated with the City of Bryan.

3. Modify the simulated pumping at Skiles Family Partnership to reflect the reported values in 2011-2015, and to reflect the permitted amount for 2016-2070.

4. Reduce the amount of predicted pumping at the Calvert Mine so that the overall MAG for Brazos and Robertson counties combined remains the same. This results in an 8,700 AFY increase in Brazos County, and a commensurate decrease in Robertson County.

The effect of making the revisions listed above in PS6_mod are that for the Simsboro Aquifer in 2070, there will be (1) a 14 foot increase in proposed DFCs in Robertson County, (2) an 18 foot increase in proposed DFCs in Brazos County, and (3) a 16 foot increase in proposed DFCs for BVGCD.

APPENDIX T

GMA 12’S RESPONSES TO COMMENTS FOR LOST PINES GCD

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ENERGY • WATER • COMMUNITY SERVICES

July 14, 2016

General Manager and Board of Directors
Lost Pines Groundwater Conservation District
908 Loop 230
P.O. Box 1027
Smithville, Texas 78957

Re: Lost Pines Groundwater Conservation District's Proposed Desired Future Condition for the Simsboro Aquifer

Dear General Manager and Members of the Board:

Pursuant to permits issued by the Lost Pines Groundwater Conservation District (LPGCD or "District"), the Lower Colorado River Authority (LCRA) has developed a groundwater supply at our Lost Pines Power Park in Bastrop County and realizes the importance of groundwater in helping to meet the water needs of the area. In addition to our investment at the power park, LCRA has purchased groundwater rights on other property over the Simsboro aquifer and thus has a vested interest in the management and regulation imposed on the groundwater resources within our service area.

LCRA has reviewed the Desired Future Condition (DFC) proposed by the District for the Simsboro aquifer, as well as those proposed by the other groundwater conservation districts within Groundwater Management Area 12 (GMA 12). As a steward of significant surface water resources upon which competing demands are placed, LCRA understands the responsibility on each of the districts within GMA 12 to fairly and equitably manage groundwater resources. However, LCRA is concerned that the DFCs do not reasonably protect the rights of groundwater owners within the Lost Pines GCD. As LCRA has previously expressed in comments to GMA 12, significantly different DFCs within a common aquifer, which is substantially similar throughout the GMA, poses a significant risk of impairing property rights of those within districts with more restrictive drawdown limits. Because Lost Pines GCD is one of those districts that has adopted a more restrictive drawdown than its neighboring districts over the same aquifer, LCRA's groundwater rights are more likely to be restricted in this manner in the future. LCRA encourages the District to revisit this disparity with the other districts within GMA 12 and reconsider LCRA's proposal to adopt a uniform DFC for the entire GMA 12 that focuses not on drawdown but on water remaining in storage in the aquifer.

LCRA is also concerned that the modeling relied upon to develop the scenarios for consideration of a DFC did not include reasonable assumptions regarding groundwater use within the Lost Pines GCD. Specifically, it is LCRA's understanding that the modeling performed for the proposed DFC limited the District-wide pumpage to the volume in the 2010 DFC process extended to the 2070 horizon and did not include any increased pumping from the Simsboro sufficient to account for permits issued in the District since 2010, when the current DFC was adopted.

LCRA appreciates the opportunity to make comments on this very important matter. If you have any questions regarding these comments, please contact me at 1-800-776-5272, ext. 6822, or email at david.wheelock@lcra.org.

Sincerely,

David Wheelock

David Wheelock, P.E.
Manager, Water Supply Planning

enclosure

LCRA
ENERGY • WATER • COMMUNITY SERVICES

bcc: Karen Bondy
Leonard Oliver
Lyn Clancy
David Wheelock
Reading File

March 7, 2016

Mr. Nathan Ausley, Chair
Groundwater Management Area 12
c/o Post Oak Savannah Groundwater Conservation District
P.O. Box 92
Milano, TX 76556

Re: Proposed Revision to Desired Future Conditions for the Simsboro Unit of the Carrizo/Wilcox Aquifer

Dear Mr. Ausley:

The Carrizo/Wilcox aquifer is a statewide and regional resource with significant quantities of water in the various formations in the aquifer. LCRA has developed a groundwater supply in the Simsboro formation of the aquifer at our Lost Pines Power Park in Bastrop County and realizes the importance of the aquifer in helping to meet the water needs of the area. LCRA commends the Groundwater Management Area 12 (GMA) for the detailed and diligent review being made of the current Desired Future Conditions for the aquifers within the GMA. LCRA is a steward of major surface water resources in and near the area of the GMA and, we understand the responsibility each of the districts in the GMA have for fairly and equitably managing groundwater resources.

In addition to our investment at the power park, LCRA has purchased pumping rights on other property located over the Simsboro aquifer and we have a vested interest in the management and regulation imposed on the groundwater resources within our service area.

The current DFCs in GMA 12 are based on a projected future drawdown of the aquifer occurring in 2060 at the end of the planning horizon for the 2012 State Water Plan. However, LCRA is concerned that the DFCs for the Simsboro formation vary from GCD to GCD within the GMA. For instance, the DFC for the Mid-East Texas GCD is 115-ft of drawdown, while the adjacent Brazos Valley GCD adopted a DFC allowing a drawdown of 270-ft. The Post Oak Savannah GCD DFC is 300-ft of drawdown, while across the county line in the Lost Pines GCD, the DFC drawdown is 237-ft (63-ft difference). In the long run, this approach of having differing DFCs means that higher pumping may be allowed in GCDs that have DFCs with greater drawdowns, which could mean that pumping or production is restricted in neighboring districts with DFCs that have more restrictive drawdown limits.

LCRA is concerned these different DFCs have the potential to result in unfair, and potentially unreasonably discriminatory permit and pumping limits within GCDs with more conservative DFCs, including the LPGCD where LCRA's groundwater interests are located, even though the characteristics of the aquifer across the GMA are not significantly different.

In addition to the potential long-term effect of differing DFCs on individual permittees, the DFCs also affect the TWDB regional and state water planning effort. Because the DFCs are used to develop Modeled Available Groundwater, the DFCs indirectly limit the amount of groundwater supply the planning groups can include as available for meeting future water needs. Differing DFCs across an aquifer that is reasonably uniform in character will result in different MAGs across county lines, which, in turn, leads to an inequitable allocation of groundwater in the planning process and, ultimately, has the potential to adversely affect the viability of groundwater strategies in the state and regional planning process.

LCRA proposes that the Carrizo/Wilcox aquifer, and particularly the Simsboro formation, be developed and managed based on the physical capability of the aquifer to supply water, prudent management goals that balance interests, and uniform DFCs across the GMA consistent with aquifer characteristics. In the case of the Simsboro formation, LCRA understands there is a common pool of water in a sand formation below the GMA 12. Pumpage within the aquifer causes changes in artesian water levels throughout the aquifer. Although there are no expected near-term effects on pumpage or permits with the current approach, the current inconsistency between DFCs and the underlying aquifer response could ultimately adversely affect landowners in an inequitable manner.

Last Spring, LCRA submitted written comments to you advocating for an approach to establishing a DFC that considered actual aquifer characteristics across the entire GMA and the adoption of a uniform DFC for the entire GMA unless there are compelling scientific reasons for distinguishing between separate groundwater conservation districts. LCRA also urged more consideration of where future growth and demands are expected than reflected in a drawdown approach that appears to give more protection to historic permits. Consistent with our past comments, LCRA proposes the GCDs within GMA 12 adopt a uniform DFC across GMA 12 and implement it in a manner to ensure that existing and future users within a single GCD are not unduly impacted by actions in a neighboring GCD within GMA 12. Our proposal is to adopt a DFC that would retain a vast amount of water in storage in 2070, considering the full extent of the Simsboro formation in GMA 12.

Specifically, LCRA proposes an approach to setting DFCs that will be uniform across the resource, i.e. in this case, across the GMA 12. The proposal recognizes:

- the resource is a common pool;
- groundwater withdrawal in any part of the resource affects conditions through the pool;

- there is a large amount of water in storage and the resource should be managed to allow some use of it, while balancing the effects on the aquifer.

LCRA proposes that the DFC be developed based on the amount of water in storage. The proposal is to have a DFC condition based on leaving a large amount of water in storage at the end of the DFC planning period (i.e. the year 2070). The measurement and reporting of the amount of water in storage would be for the entirety of the aquifer in the GMA 12 and without regard to the individual GCD boundaries. The LCRA's proposed DFC offered for consideration is:

"For the Simsboro formation of the Carrizo/Wilcox Aquifer the desired future condition is: the water remaining in storage in 2070 be at least 95 percent of the amount in storage in the formation existing in 2010, based on the full extent of the Simsboro formation in GMA 12."

In closing, LCRA points out:

- A consistent DFC addresses the inter-connectedness of all users of the aquifer and the fact that there are no known significant hydrologic differences to justify different DFCs by GCD.
- A DFC based on retaining an amount of water in storage is a simple physical parameter.
- Use of a small percentage of the water in storage over the next 55 years allows for reasonable, but not excessive development of the resource.
- A uniform approach across the GMA could provide for a more fair opportunity to develop groundwater than offered by the current DFCs.

Thank you for your consideration.

Sincerely,

Karen Bendy for

David Wheelock, P.E.
Manager, Water Supply Planning

/dac

Attachment

Proposed Desired Future Condition(s) for Aquifer(s) in GMA 12

Contact Information

Name: David Wheelock

Address: 3700 Lake Austin Blvd

Phone: (512) 473-3200

Email: David.Wheelock@LCRA.org

Representing: Lower Colorado River Authority

Proposed Desired Future Condition(s)

Please be as detailed as possible in describing your proposed DFC. Include the quantifiable value and a description of the method for measuring or calculating the value. Attach additional pages as needed.

Aquifer	Proposed DFC and Measuring/Calculating Method
Simsboro	The water remaining in storage in year 2070 is to be at least 95 percent of the amount in storage in year 2010, based on the full extent of the Simsboro aquifer in GMA 12.

Consideration of Proposed Desired Future Condition(s)

The Texas Water code requires that the GMA develop DFCs that "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." In the space below, or on additional attached pages, please provide your considerations with regard to the nine items that must be considered, per the Texas Water Code, for the proposed DFC(s).

Consideration 1 – "Aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another:"

LCRA's proposal is to have a consistent DFC for the full extent of the Simsboro aquifer within the GMA precisely because there are no known, significant hydrologic differences in aquifer conditions across the management area that would justify a significantly different management approach.

Consideration 2 – "The water supply needs and water management strategies included in the state water plan:"

Under the current approach, the Modeled Available Groundwater (MAG) could be distributed across the GMA in a way that could arbitrarily and prejudicially give preference to areas with less conservative DFCs even if anticipated water demands are located elsewhere within the GMA. A more uniform approach across the GMA, as proposed by LCRA, may allow important water management strategies to be included in the state water plan within DFCs that might otherwise be excluded solely due to the existence of very different DFCs within the same GMA even though the aquifer characteristics are not substantially different.

Consideration 3 – "Hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge:"

LCRA is not aware of any substantially different hydrologic conditions within the aquifer across the GMA that would warrant adopting anything other than a uniform approach to DFCs across the GMA.

Consideration 4 – "Other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water:"

LCRA is not aware of any substantially different anticipated environmental conditions across different areas of the GMA that would warrant adopting anything other than a uniform approach to DFCs across the GMA. The proposed DFC, and any DFC that results in development of the aquifer, could change the water budget relative to groundwater and surface water interaction. In some areas of GMA 12, it is likely that groundwater that previously was discharged through evaporation, transpiration, and springflow could be captured to aquifer recharge as the effects of reduced artesian pressure from groundwater production reaches the outcrop. To the extent such capture of natural discharge occurs, it could increase the total available water supply to the region. Direct evaporation of groundwater will be reduced as will discharge via transpiration and springflow. These effects occur to varying degrees from groundwater development for any DFC.

Consideration 5 – "The impact on subsidence:"

Subsidence is limited or non-existent in the Carrizo/Wilcox aquifer due to the well consolidated materials forming the aquifer. LCRA is not aware of any substantially different subsidence concerns within the aquifer across the GMA that would warrant adopting anything other than a uniform approach to DFCs across the GMA.

Consideration 6 – "Socioeconomic impacts reasonably expected to occur:" ______

LCRA believes that the impacts of its proposal to adopt a uniform approach to DFCs across the GMA supports a positive socioeconomic impact across the GMA because it affords the best opportunity to all owners of groundwater rights to fairly develop the resource they own on a schedule that fits the demands of their particular region, in a manner that has the least potential for adversely impacting landowners within a neighboring DFC, while still retaining a significant amount of groundwater in storage over a long period of time. At present, the current approach to disparate DFCs has the potential to limit the ability to use groundwater to meet water demands within high growth areas in the GMA if the area has not adopted a more generous DFC than its neighboring DFC.

Consideration 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:"

LCRA believes its proposal affords the best opportunity to fairly protect the interests of all owners of groundwater rights within the GMA. By basing the DFC on changes in storage, rather than artesian pressure, the proposed DFC protects the rights of all owners of the common aquifer more uniformly. By monitoring and regulating according to changes in storage, all property owners are provided their fair opportunity to use the groundwater under their land, while also restraining excess depletion of storage, should such depletion start to occur.

Consideration 8 – "The feasibility of achieving the desired future condition:" ____

Adoption of a uniform DFC across the entire GMA should better allow GCDs to manage the resource towards achieving but not exceeding the DFC while avoiding the need for curtailment except in exceptional circumstances and yet affording all groundwater rights owners a fair opportunity to access the groundwater under their land.

Consideration 9 – "Any other information relevant to the specific desired future conditions:" No additional information at this time.

Response to Comments- LCRA

The Lower Colorado River Authority (LCRA) submitted comments on the proposed DFCs to the Lost Pines GCD in a letter dated July 14, 2016. In their submittal, LCRA included a letter previously submitted to GMA 12 on March 7, 2016. GMA 12 has reviewed both of the letters and attempted to identify the relevant comments on the proposed DFCs. Responses to these comments are provided below.

- *LCRA is concerned that the Lost Pines Groundwater Conservation District (LPGCD) has adopted more restrictive Desired Future Conditions (DFCs) than neighboring districts, which will impair the property rights of those within the LPGCD compared to other districts. LCRA proposes a uniform DFC across the entire GMA.*

We assume this means that the LCRA is concerned that the more restrictive DFCs in LPGCD will result in lower Managed Available Groundwater (MAG) from the aquifers. However, there is a misconception that a uniform DFC across the entire GMA will result in equal groundwater production (MAG) from all areas within the GMA. This is not the case. Equal pumpage does not result in equal drawdowns across the GMA. Similarly, equal drawdowns (DFCs) will not result in equal pumpage in all areas of the GMA.

To illustrate this, GMA 12 ran the Central Queen City-Sparta GAM with equal pumpage across all of GMA 12. This was accomplished by evenly distributing the total pumping by aquifer among all of the active model cells within GMA 12 so that each model grid cell produced the same amount of groundwater from each aquifer. After this simulation was completed, the DFCs were calculated using the same parameters as the adopted DFCs. These are summarized in Table 1 for the Simsboro Aquifer layer in the model.

Table 1. Simsboro drawdowns in 2070 (DFCs) for GMA 12 with equal production across all of GMA 12.

County	Drawdown (feet)
Bastrop	204
Brazos	299
Burleson	320
Falls	-1
Fayette	369
Freestone	128
Lee	305
Leon	302
Limestone	66
Madison	349
Milam	100
Navarro	22
Robertson	199
Williamson	40

As shown in Table 1, "equal treatment" across the GMA in terms of groundwater pumpage does not equate to equal DFCs across the GMA. Despite the fact that pumpage was identical in every model cell within GMA 12 in this simulation, drawdowns in the Simsboro Aquifer resulting from the simulation ranged from essentially zero to 369 feet. Water level changes will vary across the GMA regardless of the distribution of pumpage that occurs.

For this reason, and because GCDs can only manage groundwater and groundwater users within their boundaries, each GCD has to determine what the management goals are for their specific district as part of whatever DFCs are developed for the GMA as a whole. This means that regardless of the DFC for the GMA as a whole, each GCD will still have to determine what DFCs apply specifically to their district within the overall GMA.

- *LCRA encourages the GMA to focus on water remaining in storage rather than drawdown for a DFC. LCRA would like to see DFCs that are uniform across the aquifer(s) in GMA 12, recognizing that there is a significant amount of water in these aquifers, that the aquifers are a common pool, and production of groundwater in one part of the GMA impacts conditions throughout the pool. LCRA would like DFCs to be based on amount of water in storage- specifically that at least 95 percent of the amount in storage in 2000 remains in storage in 2070.*

Water levels are a relatively straightforward measurement-easily obtained and repeatable. Measuring storage is more problematic. There is not currently an accepted methodology for monitoring the volume in storage in these aquifers without the use of water levels measurements. LCRA has not provided a method for measuring whether the DFCs have been attained if, as suggested, the total volume remaining in storage is used as the DFC. On the other end of the spectrum from storage, other stakeholders have suggested using even more conservative metrics, such as streamflow, for DFCs. These metrics have the same issue as storage in being much more difficult to collect and rely upon. Water levels remain the best option since they are straightforward to collect, repeatable and thus defendable. This provides a firmer basis for GMA 12 to defend DFCs, in the face of competing requests for how DFC status will be measured, and therefore this is the metric that GMA 12 has decided to use for DFCs.

GMA 12 recognizes that groundwater is in storage in the unconfined and confined parts of the aquifers and this was considered during the development of DFCs. In addition, groundwater in storage increases due to recharge, and although relatively small, this increase was considered during the planning process. However, because aquifers are not stagnant bodies of water and are instead active hydrologically, other components of the water budget are also very important. These aquifers are actively recharged and actively discharge in the region through evaporation, evapotranspiration and flow to streams in the region. For this reason, even though there is a large amount of water in storage, excessive production of this groundwater may, over time, have detrimental effects on surface water in the region. Impacts to surface water resources are one of the factors required for consideration under Tex. Water Code § 36.108 and a major concern addressed in multiple stakeholder comments to GMA 12. All factors outlined in Tex. Water Code § 36.108 must be considered by GMA 12 during the development of DFCs, so simply evaluating DFCs based on total storage does not work. GMA 12 has concluded that pumping at a level that would leave 95 percent of the current amount of water in storage by 2070 would not allow

GMA 12 to achieve a balance of the production of groundwater and the conservation and protection of groundwater resources within the GMA area.

- *LCRA is concerned that the modeling conducted in developing DFCs did not include reasonable assumptions for groundwater use within LPGCD- specifically that the proposed DFC limits future pumpage without taking into account increased pumping from permits issued.*

The MAGs anticipated from the proposed DFCs are similar to those resulting from the last round of joint groundwater planning completed five years ago. The current MAGs provide for additional groundwater pumpage through the year 2070. Within the Simsboro, the current MAGs increase from 29,556 acre-feet/year in 2010 to 37,249 acre-feet/year in 2070. There is no requirement that MAGs should increase to account for permits issued.

- *LCRA is concerned that varying DFCs, and the resulting varying availability of groundwater, will indirectly limit the amount of groundwater the regional water planning groups can include to meet future needs. This has the potential to adversely affect groundwater strategies in the state and regional water planning processes.*

The production of groundwater from the aquifers within GMA 12 is being managed by the GCDs that make up GMA 12. This means that some groundwater strategies may be limited, depending on the specifics of the strategy with respect to groundwater production within the GMA. The production of groundwater from these aquifers does have impacts, and it is the duty of the GMA to assess and balance these impacts and determine the most acceptable DFC for the region. The characteristics and productivity of the aquifers and the water needs of the region are just two of the nine factors that the GMA must consider when determining DFCs. It is possible that some water management strategies are adversely impacted by the MAGs that result from the DFCs developed during joint groundwater planning.

Response to Comments- Hugh Brown

Mr. Hugh Brown made oral comments on the proposed DFCs to the Lost Pines GCD during the July 20, 2016 public hearing. GMA 12 has reviewed his comments and provided responses below.

During his oral comments Mr. Brown expressed he believed that the optimal Desired Future Conditions would be based on balancing production and recharge within the District. Since those conditions were not met by the current proposed Desired Future Conditions Mr. Brown offered the following additional comments.

- *The DFCs should incorporate demand growth within the District over the planning horizon.*
- *The impacts of decreased artesian pressures on current and future well owners should be evaluated*
- *"No fault" mitigation programs should be taken into consideration during the DFC process, especially when considering changes in production.*
- *Further evaluation of recharge to aquifers should be conducted using Luminant Three Oaks Mine as a test sight.*

GMA 12 notes that DFCs based on balancing production and recharge is not required, nor does it provide an appropriate balance between groundwater production and the conservation and preservation of the aquifers within the GMA.

- GMA 12 did use increasing amounts of groundwater production over time in preliminary model simulations, which do reflect the increase in demand over the planning horizon.
- GMA 12 did evaluate the impacts of groundwater production on artesian pressure as well as unconfined water levels across the GMA.
- Mitigation is not a part of joint groundwater planning.
- GMA 12 encourages additional research into aquifer recharge by member districts or other interested stakeholders. However, this statement is not related to the proposed DFCs developed by GMA 12, and so no further response will be provided.

Comments to
Lost Pines GCD Board of Directors and GMA-12
regarding Proposed Desired Future Conditions adopted by GMA-12.

By Steve Box, Executive Director, Environmental Stewardship

A. Environmental Stewardship, as a nonprofit corporation and landowner, owns groundwater in place and has a constitutionally-protected right to conserve and protect its fair share of the water resources associated with the commonly shared aquifers.

Environmental Stewardship (ES) is a 501(c)(3) Texas nonprofit organization whose purposes are 1) to meet current and future needs of the environment and its inhabitants by protecting and enhancing the earth's natural resources, 2) to restore and sustain ecological services using scientific information, and 3) to encourage public stewardship through environmental education and outreach. ES is a landowner in Bastrop County within the territorial jurisdiction of the Lost Pines Groundwater Conservation District (LPGCD or District).

As the owner of property[1] located adjacent to the Colorado River in the Calvert Bluff recharge zone[2], ES has ownership of groundwater in the Colorado River Alluvium, Carrizo, Calvert Bluff, Simsboro, and Hooper aquifers beneath its property, as a matter of state law.

The Texas Supreme Court (Court) and Legislature have confirmed by decision and statute that 1) landowners own, as real property, the groundwater in place beneath their land[3], 2) the landowner is entitled to produce groundwater without causing waste or malicious drainage of other property or negligently causing subsidence[4], 3) that nothing in the statutes shall deprive or divest that ownership[5], and 4) that groundwater conservation districts are the State's preferred method of regulating groundwater[6] and that GCDs working cooperatively together, on a regional basis, are the preferred method of developing and adopting desired future conditions (DFCs) for groundwater aquifers.

The Texas Supreme Court opined in the EAA v. Day decision[7] that, though groundwater is different in many respects from oil and gas, it is appropriate in certain circumstances to apply oil and gas law to the regulation of groundwater, with the caveat that "[u]nlike oil and gas, groundwater in an aquifer is often being replenished from the surface, and while it may be sold as a commodity, its uses vary widely, from irrigation, to industry, to drinking, to recreation. Groundwater regulation must take into account not only

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[1] Tahitian Village UNIT 4, Block 14, Lot 4-0950
[2] Geologic Atlas of Texas, Austin Sheet.
[3] Section 36.002 (a) of the State Water Code.
[4] Section 36.002 (b) of the State Water Code.
[5] Section 36.002 (c) of the State Water Code.
[6] Section 36.0015 of the Texas Water Code.
[7] Day Decision: The Edwards Aquifer Authority and the State of Texas, Petitioners, v. Burrell Day and Joel McDaniel, Respondents (Case No. 08-0964) Argued February 17, 2010; Opinion delivered February 24, 2012.

historical usage but future needs, including the relative importance of various uses, as well as concerns unrelated to use, such as environmental impacts and subsidence."[8] Even given such differences, however, the court felt that these differences were outweighed by the common principle that both represent "a shared resource that *must* be conserved under the Constitution"[9]. Notably, the State of Texas urged this principle on the Court in its petition for review of the lower court's decision in Day: "[W]hile there are some differences in the rules governing groundwater and hydrocarbons, at heart both are governed by the same fundamental principle: each represents a shared resource that *must* be conserved under the Constitution[10]."

Applying principles of oil and gas law, the Court found it critically important that the conflict between absolute ownership in place, as opposed to the rule of capture's absolution for draining oil and gas from the property of another, were resolved through the existence of correlative rights in the common pool[11]. Such correlative rights afford each landowner a reasonable opportunity to produce his fair share of oil and gas under his property in consideration of his absolute ownership of the oil and gas in place[12]. Pursuant to such rights, each landowner has privileges against other landowners in the common pool to take oil and gas therefrom by lawful operations; each owner has duties not to exercise his rights in a way that injures the common source of supply; each owner "has rights that other landowners not exercise their privileges of taking in such a way as to injure the common source of supply."[13]

In the oil and gas context, it is the Railroad Commission that serves as the expert to equitably balance the interests of different landowners. In the groundwater context, it is the role of groundwater districts to serve as experts, resolving conflicts of interests between not only landowners who want to produce the groundwater they own "to the limit" versus other landowners who wish to keep their groundwater in the ground, but also non-commercial uses, sustainability, and environmental considerations.

Accordingly, it is the duty of the groundwater conservation districts (GCDs) comprising Groundwater Management Area 12 (GMA-12) to protect the property rights of landowners like ES and others who want to conserve and preserve their groundwater in place for future use, non-commercial uses, sustainability, and environmental considerations by adopting desired future conditions that balance between the *development* and *conservation* of groundwater resources. As will be demonstrated in these comments, LPGCD is not in a position to demonstrate, and should not claim that the proposed DFCs achieve such balance.

[8] Day at 831
[9] Day at 832 (emphasis in original)
[10] State of Texas, Petition for Review at page 11.
[11] Elliff at 562.
[12] Elliff at 562.
[13] Elliff at 562-563.

B. Environmental Stewardship has attempted to participate in the proceedings regarding the GMA-12 review and adoption of the Desired Future Conditions (DFCs) for aquifers within its jurisdiction, but has received insufficient response.

Environmental Stewardship, as a landowner with groundwater ownership in place in the Colorado River Alluvium, Carrizo, Calvert Bluff, Simsboro and Hooper aquifers, and in seeking to fulfill its purpose to conserve and protect the water resources underlying its property, has for many years advocated before the member districts of GMA-12 and in particular before LPGCD to fulfill the District's and the GMA districts' respective duties to consider the impacts of groundwater pumping on surface waters, groundwater and surface water permits prior to permitting groundwater pumping and prior to establishing desired future conditions. ES has been joined by other organizations in its advocacy before LPGCD on permitting matters, and is now joined in these comments on DFCs by other organizations that represent a variety of local constituent interests that are aligned with ES's position as both environmental steward and landowner.

In this interest, ES attempted to participate in the DFC review process before GMA-12 and the District. <u>Unfortunately, this has been a one-sided process whereby ES has provided the GMA and Districts with its concerns but the GMA and Districts have not, to date, adequately considered ES' concerns. Nor have the GMA and Districts provided ES with a response and conclusions regarding ES' concerns, either orally or in writing, demonstrating how these concerns were, or were not, incorporated in the Proposed DFCs other than to say that the tools currently available are not adequate to make quantitative judgments regarding the impacts of pumping on surface waters, groundwater and the requirement to balance conservation and development of these resources</u>. Without adequate consideration of these critical factors, no assurances can be given that balance between development and conservation have been achieved.

Lost Pines District's reported considerations

There are only two Lost Pines District documents that reference any evaluation of the impact of requested pumping on groundwater or surface water. The first is a memorandum from Mr. Donnelly to Joe Cooper[14], and the second is General Manager Joe Cooper's recommendations to the Board[15].

Donnelly's report on item 2 - whether the proposed use of water unreasonably affects existing groundwater and surface water resources or existing permit holders - reports on the impact of End Op's pumping on two Aqua wells, two City of Elgin wells, and two Manville wells. With a caveat regarding the use of the GAM to estimate drawdown, the report concludes that

> <u>*"it is not unreasonable to expect*</u> that pumpage from the End Op project would result in additional drawdown of hundreds of feet over 50 years in the two existing Aqua permitted wells"; "it is not unreasonable to expect that pumpage

[14] Donnelly, Andy. February 6, 2013. Subject: End Op permit review items (2 & 8).
[15] Cooper, Joe. March 20, 2013. End Op LP's Applications for Well Registration, Operating Permits and Transfer Permits for Well Nos. 1-4. Presumably there are similar sets of documents for other permit applications.

> from the End Op project would result in additional drawdown of between 100 and 200 feet in the existing Elgin wells"; and of the Manville wells, "We might expect that these wells may see additional drawdown over 50 years of 100 to 200 feet". (emphasis added)

No consideration is given to other known registered Simsboro wells, and no consideration is given to known registered wells in the Carrizo, Calvert Bluff, or Hooper aquifers. Most telling, no justification is given for the implied conclusion that the impacts on the Aqua, Elgin and Manville wells are *not unreasonable*.

Donnelly's total evaluation of the impact of the proposed End Op pumping on surface waters is contained in a single paragraph:

> "*A quantitative evaluation of the impact of the proposed pumpage on surface water resources within the District is difficult to make. The only quantitative tool available is the GAM, and this model is a poor tool to effectively evaluate impacts to surface water within the District based on this application. However, because the majority of the flow of the Colorado River is controlled by the release of water from the Highland Lakes, the impacts from this project on flow in the Colorado River will not be unreasonable."*

Unlike in the evaluation of Aqua, Elgin and Manville wells, no attempt is made to inform the General Manager or the District of the predictions the GAM makes on the impact on surface waters nor the implications of those predictive trends. Certainly no justification is given for the conclusion that the impacts "*will not be unreasonable*".

The Cooper memorandum to the Board merely reflected the Donnelly report and dismissed any need to further investigate the impact of proposed pumping on other aquifers, other permits, other registered wells, or rivers, streams and surface water features without justification.

Donnelly did not use the methodology that he authored[16] titled *"Instructions for Running the Carrizo-Wilcox Ground-Water Model and Surface Water Models to Determine the Impacts of Carrizo-Wilcox Aquifer Pumping on Surface Water Flows"* to provide the General Manager or the District with estimates of the impacts of End Op pumping on the Colorado River and its tributaries. The following quotes from the report demonstrate the value of such an evaluation:

- *"All of these studies, at least to some degree, recognized that the Carrizo-Wilcox aquifer and the major streams and rivers ... are interrelated in-stream aquifer systems where ground water is in hydraulic connection with the surface-water bodies."*
- *"The outputs from the ground-water model were used with surface-water models to demonstrate how streamflows respond to changes in ground-water*

[16] Donnelly, Andrew, LBG-Guyton Associates. Date stamped October 1, 1998. "Instructions for Running the Carrizo-Wilcox Ground-Water Model and Surface Water Models to Determine the Impacts of Carrizo-Wilcox Aquifer Pumping on Surface Water Flows in the Nueces and Guadalupe-San Antonio River Basins", preface to "Interaction Between Ground Water and Surface Water in the Carrizo-Wilcox Aquifer" prepared for the Texas Water Development Board, August 1998.

levels, and also to demonstrate how water rights, streamflows and fresh-water inflows to the ... estuaries may be affected."

- *"Additionally, the results of the study indicate that average annual streamflows will be reduced in each of the two major river systems that drain the area."*
- *"The models indicate an interaction between ground water and surface water. As ground-water levels change, surface-water discharge also changes, but we currently lack the data to accurately define the magnitude of these changes."*
- *"The collection of basic hydrogeological data pertaining to the Carrizo-Wilcox aquifer should be continued and expanded in order to better understand the following: (f) degree of hydraulic connection between the Carrizo aquifer and streams, rivers, and other surface-water bodies on the outcrop."*

We infer that the District thinks Donnelly's claim that the GAM is a poor tool for evaluating the impact of the proposed pumping on surface waters is acceptable to explain its response, or lack thereof, to whether certain impacts of DFCs (or pumping) -- effects on surface water, groundwater and other permits ---- are reasonable or unreasonable. In fact, the proper tools are not “available”, at least in part, simply because in the period since desired future conditions and permitting were required to consider these factors, neither the State acting through the Legislature or the Texas Water Development Board, nor groundwater management areas and groundwater districts thought it mandatory to engage in a meaningful analysis of what could be argued to be the three most important factors in deciding how much drawdown we can tolerate. *Had ES not intervened to put GMA-12 and its member districts on the spot, it is reasonable to conclude no progress would have been made to develop those tools in the next five years*. *Likewise, no progress would be made toward achieving any certainty that balance between development and conservation has been achieved.*

As it stands now, the GMA and districts’ virtual silence in addressing even the *need* to do better in their deliberations has essentially rendered these factors superfluous for at least the next five-year planning period, without any attempt by the GMA 12 districts to even leave a “marker” that these three factors may potentially be determined to be *unreasonably* impacted, requiring a significant adjustment to the DFCs in the 2020 planning period. Negative impacts on surface water as important as those ES has raised, as well as whether impacts on groundwater (a/k/a the aquifers) and on other permits may likewise be unreasonable, should not be dismissed from the process in the meantime.

The standard definition of “consider” is to think carefully about something before making a decision. In order to demonstrate careful thought, it would seem a groundwater management area or groundwater conservation district must first make a *quantitative* analysis of the effects on groundwater, surface water, existing permits, and whether the required balancing has been achieved, in order to then actually “consider” whether such effects are unreasonably negative or balanced --- essentially, a *qualitative* analysis of the negative impacts.

Barring being in a position to quantify, let alone analyze, these impacts, it is imperative that LPGCD at least take steps to put all stakeholders on notice that the District, as the state's regulators of groundwater, has resolved to be actively engaged in promoting the public right and duty to have our natural resources preserved and protected and their use balanced between conservation and development. After all, the Conservation Amendment is the source of their regulatory authority --- the Legislature is commanded under the Conservation Amendment to "pass all such laws as are appropriate to so protect natural resources", and the Legislature has in turn spoken through the Water Code and authorized GCDs, working cooperatively together in a GMA, to be the state's preferred regulators of groundwater.

And we would also argue that reasonable regulation of groundwater by GCDs, cooperatively working together in a GMA, is a recognized exception to the rule of capture, making the adoption of DFCs or issuing permits, in circumstances where the GCD is exercising reasonable regulation, a *per se reasonable impact* on landowners' rights to sell the groundwater they own. Specifically, not being permitted to pump out and sell as much water as a person would like is a potential *reasonable* result (impact) of the state's regime of using groundwater district regulation to protecting natural resources in furtherance of the constitutional mandate of preservation and conservation. Stated another way, construing a *failure* by a GCD or GMA to reasonably establish DFCs or regulate pumping as a failure that violates the public trust, is also a reasonable construction of the Conservation Amendment.

Repeating that, while it is the Railroad Commission that serves as the expert to equitably balance the interests of different landowners in the oil and gas context, groundwater districts are the experts on groundwater that essentially must resolve the conflicts of interests between not only landowners who want to produce their groundwater "to the limit" versus other landowners who wish to keep their groundwater in the ground, but also the conflicts between maximum desired production and non-commercial uses, sustainability, and environmental considerations. We believe this equitable balance is explicitly required by the Conservation Amendment's requirement to balance development with conservation.

Accordingly, it is the duty of the GCDs comprising GMA-12 to protect the property rights of landowners like ES and others who want to conserve and preserve their groundwater in place for future use, non-commercial uses, sustainability, and environmental considerations.

We cannot emphasize enough our view that GCDs must *actively* regulate the production of groundwater, rather than being merely passive adopters of DFCs or issuers of permits with the hope of being allowed, politically and practically, to put their foot down, figuratively speaking, *after* their decisions begin to permanently harm our aquifers. The District's indifference and absence of any meaningful response to ES's input will signal just the opposite and perpetuate expectations of water marketers that the Carrizo-Wilcox Aquifer is capable of being exploited even further in future.

In short, the District will be seen as not taking its duties seriously, or at least seriously enough to lay a predicate for the District's willingness, if warranted to avoid unreasonable impacts, to make significant changes to DFCs *in the next planning round* – changes that might well reverse the drawdowns that will have previously been *inferred* to produce reasonable impacts for the first two planning periods, rather than actually having been *considered and determined to be reasonable* as the Water Code requires.

ES and other landowners have a right to expect adequate consideration of their concerns, with adequate and complete written responses provided in the explanatory report to demonstrate how our concerns were, or were not, incorporated into the finally adopted DFCs. The District should be dedicated to documenting its openness, and its resolve, to affirmatively pursue its mandate to achieve balance between development and preservation of the aquifer..

C. The Proposed Desired Future Conditions (DFCs), while far from adequate, are the best available option to enable the DFC process to move forward without compromising the currently adopted DFC. Adoption of the Proposed DFCs will allow for the Districts and GMA-12 to move to the next round of review where better information can be developed to inform on two key issues that have not been fully or adequately considered:

1. **the impacts of groundwater pumping on surface waters, other aquifers, and all landowners, and**
2. **what is required to conserve and preserve our groundwater resources.**

To do otherwise would be *premature* because GMA-12 and the Districts have not fully or adequately complied with Section 108(d)(4) and (7) to consider the impacts on the environment -- including groundwater-surface water interaction, interests and rights of landowners, and the duty to balance *conservation* and *development*.

The District and GMA-12 have not fulfilled their duty to consider, prior to adopting DFCs, the impacts of the DFCs on surface water, groundwater[17] and other permits[18]. Environmental Stewardship and others do not endorse the currently adopted DFCs[19] as being adequately and sustainably protective of the environment and the aquifers, or of property rights, but does recognize that the currently adopted DFCs are the current legal standard and, as such, should not be significantly changed until the GAM has been improved and better data is available on the nine factors for consideration prior to adopting changed DFCs. The following discussion should be read from this perspective --- our purpose is to include in the official record of the District's proceedings the extensive substance of what ES has offered for deliberation during the DFC process.

[17] Including all aquifers.
[18] Including surface water permits.
[19] ES does not endorse the currently adopted DFCs or the Proposed DFCs as being adequately and sustainably protective of the environment and the aquifers, but does recognize that this is the current legal standard and, as such, should not be significantly changed until the GAM has been improved and better data are available on the nine factors for consideration prior to adopting changed DFCs. This footnote reference applies to all aquifers. ES appealed the currently adopted DFCs. Though the appeal was dismissed on basis of administrative procedural matters, the merits of ES' appeal were never considered or answered.

ES takes this opportunity to remind GMA-12 and the Districts that the 80th Legislature established environmental flow standards[20] for the major river systems of the state, including the Colorado and Brazos rivers. ES brought this to the attention of the GMA and Districts in its June 27, 2014 presentation[21] regarding groundwater-surface water interactions. In setting these standards, the TCEQ, working through Bay and Basin Area Stakeholder Committees (including the Colorado-Lavaca[22] and Brazos Stakeholder Committees), established critical subsistence flow standards need to maintain a healthy biological soundness of these rivers and their tributaries through drought and extreme drought conditions. <u>These critical flow standards are threatened by groundwater pumping and must be considered and mitigated in establishing DFCs for aquifers that impact the Colorado and Brazos rivers and their tributaries. To date, GMA-12 has not demonstrated that it has considered this concern and has not provided written response as to how it has, or has not, incorporated that consideration in the Proposed DFCs.</u>

The Texas Water Code also requires[23] that groundwater conservation districts, before voting on the proposed desired future conditions of the aquifers under Subsection (d-2), *shall* consider nine conditions, including:

> Consideration (4) other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water; and
> Consideration (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;

Consideration (4) - other environmental impacts: Consultants presented information regarding the shortcomings of the current GMA-12 groundwater availability model (GAM) in providing quantitative information regarding the impacts of groundwater pumping on springs, streams, rivers and other surface water resources on August 13, 2015[24]. Though the presentation detailed the limitations of GAM, it did not present information and data from GAM runs to indicate what the GAM DOES predict, nor data

[20] Senate Bill 3 Passed by 80th Session of the Texas State Legislature. Signed into Law June 16, 2007. SECTION 1.06. (b) Maintaining the biological soundness of the state's rivers, lakes, bays, and estuaries is of great importance to the public's economic health and general well-being. The legislature encourages voluntary water and land stewardship to benefit the water in the state.

(c) The legislature has expressly required the commission while balancing all other public interests to consider and, to the extent practicable, provide for the freshwater inflows and instream flows necessary to maintain the viability of the state's streams, rivers, and bay and estuary systems in the commission's regular granting of permits for the use of state waters. "Environmental flow regime" means a schedule of flow quantities that reflects seasonal and yearly fluctuations that typically would vary geographically, by specific location in a watershed, and that are shown to be <u>adequate to support a sound ecological environment</u> and to maintain the productivity, extent, and persistence of key aquatic habitats in and along the affected water bodies.

[21] Environmental Stewardship. June 27, 2014. PowerPoint presentation: GMA-12 DFCs, GW-SW Considerations.

[22] Established the <u>Colorado and Lavaca Basins and Matagorda and Lavaca Bays Area Stakeholder Committee</u> (CL BBASC) that completed its recommendations report in September 2011.

[23] Section 36.108 (d)(4) and (7).

[24] Consultant's presentation on Environmental Impact Considerations: file 08.13.2015_Presnetation-Environmental-Impacts.pdf

from other sources that had been previously provided by Environmental Stewardship[25], nor did the presentation indicate the trends the GAM predicts -- regardless of whether the predictions are quantitatively accurate -- and the implication of those trends for consideration by the District Representatives.

ES acknowledged in its comments[26] on the Environmental Impact Presentation on September 21, 2015, that the GMA-12 GAM does not appear to be a sufficient tool to fully model and predict, on a quantitative basis, the impacts of modeled pumping on surface waters and springs at the level needed and requires improvements. However, ES asserted, and still asserts, that the relationship between groundwater pumping and the impacts of that pumping on the rivers and streams (outflow to surface water), springs (drains), and on the lowering of water tables and dewatering of regions of the aquifer will have significant, and, in some cases, unacceptable impacts on the ecology and biological life in the rivers, streams and springs, and on terrestrial life at or near the land surface.

These same impacts will also be experienced by human inhabitants in the form of reduced capacity or dry wells, less productive terrestrial landscape, reduced economic value of land, and increased economic costs as the ecological services provided by both groundwater and surface waters are lost and it becomes necessary to replaced those services in order to maintain a quality lifestyle in the region.

GAM Predicted Impacts on the Colorado River and aquifers

To demonstrate the impacts that the GAM predicts, ES provided GMA-12[27] and the Districts with a report by George Rice on the impacts of combined[28] pumping (baseline + End Op + Forestar + LCRA + Vista Ridge) on the Simsboro, Carrizo, Calvert Bluff and Hooper aquifers. This report also provides qualitative and quantitative data on the impact of proposed pumping on the Colorado River and its tributaries. The report contains a detailed analysis of the GAM's ability to predict trends related to pumping

[25] Box, Steve. July 25, 2013. Letter and attachments re: Data and information regarding groundwater-surface water interactions between the Carrizo-Wilcox aquifer Group and the Colorado and Brazos rivers; December 19, 2013. Letter and attached Rice Report (December 12, 2013) re: Impacts of Groundwater Pumping on the Colorado River; June 27, 2014. PowerPoint presentation titled "GMA-12 DFCs, GW-SW Considerations; March 27, 2015. Letter and five attachments re: Review of predictive scenarios for comparison to adopted desired future conditions, Attachment 1. ES DFC and MAG comparison tables, Attachment 2. Colorado River-Simsboro Aquifer Connection. Attachment 2A. Saunders, Geoffrey P. February 2006. Low Flow Gain-Loss Study of the Colorado River in Texas. TWDB Report 365, Chapter 19; Attachment 2B. Saunders, Geoffrey P. February 2009. Low-Flow Gain-Loss Study of the Colorado River in Bastrop County. TWDB Report 374, Chapter 8; Attachment 2C. Rice, George. February 2015. Evaluation of Drawdowns Resulting from Baseline Pumping and Potential Pumping from the Simsboro Aquifer in Bastrop and Lee Counties, Texas.

[26] Environmental Stewardship. September 21, 2015. Comments on Environmental Impact Presentation (on GMA-12 DFC Form).

[27] Box, Steve. March 24, 2016. ES presentation to GMA-12 of Rice report dated March 22, 2016.

[28] Rice, George. March 22, 2016. GAM Predictions of the Effects of Baseline Pumping Plus Proposed Pumping by Vista Ridge, End OP, Forestar, and LCRA.

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rate, pumping duration, and distance of pumping from the river that support the use of the trend information in public policy decision-making.

Rice's Combined pumping report concludes that baseline pumping would:

- Reduce hydraulic heads (i.e., water levels or hydraulic pressure) in the Hooper, Simsboro, Calvert Bluff and Carrizo aquifers.
- Where these aquifers are confined, the reduced heads would cause water levels in wells to decline.
- Where these aquifers are unconfined (recharge areas), the reduced heads would cause dewatering of portions of the aquifers.
- Reduce groundwater discharge to the Colorado River, thereby reducing its flow.
- Additional pumping by Vista Ridge, End Op, Forestar, and LCRA would result in greater head reductions than would baseline pumping alone, and a greater decrease in groundwater discharge to the Colorado River (Figure 1).

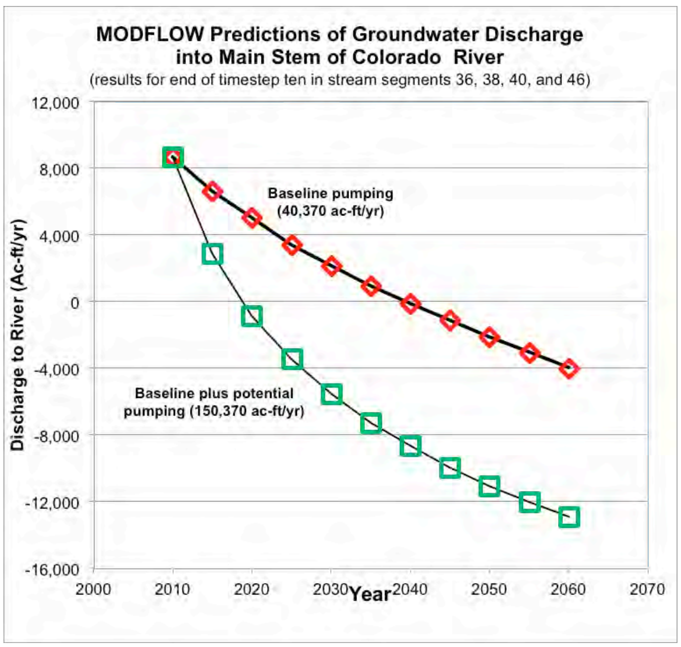

Figure 1: Predicted reduction of discharge of groundwater into the mainstream Colorado River due to combined pumping.

The GAM predicts that there will be a trend toward reduced outflows of groundwater from the aquifers into the Colorado River over the 50-year pumping period (Figure 1). Though we agree that the GAM is not suitable for making reliable quantitative predictions[29] regarding the amount of reduction or the rate of reduction, the Rice report confirms that the GAM is reliable in predicting the trend. The trend indicates that, over time, the relationship between the Colorado River -- which is currently a "gaining

[29] The limitations of the GAM in making reliable quantitative predictions is discussed in the Rice report and has been reviewed by the GMA-12 District representatives. GMA-12 districts, along with the Lower Colorado River Authority, Brazos River Authority, the Colorado-Lavaca Bay and Basin Stakeholder Committee, and Environmental Stewardship have also recognized this limitation and have raised nearly $300,000 to enable a robust groundwater-surface water interaction package to be included in the GAM improvements being implemented by INTERA under contract with the Texas Water Development Board (contract currently pending).

stream" -- and the Carrizo-Wilcox aquifer group will likely be reversed within the planning period. The GAM estimates that this change from a "gaining stream" to a "losing stream" will occur earlier with the combined pumping (perhaps as early as 2020) than with baseline pumping alone (perhaps as early as 2040). This is a significant, and unreasonable impact of groundwater pumping on the Colorado River, especially during drought conditions. This is an impact that deserves due diligence to study, monitor and mitigate potential impacts. Such due diligence has not been done and the GMA has not documented that it has considered this concern, nor how it has, or has not, included this concern in the Proposed DFCs.

The drawdown maps (Figures 2-5) associated with the combined pumping study demonstrate that the effects of groundwater pumping within Lost Pines and Post Oak Savannah Groundwater Conservation Districts (GCD), and mainly in the Simsboro aquifer, are predicted to impact not only the Simsboro aquifer, but also the Carrizo, Calvert Bluff and Hooper aquifers extending to points as far away as Gonzales, Lavaca, Colorado, Austin, Grimes and Walker counties. These aquifers are hydraulically connected throughout the Carrizo-Wilcox Aquifer Group.

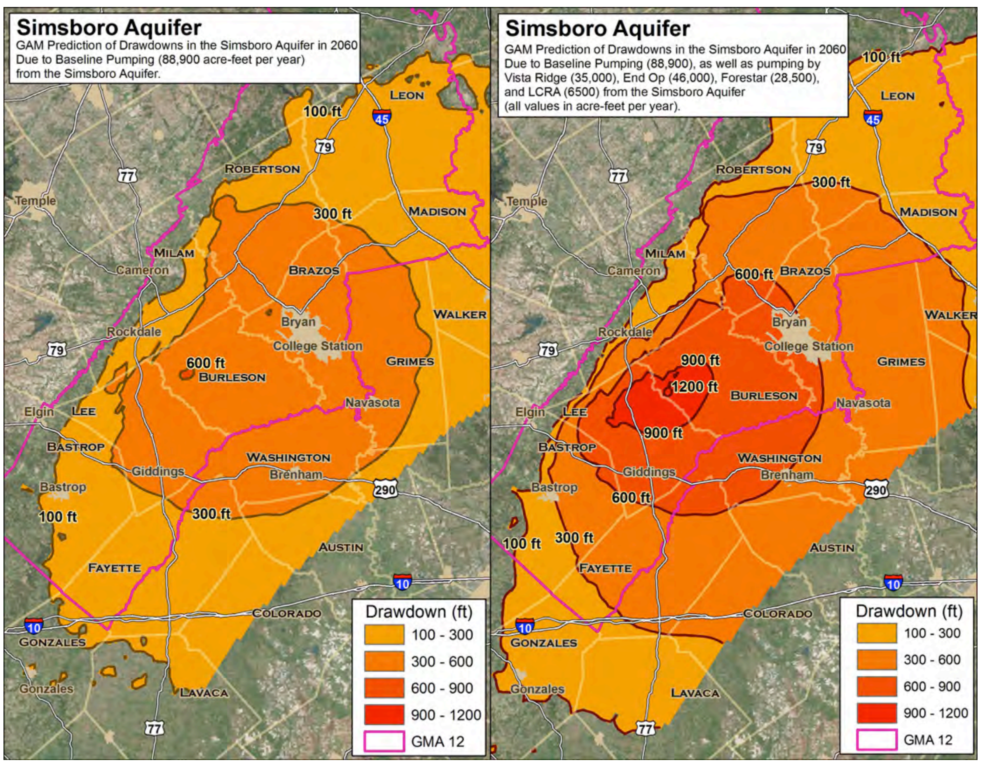

Figure 2. GAM predicted drawdowns in the Simsboro Aquifer due to baseline pumping (left) and baseline pumping plus additional pumping by Vista Ridge, End Op, Forestar, and LCRA 2000-2060 (right).

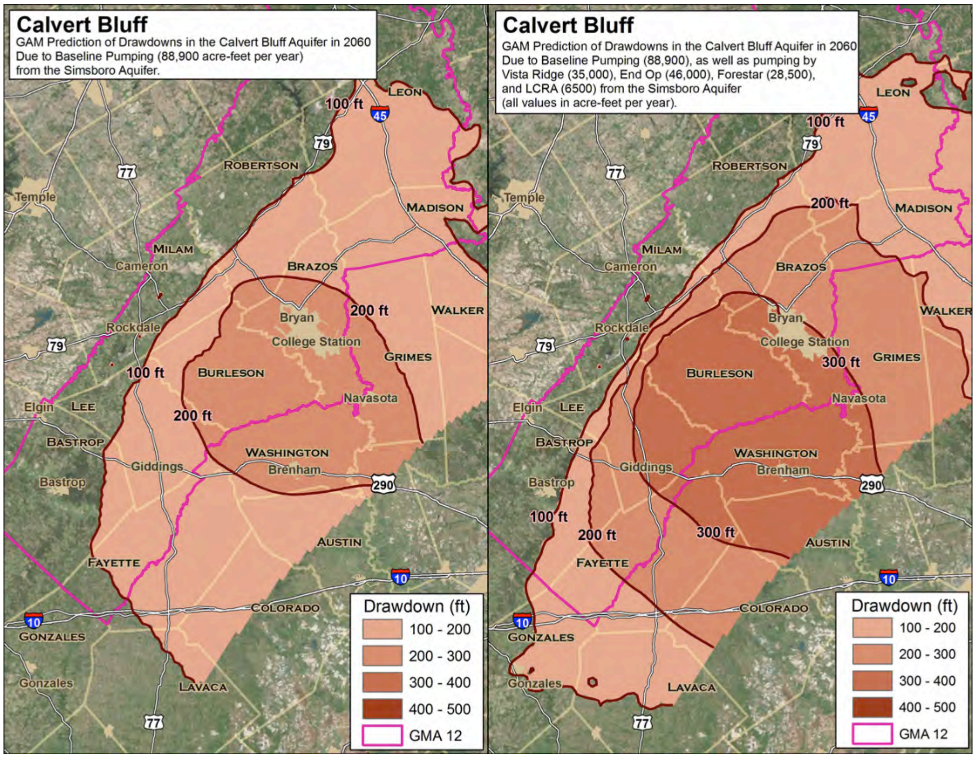

Figure 3. GAM predicted drawdowns in the Calvert Bluff Aquifer due to baseline pumping (left) and baseline pumping plus additional pumping by Vista Ridge, End Op, Forestar, and LCRA 2000-2060 (right).

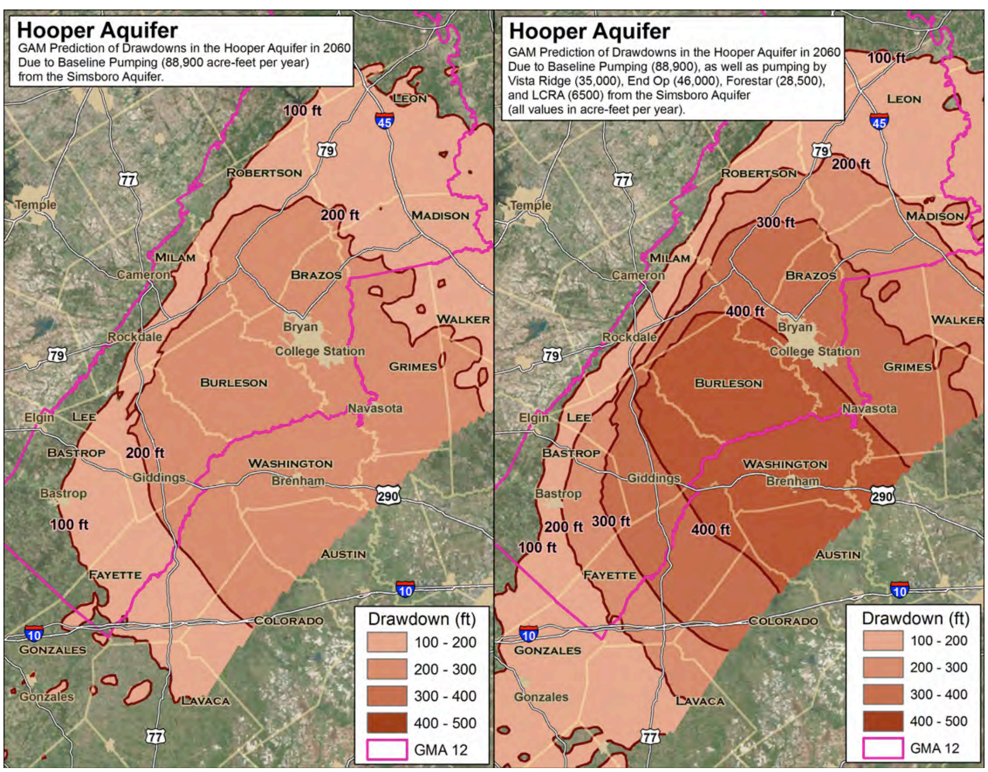

Figure 4. GAM predicted drawdowns in the Hooper Aquifer due to baseline pumping (left) and baseline pumping plus additional pumping by Vista Ridge, End Op, Forestar, and LCRA 2000-2060 (right).

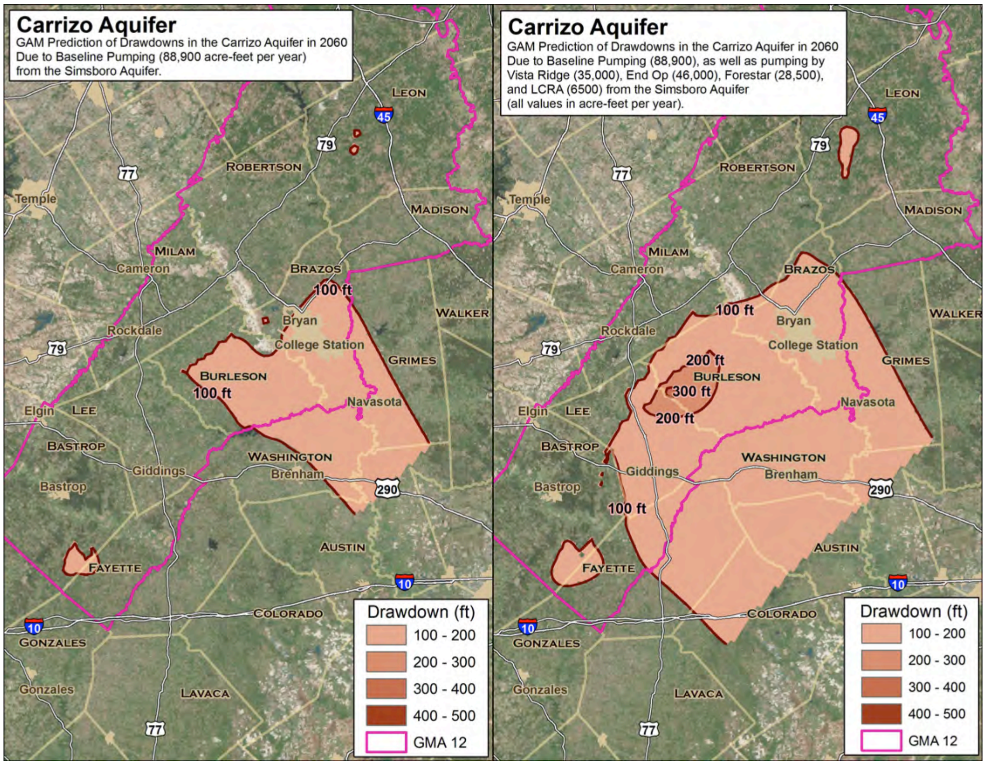

Figure 5. GAM predicted drawdowns in the Carrizo Aquifer due to baseline pumping (left) and baseline pumping plus additional pumping by Vista Ridge, End Op, Forestar, and LCRA 2000-2060 (right).

GMA-12 and the District have failed to consider the information provided to them in developing the adopted and proposed DFCs. GMA-12 has been reviewing the adopted DFCs and is considering revisions as mandated by the Texas Water Code[30]. Consultants provided information to the GMA-12 representatives on May 28, 2015, for the PS-4 scenario that included a full water budget for the current planning period through 2070 and the 1975-1999 calibration period. Environmental Stewardship analyzed the water budgets as reported on June 18, 2015[31]. The following observations, which were provided to GMA-12 and the District, demonstrate that significant impacts to surface waters, other aquifers, and shallow domestic wells are likely as a result of the anticipated pumping. The analysis indicates that:

1. Outflows to surface waters are the most significant contributor of groundwater for pumping: Outflows to surface waters are modeled to have decreased by a total of 100,000 ac-ft/yr since 1975 with the greatest declines occurring in Post Oak Savannah, Lost Pines, and Mid-East Texas respectively.
2. Vertical leakage from other aquifers into the Simsboro is the second most significant contributor of groundwater for pumping. Other aquifers have been the second most significant contributors of groundwater for pumping since 1975 and is the most significant contributor during the DFC period. Vertical inflow to the Simsboro is most significant in Post Oak Savannah, Brazos Valley, and Lost Pines respectively during the DFC period.

[30] Section 36.108(d)
[31] ES comments to GMA-12 on June 18, 2015, regarding Hydrological Conditions on GMA-12's DFC Form. See comments document for details.

3. Lateral flow (leakage) from neighboring counties is the third most significant contributor of groundwater for pumping. Lateral flow from other districts into the Simsboro in Brazos Valley is significant during the DFC period. Lateral flows out of Lost Pines and Mid-East Texas are the most significant with moderate outflows from Post Oak Savannah.
4. Storage change is the least significant contributor of water for pumping since 1975. Storage increased during the calibration period and decreases during the DFC period but is net neutral for the period. Thus it is false to state that most of the groundwater pumped is contributed from storage.

Again, to date, the GMA has not demonstrated that it has considered this concern and indicated how it has, or has not, incorporated this concern in the Proposed DFCs. As stated in our above-cited comments, ES believes that these impacts are important considerations in determining the amount of water that is available for development from the aquifers in balancing conservation and development. As such, an appropriate action is to improve the tools, as is being done with the GMA-12 GAM improvements project, and to defer significant changes in the adopted desired future conditions until we have better information available from monitoring and the improved tools to predict impacts. The Proposed Desired Future Conditions provide the deferment requested, however, to date, GMA-12 has not demonstrated that it has considered this concern, nor how it has, or has not, incorporated that consideration in the Proposed DFCs.

Consideration (7) - impact on the interests and rights in private property: Consultants presented information regarding this consideration at the June 26, 2015 meeting[32]. ES commented[33] on August 6, 2015, that ES strongly agrees, and continues to agree, with the continuum of interests -- where interests and rights range from those benefitted by present use of groundwater, to those that are benefited by leaving a significant amount of groundwater in place. ES contends that the Conservation Amendment to the Texas Constitution requires a balancing of these interests in such a way as to provide for the long-term availability of groundwater for use in perpetuity.

The statutory mandate to achieve a *balance* between the "highest practicable level of groundwater production versus the conservation, preservation, protection, recharging and prevention of waste of groundwater" must be considered in the DFC review process in order to protect the property rights of landowners. This balancing has not yet been done.

As such, ES requested in its August 6, 2015, comments that the consultant team be requested to prepare a report that quantitatively considers the impact of the pumping anticipated under the adopted desired future conditions on the property and surface water rights of landowners as described above. ES requested that the report estimate the number and percent of landowners that are beneficially and un-beneficially impacted

[32] Presentation by Monique Norman titled "Consideration of the impact on the Interests and Rights in Private Property in the Adoption of Desired Future Conditions of Aquifers."
[33] Environmental Stewardship. August 6, 2015. Comments on Needs & Strategies, Property Rights Presentation, and supplemental comments on Hydrological Conditions.

by the pumping to determine whether or not there is balance in the current and anticipated District practices.

Unfortunately, though the GMA-12 Representatives were provided with presentations regarding the requirements under Section 36.108(d), they have not developed adequate information to fully consider the impacts required by paragraphs (4) and (7).

Overall, GMA-12 and the Districts have fail, to date, to adequately consider the impacts of the currently adopted DFCs -- and the Proposed DFCs -- on spring flow, river and stream flow, and other interactions between groundwater and surface water. The GMA has not, to date, demonstrated that it has considered ES' concern, nor how it has, or has not, included that consideration in the Proposed DFCs. To their credit, the GMA-12 Districts have recognized the limitations of the GAM and have initiated work to improve the GAM with regard to its handling of faults, to update data used to develop and calibrate the model, and to install a robust package to predict the impact of groundwater pumping on rivers, streams and springs. The Districts, LCRA, BRA and the Colorado-Lavaca Bay and Basin Stakeholder Committed[34] contributed funds for this effort.

To date, the GCD's and GMA-12's efforts to "consider" whether impacts of pumping as reflected in the DFCs unreasonably impact ground and surface water, and other permits fall very short of the mark. Therefore these Proposed DFCs are *premature* with respect to protecting groundwater-surface water relationships because GMA-12 and the Districts have not yet complied with the Texas Water Code that is designed to protect surface features and shallow wells, and to guide permit decisions.

D. The amount of pumping expected jeopardizes the Desired Future Conditions (DFCs) for the aquifers, the District, adjacent Districts, and GMA-12.

The GAM predicts that permitted (baseline) pumping plus additional planned pumping will exceed the current and proposed desired future conditions (DFCs) by 200-300 feet of drawdown for the Simsboro Aquifer by 2060 (see Table 3 from Rice Report). Though not tabulated here, it is reasonable to expect that the Simsboro pumping will also have a significant effect on the DFCs of the Calvert Bluff, Hooper and Carrizo aquifers. Those impacts should be calculated by GMA-12 and the District and included in its evaluation of the effects of the proposed combined pumping on the DFC in the other aquifers. The maps (Figures 2-5) represent the drawdown of these other aquifers that results from Simsboro pumping.

[34] Environmental Stewardship initiated a project associated with the Colorado-Lavaca Bay and Basin Stakeholder Committee Senate Bill 3 funding to contribute $60,000 to the study to enable upgrading the groundwater-surface water package to a robust level that will support use of the GAM to predict local impacts of groundwater pumping on the Colorado River.

Table 3
GAM Predictions of Average Drawdowns in the Simsboro Aquifer from 2000 to 2060 Due to Baseline Pumping and Pumping by Vista Ridge, End Op, Forestar, and LCRA

GCD	DFC (ft)	Baseline drawdown (ft)	Drawdown due to additional pumping (ft)	Baseline plus additional drawdown (ft)
LPGCD	256	209	296	505
POSGCD	318	279	238	517

The GAM predicts that expected pumping in the region (baseline pumping + End Op pumping + Forestar pumping + LCRA pumping + Vista Ridge Pumping) will cause the desired future conditions of the Simsboro Aquifer to be exceeded by 200-300 ft. of drawdown.

- This level of exceedance will trigger "pro-rata" curtailment of all permitted pumping. However, once investments in contracts and pipelines have been made, and communities have been made dependent on the water, we believe it is very unlikely that such curtailment will be possible.
- Though not tabulated in the Rice Report, it is reasonable to conclude, and would be prudent to evaluate, the effect of the proposed pumping in the Simsboro aquifer on the desired future conditions (DFCs) for the Carrizo, Calvert Bluff and Hooper aquifers.

<u>Again, to date, the GMA has not demonstrated that it has considered this concern and indicated how it has, or has not, incorporated this concern in the Proposed DFCs.</u>

E. Sections 36.108(d)(4) and 36.113(d)(2) have a direct impact on interests and rights of persons who have been granted *surface water rights* in the Colorado River and Brazos rivers.

ES contends that, in balancing the use of groundwater at the *highest practicable* level of production, the GMA and Districts must also consider the impacts of groundwater withdrawal on surface water interests and rights. Two statutes[35] have been in the Texas Water Code for a number of years that reflect the Legislatures' acknowledgement that the State and GCDs have the duty to manage these resources in the manner described in the Conservation Amendment.

ES further contends that the aforementioned Sections 36.108(d)(4) and 36.113(d)(2) have a direct impact on interests and rights in private property and the rights of management area landowners, <u>*and*</u> have a direct impact on the rights of those who have been granted *surface water rights* in the Colorado River and its tributaries that are impacted when water withdrawn from under the ground has a consequential impact on the amount of groundwater that outflows from the aquifers into surface waters that are owned by the State and have previously been allocated for private use. <u>As such, it is</u>

[35] Section 36.108(d)(4) and Section 36.113(d)(2).

proper that the impact on *surface water rights* be considered under Section 36.108(c)(7).

State of Texas v. New Mexico and Colorado

The ownership relationship of groundwater and surface water is currently before the United States Supreme Court in State of Texas v. State of New Mexico and State of Colorado[36]. The State of Texas (Texas) argues that *"New Mexico, through the actions of its officers, agents and political subdivisions, has increasingly allowed the diversion of surface water, and has allowed and authorized the extraction of water from beneath the ground, downstream of Elephant Butte Dam, by individuals or entities within New Mexico for use within New Mexico. Texas argues that the excess diversion of Rio Grande surface water and the hydrologically connected underground water downstream of Elephant Butte Reservoir adversely affects the delivery of water that is intended for use within the Rio Grande Project in Texas[37]".*

The cause before the U.S. Supreme Court has not been adjudicated or otherwise settled[38], but is cited here as an example of the arguments that Texas and other persons might make should a person apply the same logic to similar situations within the State of Texas (See Attachment 1[39]).

Applying the same logic, a person might argue that Groundwater Conservation Districts (GCD, or Districts), located in Groundwater Management Area 12 (GMA-12), have taken action[40], and are continuing to take actions, that reduce Texas' surface water supplies and the apportionment of surface water it is entitled to from the Colorado and Brazos rivers, and the Highland Lakes project on the Colorado River, under the adjudication and allocation of water rights (surface water permits). The allocation of Colorado and Brazos river surface water rights is predicated on the understanding that delivery of surface water to water right holders in the Colorado and Brazos river basins would not be subject to depletions beyond those that were occurring at the time the Colorado and Brazos river surface waters were adjudicated. GCDs, through the actions of their Boards, officers, and agents, has allowed and authorized the extraction of

[36] State of Texas v. State of New Mexico and State of Colorado No. 220141 (January 2013) in the U.S. Supreme Court.

[37] Texas v. NM & CO, paragraph 18 (Attachment 2).

[38] Texas v. NM & CO. Cause No. 141 (original) in the Supreme Court of the United States, State of Texas (Plaintiff) v. State of New Mexico and State of Colorado (Defendants) was given over to a Special Master on November 3, 2014. Special Master's Case Management Order No. 11, issued on July 1, 2016, notifies that a Pre-Filing Inspection Draft of the First Interim Report which addresses four motions has been issued for review and comment and that the Special Master intends to file his report on the motions after August 1, 2016. The four motions are: New Mexico's Motion to Dismiss Texas' Complaint; New Mexico's motion to Dismiss the United States' Complaint in Intervention; and the motions to intervene filed by Elephant Butte Irrigation District and El Paso County Water Improvement District No. 1.

[39] Texas v. NM & CO, Paragraph 18 (Attachment 2).

[40] Authorized by the Texas Legislature that are, or may be, contrary to the Conservation Amendment of the Texas Constitution, in that they allow waters allocated as surface water appropriations (water rights) to be captured and made available as groundwater subject to ownership rights of landowners, but unallocated until permitted.

water[41] from beneath the ground, downstream of the Highland Lakes (in the Colorado River basin), by individuals or entities, within GCD's jurisdiction, for use both within the Districts and for export from the Districts, and have thereby increasingly allowed the diversion of surface water into underground aquifers[42]. The excess diversion of the hydrologically connected underground water, and thereby Colorado and Brazos river surface waters, adversely affects the delivery of water that is intended for use within the Colorado and Brazos river basins as allocated surface water and for environmental flows in Texas.

Despite Environmental Stewardship's request that Groundwater Conservation Districts and Groundwater Management Area 12 take action to cease or otherwise consider and manage these extractions of water from beneath the ground and the diversion and extraction of surface waters[43] and have increased over time until, in 2000, they amounted to tens of thousands of acre feet of water annually (estimated at 38,000 ac-ft/yr in 1999, and 100,000 ac-ft/yr in 2000) and are projected to increase at a high rate over the next few decades to an estimated 244,000ac-ft/yr ins 2070[44].

These extractions of water from beneath the ground[45] and the resulting surface water diversions into underground aquifers, *intercept water* that has historically been available for use by surface water right holders and for environmental flows (instream flows and freshwater inflows into bays and estuaries) in Texas, and *convert that water* for use as groundwater extracted and used within the Districts, and as groundwater extracted and transferred out of the Districts for use in other regions within Texas.

The extraction of groundwater and diversion[46] of surface water also require more water to be released from the Highland Lake reservoir, and reservoirs in the Brazos Rivers basin, depleting Highland Lake reservoir and other reservoir storage. These extractions also create deficits in tributary underground water which must be replaced before the Colorado and Brazos rivers can efficiently deliver Highland Lake and other reservoir water to water right holders and for environmental flows (instream flows and freshwater inflows to bays and estuaries). This requires additional releases of water from the Highland Lake reservoirs, and Brazos basin reservoirs, which has a detrimental effect on the amount of water stored in the Highland Lake and other reservoirs for future use.

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[41] Districts (for permits) have allowed extraction of groundwater by way of groundwater permits under 36.113(d)(2) that have the result of reducing historical outflows of groundwater to surface waters without adequate consideration of the impact of such pumping on surface waters and on surface water permits.

[42] The GMA-12 (for DFCs) and Districts (for permits) have allowed diversion of surface water into groundwater aquifers without adequate consideration of the impacts of groundwater pumping on surface waters and surface water permits as required by 36.108(d)(3)-(4) and 36.113(d)(2). The result of these actions are that historical outflows from the aquifers to the rivers and tributary streams have been reduced over time and will be further reduced as additional pumping is allowed.

[43] Texas v. NM & CO. Texas argues such diversions are unlawful.

[44] GMA-12 Hydrological Conditions Presentation by Consultants, May 28, 2015; estimates taken from PS4 scenario water budget for GMA-12 consolidated.

[45] Texas v. NM & CO. Texas argues such diversions are unlawful.

[46] Texas v. NM & CO. Texas argues such diversions are unlawful.

Depleted reserves in the Highland Lake and other reservoirs have adverse impacts on future water supplies that should otherwise be available to the Colorado and Brazos rivers for environmental flows and for delivery to water rights holders in these basins within Texas. These extractions have a direct adverse impact on the amount of water delivered to the Colorado and Brazos rivers, Matagorda Bay, and water right holders in Texas pursuant to the Colorado and Brazos river surface water allocations and adjudications, and the Lower Colorado River Authority's Water Management Plan as authorized by the Texas Commission on Environmental Quality (TCEQ). These extractions were not occurring when the Texas State Legislature established rules regarding the apportionment of surface water through the allocation of surface water rights in Texas to equitably apportion these surface waters. Thus, the Districts and GMA-12 have changed the conditions that existed when legislation was passed to establish a system to allocate surface water[47], to the detriment of the water right holders, environmental flows in the rivers and to the bays and estuaries, and to the State of Texas.

Evidence in Support of ES' Arguments

ES contends that the Sections 36.108(d)(4) and 36.113(d)(2) have a direct impact on interests and rights in private property and the rights of management area landowners, *and* have a direct impact on the rights of those who have been granted *surface water rights* that are impacted when water withdrawn from under the ground has a consequential impact on the amount of groundwater that outflows from the aquifers into surface waters that are owned by the State and have previously been allocated for private use. As such, it is proper that the impact on *surface water rights* be considered under Section 36.108(c)(7).

To illustrate the impact of planned groundwater withdrawal on surface water rights that would result from the GMA-12 Adopted DFCs, Environmental Stewardship retained a licensed geoscientist with the Texas Board of Professional Geoscientists. The naturalized flows of the Colorado and Brazos rivers were modified by removing a volume of water equivalent to the historic outflows from the aquifers to the river. A volume of withdrawal was selected to represent historical inflows from the Colorado River and Brazos Rivers. The contractor provided Environmental Stewardship with information on each water right and how it was affected by the adjustment in flow. Attachment 2[48] provides evidence of the estimated impact of groundwater withdrawals on surface water rights.

F. The resolution adopting the Proposed Desired Future Conditions (DFCs) *falsely* states that the Proposed DFCs provide a balance between highest practicable levels of groundwater production and the conservation, preservation, protection recharging, and prevention of water of groundwater in the management area.

The GMA-12 District Representatives adopted a resolution[49] concerning the proposed

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[47] And subsequent adjudication allocated water-to-water rights holders (permits).

[48] Attachment 1: ES Comments on Needs & Strategies, Property Rights, and supplemental comments on Hydrological Conditions submitted August 6, 2015, page 11 and Attachment 2.

[49] GMA-12 Adopted Resolution. July 15, 2016. RESOLUTION TO ADOPT PROPOSED DESIRED FUTURE CONDITIONS FOR AQUIFERS IN GROUNDWATER MANAGEMENT AREA 12

DFCs for the aquifers within their jurisdiction that includes the following paragraph:

> **WHEREAS, the proposed desired future conditions <u>provide a balance</u> between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater in the management area;** (emphasis added)

Based on the evidence presented herein, ES asserts, and asserted in its oral comments at the April 15, 2016 meeting, that this paragraph is not supported by the technical information presented during the review process and should be deleted from the resolution or revised to more accurately reflect the status of the DFC review process leading to the Proposed DFCs. No specific analyses have been done to quantitatively evaluate scenarios whereby the aquifers are conserved. How then can one then determine that the desired future conditions are in balance between conservation and development?

To the contrary, the evidence from the GAM pumping scenarios indicate that the aquifers associated with the Carrizo-Wilcox have not come into equilibrium -- as evidenced by the fact that using essentially the same pumping rates, but extending the DFC from 2060 to 2070, increased the amount of drawdown -- and therefore are not being pumped at a sustainable rate as required by the Conservation Amendment to the Texas Constitution and the statutes. No GAM scenario was run to estimate how long, if ever, it might take before the aquifers reach equilibrium. At no point in the review did the GMA consider or evaluate what it would mean technically to conserve, preserve, recharge and prevent waste of groundwater (what we consider a "bright line" test of protection). We re-iterated ES' challenge to the GMA that it establish a "conservation standard" that would provide the means to balance between development and conservation.

The only justification -- provided by counsel -- is that the language is statutory and required". Though the statement is not accurate, in our view, the District Representatives adopted the resolution without dissent.

If the language "is statutory and required", then, having not met those statutory requirements, the Proposed DFCs are insufficient, and should not be adopted. If, on the other hand, the resolution is required to be accurate in its description of the status of the balancing process, the paragraph needs to be re-written to indicate that the Proposed DFCs are *interim*, and the full review will be completed when the GAM improvements are in place and additional information is available for consideration.

Adopting such an erroneous statement in the resolution -- just because it is statutorily required -- brings question to the credibility of the Proposed DFCs.

As such ES is on record as having questioned the accuracy of the paragraph prior to the vote being taken.

ES' CONCERN: We are concerned that the resolution adopting the proposed DFCs *falsely* states that the DFCs are, in fact, a balance between conservation and development of these natural water resources, when, in fact, no studies presented during the review period evaluated what conditions would be necessary to sustainably conserve the aquifers or that would supported the conclusion stated in the resolution that the aquifers are, in fact, in balance. ES anticipates that once adequate tools and information are available during the next round of DFC review, these balancing considerations can be adequately evaluated and DFCs adopted that do, in fact, "balance" as described in the resolution.

F. CONCLUSIONS AND RECOMMENDATIONS:

We urge the Board and GMA-12 to 1) adopt the Proposed DFCs and 2) amend the adopting resolution to a) accurately state that the review process cannot be completed until adequate tools and information are available, and b) therefore the Proposed DFCs do not yet provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater in the management area.

WHEREAS:

1. As a landowner, with groundwater ownership as real property, ES and other landowners have rights to a fair share of the common pool. It is the duty of the groundwater conservation districts (GCDs) to protect the property rights[50] of landowners who want to conserve and preserve their groundwater in place for future use, non-commercial uses, sustainability, and environmental considerations, by adopting desired future conditions that balance between the *development* and *conservation* of groundwater resources.
2. The GMA and Districts have not adequately considered ES' concerns, nor have the GMA and Districts provided ES with a response and conclusions regarding ES' concerns demonstrating how these concerns were, or were not, incorporated in the Proposed DFCs.
3. ES and other landowners have a right to expect adequate consideration of their concerns and adequate and complete written responses in the explanatory report demonstrating how our concerns were, or were not, incorporated into the finally adopted DFCs. -- with opportunity for public comment and discussion -- prior to adoption of the final DFCs.
4. Critical environmental flow standards for the Colorado and Brazos rivers are threatened by groundwater pumping and must be considered and mitigated in establishing DFCs for aquifers that impact the Colorado and Brazos rivers and their tributaries.
5. The relationship between groundwater and surface water interaction, and the impact of groundwater pumping on the groundwater-surface water interactions are important considerations in determining the amount of water that is available for development from the aquifers in balancing conservation and development.

[50] Including the right to participate as party to administrative processes such as contested case hearings.

6. The GAM, as currently constructed, is not an adequate tool to quantitatively predict the impact of groundwater pumping on surface waters, springs, and other terrestrial environments.
7. The limitations of the GAM have been recognized and a GAM improvement project is underway to correct the deficiencies so that better information will be available to predict impacts.
8. The current GAM is sufficient to predict trends regarding the impact of groundwater pumping on surface waters, springs, and other aquifers.
9. The current GAM predicts that the groundwater-surface water relationship will reverse within the 50-year planning period
10. The current GAM predicts significant drawdown in aquifers that communicate with the Simsboro aquifer where the majority of pumping is proposed to occur.
11. Drawdown of the communicating aquifers can have a significant and potentially unreasonable impact on surface waters, springs and shallow domestic wells.
12. The District and GMA-12 have not fulfilled their duty to, prior to adopting desired future conditions (DFCs), consider the impacts of the DFCs on the Colorado River and its tributaries.
13. The GAM predicts that permitted (baseline) pumping plus additional planned pumping will exceed the current and proposed desired future conditions (DFCs) by 200-300 feet of drawdown for the Simsboro Aquifer by 2060.
14. There are logical arguments and credible evidence that the groundwater pumping proposed in the Proposed DFCs will have an adverse impact on surface water permits making it proper that the impact on *surface water rights* be considered under Section 36.108(c)(7).
15. The District and GMA-12 have not fulfilled their duty to, prior to adopting DFCs, consider the impacts of the DFCs on the other groundwater aquifers that hydrologically communicate with the Simsboro Aquifer from which the pumping is requested. Specifically, the impact on the Colorado and Brazos River Alluviums, Carrizo, Calvert Bluff, and Hooper aquifers.
16. The District and GMA-12 have not fulfilled their duty to, prior to adopting DFCs, consider the impacts of the DFCs on other permits, including registered domestic wells in hydrologically communicating aquifers referenced above.
17. The District and GMA-12 have not fulfilled their duty to, prior to adopting DFCs, consider the impacts of the DFCs on other permits, including surface water permits.
18. Environmental Stewardship and others do not endorse the currently adopted DFCs[51] as being adequately and sustainably protective of the environment and the aquifers, but does recognize that the currently adopted DFCs are the current legal standard and, as such, should not be significantly changed until the GAM has been improved and better data are available on the nine factors for consideration prior to adopting changed DFCs. This applies to all aquifers in the GMA.
19. The Proposed DFC do not significantly change the currently adopted DFCs.
20. ES disputes the accuracy of the resolution adopting the Proposed DFCs.

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[51] ES appealed the currently adopted DFCs. Though the appeal was dismissed on basis of administrative procedural matters, the merits of ES' appeal were never considered or answered.

THEREFORE, ES recommends and requests the following to remedy the inadequacies in the Proposed DFCs and the adopting resolution:

1. It is necessary and essential that the District and GMA-12 adopted the Proposed DFC in order to defer consideration of the DFCs under Section 36.108(d) when better information regarding the impact on groundwater, surface water and other permits becomes available, hopefully during the third (next) round of review.
2. The third and next round of DFC review should adequately consider:
    a. The impact of the DFCs and the pumping allowed by the DFCs on surface waters;
    b. The impact of the DFCs and the pumping allowed by the DFCs on hydrologically connected aquifers;
    c. The impact of the DFCs and the pumping allowed by the DFCs on domestic wells in hydrologically connected aquifers; and
    d. Changes that should be made in the DFCs to ensure that the DFCs are sustainable and accurately reflect a balancing of conservation and development of the aquifers.
3. The resolution adopting the DFCs <u>must</u>, before these DFCs are finally adopted, be revised to accurately reflect that the current review and consideration of the nine considerations under Section 36.108(d) is incomplete and the DFCs do not yet balance conservation and development of the aquifers.

Attachment 1.

STATE OF TEXAS, *Plaintiff*, v. STATE OF NEW MEXICO and STATE OF COLORADO, *Defendants*.

Paragraph 18 lays out Texas' argument to the U.S. Supreme Court

18. New Mexico's actions have reduced Texas' water supplies and the apportionment of water it is entitled to from the Rio Grande Project and under the Rio Grande Compact. The Rio Grande Compact is predicated on the understanding that delivery of water at the New Mexico–Texas state line would not be subject to additional depletions beyond those that were occurring at the time the Rio Grande Compact was executed. New Mexico, through the actions of its officers, agents and political subdivisions, has increasingly allowed the diversion of surface water, and has allowed and authorized the extraction of water from beneath the ground, downstream of Elephant Butte Dam, by individuals or entities within New Mexico for use within New Mexico. The excess diversion of Rio Grande surface water and the hydrologically connected underground water downstream of Elephant Butte Reservoir adversely affects the delivery of water that is intended for use within the Rio Grande Project in Texas. Despite the State of Texas' request that New Mexico take action to cease these diversions and extractions, these unlawful surface water diversions and extractions of water from beneath the ground have increased over time until, in 2011, they amounted to tens of thousands of acre-feet of water annually. These unlawful surface water diversions and extractions of water from beneath the ground intercept water that in 1938 would have been available for use in Texas, and convert that water for use in New Mexico. The unlawful diversion of surface water and extraction of underground water also require more water to be released from Elephant Butte Reservoir depleting Rio Grande Project storage. These extractions also create deficits in tributary underground water which must be replaced before the Rio Grande can efficiently deliver Rio Grande Project water. This requires additional releases of water from Elephant Butte Reservoir, which has a detrimental effect on the amount of water stored in Elephant Butte Reservoir for future use. Depleted reserves at Elephant Butte Reservoir have adverse impacts on future water supplies that should otherwise be available to the Rio Grande Project for delivery in southern New Mexico, Texas and Mexico. These extractions have a direct adverse impact on the amount of water delivered to Texas pursuant to the Rio Grande Project authorization and the Rio Grande Compact. These extractions were not occurring in 1938 when Colorado, New Mexico, and Texas entered into the Rio Grande Compact to equitably apportion these waters. Thus, New Mexico has changed the conditions that existed in 1938 when the Compact was executed to the detriment of the State of Texas.

Attachment 2 (Attachment 2 from ES August 6, 2015 comments)

IMPACT OF GROUNDWATER WITHDRAWAL ON SURFACE WATER PERMITS

To investigate the impact that would result from the planned withdrawals from the GMA-12 Adopted DFCs, Environmental Stewardship retained a licensed geoscientist with the Texas Board of Professional Geoscientists. The naturalized flows of the Colorado River at Bastrop were modified by removing a volume of water equivalent to the historic outflows from the aquifers to the river. A volume of 25,000 acre-feet per year was selected to represent historical inflows from the Colorado River. The contractor provided Environmental Stewardship with information on each water right and how it was affected by the adjustment in flow (Kennedy, 2012 - see endnote). Tables 1 & 2 illustrate this information.

Two scenarios were run for the Colorado River. In the first scenario (Table 1) 25,000 acre-feet per year of water was removed to simulate the withdrawal of historic groundwater outflows. Over 1,100 water rights were impacted up and down the Colorado River, involving over 7,300 acre-feet per year of water (that's about 2.4 billion gallons of water per year). Freshwater inflows to Matagorda Bay were reduced by about 16,000 acre-feet per year.

Table 1. Impact of groundwater withdrawal of 25,000 acre-feet per year on Colorado River Water Rights

Colorado River Water Rights

Water Rights Negatively Impacted with 25,000 ac-ft/yr removed						
Ac-Ft/Yr Range of Impact:	>500	100-500	10-100	1-10	<1	TOTAL
No. Water Rights Impacted:	4	11	25	228	890	1,158
Average Ac-Ft/Yr Impacted:	3,271	2,421	889	544	231	7,356

Average % Reduced:	>= 4%	3.0-3.9%	2.0-2.9%	1.0-1.99%	<1.0%	TOTAL
No. Reduced:	2	8	25	237	879	1,151

- TCEQ WAM Run 3 for Colorado River with 1401 Water Records (1940-1998)
- Flow Adjustment Record was used to reduce naturalized flow at Bastrop by 25,000 ac-ft/yr
- Comparing Volume Reliability Indexes
- **No changes were made to any water rights records**
- **Freshwater inflows to Matagorda Bay are reduced 16,196 ac-ft/yr.**

In the second scenario (Table 2) 40,000 acre-feet per year was removed to simulate loss of the historical gain to the Colorado River (25,000 acre-feet per year) and an additional volume to model predicted inflow to the aquifers as the river becomes a "losing" stream (15,000 acre-feet per year). In this scenario, about the same number of water rights were impacted, involving about 10,800 acre-feet per year of surface water (about 3.5 billion gallons). In addition, and significantly, the uncommitted Highland Lakes water right had to be adjusted by 6,500 acre-feet per year to keep the modeled lakes from going dry. And freshwater inflows to Matagorda Bay were reduced by about 21,500 acre-feet per year.

Table 2. Impact of groundwater withdrawal of 40,000 acre-feet per year on Colorado River Water Rights

Colorado River Water Rights

Water Rights Negatively Impacted with 40,000 ac-ft/yr removed						
Ac-Ft/Yr Range of Impact:	>500	100-500	10-100	1-10	<1	TOTAL
No. impacted:	5	14	34	303	798	1,154
Average Ac-Ft/Yr Impacted:	5,383	3,161	1,245	800	237	10,826

Average % Reduced:	>= 4%	3.0-3.9%	2.0-2.9%	1.0-1.99%	<1.0%	TOTAL
No. Reduced:	16	10	116	473	547	1,162

- TCEQ WAM Run 3 for Colorado River with 1401 Water Rights (1940-1998)
- Flow Adjustment Record was used to reduce naturalized flow at Bastrop by 40,000 ac-ft/yr
- Comparing Volume Reliability Indexes

*** Uncommitted Highland Lakes Water Right was adjusted -6,500 ac-ft/yr to avoid taking lakes to zero**
*** Freshwater inflows to Matagorda Bay are reduced 21,522 ac-ft/yr.**

In the Brazos River scenario (Table 3) 265,700,000 acre-feet per year was removed to simulate loss of the historical gain to the Brazos River In this scenario, about 884 water rights were impacted, involving about 29,168 acre-feet per year of surface water.

Table 3. Impact of groundwater withdrawal of 40,000 acre-feet per year on Brazos River Water Rights

Brazos River Water Rights

Number of Water Rights Negatively Impacted with 265,700 ac-ft/yr removed						
Ac-Ft/Yr Range:	>1000	100-999	10-99	1-9.9	<1	TOTAL
No. impacted:	7	27	126	273	451	884
Average Ac-Ft/Yr Impacted:	17,044	7,151	3,910	916	147	29,168

Average % Reduced:	>= 10 %	5.0-9.9%	2.0-4.9%	1.0-1.9%	<1.0%	TOTAL
No. Reduced:	6	159	191	182	355	893

- TCEQ WAM Run 3 for Brazos River with 1307 Water Rights (1940-1997)
- Flow Adjustment Record was used to reduce naturalized flow at Hearn by 265,700 ac-ft/yr
- Comparing Volume Reliability Indexes
- **No changes were made to any water rights records**

USING ONLY WRID WITH 0 TARGET CHANGE (UNCOMPLICATED WATER RIGHTS)
DOES NOT CONSIDER WATER RIGHT RECORDS THAT HAD NO CHANGE OR POSITIVE CHANGE

The data shows that the water that GMA-12 intends to withdraw from the river to satisfy pumping is, for the most part, already allocated in surface water right permits. There is, for all practical purposes, no unallocated water available in the Bastrop segment of the Colorado River. That withdrawal of the historic groundwater inflows will impact the water rights of over 1,000 permit holders and involve over 10,000 acre-feet per year of surface water in the Colorado River basin and over 800 permit holders and involve over 29,000 acre-feet per year of surface water in the Brazos River basin. The water to implement the GMA-12 DFCs simply is not available without damaging surface water property rights and threatening river flows and freshwater inflows to the Bay, especially during extreme drought.

In reality, we know that the impact of a call on surface water rights does not spread the impact evenly among surface water right owners. To the contrary, since calls are made on a priority date basis, most of the impact is distributed among those water right permit holders that have a priority date later than that of the right being called.

Endnote:

Kennedy, Kirk, 2012. DETAIL RELIABILITY-25KAF BASTROP REDUCTION-pasted results-02202012.SWB.xls, DETAIL RELIABILITY-40KAF BASTROP REDUCTION-pasted results-02202012.SWB.xls. These are unpublished Excel files that will be provided to GMA-12 and/or Districts upon request.

Response to Comments- Environmental Stewardship

Environmental Stewardship submitted a lengthy comment packet to the Lost Pines GCD regarding the proposed DFCs developed by GMA 12. We have identified and summarized the comments that are directly applicable to the DFCs, and responded to these comments as appropriate. Due to the length of the Environmental Stewardship comments, comments are grouped into categories, where appropriate, in order to address similar comments together for clarity and conciseness. .

Comments on the Currently Proposed DFCs

Environmental Stewardship states that the currently proposed DFCs are the best available option to move forward. Environmental Stewardship states that to not adopt the proposed DFCs as final would be premature. Environmental Stewardship states that while they do not endorse the currently proposed DFCs, they recognize that it is the current standard and should not be changed at this time.

GMA 12 agrees with Environmental Stewardship that the currently proposed DFCs are the best available option. However, despite their support of the current DFCs, Environmental Stewardship has other concerns regarding other aspects of the DFC process. Therefore, the purpose of the following responses is primarily to provide feedback on Environmental Stewardship concerns expressed on the currently proposed DFCs.

General Environmental Stewardship Comments to GMA 12

Environmental Stewardship notes that they have participated in the GMA 12 process but have received insufficient response from the GMA, and that GMA 12 has not provided a written response regarding their Environmental Stewardship concerns.

Environmental Stewardship was granted a significant amount of time to provide comments to GMA 12, including an agenda item during the June 25, 2015 GMA 12 meeting in order to present their comments on the DFC process. The members of GMA 12 have consistently listened to and considered Environmental Stewardship input, as they have done for the numerous other stakeholders that provided input during the joint groundwater planning process. The Environmental Stewardship comments, as well as all stakeholder comments on the proposed DFCs submitted during the 90-day hearing period, have been addressed in this Explanatory Report, as required. The lack of a formal response prior to this Explanatory Report does not indicate that any of these previous comments and concerns were not considered by GMA 12.

Comments on Lost Pines GCD Permits and Permit Hearings

In various parts of their comments, Environmental Stewardship comments on permits and permit hearings conducted by the Lost Pines GCD, specifically the End Op hearing process, and the potential impact of End Op and other permits on water level or artesian head changes in the aquifers.

Environmental Stewardship critiques the Lost Pines GCD's evaluation of the impact of a specific permit application on existing DFCs. By statute, the process for adopting DFCs and the process for applying

DFCs when considering permit applications are separate processes with different considerations. In the DFC process, the joint planning committee must establish DFCs for aquifers using the statutory criteria for determining the DFCs set out in Tex. Water Code § 36.108. In issuing permits, a district must consider a different set of criteria, including whether “the proposed use of water unreasonably affects existing groundwater and surface water resources or existing permit holders,” and whether issuance of the permit is consistent with the district’s duty to “manage total groundwater production on a long-term basis to achieve an applicable desired future condition” set in the DFC process. Tex. Water Code §§ 36.113(d)(2), 36.1132(b). Environmental Stewardship’s discussion attempts to insert permit criteria into a discussion of DFC criteria. The Lost Pines Groundwater Conservation District also notes that its Board’s final decision on the specific application by End Op, L.P. was not based on the memoranda that Environmental Stewardship quote, but on expert testimony offered in a contested case hearing that addressed each of the statutory permitting criteria.

The joint groundwater planning process is where DFCs are developed by the members of GMA 12, and this Explanatory Report is a place to comment on the proposed DFCs that were developed by GMA 12. Neither the GMA process nor this Explanatory Report are where specific permit hearings or permits issued by individual districts are to be commented on, and therefore GMA 12 has no response regarding comments on specific permits .

<u>Impacts on the Environment including Surface Water</u>

In various parts of their comments, Environmental Stewardship expresses concern about the potential impact of the DFCs on surface water and surface water rights, including the need to mitigate surface water rights.

Environmental Stewardship states that GMA 12 should leave some type of “marker” so that these factors can be addressed in future rounds of joint groundwater planning. GMA 12 has evaluated and considered the impacts to surface water as required in Tex. Water Code § 36.108. This discussion is included in Section 5.4 of this Explanatory Report. This issue was also discussed in multiple GMA 12 meetings, particularly during the GMA meeting held on August 13, 2015.

In regards to surface water mitigation, GMA 12 not have any statutory authority regarding surface water flows. River authorities are the entities charged with meeting critical environmental flow standards established by the TCEQ. At this time, no river authority has expressed any concerns with the proposed DFCs and their impact on environmental flows.

As acknowledged by Environmental Stewardship, the tools currently available for assessing surface water impacts are not sufficient and/or unreliable for the monitoring purposes required for DFC assessment. If better tools become available in the future to evaluate the impact of proposed DFCs on surface water, it may be appropriate to utilize those tools and incorporate those findings into future joint groundwater planning cycles. In the meantime, GMA 12 has chosen to rely on other more reliable and defendable measurements, such as water levels, for setting and assessing DFCs.

Environmental Stewardship states that GMA 12 did not consider the impacts of the DFCs on surface water, groundwater, and other permits, and that environmental flow standards are threatened by groundwater pumping and that they must be considered. Environmental Stewardship also states that impacts to the Colorado River and environmental flow standards must be mitigated.

The impact to surface water is included in one of the nine factors that must be considered by the GMA when establishing DFCs. This was considered by GMA 12 during the development of the proposed DFCs, and is described in Section 5.4 of this Explanatory Report. In addition, mitigation is not a part of the joint groundwater planning process.

On page 16, under Section E regarding Colorado and Brazos River surface water rights, Environmental Stewardship contends that the GMA and Districts must consider the impacts of groundwater withdrawals on surface water rights and cites several case studies in support of this idea.

The Texas Water Code provides that in setting DFCs, the districts in a groundwater management area shall consider, among other things: “other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water.” Tex. Water Code § 36.108(d)(4). At pages 16 to 19 of its comments, Environmental Stewardship claims that this language requires the districts to consider the impact of groundwater withdrawals allowed under an adopted DFC on surface water rights. Environmental Stewardship’s argument for this approach is based on a flawed interpretation of Texas water law.

As Environmental Stewardship recognizes, groundwater is the private property of the landowner, who may make non-wasteful use of such groundwater at will. See *Friendswood Dev. Co. v. Smith-Southwest Indus., Inc.*, 576 S.W.2d 21, 25-26 (Tex. 1978); *City of Corpus Christi v. City of Pleasanton*, 276 S.W.2d 798, 802 (Tex. 1955); *Pecos County Water Control & Improvement Dist. No. 1 v. Williams*, 271 S.W.2d 503, 505 (Tex. Civ. App.—El Paso 1954, writ ref’d n. r. e.). Groundwater only becomes state water, available for appropriation under surface water rights issued by the state, when the groundwater enters a natural watercourse. *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 822-23 (Tex. 2012); *Denis v. Kickapoo Land Co.*, 771 S.W.2d 235, 236-37 (Tex. App.—Austin 1989, writ denied). It follows from these rulings that an owner of a surface water right holds no right to privately-owned groundwater. It is only after the groundwater enters a natural watercourse that is becomes water of the state and is subject to appropriation. The owner of a surface water right, therefore, has no legal standing to enjoin the production of privately-owned groundwater, even when that production materially reduces the flow of water in the natural watercourse. *Williams*, 271 S.W.2d at 506; *Kickapoo Land Co.*, 771 S.W.2d at 236-37.

Environmental Stewardship’s reliance on the litigation between Texas and New Mexico is misplaced. That litigation asks the Supreme Court to interpret a contract among those states, the Rio Grande Compact. The Compact, greatly simplified, requires Colorado to deliver a defined amount of Rio Grande water to New Mexico at certain locations and requires New Mexico to deliver a defined amount of Rio Grande Water to Texas at certain locations. Texas argues that New Mexico is in violation of the Compact because New Mexico is not delivering the agreed-upon amount of water to Texas. This is a contract issue, not a groundwater ownership issue.

Private Property Rights

Environmental Stewardship states that it is the duty of the GCDs that comprise GMA 12 to protect the property rights of landowners, such as Environmental Stewardship, that wish to conserve and preserve their groundwater.

The impact on private property rights is one of the nine factors that GMA 12 must consider when developing DFCs, as required under Tex. Water Code § 36.108. However, not only must private property rights be balanced with the other eight factors in the development of DFCs, but GMA 12 must also balance the property rights of those who wish to conserve and preserve their groundwater with those property owners who wish to produce groundwater from their property. The impact on private property rights was considered during the development of the DFCs, and is discussed in the Explanatory Report in Section 5.7.

The Limitations and Use of the GAM

Environmental Stewardship acknowledges that the current GAM does not appear to be a sufficient tool to fully model and quantitatively predict the impacts of pumpage on surface water, but asserts that groundwater pumping and the resulting lowering of water levels will have a significant, and in some cases unacceptable, impact on surface water based on flow values produced by the GAM in question.

GMA 12 agrees that the GAM is not a sufficient tool to fully model and quantify the relationship between groundwater and surface water in the model domain. For this reason, GMA 12 does not agree with the quantified impacts of groundwater pumpage on the surface waters in the region that Environmental Stewardship subsequently submits as evidence. These surface flow values were produced by the model that Environmental Stewardship acknowledges cannot accurately simulate surface flows. Due to the limitations of the GAM, these values cannot be considered scientifically valid with respect to the simulated quantities or changes in quantities.

However, GMA 12 does acknowledge Environmental Stewardships concerns and recognizes the relationship of declining water levels and the potential for resulting decreases in discharge from the aquifer to surface water resources. This issue was discussed during the current joint groundwater planning process and will be included in future planning cycles as well.

In addition, “unacceptable” and “unreasonable” are subjective terms. Drawdowns in aquifers in the region may impact surface waters. Whether these impacts are “unreasonable” is something that will be different to different stakeholders in the region. In their definition of the term “sustainable”, Alley and others (1999) of the USGS noted that *“The definition of “unacceptable consequences” is largely subjective and may involve a large number of criteria.”* This includes the impact on surface water resources and the potential negative impact on those resources by groundwater production. This is further complicated by to the fact that the GAM is incapable of accurately quantifying this relationship, as Environmental Stewardship has recognized and acknowledged. The duty of GMA 12 is to listen to the concerns of all stakeholders and develop DFCs that best strike a balance of the concerns of everyone in the region.

The revisions to the GAM currently being undertaken by the TWDB and its consultant should improve the predictive capability of the GAM with regard to the effects of groundwater pumping on surface water.

On Achieving A Balance With The Proposed DFCs

Environmental Stewardship states that the proposed DFCs falsely state that they provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection of recharge, and prevention of waste of groundwater in the GMA because the aquifers have not come into equilibrium. Environmental Stewardship wants the statement in the proposed DFC statement removed.

GMA 12 has never stated that the aquifers will come into equilibrium, nor is it GMA 12's position that providing the highest practicable amount of production balanced with the conservation and preservation of the aquifers means that these aquifers will come into equilibrium. The production of groundwater, especially the large-scale production of groundwater, will almost certainly result in increased drawdown of water levels in an aquifer, especially as the amount of groundwater production from an aquifer increases over time.

Environmental Stewardship states that the amount of pumpage from the aquifers is not at a sustainable rate. However, the definition of sustainable groundwater production is a difficult concept to define. For example, Alley and others (1999) of the USGS noted that *"we define ground-water sustainability as development and use of ground water in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences."* And as noted above, they go on to state *"The definition of "unacceptable consequences" is largely subjective and may involve a large number of criteria."* This includes the impact on surface water resources and the potential negative impact on those resources by groundwater production. Importantly, this paper recognizes that "sustainable" does not necessarily mean that water levels in an aquifer must reach an equilibrium. GMA 12 concurs with this view, and also concurs with the statement that *"the concept of ground-water sustainability and its application to real situations is multifaceted and complex."*

Different stakeholders will have different interpretations on sustainability and how to manage groundwater resources in the region. Although Environmental Stewardship has presented their input and concerns regarding the DFCs, GMA 12 has to also consider the input of other stakeholders and must balance all of the interests and viewpoints when developing DFCs. GMA 12 aimed to balance these viewpoints, representing both production and conservation, in the current DFCs.

THORNHILL GROUP, INC.

Professional Hydrogeologists • Water Resources Specialists

July 20, 2016

Mr. James Totten, General Manager
Lost Pines Groundwater Conservation District
908 Loop 230
Smithville, Texas 78957

Re: Detailed Comments, Recommendations, and Requests Regarding the Proposed Desired Future Conditions Determinations – The Aquifer Systems in Groundwater Management Area 12

Dear Mr. Totten:

Thornhill Group, Inc. (TGI) appreciates this opportunity on behalf of Forestar (USA) Real Estate Group, Inc. (Forestar) to provide these comments, recommendations, and requests pertaining to the proposed Desired Future Conditions (DFCs) for Groundwater Management Area 12 (GMA 12). These written comments are provided during the Public Comment Period as set in the notice published by the Lost Pines Groundwater Conservation District (LPGCD) in GMA 12. TGI's recommendations provided herein are relevant to GMA 12, LPGCD, and all GCDs across Texas, Texas Water Development Board (TWDB), and the State of Texas Legislature. This letter serves to provide the LPGCD and GMA 12 for consideration alternative DFCs based on aquifer storage that are based on sound science and honor Texas Water Law compared to the legally and scientifically flawed proposed DFCs that create man-made, false groundwater shortages. The proposed DFCs, based on reversed engineered drawdowns are likely to result in dysfunctional inaccurate water planning, and premature adverse economic impacts forcing LPGCD to create rules that infringe on private property rights, ultimately resulting in a regulatory taking.

BACKGROUND

Forestar (USA) Real Estate Group, Inc. – A Vested Stakeholder

Forestar is a stakeholder in GMA 12, with approximately 20,000 acres of land leased, three (3) existing large-capacity public supply wells, and a total of 10 wells permitted by LPGCD within GMA 12. Forestar clearly meets the definition of "affected person" presented by Texas Water Code Section 36.1083.(1) and Section 36.1082. – "Appeal of Desired Future Conditions" regarding the potential outcome of the proposed DFCs. The consequences of GMA 12 actions regarding determining the availability and management of groundwater directly affect the private property rights and investment-backed expectations of Forestar.

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Purpose, Objectives and Goals

The purpose of this letter is twofold:

(i) to express to the LPGCD that the proposed DFCs fail to meet the mandate of the state legislature as defined by Senate Bill 660 (SB660 2011), and
(ii) to offer a DFC metric that meets the mandate of SB660.

Specifically, as mandated in SB660:

> "Before voting on the proposed desired future conditions of the aquifers under Subsection (d-2), the districts shall consider: … (3) hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, and the average annual recharge, inflows, and discharge" (Section 36.108(d)(3)).

TGI has extensively reviewed the proposed DFCs and based on those review, the proposed DFCs (2016) are legally and scientifically flawed because they do not consider "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" (Code §36.108 (d)(d-2)). Basing DFCs on Modeled Available Groundwater data which has been reverse engineered from water planning projections of future water needs (i) amounts to "regulation by planning" and (ii) fails to account for the real world hydrologic conditions.

DFCs should be based on the full water balance of the coterminous aquifer. Such a water balance accounts for the outflows (production/discharge) of the aquifer, as well as the inflows (including average annual recharge), which are only an extremely small percentage of the water balance of the aquifers within GMA-12. In addition to outflows and inflows, the water balance includes **storage,** the largest volumetric factor within the water balance of the aquifers within GMA-12, that has been ignored in the development of previous DFCs and the proposed DFCs. Such a water balance must also include the **total estimated recoverable storage** determined by the executive administrator of the TWDB.

DFC analyses developed to date has relied on planned (e.g., reverse engineered) outflows and estimated average historic recharge for the development of the proposed DFCs. Relying solely on developing a "sustainable pumping rate" artificially restricts the amount of pumping allowed based on estimates of recharge creating man-made, false groundwater shortage. This results in dysfunctional inaccurate water planning assessments and creates premature adverse economic impacts forcing GCDs to generate rules that infringe on **private property rights**, ultimately resulting in a **regulatory taking**. This type of erroneous and illegal regulation prompted the passage of House Bill 200 (HB200 2015), which allows affected persons (including stakeholders such as Forestar) to appeal the reasonableness of desired future conditions through the State Office of Administrative Hearings (Code §36.1083 (b)).

Forestar requests that the LPGCD work with other GCDs within GMA 12 to propose alternative DFCs for the GMA 12 aquifers that meet the requirements of SB660 by developing DFCs based on scientific assessments of real world aquifer parameters and measurements considering the following criteria as objectives when developing the alternative DFCs:

1. Implementation of groundwater management principles and rules that honor Texas Water Law in particular regarding ownership of groundwater, specifically Absolute Ownership and the Rule of Capture as clarified by Senate Bill 332 (2011);
2. Demand that groundwater management truly recognize property rights for every groundwater owner, including fair chance to produce water (i.e., improperly called fair share) and investment-back expectations;
3. Sound science based analysis that accounts for the full water balance of the coterminous aquifer addressing the outflows, inflows, and importantly the total estimated recoverable storage with an understanding that existing regulatory structures are in place designed to avoid "appropriation" of groundwater and destroy groundwater right values;
4. Provide for regional (and local) groundwater management based on proper and responsible application of sound science **<u>coterminous with the boundaries of the individual aquifers</u> NOT <u>geopolitical boundaries</u>**; and,
5. Encourage groundwater management and regulatory activities in accordance with the intent of Texas state water policy, including fair and impartial application/ administration of rules and management procedures.

The current DFCs and the currently proposed DFCs fail in satisfying the above objectives and fail to meet the mandate of SB660. Proper DFCs such as the ones recommended herein will allow for the following goals to be met:

1. To ensure fair, rational and consistent implementation of rules and policy so that all **scientifically proven** and **economically feasible** groundwater development projects can move forward to production;
2. To prevent inaccurate **"paper," "digital" or political groundwater shortages** than can lead to premature development of inefficient and expensive alternatives such as brackish groundwater desalination, seawater desalination and the construction of additional surface water reservoirs, all of which might be economically viable in

the future, but at present may not be cost effective or necessary when considered on equal economic standing with development of available groundwater resources, and,

3. To develop and effectively manage long-term, affordable, reliable and excellent quality water resources locally, regionally and throughout Texas.

GROUNDWATER MANAGEMENT AREAS – HISTORY AND DEFINITIONS

GMA Creation and Designation

When the Texas Legislature originally passed a bill in 1949 to allow for creating groundwater conservation districts, the law mandated that the boundaries of groundwater conservation districts be coterminous with aquifer boundaries (underground water reservoir), prohibiting districts formed solely based on political boundaries, per the legislation authored by Mr. I.B. Holt:

> "No petition for the creation of a District to exercise the powers and functions set forth in Subsection B of this Section 3c shall be considered by a Commissioners Court or the Board, as the case may be, unless the area to be included therein is **coterminous** with an **underground water reservoir** or **subdivision** thereof which theretofore has been defined and designated by the Board as an underground water reservoir or subdivision thereof. Such district, in conforming to a defined reservoir or subdivision, may include all or parts of a county or counties, municipal corporations or other political subdivisions, including but not limited to Water Control and Improvement Districts." (HB 162, Acts 1949, 51st R.S., ch. 306, General and Special Laws of Texas).

The allowable boundaries of groundwater districts were subsequently modified in Texas Water Code Chapter 52, but elsewhere the concept remains:

> **"Groundwater reservoir"** means a specified subsurface water-bearing reservoir having ascertainable boundaries containing groundwater" (Texas Water Code 36.001(6)).

> **"Subdivision of a groundwater reservoir"** means a definable part of a groundwater reservoir in which the groundwater supply will not be appreciably affected by withdrawing water from any other part of the reservoir, as indicated by known geological and hydrological conditions and relationships and on foreseeable economic development at the time the subdivision is designated or altered." (Texas Water Code 36.001(7))

Following the implementation of Senate Bill 1 (1997) and the Sipriano (i.e., Ozarka) supreme-court case decision (1998), the number of GCDs in Texas essentially doubled by 2001, with most of the new districts formed being single-county wide districts – most all with the goal authority to prohibit groundwater transport out of the district. The Legislature responded to the proliferation of GCDs and passed Senate Bill 2 (2001), rescinding the authority of GCDs to prohibit groundwater transport or export, redefining and increasing the roles of GMAs, and initiating a "joint-planning" process among districts within each GMA. The designation of groundwater management areas is codified in the Texas Water Code §35.004, which states the following:

> "...Each groundwater management area shall be designated with the objective of **providing the most suitable area for the management of the groundwater resources. To the extent feasible, the groundwater management area shall coincide with the boundaries of a groundwater reservoir or a subdivision of a groundwater reservoir.** The Texas Water Development Board also may consider other factors, including the boundaries of political subdivisions."

Establishment of Desired Future Conditions and Modeled Available Groundwater

Historically, the phrase **"desired future conditions" (DFCs)** describes the targeted goals of specified strategies or plans for the management or restoration of ecosystems such as forests, park lands, streams and lakes, particularly those undergoing changes or being "threatened". In some instances, DFCs were compared with "current prevailing conditions" or CPCs. With respect to groundwater in Texas, the TWDB defines DFCs as follows:

> "Desired future conditions are the desired, quantified conditions of groundwater resources (such as water levels, water quality, spring flows, or volumes) at a specified time or times in the future or in perpetuity. In essence, a desired future condition is a **management goal that captures the philosophy and policies** addressing how an aquifer will be managed. ***What do you want your aquifer to look like in the future?***" emphasis added (Mace, Petrossian, et al. 2008, 3).

The early rules for establishing DFCs provide GCDs with almost complete discretion regarding the metric or metrics selected for DFCs. In fact, the TWDB simply provided some erroneous administrative examples of possible DFC types such as:

> "(1) water levels do not decline more than 100 feet in 50 years, (2) water quality is not degraded below 1,000 milligrams per liter of total dissolved solids for 50 years, (3) spring flow is not allowed to fall below 10 cubic feet per second in times during the

drought of record for perpetuity, and (4) 50 percent of the water in storage will be available in 50 years" (Mace, Petrossian, et al. 2008, 3).

Importantly, however, the TWDB has clearly stated that pumping is not a desired future condition, but is a means to achieve a desired future condition (Petrossian, Ridgeway and Donnelly, 2007). The Texas Water Code and TWDB rules state that the TWDB, not GCDs and GMAs, determine the modeled available groundwater or MAG, based on DFC. Texas Water Code defines DFC and MAG as follows:

> "Desired [F]uture [C]ondition – The desired, quantified condition of groundwater resources (such as water levels, spring flows, or volumes) within **a management area** at one or more specified future times as defined by participating groundwater conservation districts within a **groundwater management area** as part of the joint planning process."

> "Modeled [A]vailable [G]roundwater" means the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under 36.108" (Texas Water Code 36.001 (25)).

SECOND DFC/MAG CYCLE – NEW GUIDANCE

Results of Initial DFC/MAG Cycle - 2010

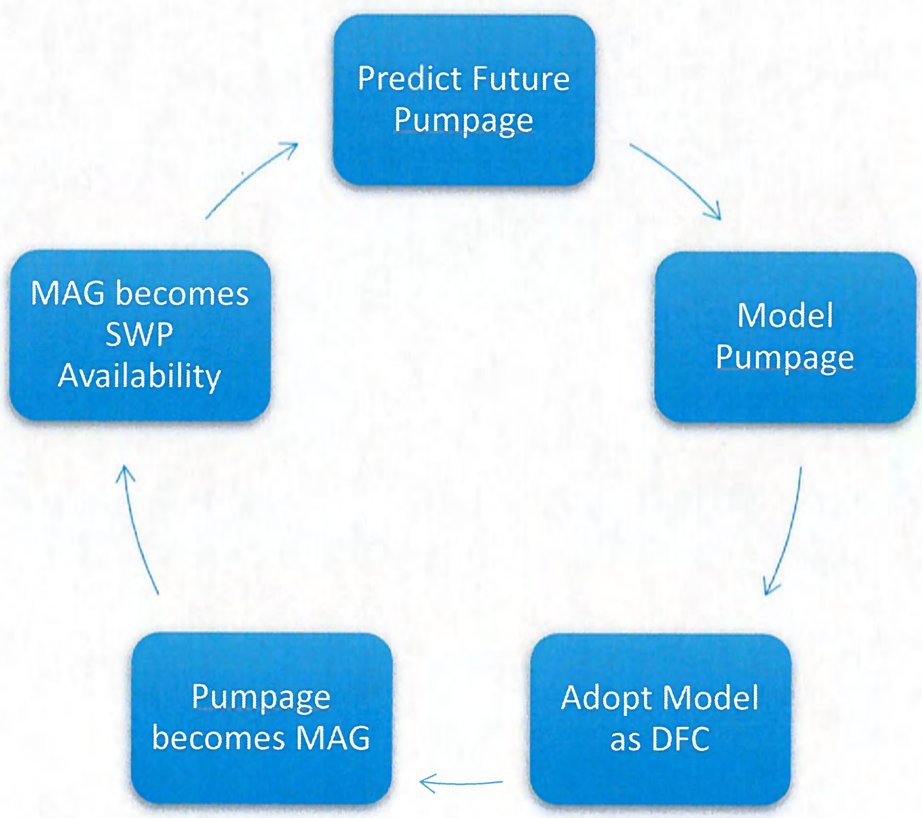
Initial DFC submittals (2010) for GMA 12 (and for many GMAs across Texas) were characterized by:

- **Arbitrary Considerations –** the TWDB nor the Texas Legislature provided substantial technical guidance to GCDs and GMAs in deriving DFCs. In fact, the TWDB seems to promote a subjective approach to DFCs with such statements as: **"What do you want your aquifer to look like in the future?"** (Mace, Petrossian, et al. 2008)**.** In fact, in a previous paper the same TWDB leadership stated when discussing a **consensus-based** groundwater management framework, "Like beauty, availability is in the eye of the beholder" (Mace, Mullican and Way 2001, 9).

- **Questionable Science –** the DFCs proposed by GMA 12 are reported as decreases in average saturated thickness for unconfined aquifers and average drawdown that is mostly determined by modeling results of the drawdown of artesian pressure heads. Using artesian drawdown to assess groundwater availability ignores aquifer storage and the true physical availability of an aquifer to recharge. As stated by a former board member of the TWDB, **"Some of the desired future conditions are being driven by…a fundamental misunderstanding of how groundwater aquifers behave…"**; and **"…groundwater districts now have the power to enforce resulting managed**

available groundwater determination that may, in effect, ignore the capability of the aquifer to produce water" (Mr. Jack Hunt, 2009).

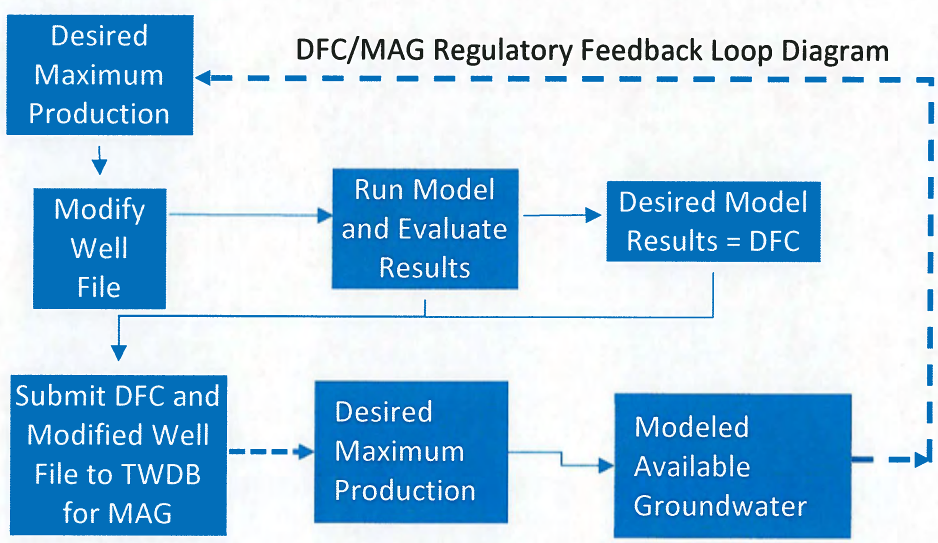
- **Prescribed Pumping, Reverse Engineering and Circular Reasoning –** in most cases, DFCs were determined based on the amount of drawdown resulting from a prescribed amount of planned future pumping. Many of these planned future pumping estimates utilized in the initial round of DFC adoption were based on 2006/2007 regional and state water planning efforts. Groundwater "availability" was limited based on a definition of "sustainability" that was erroneously characterized as the amount of recharge to an aquifer within a certain geographic area (e.g., county). These predicted sustainable pumping rates were utilized as the pumping files for GAMs, and the resulting aquifer drawdown was called the "DFC". Then, the prescribed pumping amounts were plugged into the GAM to calculate average drawdowns which became the DFCs. These DFCs were then sent to TWDB and the GAM was used to derive the MAG – **classic reverse engineering** as illustrated below:



- **Emphasis on Political Boundaries –** DFCs for GMA 12 were determined for the aquifers but not based on a conterminous boundary but a political boundary with each GCD or county within the GMA having different values. With most counties in GCDs, and partial counties not within districts; DFCs are based on political boundaries and not coterminous with an underground water reservoir or subdivision, which is contrary to the original philosophy of the Texas Legislature in the development of GMAs. More importantly when defining desired future conditions of the aquifers, geopolitical boundaries do not honor the hydrogeologic and hydrologic conditions of aquifers. Such thinking allows for inequity in the opportunity to exercise property rights.

The initial DFC process has resulted in considerable regulatory, management and planning confusion. Across Texas, the DFC process has resulted in arbitrary permit denials or restrictions, false "paper", "digital" and/or "political" water shortages, unnecessary restrictions on groundwater production, stifling of groundwater supply development, uncertainty, and considerable taking of private property rights resulting in devaluing of private property in regards to groundwater availability.

HB 1763 (2005) mandated that the MAG be used as the groundwater availability numbers in the regional and state water plans. GCDs and GMAs have a combined propensity to reverse engineer DFCs based on water planning projections, as a result the current DFC/MAG process is largely a "regulation by planning" process, and creates as illustrated below by Mr. James Bené, P.G. of R.W. Harden & Associates, Inc., a "regulatory feedback loop".



New Considerations for New DFCs

In 2015 the Texas Legislature took notice of the confusion, technical fallacies, understated groundwater availability and hydropolitical gridlock caused by the first cycle of DFCs. With new legislation (SB 332 and SB 660) and the Texas Supreme Court ruling in the Day Case having clarified and strengthened the understanding of **absolute groundwater ownership** as a property right and **the Rule of Capture.** SB 660 and the associated TWDB rules set forth some important and relevant new considerations for GCDs and GMAs when determining desired future conditions. In establishing DFCs, SB660 clarified Texas Water Code §36.108 (d) to now include the following factors as considerations:

"1. aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another;
   a. for each aquifer, subdivision of an aquifer, or geologic strata and
   b. for each geographic area overlying an aquifer
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 <u>total estimated recoverable storage</u> as provided by the executive administrator, and the average annual recharge, inflows, and discharge;**
4. other environmental 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;**
8. the feasibility of achieving the desired future condition; and,
9. any other information relevant to the specific desired future conditions."

Additionally, DFCs proposed under Texas Water Code §36.108 (d-1) and (d-2) must also:

"a. be established for each aquifer, subdivision of aquifer, or geologic strata, or
b. be established for each geographic area overlying an aquifer in whole or in part or subdivisions of an aquifer; and,
c. **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."**

The considerations that are new and significant with respect to the current cycle of establishing DFCs and MAGs though the joint-planning process are expressed in bold above.

GMA 12 PROPOSED DFCS for Carrizo-Wilcox, Gulf Coast, Queen City, Sparta, Trinity, and Yegua-Jackson Aquifers

The GCDs of GMA 12 approved for adoption DFCs for all aquifers within the GMA per Resolution DFCs_04-15-16. Based on a review of the resolution, reviews of previous investigations, and ongoing assessments, TGI provides the following assessments of the proposed DFCs as associated with the various aquifers and hydrogeologic conditions in the GMA 12 Area, which include, the Carrizo-Wilcox, Gulf Coast, Queen City, Sparta, Trinity, and Yegua-Jackson Aquifers.

Assessment of Proposed 2016 DFCs

The processes utilized and the resulting DFCs for the 2016 joint-planning cycle for 2016 are quite similar to those for the 2010 DFCs. For the aquifers in the Carrizo-Wilcox, Gulf Coast, Queen City, Sparta, Trinity, and Yegua-Jackson Aquifers, the DFCs are to be measured from baseline conditions for 2000. The proposed 2016 DFCs for the various aquifers within GMA 12 are not scientifically or legally defensible for reasons provided in this section of these comments.

DFCs are Based on Regional Groundwater Models with Prescribed Limitations

The TWDB and contracted regional groundwater model developers have clearly defined the limitations of the GAMs in the reports summarizing the modeling effort (Mace, et al. 2000a; Dutton, et al. 2002; and Kelley, et al. 2004). These limitations of the regional groundwater models have been inherently ignored by GMA 12 and GCDs when the results of the GAM models are used to assess site-specific permits. Below are prescribed limits of the GAM models as quoted from the TWDB for the Trinity, Carrizo-Wilcox, Queen City, and Sparta aquifers directly from the GAM Reports:

- "Typical limitations of numerical models of groundwater flow include (1) quality and quantity of input data, (2) assumptions and simplifications used in developing the model, and (3) the scale of application of the model (Mace and others, 2000a). These affect where and what kind of situation the model is applicable and how predictions may be made, interpreted, and used" (Dutton, et al. 2002, 265).
- "The square-mile-grid cell size limits the applicability of the model at a local level. The model would not be appropriate in its present form for the detailed work needed for designing and locating individual wells in well fields" (Dutton, et al. 2002, 271).

- "Water-level measurements are needed as targets for steady-state calibration. However, where there is a well, water levels have often been affected by groundwater pumpage. As a result, valid targets for predevelopment conditions were limited, because wells were typically drilled for pumpage." (Kelley, et al. 2004, 8-28);
- "Developing the supporting database for a regional model at this scale and with this large number of grid cells is a challenge. The Central and Northern Queen City and Sparta GAMs contain more than 170,000 active model cells each" (Kelley, et al. 2004, 11-1). "The model database for [geologic] structure for these GAMs was developed from a total of approximately 250 well logs" (Kelley, et al. 2004, 11-1). with these models comprising approximately 8 layers each and assuming conservatively that each of the 250 well logs fully penetrate each of the 8 layers, the geologic frame work for the GAM is developed from data covering approximately 1.18% percent of the cells in the total model area.
- "The structural surfaces ... have been developed based upon a sparse data set as compared to the density of the model grid nodes. Because these models have been developed on a super-regional scale, structural data will not have every bend and discontinuity found at a local scale. However, we believe that the structural data is adequate for the scale and purpose of the models. Refinements to structure may become necessary as these models are refined to specific counties or subregions" (Kelley, et al. 2004, 11-1, 11-2).
- "There are many parameters which control groundwater flow within the aquifers and model behavior. For the steady-state models, the primary parameters controlling model behavior are recharge and vertical conductivity. Generally, for the transient models, the primary parameters controlling model behavior are pumping and horizontal hydraulic conductivity... Information regarding hydraulic conductivity is limited within the study region" (Kelley, et al. 2004, 11-2).
- **"The water removed by pumping is supplied through decreased groundwater storage, reduced groundwater discharge, and sometimes increased recharge"** (Kelley, et al. 2004, 5-4). **(emphasis added)**
- **"The transient model is insensitive to recharge, because of the large storage capacity in the outcrop"** (Kelley, et al. 2004, 9-2). **(emphasis added)**
- "The data set for storativity is very limited for the Queen City and Sparta aquifers. We used the available estimates along with aquifer lithology to scale up storativity to the model scale...However, there is uncertainty in the storativity distributions, especially with respect to how storativity decreases with depth...The models are less sensitive to storage than aquifer transmissivity because drawdown is much more a function of transmissivity than storage. **However, storage is a critical parameter for availability models. Aquifer storage is a crucial parameter in determining when, or if, a developed aquifer will transition from providing water from storage to providing**

water from discharge capture (emphasis added). These GAMs incorporate a reasonable estimate of storage for the Queen City and Sparta aquifers, but these estimates could be improved with more measurements" (Kelley, et al. 2004, page 11-3).

- "Recharge is an important parameter requiring specification and estimation in groundwater availability models. There are no satisfactory methods for measuring recharge at the scale of interest for these models...**We recognize that the regional estimates of recharge included in these models <u>should be considered to be very uncertain</u> (emphasis added)**" (Kelley, et al. 2004, page 11-3).
- **"The primary type of calibration target for the GAM is hydraulic head. There is a general lack of hydraulic heads representative of the predevelopment for all model layer... The model calibration could be improved by an increased density of head targets in these areas. Many of the groundwater conservation districts have implemented, or are in the process of implementing, monitoring programs. These efforts should be continued and supported (emphasis added)"** (Kelley, et al. 2004, page 11-4).
- "The models are developed at a grid scale of one square mile. **At this scale, the models are not capable of predicting aquifer responses at specific points such as a particular well...The model was built to determine how regional water levels will respond to water resource development in an area smaller than a county and larger than a square mile.** The concept of a grid-block effective radius is a good way to illustrate the idea of scale and how drawdown at a particular well would relate to drawdown as predicted by a GAM." (Kelley, et al. 2004, page 11-6 and 11-7).
- **"The GAMs are routinely used to develop estimates of recharge to aid in groundwater availability planning. The validity of this concept is questionable in the aquifers that are the subject of this report (see Bredehoeft, 2002 for a complete review of these concepts)"** (Kelley, et al. 2004, page 11-7).
- **"The GAMs were developed on a regional scale and are applicable for assessing regional aquifer conditions resulting from groundwater development over a fifty-year time period"** (Kelley, et al. 2004, page 11-9) as shown on the Figure 11.1 from Kelley, et al. (2004) on the next page.

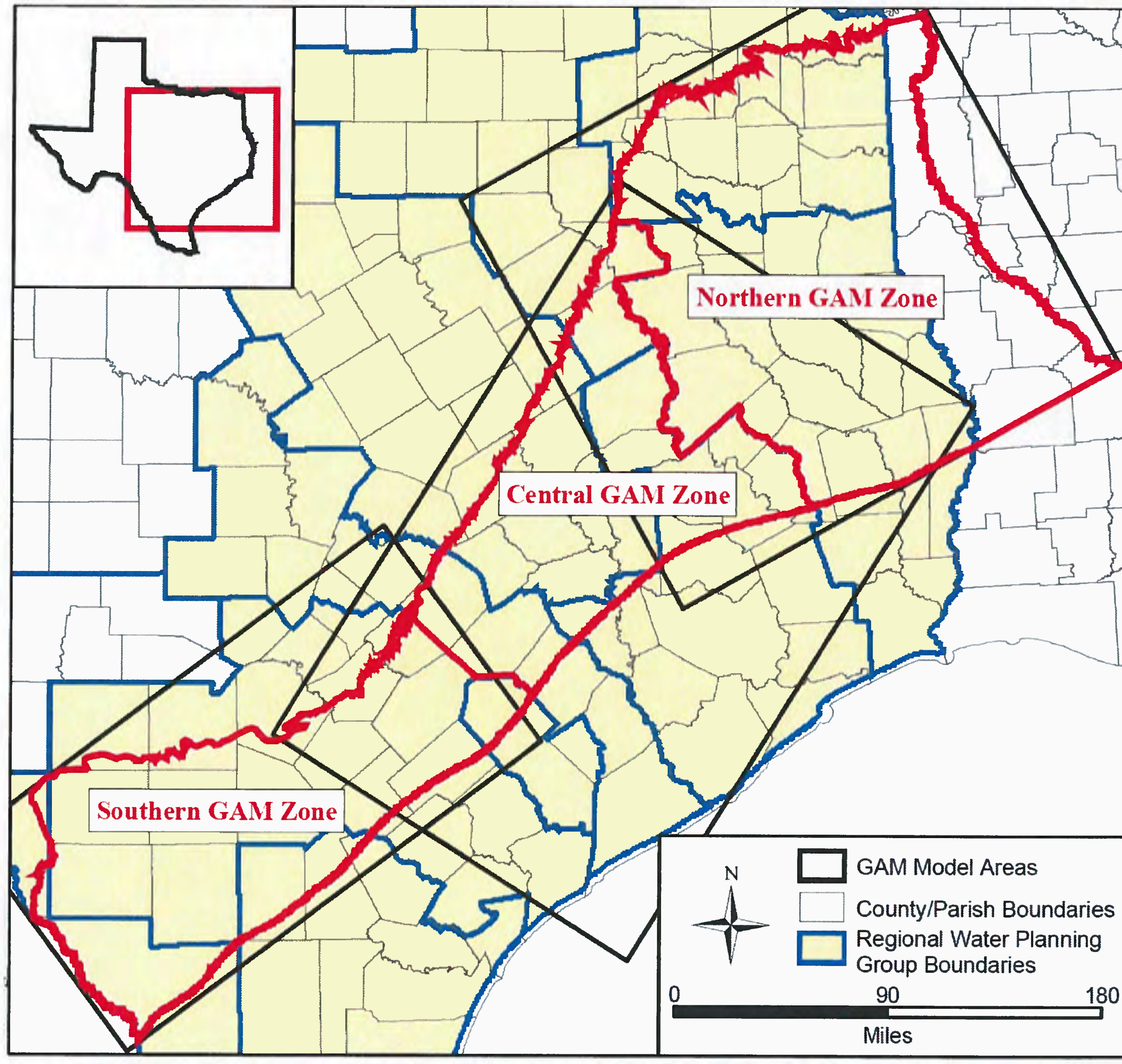


Figure 11.1 Recommended areas of applicability for each GAM.

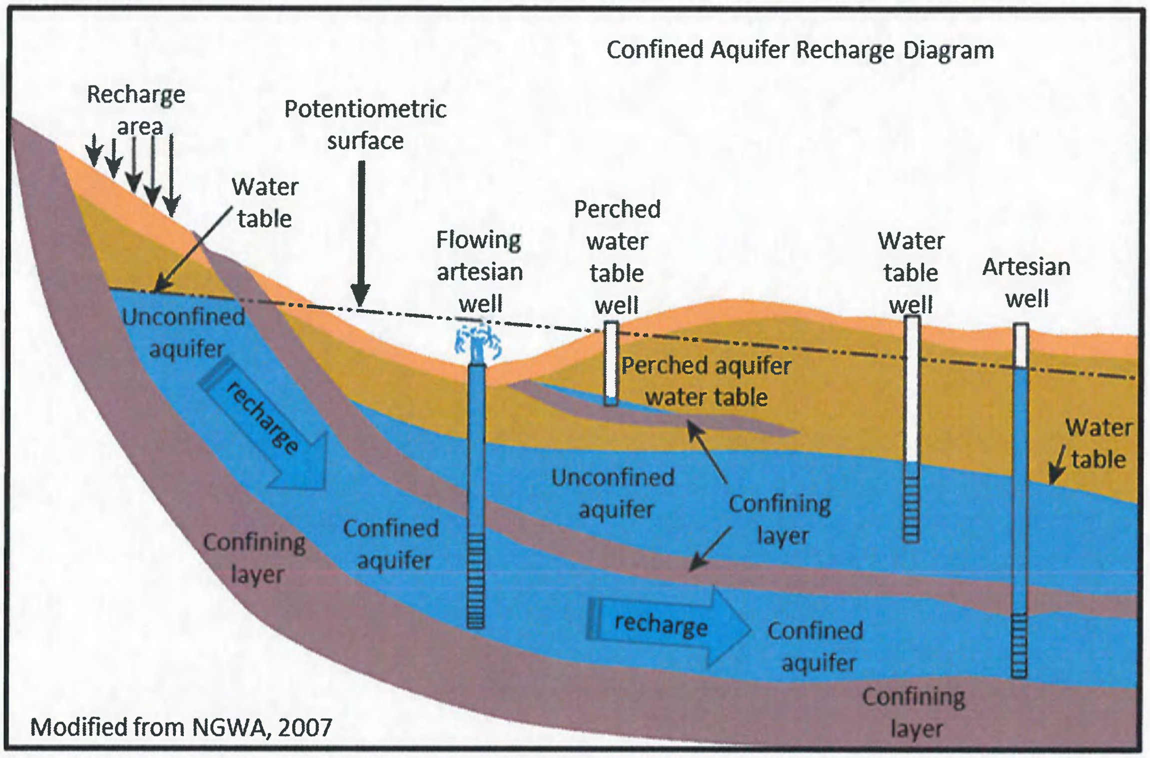
Misapplication of Basic Hydrogeologic Principles

The DFCs adopted by GMA 12 for 2010 and those proposed for 2016 result in a false assessment of groundwater availability in the Carrizo-Wilcox, Gulf Coast, Queen City, Sparta, Trinity, and Yegua-Jackson Aquifers. Specifically, the use of the stated metric of modeled average drawdown does not account for fundamental hydrogeologic principles of how aquifers, in particular how confined aquifers, really work.

- **Average Drawdown as a Water Availability Metric –** Drawdown is useful in understanding the potential yield of a well completed in an aquifer coupled with changes in aquifer storage resulting from pumping, but drawdown is not a standalone metric to assess groundwater availability in confined aquifers. Drawdown in a confined aquifer is not a metric to assess impacts to spring flows or stream flows from pumping. Drawdown in confined aquifers can only be measured at outcrop areas where a change in storage can be physically measured via monitor wells. Artesian water levels represent the pressure in the aquifer and not the volume of water stored in the reservoir. Drawdown of artesian water levels is a response to a pressure change in the aquifer is undergoing at that location, and is not a measure of depletion of groundwater in the aquifer and actually indicates the aquifer(s) is still completely full of water allowing water levels to rise above the top of the aquifer. Drawdown of artesian water levels is actually a measure of the limitation of the formation to transmit water (and the corresponding pressure) from the recharge area to the aquifer in the area of the well as such artesian drawdown is specific to the local aquifer near the location of the pumping well. This can be illustrated in the image on the following page. If similar levels of pumping are performed in the flowing artesian well and the artesian well, the drawdown in the flowing artesian would be expected to be less than the level of drawdown of the artesian well because the transmittal of the pressure front should be easier closer to the recharge area.

  Using drawdown to forecast future aquifer pressure response involves precise location of the pumping wells, accurate application of the magnitude and timing of future pumping, and an understanding of the aquifer recharge mechanism. Simply relying on artesian drawdown to assess groundwater availability ignores actual amount of total aquifer storage and the physical availability of groundwater in the aquifer, and ultimately artificially restricts the amount of pumping allowed creating a man-made, false groundwater shortage.

- **Proposed DFCs Ignore Aquifer Storage and Water Balance (e.g., SB660) –** the proposed DFCs having been based on modelled average drawdowns and strict pumping and recharge scenarios ignore aquifer storage and the entire water balance. The input of average recharge rates into a model based on sparse historic activity ignores a fundamental natural water balance occurrence as the increase in pumping causes an increase in aquifer recharge. This has been previously explained in great detail by WF Guyton in the 1975 Report on Ground-Water Conditions in the Conroe-Woodlands Area, Texas in relation to the Gulf Coast Aquifer, but would be applicable to the Aquifers in GMA 12 as well.



The Texas Legislature mandated in SB 660 that GMAs and GCDs consider aquifer storage, inflows and outflows – the 3 components of a water balance – when adopting DFCs. The total water balance is the only true way to measure groundwater availability, and in confined aquifers, storage is the largest component of the water balance.

The fact that the majority of groundwater in confined aquifers is located in storage is precisely what the legislature identified in mandating that GCDs and GMAs consider total estimated recoverable storage (TERS) and recharge, inflows and discharge when developing DFCs. Storage **must** be considered in context of the Texas Water Code and Texas Administrative Code, as well as hydrogeologically. The Texas Water Law defines total aquifer storage and total estimated recoverable storage (TERS) as follows:

- **"total aquifer storage"** means the total calculated volume of groundwater that an aquifer is capable of producing (Texas Water Code, §36.001 (24)).
- **Total Estimated Recoverable Storage –** the estimated amount of groundwater within an aquifer that accounts for recovery scenarios that range from 25% to 75% of the porosity adjusted aquifer volume (Texas Administrative Code §356.10 (24)).

Based on these definitions, TERS is a subset of total aquifer storage. For example, the **total aquifer storage** for the Carrizo-Wilcox, Gulf Coast, Queen City, Sparta, Trinity, and Yegua-Jackson Aquifers within GMA 12 is reported by the TWDB to be 1.38 billion acre-feet (Wade and Shi, 2014). The TERS for the Gulf Coast Aquifer system within GMA 14 is between 25 and 75 percent of that volume, or between 345,000,000 and 1,035,000,000 acre-feet.

The TERS numbers developed by the TWDB demonstrates the huge volumes of water that are present in storage in these confined aquifers. The MAGs derived from modeled average drawdown based DFCs indicate very limited supplies of groundwater are available. While it is common among groundwater hydrologists to acknowledge the importance of aquifer storage in the High Plains (i.e., Ogallala) aquifer, there has been an unfounded resistance by GCDs to acknowledge the importance of aquifer storage and most importantly the recoverable portion of that storage. This is especially true for LPGCD and other districts located atop aquifers such as the Trinity, Carrizo-Wilcox and Gulf Coast aquifers. Some GCDs and subsidence districts have even published press releases and other misinformation indicating that the TERS within their jurisdiction is **"irrelevant"** and **"misleading"**, stating that only a small percentage of TERS can be economically recovered and that other issues such as subsidence, deep artesian water levels, water levels dropping below pumps, water quality and changes to surface water-groundwater interaction are not contemplated in the TERS numbers. The TWDB published similar ideas in a presentation titled **"Total Estimated Recoverable Storage and Modeled Available Groundwater – Why They Are Different"** (Ridgeway and French 2014). Similarly, Wade A. Oliver, P.G. of INTERA presented to the Texas Association of Groundwater Districts (TAGD) a statement regarding the amount of storage from an aquifer than can be recovered:

> "Likely no more than 3 – 15% for most dipping, confined aquifer in Texas (Trinity, Carrizo-Wilcox, Gulf Coast, etc.). Recovery of anywhere close to 75% is physically impossible **given current well depths and impacts to water levels, quality, existing wells, well yields, surface water, and subsidence"** (Oliver 2014).

Contrary to Mr. Oliver's presentation cited above, Mr. Oliver presented a different presentation to the Lone Star GCD on August 7, 2014, as an employee of INTERA and on behalf of several "sponsors" in the public hearing at Lone Star GCD that it is only practicable to drain an even smaller percentage of storage. Similarly, Mr. Van Kelley of INTERA presented to Lone Star GCD in the public hearing on DFCs, and cited a brackish groundwater report by LBG-Guyton Associates (LBG), providing a quote and reference that LBG stated that only 0.3 percent of aquifer storage can be depleted safely in producing from dipping artesian aquifers (Personal communication, Kelley 2015). However, the referenced report by LBG actually stated that depletion of storage while the aquifer remains viable could be much more, and simply stated a large range, acknowledging that large volumes of water can be produced from deep artesian aquifers (LGB-Guyton, 2003).

In arguing that only a small amount of TERS can be (economically) recovered, the TWDB and Oliver note that other factors are not considered, including water quality, changes in water quality, deep artesian water levels, water levels dropping below pumps, changes in groundwater-surface water interaction, and subsidence. Importantly, the Texas Water Code and current water regulations already contain provisions that contemplate subsidence and changes in water quality (e.g., definition of waste) in assessing whether groundwater can be produced. In fact, the other factors not addressed by Texas water regulations mentioned by the TWDB and Mr. Wade in their explanations as to why only a small portion of TERS can be produced are economic factors, and not groundwater availability factors based on the aquifer characteristics.

Certainly, deeper water levels may be inconvenient and may lead to additional costs, and socio-economics are part of the considerations the Texas Legislature identified in SB660 in reference to establishing new DFCs. However, the socio-economic considerations of deeper well pumps for groundwater supplies must be assessed in comparison to expenses of developing alternative water supplies. The costs of setting pumps deeper and the lifting costs of deeper set pumps should be compared directly to the socio-economics of new surface water reservoirs, installing and operating treatment plans, developing new water transmission systems, costs of desalinating brines, developing aquifer storage and recovery (ASR) fields, the cost of developing reuse systems, etc. While deeper set well pumps and increased lifting costs are factors that affect the economic viability of groundwater development, these factors are not limitations on the capabilities of the GMA 12 aquifers to produce water. Deeper set well pumps and increased lifting cost are factors that need to be assessed as overall water-planning considerations when assessing the potential options to supplying water within an area.

It is important that the GCDs developing DFCs understand that large artesian water-level declines can occur locally while having essentially no impact on groundwater availability because of the capacity of water present in aquifer storage. Artesian drawdown is not directly tied to aquifer hydraulics (e.g., transmissivity) and is practically not affected by aquifer storage or recharge. Most importantly to the development of DFCs, very small (less than five percent) reductions in aquifer storage can result in large available aquifer production volumes.

Ramifications of Proposed DFCs

The current and proposed DFCs are not scientifically and legally defensible primarily because they are based on modeled average artesian drawdown that is back-calculated from prescribed pumping amounts. And because separate DFCs are provided for geopolitical subdivisions and not the overly large, contiguous and hydraulically continuous aquifers, the current DFCs:

- May not be achievable as defined;
- Create false groundwater shortages;
- Lead to dysfunctional and inaccurate water planning;
- Can result in unnecessary or premature adverse economic impacts; and,
- Likely result in GCD rules and management procedures that infringe on private property rights, as artesian pressure is not a viable management criterion to assign "fair chance".

In developing the GAMs used to develop the DFCs very clear limitations are defined for the models.

REQUEST AND RECOMMENDATIONS

Requested Alternative DFCs for Consideration

TGI, on behalf of Forestar, formally recommends that GMA 12 consider alternative DFCs for the aquifers in the Carrizo-Wilcox, Gulf Coast, Queen City, Sparta, Trinity, and Yegua-Jackson Aquifers as follows:

- All DFCs should apply uniformly across all management areas that are coterminous with the boundaries of the individual aquifers or subdivisions of a groundwater reservoir as defined in Texas Water Code Section 36.001.(7) within GMA 12, and not vary based on geopolitical boundaries;

- Aquifer-specific DFCs:
  - **Queen City Aquifer and Sparta Aquifer– the aquifer retains at least 99 percent of the pre-development storage capacity within GMA 12 by 2070;**
  - **Brazos River Alluvium, Calvert Bluff Aquifer, Carrizo Aquifer, Hooper Aquifer, Simsboro Aquifer, and Yegua-Jackson Aquifer- the aquifer retains at least 98 percent of the pre-development storage capacity within GMA 12 by 2070;**

Table of Proposed 2070 Storage Based DFCs Compared to 2014 TWDB TERS

	Aquifer Storage in Acre-ft						
	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper	Yegua Jackson
2014 TERS	80,000,000	160,000,000	126,000,000	370,000,000	230,000,000	290,000,000	110,000,000
2070 DFC	**79,200,000**	**158,500,000**	**124,800,000**	**366,700,000**	**227,100,000**	**285,400,000**	**107,900,000**

Storage based DFCs will (i) remove the "regulation by planning" aspect of the current DFC methodology, and (ii) require development of DFCs based on scientific assessment that meet the requirements of SB660. Storage based DFCs will:

- Assess the true aquifer capabilities of production/discharge, storage, and inflows/recharge;
- Remove the arbitrary nature of artesian drawdown DFCs;
- Allow for accurate, reliable, and informed planning based on actual monitored groundwater data;
- Include all Chapter 36 protections (subsidence and water quality); and,
- Provide economic choices between deeper water wells, more water wells, surface water utilization, and application of treatment technologies on lower quality water sources.

LPGCD Must Address Proposed DFCs per Statutory Requirements

SB 660 and subsequent rules in the Texas Water Code have added requirement to GCDs and GMAs in establishing DFCs. DFC submittals must now include:

> "A copy of the adopted desired conditions and **the explanatory report** addressing the information required by Texas Water Code §36.108(d-3) and the criteria in Texas Water Code §36.108(d)" (31 Texas Administrative Code §356.32).

The TWDB states that the required **EXPLANATORY REPORT** "…will also be a key document if a petition is filed challenging the reasonableness of a desired future condition" (TWDB 2013). The TWDB also recommends that the explanatory report "…be organized in such a way as to facilitate use by groundwater stakeholders and district conditions" (TWDB 2013). The TWDB notes that, according to Texas Water Code § 36.108 (d-3), "…the district representatives shall produce a desired future conditions explanatory report for the management area and submit to the TWDB and each district in the management area proof that notice was posted for the joint planning meeting, a copy of the resolution, and a copy of the explanatory report. The report must:

"1. identify each desired future condition;
2. provide the policy and technical justifications for each desired future condition;
3. include documentation that the factors under Texas Water Code §36.108 (d) were considered by the districts and a discussion of how the adopted desired future conditions impact each factor;
4. list other desired future condition options considered, if any, and the reasons why those options were not adopted; and,
5. <u>discuss reasons why recommendations made by advisory committees and relevant public comments received by the districts were or were not incorporated into the DFCs</u>."

Exclusion of the Proposed Alternative DFCs submitted herein as *relevant public comments* would be justification for filing an appeal of the reasonableness of any DFCs presented. HB200 passed in 2015 allows affected persons to file appeals challenging the reasonableness of desired future conditions through the State Office of Administrative Hearings.

Other Recommendations

In addition to the previously identified comments and the proposed alternative DFCs, TGI on behalf of Forestar recommends LPGCD and GMA 12 the following:

1. Ensure that a DFC can be achieved while honoring **law** and **private property rights**, and a DFC that accurately reflect the physical availability of groundwater in the aquifer;
2. Require the assessment of whether a DFC has been impaired based on valid scientific methods that utilize actual water-level monitoring data, specifically in the outcrop areas. Equally important ensure that DFCs are NOT developed relying on the utilization of model runs that contain substantial limitations and assumptions that result in egregious errors when applied on the level of an individual permit as the errors in the assumptions of the models can be demonstrated through new data collection from exploration, discovery, and aquifer monitoring as *not reflective of current real world conditions* let alone being applicable 60 years in the future;
3. Accurately establish an effective water-level monitoring program that has acceptable spatial and temporal coverage across the conterminous aquifers (water-table and artesian portions as appropriate) the existing conditions that will serve as the baseline for future assessments of whether storage DFCs are being achieved;
4. Recognize that aquifer water table levels and storage change ***<u>very slowly</u>***. Therefore, extending permit terms can be done without adverse ramifications;

5. As recommended in TWDB GAM reports, prohibit ***regional*** GAM runs from being utilized outside the clearly defined (by TWDB) limitations of the model by applying modeled drawdowns to site specific levels as the basis to grant or deny permits; and,
6. Do not base groundwater availability on regional groundwater models developed using production "needs assessments" for regional water planning determinations that have been projected 60 years into the future.

TGI appreciates the opportunity to provide you this assessment of the currently proposed GMA 12 DFCs, and to present you with an alternative DFC methodology for formal consideration. TGI believes the alternative DFC methodology recommended herein to GMA 12 and LPGCD should be given serious consideration, and fully evaluated before the GMA, and LPGCD, finalize the adoption of these new DFCs that are legally and scientifically flawed. The alternative DFC proposed herein best honors Texas Water Law, private property rights associated with the absolute ownership of groundwater, the Rule of Capture, and represents a true assessment of the aquifer's capability to produce long-term groundwater supplies based on coterminous aquifer's water balance.

If you have any questions, please call.

STATE OF TEXAS
BRIAN K. BOHM
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10141
LICENSED
PROFESSIONAL GEOSCIENTIST

Sincerely,
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Managing Associate

cc: Mr. Bill Goodrum, Forestar Group
Mr. Phil Weber, Forestar Group
Mr. Ed McCarthy, Jackson, Sjoberg, McCarthy & Townsend, L.L.P.
Mr. Mike Thornhill, P.G., Thornhill Group, Inc.

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Response to Comments- Forestar/Thornhill Group, Inc.

Thornhill Group, Inc. (TGI) submitted comments on behalf of Forestar (USA) Real Estate Group, Inc. (Forestar). However, many of the comments provided are not comments specific to the GMA 12 DFCs but rather cover topics such as background on Forestar and general concepts regarding groundwater management in Texas. GMA 12 has attempted to identify pertinent comments specific to the proposed DFCs and has provided responses below.

<u>The Term "Availability"</u>

In their comments, Forestar states that the DFCs proposed by GMA 12 are based on questionable science. The DFCs are reported as decreases in average saturated thicknesses for unconfined aquifers and average drawdown based on modeling results of artesian heads (for confined aquifers). Forestar asserts that by ignoring aquifer storage, GMA 12 is ignoring the true physical availability of the aquifer.

The term "availability" is used by Forestar in a different context than how the term is used by GMA 12 in joint groundwater planning. Forestar uses the term "availability" as a purely technical term, also referring to it as the "physical availability" of groundwater. This usage of the term is equivalent to the amount of groundwater in the aquifer that can be physically produced, regardless of all other factors or limitations. In this limited sense, GMA 12 does not argue that more groundwater is physically available than can be extracted under the adopted DFCs.

However, in joint groundwater planning, the term "availability" is a planning term, not a strictly scientific/technical term. As used in joint planning, groundwater "availability" must account for management and policy considerations *in addition to* the physical availability of groundwater in the aquifers. Policy decisions are implemented in the form of DFCs at the GMA level and rules at the GCD level. During the development of the DFCs, the GMA did consider the physical availability of groundwater from the aquifer as required in Tex. Water Code § 36.108, as well as impact on the environment, water needs and management strategies, socio-economic impacts, private property rights, subsidence, and other factors.

As Forestar asserts in their comments, the aquifers in GMA 12 have the ability to produce more water than is currently included in the modeled available groundwater (MAG) estimates. However, the increased production from these aquifers does come with consequences in the form of decreased water levels, decreased outflow to surface water, etc. It is the duty of GMA 12 to balance all of these consequences when developing a set of DFCs. GMA 12 must not only maximize the amount of production that can occur from each aquifer within the GMA, but also must balance the amount of production with the conservation, preservation, and protection of the aquifer. This concept is clearly detailed in the Tex. Water Code § 36.108 (d-2) which states "The desired future conditions … must 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." This makes it clear that although the aquifers may be capable of physically producing more water, this must be balanced with the desire to also conserve, preserve, and protect the aquifer. This balance is what GMA 12 has attempted to achieve with the DFCs that were developed during this round of joint groundwater planning. Because there are so many stakeholders in GMA 12 with such highly differing interests in the DFC development process, the resulting DFCs must be a compromise that will likely not completely satisfy any individual set of stakeholders.

<u>Currently Proposed DFCs are Flawed and Do Not Meet the Intent of SB 660</u>

In their comments, Forestar quotes from SB 660 regarding the factors that the GMAs must consider prior to voting on the proposed DFC. Forestar states that the proposed DFCs are legally and scientifically flawed because they do not consider a balance between the highest practicable level of production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater.

GMA 12 developed DFCs with a balance between production and conservation in mind. In the GMA 12 region this is a difficult balance to reach due to the widely differing opinions that GMA 12 stakeholders have regarding the best approach to aquifer management. Some stakeholders view the conservation of groundwater as paramount, and are actively soliciting the GMA to reduce the production of groundwater to reduce impacts on surface water resources in the region. Other stakeholders are actively trying to get the GMA to increase the allowable production of groundwater for water supply purposes. These different stakeholders have fundamentally different perspectives regarding the management of groundwater resources, and there is no balance (i.e. DFCs) that will completely satisfy the concerns of all stakeholders at the same time.

As noted in Section 8 of the Explanatory Report, GMA 12 feels we have developed a DFC that balances production and conservation, preservation, and protection. A somewhat conservative approach was taken during the second round of joint groundwater planning for GMA 12 due to issues identified with the Central Queen City-Sparta GAM. A revision of this model to correct these deficiencies is currently underway. Many stakeholders argued, and GMA 12 agrees, that until this revision is done, the best approach is to make minimal revisions to the DFCs and then re-evaluate them in the next round of planning when the revised model is available for use by GMA 12.

<u>Reverse Engineering of DFCs</u>

In various parts of their comments, Forestar states that the DFCs are "reverse engineered" and employ circular reasoning that results in MAGs that are pre-determined by the GMA based on water planning needs. Forestar stated that future pumping in the first round of joint groundwater planning was based on 2006/2007 planning efforts, and that groundwater "availability" was limited based on the amount of recharge to an aquifer within a certain area. Forestar states that because the DFCs are based on MAGs "reverse engineered" from future needs estimated during the regional water planning process, the DFCs are essentially "regulation by planning" and fail to account for real-world conditions.

It is reasonable for GMAs to want to understand the ramifications of major policy decisions--in this case the implementation of DFCs--prior to adopting these policies. In fact, when HB 1763 was first implemented, the TWDB encouraged districts to "know what the answer is" prior to submitting their DFCs (Mace and others, 2008). This meant that the GMAs should know, at least approximately, what their MAGs would be prior to finalizing DFCs, in order to avoid drastic unforeseen consequences for stakeholders. Many GMAs across the state evaluate the relationship between pumping and DFCs prior to finalizing the DFCs. This approach of understanding what impact major policy decisions (DFCs) would have on available groundwater resources is reasonable and prudent.

<u>The Consideration and Use of Total Storage in the DFC</u>

In various parts of their comments, Forestar states that the DFC should be based on the full water balance of the coterminous aquifer, and must include the total estimated recoverable storage. Forestar states that GMA 12 needs to account for the full water balance, including inflows, outflows, and total storage of the aquifer, understanding that regulatory structure exists that avoid the "appropriation" of groundwater. Forestar feels that the proposed DFCs ignore aquifer storage and water balance, and use average recharge rates which ignore the impact of pumpage on aquifer recharge.

The adopted DFCs do not ignore aquifer storage and water balance. The aquifer storage (including TERS) was considered during the DFC development process as required in Tex. Water Code § 36.108. GMA 12 is using the average recharge rate that is used in the TWDB Central Queen City-Sparta GAM. GMA 12 recognizes the limitations inherent in recharge estimates. However, the use of average recharge rates from the calibrated GAM is logical as this is the most current published recharge estimate available. This is also the recharge estimate that will be used by the TWDB in their calculations of MAGs based on the final DFCs submitted by the GMAs.

GMA 12 recognizes that groundwater is in storage in the unconfined and confined parts of the aquifers and this was considered during the development of DFCs. In addition, groundwater in storage increases due to recharge, and although relatively small, this increase was considered during the planning process. However, because aquifers are not stagnant bodies of water and are instead active hydrologically, other components of the water budget are also very important. These aquifers are actively recharged and actively discharge in the region through evaporation, evapotranspiration and to surface water bodies. For this reason, even though there is a large amount of water in storage, excessive production of this groundwater may, over time, have detrimental effects on surface water in the region. Impacts to surface water resources are one of the factors required for consideration under Tex. Water Code § 36.108 and a major concern addressed in multiple stakeholder comments to GMA 12. All factors outlined in Tex. Water Code § 36.108 must be considered by GMA 12 during the development of DFCs, so simply evaluating DFCs based on total storage does not work.

<u>Total Estimated Recoverable Storage (TERS)</u>

In various parts of their comments, Forestar states the need to use the TERS values in the DFC considerations and that the DFCs should be based on the total storage in the aquifer and must include the TERS.

GMA 12 disagrees with this viewpoint. Tex. Water Code § 36.108 makes it clear that there are nine factors that must be considered when developing DFCs. None of the nine factors are prioritized in Tex. Water Code § 36.108 and none are specifically mandated to be used in the DFCs that are ultimately developed. The TERS values provide by TWDB were considered by GMA 12 as part of the discussion on hydrologic conditions during the development of DFCs as described in Section 5.3 of this Explanatory Report. While the total storage is significant in the aquifers in GMA 12, inflows to and outflows from the aquifer are also very important. Simply because the total volume in storage is much larger than the groundwater inflows and outflows does not lessen the importance of these components to many stakeholders in the region, and GMA 12 had to consider the views of these other stakeholders in addition to those of Forestar.

Private Property Rights

In their comments, Forestar states that the DFC analyses have relied only on a pre-determined pumping rate to develop the DFCs, which artificially restricts the amount of pumpage allowed and thus creates a false shortage of available groundwater in the planning region. Forestar states that this results in premature adverse economic impacts, forcing GCDs to generate rules that infringe on private property rights and ultimately result in a regulatory taking. Forestar asks that GMA 12 develop DFCs that honor Texas Water Law regarding Absolute Ownership and the Rule of Capture.

Whether the resulting availability of groundwater in the region infringes on private property rights is one of the nine factors evaluated as part of the DFC development process, as required in Tex. Water Code § 36.108. GMA 12's review determined that by setting the DFCs at the levels that were proposed, it is anticipated that sufficient water will be provided to meet current and future demands while providing water availability for growth and preservation. GMA 12 feels this is the appropriate balance between production and conservation, and this means that a balance was achieved. As reviewed in Section 5.7 of this Explanatory Report, GMA 12 does not feel that the adopted DFCs infringe on private property rights. With respect to regulatory takings, GMA 12 does not agree that the DFCs would necessarily result in a regulatory taking.

GMA 12 recognizes the ownership of groundwater by landowners. However, the legislature and courts have clearly indicated that resources such as groundwater can be managed/regulated. The DFC process as well as the goals of individual GCDs and the rules promulgated to reach those goals are part of the management of groundwater in the state. The state has made it clear that GCDs are the preferred alternative to the Rule of Capture, and this is how the state of Texas manages groundwater resources.

Geopolitical Boundaries

Forestar comments that local and regional management of groundwater should be based on the proper application of sound science to the entire aquifer and not based on geopolitical boundaries. Forestar states that there is an emphasis on political boundaries. They state that the DFCs were determined not based on the aquifer boundaries themselves, but rather on GCD political boundaries, with different GCDs having different DFCs. They conclude that DFCs should apply uniformly across all management areas that are coterminous with the boundaries of each aquifer and not based on geopolitical boundaries.

GMA 12 is composed of several different GCDs, each of which manages a separate portion of the aquifer. Groundwater management undertaken by GCDs is restricted to the geopolitical boundaries of each district. Each GCD was created separately, usually by the Texas legislature. By their very nature, GCDs are based on geopolitical boundaries. By statute, GCDs cannot regulate outside of their district boundary, and the rules that they pass in order to regulate the management of groundwater only apply within their boundaries.

Joint groundwater planning is the way these districts plan and manage across the full extent of an aquifer, but this does not change the fact that each individual district can only manage their own district. Therefore, even if a DFC is stated for the entire GMA, each individual district will have to determine what the DFC will be for their district that contributes to the overall DFC for the GMA.

There is a misunderstanding that different DFCs means that landowners in different GCDs are being "treated differently". However, enforcing equal DFCs/drawdowns across all GCDs would not result in equal permitted pumpage. This is the result of the varying nature of the aquifers, the spatial distribution of the aquifers within the GMA, and the additive nature of drawdowns resulting from the production of groundwater from wells, among other things.

To illustrate this, GMA 12 ran the GAM with equal pumpage across all of GMA 12. This was accomplished by evenly distributing the total pumping by aquifer among all of the active model cells within GMA 12 so that each model grid cell produced the same amount of groundwater from each aquifer. After this simulation was completed, the DFCs were calculated using the same parameters as the adopted DFCs. These are summarized in Table 1 for the Simsboro Aquifer layer in the model.

Table 1. Simsboro drawdowns in 2070 (DFCs) for GMA 12 with equal production across all of GMA 12.

County	Drawdown (feet)
Bastrop	204
Brazos	299
Burleson	320
Falls	-1
Fayette	369
Freestone	128
Lee	305
Leon	302
Limestone	66
Madison	349
Milam	100
Navarro	22
Robertson	199
Williamson	40

As shown in Table 1, "equal treatment" across the GMA in terms of groundwater pumpage does not equate to equal DFCs across the GMA. Despite the fact that pumpage was identical in every model cell within GMA 12 in this simulation, drawdowns in the Simsboro Aquifer resulting from the simulation ranged from essentially zero to 369 feet. Water level changes will vary across the GMA regardless of the distribution of pumpage that occurs.

For this reason, and because GCDs can only manage groundwater and groundwater users within their boundaries, each GCD has to determine what the management goals are for their specific district as part of whatever DFCs are developed for the GMA as a whole. This means that regardless of the DFC for the GMA as a whole, each GCD will still have to determine what DFCs apply specifically to their district within the overall GMA.

Proposed DFCs Are Very Similar to 2010 DFCs

Forestar noted that the process used and the resulting DFCs are very similar to the 2010 DFCs.

The adopted DFCs for GMA 12 are similar to those adopted by GMA 12 in 2010. Minor adjustments were made to the DFCs to account for new information regarding site conditions and for a change from a planning period ending in 2060 to a planning period ending in 2070.

The reason that the existing and the adopted DFCs are very similar is because GMA 12 had similar objectives for groundwater management for the two joint planning cycles. The joint groundwater planning process has undergone some significant changes since the first round of planning, especially the inclusion of the nine factors that must be considered by the GMA when developing DFCs, as stated in Tex. Water Code § 36.108. However, most of these factors were things that were taken into consideration during the first round of joint groundwater planning, just not as formally as currently specified in statute.

In addition, GMA 12 recognized that the TWDB is currently updating the Central Queen City-Sparta GAM, and decided that a full re-evaluation of the DFCs would be done during the third round of joint groundwater planning, once the revision of the GAM is complete and available for use by GMA 12. For these reasons, the adopted DFCs were very similar to the existing DFCs.

GAM Limitations

In their comments, Forestar states that the GAMs have clearly defined limitations and provides some details on these limitations. Forestar then states that these limitations have been ignored by GMA 12 and GCDs when the GAMs are used to assess site-specific permits.

Site-specific permit evaluations conducted by individual GCDs will not be addressed here. The joint groundwater planning process and this Explanatory Report are for the development of DFCs for GMA 12. GMA 12 understands that the GAMs have limitations. However, the groundwater models used in the joint groundwater planning process are a way of evaluating the ramifications of the policy decisions being made by the GMA. These are the same models used by the TWDB in the calculation of MAGs, and therefore it is logical for the GMAs to use these models too.

Drawdown Is Not a Valid Metric for DFCs

Forestar comments that average drawdown is not a valid metric to assess groundwater availability in confined aquifers, and that GMA 12 needs to establish an effective monitoring program that has acceptable spatial and temporal coverage across the aquifers that can serve as a baseline for future assessments of whether storage DFCs can be achieved.

Measurement of artesian pressures is a valid methodology for assessing aquifer conditions. However, GMA 12 recognizes that there are limitations to having average drawdowns for each aquifer across the entire county/GCD, including areas where there are no wells and therefore no ability to monitor water levels. For this reason, member GCDs within GMA 12 are considering whether to refine the extent of the DFC monitoring area to more accurately reflect the use patterns within the aquifers and the areas where protections are most needed. GMA 12 expects to consider an adjustment of the area defined for DFCs during the next round of joint groundwater planning. The GCDs within GMA 12 are working to expand the well water level monitoring network to improve spatial and temporal coverage.

<u>False Water Shortages</u>

Forestar states that inaccurate "paper" groundwater shortages can lead to the premature development of more expensive alternatives of water which may not be necessary or cost effective at the present moment.

The final modeled available groundwater based on the DFCs developed by GMA 12 is determined by the TWDB. These DFCs are policy decisions made by the GMA, and we understand that not every stakeholder will agree with these policy decisions. Because the DFCs are policy decisions, the resulting groundwater availabilities (MAGs) are also based on the policies made by GMA 12, and not solely a function of the physical availability of groundwater, as discussed above.

The development of the DFCs were made based on the input from all of the GCDs in the GMA and on the consideration of the nine factors required in statute. The comments made by many stakeholders, including Forestar, were considered by the GMA during the development of the proposed DFCs. The final MAGs will be determined by the TWDB based on the adopted DFCs. Any perceived "paper" shortage is a result of the impossibility of crafting DFCs that will both satisfy all stakeholders and balance production and conservation.

<u>Socio-Economic Impacts</u>

Forestar comments that the DFCs can result in unnecessary or premature adverse economic impacts

A socio-economic analysis was done by GMA 12 and was considered during the development of the DFCs as required in Tex. Water Code § 36.108.This analysis is summarized in Section 5.6 of this Explanatory Report. It is important to note that GMA 12 is required to consider the adverse economic impacts of excessive groundwater production as well as those of not producing more groundwater.

<u>Forestar's Proposed DFCs</u>

Forestar argues that water level measurement is a poor metric and DFCs should be based on storage instead. Forestar has proposed aquifer specific DFCs that require that the aquifer retains at least 99 percent of the pre-development storage capacity within GMA 12 by 2070 for the Queen City and Sparta aquifers, or 98 percent of the pre-development storage capacity within GMA 12 by 2070 for the Brazos River Alluvium, Calvert Bluff Aquifer, Carrizo Aquifer, Hooper Aquifer, Simsboro Aquifer, and Yegua-Jackson aquifer. A table is included in the Forestar comments with a quantification of the proposed DFCs, and is shown below.

Because the proposed DFC values in Forestar's table do not match the stated DFC percentages in the statement preceding the table, GMA 12 will only address information provided in the text of their letter.

Water levels are a relatively straightforward measurement-easily obtained and repeatable. Measuring storage is more problematic. There is not currently an accepted methodology for monitoring the volume in storage in these aquifers without the use of water levels measurements. Forestar has not provided a method for measuring whether the DFCs have been attained if, as suggested, the total volume remaining in storage is used as the DFC. On the other end of the spectrum from storage, other stakeholders have suggested using even more conservative metrics, such as streamflow, for DFCs. These metrics have the same issue as storage in being much more difficult to collect and rely upon. Water levels remain the best option since they are straightforward to collect, repeatable and thus defendable. This provides a firmer basis for GMA 12 to defend DFCs, in the face of competing requests for how DFC status will be measured, and therefore this is the metric that GMA 12 has decided to use for DFCs.

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APPENDIX U

GMA 12'S RESPONSES TO COMMENTS FOR POST OAK SAVANNAH GCD

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Comments Submitted by Mr. Chubb on March 24, 2016
in Response to GMA 12 Request for
Comments Regarding Pumping Scenario 4

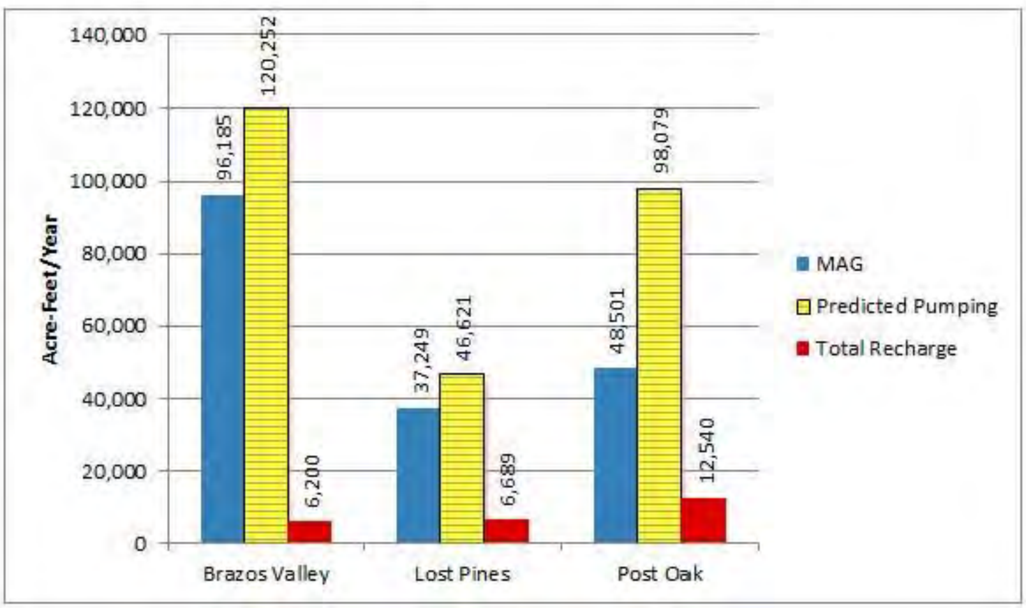
The aquifers are not ours;
we're just borrowing them from future generations.

The title of my comments should be the guiding principle for all GMA-12 groundwater districts.

The recently distributed GMA-12 document (see attached), however, caused me to question if the groundwater districts have lost sight of their responsibility to preserve and conserve our aquifers for future generations.

My comments and supporting discussion follow.

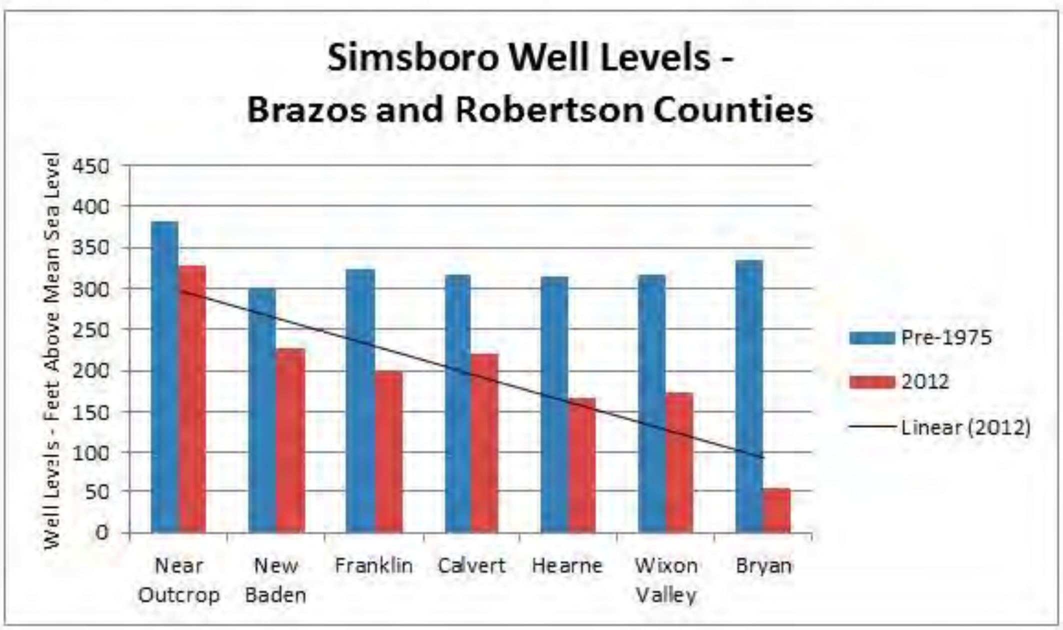
Graph 1: The Overpumping of the Simsboro Aquifer in GMA-12.



NOTES:

1. The graph allows a comparison of the MAG, Predicted Pumping, and Total Recharge for the Simsboro Aquifer in three of the GMA-12 groundwater districts.
2. MAG is the Modeled Available Groundwater for 2060 calculated by the Texas Water Development Board – it is the amount of groundwater which can be pumped to achieve the Desired Future Conditions which are crafted by the groundwater districts.
3. Predicted Pumping for 2070 is a number derived by the groundwater districts.
4. MAG and Predicted Pumping were extracted from the attached GMA-12 document.
5. Total Recharge is the amount of rainfall falling on the outcrop area that penetrates into the outcrop area - the values were extracted from the groundwater districts' management plans.
6. The included groundwater districts are: Brazos Valley Groundwater Conservation District; Lost Pines Groundwater Conservation District; Post Oak Savannah Groundwater Conservation District.
7. Predicted Pumping exceeds the Total Recharge by 1,940% for Brazos Valley.
8. The Simsboro is being depleted because pumping exceeds recharge.

Graph 2: Example of the effects of pumping exceeding recharge.



NOTES:

1. Brazos and Robertson Counties were studied because of the extensive amount of historic well data and the long time-period of significant pumping in the municipal well fields north of Bryan.
2. The pre-1975 and 2012 average water levels of all state-monitored Simsboro wells in Brazos and Robertson Counties are compared – raw data provided by Texas Water Development Board.
3. Before overpumping started in 1975, the Pre-1975 wells' groundwater levels were all about 320 feet above mean sea level with some wells spouting groundwater 45 feet into the air.
4. Data are grouped according to latitude starting with the lowest latitude (Bryan) and progressing to the highest latitude (the Near Outcrop is in northernmost Robertson County).
5. The Near Outcrop is 38 miles north of the Bryan/College Station/Texas A&M well fields located just north of Bryan.
6. In 2011, total Simsboro pumping permits for both counties equaled 109,430 acre-feet while 68,075 acre-feet of Simsboro groundwater was reported as pumped: Bryan/College Station/ Texas A&M held over 55% of the permits and accounted for over 55% of the pumping.
7. The total recharge amount for the Simsboro in the two counties is only 6,200 acre-feet/year.
8. In 2011, Simsboro pumping permits exceeded Simsboro total recharge by 1,765%.
9. The Simsboro wells have experienced significant declines because the aquifer is being pumped in amounts greater than recharge.
10. The aquifer is not being preserved and conserved for future generations.
11. Permit/pumping data provided by Brazos Valley Groundwater Conservation District; recharge amount from Brazos Valley Groundwater Conservation District Management Plan.

<u>COMMENT 1:</u> *The total and deep recharge rates for each aquifer in each groundwater district should be included in all GMA-12 reports.*

Out of all the problems revealed in the two graphs, none was more stunning than the GMA-12 'predicted pumping' amount exceeding recharge by 1,940% (see Graph 1).

Without recharge amounts to serve as yardsticks in Graph 1, no one would have understood the magnitude of the over-pumping planned for the Simsboro.

Recharge amounts for the aquifers were not included in the attached GMA-12 document circulated for comment.

The word "recharge" is almost never mentioned at a groundwater district meeting. This has always surprised me because most, if not all, people understand the basic hydrogeological concept that recharge is a most important consideration when planning how to sustain aquifers for the future.

In fact, 27 European nations have recently adopted laws requiring that aquifers be pumped at a rate less than their recharge.

<u>COMMENT 2:</u> *The GMA-12 groundwater districts featured in Graph 1 should be required to identify their groundwater management plans for the Simsboro Aquifer as 'Managed Depletion.' In addition, any other aquifers being depleted because of a GMA-12 groundwater district's management plan should be identified as a 'Managed Depletion' aquifer.*

I believe that anyone looking at the above two graphs would conclude: 1) the groundwater districts are using 'Managed Depletion' as their management plan; and 2) the Simsboro is being mined (defined as pumping exceeding recharge) and not being protected for future generations.

These facts should be made clear to the public.

COMMENT 3: *The desired future conditions (DFCs) of all the aquifers in the GMA-12 groundwater districts should allow the aquifers to be sustained for future generations. If the DFCs are not close to zero drawdown, the districts should 1) explain why they cannot prevent the depletion of the aquifers, and 2) present their future plans to alleviate the mining of the Simsboro and other aquifers.*

As an example, the three GMA-12 groundwater districts in Graph 1 have set Simsboro DFCs close to an average 300-foot drawdown which means that the aquifer is being depleted. But what truly reveals their inability to protect our aquifers is that their target 300-foot drawdown (which was set only five years ago) will be exceeded by 200 feet based on the predicted pumping (see Page 19 of attached document).

This unacceptable situation stems from the fact that the predicted pumping exceeds the MAG for each of the groundwater districts – and in the case of Post Oak, the predicted pumping exceeds the MAG by 100% (see Graph 1). If the permitting and pumping are not regulated, one has to question why have a groundwater district and why spend significant amounts of money establishing a DFC.

The groundwater districts should adopt DFCs with a much lower drawdown – and keep the permitting and pumping below the MAG.

Setting DFCs that are achieved only by mining of aquifers does not fulfill the purposes of groundwater districts as outlined in Chapter 36 of the Texas Water Code. Those purposes encompass the conservation, preservation, protection, and recharging of aquifers.

COMMENT 4: *GMA-12 groundwater districts should protect landowners' property rights by using rules promulgated by the Kenedy County Groundwater Conservation District as a model.*

COMMENT 5: *The GMA-12 groundwater districts need to provide a complete accounting of why the aquifers continue to be depleted even though they have spent multi-millions of dollars to preserve and conserve the aquifers.*

The citizens established the GMA-12 groundwater districts to preserve and conserve the aquifers.

Texas State Senator Steve Ogden who sponsored the legislation forming Brazos Valley and Post Oak stated in 2001: "The primary driving force of the groundwater conservation districts was a concern that this was the only way we could possibly protect ourselves if someone wanted to come in and drill water wells in the Carrizo-Wilcox Aquifer, and transport large quantities of water to any place under the sun."

The data displayed in Graphs **1** and 2 suggest that the Simsboro Aquifer is not being preserved and conserved; instead it is being mined and depleted. The other aquifers – especially the Carrizo - are also being depleted based on the adopted DFCs.

The GMA-12 groundwater districts need to be held accountable for not only explaining why the groundwater levels are declining but also where the millions of dollars have gone.

For example, each GMA-12 groundwater district should provide an accounting for how much money has been spent to enhance the recharge of the Simsboro Aquifer since the district's formation.

I believe that the citizens who approved the formation of the groundwater districts have the right to know why the groundwater districts have adopted management plans that allow our aquifers to be depleted – and how they plan to change the management plans so that our aquifers can be preserved and conserved for our children and their children. Governmental agencies such as groundwater districts are expected to be transparent and accountable.

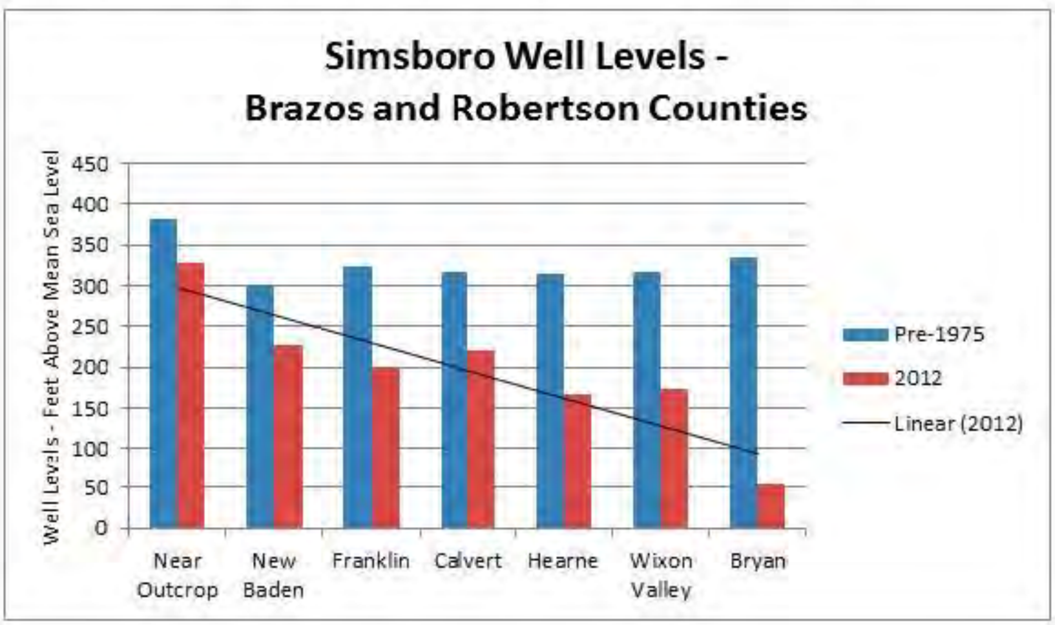
Comments submitted by:

Curtis Chubb, Ph.D.
Landowner
Milam County, Texas
24 March 2015

NOTES:

1. The graph allows a comparison of the MAG, Predicted Pumping, and Total Recharge for the Simsboro Aquifer in three of the GMA-12 groundwater districts.
2. MAG is the Modeled Available Groundwater for 2060 calculated by the Texas Water Development Board – it is the amount of groundwater which can be pumped to achieve the Desired Future Conditions which are crafted by the groundwater districts.
3. Predicted Pumping for 2070 is a number derived by the groundwater districts.
4. MAG and Predicted Pumping were extracted from the attached GMA-12 document.
5. Total Recharge is the amount of rainfall falling on the outcrop area that penetrates into the outcrop area - the values were extracted from the groundwater districts' management plans.
6. The included groundwater districts are: Brazos Valley Groundwater Conservation District; Lost Pines Groundwater Conservation District; Post Oak Savannah Groundwater Conservation District.
7. Predicted Pumping exceeds the Total Recharge by 1,940% for Brazos Valley.
8. The Simsboro is being depleted because pumping exceeds recharge.

Graph 2: Example of the effects of pumping exceeding recharge.



Responses to Comments Submitted by Mr. Chubb
on March 24, 2016 in Response to GMA 12 Request
for Comments Regarding Pumping Scenario 4

Comment 1: The total and deep recharge rates for each aquifer in each groundwater district should be included in all GMA-12 reports.

Response: Deep recharge has not been presented to GMA 12 by the districts because the current groundwater availability models (GAMs) for GMA 12 do not have the capability to distinguish deep recharge from total recharge. However, the update to the Central Queen City/Sparta GAM, which is partly funded by the GMA 12 Districts, will have the capability to provide estimates of deep recharge. Therefore, we anticipate deep recharge to be a larger part of GMA 12 discussions in the future.

Although Mr. Chubb considers recharge to be a paramount evaluation factor, the Texas Water Code Section 36.108(d) does not actually explicitly mention recharge as one of following nine factors to be considered by a GMA when adopting a Desired Future Condition.

Although not explicitly mentioned in Texas Water Code Section 36.108(d), GMA 12 does acknowledge that recharge is one of the several contributory components to the hydrological conditions. GMA-12 recognizes the potential importance of recharge and for this reason has given it considerable attention during the development of the proposed DFCs. In fact, one of GMA 12's detailed presentations on recharge was given at the May 28, 2015 meeting, two months after receiving Mr. Chubb's comments. The presentation was part of a 90-slide presentation on hydrological conditions, which is summarized in this Explanatory Report in Section 5.3 It included a detailed discussion of the simulated yearly water budget components, including recharge from 1975 to 2000 and from 2000 to 2070 for the Carrizo, Simsboro, and total recharge. In addition to the GMA 12 presentations that addressed recharge, recharge values are readily available to the public in the GMA 12 District's groundwater management plans, which can be found on the district web sites for each district in GMA 12.

Comment 2: The GMA-12 groundwater districts in Graph 1 should be required to identify their groundwater management plans for the Simsboro Aquifer as "Managed Depletion.' In addition, any other aquifers being depleted because of GMA-12 groundwater district's management plan should be identified as 'Managed Depletion' aquifer

Response: The comment is primarily concerned with the development of a district's Management Plan and is only indirectly related to the GMA 12 joint planning process for setting DFCs. However, there are a few points that should be discussed regarding Mr. Chubb's comment. The convention used by GMA 12 Districts to name their groundwater management plan as "a groundwater management plan' is described in Chapter 36 of the

Texas Water Code.

<u>Comment 3: The desired future conditions (DFCs) of all aquifers in GMA-12 groundwater districts should allow the aquifers to be sustained for future generations. If the DFCs are not close to zero drawdown, the districts should 1) explain why they cannot prevent the depletion of the aquifers, and 2) present their future plans to alleviate the mining of the Simsboro and other aquifer.</u>

Response: The comment expresses Mr. Chubb's vision of how to prepare a DFC statement and explanatory report. His proposed approach disregards and is contrary to the requirements to Section 36.108 of the Texas Water Code. Section 36.108(d) requires that all nine factors listed in response to comment #1 be considered in order to 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 (Section 36.108c)."

<u>Comment 4: GMA-12 groundwater districts should protect landowner's property rights by using rules promulgated by the Kenedy County Groundwater Conservation District as a model.</u>

Response: The comment expresses Mr. Chubb's idea of how a GCD should protect property rights. As each GCD crafts its rules to fit local conditions that may not apply in other GCDs, it is unclear what bearing, if any, Kenedy County GCD rules has on the development and evaluation of DFCs in GMA 12.

<u>Comment 5: GMA-12 groundwater districts need to provide a complete accounting of why the aquifers continue to be depleted even though they have spent multi-million of dollars to preserve and conserve aquifers</u>

Response: The comment is asking why GMA-12 is considering DFCs that allow water levels to decline over time. Among the reasons that GMA 12 has voted to allow reduction in water levels over time is that such reductions have been deemed necessary to perform their responsibilities. Per Section 36.0015(b) " Groundwater conservation districts ….. are the state's preferred method of groundwater management in order to protect property rights, balance the conservation and development of groundwater to meet the needs of this state, and use the best available science in the conservation and development of groundwater through rules developed, adopted, and promulgated by a district in accordance with the provisions of this chapter.' Mr. Chubb's desire to have GCD primarily prevent depletion and to preserve and to conserve aquifers is not aligned with the stated purpose of GCDs in Chapter 36 and the goals of the joint planning process explained in Section 36.108(d) of the Texas Water Code.

APPENDIX V

GMA 12'S RESPONSES TO TEXAS WATER DEVELOPMENT BOARD CLARIFICATIONS AND ASSUMPTIONS REQUEST

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Texas Water Development Board Clarifications and Assumptions Request

Clarifications and assumptions for the Carrizo-Wilcox, Queen City, and Sparta aquifers:

1. **Our calculated drawdowns for the Simsboro and Hooper aquifers in Lost Pines Groundwater Conservation District exceed the variances specified for the desired future condition (see Table 1 below).**
We calculated average water level drawdowns from 2000 through 2069 based on the well file submitted with the desired future condition package (PS10.wel). The drawdowns listed in Table 4-1 of the explanatory report for the Simsboro and Hooper aquifers in Lost Pines Groundwater Conservation District exceed the variances specified for the desired future condition. Our drawdown calculations agree within one foot of the average drawdown values presented in Table 4-1 of the explanatory report for the other groundwater conservation districts and counties (with the exception of Fayette County Groundwater Conservation District, discussed in item 2 below). Please either resubmit model files that produce drawdowns that are within the specified variances or increase the specified variances for the Simsboro and Hooper aquifers in Lost Pines Groundwater Conservation District. Otherwise, we will adjust pumping to match the desired future conditions.

Table 1

TWDB Calculated Drawdowns (feet)						
Row Labels	**Sparta**	**QC**	**Carrizo**	**Calvert**	**Simsboro**	**Hooper**
Brazos Valley GCD	13	13	61	126	296	209
Fayette County GCD	56	70	122	164	276	282
Lost Pines GCD	4	16	68	110	257	185
Mid-East Texas GCD	0	-3	81	90	138	126
ND Falls	np	np	np	np	-2	27
ND Limestone	np	np	np	11	51	53
ND Navarro	np	np	np	-1	3	3
ND Williamson	np	np	np	-11	47	69
Post Oak Savannah GCD	29	30	67	150	325	208
Grand Total	**16**	**16**	**75**	**115**	**231**	**171**

GMA 12 Response: *As indicated in the Explanatory Report, a new pumping scenario, called PS-12, has been developed which brings the Lost Pines GCD calculated water level drawdowns within the variances specified in the desired future conditions resolution.*

2. **Our calculated drawdowns for the Sparta and Carrizo aquifers in Fayette County Groundwater Conservation District exceed the variances specified for the desired future condition.**
We calculated average water level drawdowns based only on aquifer areas within Groundwater Management Area 12. However, when we calculate average drawdowns for the model extent for all of Fayette County Groundwater Conservation District, including the area in Groundwater Management Area 15, our values are within one foot of the desired future conditions for Fayette County Groundwater Conservation District and within one foot of the values in Table 4-1 of the Explanatory Report. Please either resubmit model files that produce drawdowns within Groundwater Management Area 12 that are within the specified variances or increase the specified variances for the Sparta and Carrizo aquifers in Fayette County Groundwater Conservation District. Otherwise, we will adjust pumping to match the desired future conditions.

GMA 12 Response: *Based on discussions with the Texas Water Development Board, the DFC Resolution for GMA 12 has been amended to indicate that all of Fayette County is to be used for the calculation of water level drawdowns for the DFCs, not just the portion of these aquifers within GMA 12. The reason for this is that these aquifers have been declared non-relevant by GMA 15 under the assumption that all management of these aquifers by the Fayette County GCD will be done through GMA 12.*

3. **Adjustments will be based on matching groundwater conservation district or county desired future conditions (per aquifer) rather than the GMA 12 overall desired future conditions (per aquifer).**
If pumping adjustments are required to match the desired future conditions we will focus on matching groundwater conservation district or county-based desired future conditions rather than GMA 12 overall desired future conditions per county. Also, note that if we need to adjust pumping to match one groundwater conservation district's desired future conditions then drawdowns in adjacent groundwater conservation districts may move out of tolerance which would require pumping to be adjusted in multiple counties.

GMA 12 Response: *GMA 12 agrees that any pumping adjustments required should be done to match GCD or county-based desired future conditions rather than overall GMA 12 conditions.*

4. **Use the model extent rather than official aquifer extent within Groundwater Management Area 12 to calculate the desired future condition and modeled available groundwater for all model layers.**
This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within one foot of the results presented in Table 4-1 of

the explanatory report, with the exception of Lost Pines Groundwater Conservation District and Fayette County Groundwater Conservation District as discussed in items 1 and 2 above. Please indicate whether or not this is an acceptable assumption.

GMA 12 Response: *GMA 12 agrees that the model extent should be used instead of the official aquifer extent when calculating water level drawdowns.*

5. **Dry cells are excluded from the calculation of average drawdowns for the desired future conditions and are excluded when calculating the modeled available groundwater.**
   This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within one foot of the results presented in Table 4-1 of the explanatory report, with the exception of Lost Pines Groundwater Conservation District and Fayette County Groundwater Conservation District as discussed in items 1 and 2 above. Please indicate whether or not this is an acceptable assumption.

   GMA 12 Response: *GMA 12 agrees that dry cells should be excluded from the calculation of average water level drawdowns for desired future conditions and excluded when calculating the modeled available groundwater.*

6. **Use Stress Period 95 from the groundwater availability model to calculate water level drawdowns and extract modeled available groundwater.**
   The desired future condition states that the drawdowns are based on January 2000 through December 2069. The stress period corresponding to December 2069 in the model run is stress period 95, which is the next to last stress period in the run rather than the final stress period. This will be the last stress period for which modeled available groundwater values will be extracted rather than the final stress period.

   GMA 12 Response: *GMA 12 agrees that stress period 95 should be used to calculate water level drawdowns and extract modeled available groundwater.*

Clarifications and assumptions for the Yegua-Jackson Aquifer:

7. **Our calculated drawdowns for the Yegua-Jackson Aquifer in Post Oak Savannah Groundwater Conservation District exceed the variances specified for the desired future condition (see Table 2 below).**
   We have calculated average water level drawdowns from 2010 through 2069 based on the well file submitted with the desired future condition package (ygjk_GMA12_PS1.wel). We calculated an average drawdown of 89 feet in Post Oak Savannah Groundwater Conservation District compared with a desired future condition of 100 feet, which is a difference of 11 percent. Please either resubmit model files that produce drawdowns are that within the specified variances or increase the specified variances for the Yegua-Jackson Aquifer in Post Oak Savannah Groundwater Conservation District. Otherwise, we will adjust pumping to match the desired future conditions within the specified variances.

   Table 2

TWDB Calculated Drawdowns (feet)			
GCD	Yegua	Jackson	Yegua-Jackson
Brazos Valley GCD	63	110	
Fayette County GCD			71
Mid-East Texas GCD			7
Post Oak Savannah GCD			89
GMA 12			62

   GMA 12 Response: *GMA 12 used the end of stress period 39 (year 2009) and stress period 99 (year 2069) to calculate the drawdowns for POSGCD. This information was emailed to Dr. Shirley Wade at TWDB on August 1, 2017. Dr. Shirley Wade confirmed on August 4, 2017 that GMA 12 could use stress period 39 for the calculation, and therefore no change in the DFC statement is required.*

8. **Adjustments will be based on matching groundwater conservation district or county desired future conditions (per aquifer) rather than the GMA 12 overall desired future conditions (per aquifer).**
   If pumping adjustments are required to match the desired future conditions we will focus on matching groundwater conservation district or county-based desired future conditions rather than GMA 12 overall desired future conditions per county. Also, note that if we need to adjust pumping to match one groundwater conservation district's desired future conditions then drawdowns in adjacent groundwater conservation districts may move out of tolerance which would require pumping to be adjusted in multiple counties.

   GMA 12 Response: *GMA 12 agrees that any pumping adjustments required should be done to match GCD or county desired future conditions rather than overall GMA 12 conditions.*

9. **We excluded pass through layers in the average drawdown calculation.**
Model layers two, three, and four have pass through layers. The drawdown in the pass through layer cells (ibound value = 6) were not included in the average for the Yegua-Jackson Aquifer. Please indicate whether or not this is an acceptable assumption.

GMA 12 Response: *GMA 12 agrees that pass through layers should not be included in the calculation of water level drawdowns for the Yegua-Jackson Aquifer.*

10. **Use the model extent rather than official aquifer extent within Groundwater Management Area 12 to calculate the desired future condition and modeled available groundwater for all model layers.**
This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within the tolerance for all groundwater conservation districts except Post Oak Savannah discussed in item one above. Please indicate whether or not this is an acceptable assumption.

GMA 12 Response: *GMA 12 agrees that the model extent should be used instead of the official aquifer extent when calculating water level drawdowns.*

11. **Dry cells are excluded from the calculation of average drawdowns for the desired future conditions and are excluded when calculating the modeled available groundwater.**
This assumption was not mentioned in the explanatory report. When we make this assumption our results agree within the tolerance for all groundwater conservation districts except Post Oak Savannah discussed in item one above. Please indicate whether or not this is an acceptable assumption.

GMA 12 Response: *GMA 12 agrees that dry cells should be excluded from the calculation of average water level drawdowns for desired future conditions and excluded when calculating the modeled available groundwater.*

12. **Use Stress Period 99 from the groundwater availability model to calculate water level drawdowns and extract modeled available groundwater.**
The desired future condition states that the drawdowns are based on January 2010 through December 2069. The stress period corresponding to December 2069 in the model run is stress period 99, which is the next to last stress period in the run rather than the final stress period. This will be the last stress period for which modeled available groundwater values will be extracted rather than the final stress period.

GMA 12 Response: *GMA 12 agrees that the stress period 99 will be the last period for which modeled available groundwater values will be extracted.*

Methods and assumptions for the Brazos River Alluvium Aquifer:

13. **We have estimated preliminary modeled available groundwater values based on the Brazos River Alluvium Groundwater Availability Model (Table 1).** We calculated percent saturation and water level declines using the groundwater availability model for the Brazos River Alluvium. Pumping amounts in Burleson, Brazos, Milam, and Robertson counties were adjusted to match the desired future conditions for Brazos Valley and Post Oak Savannah Groundwater Conservation Districts. The desired future conditions were achieved within one foot or one percentage point with the exception that it was not possible to decrease percent saturation in the Brazos Valley Groundwater Conservation District south of Highway 21 below 45 percent, because the model would not converge with additional pumping. The estimated pumping to achieve the desired future conditions is listed in Table 1. Please note, using this method, the preliminary estimated modeled available groundwater for Milam County is almost twice the estimated total storage (Table 1).

Table 1 Preliminary Groundwater Availability Model Results

Area	Desired Future Condition	Model Results	Estimated total storage (acre-feet)	Model Estimated MAG (acre-feet per year)
Brazos Valley GCD North of Highway 21	> 30% saturation	30% saturation	270,000 (Robertson County)	71,750
Brazos Valley GCD South of Highway 21	> 40% saturation	45% saturation	290,000 (Brazos County)	65,602
Burleson County	6 feet decline	5.8 feet decline	450,000	28,413
Milam County	5 feet decline	4.6 feet decline	28,000	55,556

GMA 12 Response: *GMA 12 does not disagree that the model can perform in the manner described. GMA 12 agrees with the modeled available groundwater estimates provided in Table 1.*

14. **We used average recharge and streamflow for the predictive portion of the groundwater availability model of the Brazos River Alluvium Aquifer.** The historical groundwater availability model for the Brazos River Alluvium was extended from 2012 to 2070 by adding 58 annual stress periods to the model. The recharge package and streamflow routing package were extended to 2070 by using average recharge and average streamflow. The average recharge and streamflow were based on the historical model for the period from 2000 to 2012. These years were selected for averaging because the character of the modeled aquifer water budget seems to change in the year 2000.

GMA 12 Response: *GMA 12 agrees with the approach of using recharge and streamflow based on the historical model for the period from 2000 to 2012.*

15. **We used the average annual pumping for the last year of the historical model to create the initial pumping distribution for the predictive model.**
We calculated annual average pumping using the last 12 months of the historical model. The pumping was then uniformly scaled to best match the desired future conditions for Brazos Valley and Post Oak Savannah Groundwater Conservation Districts. Deep flow due to pumping from underlying units was based on the modeled available groundwater runs for the underlying aquifers (central part of the Queen City and Sparta aquifers, Yegua-Jackson Aquifer, and northern part of the Gulf Coast Aquifer System). The deep flow portion of the pumping was not adjusted to match the desired future conditions of the Brazos River Alluvium and was based only on the model runs for the underlying aquifers.

    GMA 12 Response: *GMA 12 agrees with using the calculated annual average pumping for the last 12 months of the historical model to develop the initial pumping distribution for the predictive model.*

16. **Dry cells do not occur in the groundwater availability for the groundwater availability model for the Brazos River Alluvium Aquifer.**
Pumping is reduced by the model code in some model cells to prevent cells from going dry. All reported pumping amounts are from the budget output files rather than the well file input package and reflect what was actually pumping in the model.

    GMA 12 Response: *GMA 12 agrees with the reduction in pumping by the model code to prevent the cells from going dry.*

17. **We will use a tolerance of up to one foot or 5 percent (whichever is greater) when comparing desired future conditions to average drawdown calculations or percent saturation values from the model files for the Brazos River Alluvium Aquifer.**

    GMA 12 Response: *GMA 12 agrees with using a tolerance of up to one foot or 5 percent (whichever is greater) when comparing desired future conditions to average water level drawdown calculations or percent saturation values from the model files.*

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