DESIRED FUTURE CONDITION EXPLANATORY REPORT FOR GROUNDWATER MANAGEMENT AREA 15

This report was considered and approved by the member districts of Groundwater Management Area 15 on June 14, 2016.

Member Districts:

1. Aransas County Groundwater Conservation District
2. Bee Groundwater Conservation District
3. Calhoun County Groundwater Conservation District
4. Coastal Bend Groundwater Conservation District
5. Coastal Plains Groundwater Conservation District
6. Colorado County Groundwater Conservation District
7. Corpus Christi ASR Conservation District
8. Evergreen Underground Water Conservation District
9. Fayette County Groundwater Conservation District
10. Goliad County Groundwater Conservation District
11. Pecan Valley Groundwater Conservation District
12. Refugio Groundwater Conservation District
13. Texana Groundwater Conservation District
14. Victoria County Groundwater Conservation District

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6/18/2016 — Date

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ACROYNMS AND ABBREVIATIONS

AFY	acre feet per year
ASCRD	Aquifer Storage & Recovery Conservation District
CGC GAM	Central Gulf Coast Aquifers GAM
DFC	Desired Future Condition
GAM	groundwater availability model
GMA	Groundwater Management Area
GW-SW	Groundwater-surface water
HB	House Bill
INTERA	INTERA Incorporated
LCRB	Lower Colorado River Basin
MAG	modeled available groundwater
RFP	request for proposal
RMSE	root mean square error
TERS	total estimated recoverable storage
TWDB	Texas Water Development Board
UWCD	Underground Water Conservation District

1.0 INTRODUCTION

1.1 GMA 15

Groundwater Management Areas (GMAs) were created "in order to provide for the conservation, preservation, protection, recharging, and prevention of waste of the 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 management areas may be created..." (Texas Water Code §35.001).

The responsibility for GMA delineation was delegated to the Texas Water Development Board (TWDB). (Section 35.004, Chapter 35, Title 2, Texas Water Code). The initial GMA delineations were adopted on December 15, 2002, and are modified as necessary according to agency rules. There are 16 GMAs in Texas. **Figure 1-1** shows the boundaries of these 16 GMAs, including GMA 15. **Figure 1-2** shows the location of the 14 Groundwater Conservation Districts (GCDs) that are contained wholly or in part within the boundary of GMA 15: These 14 GCDs are Aransas County GCD, Bee GCD, Calhoun County GCD, Coastal Bend GCD, Coastal Plains GCD, Colorado County GCD, Corpus Christi Aquifer Storage & Recovery Conservation District (ASRCD), Evergreen Underground Water Conservation District (UWCD), Fayette County GCD, Goliad County GCD, Pecan Valley GCD, Refugio GCD, Texana GCD, and Victoria County GCD.

In GMA 15, the TWDB recognizes two major aquifers and three minor aquifers. **Figure 1-3** shows the footprints of the two major aquifers, the Gulf Coast and the Carrizo-Wilcox aquifers. The Carrizo-Wilcox occurs only as a subcrop in the four most up-dip counties, DeWitt, Karnes, Lavaca, and Fayette counties. **Figure 1-4** shows the footprints of the minor aquifers, which are the Yegua-Jackson, the Sparta and the Queen City aquifers. These three minor aquifers only occur as subcrops in Fayette County. **Table 1-1** is a stratigraphic column showing relative age and placement of the aquifers.

Table 1-1 A simplified stratigraphic column for GMA 15 (modified from Young and others, 2010)

<table>
<tr><th>EPOCH</th><th colspan="2">Hydrogeologic Unit</th></tr>
<tr><td>Holocene</td><td rowspan="3">Chicot Aquifer</td><td rowspan="7">Gulf Coast Aquifer</td></tr>
<tr><td>Pleistocene</td></tr>
<tr><td>Pliocene</td></tr>
<tr><td rowspan="3">Miocene</td><td>Evangeline Aquifer</td></tr>
<tr><td>Burkeville Confining Unit</td></tr>
<tr><td rowspan="2">Jasper Aquifer</td></tr>
<tr><td rowspan="2">Oligocene</td></tr>
<tr><td colspan="2">aquitard</td></tr>
<tr><td rowspan="5">Eocene</td><td colspan="2">Yegua-Jackson Aquifer</td></tr>
<tr><td colspan="2">Sparta Aquifer</td></tr>
<tr><td colspan="2">Queen City Aquifer</td></tr>
<tr><td colspan="2">aquitard</td></tr>
<tr><td colspan="2" rowspan="2">Carrizo-Wilcox Aquifer</td></tr>
<tr><td>Paleocene</td></tr>
</table>

In this report, the Gulf Coast Aquifer will be divided into four major hydrogeologic units, which are shown in Table 1-1. These four units are, from youngest to oldest, the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper Aquifer.

There are fourteen counties in GMA 15. **Table 1-2** lists the fourteen counties and their area and population projects. In 2010, the fourteen counties had a population of 369,500 people, and the county with the largest population was Victoria County, with 86,800 people. The population of the fourteen counties is expected to grow to 473,000 people in 2070, with Victoria expanding to a population of 116,500 people.

Table 1-2 Population projection from the 2017 State Water Plan by county and the area for the counties

County Name	Area (sq miles)[1]	2010[2]	2020	2030	2040	2050	2060	2070
Aransas	252	23,158	24,463	24,991	24,937	25,102	25,103	25,104
Bee	880	31,861	33,478	34,879	35,487	35,545	35,579	35,590
Calhoun	506	21,381	24,037	26,866	29,622	32,276	34,906	37,454
Colorado	960	20,874	21,884	22,836	23,544	24,582	25,449	26,293
DeWitt	909	20,097	20,855	21,555	21,900	22,216	22,425	22,572
Fayette	950	24,554	28,373	32,384	35,108	37,351	39,119	40,476
Goliad	852	7,210	8,427	9,519	10,239	10,545	10,759	10,884
Jackson	829	14,075	14,606	15,119	15,336	15,515	15,627	15,699
Karnes	747	14,824	15,456	15,938	15,968	15,968	15,968	15,968
Lavaca	970	19,263	19,263	19,263	19,263	19,263	19,263	19,263
Matagorda	1,100	36,702	39,166	41,226	42,548	43,570	44,296	44,815
Refugio	770	7,383	7,687	7,929	7,985	8,119	8,175	8,213
Victoria	882	86,793	93,857	100,260	105,298	109,785	113,470	116,522
Wharton	1,086	41,280	43,804	46,614	48,860	50,804	52,599	54,189
GMA 15 Total		**369,455**	**395,356**	**419,379**	**436,095**	**450,641**	**462,738**	**473,042**

[1] Source of county areas is http://www.indexmundi.com/facts/united-states/quick-facts/texas/land-area#table

[2] 2010 is based on the United States Census

1.2 Joint Planning Process

The joint-planning process was first adopted by the Texas Legislature with the passage of House Bill (HB) 1763 in 2005. One of the requirements of HB 1763 is that, where two or more districts are located within the same boundaries of GMA, the districts shall establish Desired Future Conditions (DFCs) for all relevant aquifers in the GMA by no later than September 1, 2010 and every five years thereafter.

DFCs are defined in Title 31, Part 10, §356.10 (6) of the Texas Administrative Code as "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."

The specified future time extends through at least the period that includes the current planning period for the development of regional water plans pursuant to §16.053, Texas Water Code, or in perpetuity, as defined by participating districts within a GMA as part of the joint planning process. DFCs have to be physically possible, individually and collectively, if different DFCs are stated for different geographic areas overlying an aquifer or subdivision of an aquifer.

The joint-planning process was expanded significantly by the passage of Senate Bill 660 in 2011. The more substantive elements of the expanded process include: (1) new requirements that an explanatory report be developed and submitted at the conclusion of the joint-planning process to document that certain required factors for consideration have been addressed; (2) a change from requirements involving estimates of managed available groundwater to modeled available groundwater (MAG) (including the process for addressing exempt use); (3) new requirements for individual districts to provide for a 90-day public comment period, during which the individual district is to a hold public hearing on proposed DFCs before final adoption by at least two thirds of the district representatives in the GMA; and (4) as soon as possible after final adoption of the DFCs by district representatives in the GMA, individual districts are finally then to adopt the DFCs. Solely applicable to the current round of joint-planning, the deadline for adopting proposed DFCs was extended to May 1, 2016, by the passage of Senate Bill 1282 by the Texas Legislature in 2013.

If a GMA includes more than one district, those districts must engage in a joint planning process, including at least an annual meeting. The districts must jointly determine the DFCs for the management area and, in doing so, are required to consider the nine following factors:

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;
8. the feasibility of achieving the DFC; and
9. any other information relevant to the specific DFCs.

After DFCs are adopted by a GMA, the TWDB calculates Modeled Available Groundwater (MAG) based on the DFCs. A MAG is defined in Title 31, Part 10, §356.10 (13) of the Texas Administrative Code as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition."

1.3 GMA 15 Joint Planning

The joint-planning process established by HB 1763 in 2005 and amended by Senate Bill 660 in 2011 is a public, transparent process, where all planning decisions are made in open, publicly noticed meetings in accordance with provisions contained in Texas Water Code Chapter 36. From 2012 to 2015, GMA 15 convened 18 times within the boundary of the GMA at the dates listed in **Table 1-3**. All of the meetings were open to the public. All meeting notices were posted at least 10 days in advance of the meeting and included an invite to submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County GCD by mail at 2805 N. Navarro St. Suite 210, Victoria, TX 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6883.

Table 1-3 lists the dates and the major discussion topics of the GMA 15 joint planning meetings from 2012 to 2015. **Appendix A** contains the meeting notices and the minutes for the meetings. In June 2013, GMA 15 selected INTERA Incorporated (INTERA) to be their technical consultant. INTERA performed the groundwater availability model (GAM) simulations for GMA 15, provided technical guidance, and supported the preparation of this explanatory report.

Table 1-3 List of meetings that were convened GMA 15 from 2012 to 2016

Meeting Date	Quorum Present	Major Discussion Topic
June 20, 2012	Yes	Discussed joint planning requirements, groundwater monitoring and DFC compliance, regional water planning
October 10, 2012	Yes	GCDs report on recent and on-going hydrogeology projects, methods for estimating groundwater usage, appointed officers, interlocal GCD agreements, discussion of GCD management plans
February 14, 2013	Yes	Aquifer use and measured groundwater levels, RFP for hiring a consultant, possible use of LCRB model as alternative groundwater model
April 11, 2013	Yes	Population estimates, GCD annual reports, responses from RFP for consultant
June 13, 2013	Yes	GCD Management Plans, population estimates, INTERA selected as consultant
October 10, 2013	Yes	Lavaca GCD dissolved, regional water planning, GCD management plans, officer election
January 9, 2014	Yes	Regional water planning, review of GCD management plans, PDFCs, anticipated future pumping scenarios for GAM runs
April 10, 2014	Yes	Pumping scenarios for GAM Runs, assessment of GCD management plans on DFCs, TWDB report on an updated GAM*
July 10, 2014	Yes	Assessment of GCD management plans on DFCs, baseline and high-production pumping scenarios
October 9, 2014	Yes	GCD management plans, regional water planning, submitted INTERA files on water budgets, TERS, historical pumping
January 8, 2015	Yes	Social economic impact of DFCs, aquifer sustainability
April 9, 2015	Yes	Regional water planning issues, future pumping scenarios, impacts of drought on DFCs
July 15, 2015	Yes	Feasibility of DFCs, INTERA presentation, considerations regarding subsidence, social economic, personal property
August 13, 2015	Yes	Review of INTERA DFC pumping runs
October 8, 2015	Yes	Review of DFC pumping runs, review DFC adoption steps
December 9, 2015	Yes	Review of nine factors to consider regarding DFCs
January 16, 2016	Yes	Proposed DFCs
April 29, 2016	Yes	District Summaries of Public Comment Period, Adoption of DFCs

During the GMA 15 meeting on January 14, 2016, GMA 15 designated the draft Groundwater Management Area 15 Desired Future Conditions language, with modification, as the Proposed Desired Future Conditions of Groundwater Management Area 15. As required by Texas Water Code Section

36.108(d-2), the proposed DFCs were subsequently distributed to the individual districts in GMA 15. A period of not less than 90 days was provided to allow for public comments on the proposed DFCs; during this comment period, each district held a public hearing on the proposed DFCs. **Table 1-4** lists the date that each district conducted a public hearing on the proposed DFCs.

Table 1-4 Public hearings conducted by the GCDs regarding the proposed DFCs

GCD	Public Hearing Date
Aransas County GCD	March 23, 2016
Bee GCD	March 23, 2016
Calhoun County GCD	April 18, 2016
Coastal Bend GCD	April 25, 2016
Coastal Plains GCD	April 25, 2016
Colorado County GCD	April 27, 2016
Corpus Christi ASRCD	February 4, 2016
Evergreen UWCD	April 22, 2016
Fayette County GCD	March 7, 2016
Goliad County GCD	April 18, 2016
Pecan Valley GCD	April 19, 2016
Refugio GCD	April 18, 2016
Texana GCD	April 14, 2016
Victoria County GCD	April 15, 2016

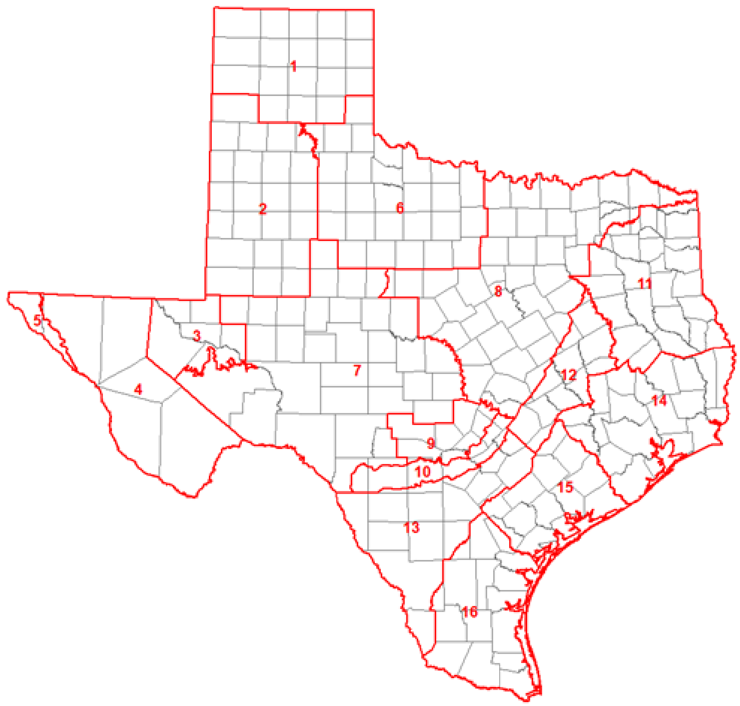


Figure 1-1 Delineation of 16 groundwater management zones in Texas (obtained from http://www.twdb.texas.gov/groundwater/management_areas/index.asp)

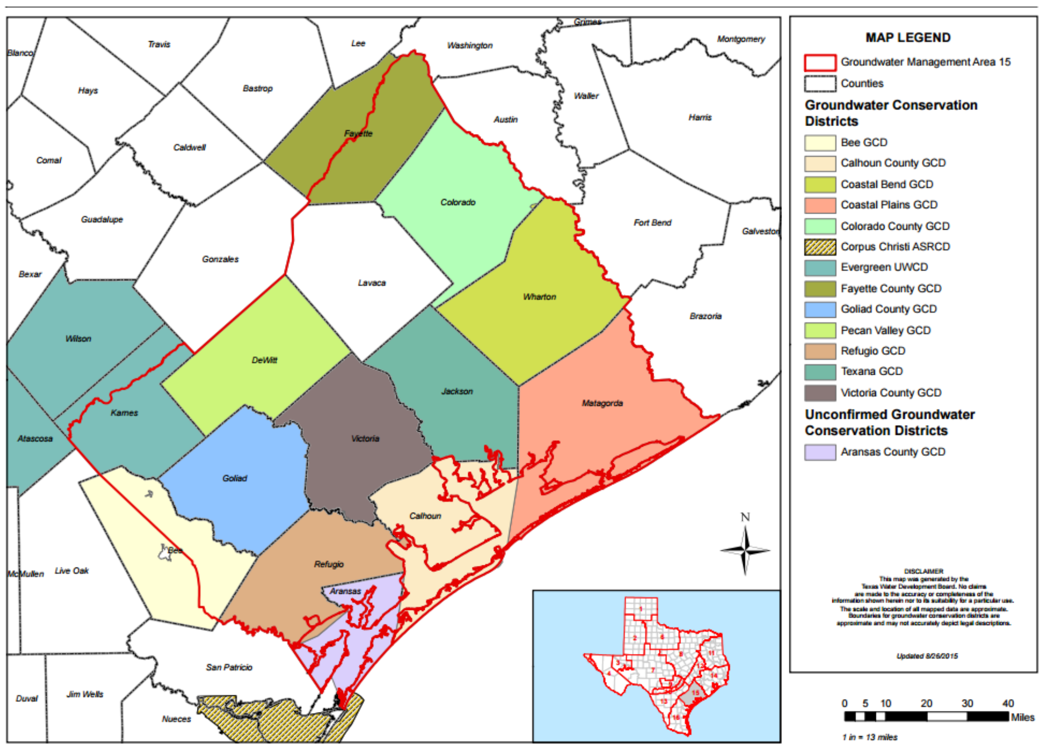


Figure 1-2 Delineation of GMA 15 showing locations of GCDs (obtained from http://www.twdb.texas.gov/groundwater/management_areas/gma15.asp)

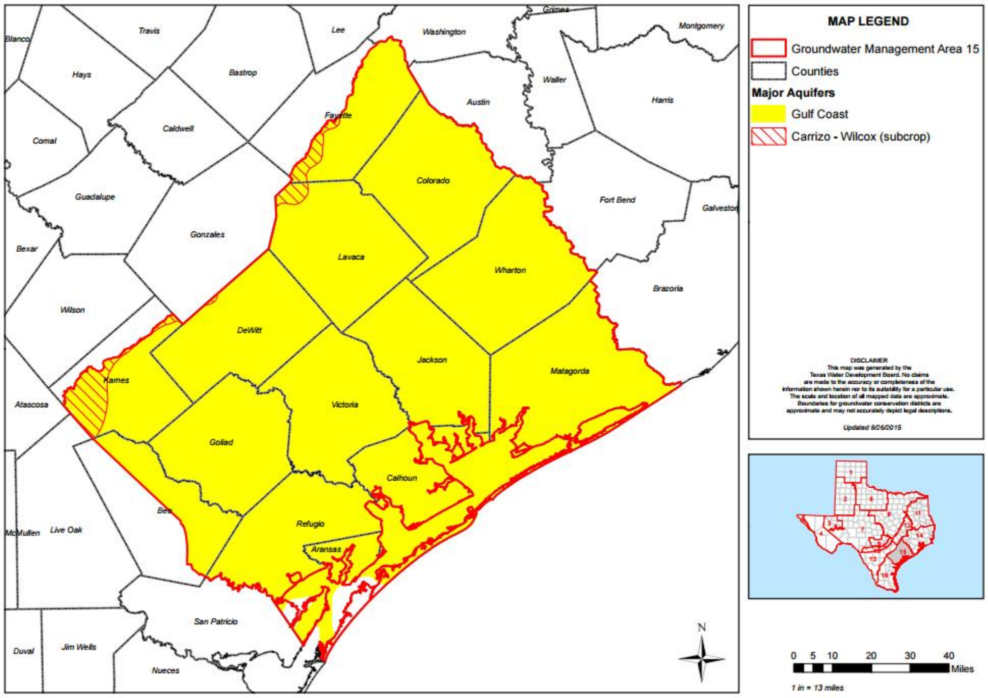


Figure 1-3 Map of GMA 15 major aquifer boundaries (obtained from http://www.twdb.texas.gov/groundwater/management_areas/gma15.asp)

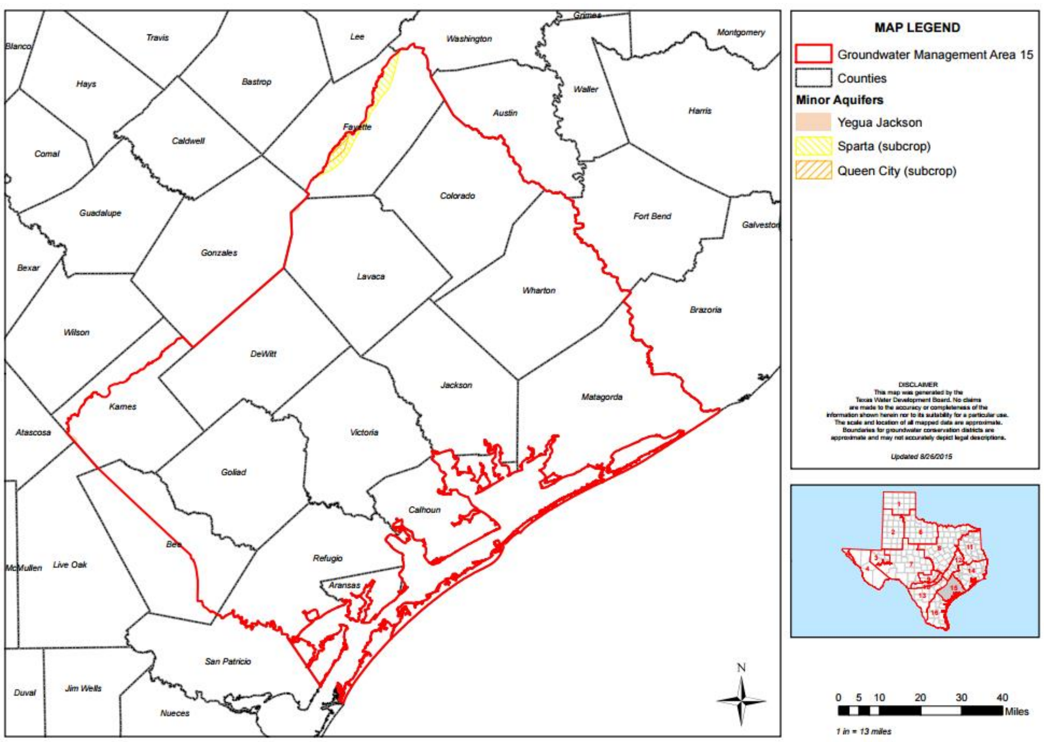


Figure 1-4 Map of GMA 15 minor aquifer boundaries (obtained from http://www.twdb.texas.gov/groundwater/management_areas/gma15.asp)

2.0 GMA 15 DESIRED FUTURE CONDITIONS

2.1 Gulf Coast Aquifers

The three Gulf Coast aquifers of interest are the Chicot Aquifer, the Evangeline Aquifer, and the Jasper Aquifer. As shown in Table 1-1, the Burkeville Confining Unit lies between and separates the Evangeline and the Jasper aquifers. For the purpose of establishing DFCs, GMA 15 has adopted the boundaries in the Central Gulf Coast GAM (CGC GAM) (Chowdhury and others, 2004) to define the areas and volumes associated with the Chicot Aquifer, Evangeline Aquifer, the Jasper Aquifer, and the Burkeville Confining Unit.

On April 29, 2016, GMA 15 Representatives approved resolution 2016-01 titled Resolution to Adopt the Desired Future Conditions for Groundwater Management Area 15. **Appendix B** contains the resolution. The adopted DFCs are based on acceptable levels of drawdown for each county and the entire groundwater management area from 2000 to 2070. Groundwater Management Area 15 adopts Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline Aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 adopts Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and adopts a Desired Future Condition for the counties in the groundwater management area (GMA-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in **Table A-1** at December 2069.

Table A-1 Desired Future Conditions for GMA 15 expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County	0 feet of drawdown of the Gulf Coast Aquifer System
Bee County	7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County	5 feet of drawdown of the Gulf Coast Aquifer System
Colorado County	17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer
Dewitt County	17 feet of drawdown of the Gulf Coast Aquifer System
Fayette County	16 feet of drawdown of the Gulf Coast Aquifer System
Goliad County	10 feet of drawdown of the Gulf Coast Aquifer System
Jackson County	15 feet of drawdown of the Gulf Coast Aquifer System
Karnes County	22 feet of drawdown of the Gulf Coast Aquifer System
Lavaca County	18 feet of drawdown of the Gulf Coast Aquifer System
Matagorda County	11 feet of drawdown of the Chicot and Evangeline Aquifers
Refugio County	5 feet of drawdown of the Gulf Coast Aquifer System
Victoria County	5 feet of drawdown of the Gulf Coast Aquifer System
Wharton County	15 feet of drawdown of the Chicot and Evangeline Aquifers

2.2 Carrizo-Wilcox Aquifer

GMA 15 considers the portion of the Carrizo-Wilcox Aquifer within boundary of GMA 15 non-relevant for joint planning purposes. The portion of this aquifer system present within GMA 15 is small, downdip, and only present at great depths. Use and projected demands from the Carrizo-Wilcox Aquifer within GMA 15 is negligible to non-existent. The total estimated recoverable storage (TERS) for the Carrizo-Wilcox is 17,475,000 to 52,425,000 acre-feet for all of GMA 15. Approximately 85% of the TERS present within GMA 15 is within the boundaries of Evergreen UWCD and Fayette County GCD. Evergreen UWCD and Fayette County GCD manage their Carrizo-Wilcox resources as part of GMA 13 and GMA 12, respectively. Therefore, GMA 15 concludes that the desired future conditions in adjacent or hydraulically connected relevant aquifers will not be affected.

2.3 Yegua-Jackson, Sparta, and Queen-City aquifers

GMA 15 considers the portions of the Yegua-Jackson, Sparta, and Queen-City Aquifers within the boundary of GMA 15 non-relevant for joint planning purposes. The portions of these aquifers within GMA 15 are small. Use and projected demands from these aquifers within GMA 15 is negligible to non-existent. The TERS for the Queen City Aquifer is 160,000 to 480,000 acre-feet for all of GMA 15 and located only within Fayette County. The TERS for the Sparta Aquifer is 725,000 to 2,175,000 acre-feet for all of GMA 15 and located only within Fayette County. The Fayette County GCD has additional groundwater resources in both the Queen City and Sparta aquifers outside of GMA 15 and manages these resources as part of GMA 12. The TERS for the Yegua-Jackson Aquifer is 202,500 to 607,500 acre-feet for all of GMA 15 and located only within Karnes County and Lavaca County. The boundary of Evergreen UWCD includes Karnes County. Evergreen UWCD manages the Yegua-Jackson Aquifer resources as part of GMA 13. Estimated use from the Yegua-Jackson Aquifer within Lavaca County is less than 10 acre-feet/year. Lavaca County is not located within the boundary of an existing groundwater conservation district and the groundwater resources within are not managed. Therefore, GMA 15 concludes that the desired future conditions in adjacent or hydraulically connected relevant aquifers will not be affected.

3.0 POLICY JUSTIFICATION

The adoption of DFCs by districts, pursuant to the requirements and procedures set forth in Texas Water Code Chapter 36, is an important policy-making function. DFCs are planning goals that state a desired condition of the groundwater resources in the future in order to promote better long-term management of those resources. Districts are authorized to utilize different approaches in developing and adopting DFCs based on local conditions and the consideration of other statutory criteria as set forth in Texas Water Code Section 36.108.

GMA 15 and each of its member districts evaluated DFCs with regard to the nine factors required by Texas Water Code Section 36.108(d), as listed in Section 1.2. In addition to these nine factors, GMA 15 and the individual districts evaluated DFCs with regard to providing a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, and recharging, and prevention of waste of groundwater in GMA 15.

In evaluating the DFCs, GMA 15 and the individual districts recognizes that: 1) the production capability of the aquifer varies significantly across GMA 15, 2) historical groundwater production is significantly different across GMA 15, and 3) the importance of groundwater production to the social-economic livelihood of an area is significantly varied among the districts. As a result of this recognition, a key GMA 15 policy decision was to allow districts to set different DFCs for portion of a specific aquifer within their boundaries, as long as the different DFCs could be shown to be physically possible. The allowance of different DFCs among the districts is justified for several reasons. One reason is that the Texas Water Code Section 36.108(d)(1) authorizes the adoption of different DFCs for different geographic areas over the same aquifer based on the boundaries of political subdivisions. The statute expressly and specifically directs districts "to consider uses or conditions of an aquifer within the management area, including conditions that differ substantially from one geographic area to another" when developing and adopting DFCs for:

1. each aquifer, subdivision of an aquifer, or geologic strata located in whole or in part within the boundaries of the management area; *or*
2. each geographic area overlying an aquifer in whole or in part or subdivision of an aquifer within the boundaries of the management area.

The Legislature's addition of the phrase "in whole or in part" makes it clear that districts may establish a "different" DFC for a geographic area that does not cover the entire aquifer but only part of that aquifer. Moreover, the plain meaning of the term "geographic area" in this context clearly includes an area defined by political boundaries, such as those of a district or a county.

Each district in GMA 15 submitted a summary of the public comment period and public hearing regarding the proposed DFCs inclusive of all relevant comments received during the 90-day public comment period regarding the proposed DFCs, any suggested revisions to the proposed DFCS, and the basis for the revisions. The summaries are provided in **Appendix C**. GMA 15 Representatives reviewed the summary submittals during a meeting held on April 29, 2016. The DFCs that were considered and proposed for final adoption specify acceptable drawdown levels in the Gulf Coast aquifers on a county-by-county basis and across the entire GMA 15.

4.0 TECHNICAL JUSTIFICATION

The adopted DFCs for the Gulf Coast Aquifer in Section 2.0 were partly developed from simulations of various future pumping scenarios using the CGC GAM (Chowdhury and others, 2004).

4.1 Overview of the Central Gulf Coast GAM (CGC GAM)

The development of the CGC GAM (Chowdhury and others, 2004) began with Waterstone Environmental Hydrology and Engineering, Inc. (Waterstone and Parsons, 2003), and was completed by the TWDB. **Figure 4-1** shows the model domain for the CGC GAM. The model boundary is defined by: (1) the limits of the outcrop area in the west, (2) the Gulf of Mexico, (3) groundwater divide to the north through the Colorado-Fort Bend-Brazoria counties, and (4) groundwater divide to the south through Jim Hogg, Brooks, and Kenedy counties. The model has four layers, which from top to bottom represent the Chicot Aquifer, the Evangeline Aquifer, the Burkeville confining Unit, and the Jasper Aquifer. **Figure 4-2** shows the layering of the model using both three-dimensional and two-dimensional surfaces.

The groundwater code used to model the groundwater flow is MODFLOW-96 (Harbaugh and McDonald, 1996). MODFLOW-96 is code that solves the groundwater flow equation for a finite-difference numerical grid. The numerical grid for the CGC GAM consists of grid cells with dimensions of one mile by one mile. The thickness of each grid cell equals the thickness of the model layer/geologic unit that it represents. The dimension of the grid cell is important because it limits the resolution at which the groundwater system can be described. Among the limitations placed on the model solution by the numerical grid are the following:

- the aquifer properties assigned to a grid cell are assumed to be uniform and constant;
- all the of wells located within the area of a grid cell are represented by a single well at the center of the grid cell;
- all of the wells that pump from a geologic unit are assumed be screened across the entire length of the geologic unit; and
- the water level for the entire grid cell volume is represented by a single value at the center of the grid cell.

The model approach described by the TWDB (Chowdhury and others, 2004) includes: (1) calibrating the model for steady-state conditions from 1910 to 1940 (based on assumptions of no water level change during pre-pumping conditions), and (2) calibrating the model for transient conditions from 1940 to 1999 (based on assumed yearly changes in pumping). The steady-state calibration was performed primarily to investigate the model sensitivity to changes in aquifer properties and boundary conditions. The transient calibration was performed to estimate the final aquifer parameters and boundary conditions for the final model.

The transient calibration by the TWDB primarily focused on adjusting hydraulic parameters to match measured water levels obtained from the TWDB groundwater well database. The vast majority of the water levels used to calibrate the model are from the Chicot and Evangeline aquifers. Only a few water level measurements were associated with the Burkeville Confining Unit and the Jasper aquifer. Both the TWDB and the Waterstone reports provide relatively little information regarding aquifer properties, recharge distributions, and hydraulic boundary conditions. As a result, a reader has little to no information with which to evaluate the reasonableness of many model parameters important to making predictions of pumping impacts.

4.2 Development of the CGC GAM

The primary criteria used by the TWDB to evaluate the model calibration results were comparison between simulated and measured water levels. A standard metric for assessing the goodness in matching historic water levels is the root-mean square error (RMSE). The RMSE is a measure of the average difference between the measured and simulated water levels. The acceptable value of RMSE is both model- and problem-dependent. For regional models that span hundreds of miles, an RMSE of about 10% of the range in head values is generally accepted as a minimum goal during model calibration.

Chowdhury and others (2004) use water levels from 1989 and 1999 to calibrate the CGC GAM. **Figure 4-3** compares the measured and simulated water levels for 1989 and 1999, respectively. The RMSE for the calibration is 46 feet for 1989 and 36 feet for 1999. The RMSE values for the 1989 calibration period and for the 1999 calibration period are about 5% of the total change in water levels across the model area shown in Figure 4-1.

In addition to water levels, Chowdhury and others (2004) show matches for baseflows in streams. **Figure 4-4** shows comparisons between measured and simulated base flows for three river gages in the model domain. The figures show that the simulated base flows are significantly lower than the measured values. Referring to the underestimated stream flows in Figure 4-4, Chowdhury and others (2004) state:

> "In regional groundwater flow models, it is always difficult to reproduce baseflow where the errors in the simulated heads in the aquifers could be potentially large and the state in the river are fixed. A global increase in stream conductance causes too much of a hydraulic interaction between the aquifers and the streams in the central Gulf Coast GAM (Waterstone and Parson, 2003) and would require unreasonable recharge to calibrate the model."

Among the concerns with the calibration of the CGC GAM is that Chowdhury and others (2004) and Waterstone and Parson (2003) provide relatively little documentation and data that can be used to check the reasonableness of the model parameters. With regard to hydraulic properties, Chowdhury and others (2004) do not present any results from specific aquifer tests, geophysical logs, or regional hydrogeological studies to justify their parameterization of the aquifer properties. Chowdhury and others (2004) use three hydraulic conductivity zones (**Figure 4-5**) to model the Evangeline Aquifer but they do not compare these zonation values and results from analysis of field data.

With regard to pumping rates, Chowdhury and others (2004) state that they recalibrated the Waterstone draft GAM based on TWDB estimates of pumpage distribution. However, Chowdhury and others (2004) do not discuss the procedure used to assign TWDB pumping rates to the grid cells among the aquifer layers and the potential sources of error and uncertainty.

Chowdhury and others (2004) present the following three water budgets for the CGC GAM: 1) steady-state for pre-development; 2) transient conditions for 1989; and, 3) transient conditions for 1999. Water budgets provide a breakdown of where the sources and discharges of water occur in the groundwater model. All three of these water budgets are reproduced and shown in **Table 4-1**.

The water budget for the pre-development conditions, which represents the time prior to pumping, is about 600,000 acre feet per year (AFY). The two primary sources of inflow are streams (69%) and recharge from precipitation (29%). The two primary sources of outflows are streams (84%) and the Gulf of Mexico (16%). The average water budget for the 1989 and the 1999 pumping conditions is about 1,000,000 AFY. The increase in the water budget is caused by groundwater pumping, which averages

Table 4-1 Water budgets from the CGC GAM (from Chowdhury and others, 2004)

Steady-state Conditions for Pre-Development				
Parameter	**Flow (in) (AFY)**	**Flow (out) (AFY)**	**Flow (in) (percent)**	**Flow (out) (percent)**
Drains	0	-4,075	0%	1%
Lake Leakage	9,319	0	2%	0%
Evapo-transpiration	0	0	0%	0%
Gulf of Mexico	0	-97,008	0%	16%
Recharge	180,796	0	29%	0%
Stream Leakage	426,578	-515,610	69%	84%
Total	**616,693**	**-616,693**	**100%**	**100%**
Transient Conditions for 1989				
Parameter	**Flow (in) (AFY)**	**Flow (out) (AFY)**	**Flow (in) (percent)**	**Flow (out) (percent)**
Storage	365,155	-237,054	32.53%	21.12%
Pumping	0	-386,932	0%	34%
Drains	0	-1,832	0%	0%
Lake Leakage	21,752	0	2%	0%
Evapo-transpiration	0	-37,920	0%	3%
Gulf of Mexico	2,579	-71,551	0%	6%
Recharge	265,448	0	24%	0%
Stream Leakage	467,671	-387,296	42%	35%
Total	**1,122,605**	**-1,122,585**	**100%**	**100%**
Transient Conditions for 1999				
Parameter	**Flow (in) (AFY)**	**Flow (out) (AFY)**	**Flow (in) (percent)**	**Flow (out) (percent)**
Storage	248,228	-22,549	25.53%	2.32%
Pumping	0	-425,020	0%	44%
Drains	0	-2,035	0%	0%
Lake Leakage	21,409	0	2%	0%
Evapo-transpiration	0	-20,958	0%	2%
Gulf of Mexico	1,299	-87,330	0%	9%
Recharge	182,909	0	19%	0%
Stream Leakage	518,498	-414,450	53%	43%
Total	**972,343**	**-972,342**	**100%**	**100%**

about 400,000 AFY. The three major sources of inflow are leakage from stream (47%), water release from aquifer storage (29%), and recharge (21%). The three major sources of discharge are groundwater flow to streams (39%), pumping from the aquifer (39%), and addition of water into storage (12%).

4.3 Application of CGC GAM

The CGC GAM was used to simulate the impact of pumping for a period from January 1, 2000 to December 31, 2071. The initial water level conditions for the predictive GAM runs from Chowdhury and others (2004) for December 1999 and are shown in **Figure 4-6**. To help establish appropriate benchmarks for districts to evaluate pumping impacts, **Appendix D** presents the water budgets for each county for 1999. These water budgets were presented to the GMA 15 by INTERA on April 10, 2014.

Two scenarios of pumping rates and locations were generated by the GMA 15 for the time period from 2000 to 2070 to represent alternative future pumping scenarios. Each pumping scenario is contained in a single computer file that can be read and used by the CGC GAM. The two scenarios are called “Baseline” and “High-Production.” The “Baseline” scenario represented a district’s current MAG, with updates to account for anticipated district growth and/or permits recently awarded. There was no consensus among the districts for a definition of “High-Production.” The “High-Production” scenario was developed to allow several districts to evaluate the impact of increased pumping on drawdowns.

In order to help represent spatial and temporal trends of interest to the districts adequately, the pumping scenarios were generated using a template that allowed yearly changes in pumping in any grid cell or group of cells in the GAM, so that the districts could represent future pumping rates at the temporal and spatial resolution they deemed appropriate for the joint planning process. Several versions of the Baseline and the High-Production pumping files were generated and run with the CGC GAM in 2014. The final set of pumping files used to help establish the adopted DFCs include the designation “Option 1.” **Table 4-2** presents the pumping by county and by aquifer in 2070 for the Baseline Option 1 pumping scenario. **Table 4-3** presents the pumping by county and by aquifer in 2070 for the High-Production Option 1 pumping scenario. **Figure 4-7** shows the annual variation of total pumping by county for the Baseline Option 1 pumping scenario. **Figure 4-8** shows the annual variation of total pumping by county for the High-Production Option 1 pumping scenario.

Table 4-2 2070 pumping rates associated with the Baseline Pumping Scenario

County	Chicot Aquifer	Evangeline Aquifer	Burkeville Confining Unit	Jasper Aquifer	Total
Aransas	1,863	0	0	0	**1,863**
Austin	3,180	4,006	5	22	**7,214**
Bee	3,707	5,505	17	289	**9,518**
Brazoria	8,901	289	0	0	**9,189**
Calhoun	7,950	68	0	0	**8,018**
Colorado	31,602	40,066	0	919	**72,587**
Dewitt	1,019	7,818	166	6,408	**15,411**
Fayette	0	264	405	1,878	**2,546**
Fort Bend	6,248	5,381	0	0	**11,629**
Goliad	714	10,702	306	102	**11,824**
Jackson	66,147	24,529	0	0	**90,676**
Karnes	0	105	627	3,262	**3,993**
Lavaca	3,095	12,647	151	4,692	**20,585**
Matagorda	33,898	7,121	0	0	**41,020**
Refugio	3,383	2,636	0	0	**6,019**
Victoria	32,170	27,873	0	0	**60,043**
Wharton	114,878	66,575	0	0	**181,452**
Total	**318,755**	**215,584**	**1,676**	**17,572**	**553,587**

Table 4-3 2070 pumping rates associated with the High-Production Pumping Scenario

County	Chicot Aquifer	Evangeline Aquifer	Burkeville Confining Unit	Jasper Aquifer	Total
Aransas	1,863	0	0	0	**1,863**
Austin	3,180	4,006	5	22	**7,214**
Bee	3,707	5,505	17	289	**9,518**
Brazoria	8,901	289	0	0	**9,189**
Calhoun	12,456	10,070	0	0	**22,526**
Colorado	48,419	62,874	0	919	**112,211**
Dewitt	1,019	7,813	165	19,178	**28,176**
Fayette	0	914	1,380	6,664	**8,958**
Fort Bend	6,286	5,381	0	0	**11,667**
Goliad	724	12,288	311	286	**13,609**
Jackson	92,308	85,452	0	0	**177,760**
Karnes	0	105	737	4,485	**5,327**
Lavaca	3,095	12,647	151	4,692	**20,585**
Matagorda	42,732	9,063	0	0	**51,795**
Refugio	6,379	37,951	0	0	**44,331**
Victoria	104,670	70,373	0	50,000	**225,043**
Wharton	135,864	78,713	0	0	**214,577**
Total	**471,604**	**403,442**	**2,766**	**86,536**	**964,348**

The CGC GAM was used to simulate future groundwater conditions using the same average conditions for recharge and stream water levels used by the TWDB to generate MAGs from the 2010 DFCs (Hill and Oliver, 2011). The average drawdowns for each county by aquifer are presented in **Table 4-4** for the Baseline Option 1 simulation and in **Table 4-5** for the High-Production Option 1 simulation. To evaluate the sensitivity of predicted drawdown to recharge, the Baseline Option 1 future pumping scenario was also run with 50% of the average recharge rate. Simulated average drawdown results for the “50% recharge” simulation are provided in **Table 4-6**. Prior to considering the results in Tables 4-4, 4-5, and 4-6 for proposing DFCs, GMA 15 had the TWDB verify the values in Table 4-4 by recalculating the average drawdowns using the codes developed by the TWDB.

Table 4-4 Average drawdowns (feet) from 2000 to 2070 for the Baseline Option 1 Pumping Scenario

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System	Overall (without Burkeville)
Aransas	-0.1	5.8	0.0	NA	NA	0.0	**0.0**
Bee	1.3	8.7	6.2	7.7	5.6	6.5	**6.0**
Calhoun	-0.6	10.7	2.6	2.8	NA	2.6	**2.6**
Colorado	12.8	26.0	20.1	22.6	24.8	22.0	**21.8**
Dewitt	1.2	6.1	5.4	17.0	26.1	17.3	**17.4**
Fayette	NA	5.6	5.6	17.7	18.1	16.1	**15.5**
Goliad	-3.4	0.7	-0.1	7.2	10.5	5.2	**4.2**
Jackson	15.2	20.2	17.7	14.4	22.0	17.5	**18.5**
Karnes	NA	0.3	0.3	18.2	24.0	20.4	**21.0**
Lavaca	7.2	6.8	6.9	16.1	31.1	17.6	**18.2**
Matagorda	4.0	17.2	8.0	16.7	NA	8.8	**8.0**
Refugio	-0.4	7.3	3.2	2.8	NA	3.1	**3.2**
Victoria	-4.4	6.0	1.0	5.0	9.5	3.5	**3.0**
Wharton	14.6	12.4	13.5	25.5	28.4	20.0	**18.1**
Average	**5.5**	**11.4**	**8.5**	**15.1**	**22.0**	**13.2**	**12.6**

NA – not applicable because model does include this unit in this county

Table 4-5 Average drawdowns (feet) from 2000 to 2070 for the High-Production Option 1 Pumping Scenario

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System	Overall (without Burkeville)
Aransas	0.0	46.0	1.1	NA	NA	1.1	**1.1**
Bee	3.8	15.4	11.5	11.1	6.5	10.1	**9.7**
Calhoun	4.5	108.4	34.1	7.9	NA	33.9	**34.1**
Colorado	30.4	54.3	43.6	36.7	36.6	40.0	**41.1**
Dewitt	4.0	9.5	8.7	27.0	53.3	32.4	**34.5**
Fayette	NA	15.0	15.0	40.5	50.4	42.6	**43.2**
Goliad	4.5	13.1	11.3	12.9	19.6	14.2	**14.7**
Jackson	65.4	143.6	104.4	52.8	42.0	82.2	**92.0**
Karnes	NA	1.6	1.6	21.3	32.8	27.2	**28.7**
Lavaca	25.0	19.1	20.9	21.2	35.6	25.9	**27.7**
Matagorda	8.2	65.2	25.5	27.3	NA	25.7	**25.5**
Refugio	1.6	67.7	32.0	20.0	NA	30.2	**32.0**
Victoria	27.0	81.3	55.1	68.3	180.1	79.5	**83.8**
Wharton	38.4	60.7	49.6	43.6	38.3	45.5	**46.1**
Average	**20.7**	**56.2**	**38.7**	**34.9**	**46.7**	**39.6**	**41.1**

Table 4-6 Average drawdowns (feet) from 2000 to 2070 for the Baseline Option 1 Pumping Scenario with 50% pumping

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System	Overall (without Burkeville)
Aransas	-0.1	7.0	0.1	NA	NA	0.1	**0.1**
Bee	14.7	19.8	18.0	13.4	9.6	14.4	**14.9**
Calhoun	-0.4	12.2	3.2	2.9	NA	3.2	**3.2**
Colorado	27.4	38.8	33.7	29.8	30.0	31.7	**32.4**
Dewitt	9.6	8.9	9.0	19.7	28.1	20.1	**20.2**
Fayette	NA	12.6	12.6	21.7	20.8	19.9	**19.1**
Goliad	3.0	5.0	4.6	9.9	12.7	8.5	**7.9**
Jackson	23.8	27.4	25.6	17.2	23.8	23.2	**25.2**
Karnes	NA	12.2	12.2	22.6	25.6	23.6	**23.9**
Lavaca	24.0	13.4	16.6	19.4	33.4	23.0	**24.4**
Matagorda	4.5	19.4	9.0	17.3	NA	9.8	**9.0**
Refugio	0.6	9.9	4.9	4.2	NA	4.8	**4.9**
Victoria	-0.3	9.4	4.8	7.0	11.7	6.5	**6.4**
Wharton	21.4	19.2	20.3	28.4	30.4	24.7	**23.4**
Average	**10.4**	**17.6**	**14.1**	**18.8**	**24.7**	**17.6**	**17.2**

4.4 Evidence and Sources of Predictive Uncertainty in CGC GAM Simulations of Pumping Scenarios

During the July 2015 GMA 15 meeting, INTERA discussed sources of error and uncertainty in the predicted water levels in Tables 4-4,4-5, 4-6. A list of these sources is presented in **Figure 4-9**. **Appendix E** contains the slide presentation that INTERA presented to GMA 15 regarding predictive uncertainty associated with the CGC GAM. Several of the documented sources of uncertainty include flaws in the conceptual groundwater flow model, insufficient field data, inaccurate aquifer properties, oversimplified aquifer dynamics, improper aquifer boundaries and stratigraphy, and inadequate numerical spatial resolution. Among the references discussed to illustrate examples of the documented sources of uncertainty and error in the CGC GAM are Chowdhury and others (2004), TWDB (2014), Young (2012; 2014), Young and Kelley (2006), and Young and others (2010; 2012; 2013). A key message in the July discussion was the TWDB statement regarding the CGC GAM simulations by Hill and Oliver (2011):

> "The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:
>
> 'Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it

possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results.'

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time."

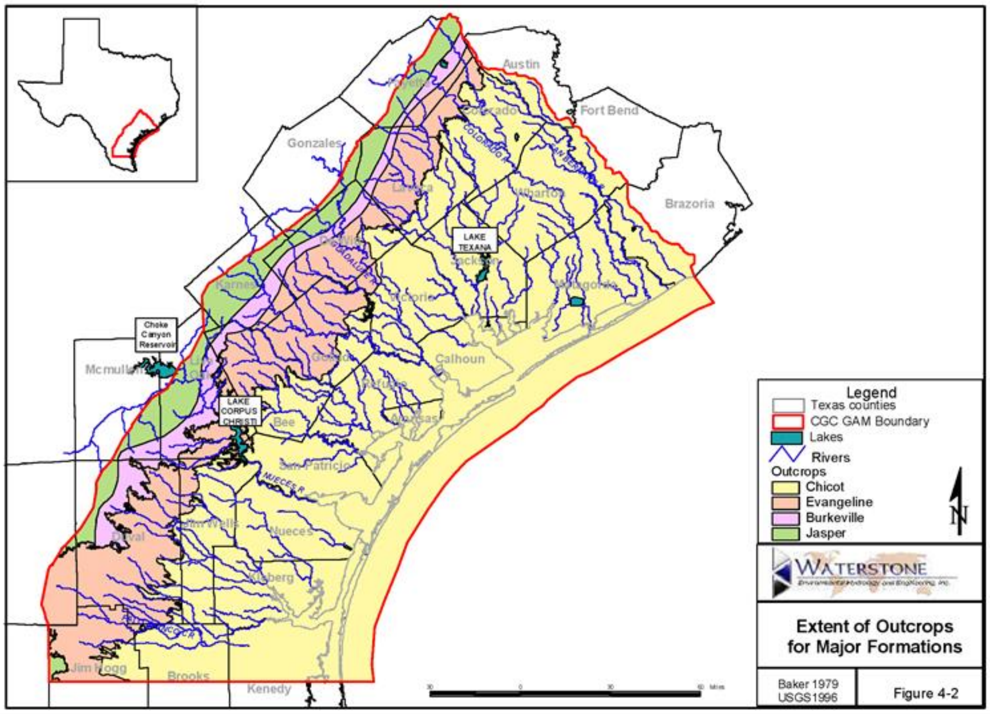


Figure 4-1 Model domain for the Central Gulf Coast GAM (Waterstone and Parson, 2003)

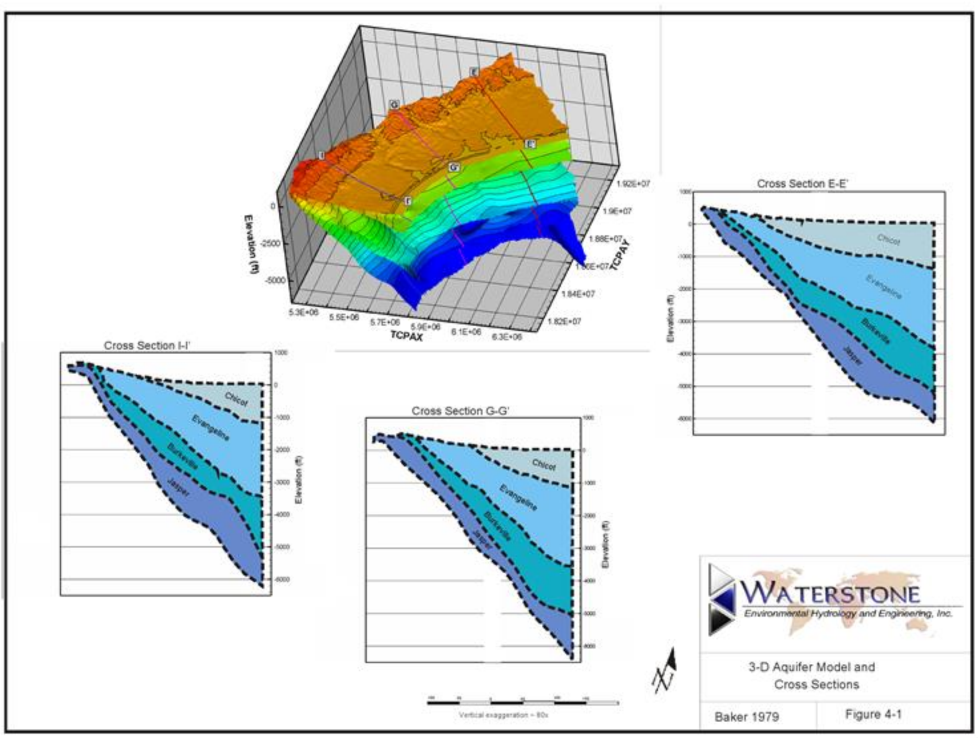


Figure 4-2 Three-dimensional surfaces and two-dimensional cross-sections showing the model layers for the Central Gulf Coast GAM (Waterstone and Parson, 2003)

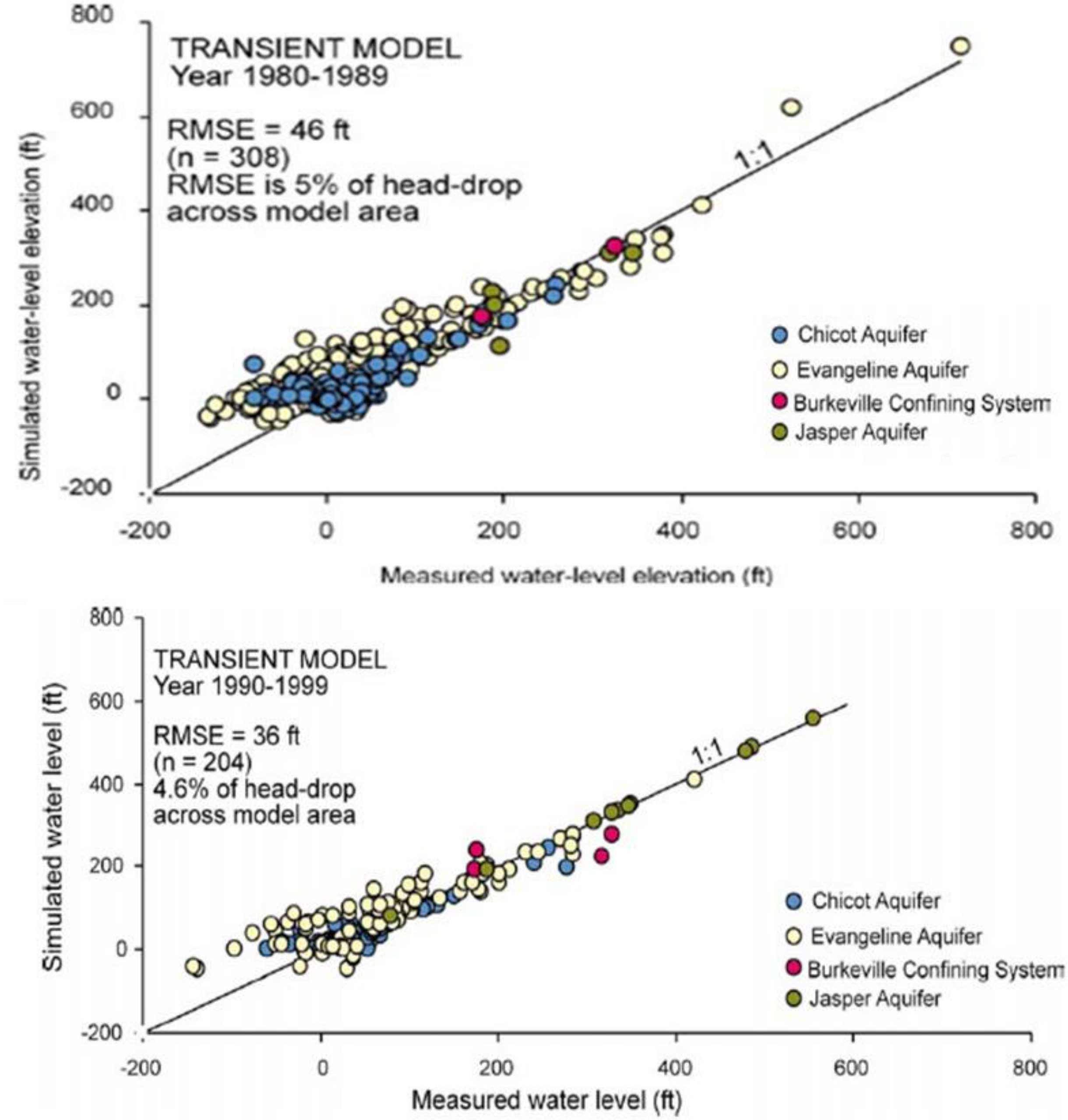
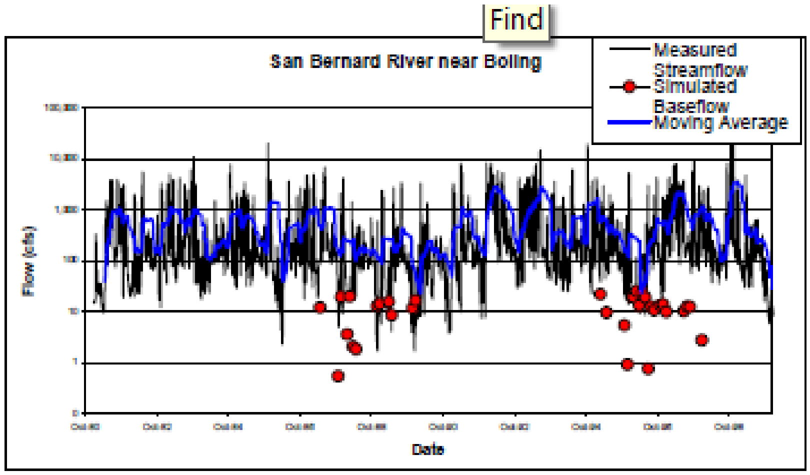
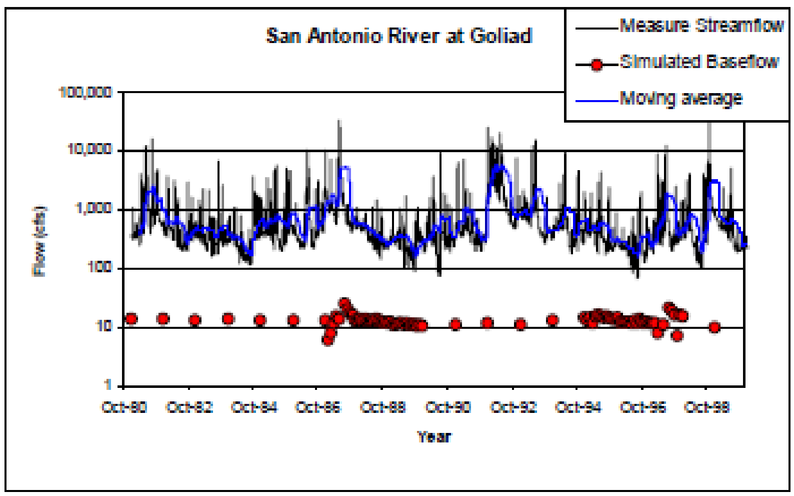


Figure 4-3 Comparison of measured and simulated water levels presented by Chowdhury and others (2004) for the CGC GAM for 1989 (top plot) and 1999 (bottom plot)

(a)



(b)



(c)

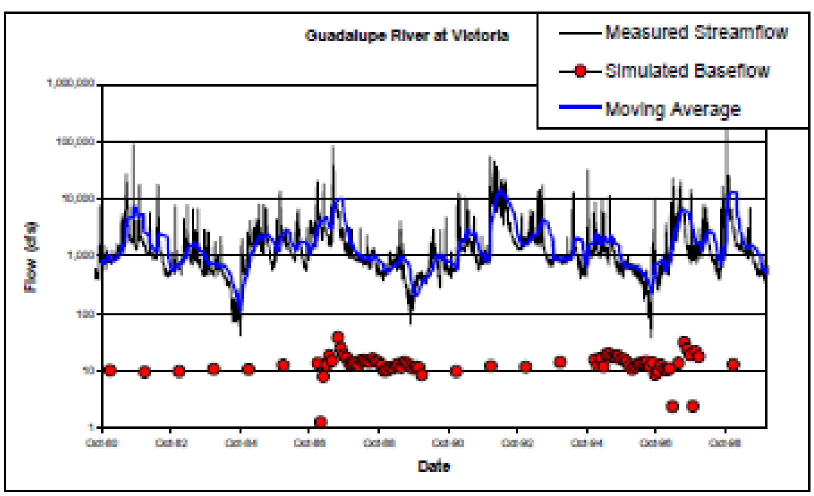


Figure 4-4 Comparison of streamflow hydrographs with simulated baseflow for the (a) San Bernard River near Boling, (b) San Antonio River at Goliad, and (c) Guadalupe River at Victoria (Chowdhury and others, 2004)

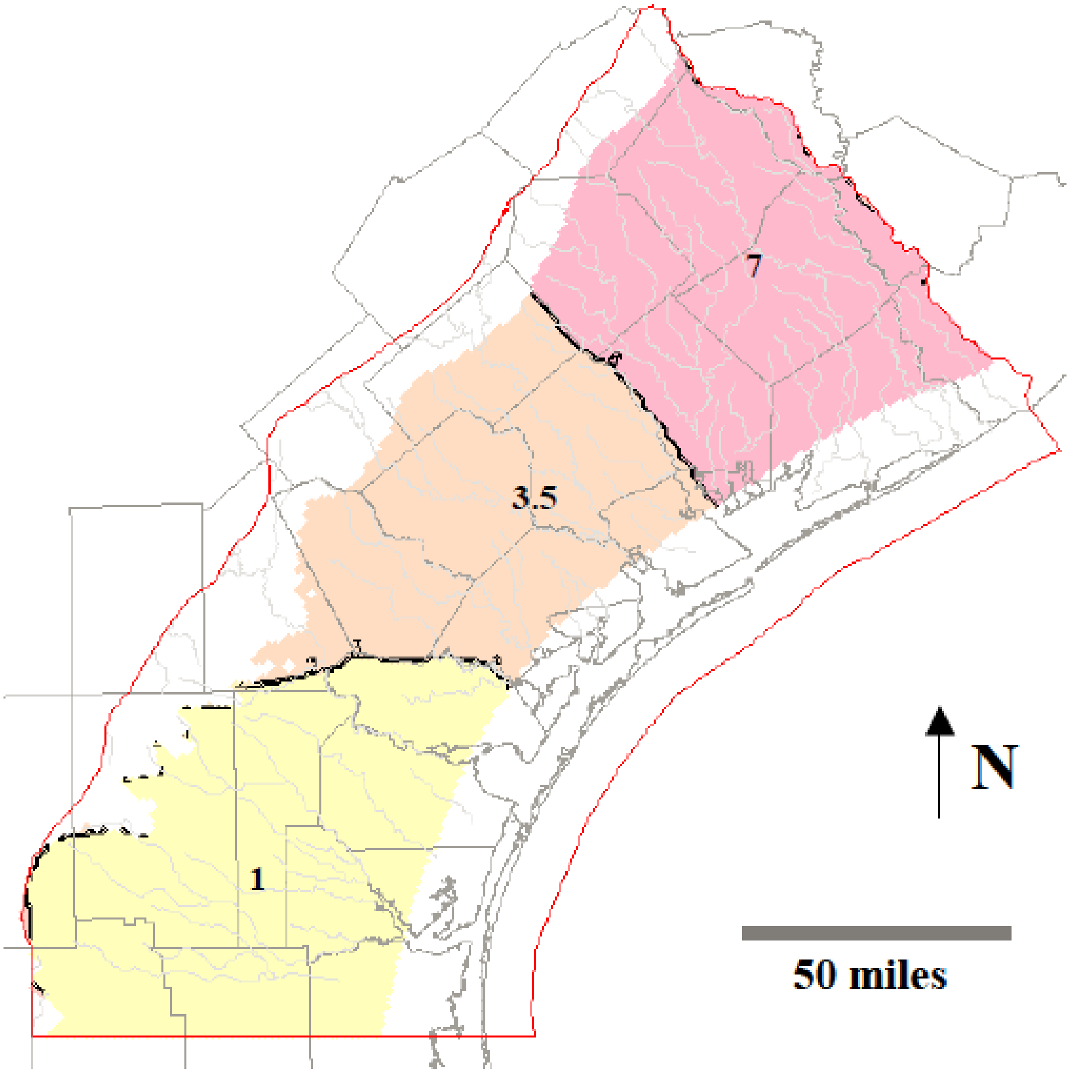


Figure 4-5 Hydraulic conductivity zones in the Evangeline Aquifer used from the calibrated CGC GAM. Hydraulic conductivity values labeled for each zone are in ft/day (from Waterstone and Parsons, 2003)

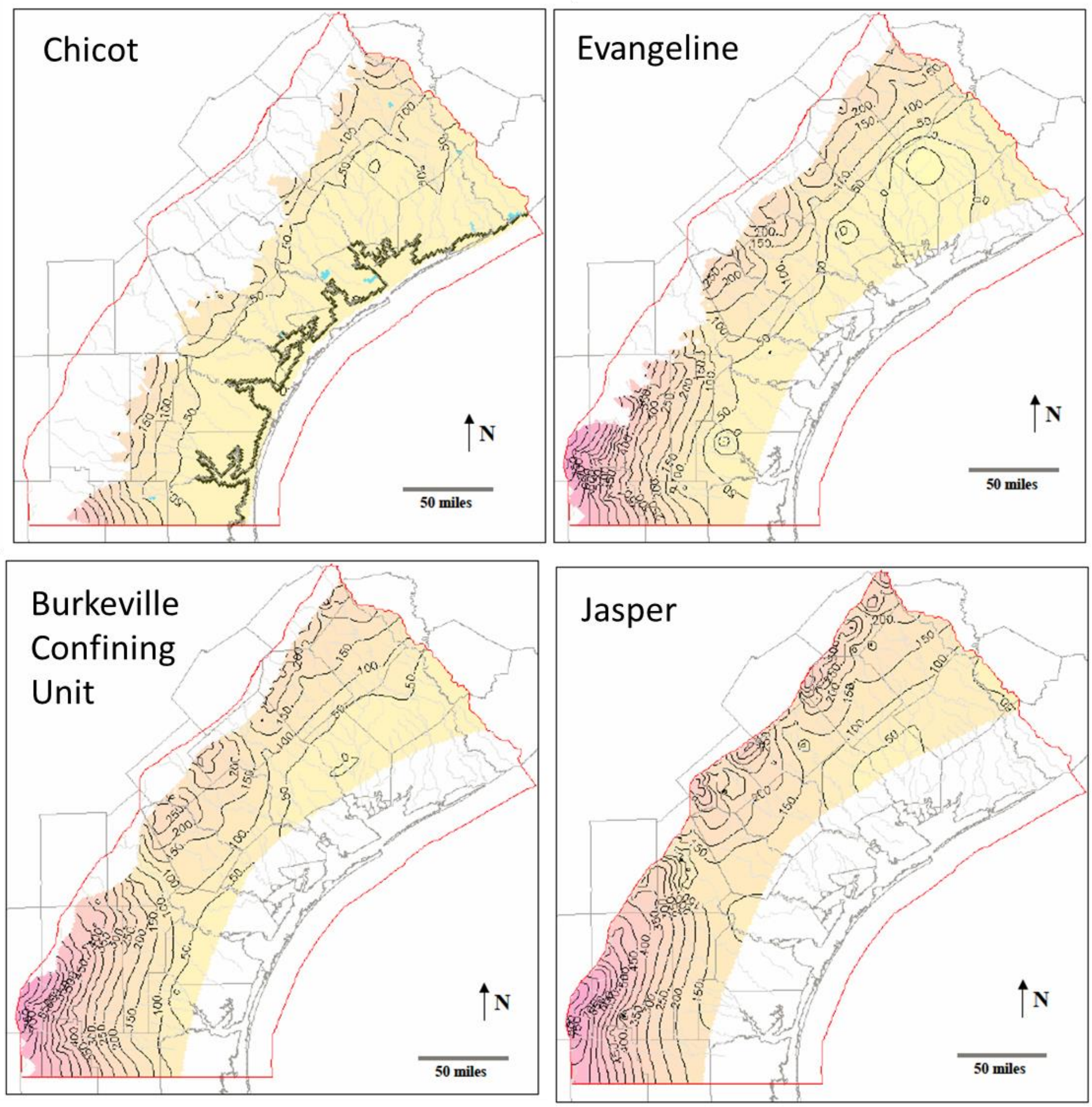


Figure 4-6 1999 Water levels simulated for the Chicot Aquifer, Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper Aquifer by the Central Gulf Coast GAM (Chowdhury and others, 2004).

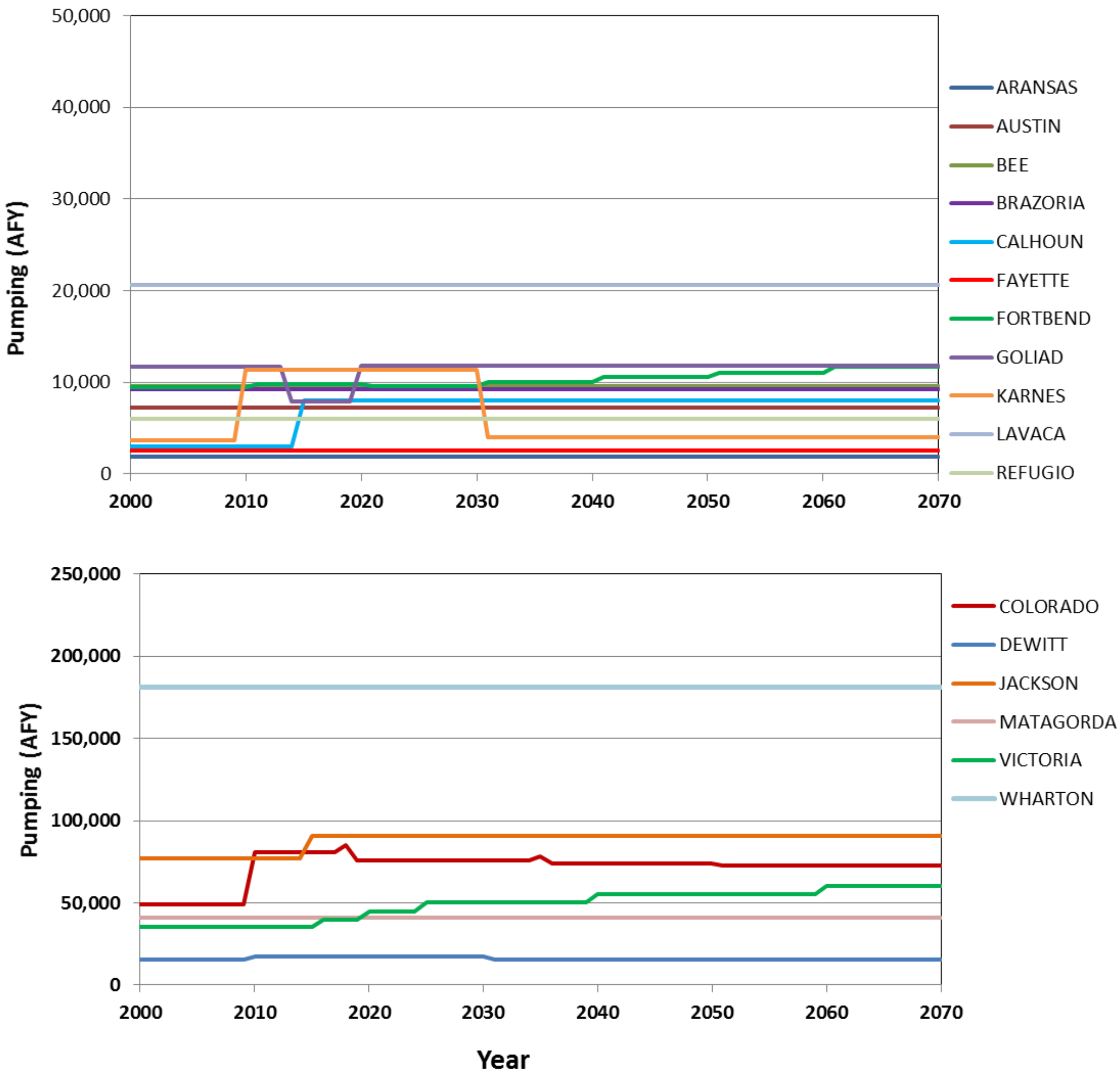


Figure 4-7 Annual changes in pumping by county for the Baseline Future Pumping Scenario

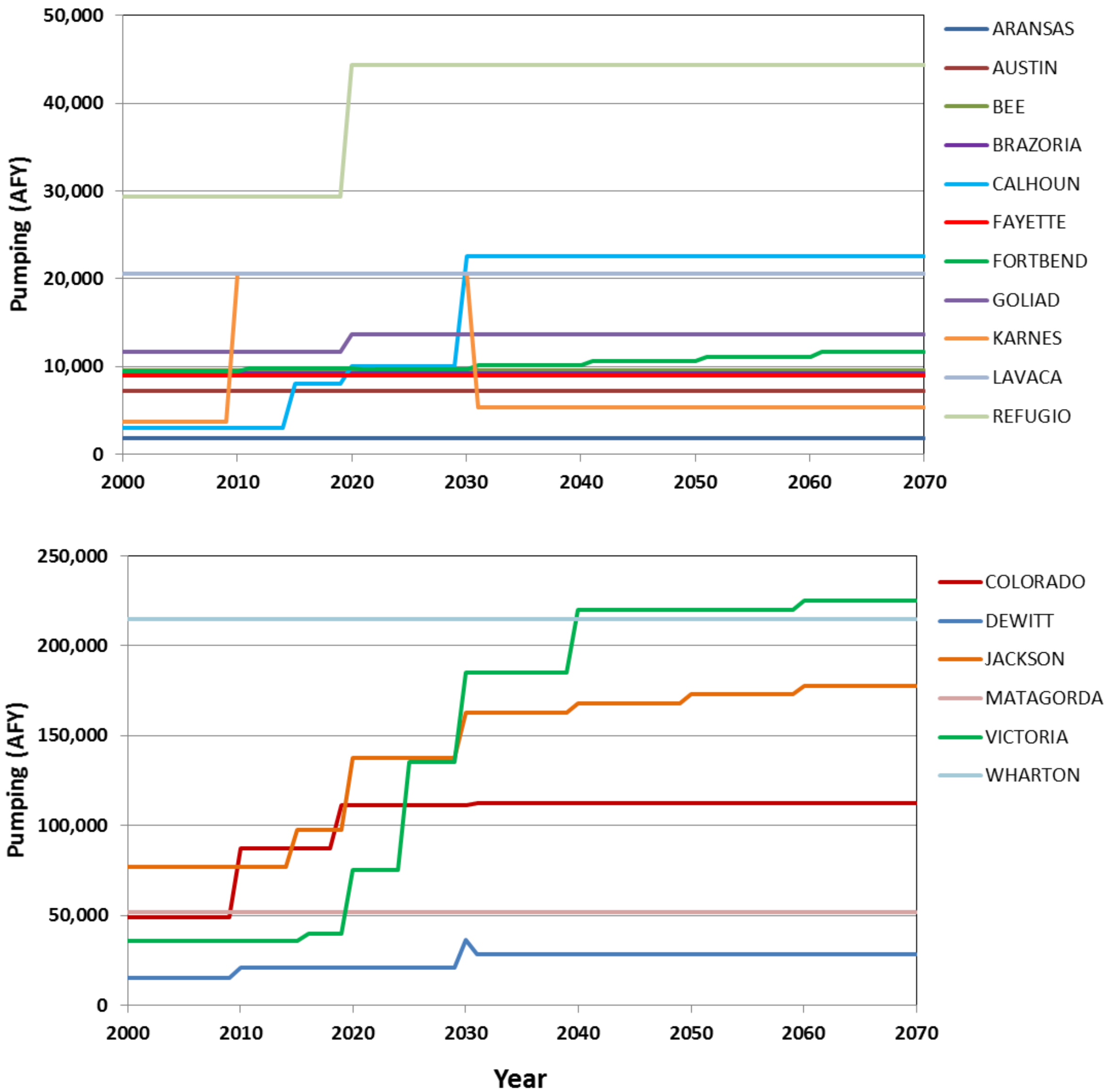


Figure 4-8 Annual changes in pumping by county for the High-Production Future Pumping Scenario

1. **Central Gulf Coast GAM Report (2004)**
   a. **Calibration statistics between measured and model values**
   b. **Plots of residuals for different aquifers**

2. **LCRA-SAWS Water Project (LSWP) Reports (2005 to 2009)**
   a. **Spatial placement of pumping**
   b. **Vertical placement of pumping**
   c. **Temporal and Spatial distribution of recharge**
   d. **Numerical discretization around streams**
   e. **Aquifer boundaries**
   f. **Spatial variability in aquifers**
   g. **Addition of land subsidence (aquifer storage)**

3. **DFC Presentation to GMA 15 on Behalf of CCGCD, CBGCD, CPGCD (2010)**
   a. **Volume-weighted versus area-weighted drawdown averages**
   b. **Difference in pumping by aquifer between GMA model and reported by district**
   c. **Incomplete spatial coverage of aquifers by active model grid cells**

4. **PVGCD Report Regarding the Impacts of Large-scale Pumping (2012)**
   a. **Catahoula is an important Gulf Coast Geologic Unit**
   b. **Burkeville is not a low permeability unit for most of DeWitt County**
   c. **Jasper and Burkeville transmissivity is too low. Non-uniqueness of Central GAM calibration – can be recalibrated with much high recharge and transmissivity values**

5. **VCGCD Report discussing Science Development Program (2012)**
   a. **Aquifer boundaries and hydraulic properties – Burkeville K too low and K distribution for Chicot and Evangeline not consistent with field data**
   b. **Recharge and GW-SW exchange**

6. **VCGCD Report discussing Transmissivity values from Aquifer Tests (2014)/ TWDB Regional ASR & OCS Plan for Golden Crescent Region of Texas (2014)**
   a. **Evangeline modeled transmissivity values are too low in Victoria County**
   b. **Notable differenced between measured and modeled transmissivity in Jackson County**

7. **TWDB Report Evaluation of Hydrogeochemical Data regarding Implication to Developing Gulf Coast GAMs (2013)**
   a. **Implications to Conceptual Model**
   b. **Considerations for Implementing Recharge and GW-SW Interaction**

8. **On-going studies by CBGCD, CPGCD, VCGCD, TGCD, RGCD, EUWCD, and PVGCD to Support Development of GAM 15 & 16 (2015)**
   a. **Groundwater-surface water interaction**
   b. **Aquifer Hydraulic Properties are spatially variable**
   c. **Considerable uncertainty in recharge estimates**
   d. **Land-Subsidence has appear to occurred**

Figure 4-9 Eight different studies that document source of predictive error and uncertainty in the CGC GAM simulations

5.0 FACTORS CONSIDERED FOR THE DESIRED FUTURE CONDITIONS

Section 36.108(d)(1-8) of the Texas Water Code requires districts of a GMA document the consideration of the nine listed factors (provided in Section 1.2) prior to proposing a DFC. This section of the explanatory report summarizes information considered by GMA 15 regarding the factors.

5.1 Aquifer Uses and Conditions

Texas Water Code Section 36.108(d)(1) directs districts to consider, during the joint-planning process, "aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another." Information on aquifer uses and conditions that was discussed in the GMA 15 includes, but is not limited, to the following:

- The TWDB water use surveys
- The TWDB historical groundwater pumping database
- The TWDB groundwater well database
- Documentation of the CGC GAM including Chowdhury and others (2004) and Waterstone and Parson (2003)
- Documentation of the Lower Colorado River Basin Model Report (Young and Kelley, 2006; Young and others, 2009)
- Reponses from the districts regarding GMA 15 Questionnaire #2

As summarized in the GMA 15 December 2015 meeting minutes:

> "The aquifer uses and conditions differ substantially across Groundwater Management Area 15. Groundwater production is generally greater in the northeastern portions of GMA 15 in Colorado, Wharton, Matagorda, and Jackson counties. Groundwater in the northeastern portion of GMA 15 is predominately used for irrigation purposes. Groundwater production in the central portion of GMA 15 in Victoria County is predominately used for irrigation, municipal, and industrial uses. Groundwater production in the north central portion of GMA 15 in DeWitt County and Karnes County is predominately used for domestic and livestock purposes as well as supporting oil and gas production in the Eagle Ford Shale. Groundwater production in the southwestern portions of GMA 15 is predominately used for domestic, livestock, and agricultural uses. The condition of the Gulf Coast Aquifer differs significantly geographically. Generally, the capacity of the Gulf Coast Aquifer to produce groundwater increases to the northeast and decreases to the southwest as well as increase down dip relative to up dip portions of the Gulf Coast Aquifer."

The differences in the groundwater pumped by the counties were discussed in the April 2014 meeting. A planning sheet, provided in **Appendix F**, was distributed to each district that contained the following information for each county:

- TWDB pumping estimates from 2000 to 2011
- Decadal values for current MAGs
- Decadal summary of the 2012 State Water Plan for groundwater supplies, water demands and groundwater supply strategies
- Decadal summary of the 2017 State Water Plan Water Demands

- Total Estimated Recoverable Storage

Table 5-1 summarizes the average and median groundwater pumping from 2000 to 2011 based on the TWDB groundwater database. The average county pumping in the Gulf Coast Aquifer ranges from a low of 483 AFY in Aransas County to a high of 127,475 AFY in Wharton County. Over 80% of the pumping in the 14 counties occurs in four northeast counties: Wharton, Matagorda, Colorado, and Jackson counties. Pumping in these four counties is dominated by irrigation.

Table 5-1 Average groundwater pumping (AFY) from 2000 to 2011 for counties in GMA 15 based on TWDB historical groundwater pumping

County	Aquifer	Average	Median	Minimum	Maximum
Aransas	Gulf Coast Aquifer	483	483	425	589
	Other Aquifer	18	11	1	55
	Unknown	4	3	0	10
	Subtotal	**505**	**497**	**426**	**655**
Bee	Edwards-BFZ Aquifer	105	91	78	178
	Gulf Coast Aquifer	6,568	5,988	5,545	8,916
	Other Aquifer	279	263	157	491
	Unknown	206	205	195	218
	Subtotal	**7,159**	**6,547**	**5,975**	**9,803**
Calhoun	Gulf Coast Aquifer	1,000	618	489	1,854
	Other Aquifer	21	14	0	54
	Unknown	13	14	2	23
	Subtotal	**1,034**	**646**	**491**	**1,932**
Colorado	Gulf Coast Aquifer	30,476	26,925	20,397	54,843
	Other Aquifer	742	742	168	1,315
	Trinity Aquifer*	468	0	0	3,311
	Unknown	196	0	0	725
	Subtotal	**31,882**	**27,667**	**20,565**	**60,194**
DeWitt	Gulf Coast Aquifer	4,821	4,776	3,889	6,188
	Other Aquifer	42	42	4	97
	Unknown	595	265	43	1,808
	Subtotal	**5,458**	**5,083**	**3,936**	**8,093**
Fayette	Carrizo-Wilcox Aquifer	19	14	2	44
	Gulf Coast Aquifer	3,082	3,306	1,493	3,911
	Other Aquifer	196	117	77	573
	Queen City Aquifer	5	1	0	14
	Sparta Aquifer	220	138	94	758
	Unknown	34	29	20	57
	Yegua-Jackson Aquifer	236	111	61	1150
	Subtotal	**3,792**	**3,715**	**1,747**	**6,506**

County	Aquifer	Average	Median	Minimum	Maximum
Goliad	Gulf Coast Aquifer	3,395	3,878	1,093	5,272
	Unknown	40	42	30	46
	Subtotal	**3,435**	**3,920**	**1,123**	**5,318**
Jackson	Gulf Coast Aquifer	46,373	44,056	36,064	90,186
	Other Aquifer	624	682	6	1,184
	Unknown	40	43	31	43
	Subtotal	**47,037**	**44,781**	**36,101**	**9,1413**
Karnes	Carrizo-Wilcox Aquifer	167	153	98	276
	Gulf Coast Aquifer	3,457	3,405	2,638	4,408
	Unknown	690	218	0	2,326
	Yegua-Jackson Aquifer	267	326	48	487
	Subtotal	**4,581**	**4,101**	**2,785**	**7,497**
Lavaca	Gulf Coast Aquifer	9,219	8,573	6,993	13,683
	Other Aquifer	999	999	676	1,322
	Unknown	74	54	54	133
	Yegua-Jackson Aquifer	7	7	6	8
	Subtotal	**10,298**	**9,633**	**7,729**	**15,146**
Matagorda	Gulf Coast Aquifer	34,945	32,418	21,060	55,044
	Other Aquifer	380	25	14	2,171
	Unknown	45	43	38	55
	Subtotal	**35,369**	**32,486**	**21,112**	**57,270**
Refugio	Gulf Coast Aquifer	2,269	2,077	1,625	3,930
	Unknown	47	48	30	62
	Subtotal	**2,316**	**2,124**	**1,655**	**3,992**
Victoria	Gulf Coast Aquifer	13,900	11,253	6,430	32,864
	Unknown	40	42	32	45
	Subtotal	**13,941**	**11,295**	**6,462**	**32,909**
Wharton	Gulf Coast Aquifer	127,475	13,0978	87,380	185,772
	Other Aquifer	1,976	1,976	1,909	2,042
	Unknown	51	55	38	56
	Subtotal	**129,501**	**133,008**	**89,327**	**187,871**

*Note: there no pumping from the Trinity Aquifer in Colorado. There values are incorrectly stated in the TWDB historical pumping database

The spatial distribution of the pumping across the counties and among the Chicot Aquifer, Evangeline Aquifer, Burkeville Confining Unit, and Jasper aquifer is provided in **Appendix G**. **Appendix H** illustrates the spatial distribution of pumping by county used to establish the DFC and MAG during the 2010 joint planning. The figures in Appendices G and H show the total pumping across a grid cell. Each grid cell covers one square mile. To help facilitate comparison of pumping among counties and among the four hydrogeological units, the pumping rate per grid cell is color-coded using the same scale for all figures. The scale consists of the following seven intervals:

1. no pumping;
2. < 10 AFY;
3. 10 to 30 AFY;
4. 30 to 100 AFY;
5. 100 to 300 AFY;
6. 300 to 1,000 AFY; and
7. > 1,000 AFY.

The information in Appendices G and H was first presented in the April 2014 GMA 15 meeting and discussed during several later GMA 15 meetings. Based on considerations of information in Section 5.1, GMA 15 anticipates that the adoption of the DFCs will not impact the aquifer use and conditions within GMA 15 significantly during the planning horizon and would 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.

5.2 Water Supply Needs and Water Management Strategies

Texas Water Code Section 36.108 (d)(2) directs districts to consider, during the joint-planning process, the water supply needs and water management strategies included in the state water plan. GMA 15 comprises an area spanning Regional Water Planning Areas K, L, N, and P. District representatives from GMA 15 attended the planning meetings for Regions K, L, N, and P. During the planning period, the representatives provided reports to the GMA 15 regarding the activities of the planning groups. In addition to considering the regional planning reports, the district representatives considered water supply needs and recommended water management strategies included in 2012 State Water Plan and the 2017 State Water Planned Water Demands, which are contained in Appendix F.

The overall water needs for a region, as defined within the Texas State Water Plan, are the demands (based on water demand projections developed during the water planning process for six major water use sectors) that cannot be met with existing supplies. These existing supplies may be inadequate to satisfy demands due to natural conditions (e.g., instance, sustainable supply of an aquifer or firm yield of a reservoir) or infrastructure limitations (e.g., inadequate diversion, treatment, or transmission capacity). A review of the future water management strategies within a region gives some insight into the potential future supply for meeting an identified need. Therefore, future groundwater management strategies identified in the 2012 Texas State Water Plan indicate the potential future demand for groundwater in addition to currently utilized supplies. **Table 5-2** provides 2012 State Water Planning Values for 2060 for GMA 15 Counties. The summation of Gulf Coast groundwater strategies for the 14 counties is 142,654 AFY. Over 90% of these strategies are associated with Wharton, Matagorda, Jackson, and Colorado counties. These large numbers indicate a potential future demand for groundwater in these four counties, in addition to currently utilized supplies.

Based on a review of the a summary of the water supply needs and water management strategies of the 2012 Texas State Water Plan, GMA 15 determined that the proposed DFCs are not anticipated to have a significant impact on the water supplies, water supply needs, or water management strategies of the 2012 Texas State Water Plan during the planning horizon and would 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.

Table 5-2 2012 State Water Planning values for 2060 for GMA 15 counties in addition to 2010 MAG values

County	MAG	2012 State Water Plan Amounts for 2060 (AFY)			
		Groundwater Supplies	Water* Demands	Water* Supply Need (-) Surplus (+)	Gulf Coast Strategy
Aransas	1,862	579	4,335	-1,579	200
Bee (GMA 15)	10,660	7,121	11,578	-890	11,016
Calhoun	2,995	2,345	86,370	8,206	0
Colorado	48,953	38,508	188,786	-7,357	15,519
Dewitt	14,616	10,335	4,907	6,394	0
Fayette	18,917	11,742	79,542	-25,054	632
Goliad	11,699	4,566	19,224	6,728	0
Jackson	76,386	57,728	63,531	-3,971	5,053
Karnes (GMA 15)	3,116	5,269	6,167	536	161
Lavaca	20,373	14,445	13,550	895	0
Matagorda	45,896	36,302	319,162	-137,320	29,566
Refugio	29,328	2,952	2,002	1,262	0
Victoria	35,694	30,941	126,617	-65,275	0
Wharton	178,493	171,310	297,503	-60,550	80,507
Total	**498,988**	**394,143**	**122,3274**	**-277,975**	**142,654**

*water demands and water supply includes both groundwater and surfwater demands and supplies

5.3 Hydrological Conditions

Texas Water Code Section 36.108 (d)(3) requires that all GCDs, during the joint-planning process, consider hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage (TERS) as provided by the TWDB executive administrator, and the average annual recharge, inflows, and discharge. As part of the joint-planning process, district representatives in GMA 15 reviewed and considered estimates of TERS, inflows, outflows, recharge, and discharge for all relevant aquifers based on results from the most recently adopted GAMs and technical assessments from the TWDB.

5.3.1 Total Estimated Recoverable Storage (TERS)

The Texas Administrative Code Rule §356.10 (Texas Administrative Code, 2011) defines the TERS 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. TERS 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 differentiate between different water quality types.

Wade and Anaya (2014) calculate TERS for the portion of the aquifers within GMA 15 that lies within the official lateral aquifer boundaries as delineated by George and others (2011). **Appendix I** presents the report by Wade and Anaya (2014) in its entirety. **Table 5-3** and **Figure 5-1** present the TERS values calculated for portions Gulf Coast Aquifer in 14 counties of interest. The TERS 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.

Table 5-3 Total Estimated Recoverable Storage by County for the Gulf Coast Aquifer Provided by Wade and Anaya (2014).

County	25% of Total Storage	75% of Total Storage
Aransas	1,375,000	4,125,000
Bee	3,000,000	9,000,000
Calhoun	4,250,000	12,750,000
Colorado	7,000,000	21,000,000
DeWitt	5,550,000	16,650,000
Fayette	5,860,000	17,580,000
Goliad	6,500,000	19,500,000
Jackson	11,250,000	33,750,000
Karnes	12,397,500	37,192,500
Lavaca	8,080,000	24,240,000
Matagorda	12,000,000	36,000,000
Refugio	5,750,000	17,250,000
Victoria	9,750,000	29,250,000
Wharton	18,000,000	54,000,000

During the GMA 15 April 2015 meeting, INTERA provided a summary of the TERS values per county in the Groundwater Planning Datasheets (Appendix I) and explained the assumptions and methods used to calculate TERS. Several example calculations were demonstrated for the district members. **Appendix J** provides the INTERA entire presentation as provided in April 2015.

5.3.2 Groundwater Water Budgets and Issues of Pumping Sustainability

During the GMA 15 April 2015 meeting, INTERA presented historical water budgets by county for the years 1981, 1990, and 1999 (see Appendix J). The important concepts of aquifer dynamics and their role in determining groundwater availability were explained. In addition, the inflow and outflow water budget were discussed in terms of factors important to establishing sustainable groundwater pumping rates. A modeling example from GMA 15 was presented to illustrate that a major consideration when estimating sustainable pumping rates is how accurately the GAM predicts/represents the processes responsible for captured groundwater flow by pumping. Among the important points regarding the groundwater water budgets and sustainability is tracking the shape of the curve showing average-drawdown changes over time and the curve of storage depletion over time.

The key water budget concepts discussed the April 2015 GMA 15 meeting were reiterated at several other meetings and at all meetings where water budget results were discussed. **Figure 5-2** provides example water budgets for Matagorda and Refugio counties that are in Appendix J and associated with Baseline Option 1. The water budgets have been developed with sufficient detail to understand the exchange of groundwater flow between counties, between aquifers, and between surface water and groundwater. **Figure 5-3** shows plots of average drawdown over time from 2000 to 2070 for Matagorda and Refugio counties that are in Appendix J and are associated with Baseline Option 1. The drawdown curves have sufficient resolution so that annual changes can be visually tracked and evaluated to determine whether or not the pumping rate is sustainable. **Figure 5-4** is a plot of water levels in the Chicot Aquifer in 2070 predicted by the Baseline Option 1 pumping scenario and is included in Appendix J. The contours of the water levels are in sufficient detail so that the general groundwater flow direction can be deduced within and between counties.

5.3.3 Overall Assessment

Based on a review of the TERS and simulated water budgets associated with the Baseline (Option 1) model run, the adoption of the DFCs of GMA 15 are not anticipated to impact the hydrological conditions within GMA 15 significantly during the planning horizon and would 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.

5.4 Environmental Factors

Texas Water Code §36.108 (d)(4) requires that districts, during the joint-planning process, consider environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water. The primary environmental factor of interest in GMA 15 is whether or not groundwater pumping has an adverse impact on baseflows in rivers and streams. During the first, as well as this joint planning session, GMA 15 members have been concerned that the CGC GAM provides inaccurate estimates of groundwater-surface water exchange. These concerns are based on comparison with simulations of GW-SW interactions simulated by the Lower Colorado River Basin (LCRB) model (Young and others, 2010) and the inability of the CGC GAM to reasonably predict river baseflow (Chowdhury and others, 2004). A consensus among GMA 15 members is that the CGC GAM underestimates the contribution of groundwater to stream baseflow during pre-development conditions and overestimates the capture of stream baseflow for pumping conditions. The poor performance of the CGC GAM (see **Figure 4-4**) is believed to be caused by improper and excessively large numerical grid cells around the rivers and near the ground surface, which prevents a proper numerical representation of a shallow groundwater system.

The inability of the CGC GAM to predict GW-SW interactions adequately was discussed in several meetings and include discussions of the following topics: 1) the possible use of the LCRB model in conjunction with the CGC GAM; 2) the update of the CGC GAM by the TWDB; 3) uncertainty and error associated with the CGC GAM predictions; and 4) the concerns expressed by the Goliad County GCD dated August 19, 2015 to Dr. Steve Young (**Appendix L**). With regard to the problems with the CGC GAM with accurately predicting GW-SW interaction, the Goliad County GCD states in their August 19, 2015 letter to Dr. Young:

> "GCGCD has expressed a great interest in working with TWDB in developing the updated model of the Gulf Coast Aquifer for the Central Gulf Coast. In addition to the question of recharge, GCGCD is concerned that the modeled water budget shows a significant inflow

of streams to the Evangeline and Chicot Aquifers. The USGS gain-loss studies of the Lower San Antonio River Basin and the Coleto Creek Watershed shows in both studies a surface water gain from the Aquifer. This discrepancy needs extensive further evaluation."

In addition, during the joint planning process, GCGCD included the following response to one of the survey questions:

"Spring flow has declined in Goliad County for many years and continued drawdown of the aquifer will result in a further decline in spring flow."

The general consensus of GMA 15 is that the CGC GAM may not be a reliable predictor of GW-SW interaction for some pumping scenarios. As a result, the flow rates associated with GW-SW interactions in the calculated water budgets in Appendices C & K are considered by some GMA 15 districts as unreliable. In assessing the potential environmental impacts of pumping on GW-SW interaction, each district reviewed other information besides the results predicted by the CGC GAM. Such information included gain-loss studies performed on streams and results from other groundwater models and surface water models. Based on the collective analyses of the districts regarding GW-SW interaction, GMA 15 anticipates that the pumping rates associated with the Baseline (Option 1) will not impact environmental conditions significantly during the planning horizon and would 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.

5.5 Subsidence

Texas Water Code Section 36.108 (d)(5) requires that districts, during the joint-planning process, consider the impacts of proposed DFCs on subsidence. Along the Texas Gulf Coast Aquifer, land subsidence is a potentially important issue associated with the management of groundwater. In Harris County, the pumping of groundwater has caused the land surface to subside more than three feet across most of the county and more than nine feet across the southeast part of the county. To help prevent land subsidence in the Gulf Coast, the Houston-Galveston Subsidence District was created in 1975, and the Fort Bend Subsidence District was created in 1989. Groundwater level decline, subsidence, and faulting are inter-related in the Gulf Coast Aquifer system, all having the potential for an adverse economic impact (Campbell and others, 2013). Jones and Larson (1975) estimated the cost associated with land subsidence in an approximately 900 square mile area, including the small portion of Harris County and some shoreline in Galveston County, to be about $32 million (about $150 million in 2015 terms) annually.

Land subsidence was discussed at several GMA 15 meetings, including April 10, 2015; July 15, 2015; December 9, 2015; and April 29, 2016. In July 15, 2015 (**Appendix M**) INTERA presented results from an ongoing study on land subsidence in GMA 15 funded by districts in GMA 15. **Figure 5-5** (from Appendix M) was discussed to demonstrate that land subsidence has occurred in GMA 15 and will likely continue occurring in the near future. During the discussion, four districts were identified as being interested in setting a DFC for land subsidence. Among the obstacles for setting a DFC for land subsidence is demonstrating compliance because of the inability of the districts to measure subsidence.

On April 29, 2016, INTERA provided a summary of an investigation into modeling and measuring land subsidence in the Texas central Gulf Coast. The presentation is provided in **Appendix N**. During the discussion, INTERA presented a paragraph of the study's Executive Summary that concisely summarizes the estimated historical land subsidence in GMA 15. This paragraph from Young (2016) is reproduced below:

> "The report presents ground surface elevation data from National Geodectic Survey (NGS) benchmarks called Permanent Identifiers (PIDs), old topographic maps, and LIght and raDAR (LIDAR) data from seven counties in GMA 15. The PID data provide ground surface elevations at 1,700 point locations prior to 1950. The topographic maps cover approximately 2,150 square miles and were constructed between 1950 and 1960. To extract point location data from the topographic maps, the maps were digitized and converted to Geographic Information System (GIS) files. The LIDAR data cover approximately 2,500 square miles and were collected after 2006. The joint analysis of these three data sets support the following conclusions:
>
> - The LIDAR and PID data indicate that DeWitt, Jackson, Matagorda, Refugio, Victoria, and Wharton counties have experienced at least 2 ft of land subsidence, and Calhoun County has experienced at least 1.5 ft of land subsidence.
> - The LIDAR and topographic map data indicate that Calhoun, DeWitt, Jackson, Matagorda, Refugio, Victoria, and Wharton counties have experienced at least 2 ft of land subsidence since 1950.
> - An analysis of the PID data, topographic map data, and LIDAR data indicates that more than two feet of average subsidence has occurred across about 100 square miles covering southwest Wharton, southeast Jackson, and northwest Matagorda counties."

During the GMA 15 discussion on April 29, 2016 INTERA presented an approach for performing scoping calculations of land subsidence based on simulated drawdowns from a groundwater model. The approach was demonstrated for the 14 locations shown in **Figure 5-6**. **Table 5-4** presents the calculated land subsidence at the 14 locations based on water levels predicted by the CGC GAM in 1999 and by the DFC GAM Run based on the Baseline Option 1 pumping file. Over the 70-year period, the anticipated increase in land subsidence at the 14 locations ranges between 0.1 and 1.2 feet. INTERA emphasizes that the values in **Table 5-4** have several major assumptions that should to be investigated and vetted fully prior to acting on any predicted land subsidence.

For this joint-planning session, no district proposed a DFC for land subsidence, but several districts are interested in establishing monitoring systems to measure land subsidence and for continuing further research into improving GMA 15's ability to predict land subsidence. As information becomes available, several GCDs may adjust their management plans and groundwater rules to prevent land subsidence, until which time the conditions are appropriate to propose DFCs for land subsidence.

Table 5-4 Prediction of land subsidence at fourteen sites in GMA 15 for the years 2000 and 2070 using drawdown simulated by the Central Gulf Coast GAM (Chowdhury and others, 2004) and clay thickness data from Young and others (2010; 2012)

ID	County	Drawdown (ft)								Clay Thickness (ft)				Land Subsidence (ft)	
		Chicot		Evangeline		Burkeville		Jasper		Chicot	Evangeline	Burkeville	Jasper	1940-2000	1940-2070
		1940-2000	1940-2070	1940-2000	1940-2070	1940-2000	1940-2070	1940-2000	1940-2070						
1	Calhoun	7.4	3.4	12.4	18.9	-	-	-	-	226	1299	418	925	0.4	0.5
2	Calhoun	-0.8	2.2	22.9	40.6	-	-	-	-	369	1442	407	1377	0.7	1.2
3	Dewitt	-	-	0.8	1.0	3.4	9.8	7.9	24.1	-	349	318	516	0.1	0.3
4	Dewitt	-	-	9.5	15.6	51.7	73.0	142.3	185.2	-	116	331	537	1.9	2.5
5	Jackson	18.7	55.7	64.7	88.1	39.2	56.3	22.0	45.4	139	683	224	618	1.4	2.2
6	Jackson	12.1	32.4	55.9	78.4	33.0	52.6	-	-	360	1096	339	966	1.5	2.3
7	Matagorda	-1.7	1.2	39.4	57.4	-	-	-	-	482	1569	652	1220	1.2	1.8
8	Matagorda	2.1	0.8	37.9	49.0	13.1	27.0	-	-	203	1264	415	1400	1.1	1.5
9	Refugio	5.2	1.8	3.4	10.1	-0.1	3.9	-	-	128	835	270	722	0.1	0.2
10	Refugio	0.3	1.2	4.1	15.5	-	-	-	-	264	1141	264	726	0.1	0.4
11	Victoria	5.0	8.0	13.2	40.1	1.7	6.4	-	-	207	757	225	550	0.2	0.7
12	Victoria	27.0	34.9	45.3	52.5	38.0	43.9	26.2	33.0	108	605	190	785	1.2	1.4
13	Wharton	75.4	94.1	156.7	149.8	61.9	90.2	27.9	59.9	84	780	266	610	3.2	3.7
14	Wharton	8.7	27.5	57.4	91.0	44.5	80.9	38.2	72.2	78	599	287	842	1.6	2.8

5.6 Socioeconomics

Texas Water Code Section 36.108 (d)(6) requires that GCDs consider socioeconomic impacts reasonably expected to occur as a result of the proposed DFCs for relevant aquifers as part of the joint-planning process. There is a lack of information available to GCDs regarding socioeconomic impacts that would be considered relevant to the joint-planning process. However, Texas statute requires that regional water plans include a quantitative description of the socioeconomic impacts of not meeting the identified water needs. Historically, this analysis has been performed for regional water planning groups by the TWDB. As a result, this section will rely heavily on the TWDB analyses for planning regions within GMA 15. In addition, GMA 15 Representatives participated in a questionnaire that covered several topics, including potential socioeconomic impacts of the proposed DFC. In addition to a short review of the TWDB regional planning socioeconomic impact analysis, this section will end with a qualitative discussion of socioeconomic impacts of the proposed DFCs based upon the questionnaire and discussion in public meetings held by GMA 15.

5.6.1 Regional Planning Assessment of Socioeconomic Impact

Consideration of socioeconomic impacts as part of water planning in Texas has been a fundamental element of the planning process dating back to the 1990s. Texas Water Code Section 16.051 (a) states that the TWDB "shall prepare, develop, formulate, and adopt a comprehensive state water plan that...

shall provide for... further economic development." Title 31 of the Texas Administrative Code, Section 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." The socioeconomic analysis provided by the TWDB to support planning groups provides the only available consistent analysis of socioeconomic impacts of unmet water needs available for the state and as such is a valuable analysis for joint planning.

Socioeconomic analysis of unmet water needs is performed by the TWDB at the request of the individual regional water planning groups and is based on water supply needs from the regional water plans. A general description of the methodology and approach is reproduced below from "Socioeconomic Impacts of Projected Water Shortages for the Region P Regional Water Planning Group" (Ellis, Cho and Kluge, 2015a).

> "The analysis was performed using an economic modeling software package, IMPLAN (Impact for Planning Analysis), as well as other economic analysis techniques, and represents a snapshot of socioeconomic impacts that may occur during a single year during a drought of record within each of the planning decades. For each water use category, the evaluation focused on estimating income losses and job losses. The income losses represent an approximation of gross domestic product (GDP) that would be foregone if water needs are not met.
>
> The analysis also provides estimates of financial transfer impacts, which include tax losses (state, local, and utility tax collections); water trucking costs; and utility revenue losses. In addition, social impacts were estimated, encompassing lost consumer surplus (a welfare economics measure of consumer wellbeing); as well as population and school enrollment losses."

At the beginning of this round of joint-planning, GMA 15 Representatives only had access to the 2011 Regional Water Plan socioeconomic analyses (Norvell and Shaw, 2010a, 2010b, 2010c and 2010d). INTERA sent these technical reports to GMA 15 for circulation among district representatives on October 13, 2015. Since that time, the 2016 Regional Water Plans have been approved with updated socioeconomic analyses (Ellis, Cho and Kluge, 2015a, 2015b, 2015c and 2015d). Results presented in this section are taken from the 2016 Regional Water Plans, and all impact estimates are in 2013 dollars.

The socioeconomic impact analysis provided by the TWDB to Region K, Region L, Region N and Region P regional water planning groups for the 2016 regional water plans informed the district representatives' considerations of socioeconomic impacts reasonably expected to occur as a result of the proposed DFCs for relevant aquifers in GMA 15. These technical memoranda are included in their entirety as **Appendix O**, **Appendix P, Appendix Q** and **Appendix R**, respectively. To illustrate the impacts of not meeting water supply needs, examples for specific water user groups for each of the four regional water planning areas (K, L, N and O) along with regional summaries for Region L were presented to GMA 15 Representatives. These details are provided in **Appendix S**, which provides INTERA's presentation made to the GMA 15 Representatives on April 29, 2016.

A consistent method of evaluating losses across regions is to review regional social impacts calculated by the TWDB in their analysis. **Table 5-5** provides a summary of the consumer surplus losses, population losses and school enrollment losses from not meeting water supply needs for Region L in GMA 15. Region

L is presented because impacts to Region L are most significant. One can review all sector impacts as well as social impacts for all regions through review of **Appendices O through R**.

Table 5-5 Region-wide Social Impacts of Water Shortages in Region L (from Ellis, Cho and Kluge, 2015b).

Impact Measures	2020	2030	2040	2050	2060	2070
Consumer surplus losses ($ millions)	$29	$58	$108	$171	$264	$403
Population losses	3,356	3,821	4,324	4,693	5,591	9,199
School enrollment losses	621	707	800	868	1,034	1,702

* Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000

The total economic impacts are significant, with Region L experiencing $1.99 billion in income losses and almost 18,300 job losses in 2020 if no water management strategies are implemented to meet projected shortages. Region K could suffer income losses of $1.557 billion in 2020 and a loss of 9,877 jobs. Region P income losses could be $9 million in 2020, with job losses estimated at 279. In Region N, income losses could be $4.49 billion in 2020, with job losses estimated at 24,000.

5.6.2 Other Considerations of Socioeconomic Impacts

While the information on socioeconomic impacts of not meeting water supply needs as quantified in the adopted 2016 regional water plans is useful for GMA 15 Representatives to consider, the factor to consider in joint-planning is what socioeconomic impacts result from the DFCs.

The challenge in joint-planning relative to regional planning is that no standardized local or regional socioeconomics analytical tool has been developed to support joint-planning. Also, the nature of socioeconomic impacts from proposed DFCs is unique from one GCD to another within a common GMA in that two or more GCDs may share a common DFC, but the method adopted by the individual GCD to achieve the DFC through local regulatory plans will inevitably result in differences in socioeconomic impacts.

Instead, GMA 15 - Representatives, through public meetings and through a questionnaire process, had discussions of qualitative socioeconomic impacts that may result from proposed DFCs. These impacts were both positive and negative, depending on the timing of the consideration. A summary of the results of the GMA 15 discussion and the results from the questionnaire can be found in INTERA's July 15, 2015 GMA 15 presentation provided in **Appendix M** of this report.

Among the concerns expressed by the GCD is the economic impact of water level drawdown. Lower water levels in a well can cause types of costs: deeper well cost and pumping cost. In GMA 15, Goliad County GCD performed a preliminary cost impact analysis, which is provided in **Appendix T**. When an existing water source is no longer productive a replacement well is required or in the case of a new location, the well will need to be drilled deeper. In Goliad County, the depth between productive sands varies from 50-100 feet in most areas. A budget price for a new well, drilled well only, is $6500. Adding 75 feet to the depth adds $1500 to the cost. Goliad County GCD estimates that for each drop of 10 feet of water level to wells that pump a cumulative total of 7000 acre feet per year, the additional annual pumping cost is approximately $1,000,000.

Based on a review of the TWDB socioeconomic impact analysis for Region K, L, N, and P and related factors, GMA 15 members do not anticipate that the adoption of the DFCs of GMA 15 will adversely impact the socioeconomics in GMA 15 during the planning horizon and would 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.

5.7 Private Property Rights

Texas Water Code Section 36.108(d)(7) requires that district representatives consider the impact of proposed DFCs 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 Section 36.002. GMA 15 recognizes that the primary vehicle in which private property rights are protected in GMA 15 is through each GCD's management plan and groundwater rules. Because the local hydrogeological conditions, environmental, and socioeconomic factors vary across GMA 15, the manner in which GCDs protect private property rights may vary among the GCDs.

GMA 15 members considered property rights when it reviewed other district groundwater management plan, participated in the GMA's survey questions regarding property rights, and it discussed recent court cases involving groundwater. The GMA 15 survey questions asked each GCD to describe the consequences related to private property rights, especially negative impacts, that may occur if the adopted DFCs did not achieve 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. During the July 2015 meeting, GMA 15 members discussed the potential consequences of too lax or too restrictive DFCs on personal property rights. In short, there are undesirable consequences that affect individual landowners if the DFCs are too lax or too restrictive. Some of the issues addressed by the district representatives are documented in INTERA's presentation (**Appendix M**) that provides GCD responses to the survey's questions regarding personal property rights. To assist GCDs with responding to public comments on the proposed DFCs, INTERA presented the information in **Appendix U** at the GMA 15 meeting on April 29, 2016. A keystone to all discussions regarding personal property rights is the Texas Water Code Section 36.002, which reads as follows:

> "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 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, but does not 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; 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.
(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.

(e)This section does not affect the ability to regulate groundwater in any manner authorized under:

1) Chapter 626, Acts of the 73rd Legislature, Regular Session, 1993, for the Edwards Aquifer Authority;
2) Chapter 8801, Special District Local Laws Code, for the Harris-Galveston Subsidence District; and
3) Chapter 8834, Special District Local Laws Code, for the Fort Bend Subsidence District."

Based on a review of the districts management plans and related factors, the majority of the GMA 15 members do not anticipate that the adoption of the DFCs of GMA 15 will impact the hydrological conditions within GMA 15 significantly affect personal property rights associated with groundwater during the planning horizon and would 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. Among the GCDs that did not embrace this position was Goliad County GCD. Goliad County GCD's position is that the adoption of the DFC could significantly impact interests and rights in private property within Goliad County.

5.8 Feasibility of Achieving the Proposed Desired Future Condition

Texas Water Code Section 36.108 (d)(8) requires that GCDs, during the joint-planning process, consider the feasibility of achieving the proposed DFC(s). This requirement was added to the joint-planning process with the passage of Senate Bill 660 by the 82nd Texas Legislature in 2011. However, this review concept actually dates back to the rules adopted by the TWDB in 2007 to provide guidance as to what the TWDB would consider during a petition process regarding the reasonableness of an adopted DFC. In these rules, the TWDB required that an adopted DFC must be physically possible from a hydrological perspective.

During the TWDB's review of multiple petitions regarding the reasonableness of adopted DFCs in GMAs from 2010 to 2011, the evaluation of whether or not an adopted DFC was physically possible was based on whether or not the DFC(s) could be reasonably simulated using the TWDB's adopted GAM for the aquifer(s) in question. This was a valid approach because if an adopted DFC was not physically possible, then, under the physical laws of hydrology as incorporated in the mathematical calculations executed during model simulations, the model would not execute the prescribed simulation successfully.

GMA 15 considers a valid evaluation of the feasibility of DFCs as whether or not the proposed DFCs are consistent with the DFCs predicted by the CGC GAM, using appropriate and reasonable environmental conditions and within the confidence limits of the CGC GAM. GMA 15 recognizes the GAMs as representing the best science for understanding the groundwater flow systems in GAM 15, while at the same time recognizing that the GAMs have been demonstrated to contain error and uncertainty. As such, GMA 15 will presume that DFCs are feasible if they can be generated by a GAM within a reasonable tolerance. GMA 15 spent several meetings discussing the potential limitations of the CGC GAM, and what reasonable tolerance limits are for CGC predictions of average drawdown values (see **Appendix M**). Among these reasons for using tolerance criteria for evaluating the feasibility of a DFC are:

- GAM Predictive Uncertainty/Error
- Unknown Errors in Stargin 1999 Water Level Conditions
- Uncertainty in Future Environmental Conditions (for instance recharge and rivers levels)
- Uncertainty in Future Pumping Rates & Locations
- Error/Uncertainty in Measurement of DFCs to Demonstrate Compliance
- Non-uniqueness of model calibration

In light of the issues above and other known limitations and possible errors in the CGC GAM, GMA 15 members agreed that DFCs would be considerable feasible, compatible and physically possible if the difference between the proposed DFCs and the DFC predicted by the CGC GAM are within 3.5 feet, except in the case of Goliad County. For this comparison, the DFCs of interest are average drawdown values from 2000 to 2070 for an aquifer in a county. Factors considered for a determining tolerance criterion of 3.5 feet include:

- Residuals and RMSE between the measured and simulated values for historical water levels produced by the CGC GAM;
- Sensitivity of the simulated drawdown to the recharge rate used in the predictive simulation and estimates of uncertainty in the magnitude and distribution of historical and predicted recharge rates;
- Sensitivity of the simulated drawdown to the hydraulic properties of the aquifer properties in the predicted simulation and observed differences between measured hydraulic aquifer properties and modeled aquifer hydraulic properties in the CGC GAM;
- Uncertainty in the temporal and spatial distribution of historical and future pumping in the GMA 15 counties; and
- The list of evidence and sources of GAM predictive uncertainty in **Appendix M**.

GMA 15 considers the proposed Goliad County DFCs to be compatible and physically possible if the difference between the proposed and predicted DFCs are within 5.0 feet. Factors considered by GMA 15 for determining the tolerance criterion of 5.0 feet have been documented by Goliad County GCD (see **Appendix L** and **Appendix V**) and include:

- an evaluation of water level change in 60 Evangeline Aquifer wells from 2003 to 2015, which indicates that the GAM underpredicts drawdown in the Evangeline Aquifer underlying Goliad County;

- an evaluation of water level change in 15 Chicot Aquifer wells from 2003 to 2015, which indicates that the GAM underpredicts drawdown in the Chicot Aquifer underlying Goliad County;
- an evaluation of gain-loss studies performed by the United States Geological Survey that indicates that the GAM overpredicts leakage from the streams in areas of pumping; and
- evidence suggesting that the GAM's average recharge rate for Goliad County is too high.

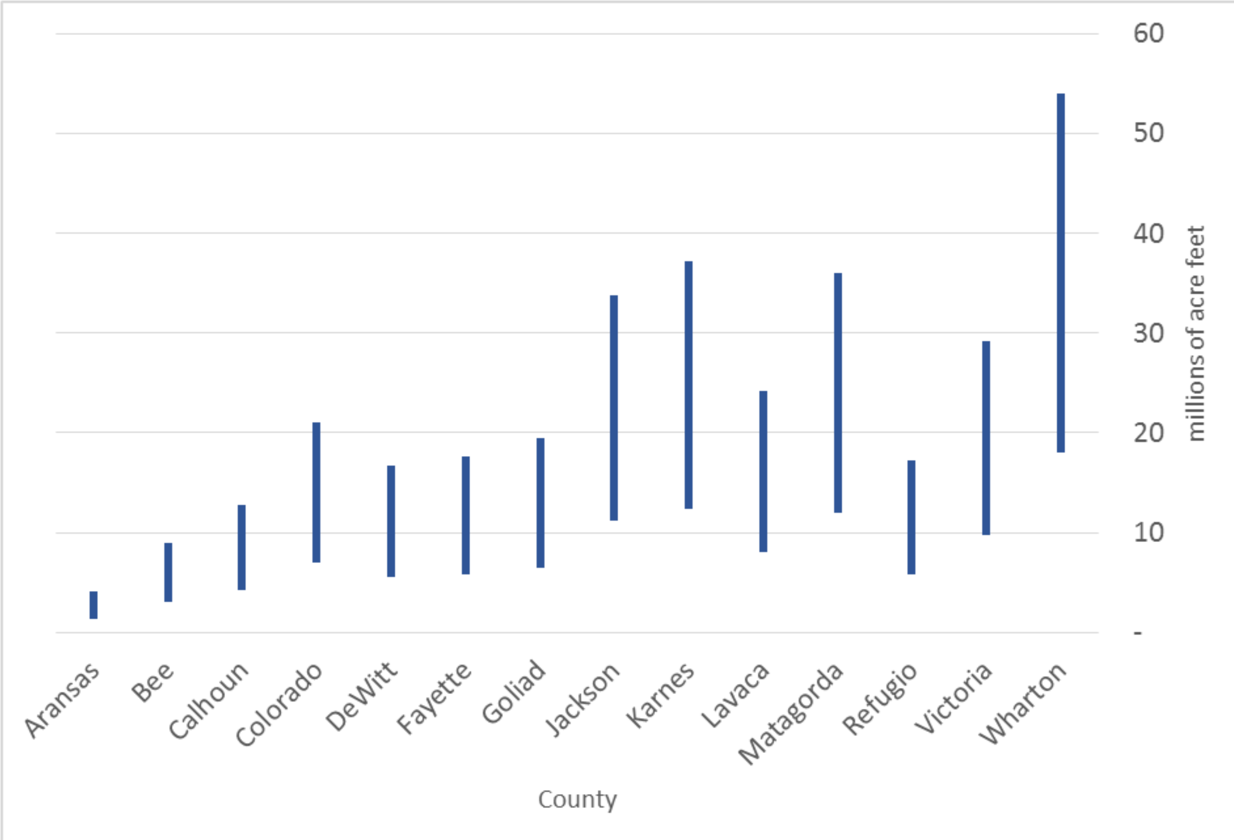
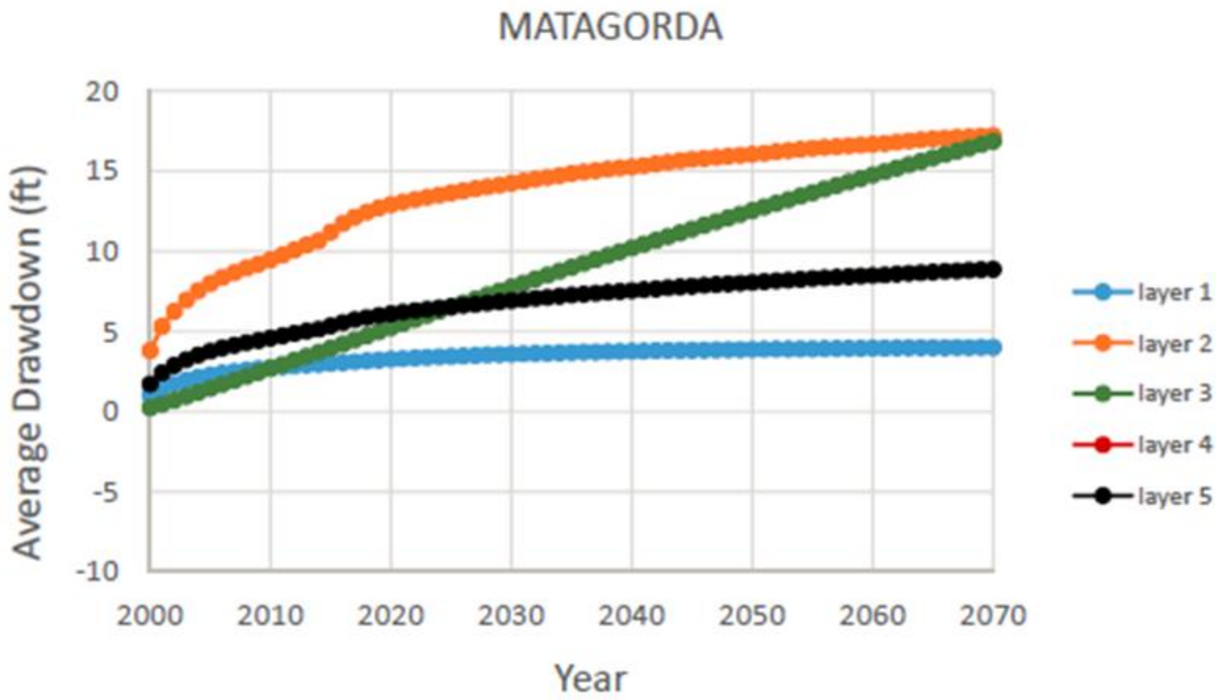


Figure 5-1 Total Estimated Recoverable Storage by County for the Gulf Coast Aquifer Provided by Wade and Anaya (2014).

Matagorda	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	792	0	0	-	792	0	0	-	792	0	0	-
Recharge	22,372	0	0	-	22,372	0	0	-	22,372	0	0	-
Net Stream Leakage	32,163	0	0	-	33,575	0	0	-	34,247	0	0	-
Net Vertical Leakage Upper	-	9,009	-	-	-	9,306	-	-	-	9,533	-	-
Net Vertical Leakage Lower	-	318	0	-	-	291	0	-	-	262	0	-
Net Lateral Flow From Brazoria	-	1,218	-	-	-	1,212	-	-	-	1,180	-	-
Net Lateral Flow From Wharton	2,288	-	3	-	1,731	-	2	-	1,466	-	-	-
Total Inflow	*57,615*	*10,545*	*3*	-	*58,470*	*10,809*	*2*	-	*58,877*	*10,975*	-	-
Outflow												
Wells	31,733	7,121	0	-	31,733	7,121	0	-	31,733	7,121	0	-
Drains	243	0	0	-	241	0	0	-	240	0	0	-
Et	3,023	0	0	-	3,011	0	0	-	3,005	0	0	-
Net Head Dep Bounds	5,277	0	0	-	5,118	0	0	-	5,053	0	0	-
Net Vertical Leakage Upper	-	-	318	-	-	-	291	-	-	-	262	-
Net Vertical Leakage Lower	9,009	-	-	-	9,306	-	-	-	9,533	-	-	-
Net Lateral Flow To Brazoria	2,791	-	6	-	2,807	-	6	-	2,819	-	6	-
Net Lateral Flow To Calhoun	57	-	-	-	56	-	-	-	56	-	-	-
Net Lateral Flow To Jackson	346	595	-	-	579	610	-	-	682	620	-	-
Net Lateral Flow To Wharton	-	2,914	-	-	-	3,122	-	-	-	3,267	-	-
Net Lateral Outflow To Other Areas	6,176	-	-	-	6,014	-	-	-	5,948	-	-	-
Total Outflow	*58,655*	*10,630*	*324*	-	*58,865*	*10,853*	*297*	-	*59,069*	*11,008*	*268*	-
Inflow - Outflow	-1,040	-85	-321	-	-395	-44	-295	-	-192	-33	-268	-
Storage Change	-1,045	-70	-321	-	-395	-38	-295	-	-191	-24	-267	-
Model Error	5	-15	0	-	0	-6	0	-	-1	-9	-1	-
Model Error (percent)	0.01%	0.14%	0.00%	-	0.00%	0.06%	0.00%	-	0.00%	0.08%	0.37%	-

Refugio	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	14,562	0	0	-	14,562	0	0	-	14,562	0	0	-
Net Vertical Leakage Lower	397	98	0	-	305	92	0	-	250	85	0	-
Net Lateral Flow From Bee	5,130	2,573	16	-	5,077	2,549	15	-	4,944	2,530	15	-
Net Lateral Flow From Goliad	3,118	2,809	12	-	3,101	2,806	12	-	3,098	2,807	12	-
Net Lateral Flow From Victoria	223	-	-	-	166	-	-	-	163	-	-	-
Total Inflow	*23,430*	*5,480*	*28*	-	*23,211*	*5,447*	*27*	-	*23,017*	*5,422*	*27*	-
Outflow												
Wells	3,226	2,624	0	-	3,226	2,624	0	-	3,226	2,624	0	-
Drains	111	0	0	-	110	0	0	-	110	0	0	-
Et	1,846	0	0	-	1,843	0	0	-	1,842	0	0	-
Head Dep Bounds	4,905	0	0	-	4,888	0	0	-	4,882	0	0	-
Net Stream Leakage	4,419	0	0	-	3,985	0	0	-	3,707	0	0	-
Net Vertical Leakage Upper	-	397	98	-	-	305	92	-	-	250	85	-
Net Lateral Flow To Aransas	2,195	34	-	-	2,193	33	-	-	2,193	33	-	-
Net Lateral Flow To Calhoun	489	108	-	-	494	115	-	-	497	122	-	-
Net Lateral Flow To San Patricio	2,883	789	3	-	3,026	809	3	-	3,108	820	4	-
Net Lateral Flow To Victoria	-	1,520	-	-	-	1,540	-	-	-	1,551	-	-
Net Lateral Outflow To Other Areas	3,477	24	-	-	3,473	25	-	-	3,472	24	-	-
Total Outflow	*23,551*	*5,496*	*101*	-	*23,238*	*5,451*	*95*	-	*23,037*	*5,424*	*89*	-
Inflow - Outflow	-121	-16	-73	-	-27	-4	-68	-	-20	-2	-62	-
Storage Change	-123	-20	-73	-	-30	-4	-68	-	-21	-4	-62	-
Model Error	2	4	0	-	3	0	0	-	1	2	0	-
Model Error (percent)	0.01%	0.07%	0.00%	-	0.01%	0.00%	0.00%	-	0.00%	0.04%	0.00%	-

Figure 5-2 Water budgets calculated for Matagorda and Refugio counties from GMA 15 Baseline Option 1 DFC model simulation



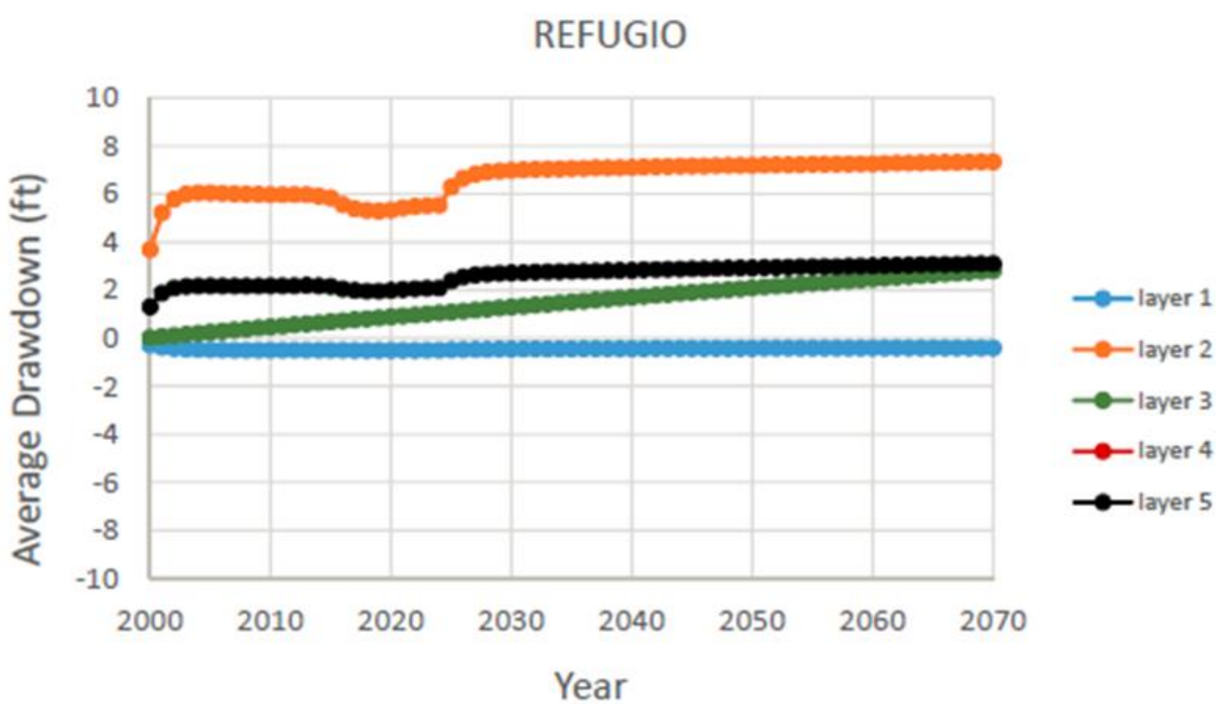


Figure 5-3 Average drawdown curves from 2000 to 2070 calculated for Matagorda and Refugio counties from GMA 15 Baseline Option 1 DFC model simulation (model layer 1 represents the Chicot Aquifer, layer 2 the Evangeline Aquifer, layer 3 the Burkeville confining unit, and layer 4 the Jasper Aquifer)

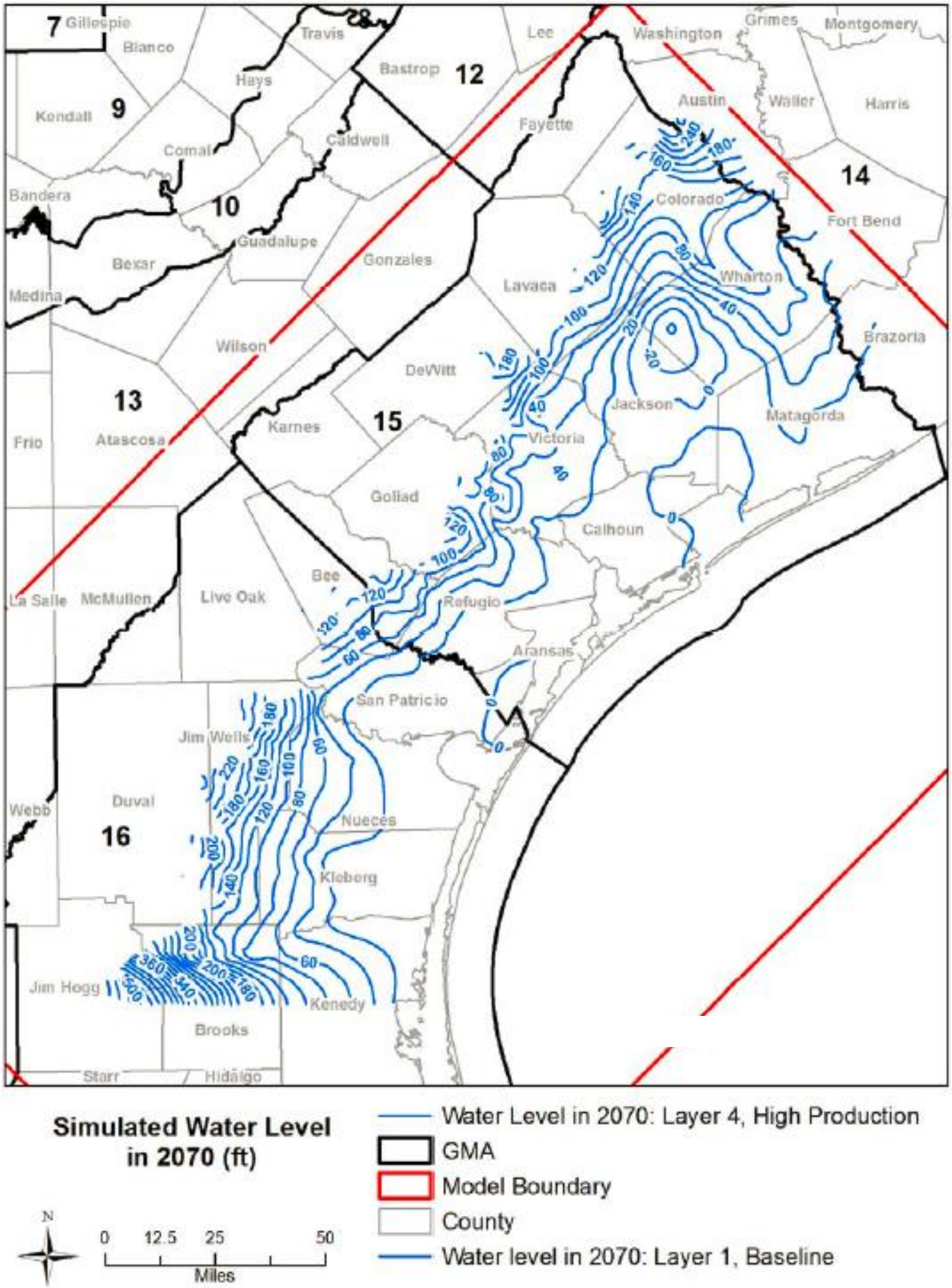


Figure 5-4 Contours of 2070 water levels for the Chicot Aquifer for from GMA 15 Baseline Option 1 DFC model simulation

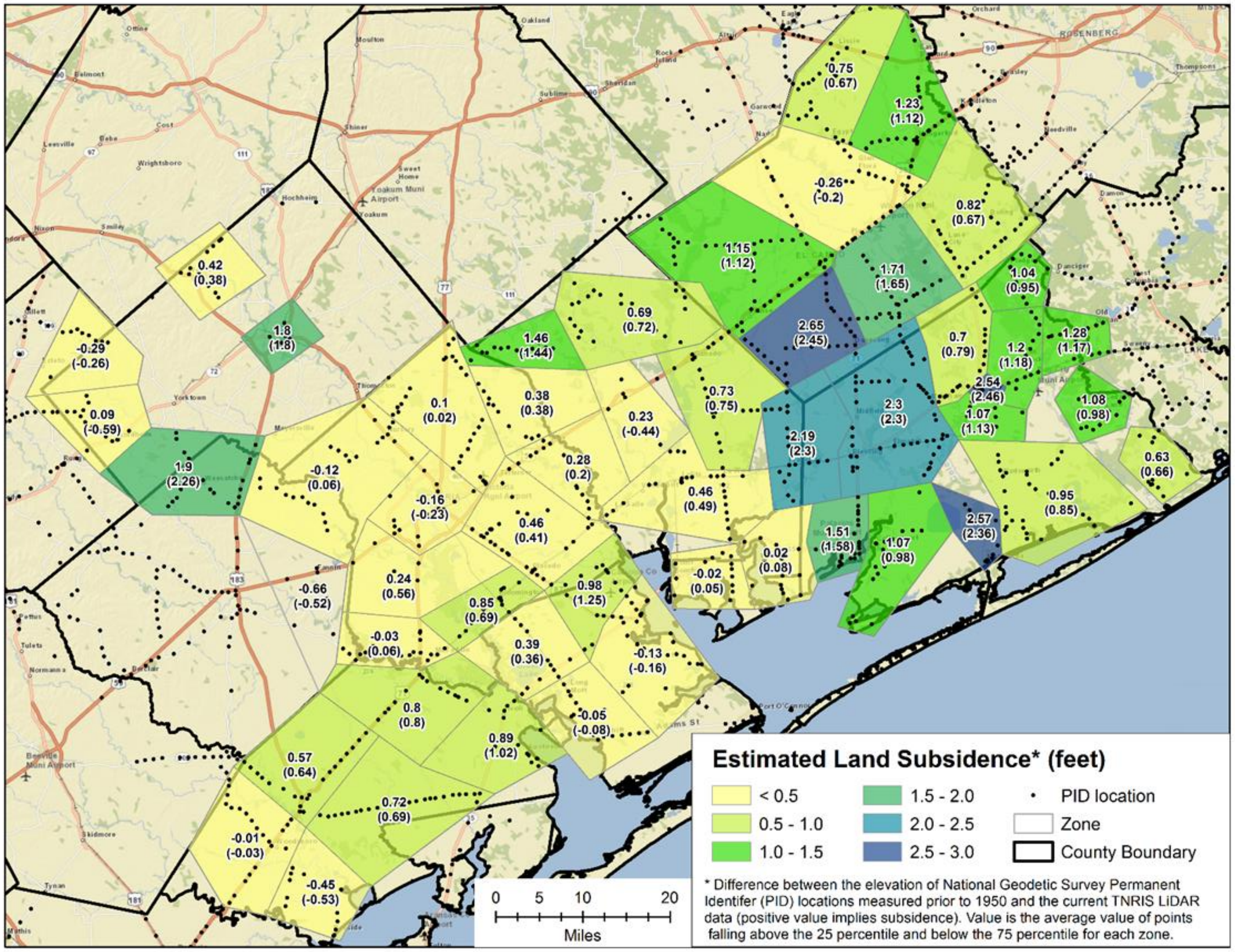


Figure 5-5 Estimated average land subsidence from before 1950 to after 2003 for specific polygons as determined by the difference between ground surface elevation from PIDs surveyed prior to 1950 and from LIDAR surveys after 2006 at the locations of the PIDs. Land Subsidence values are expressed as averages and medians (in parenthesis) of the differences calculated at PIDS located inside the polygons. Positive values indicate lower ground surface elevation at later time. Negative values indicate higher ground surface elevation at later time.

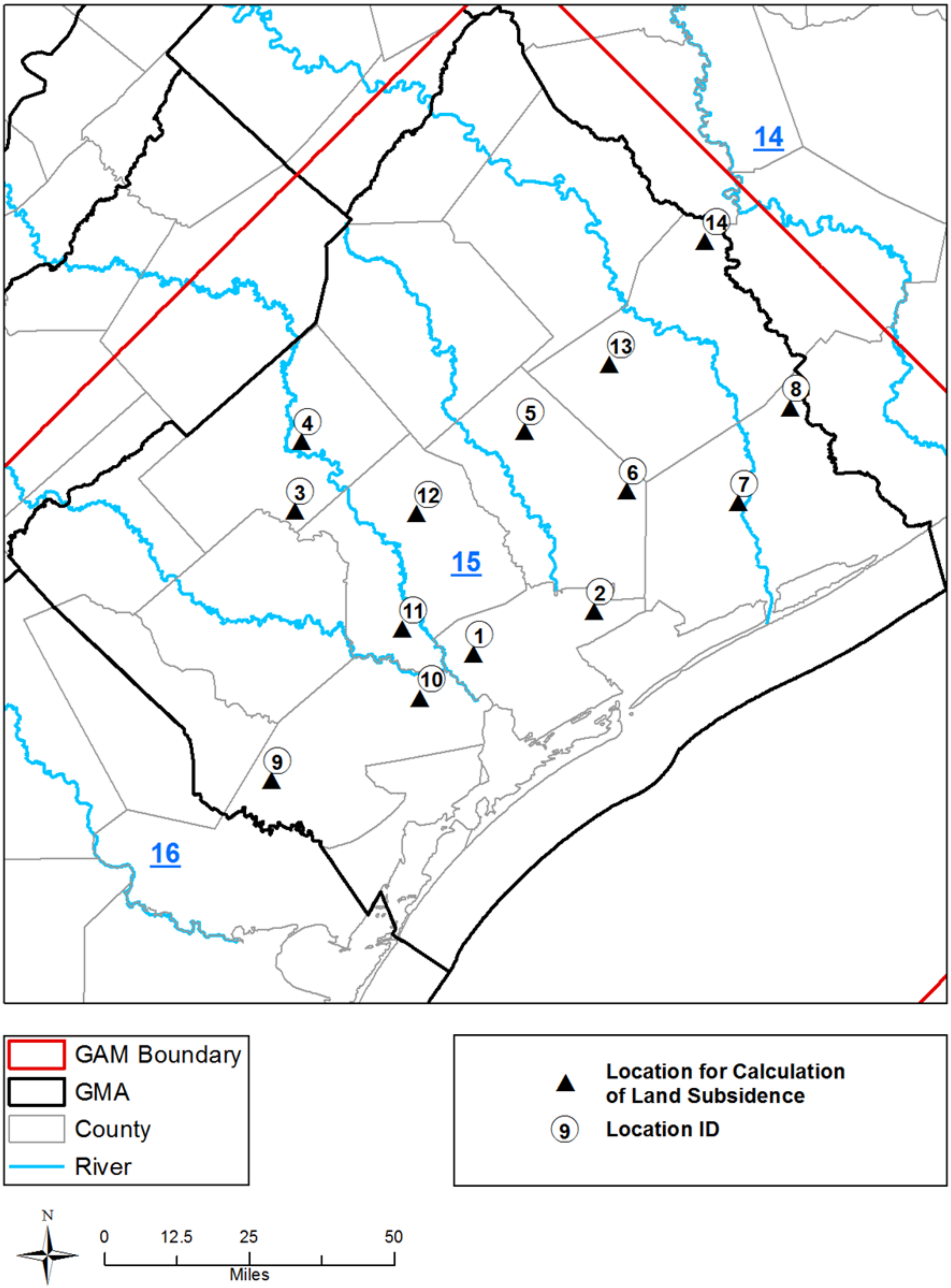


Figure 5-6 Locations in GMA 15 where land subsidence is calculated in Table 5-6.

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Appendix A

Copies of Agenda and Minutes for GMA 15 2012 – Present

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Tuesday, June 14, 2016 at the Pattie Dodson Health Center, 2805 N. Navarro St., Rm. 108, Victoria, Texas**. The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on matters related to the minutes of the previous meeting.
4. Consideration of and possible action on matters related to budget and financial reports of Groundwater Management Area 15.
5. Consideration of and possible action on matters related to professional services for the development and adoption of desired future conditions for Aquifers within Groundwater Management Area 15.
6. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts and Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on matters related to the development of the Explanatory Report for the Desired Future Conditions of Groundwater Management Area 15.
9. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
10. Receive public comment.
11. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N.

Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Friday, April 29, 2016 at the Pattie Dodson Health Center, 2805 N. Navarro St., Rm. 108, Victoria, Texas.** The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on matters related to the minutes of the previous meeting.
4. Consideration of and possible action on matters related to budget and financial reports of Groundwater Management Area 15.
5. Consideration of and possible action on matters related to professional services for the development and adoption of desired future conditions for Aquifers within Groundwater Management Area 15.
6. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts and Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of (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.

9. Consideration of and possible action on matters related to the public comment summaries submitted by member districts to Groundwater Management Area 15 in accordance with Section 36.108(d-2) of the Texas Water Code.
10. Consideration of and possible action on matters related to the review of reports, any district's suggested revisions to the proposed desired future conditions, and adoption of desired future conditions for Groundwater Management Area 15 in accordance with Section 36.108(d-3) of the Texas Water Code.
11. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
12. Receive public comment.
13. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2016 APR -8 P 2:21

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Wednesday, December 9, 2015 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901**. The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on matters related to the minutes of the previous meeting.
4. Consideration of and possible action on matters related to budget and financial reports of Groundwater Management Area 15.
5. Consideration of and possible action on matters related to professional services for the development and adoption of desired future conditions for Aquifers within Groundwater Management Area 15.
6. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts and Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on matters related to the review of management plans and accomplishments of member districts of Groundwater Management Area 15.
9. Consideration of and possible action on matters related to the joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.
10. Consideration of (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.

11. Consideration of and possible action on matters related to the methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.
12. Consideration of and possible action on the matters related to proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
13. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
14. Receive public comment.
15. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim 11/24/15

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2015 NOV 25 A 11:55

Heidi Easley
COUNTY CLERK
VICTORIA COUNTY, TEXAS

Donna Yanta

From: tel: 3615756276 <unknown_caller14@um.att.com>
Sent: Wednesday, December 09, 2015 10:37 AM
To: VICTORIA; COUNTY GROUND WATER CONSERVATI
Subject: Fwd: Fax message from VICTORIA CTY OF (3615756276) to 3615790041
Attachments: fax.pdf

The attached message was recently left in your AT&T Unified Messaging℠ mailbox. We are sending you this email because you have asked for your messages to be forwarded to this address.

The original message is still in your account.

115 N. Bridge, Room 103
Victoria Tx 77901
P O Box 1968
Victoria Tx 77902-1968
Phone: 361-575-1478
Fax: 361-575-6276

Victoria County Clerk

Fax

To:	Donna	**From:**	Victoria County Clerk Stefanie Tumlinson
Fax:	1-361-579-0041	**Date:**	12-9-2015
Phone:		**Pages:**	3 including cover
Re:	Notice of Meeting Groundwater Management Area 15	**CC:**	

Urgent ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

•**Comments:**

FILED

2015 SEP 28 A 7:59

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, October 8, 2015 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901**. The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.
5. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
6. Consideration of and possible action on reports and communication from GMA 15 member districts and GMA 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to GMA 15.
8. Consideration of and possible action on the review of management plans and accomplishments of member districts of GMA 15.
9. Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of GMA 15.
10. Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of GMA 15.
11. Consideration of and possible action on the review of proposals of member districts of GMA 15 to adopt new or amend existing desired future conditions.
12. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
13. Receive public comment.
14. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Victoria County Groundwater Conservation District

Directors:

Mark Meek *President*	Jerry Hroch *Vice-President*	Barbara Dietzel *Secretary*	Thurman Clements Kenneth Eller

September 25, 2015

Dear Victoria County Clerk,

Groundwater Management Area 15 is scheduled to conduct a joint planning meeting in accordance with provisions of Chapter 36 of the Texas Water Code and Chapter 551 of the Government Code. With this fax transmittal, GMA 15 is providing notice to you as required by 36.108(e)2 of the Texas Water Code.

Regards,

Donna Yanta for Tim Andruss

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2015 SEP 28 A 7:59

COUNTY CLERK
VICTORIA COUNTY, TEXAS

2805 N. Navarro St. Suite 210, Victoria, TX 77901, Phone (361) 579-6863, Fax (361) 579-0041

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, August 13, 2015 at the De Witt County Annex located at 115 N. Gonzales Cuero, TX 77954**. The meeting will be open to the public.
Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.
5. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
6. Consideration of and possible action on reports and communication from GMA 15 member districts and GMA 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to GMA 15.
8. Consideration of and possible action on the review of management plans and accomplishments of member districts of GMA 15.
9. Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of GMA 15.
10. Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of GMA 15.
11. Consideration of and possible action on the review of proposals of member districts of GMA 15 to adopt new or amend existing desired future conditions.
12. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
13. Receive public comment.
14. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Wednesday, July 15, 2015 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901.** The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.
5. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
6. Consideration of and possible action on reports and communication from GMA 15 member districts and GMA 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to GMA 15.
8. Consideration of and possible action on the review of management plans and accomplishments of member districts of GMA 15.
9. Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of GMA 15.
10. Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of GMA 15.
11. Consideration of and possible action on the review of proposals of member districts of GMA 15 to adopt new or amend existing desired future conditions.
12. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
13. Receive public comment.
14. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

6/26/15

Tim Andruss, Administrator
Groundwater Management Area 15

FILED
2015 JUN 26 P 4:08

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, April 9, 2015 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901**. The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.
5. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
6. Consideration of and possible action on reports and communication from GMA 15 member districts, GMA 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to GMA 15.
8. Consideration of and possible action on the review of management plans and accomplishments of member districts of GMA 15.
9. Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of GMA 15.
10. Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of GMA 15.
11. Consideration of and possible action on the review of proposals of member districts of GMA 15 to adopt new or amend existing desired future conditions.
12. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
13. Receive public comment.
14. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2015 MAR 27 A 11: 28

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, January 14, 2016 at the City of Victoria Surface Water Treatment Plant, 2902 N. Bluff St, Victoria, Texas.** The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on matters related to the minutes of the previous meeting.
4. Consideration of and possible action on matters related to budget and financial reports of Groundwater Management Area 15.
5. Consideration of and possible action on matters related to professional services for the development and adoption of desired future conditions for Aquifers within Groundwater Management Area 15.
6. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts and Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on matters related to the review of management plans and accomplishments of member districts of Groundwater Management Area 15.
9. Consideration of and possible action on matters related to the joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.
10. Consideration of (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.

11. Consideration of and possible action on matters related to the methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.
12. Consideration of and possible action on the matters related to proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
13. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
14. Receive public comment.
15. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

FILED
2015 DEC 22 A 10:35
COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, January 8, 2015 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901**. The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on election of GMA 15 Committee Chair, Vice-Chair, Treasurer, and Administrator.
4. Consideration of and possible action on election of GMA 15 representatives to Region K, Region L, Region N, and Region P Regional Water Planning Groups.
5. Consideration of and possible action on minutes of the previous meeting.
6. Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.
7. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
8. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
9. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
10. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
11. Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.
12. Consideration of and possible action on the review of accomplishments of the management area.
13. Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

14. Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.
15. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
16. Consideration of and possible action on identification and scheduling of future agenda items and meetings.
17. Receive public comment.
18. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2014 DEC 22 P 4: 01

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Victoria County Groundwater Conservation District

December 22, 2014

Dear Victoria County Clerk,

Groundwater Management Area 15 is scheduled to conduct a joint planning meeting in accordance with provisions of Chapter 36 of the Texas Water Code and Chapter 551 of the Government Code. With this fax transmittal, GMA 15 is providing notice to you as required by 36.108(e)2 of the Texas Water Code.

Regards,

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2014 DEC 22 P 4:02

COUNTY CLERK
VICTORIA COUNTY, TEXAS

2805 N. Navarro St. Suite 210, Victoria, TX 77901, Phone (361) 579-6863, Fax (361) 579-0041

2805 N. Navarro St., Ste. 210
Victoria, Texas 77901
(361) 579-6863 Office #
(361) 579-0041 Fax #

Victoria County Groundwater Conservation District

Fax

~~To:~~ from:	Betty Tovar (Victoria Co)	~~From:~~ To:	Tim Andruss, VCGCD
Fax:	575-6276	Pages:	4
Phone:		Date:	12/22/2014
Re:	GMA 15 Meeting Notice	cc:	

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Donna Yanta

From:	tel: 3615756276 <unknown_caller14@um.att.com>
Sent:	Monday, December 22, 2014 4:08 PM
To:	VICTORIA; COUNTY GROUND WATER CONSERVATI
Subject:	Fwd: Fax message from VICTORIA CTY OF (3615756276) to 3615790041
Attachments:	fax.pdf

The attached message was recently left in your AT&T Unified Messaging℠ mailbox. We are sending you this email because you have asked for your messages to be forwarded to this address.

The original message is still in your account.

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, October 9, 2014 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901.** The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.
5. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
6. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
7. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
8. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
9. Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.
10. Consideration of and possible action on groundwater pumping scenarios and groundwater availability modeling efforts for Groundwater Management Area 15.
11. Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.
12. Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
13. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
14. Consideration of and possible action on identification and scheduling of future agenda items.

15. Receive public comment.
16. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Victoria County Groundwater Conservation District

September 26, 2014

Dear Victoria County Clerk,

Groundwater Management Area 15 is scheduled to conduct a joint planning meeting in accordance with provisions of Chapter 36 of the Texas Water Code and Chapter 551 of the Government Code. With this fax transmittal, GMA 15 is providing notice to you as required by 36.108(e)2 of the Texas Water Code.

Regards,

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2014 SEP 26 A 11: 06

COUNTY CLERK
VICTORIA COUNTY, TEXAS

2805 N. Navarro St. Suite 210, Victoria, TX 77901, Phone (361) 579-6863, Fax (361) 579-0041

FILED

2014 JUN 27 P 2:59

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, July 10, 2014 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901.** The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget, financial reports and future funding requirements.
5. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
6. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
7. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
8. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
9. Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.
10. Consideration of and possible action on the review of accomplishments of Groundwater Management Area 15.
11. Consideration of and possible action on groundwater pumping

scenarios associated with groundwater availability modeling efforts for Groundwater Management Area 15.

12. Consideration of and possible action on groundwater availability models related to the development of desired future conditions for Groundwater Management Area 15.
13. Consideration of and possible action on designation of relevant aquifers related to development of desired future conditions for Groundwater Management Area 15.
14. Consideration of and possible action on estimation of exempt use groundwater production within Groundwater Management Area 15.
15. Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.
16. Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
17. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
18. Consideration of and possible action on identification and scheduling of future agenda items.
19. Receive public comment.
20. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Victoria County Groundwater Conservation District

Directors:

Mark Meek	Jerry Hroch	Barbara Dietzel	Thurman Clements
President	*Vice-President*	*Secretary*	Kenneth Eller

June 27, 2014

Dear County Clerk,

Groundwater Management Area 15, which encompasses your county, is scheduled to conduct a joint planning meeting in accordance with provisions of Chapter 36 of the Texas Water Code and Chapter 551 of the Government Code. With this fax transmittal, GMA 15 is providing notice to you as required by 36.108(e) 2 of the Texas Water Code.

Regards,

Tim Andruss, Administrator
Groundwater Management Area 15

2805 N. Navarro St. Suite 210, Victoria, TX 77901, Phone (361) 579-6863, *Fax (361) 579-0041*

2805 N. Navarro St., Ste. 210
Victoria, Texas 77901
(361) 579-6863 Office #
(361) 579-0041 Fax #

Victoria County Groundwater Conservation District

Fax

~~To:~~ FROM:	Betty Tovar (Victoria Co)	~~From:~~ TO:	Tim Andruss, VCGCD
Fax:	575-6276	Pages:	4
Phone:		Date:	6/~~26~~ 27/2014
Re:	GMA 15 Meeting Notice	cc:	

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, April 10, 2014 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901.** The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget and financial reports.
5. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
6. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.
9. Consideration of and possible action on the review of accomplishments of the management area.
10. Consideration of and possible action on aquifer monitoring efforts of member districts of Groundwater Management Area 15.
11. Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
12. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
13. Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
14. Consideration of and possible action on identification and scheduling of future agenda items.
15. Receive public comment.
16. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Victoria County Groundwater Conservation District

March 26, 2014

Dear Victoria County Clerk,

Groundwater Management Area 15 is scheduled to conduct a joint planning meeting in accordance with provisions of Chapter 36 of the Texas Water Code and Chapter 551 of the Government Code. With this fax transmittal, GMA 15 is providing notice to you as required by 36.108(e)2 of the Texas Water Code.

Regards,

Tim Andruss, Administrator
Groundwater Management Area 15

FILED RO
2014 MAR 27 AM 8:06

COUNTY CLERK
VICTORIA COUNTY, TEXAS

2805 N. Navarro St. Suite 210, Victoria, TX 77901, Phone (361) 579-6863, Fax (361) 579-0041

2805 N. Navarro St., Ste. 210
Victoria, Texas 77901
(361) 579-6863 Office #
(361) 579-0041 Fax #

Victoria County
Groundwater
Conservation District

Fax

FROM		TO:	
~~To:~~	Betty Tovar (Victoria Co)	~~From:~~	Tim Andruss, VCGCD
Fax:	575-6276 by Ronnie Orsak Deputy	Pages:	4
Phone:		Date:	3/26/2014
Re:	GMA 15 Meeting Notice	cc:	

☐ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

FILED
by Ronnie Olcca Deputy
2013 DEC 17 PM 2:14

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, January 9, 2014 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901.** The meeting will be open to the public.

Agenda:

1. Call to order and welcome guests.
2. Receive public comment.
3. Consideration of and possible action on minutes of the previous meeting.
4. Consideration of and possible action on GMA 15 budget and financial reports.
5. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
6. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on appointment of Groundwater Management Area 15 representatives for regional water planning groups.
8. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
9. Consideration of and possible action on regional water planning group member alternates.
10. Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.
11. Consideration of and possible action on the review of accomplishments of the management area.
12. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
13. Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.
14. Consideration of and possible action on identification and scheduling of future agenda items.
15. Receive public comment.
16. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

12/17/13

Tim Andruss, Administrator
Groundwater Management Area 15

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at **9:30 AM on Thursday, October 10, 2013 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901**. The meeting will be open to the public.

Agenda:

1. Call to order.
2. Welcome guests and introductions.
3. Receive public comment.
4. Consideration of and possible action on minutes of the previous meeting.
5. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
6. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on an agreement to obtain professional services from the preferred respondent to the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15
9. Consideration of and possible action on election of GMA-15 Joint Planning Committee Officers.
10. Consideration of and possible action on selection of a GMA-15 Joint Planning Committee Administrator.
11. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
12. Consideration of and possible action on identification and scheduling of future agenda items.
13. Receive public comment.
14. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

9/26/13

Tim Andruss, Administrator
Groundwater Management Area 15

FILED

2013 SEP 26 PM 4:08

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at 9:30 AM on Thursday, June 13, 2013 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901. The meeting will be open to the public.

Agenda:

1. Call to order.
2. Welcome guests and introductions.
3. Receive public comment.
4. Consideration of and possible action on minutes of the previous meeting.
5. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
6. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on the presentations and proposals provided by respondents regarding the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.
9. Consideration of and possible action on the selection of and negotiation with a preferred respondent to the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.
10. Consideration of and possible action on an agreement to obtain professional services from the preferred respondent to the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.
11. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
12. Consideration of and possible action on identification and scheduling of future agenda items.

13. Receive public comment.
14. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

FILED
by Ronnie Arsak Deputy
2013 MAY 24 PM 3:52

COUNTY CLERK
VICTORIA COUNTY, TEXAS

FILED
By Ronnie Arsak Deputy
2013 MAR 28 PM 3:45

COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at 9:30 AM on Thursday, April 11, 2013 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901. The meeting will be open to the public.

Agenda:

1. Call to order.
2. Welcome guests and introductions.
3. Receive public comment.
4. Consideration of and possible action on minutes of the previous meeting.
5. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
6. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on standard financial practices and procedures concerning funds collected from member districts under the Interlocal Cost Sharing Agreement For Groundwater Management Area 15.
9. Consideration of and possible action on impact on the Groundwater Management Area 15 Desired Future Condition in areas without properly organized groundwater conservation districts.
10. Consideration of and possible action on the review of accomplishments of the member districts of Groundwater Management Area 15.
11. Consideration of and possible action on requests for proposal for technical support and administrative support to GMA-15 Joint Planning Committee and responses.
12. Consideration of and possible action on the use of an alternate groundwater availability model for joint planning purposes within Groundwater Management Area 15.

13. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
14. Consideration of and possible action on identification and scheduling of future agenda items.
15. Receive public comment.
16. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at 9:30 AM on Thursday, February 14, 2013 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901. The meeting will be open to the public.

Agenda:

1. Call to order.
2. Welcome guests and introductions.
3. Receive public comment.
4. Consideration of and possible action on minutes of the previous meeting.
5. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
6. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.
8. Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.
9. Consideration of and possible action on the review of accomplishments of the member districts of Groundwater Management Area 15.
10. Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.
11. Consideration of and possible action on requests for proposal for technical support and administrative support to GMA-15 Joint Planning Committee.
12. Consideration of and possible action on potential interlocal agreement between GMA-15 Joint Planning Committee member districts to financially support joint planning activities.

13. Consideration of and possible action on the use of an alternate groundwater availability model for joint planning purposes within Groundwater Management Area 15.
14. Consideration of and possible action on identification and scheduling of future agenda items.
15. Receive public comment.
16. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

Tim Andruss, Administrator
Groundwater Management Area 15

Victoria County Groundwater Conservation District

FILED

2012 OCT -8 AM 8:04

Directors:

Mark Meek, *President*
Jerry Hroch, *Vice-President*
Barbara Dietzel, *Secretary*
Thurman Clements
~~Kenneth Eller~~

COUNTY CLERK
VICTORIA COUNTY, TEXAS
by Ronnie Orsak, Deputy

NOTICE OF MEETING
VICTORIA COUNTY GROUNDWATER CONSERVATION DISTRICT
BOARD OF DIRECTORS

Notice is given in accordance with Chapter 551-Government Code (V.T.C.A.) Texas Open Meetings Act that the Victoria County Groundwater Conservation District Board of Directors may attend a joint planning meeting of Groundwater Management Area 15 on Wednesday, October 10, 2012 at 9:30 AM at the Dr. Patti Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901.

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at 9:30 AM on Wednesday, October 10, 2012 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901. The meeting will be open to the public.

Agenda:

1. Call to order.
2. Welcome guests and introductions.
3. Receive public comment.
4. Consideration of and possible action on minutes of the previous meeting.
5. Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.
6. Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

2805 N. Navarro St. Suite 210, Victoria, TX 77901, Phone (361) 579-6863, Fax (361) 579-0041

Victoria County Groundwater Conservation District

8. Consideration of and possible action on administrative procedures for Groundwater Management Area 15.
9. Consideration of and possible action on election of GMA-15 Joint Planning Committee Officers.
10. Consideration of and possible action on selection of a GMA-15 Joint Planning Committee Administrator.
11. Consideration of and possible action on future meeting schedule for GMA-15 Joint Planning Committee.
12. Consideration of and possible action on requests for proposal for technical support and administrative support to GMA-15 Joint Planning Committee.
13. Consideration of and possible action on potential interlocal agreement between GMA-15 Joint Planning Committee member districts to financially support joint planning activities.
14. Consideration of and possible action on approaches to evaluating achievement of desired future conditions.
15. Consideration of and possible action on groundwater level monitoring within Groundwater Management Area 15.
16. Receive public comment.
17. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

The Victoria County Groundwater Conservation District may close the meeting, if necessary, to conduct private consultation with VCGCD attorney regarding matters protected by the attorney-client privilege pursuant to V.T.C.A. Government Code 551.071 or to discuss matters regarding personnel pursuant to V.T.C.A. Government Code 511.074. The Victoria County Groundwater Conservation District will return to open meeting, if necessary, to take any action deemed necessary based on discussion in closed meeting pursuant to V.T.C.A. Government Code 551.102.

Tim Andruss, General Manager

72 Hour Notice Date: 10/5/12

In Accordance with Title III of the Americans with Disabilities Act, we invite all attendees to advise us of any special accommodations due to disability. Please submit your request as far as possible in advance of programs you wish to attend.

FILED
By: [signature] Deputy
2012 JUN -8 PM 2:38

[signature]
COUNTY CLERK
VICTORIA COUNTY, TEXAS

Notice of Meeting
Groundwater Management Area 15

Notice is hereby given in accordance with Chapter 36 of the Texas Water Code that the groundwater conservation districts located wholly or partially with Groundwater Management Area 15 consisting of Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Lavaca County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District will hold a joint planning meeting at 9:30 AM on Wednesday, June 20, 2012 at the Dr. Pattie Dodson Health Center, 2805 N. Navarro St., Room 108, Victoria, Texas 77901. The meeting will be open to the public.

Agenda:

1. Call to order.
2. Welcome guests and introductions.
3. Receive public comment.
4. Consideration of and possible action on minutes of the previous meeting.
5. Consideration of and possible action on reports and communication from Groundwater Management Area15 member districts.
6. Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.
7. Consideration of and possible action on administrative procedures for Groundwater Management Area 15.
8. Consideration of and possible action on impacts on joint planning and Groundwater Management Area 15 caused by changes in Texas Water Code.
9. Receive public comment.
10. Adjournment.

Please submit comments, questions, and requests for additional information to Tim Andruss of the Victoria County Groundwater Conservation District by mail at 2805 N. Navarro St., Suite 210, Victoria, Texas 77901, by email at admin@vcgcd.org, or by phone at (361) 579-6863.

[signature] 6/6/12
Tim Andruss, Administrator
Groundwater Management Area 15

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened at 9:30 AM on Thursday, January 14, 2016 at the City of Victoria Surface Water Treatment Plant, 2902 N. Bluff St, Victoria, Texas.

Members GCD Representatives Present:

1	Aransas County Groundwater Conservation District	Tom Callum
2	Bee Groundwater Conservation District	Mark Sugerek
3	Calhoun County Groundwater Conservation District	Tim Andruss
4	Coastal Bend Groundwater Conservation District	Neil Hudgins
5	Coastal Plains Groundwater Conservation District	Neil Hudgins
6	Colorado County Groundwater Conservation District	Jim Brasher
7	Corpus Christi ASR Conservation District	Brent Clayton
8	Evergreen Underground Water Conservation District	Russell Labus
9	Fayette County Groundwater Conservation District	David Van Dresar
10	Goliad County Groundwater Conservation District	Art Dohmann
11	Pecan Valley Groundwater Conservation District	
12	Refugio Groundwater Conservation District	Carroll Borden
13	Texana Groundwater Conservation District	Tim Andruss
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:37 AM. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments.

No action was taken.

Agenda Item 3: Consideration of and possible action on matters related to the minutes of the previous meeting.

Mr. Andruss explained that the minutes of the previous meeting were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Van Dresar moved to approve the meeting minutes for December 9, 2015 with revision. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on matters related to budget and financial reports of Groundwater Management Area 15.

Mr. Andruss explained that the financial reports for the GMA 15 joint planning funds as of January 11, 2016 were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Dohmann moved to accept the financial reports for the GMA 15 joint planning funds as of January 11, 2016 as provided by Ms. Krause. Mr. Hudgins seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on matters related to professional services for the development and adoption of desired future conditions for Aquifers within Groundwater Management Area 15.

Mr. Andruss explained that the Committee, via VCGCD, has received the following invoices:

INV #11-15-89 - INTERA	$1,042.77

MOTION: Mr. Dohmann moved 1) to authorize Ms. Krause of Pecan Valley GCD as the GMA 15 Committee Treasurer to issue a disbursement to Victoria County GCD from the GMA 15 joint planning funds in the amount of $1,042.77; 2) request that VCGCD issue payment to INTERA for invoices INV #11-15-89 in the amount of $1,042.77 upon receipt of funds from PVGCD in the same amount. Mr. Brasher seconded the motion. The motion passed.

Agenda Item 6: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts and Groundwater Management Area 15 representatives to Regional Water Planning Groups.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. Bradley of TWDB informed the committee of developments and activities at the Texas Water Development Board related to water planning with specifics regarding progress toward adopting DFCs by GMA 14 and GMA 9 as well as exempt use groundwater production estimates.

No action was taken.

Agenda Item 8: Consideration of and possible action on matters related to the review of management plans and accomplishments of member districts of Groundwater Management Area 15.

Mr. Labus provided an update regarding efforts by Evergreen Underground WCD to revise its management plan.

No action was taken.

Agenda Item 9: Consideration of and possible action on matters related to the joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

Mr. Andruss explained that, per the schedule of the remaining DFC adoption steps adopted by the GMA representatives at the meeting held on December 9, 2015, the GMA is scheduled to complete the following tasks on January 14, 2016:

1. GMA 15 Representatives vote to designate the Proposed Desired Future Conditions of Groundwater Management Area 15, per 36.108(d);
2. -GMA 15 Representatives consider "factors" specified in items 1 through 9, per 36.108(d);
3. GMA 15 Representatives vote to distribute the Proposed Desired Future Conditions of Groundwater Management Area 15 (Requires approval by 2/3 of all district representatives), per 36.108(d-2).

MOTION: Mr. Andruss moved to designate the draft Groundwater Management Area 15 Proposed Desired Future Condition language as modified by the committee as the Proposed Desired Future Conditions of Groundwater Management Area 15 and move to authorize the GMA 15 Administrator to distribute the Proposed Desired Future Conditions of Groundwater Management Area 15 and supporting materials to the member districts of Groundwater Management Area 15. The meeting will be open to the public. Mr. Brasher seconded the motion. The motion passed with the following vote:

Member District	Representative	Aye	Nay
Aransas County GCD	Tom Callum	X	
Bee GCD	Mark Sugerek	X	
Calhoun County GCD	Tim Andruss	X	
Coastal Bend GCD	Neil Hudgins	X	
Coastal Plains GCD	Neil Hudgins	X	
Colorado County GCD	Jim Brasher	X	
Corpus Christi ASR CD	Brent Clayton	X	
Evergreen Underground WCD	Russell Labus	X	
Fayette County GCD	David Van Dresar		X

Goliad County GCD	Art Dohmann	X	
Pecan Valley GCD			
Refugio GCD	Carroll Borden	X	
Texana GCD	Tim Andruss	X	
Victoria County GCD	Tim Andruss	X	

Agenda Item 10: Consideration of (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.

Mr. Andruss explained that the GMA 15 meeting held on December 9, 2015, the GMA 15 Representatives considered draft language regarding the factors established under TWC 36.108(d)(1) through TWC 36.108(d)(9) and the impact of adopting desired future conditions as described in the GMA 15 Provisional Desired Future Conditions. Victoria County Groundwater Conservation District considered the factors and the draft language developed for GMA 15 at its meeting held on December 18, 2015. Texana Groundwater Conservation District considered the factors and the draft language developed for GMA 15 at its meeting held on December 17, 2015. Refugio Groundwater Conservation District considered the factors and the draft language developed for GMA 15 at its meeting held on December 14, 2015. Calhoun County Groundwater Conservation District considered the factors and the draft language developed for GMA 15 at its meeting held on December 16, 2015.

Mr. Van Dresar explained that Fayette County GCD had considered the factors established under TWC 36.108(d)(1) through TWC 36.108(d)(9) in November of 2015.

Mr. Dohmann provided a handout to the members regarding the factors established under TWC 36.108(d)(1) through TWC 36.108(d)(9) developed by Goliad County GCD with a request that the handout be incorporated into the GMA 15 explanatory report.

No action was taken.

Agenda Item 11: Consideration of and possible action on matters related to the methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

No action was taken.

Agenda Item 12: Consideration of and possible action on the matters related to proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 13: Consideration of and possible action on identification and scheduling of future agenda items and meetings.

Mr. James Allison provided comments regarding the approval process and work accomplished by GMA 15.

Agenda Item 14: Receive public comment.

Agenda Item 15: Adjournment.

MOTION: At 10:37 AM, Mr. Stewart moved to adjourn the meeting. Mr. Van Dresar seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 29th day of April a.d. 2016.

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Groundwater Management Area 15 Representative

ATTEST:

James E. Brasher
Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on December 9, 2015.

Members GCD Representatives Present:

1	Aransas County Groundwater Conservation District	Lynn Wildman
2	Bee Groundwater Conservation District	Lonnie Stewart
3	Calhoun County Groundwater Conservation District	Tim Andruss
4	Coastal Bend Groundwater Conservation District	Neil Hudgins
5	Coastal Plains Groundwater Conservation District	Neil Hudgins
6	Colorado County Groundwater Conservation District	Jim Brasher
7	Corpus Christi ASR Conservation District	Brent Clayton
8	Evergreen Underground Water Conservation District	Russell Labus
9	Fayette County Groundwater Conservation District	David Van Dresar
10	Goliad County Groundwater Conservation District	Art Dohmann
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	Tim Andruss
13	Texana Groundwater Conservation District	Tim Andruss
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:30 AM. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments.

No action was taken.

Agenda Item 3: Consideration of and possible action on matters related to the minutes of the previous meeting.

Mr. Andruss explained that the minutes of the previous meeting were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Hudgins moved to approve the meeting minutes as drafted. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on matters related to budget and financial reports of Groundwater Management Area 15.

Mr. Andruss explained that the financial reports for the GMA 15 joint planning funds as of November 25, 2015 were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Van Dresar moved to accept the financial reports for the GMA 15 joint planning funds as of November 25, 2015 as provided by Ms. Krause. Mr. Hudgins seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on matters related to professional services for the development and adoption of desired future conditions for Aquifers within Groundwater Management Area 15.

Mr. Andruss explained that the Committee, via VCGCD, has received the following invoices:

INV #09-15-114 - INTERA	$155.00

MOTION: Mr. Brasher moved 1) to authorize Ms. Krause of Pecan Valley GCD as the GMA 15 Committee Treasurer to issue a disbursement to Victoria County GCD from the GMA 15 joint planning funds in the amount of $155.00; 2) request that VCGCD issue payment to INTERA for invoices INV #09-15-114 in the amount of $155.00 upon receipt of funds from PVGCD in the same amount. Mr. Hudgins seconded the motion. The motion passed.

Mr. Andruss explained that term for the Interlocal Cost Sharing Agreement for Groundwater Management Area 15 ended on July 14, 2015 and that the agreement includes provisions for extending of the term of the agreement beyond July 14, 2015.

MOTION: Mr. Hudgins moved to extend the Interlocal Cost Sharing Agreement for Groundwater Management Area 15 until August 1, 2016 and request that the GMA 15 administrator to transmit a letters to each party of the agreement providing notice of the extension. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 6: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts and Groundwater Management Area 15 representatives to Regional Water Planning Groups.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. Bradley of TWDB informed the committee of developments and activities at the Texas Water Development Board related to water planning with specifics regarding state water plan adoption, funding programs, and exempt use groundwater production estimates.

No action was taken.

Agenda Item 8: Consideration of and possible action on matters related to the review of management plans and accomplishments of member districts of Groundwater Management Area 15.

No action was taken.

Agenda Item 9: Consideration of and possible action on matters related to the joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

Mr. Andruss explained that GMA 15 and individual districts have a significant number of steps remaining to be completed as part of the adoption process as prescribed by Chapter 36 of the Texas Water Code. The distinct steps are listed below. Given the statutory deadline for proposing desired future conditions and the time required to complete the prerequisite tasks, GMA 15 must take action to complete tasks immediately. A proposed schedule has been prepared for consideration.

Remaining DFC Adoption Steps:

1. GMA 15 Representatives vote to designate final provisional DFC language as the Proposed Desired Future Conditions of Ground\water Management Area 15, per 36.108(d);
2. GMA 15 Representatives consider "factors" specified in items 1 through 9, per 36.108(d);
3. GMA 15 Representatives vote to distribute the Proposed Desired Future Conditions of Groundwater Management Area 15 (Requires approval by 2/3 of all district representatives), per 36.108(d-2);
4. GMA 15 Administrator mails the Proposed Desired Future Conditions of Groundwater Management Area 15 and supporting materials;
5. Districts accept public comments on the Proposed Desired Future Conditions of Groundwater Management Area 15 for at least 90 days commencing on date GMA 15 Administrator distributes the Proposed Desired Future Conditions of Groundwater Management Area 15 (i.e., the public comment period), per 36.108(d-2);
6. Districts make available a copy of the Proposed Desired Future Conditions of Groundwater Management Area 15 and supporting materials in its office

during the public comment period, per 36.108(d-2);

7. District s hold a public hearings, per 36.108(d-2),
    1. during the public comment period, and
    2. after the District posts notice as required by 36.063;
8. Districts compile, after the public comment period, a summary of relevant comments received, any suggested revisions to the proposed desired future conditions, and basis for the revisions, per 36.108(d-2);
9. Districts submit their public comment period summaries to GMA 15 Administrator, per 36.108(d-2):
10. GMA 15 Representatives review the public comment summaries and consider any suggested revisions to the Proposed Desired Future Conditions of Groundwater Management Area 15 upon receipt of all summaries or the expiration of the public comment period, per 36.108(d-3);
11. GMA 15 Representatives proposes for adoption desired future conditions for GMA 15, per 36.108(d-3) (STATUTORY DEADLINE: May 1, 2016, per 136.108(d-5));
12. GMA 15 Representatives vote to adopt the desired future condition for GMA 15 by resolution (Requires approval by 2/3 of all district representatives), per 36.108(d-3);
13. GMA 15 Representatives produce a desired future condition explanatory report, per 36.108(d-3);
14. GMA 15 Administrator sends to TWDB and Districts the following, per 108(d-3):
    1. proof that notice was posted for the joint planning meeting,
    2. a copy of the resolution adopting the desired future condition, and
    3. a copy of the explanatory report:

15. Districts adopts the desired future conditions and explanatory report after receiving the resolution adopting the desired future condition and a copy of the explanatory report, per 36.108(d4).

Mr. Andruss proposed the following schedule for completing the remaining DFC adoption steps:
Proposed Schedule;
Remaining Step 1; January 14, 2016
Remaining Step 2; January 14, 2016
Remaining Step 3; January 14, 2016
Remaining Step 4; January 15, 2016
Remaining Step 5; January 15, 2016 - April 13, 2015
Remaining Step 6; January 15, 2016 - April 13, 2015
Remaining Step 7; April 14 -18, 2016
Remaining Step 8; April 18-22, 2016
Remaining Step 9; April 25 - 27, 2016
Remaining Step 10; April 29, 2016
Remaining Step 11: April 29, 2016
Remaining Step 12: April 29, 2016

Remaining Step 13; May 12, 2016 *
Remaining Step 14: May 13, 2016

Mr. Dohmann of the Goliad County Groundwater Conservation District questioned the variable value used for average recharge in the different GAM runs performed for Groundwater Management Area 15 and requested that Texas Water Development Board address the issue. Mr. Bradley of the Texas Water Development Board agreed to review the matter and provide a response to Mr. Dohmann.

MOTION: Mr. Hudgins moved to accept and approve the proposed schedule for adopting desired future conditions for Groundwater Management Area 15 and request that INTERA prepare a preliminary draft of the explanatory report. Mr. Van Dresar seconded the motion. The motion passed.

Agenda Item 10: Consideration of (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.

Mr. Andruss explained that GMA 15 Representatives are required to consider nine specific factors before voting to adopt any proposed desired future condition. GMA 15 has previously considered, to some extent, the factors of 36.108(d), with the exception of 36.108(d)(3), with the the development, response and subsequent consideration of responses to the GMA 15 Development Survey. In summary, Groundwater Management Area 15 solicited input from GMA 15 representatives regarding certain factors specified under 36.108(d) on March 27, 2015 with the transmittal of the GMA 15 DFC Development Survey. The GMA 15 Representatives considered the GMA 15 DFC Development Survey at the meeting held on April 9, 2015. Through the DFC Development Survey, GMA 15 specifically solicited input from member districts related to TWC 36.108(d)(1), 36.108(d)(2), 36.108(d)(4), 36.108(d)(5), 36.108(d)(6), 36.108(d)(7), 36.108(d)(8), and 36.108(d)(9). Calhoun County GCD, Coastal Bend GCD, Fayette County GCD, Goliad County GCD, Pecan Valley GCD, Refugio GCD, Texana GCD, and Victoria County GCD provided responses to the survey. On July 15, 2015, GMA 15 representatives considered the survey responses and related topics. Below is a draft write-up regarding the consideration of the factors:

Under 36.108(d)(1), member district are required to consider aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another. The aquifer uses and conditions differ substantially across Groundwater Management Area 15. Groundwater production is generally greater in the northeastern portions of GMA 15 in Colorado, Wharton, Matagorda, and Jackson Counties. Groundwater in northeastern portion of GMA 15 is predominately used for irrigation purposes. Groundwater production in the central portion of GMA 15 in Victoria County is predominately used for irrigation, municipal, and industrial uses. Groundwater production in the north central portion of GMA 15 in DeWitt County and Karnes County is predominately used for domestic and livestock purposes as well as supporting oil and gas production in the Eagle Ford Shale. Groundwater production in the southwestern portions of GMA 15 is predominately used for domestic, livestock, and agricultural uses. The condition of the Gulf Coast Aquifer differs significantly geographically. Generally, the capacity of the Gulf Coast Aquifer to produce groundwater increases to the northeast and decreases to the southwest as well as increase down dip relative to up dip portions of the Gulf Coast Aquifer. The adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact aquifer uses or conditions during the planning horizon and would 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.

Under 36.108(d)(2), member district are required to consider the water supply needs and water management strategies included in the state water plan. Based on a review of the a summary of the water supply needs and water management strategies of the 2012 Texas State Water Plan, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact the water supplies, water supply needs, or water management strategies of the 2012 Texas State Water Plan during the planning horizon and would 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.

Under 36.108(d)(3), member districts are required to consider 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. The Texas Water Development Board published total estimated recoverable storage for aquifers within GMA 15 in a report titled GAM Task 13-038: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 15. The total estimated recoverable storage for the Gulf Coast Aquifer within GMA 15 ranges between 92,200,000 acre-feet and 276,600,000 acre-feet. Based on a review of the total estimated recoverable storage and simulated water budgets associated with the Baseline (Option 1) and High Production (Option 1) model runs, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact the hydrological conditions within GMA 15 during the planning horizon and would 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.

Under 36.108(d)(4), member districts are required to consider other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water. Based on a review of the simulated water budgets associated with the Baseline (Option 1) and High Production (Option 1) model runs, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact environmental conditions during the planning horizon and would 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.

Under 36.108(d)(5), member districts are required to consider the impact on subsidence. Based on a reports developed by INTERA for member districts related to subsidence within GMA 15, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact subsidence during the planning horizon and would 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.

Under 36.108(d)(6), member districts are required to consider socioeconomic impacts reasonably expected to occur. Based on a review of the water management strategies of the 2012 Texas State Water Plan associate with supplies from the Gulf Coast Aquifer within GMA 15 and the anticipated impact on groundwater resources caused by groundwater production in the future, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact socioeconomic conditions within GMA 15 during the planning horizon and would 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.

Under 36.108(d)(7), member districts are required to consider the impact on the interests and rights in private property. The member district recognize that the regulation of groundwater production, including the adoption of desired future conditions, could significantly impact interests and rights in private property. Based on estimations of existing groundwater production, existing groundwater regulations, and the proposed water management strategies of the 2012 Texas State Water Plan, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact interests and rights in private property within GMA 15 during the planning horizon and would 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.

Under 36.108(d)(8), member districts are required to consider the feasibility of achieving the desired future condition. Based on predictive groundwater availability modeling conducted by GMA 15, the achievement of the desired future conditions are considered feasible and physically compatible.

No action was taken.

Agenda Item 11: Consideration of and possible action on matters related to the methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

No action was taken.

Agenda Item 12: Consideration of and possible action on the matters related to proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 13: Consideration of and possible action on identification and scheduling of future agenda items and meetings.

No public comment provided.

Agenda Item 14: Receive public comment.

Agenda Item 15: Adjournment.

MOTION: At 10:37 AM, Mr. Stewart moved to adjourn the meeting. Mr. Van Dresar seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 14th day of JANUARY a.d. 2016.

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Groundwater Management Area 15 Representative

ATTEST:

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Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on October 8, 2015.

Members GCD Representatives Present:

1	Aransas County Groundwater Conservation District	
2	Bee Groundwater Conservation District	Lonnie Stewart
3	Calhoun County Groundwater Conservation District	Frank Anzaldua
4	Coastal Bend Groundwater Conservation District	Neil Hudgins
5	Coastal Plains Groundwater Conservation District	Neil Hudgins
6	Colorado County Groundwater Conservation District	Jim Brasher
7	Corpus Christi ASR Conservation District	
8	Evergreen Underground Water Conservation District	Russell Labus
9	Fayette County Groundwater Conservation District	David Van Dresar
10	Goliad County Groundwater Conservation District	Art Dohmann
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	Tim Andruss
13	Texana Groundwater Conservation District	Tim Andruss
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:31 AM. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments.

No action was taken.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

Mr. Andruss explained that the minutes of the previous meeting were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Anzaldua moved to approve the meeting minutes as drafted. Mr. Van Dresar seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.

MOTION: Mr. Anzaldua moved to accept the GMA 15 Financials - 20151005 as provided by Ms. Krause. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss explained that the Committee, via VCGCD, has received the following invoices:

INV #07-15-59 - INTERA	$2,460.00
INV #08-15-88- INTERA	$1,438.83

MOTION: Mr. Anzaldua moved 1) to authorize Ms. Krause of Pecan Valley GCD as the GMA 15 Committee Treasurer to issue a disbursement to Victoria County GCD from the GMA 15 joint planning funds in the amount of $3,898.83; 2) request that VCGCD issue payment to INTERA for invoices INV #07-15-59 , and INV #08-15-88in the amount of $3,898.83upon receipt of funds from PVGCD in the same amount. Mr. Hudgins seconded the motion. The motion passed.

Agenda Item 6: Consideration of and possible action on reports and communication from GMA 15 member districts, GMA 15 representatives to Regional Water Planning Groups.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. Bradley of TWDB informed the committee of recent developments a the Texas Water Development Board including changes to the information systems used to store and manage water well log data.

No action was taken.

Agenda Item 8: Consideration of and possible action on the review of management plans and accomplishments of member districts of Groundwater Management Area 15.

No action was taken.

Agenda Item 9: Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

Mr. Young of INTERA provided a report on modeling results developed for GMA 15. The report included information related to revised summary information for the following predictive modeling scenarios: Baseline, Baseline (50% Recharge), and High Production. The discussion related to the report focused on the difference between two approaches (Option 0 and Option 1) employed by INTERA address their concern that the procedure for revising groundwater pumping values for predictive model scenarios was not properly understood by the member districts of GMA 15. Additional information regarding the revised summary information is contained in a memorandum submitted to GMA 15 by INTERA on September 30, 2015.

The GMA 15 representatives considered the revised summary information provided by INTERA and specified values to serve as provisional desired future condition parameters on a county-by-county basis and for the groundwater management area. The values were specified for the purpose of supporting a request to review the provisional desired future condition values and supporting information by TWDB.

Mr. Andruss agreed to develop a summary of considerations conducted by GMA 15 representatives related to Section 36.108(d)(1-9).

MOTION: Mr. Andruss moved to authorize INTERA to submit a request to TWDB to review and comment on the provisional desired future condition parameters and supporting data. Mr. Brasher seconded the motion. The motion passed.

Agenda Item 10: Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

No action was taken.

Agenda Item 11: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 12: Consideration of and possible action on identification and scheduling of future agenda items.

December 10, 2015 was identified as a possible meeting date.

Agenda Item 13: Receive public comment.

No public comment provided.

Agenda Item 14: Adjournment

MOTION: At 11:43 AM, Mr. Van Dresar moved to adjourn the meeting. Mr. Stewart seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 9th day of December a.d. 2015.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the **De Witt County Annex located at 115 N. Gonzales Cuero, TX 77954** at 9:30 AM on **Thursday, August 13, 2015**.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	
2	Calhoun County Groundwater Conservation District	Tim Andruss
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	Charlotte Krause
11	Refugio Groundwater Conservation District	Tim Andruss
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:32 AM. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments.

No action was taken.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

Mr. Andruss explained that the minutes of the previous meeting were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Hudgins moved to approve the meeting minutes as drafted. Mr. Labus seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.

Ms. Krause provided a financial report for bank account in which the joint planning funds are deposited.

MOTION: Mr. Hudgins moved to accept the financial report as provided by Ms. Krause. Ms. Krause seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

No action was taken.

Agenda Item 6: Consideration of and possible action on reports and communication from GMA 15 member districts, GMA 15 representatives to Regional Water Planning Groups.

Mr. Labus provided an update regarding the Evergreen Underground Water Conservation District's opposition to the Cibolo Valley Local Government Corporation's Carrizo Aquifer Water Management Strategy for Wilson County.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. Bradley notified the members that 1) the Texas Water Development Board anticipated adoption of the regional water plans earlier, by several months, than has typically occurred and 2) GMA 14 had recently proposed a DFC.

No action was taken.

Agenda Item 8: Consideration of and possible action on the review of management plans and accomplishments of member districts of Groundwater Management Area 15.

Mr. Van Dresar submitted a report related to the review of management plans within Groundwater Management Area 15.

No action was taken.

Agenda Item 9: Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

Ms. Krause and Mr. Labus stated that the groundwater production used for DeWitt County and Karnes County for the High Production Modeling Scenario contained errors. Ms. Krause and Mr. Labus requested the INTERA review the modeling inputs and outputs and make the necessary corrections to address any identified issues.

Mr. Van Dresar stated that the modeling information for the Baseline Production Scenario and High Production Scenario contained errors regarding Fayette County. Mr. Van Dresar requested that INTERA review the related information, make any necessary correction, and submit the associated modeling files to GMA 15 for review by his technical consultant.

No action was taken.

Agenda Item 10: Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

No action was taken.

Agenda Item 11: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 12: Consideration of and possible action on identification and scheduling of future agenda items.

The representatives identified October 8, 2015 at the next date to hold a meeting of Groundwater Management Area 15.

Agenda Item 13: Receive public comment.

No public comment provided.

Agenda Item 14: Adjournment

MOTION: At 9:30 AM, Mr. Van Dresar moved to adjourn the meeting. Mr. Dohmann seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 8 day of Oct a.d. 2015.

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Groundwater Management Area 15 Representative

ATTEST:

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Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on July 15, 2015.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Stewart
2	Calhoun County Groundwater Conservation District	Tim Andruss
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	Brent Clayton
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	Charlotte Krause
11	Refugio Groundwater Conservation District	Tim Andruss
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:31 AM. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments..

No action was taken.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

Mr. Andruss explained that the minutes of the previous meeting were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Van Dresar moved to approve the meeting minutes as drafted. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.

MOTION: Mr. Hudgins moved to accept the GMA 15 Joint Funding - Balance Sheet – 20150709 as provided by Ms. Krause. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss explained that the Committee, via VCGCD, has received two invoices from INTERA for services provided under the consultancy contract:

INV #04-15-98	$680.00
INV #05-15-32	$620.00

MOTION: Mr. Andruss moved 1) to authorize Charlotte Krause of PVGCD as the GMA 15 Committee Treasurer to issue a disbursement to VCGCD from the GMA 15 joint planning funds in the amount of $1,300.00; 2) request that VCGCD issue payment to INTERA for invoices INV #04-15-98, and INV #05-15-32 in the amount of $1,300.00 upon receipt of funds from PVGCD in the same amount.

Agenda Item 6: Consideration of and possible action on reports and communication from GMA 15 member districts, GMA 15 representatives to Regional Water Planning Groups.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. French informed the Committee of a letter being sent to all groundwater conservation districts regarding the adoption of desired future conditions and the impact on the regional water planning process.

Ms. Ridgeway provided presentation regarding groundwater availability modeling conducted by the Texas Water Development Board.

No action was taken.

Agenda Item 8: Consideration of and possible action on the review of management plans and accomplishments of member districts of Groundwater Management Area 15.

No action was taken.

Agenda Item 9: Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

Mr. Young of INTERA presented information regarding the DFC Development Survey, modeling results, variance allowances for comparison of DFCs to model runs, and suggestions regarding approaches to establishing DFCs for GMA 15.

Representatives discussed the information provided with an emphasis on the comparing modeling results as it related to the suggested variance allowance concept put forth by Mr. Young.

Mr. Dohmann provided the Committee with a proposed DFC for Goliad County using data from the Baseline Run with 50% Recharge model run.

Mr. Andruss explained that, according to the adopted schedule for DFC development, the next meeting of GMA 15 was planned for August 2015 and recommended the August 13 as the meeting date.

No action was taken.

Agenda Item 10: Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

No action was taken.

Agenda Item 11: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 12: Consideration of and possible action on identification and scheduling of future agenda items.

No action was taken.

Agenda Item 13: Receive public comment.

No public comment provided.

Agenda Item 14: Adjournment

MOTION: At approximately 12:50 PM, Mr. Van Dresar moved to adjourn the meeting. Ms. Krause seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 13 day of August a.d. 2015.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on April 9, 2015.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Stewart
2	Calhoun County Groundwater Conservation District	Tim Andruss
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	-
6	Corpus Christi ASR Conservation District	-
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	Charlotte Krause
11	Refugio Groundwater Conservation District	Tim Andruss
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:30 AM. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments. Mr. Dohmann provided information regarding ongoing efforts by the EPA regarding rules related to insitu uranium mining.

No action was taken.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

Mr. Andruss explained that the minutes of the previous meeting were sent to the GMA 15 representatives prior to this meeting.

MOTION: Mr. Van Dresar moved to approve the meeting minutes as drafted. Mr. Hudgins seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.

MOTION: Mr. Van Dresar moved to accept the GMA 15 Joint Funding - Balance Sheet – 20150108 as provided by Ms. Krause with the request that Ms. Krause submit the profit and loss report for the same period the member districts. Mr. Hudgins seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss explained that the Committee, via VCGCD, has received two invoices from INTERA for services provided under the consultancy contract:

INV #01-15-74	$2,907.50
INV #02-15-83	$1,457.50

MOTION: Mr. Hudgins moved 1) to authorize Charlotte Krause of PVGCD as the GMA 15 Committee Treasurer to issue a disbursement to VCGCD from the GMA 15 joint planning funds in the amount of $4,365.00; 2) request that VCGCD issue payment to INTERA for invoices 01-15-74, and 02-15-83 in the amount of $4,365.00 upon receipt of funds from PVGCD in the same amount; and 3) request that future invoices related to the services provide to GMA 15 be itemized and correlated to the tasks in the approved scope of work. Mr. Van Dresar seconded the motion. Mr. Dohmann voted against the motion. The motion passed with 10 votes for and 1 vote against.

Agenda Item 6: Consideration of and possible action on reports and communication from GMA 15 member districts, GMA 15 representatives to Regional Water Planning Groups.

Mr. Dohmann provided information regarding the recent activities of Region L.
Mr. Van Dressar provided information regarding the recent activities of Region K.
Mr. Hudgins provided information regarding the recent activities of Region P.
Mr. Stewart provided information regarding the recent activities of Region N.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. Allen provided a message from Mr. French regarding TWDB's interpretation of TWC 36.108 regarding the deadline for proposing a DFC.

Mr. Dohmann requested that TWDB make a presentation to the Committee at an upcoming meeting regarding the GAM update project for the Gulf Coast Aquifer.

No action was taken.

Agenda Item 8: Consideration of and possible action on the review of management plans and accomplishments of member districts of Groundwater Management Area 15.

Mr. Andruss presented the following Assessment of Management Plans of Districts within Groundwater Management Area 15:

District Name / Plan Version	TWC 36.108(c)(1): Impact of MP Goals on Planning	TWC 36.108(c)(2): Effectiveness of MP Measures for Conserving and Protecting GW and Preventing Waste of GW	TWC 36.108(c)(2): Degree to which MP achieve the DFC
Bee Groundwater Conservation District / Version 2013	Positive Impact	Positive Effect	Adequate Achievement of DFC
Calhoun County Groundwater Conservation District	N/A	N/A	N/A
Coastal Bend Groundwater Conservation District / Version 2014	Positive Impact	Positive Effect	Adequate Achievement of DFC
Coastal Plains Groundwater Conservation District / Version 2009	Positive Impact	Positive Effect	N/A - MP Adopted prior to DFC Adoption by GMA 15
Colorado County Groundwater Conservation District / Version 2014	Positive Impact	Positive Effect	Adequate Achievement of DFC
Corpus Christi ASR Conservation District / Version 2014	Positive Impact	Positive Effect	Adequate Achievement of DFC
Evergreen Underground Water Conservation District / Version 2011	Positive Impact	Positive Effect	N/A - MP Adopted prior to MAG development by TWDB
Fayette County Groundwater Conservation District / Version 2013	Positive Impact	Positive Effect	Adequate Achievement of DFC
Goliad County Groundwater Conservation District / 2013	Positive Impact	Positive Effect	Adequate Achievement of DFC
Pecan Valley Groundwater Conservation District /	Positive Impact	Positive Effect	Adequate Achievement of DFC

Version 2014			
Refugio Groundwater Conservation District / Version 2014	Positive Impact	Positive Effect	Adequate Achievement of DFC
Texana Groundwater Conservation District / Version 2011	Positive Impact	Positive Effect	Adequate Achievement of DFC
Victoria County Groundwater Conservation District / Version 2013	Positive Impact	Positive Effect	Adequate Achievement of DFC

MOTION: Mr. Stewart moved to accept the assessment of management plans of member districts of Groundwater Management Area 15. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 9: Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

The Committee considered the GMA 15 – DFC Development Survey. Members expressed concern about the ability to respond to the survey in general, specific portions of the survey, and the lack of questions regarding topics of interest to them. **The Committee established a deadline of May 15, 2015 for submitting responses to the survey to the GMA 15 Administrator. The survey responses would be forwarded to INTERA the week of May 17, 2015.**

The Committee considered future simulations of pumping scenarios. The discussion focused on the appropriate method to examine the effects of prolonged drought. **The Committee authorized the GMA 15 Administrator to request that INTERA run a simulation of the Baseline Pumping Scenario with recharge reduced by 50% during the predictive period.**

The Committee considered a proposed schedule for tasks to be completed by GMA 15 for the proposal and adoption of Desired Future Condition. **The Committee accepted the proposed schedule and authorized the GMA 15 Administrator to schedule and prepare for any necessary meeting to comply with the schedule.**

Agenda Item 10: Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

No action was taken.

Agenda Item 11: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 12: Consideration of and possible action on identification and scheduling of future agenda items.

No action was taken.

Agenda Item 13: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment provided.

Agenda Item 14: Adjournment

MOTION: At approximately 11:30 AM, Mr. Van Dresar moved to adjourn the meeting. Mr. Labus seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 15 day of July a.d. 2015.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on January 8, 2015.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	-
2	Calhoun County Groundwater Conservation District	Tim Andruss
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	-
6	Corpus Christi ASR Conservation District	-
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	Charlotte Krause
11	Refugio Groundwater Conservation District	Tim Andruss
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:30 AM. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments.

No action was taken.

Agenda Item 3: Consideration of and possible action on election of GMA 15 Committee Chair, Vice-Chair, Treasurer, and Administrator.

Mr. Andruss explained that The GMA 15 By-Laws require the annual election of GMA-15 Joint Planning Committee Officers. Previously, Mr. Andruss was selected to serve as Chairman; Mr. Hudgins was selected to serve as Vice-Chairman; and Ms. Krause was selected to serve as Treasurer.

The GMA 15 By-Laws require the annual selection of a GMA-15 Joint Planning Committee Administrator. Mr. Andruss was selected to serve as Administrator.

MOTION: Mr. Hudgins moved to retain Mr. Andruss as the Chair and Administrator, Mr. Hudgins as the Vice-Chair, Ms. Krause as Treasurer. Mr. Van Dresser seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on election of GMA 15 representatives to Region K, Region L, Region N, and Region P Regional Water Planning Groups.

Mr. Andruss explained that on December 8, 2011, the GMA 15 representatives appointed the Regional Water Planning Group Representation as follows:
Region K - Jim Brasher of Colorado County GCD
Region P - Neil Hudgins of Coastal Bend GCD and Coastal Plains GCD
Region L - Art Dohmann of Goliad County GCD
Region N - Mark Sugarek of Bee GCD.

No action was taken.

Agenda Item 5: Consideration of and possible action on minutes of the previous meeting.

Mr. Andruss explained that the minutes of the previous meeting were sent to the GMA 15 representatives prior to this meeting. Mr. Dohmann requested that the draft minutes be revised to include language related to the representatives' discussion of additional model runs (see page 4 of revised draft minutes in packet).

MOTION: Mr. Van Dresar moved to approve the meeting minutes as revised. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 6: Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.

Mr. Andruss explained that according to the reports provided by Ms. Krause of Pecan Valley GCD, the GMA 15 joint planning account balance as of November 30, 2014 was $36,658.62. At the previous meeting, the Committee authorized the payment of outstanding invoices in an amount of $1,747.50. The remaining budget for professional services is $34,905.12.

No action taken.

Agenda Item 7: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss explained that The Committee, via VCGCD, had received three invoices from INTERA (see attached) for services provided under the consultancy contract:

Inv# 09-14-49	$11,142.50
Inv# 10-14-92	$3,802.50
Inv# 11-14-47	$4,735.00

Upon examination, the Committee identified that lin# 11-14-47 was not related to the services being provided to GMA 15 under the joint funding agreements and contract with INTERA.

MOTION: Mr. Van Dresar moved 1) to authorize Charlotte Krause of PVGCD as the GMA 15 Committee Treasurer to issued a disbursement to VCGCD from the GMA 15 joint planning funds in the amount of $14,945.00; 2) request that VCGCD issue payment to INTERA for invoices 09-14-49, and 10-14-92 in the amount of $14,945.00 upon receipt of funds from PVGCD in the same amount; and 3) request that future invoices to related to the services provide to GMA 15 be itemized and correlated to the tasks in the approved scope of work. Mr. Hudgins seconded the motion. Mr. Dohmann abstained from the vote. The motion passed.

Agenda Item 8: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Dohmann provided information regarding the economic impact of DFC in Goliad County. The Committee discussed the information provided by Mr. Dohmann.

No action was taken.

Agenda Item 9: Consideration of and possible action on reports and communication from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Representatives to Region L provided an update on recent activities within the regional water planning group.

No action was taken.

Agenda Item 10: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. van Oort, Mr. French, and Ms. Ridgeway of the Texas Water Development Board provided information regarding the GAM update project for the Gulf Coast Aquifer and the DFC development and adoption process.

Mr. Dohmann requested that TWDB make a presentation to the Committee at an upcoming meeting regarding the GAM update project for the Gulf Coast Aquifer.

No action was taken.

Agenda Item 11: Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.

Mr. Andruss presented the following Assessment of Management Plans of Districts within Groundwater Management Area 15 that have been submitted to GMA 15:

District Name / Plan Version	TWC 36.108(c)(1): Impact of MP Goals on Planning	TWC 36.108(c)(2): Effectiveness of MP Measures for Conserving and Protecting GW and Preventing Waste of GW	TWC 36.108(c)(2): Degree to which MP achieve the DFC
Colorado County Groundwater Conservation District / Version 2014	Positive Impact	Positive Effect	Adequate Achievement of DFC

No action was taken.

Agenda Item 12: Consideration of and possible action on the review of accomplishments of the management area.

No action was taken.

Agenda Item 13: Consideration of and possible action on joint planning efforts, including the development of Desired Future Conditions, of Groundwater Management Area 15.

Mr. Andruss explained that:

At the previous meeting, the Committee agree to submit comments and questions by mid-November to be forwarded to INTERA. Ultimately, comments and questions were submitted by Mr. Dohmann and Mr. Andruss.

Mr. Dohmann's comments address a number of possible issues including 1) illogical/absurd results of the Baseline and High-Demand pumping scenarios, 2) substantial difference between GAM-predicted drawdown and field-measured water levels/drawdown, and 3) the results of the Baseline and High-Demand pumping scenarios are disastrous for Goliad County. (See Attached Email Message)

Mr. Andruss' requested data regarding data related to the evaluation of sustainability. (See Attached Email Message)

INTERA provided a letter response to the comments and request for information. Regarding the comments provided by Mr. Dohmann, INTERA suggest that GMA 15 member districts provide feedback regarding a number topics (i.e., "list of questions for districts") and consider adopting a policy of utilizing the MAG for the purpose of demonstrating DFC feasibility. Regarding the request for information related to sustainability, INTERA provided charts depicting average drawdown by layer by county over the predictive period for both the Baseline and High-Demand Pumping Scenarios.

Mr. Van Dresar requested that INTERA provide the underlying data for the average drawdown charts.

Mr. Andruss offered to forward the draft list of questions to the GMA 15 representatives.

Agenda Item 14: Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

No action was taken.

Agenda Item 15: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 16: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss notified the GMA 15 representatives that the next GMA 15 meeting is scheduled for April 9, 2015.

No action was taken.

Agenda Item 17: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment provided.

Agenda Item 18: Adjournment

MOTION: At 11:01 AM, Mr. Van Dresar moved to adjourn the meeting. Mr. Labus seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 9th day of April a.d. 2015.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on October 9, 2014.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Stewart
2	Calhoun County Groundwater Conservation District	Tim Andruss
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	-
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	-
11	Refugio Groundwater Conservation District	Tim Andruss
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:30 AM on October 9, 2014. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments.

No action was taken.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of July 10, 2014.

MOTION: Mr. Van Dresar moved to approve the meeting minutes as drafted. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.

No action taken.

Agenda Item 5: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

The Committee, via VCGCD, has received three invoices from INTERA (see attached) for services provided under the consultancy contract:

Inv# 06-14-122	$1,050.00
Inv# 07-14-83	$435.00
Inv# 08-14-102	$262.50

As of July 2014, the joint funding balance for the Committee was $44655.82. At the previous meeting, the Committee authorized the payment of outstanding invoices in an amount of $7,997.20. The resulting budget for professional services is $36,658.62.

MOTION: Mr. Dohmann moved to authorize Charlotte Krause of PVGCD as the GMA 15 Committee Treasurer to issued a disbursement to VCGCD from the GMA 15 joint planning funds in the amount of $1,747.50 and request that VCGCD issue payment to INTERA for invoices 06-14-122, 07-14-83, and 08-14-102 in the amount of $1,747.50 upon receipt of funds from PVGCD in the same amount. Mr. Hudgins seconded the motion. The motion passed.

Agenda Item 6: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Representatives from Coastal Plains GCD, Coastal Bend GCD, and Colorado County GCD notified the Committee that the districts were completing the process to revise and update their management plans.

Mr. Dohmann provided information regarding a proposed open-pit disposal facility planned for construction and operation in DeWitt County.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports and communication from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Representatives to Region L and Region K provided an update on recent activities within the regional water planning groups.

No action was taken.

Agenda Item 8: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. van Oort and Mr. Shaw of the Texas Water Development Board provided information regarding a new DFC check-list, the GAM update project for the Gulf Coast Aquifer, and Agricultural Ombudsman program.

Mr. Dohmann requested that TWDB make a presentation to the Committee at an upcoming meeting regarding the GAM update project for the Gulf Coast Aquifer.

No action was taken.

Agenda Item 9: Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.

Mr. Andruss presented the following Assessment of Management Plans of Districts within Groundwater Management Area 15 that have been submitted to GMA 15:

District Name / Plan Version	TWC 36.108(c)(1): Impact of MP Goals on Planning	TWC 36.108(c)(2): Effectiveness of MP Measures for Conserving and Protecting GW and Preventing Waste of GW	TWC 36.108(c)(2): Degree to which MP achieve the DFC
Corpus Christi ASR Conservation District / Version 2014	Positive Impact	Positive Effect	N/A - MP Adopted prior to DFC Adoption by GMA 15
Refugio Groundwater Conservation District / Version 2014	Positive Impact	Positive Effect	Adequate Achievement of DFC

No action was taken.

Agenda Item 10: Consideration of and possible action on groundwater pumping scenarios associated with groundwater availability modeling efforts for Groundwater Management Area 15.

Mr. Andruss explained that:

On October 7 and 8, INTERA submitted a number of computer files that contain data (charts, graphs, maps, and GIS data) produced from the modeling of the "Baseline" and "High Production" pumping scenarios submitted by the GMA 15 member districts. GMA 15 representatives, via email, were notified that this information was placed on the GMA 15 web page on the VCGCD website (http://www.vcgcd.org/gma-15.html).

Based on conversations with INTERA, it was agreed that the best use of time and resources would result from member districts reviewing the information contained within the files and submitting comments and questions to the GMA 15 Administrator.

Mr. Andruss requested that member districts submit all comments and questions to him by November 15, 2014 to ensure timely compilation of those comments and submittal to INTERA.

The member districts discussed that Intera was budgeted to make 1 or 2 additional runs and the potential for a run or runs with revised parameters.

Agenda Item 11: Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

The Committee discussed the matter and will provide opportunities at future meetings for member districts to present information regarding their efforts to evaluate DFC achievement and compliance.

No action was taken.

Agenda Item 12: Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

No action was taken.

Agenda Item 13: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 14: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss notified the GMA 15 representatives that the next GMA 15 meeting is scheduled for January 8, 2015.

No action was taken.

Agenda Item 15: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment provided.

Agenda Item 26: Adjournment

MOTION: At 11:05 PM, Mr. Dohmann moved to adjourn the meeting. Mr. Stewart seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 8th day of January a.d. 2015.

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Groundwater Management Area 15 Representative

ATTEST:

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Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on July 10, 2014.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	
2	Calhoun County Groundwater Conservation District	Tim Andruss
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	Brent Clayton
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	Charlotte Krause
11	Refugio Groundwater Conservation District	Tim Andruss
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:40 AM on July 10, 2014. A quorum was present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments.

No action was taken.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of April 10, 2014.

MOTION: Mr. Van Dresar moved to approve the meeting minutes as drafted. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget, financial reports, and future funding requirements.

Mr. Andruss explained that on July 8, 2014, Ms. Krause provided a financial report related to the funds collected to support the GMA 15 joint planning process.

MOTION: Mr. Hudgins moved to accept and approve the financial reports for July 2014. Mr. Van Dresar seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss explained that the Committee, via VCGCD, has received three invoices from INTERA for services provided under the consultancy contract:
Inv# 03-14-119 $2,587.50; Inv# 04-14-90 $5,179.70; Inv# 05-14-108 $230.00.

MOTION: Mr. Andrus moved to authorize Charlotte Krause of PVGCD as the GMA 15 Committee Treasurer to issued a disbursement to VCGCD from the GMA 15 joint planning funds in the amount of $7,997.20 and request that VCGCD issue payment to INTERA for invoices 03-14-119, 04-14-90, and 05-14-108 in the amount of $7,997.20 upon receipt of funds from PVGCD in the same amount. Mr. Brasher seconded the motion. The motion passed.

Agenda Item 6: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports and communication from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

No action was taken.

Agenda Item 8: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Ms. Petrossian informed the Committee that the Board had recently undergone some re-organization and the representatives that would attend future meetings would likely change. Mr. Van Oort was introduced. In addition, a document developed by TWDB titled The Role of Modeled Available Groundwater in Regional Water Planning was provided to the Committee.

No action was taken.

Agenda Item 9: Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.

Mr. Andruss presented the following Assessment of Management Plans of Districts within Groundwater Management Area 15 that have been submitted to GMA 15:

District Name / Plan Version	TWC 36.108(c)(1): Impact of MP Goals on Planning	TWC 36.108(c)(2): Effectiveness of MP Measures for Conserving and Protecting GW and Preventing Waste of GW	TWC 36.108(c)(2): Degree to which MP achieve the DFC
Bee Groundwater Conservation District / Version 2013	Positive Impact	Positive Effect	Adequate Achievement of DFC
Calhoun County Groundwater Conservation District	N/A	N/A	N/A
Coastal Bend Groundwater Conservation District / Version 2009	Positive Impact	Positive Effect	N/A - MP Adopted prior to DFC Adoption by GMA 15
Coastal Plains Groundwater Conservation District / Version 2009	Positive Impact	Positive Effect	N/A - MP Adopted prior to DFC Adoption by GMA 15
Colorado County Groundwater Conservation District / Version 2009	Positive Impact	Positive Effect	N/A - MP Adopted prior to DFC Adoption by GMA 15
Corpus Christi ASR Conservation District / Version 2008	Positive Impact	Positive Effect	N/A - MP Adopted prior to DFC Adoption by GMA 15
Evergreen Underground Water Conservation District / Version 2011	Positive Impact	Positive Effect	N/A - MP Adopted prior to MAG development by TWDB
Fayette County Groundwater Conservation District / Version 2013	Positive Impact	Positive Effect	Adequate Achievement of DFC
Goliad County	Positive Impact	Positive Effect	Adequate

Groundwater Conservation District / 2013			Achievement of DFC
Pecan Valley Groundwater Conservation District / Version 2014	Positive Impact	Positive Effect	Adequate Achievement of DFC
Refugio Groundwater Conservation District / Version 2009	Positive Impact	Positive Effect	N/A - MP Adopted prior to DFC Adoption by GMA 15
Texana Groundwater Conservation District / Version 2011	Positive Impact	Positive Effect	Adequate Achievement of DFC
Victoria County Groundwater Conservation District / Version 2013	Positive Impact	Positive Effect	Adequate Achievement of DFC

Mr. Andruss recommended that member districts consider the management plans of the other districts within Groundwater Management Area 15 as required by TWC 36.108(b) and submit a statement to the GMA 15 Administrator regarding their assessment of the management plans as described in TWC 36.108(c).

No action was taken.

Agenda Item 10: Consideration of and possible action on the review of accomplishments of Groundwater Management Area 15.

Mr. Andruss provided the following chart of accomplishments of the member districts within GMA 15:

District	Achievements and Accomplishments
Bee Groundwater Conservation District	See Annual Report published at:http://www.vcgcd.org/gma-15.html
Calhoun County Groundwater Conservation District	• Organized the Temporary Board of Directors • Adopted Policy Position Statements Of Calhoun County Groundwater Conservation District
Coastal Bend Groundwater Conservation District	See Annual Report published at:http://www.vcgcd.org/gma-15.html
Coastal Plains Groundwater Conservation District	
Colorado County Groundwater Conservation District	See Annual Report published at:http://www.vcgcd.org/gma-15.html

Corpus Christi ASR Conservation District	• Had TWDB report complete titled: Geologic Characterization of and Data Collection in the Corpus Christi Aquifer Storage and Recovery Conservation District and Surrounding Counties • Database was included in the above report. Staff compiled wells from database into a list specific to the district. • Fee: The board approved a permit application fee for the district for the first time • Management Plan: The board approved a management plan that was submitted to the TWDB • New Board Members: The district voted in two new board members after one retirement and one resignation.
Evergreen Underground Water Conservation District	See Annual Report published at:http://www.vcgcd.org/gma-15.html
Fayette County Groundwater Conservation District	See Annual Report published at:http://www.vcgcd.org/gma-15.html
Goliad County Groundwater Conservation District	See Annual Report published at:http://www.vcgcd.org/gma-15.html
Pecan Valley Groundwater Conservation District	See Annual Report published at:http://www.vcgcd.org/gma-15.html
Refugio Groundwater Conservation District	
Texana Groundwater Conservation District	• Satisfiedall management plan goals and objectives for FY13 • Expanded aquifer monitoring network • Developed well registration and permitting program • Investigated and Cooperated with TxRRC on Clean-up of Abandoned Oil Field See Annual Report published at:http://www.vcgcd.org/gma-15.html
Victoria County Groundwater Conservation District	• Satisfied all management plan goals and objectives for FY13 • Expanded aquifer monitoring network • Co-sponsored Regional ASR Feasibility Study • Adopted revised management plan • Sponsored Pump Test Study of Public Water System wells in Victoria See Annual Report published at:http://www.vcgcd.org/gma-15.html

No action was taken.

Agenda Item 11: Consideration of and possible action on groundwater pumping scenarios associated with groundwater availability modeling efforts for Groundwater Management Area 15.

Mr. Andruss explained that:

At the April 10, 2014 GMA 15 meeting, the representatives passed a motion establishing the following modeling scenarios to be evaluated by the technical consultants based on input provided by the member districts of GMA 15: "Baseline Scenario" intended to represent a groundwater production scenario within GMA 15 with a high degree of probability of occurring based on reasonably expected levels of development and groundwater demand; and "High Stress/High Demand Scenario" intended to represent a groundwater production scenario within GMA 15 with a relatively lower degree of probability of occurring based on maximum conceivable levels of development and groundwater demand.

INTERA provided map and spreadsheet templates to for the purpose of capturing the pumping scenario input from each member district. Each member district, except Corpus Christi ASR Conservation District, provided input regarding their preferences for the pumping scenarios. See Attached.

The representatives passed motions authorizing Mr. Andruss to contact the commissioners' courts for those counties with GCD representation at GMA 15 and the chairmen of GMA 14 and GMA 16 for the purpose of seeking input for their respective areas for GMA 15 modeling efforts. GMA 14 responded to the information request.

The Committee reviewed the pumping zones and pumping schedules provided by member districts. Evergreen UWCD, Pecan Valley GCD, and Colorado County GCD agreed to provide revisions to the draft pumping zones and pumping schedules. Fayette County GCD agreed to review their submittal and provide any necessary corrections.

The Committee agree to authorize 1) the GMA 15 Administrator to gather any additional submittals and revisions related to the Baseline and High-Demand modeling scenarios from member districts, and 2) the GMA 15 Administrator to transmit the member district submittals and the adjacent GMA submittals to INTERA for the purposes to executing the associated model runs.

Agenda Item 12: Consideration of and possible action on groundwater availability models related to the development of desired future conditions for Groundwater Management Area 15.

Mr. Andruss explained that on July 22, 2014, Texas Water Development Board staff held a meeting, and invited the Technical Advisory Group (TAG) for the Groundwater Availability Modeling (GAM) Program to provide guidance to the TWDB on the GAM program. The agenda of the meeting included discuss items: (1) the status of GAM Program, (2) feedback concerning the next round of GAM projects, and (3) feedback concerning GAM review and adoption of models developed outside of the program. The GMA 15 representatives have discussed and expressed concern regarding the Central Gulf Coast Groundwater Availability Model.

Mr. Andruss recommended that member districts consider the impact, if any, model revisions or other GAM-related initiatives would have on the present and future joint planning efforts of GMA 15.

No action was taken.

Agenda Item 13: Consideration of and possible action on designation of relevant aquifers related to development of desired future conditions for Groundwater Management Area 15.

Mr. Andruss explained that under TWC 36. 108(d), GMAs must propose for adoption desired future conditions for the relevant aquifers. During the previous DFC development cycle, GMA 15 designated the Gulf Coast Aquifer System as a relevant aquifer and subsequently developed a DFC for the aquifer. The decision to limit the designation of relevant aquifers within GMA 15 to the Gulf Coast Aquifer System was based on a number of practical considerations including the lack of suitable groundwater availability models for other aquifers intersecting GMA 15 and the limited, if not complete absence, of groundwater production from the other aquifers. The decision appeared to be appropriate given practical considerations and the statutory requirements in effect at the time.

However, given the present circumstances (i.e., increase interest in poor-quality groundwater resources) related to water planning and statutory requirements for groundwater management, a limiting the designation of relevant aquifers to the Gulf Coast Aquifer System (despite the practical considerations above) may not be appropriate during the current DFC development cycle.

Mr. Andruss recommended that each district consider the matter of relevant aquifer designations and provide feedback to the GMA 15 administrator prior to the next GMA 15 meeting scheduled for October 9, 2014.

No action was taken.

Agenda Item 14: Consideration of and possible action on estimation of exempt use groundwater production within Groundwater Management Area 15.

No action was taken.

Agenda Item 15: Consideration of and possible action on methods and approaches to evaluate compliance and achievement of desired future conditions of Groundwater Management Area 15.

Mr. Andruss explained that in the past, a number of representatives expressed an interest in discussing the methods and approaches used by member districts to evaluate aquifer conditions relative to the GMA 15 DFC.

No action was taken.

Agenda Item 16: Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

No action was taken.

Agenda Item 17: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

No action was taken.

Agenda Item 18: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss notified the GMA 15 representatives that the next GMA 15 meeting is scheduled for October 9, 2014.

No action was taken.

Agenda Item 19: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment provided.

Agenda Item 20: Adjournment

MOTION: At 11:49 PM, Mr. Van Dresar moved to adjourn the meeting. Mr. Labus seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 9th day of Oct. a.d. 2014.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on April 10, 2014.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Stewart
2	Calhoun County Groundwater Conservation District	Tim Andruss
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	Brent Clayton
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	Charlotte Krause
11	Refugio Groundwater Conservation District	R. W. West (non-voting)
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:31 AM on April 10, 2014. A quorum to conduct business was declared present.

Attached to these minutes is a copy of the meeting sign-in sheet.

No action was taken.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments. Mr. Jerry James provided an update regarding the City of Victoria's efforts to obtain amendments to certain surface water permits.

No action was taken.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of January 9, 2014.

MOTION: Mr. Van Dresar moved to approve the meeting minutes as drafted. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget and financial reports.

Mr. Andruss explained that on April 8, 2014, Ms. Krause provided a financial report related to the funds collected to support the GMA 15 joint planning process.

MOTION: Mr. Dohmann moved to accept and approve the financial reports for April 2014. Mr. Van Dresar seconded the motion. The motion passed.

Agenda Item 13: Consideration of and possible action on invoices for professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss explained that the Committee, via VCGCD, had receive two invoices from INTERA for services provided under the consultancy contract in the amounts of $3,477.50 and $1,866.68.

MOTION: Mr. Dohmann moved to authorize Charlotte Krause of PVGCD as the GMA 15 Committee Treasurer to issued a disbursement to VCGCD from the GMA 15 joint planning funds in the amount of $5,344.18 and request that VCGCD issue payment to INTERA for invoices 01-14-113 and 02-14-39 in the amount of $5.344.18 upon receipt of funds from PVGCD in the same amount. Mr. Brasher seconded the motion. The motion passed.

Agenda Item 11: Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss requested the Mr. Young and Mr. Oliver of INTERA provide the Committee with a presentation regarding the professional services to be provided and the decision topics to be considered by the Committee.

The Committee participated in discussions regarding the following topics lead by INTERA: 1. Meeting Objectives; 2. 2010 Joint Planning Process; 3. INTERA Survey Results; 4. Desired Future Conditions Considerations; 5. Desired Future Condition Requirements; 6. Groundwater Availability Model Runs; 7. Pumping Distributions for GAM simulations; 8. Explanatory Report; 9. Responsibilities of INTERA and GAM 15 Districts; 10. Proposed Schedule; 11. Review and Document Meeting Decisions.

MOTION: Mr. Dohmann moved to apply the ratio groundwater supplies and strategies to surface water supplies and strategies of the 2012 State Water Plan (groundwater/surface water split) to the demands established for the 2017 State Water Plan in the event that GMA 15 elects to conduct a model run examining a pumping scenario approximating production for the 2017 State Water Plan which was not yet complete. Mr. Brasher seconded the motion. The motion passed.

MOTION: Mr. Andruss moved to authorize the GMA 15 Chairman to communicate with and seek input regarding modeling efforts by GMA 15 from the commissioners' courts of the counties within GMA 15 without representation by a GCD. Mr. Dohmann seconded the motion. The motion passed.

MOTION: Mr. Andruss moved to authorize the GMA 15 Chairman to communicate with and seek input regarding modeling efforts by GMA 15 from Groundwater Management Area 14 and Groundwater Management Area 16. Mr. Dohmann seconded the motion. The motion passed.

MOTION: Mr. Stewart moved establish year 1999 as the beginning of the predictive time frame for future model runs of GMA 15. Mr. Brasher seconded the motion. The motion passed. Mr. Dohmann abstained.

MOTION: Mr Van Dresar moved to establish year 2070 as the end of the predictive time frame for future model runs of GMA 15. Mr. Sugarek seconded the motion. The motion passed.

MOTION: Mr. Sugarek moved to establish the following list as the scales to report model scenario results: Average for whole Gulf Coast Aquifer System; Average for each unit in Gulf Coast Aquifer System; Average by county/district for Gulf Coast Aquifer; Average by county/district for each unit of the Gulf Coast Aquifer (Chicot, Evangeline, Burkeville, Jasper); Separate outcrop from down-dip (approximates unconfined and confined areas). Mr. Dohmann seconded the motion. The motion passed.

MOTION: Mr. Andruss moved to establish the following modeling scenarios to be evaluated by the technical consultants based on input provided by the member districts of GMA 15: "Baseline Scenario" intended to represent a groundwater production scenario within GMA 15 with a high degree of probability of occurring based on reasonably expected levels of development and groundwater demand; and "High Stress/High Demand Scenario" intended to represent a groundwater production scenario within GMA 15 with a relatively lower degree of probability of occurring based on maximum conceivable levels of development and groundwater demand. Mr. Labus seconded the motion. The motion passed.

Agenda Item 8: Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.

Mr. Andruss provided the following draft assessment of management plans of districts within Groundwater Management Area 15 that have been adopted or revised after 2/14/2013:

District Name	TWC 36.108(c)(1): Impact of MP Goals on Planning	TWC 36.108(c)(2): Effectiveness of MP Measures for Conserving and Protecting GW and Preventing Waste of GW	TWC 36.108(c)(2): Degree to which MP achieve the DFC
Fayette County Groundwater Conservation District	Positive Impact	Positive Effect	Adequate Achievement of DFC
Goliad County Groundwater Conservation District	Positive Impact	Positive Effect	Adequate Achievement of DFC
Victoria County Groundwater Conservation District	Positive Impact	Positive Effect	Adequate Achievement of DFC

No action was taken.

Agenda Item 9: Consideration of and possible action on the review of accomplishments of the management area.

Mr. Andruss provided the following listing of achievements and accomplishments within Groundwater Management Area 15:

District	Achievements and Accomplishments
Bee Groundwater Conservation District	
Calhoun County Groundwater Conservation District	• Organized the Temporary Board of Directors • Adopted Policy Position Statements Of Calhoun County Groundwater Conservation District
Coastal Bend Groundwater Conservation District	
Coastal Plains Groundwater Conservation District	
Colorado County Groundwater Conservation District	
Corpus Christi ASR Conservation District	• Had TWDB report complete titled: Geologic Characterization of and Data Collection in the Corpus Christi Aquifer Storage and Recovery Conservation District and Surrounding Counties • Database was included in the above report. Staff compiled wells from database into a list specific to the district. • Fee: The board approved a permit application fee for the district for the first time • Management Plan: The board approved a management plan that was submitted to the TWDB • New Board Members: The district voted in two new board members after one retirement and one resignation.
Evergreen Underground Water Conservation District	
Fayette County Groundwater Conservation District	
Goliad County Groundwater Conservation District	
Pecan Valley Groundwater	

Conservation District	
Refugio Groundwater Conservation District	
Texana Groundwater Conservation District	• Satisfied all management plan goals and objectives for FY13 • Expanded aquifer monitoring network • Developed well registration and permitting program • Investigated and Cooperated with TxRRC on Clean-up of Abandoned Oil Field
Victoria County Groundwater Conservation District	• Satisfied all management plan goals and objectives for FY13 • Expanded aquifer monitoring network • Co-sponsored Regional ASR Feasibility Study • Adopted revised management plan • Sponsored Pump Test Study of Public Water System wells in Victoria

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Ms. Petrossian informed the Committee that TWDB was investigating work efforts to improve the Southern Gulf Coast GAM and the modified Southern Gulf Coast GAM may be used to develop Modeled Available Groundwater estimates for GMA 15 in the future.

No action was taken.

Agenda Item 6: Consideration of and possible action on reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Mr. Brasher provided an update on planning activities of Region K RWPG including intent of some GCDs within the Region K RWPG to seek funding for groundwater joint planning efforts from regional water planning groups.

No action was taken.

Agenda Item 14: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss notified the GMA 15 representatives that the next GMA 15 meeting is scheduled for July 10, 2014.

Agenda Item 15: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment provided.

Agenda Item 16: Adjournment

MOTION: At 2:40 PM, Mr. Stewart moved to adjourn the meeting. Mr. Van Dresar seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 10th day of July a.d. 2014.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on January 9, 2014.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Steward
2	Calhoun County Groundwater Conservation District	Frank Anzaldua
3	Coastal Bend Groundwater Conservation District	
4	Coastal Plains Groundwater Conservation District	
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Lavaca County Groundwater Conservation District	
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	
13	Texana Groundwater Conservation District	Tim Andruss
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to order and welcome guests.

Mr. Andruss called the meeting to order at 9:30 AM on January 9, 2014. A quorum to conduct business was declared present.

Attached to these minutes is a copy of the meeting sign-in sheet.

Agenda Item 2: Receive public comment.

Mr. Andruss offer to accept any public comments. Mr. Loffgren provided comments related to best use of tax revenue and the use of fees to fund district operations.

Agenda Item 3: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of October 20, 2013.

MOTION: Mr. Stewart moved to approve the meeting minutes as drafted. Ms. Krause seconded the motion. The motion passed.

Agenda Item 4: Consideration of and possible action on GMA 15 budget and financial reports.

Ms. Krause summarized the information provided in the financial reports noting the only outstanding contribution to the joint planning funding was Corpus Christi ASRCD.

MOTION: Mr. Andruss moved to approve the financial statements of January 8, 2014 as submitted by Ms. Krause. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 5: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Dohmann provided an update of related to Goliad County GCD including information regarding water level data measurements as compared to predicted water levels derived from the GMA 15 DFC MAG Run. Mr. Dohmann requested that each member GCD provide information regarding their water level monitoring efforts to the GMA at an upcoming meeting.

Mr. Van Dresar explained that Fayette County GCD had recently adopted a management plan and a rule revision effort was underway.

No action was taken.

Agenda Item 6: Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Mr. Brasher provided an update on planning activities of Region K RWPG including the impact of implementation of requirements associated with "Prop 6".

Mr. Dohmann provided an update on the planning activities of Region L RWPG including recent adjustments to the irrigation water usage estimates being more closely aligned with the information held by GCDs in the planning group area.

No action was taken.

Agenda Item 7: Consideration of and possible action on appointment of Groundwater Management Area 15 representatives for regional water planning groups.

The GMA 15 representatives discussed the current representation as appointed by the committee in the past.

No action was taken.

Agenda Item 9: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Ms. Backhouse provided a summary of the recent developments at TWDB including reorganization of the agency, rule making related to implementation of the SWIF funds, TWDB memo regarding GCD exemptions, and estimates of Total Recoverable Storage for GMA 15.

No action was taken.

Agenda Item 9: Consideration of and possible action on regional water planning group member alternates.

Mr. Andruss explained that the Region L Administrator has requested that each member of Region L RWPG designate an alternate representatives. The GMA 15 representatives discussed the advantages, disadvantages, and the appropriated approach to designating alternate representatives from GMA 15 to RWPGs.

MOTION: Mr. Van Dresar moved to authorize GMA 15 representatives to regional water planning groups to designated alternate representatives in accordance with the applicable RWPG by-laws that satisfy the conditions and requirements to be a representative to GMA 15. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 10: Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.

Mr. Andruss explained that GMA 15 and the GCDs individually have an ongoing responsibility to review the management plans of member GCDs.

Mr. Andruss agree to facilitate this effort by assembling the management plans of the member GCDs and developing an assessment of the management plans in accordance with Sec 36.108 Texas Water Code.

The GMA 15 representatives agreed that, by February 15, each GCD was to either submit a copy of their approved management plan to the Administrator or send an email message to the administrator identify the internet location from which the management plan could be downloaded.

The GMA 15 representatives agreed that the review of the management plans would be considered at the April 10, 2014 GMA 15 meeting.

Agenda Item 11: Consideration of and possible action on the review of accomplishments of the management area.

Mr. Andruss explained that GMA 15 has an ongoing responsibility to review the accomplishments of the management area.

Mr. Andruss agree to facilitate this effort by assembling the annual reports of the member GCDs and developing an assessment of the reports in accordance with Sec 36.108 Texas Water Code.

The GMA 15 representatives agreed that, by February 15, each GCD was to submit a copy of their most recently approved annual report to the Administrator.

The GMA 15 representatives agreed that the review of the accomplishments would be considered at the April 10, 2014 GMA 15 meeting.

Agenda Item 12: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

Mr. Andruss notified the GMA 15 representatives that the Victoria County Groundwater Conservation District Board of Directors requests that the GMA consider a new or amended DFC that does not a reference Table 7 of GAM Run 10-008 Addendum.

The GMA 15 representatives discussed the various methods and approaches that could be used to define a DFC as well as the possible consequences related to those approaches.

Agenda Item 13: Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss notified the committee that VCGCD and Intera has finalized and executed an agreement for the professional services related to the development and adoption of DFCs for Aquifers within GMA 15.

The GMA 15 representatives discussed the documentation/questionnaire provided Intera to be used to obtain feedback from member GCDs regarding their preferences for the DFC for GMA 15.

The GMA 15 representatives agreed to request that each GCD submit their feedback, both completed questionnaire and requested pumping adjustments for GAM runs to the Administrator by February 15, 2014.

Mr. Andruss agree to inquire about obtaining the "2010 DFC joint-planning file" for use by the GCDs to respond to the Intera's request for pumping adjustment information.

Agenda Item 14: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss notified the GMA 15 representatives that the next GMA 15 meeting is scheduled for April 10, 2014 and that the following topics would be placed on the agenda:

- Review of management plans of member districts of Groundwater Management Area 15
- Review of accomplishments of the management area
- Professional services related to the development and adoption of DFCs for Aquifers within GMA 15
- GCD reports on monitoring and DFC achievement

Mr. Andruss requested that any representative wishing to have an additional item added to the meeting agenda should notify him by March 24, 2014.

Agenda Item 9: Receive public comment.

Mr. Andruss offer to accept any public comments. Mr. James requested that GMA 15 meeting packets be provided to the public in advance to the meeting.

Agenda Item 10: Adjournment

MOTION: At 11:49 AM, Mr. Stewart moved to adjourn the meeting. Mr. Labus seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 10th day of April a.d. 2014.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on October 10, 2013.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Stewart
2	Calhoun County Groundwater Conservation District	Frank Anzaldua
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	
6	Corpus Christi ASR Conservation District	
7	Evergreen Underground Water Conservation District	Russell Labus
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Pecan Valley Groundwater Conservation District	Charlotte Krause
11	Refugio Groundwater Conservation District	Shana Niemann
12	Texana Groundwater Conservation District	Tim Andruss
13	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to Order

Mr. Andruss called the meeting to order at 9:32 AM on October 10, 2013. A quorum to conduct business was declared present.

Mr. Andruss informed the committee that a letter from Mr. Kelly Mills of TCEQ had been received which indicated that Lavaca County GCD is dissolved as of September 1, 2013.

Attached to these minutes is a copy of the meeting sign-in sheet.

Agenda Item 2: Welcome guests and introductions

Mr. Andruss welcomed the guests and various members of the audience introduced themselves to the committee.

No action was taken.

Agenda Item 3: Receive public comment.

Mr. Andruss offer to accept any public comments. No comments were provided.

No action was taken.

Agenda Item 4: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of June 13, 2013.

MOTION: Mr. Van Dresar moved to approve the meeting minutes as drafted. Ms. Neimann seconded the motion. The motion passed unanimously.

Agenda Item 5: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Van Dresar informed the committee that Fayette County GCD's management plan had been approved by TWDB.

Mr. Dohmann informed the committee that Goliad County GCD's management plan had been approved by TWDB.

Ms. Krause informed the committee that Pecan Valley GCD had proposed rule changes.

Mr. Andruss informed the committee that Victoria County GCD's management plan had been approved by TWDB and proposed ruled changes.

No action was taken.

Agenda Item 6: Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Mr. Dohmann provided an update regarding matters relevant to the planning activities of the Region L water planning group including information related to non-municipal demands, per capita water usage values, and GBRA's application for surface water permits to TCEQ.

Mr. Van Dresar provided an update regarding matters relevant to the planning activities of the Region K water planning group including Proposition 6, prioritization of projects, and 2070 MAG values.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Ms. Backhouse of TWDB submitted to the committee a guidance document related to DFC explanatory reports. Attached to these minutes is a copy of the guidance document.

No action was taken.

Agenda Item 8: Consideration of and possible action on an agreement to obtain professional services from the preferred respondent to the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss provided the following summary in the meeting packet.

On June 13, 2013, the GMA 15 representatives established a committee to negotiate terms with the Intera Inc. as the preferred respondent to GMA 15's RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.

The committee comprised of Mr. Brasher, Mr. Dohmann and Mr. Andruss met and communicated via email to identify the points of negotiation regarding Intera's proposal. In August 2013, the committee identified the tasks of Intera's proposal that it preferred by adjusted to address the funding issue. The letter is included in the packet.

In a letter dated September 4, 2013, Steve Young expressed Intera's agreement with the proposed adjustments to the tasks of the proposal. The letter is included in the packet.

The committee discussed the matter.

MOTION: Mr. Van Dresar moved to accept the revisions to Intera's proposal for providing Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15 as documented in Intera's letter dated September 4, 2013 and request that the Victoria County Groundwater Conservation District Board of Directors consider entering into an agreement with Intera Inc. for the purposes obtaining the services on the behalf of GMA 15 and its member districts in accordance with GMA 15's Cost Sharing Agreement. Mr. Stewart seconded the motion. The motion passed.

Agenda Item 9: Consideration of and possible action on election of GMA-15 Joint Planning Committee Officers.

Mr. Andruss provided the following summary in the meeting packet.

The GMA 15 By-Laws require the annual election of GMA-15 Joint Planning Committee Officers. The committee elected officers in October 2012. Mr. Andruss was elected to serve as Chairman, Mr. Hudgins was elected to serve as Vice-Chairman, and Ms. Krause was elected to serve as Treasurer.

MOTION: Mr. Stewart moved to re-elect the Mr. Andruss as Chairman, Mr. Hudgins as Vice-Chairman, and Ms. Krause as Treasurer. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 10: Consideration of and possible action on selection of a GMA-15 Joint Planning Committee Administrator.

Mr. Andruss provided the following summary in the meeting packet.

The GMA 15 By-Laws require the annual selection of a GMA-15 Joint Planning Committee Administrator. The committee selected the administrator in October 2012. Mr. Andruss was selected to serve as Administrator.

MOTION: Mr. Stewart moved to re-elect Mr. Andruss as the Administrator. Mr. Dohmann seconded the motion. The motion passed.

Agenda Item 11: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

Mr. Andruss provided the following summary in the meeting packet.

Previously, the member districts passed a motion requesting that "any member district proposing to adopt a new or amended DFC provide at least 60-day notice prior to the next GMA 15 meeting to the GMA-15 Administrator."

As of October 9, 2013, GMA 15 had not received any requests to adopt a new or amended DFC.

No action was taken.

Agenda Item 12: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss provided the following summary in the meeting packet.

The next meeting will be scheduled January 9, 2014. The agenda for the January 9, 2014 meeting will include the following:

1. *Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.*

2. *Consideration of and possible action on the review of accomplishments of the management area.*
3. *Consideration of and possible action on professional services related to the development and adoption of DFCs for Aquifers within GMA 15.*
4. *Consideration of and possible action on appointment of GMA 15 representatives to regional water planning groups.*

GMA 15 Representatives wishing to have other agenda items added to the meeting for January 9, 2014, should notify the administrator in writing by December 20, 2013.

No action was taken.

Agenda Item 13: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comments were provided.

No action was taken.

Agenda Item 14: Adjournment

MOTION: At 10:15 AM, Ms. Neimann moved to adjourn the meeting. Mr. Van Dresar seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

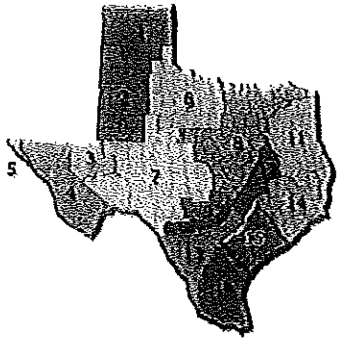
Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 9th day of January a.d. 2014.

____
Groundwater Management Area 15 Representative

ATTEST:

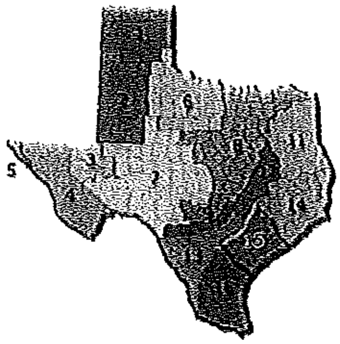
____
Groundwater Management Area 15 Representative



GMA 15

DATE: October 10, 2013

NAME	COMPANY OR ORGANIZATION
Bill Thaman	FREESE AND NICHOLS
ART DOHMANN	GCGCD
Shana P. Niemann	Refugio GCD
Robert West	"
Russell Labus	Evergreen UWCD
LONNIE STEWART	Bee GCD
Paul Kirby	DBS+A
K Ell[illegible]	VCGCD
FRANK ANZALDUA	CCGWCD
Barbara Smith	GCGCD
Leo J wick	FCGWA
DAVID A. VAN DRESAR	FCGCD.
[illegible]	CBGCD/CPGCD
[illegible]	CON
James Dodson	NEI



GMA 15

DATE: October 10, 2013

NAME	COMPANY OR ORGANIZATION
Jack Wright	O'Connor Energy

Explanatory Report for Submittal of Desired Future Conditions to the Texas Water Development Board

Texas Water Code § 36.108 requires groundwater conservation districts to submit desired future conditions of the groundwater resources in their groundwater management area to the executive administrator of the Texas Water Development Board (TWDB). The TWDB expects to receive the following in a submission packet (31 Texas Administrative Code § 356.32) no later than 60 days after final adoption by the groundwater management area of a desired future condition:

- A copy of the adopted desired future 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);
- a copy of the resolution from the groundwater conservation districts, within a groundwater management area, adopting the desired future conditions;
- a copy of the notice that was posted for the joint planning meeting at which the districts collectively adopted the desired future condition(s);
- the name of the designated representative of the districts in the groundwater management area;
- any groundwater availability model files or aquifer assessments acceptable to the executive administrator used in developing the adopted desired future conditions with documentation sufficient for TWDB staff to replicate the work; and,
- any other information the executive administrator may require in order to estimate the modeled available groundwater.

The Texas Water Code and TWDB rules do not specify a format or organization for the explanatory report. Therefore, districts in groundwater management areas are free to develop explanatory reports that best suit the needs of the districts and fulfill the requirements of the statute. The TWDB recommends that an explanatory report be organized in such a way as to facilitate use by groundwater stakeholders and district constituents. The report will also be a key document if a petition is filed challenging the reasonableness of a desired future condition. The following paragraphs describe a possible approach to organizing the explanatory report.

Elements of the Explanatory Report

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. 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.

Factors identified in Texas Water Code §36.108 (d) that are to be discussed in the explanatory report include:

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 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.

The desired future conditions proposed under Texas Water Code §36.108 (d) must:

a. be established for each aquifer, subdivision of an aquifer, or geologic strata, or
b. be established for each geographic area overlying an aquifer in whole or in part or subdivision 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.

Possible Outline of the Explanatory Report[1]

Considering the above requirements and factors, one option for organizing the explanatory report would include the following outline:

[1] The TWDB does not recommend, endorse, or approve a particular outline; the option presented is one possibility to consider that would address the provisions of TWC §36.108. Districts in a groundwater management area should identify a report presentation style that best suits the needs of its member districts and constituents.

1. Aquifer A (includes aquifer description and the desired future condition)
   1.1. Policy justification
   1.2. Technical justification
   1.3. Factor consideration
      1.3.1. Aquifer uses or conditions
      1.3.2. Water supply needs
      1.3.3. Water management strategies
      1.3.4. Hydrological conditions
         1.3.4.1. Total estimated recoverable storage (provided by TWDB)
         1.3.4.2. Average annual recharge
         1.3.4.3. Inflows
         1.3.4.4. Discharge
      1.3.5. Environmental impacts
         1.3.5.1. Springflow
         1.3.5.2. Groundwater/Surface Water Interaction
      1.3.6. Subsidence impacts
      1.3.7. Socioeconomic impacts
      1.3.8. Private property impacts
      1.3.9. Achievement feasibility
      1.3.10. Other information
   1.4. Discussion of other desired future conditions considered
   1.5. Discussion of other recommendations
      1.5.1. Advisory committees
      1.5.2. Public comments
2. Aquifer B (repeat outline for Aquifer A, as appropriate and applicable)

Appendices (such as the Total Estimated Recoverable Storage report from the TWDB, applicable GAM runs, other supporting documentation as necessary to support the desired future conditions report)

Documentation Supporting Classification of an Aquifer as Non-Relevant

Districts in a groundwater management area may, as part of the process for adopting and submitting desired future conditions, propose classification of a portion or portions of a relevant aquifer as non-relevant (31 Texas Administrative Code 356.31 (b)). This proposed classification of an aquifer may be made if the districts determine that aquifer characteristics, groundwater demands, and current groundwater uses do not warrant adoption of a desired future condition.

The districts must submit to the TWDB the following documentation for the portion of the aquifer proposed to be classified as non-relevant:

1. A description, location, and/or map of the aquifer or portion of the aquifer;

2. A summary of aquifer characteristics, groundwater demands, and current groundwater uses, including the total estimated recoverable storage as provided by the TWDB, that support the conclusion that desired future conditions in adjacent or hydraulically connected relevant aquifer(s) will not be affected; and

3. An explanation of why the aquifer or portion of the aquifer is non-relevant for joint planning purposes.

Submission Packet

The TWDB expects to receive desired future conditions for the entirety of each aquifer in the groundwater management area in the submission packet. A packet will be considered as administratively complete when it contains all of the required documents. A completed packet needs to be sent by certified mail (or other traceable method) to the TWDB at the following address:

Executive Administrator
Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

If sending by private carrier, please send to this address:

Executive Administrator
Texas Water Development Board
1700 North Congress Avenue
Austin, Texas 78701
(512) 463-7847

Updated 07/13

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on June 13, 2013.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Stewart
2	Calhoun County Groundwater Conservation District	Frank Anzaldua
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	Brent Clayton
7	Evergreen Underground Water Conservation District	Mike Mahoney
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Lavaca County Groundwater Conservation District	
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	Shana Niemann
13	Texana Groundwater Conservation District	Tim Andruss
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to Order

Mr. Andruss called the meeting to order at 9:30 AM on June 13, 2013. A quorum to conduct business was declared present.

Agenda Item 2: Welcome guests and introductions

Mr. Andruss welcomed the guests.

Agenda Item 3: Receive public comment.

Mr. Andruss offer to accept any public comments.

Mr. James Dodson of Naismith Engineering informed the GMA 15 representatives of a feasibility study related to regional aquifer storage and recovery projects in the general area of Victoria, Jackson, and Calhoun County.

Agenda Item 4: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of April 11, 2013.

MOTION: Mr. Dohmann moved to approve the meeting minutes as drafted. Mr. Stewart seconded the motion. The motion passed unanimously.

Agenda Item 5: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Dohmann informed the GMA 15 representatives that the Goliad County GCD had received pre-approval of its management plan from Texas Water Development Board and that a hearing regarding the management plan was scheduled for July 1, 2013.

Mr. Andruss informed the GMA 15 representatives that the Victoria County GCD had submitted its proposed revised management plan to Texas Water Development Board for pre-review.

No action was taken.

Agenda Item 6: Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Mr. Dohmann informed the GMA 15 representatives that Region L had discussed issues with the recent population census and the problem associated with under-reported populations with the region.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Ms. Backhouse of TWDB informed the GMA 15 representatives that TWDB was working on guidance documents related to future DFC submittals and calculations related to Total Recoverable Volumes are anticipated being completed by the end of August 2013.

No action was taken.

Agenda Item 8: Consideration of and possible action on the presentations and proposals provided by respondents regarding the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.

Mr. Andruss explained that each respondent to GMA 15's RFP for Professional Services had been invited to the meeting for the purposes of making a presentation to the GMA 15 representatives regarding their proposal.

Representatives from DBS&A and Intera as well as Dr. Uddameri presented their proposals to the GMA 15 representatives.

No action was taken.

Agenda Item 9: Consideration of and possible action on the selection of and negotiation with a preferred respondent to the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.

The GMA 15 representatives agreed to a process of voting for the designation of a preferred respondent. Each GMA 15 representative cast a vote for his or her preferred respondent.

MOTION: Mr. Mahoney moved to select Intera as the preferred respondent and identify DBS&A as the alternate preferred respondent for the purposes of negotiating terms if an agreement is not reached with Intera. Mr. Anzaldua seconded the motion. The motion passed with 11 ayes and 2 nays.

Agenda Item 10: Consideration of and possible action on an agreement to obtain professional services from the preferred respondent to the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15.

The GMA 15 representatives discussed issues and concerns regarding the process to negotiate terms with the preferred respondents, in particular, the issue related to available funding levels and estimated costs included in the proposals.

MOTION: Mr. Andruss moved to establish a committee to negotiated with the preferred respondents for the purposes of making a recommendation regarding negotiated terms for the services to be provided in response to the RFP for Professional Services related to Development and Adoption of DFCs for Aquifers within GMA 15. Mr. Brasher seconded the motion. The motion passed unanimously.

Mr. Andruss, Mr. Brasher, and Mr. Dohmann agreed to serve on the committee.

Agenda Item 11: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

Mr. Andruss explained that, previously, the member districts passed a motion requesting that "any member district proposing to adopt a new or amended DFC provide at least 60-day notice prior to the next GMA 15 meeting to the GMA-15

Administrator."

Mr. Andruss explained that, as of June 10, 2013, GMA 15 had not received any requests to adopt a new or amended DFC.

No action taken.

Agenda Item 14: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss explained that the next meeting was scheduled for July 11, 2013.

No action taken.

Agenda Item 15: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment was offered.

Agenda Item 16: Adjournment

MOTION: At approximately 1:00 PM, Mr. Van Dresar moved to adjourn the meeting. Ms. Niemann seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 10th day of October a.d. 2013.

____
Groundwater Management Area 15 Representative

ATTEST:

____
Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on April 11, 2013.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Mark Sugarek
2	Calhoun County Groundwater Conservation District	Frank Anzaldua
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	Brent Clayton
7	Evergreen Underground Water Conservation District	Diane Savage
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Lavaca County Groundwater Conservation District	
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	
13	Texana Groundwater Conservation District	Tim Andruss
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to Order

Mr. Andruss called the meeting to order at 9:30 AM on April 11, 2013. A quorum to conduct business was declared present.

Attached to these minutes is a copy of the meeting sign-in sheet.

Agenda Item 2: Welcome guests and introductions

Mr. Andruss welcomed the guests.

Agenda Item 3: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment was offered.

Agenda Item 4: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of February 14, 2013.

MOTION: Mr. Van Dresar moved to approve the meeting minutes as drafted. Mr. Hudgins seconded the motion. The motion passed unanimously.

Agenda Item 5: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Dohmann provided an update on water level monitoring activities in Goliad County. Supporting documentation provided by Mr. Dohmann is included as an attachment.

No action was taken.

Agenda Item 6: Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Mr. Brasher explained that Region K had discussed population estimates provided TWDB and water management strategies.

Mr. Dohmann explained that Region L had discussed new water management strategies related to small municipalities and the issue of overdrafts in the state water plan.

Mr. Sugarek explained that Region N had discussed that population estimates may not be accurate.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Mr. Bradley of TWDB explained that TWDB was working on calculations related to Total Recoverable Volumes and anticipated completing the work by the end of the 2013.

Mr. Dohmann encouraged all GCDs to submit estimates of exempt use to TWDB.

No action was taken.

Agenda Item 8: Consideration of and possible action on standard financial practices and procedures concerning funds collected from member districts under the Interlocal Cost Sharing Agreement For Groundwater Management Area 15.

Mr. Andruss explained that, as of April 10, 2013, the following member districts had informed the GMA that they had approved the GMA 15 by-laws and cost sharing agreement according to available information:

Fayette County Groundwater Conservation District	By-Laws Cost Sharing Agreement
Goliad County Groundwater Conservation District	By-Laws Cost Sharing Agreement
Pecan Valley Groundwater Conservation District	By-Laws Cost Sharing Agreement
Texana Groundwater Conservation District	By-Laws Cost Sharing Agreement
Victoria County Groundwater Conservation District	By-Laws Cost Sharing Agreement

Mr. Andruss explained that several GCDs expressed a strong desire for (1) standardized reporting procedures related to the funds contributed to the GMA's joint planning efforts under the Interlocal Cost Sharing Agreement, and (2) separation of GMA 15 funds from other funds of the Treasurer's GCD.

Representatives from the following GCDs explained that the By-Laws and Cost Sharing Agreement had been approved by resolution: Coastal Bend GCD, Coastal Plains GCD, Colorado County GCD, and Evergreen UWCD.

Ms. Krause reviewed the proposed procedures to be used by Pecan Valley GCD serving in the capacity as GMA 15 Treasurer and GMA 15 regarding the processing of handling the funds of the GMA as well as financial reporting related to the GMA 15 funds. Supporting documentation provided by Ms. Krause is included as an attachment.

MOTION: Mr. Van Dresar moved to accept the procedures as proposed by Ms. Krause as the standard financial procedures of GMA 15. Mr. Dohmann seconded the motion. The motion passed unanimously.

Agenda Item 9: Consideration of and possible action on impact on the Groundwater Management Area 15 Desired Future Condition in areas without properly organized groundwater conservation districts.

Mr. Andruss explained that on March 20, 2013, Mr. Dohmann notified the GMA that he had received information that water wells were going dry in Lavaca County and inquired as to whether or not GMA 15 should consider supporting aquifer monitoring in Lavaca County.

In late 2012, both Victoria County GCD and Texana GCD adopted resolutions requesting "that the groundwater conservation district in Lavaca County be properly organized and that it act expeditiously to adopt a suitable management plan and rules for the protection of our area groundwater." In both cases the Boards expressed their concern that the lack of aquifer management could have a negative effect on the joint planning process. The resolutions were forwarded to legislators, commission court, and temporary directors of Lavaca County GCD.

The member district representatives express an interest in gathering additional information.

Mr. Andruss appointed the following member district representatives to serve on a subcommittee to gather additional information regarding water levels in Lavaca County: Mr. Brasher (Subcommittee Chair), Mr. Dohmann, Ms. Krause, and Mr. Van Dresar.

Agenda Item 10: Consideration of and possible action on the review of accomplishments of the member districts of Groundwater Management Area 15.

Mr. Andruss explained that Chapter 36 of TWC requires GMAs to review the accomplishments of the management area.

Mr. Andruss explained that, at the previous GMA 15 meeting, the member districts passed a motion requesting "that member district consider the management plans of districts within Groundwater Management Area 15 as required by TWC 36.108(b) and submit a statement to the GMA 15 Administrator regarding their assessment of the management plans as described in TWC 36.108(c)."

Mr. Andruss explained that, at the same meeting, the member districts passed a motion requesting "that the member districts submit to the GMA-15 Administrator by March 31, 2013 a copy of the district's most-recently approved annual report and summary of specific accomplishments directly related to joint planning in GMA 15."

Mr. Andruss explained that, as of April 9, 2013, the GMA had not received the statements regarding management plans or approved annual reports from all of the member districts. (http://www.vcgcd.org/gma-15.html) Paper copies of the annual reports will not be provided to member district as part of future meeting packets.

No action taken.

Agenda Item 11: Consideration of and possible action on requests for proposal for technical support and administrative support to GMA-15 Joint Planning Committee and responses.

Mr. Andruss explained that, at the previous meeting, the member districts passed a motion authorizing "the GMA-15 Administrator to solicit proposals to the Request for Proposals for Professional Services related to Development and Adoption of Desired Future Conditions for Aquifers within Groundwater Management Area 15."

GMA 15 has received responses from the following entities:

- Daniel B. Stephens and Associates, Inc.
- Intera Geosciences and Engineering
- Venkatesh Uddameri, Ph.D., P.E.

Mr. Andruss explained that the proposals would be posted online for the review and evaluation by member districts and that an interim meeting of GMA 15 would scheduled for the purposes of receiving presentations from the respondents regarding their proposals.

Agenda Item 12: Consideration of and possible action on the use of an alternate groundwater availability model for joint planning purposes within Groundwater Management Area 15.

Mr. Andruss explained that, at t the last GMA 15 meeting, Mr. Gertson requested that this agenda item be carried forward to this meeting agenda.

No action taken.

Agenda Item 13: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

Mr. Andruss explained that , previously, the member districts passed a motion requesting that "any member district proposing to adopt a new or amended DFC provide at least 60-day notice prior to the next GMA 15 meeting to the GMA-15 Administrator."

Mr. Andruss explained that, as of April 9, 2013, GMA 15 has not received any requests to adopt a new or amended DFC.

No action taken.

Agenda Item 14: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss explained that the next regularly scheduled meeting for GMA 15 was scheduled for July 11, 2013.

Mr. Andruss explained that the following items would be placed on the agenda for the next regularly scheduled meeting:

- Consideration of and possible action on the review of management plans and accomplishments of the member districts of Groundwater Management Area 15.
- Consideration of and possible action on requests for proposal for technical support and administrative support to GMA-15 Joint Planning Committee and responses.
- Consideration of and possible action on impact on the Groundwater Management Area 15 Desired Future Condition in areas without properly organized groundwater conservation districts.
- Consideration of and possible action on the use of an alternate groundwater availability model for joint planning purposes within Groundwater Management Area 15.

Agenda Item 15: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment was offered.

Agenda Item 16: Adjournment

MOTION: At 11:07 AM, Mr. Dohmann moved to adjourn the meeting. Mr. Van Dresar seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 13 day of JUNE a.d. 2013.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on February 14, 2013.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Mark Sugarek
2	Calhoun County Groundwater Conservation District	-
3	Coastal Bend Groundwater Conservation District	Ronald Gertson
4	Coastal Plains Groundwater Conservation District	-
5	Colorado County Groundwater Conservation District	-
6	Corpus Christi ASR Conservation District	Brent Clayton
7	Evergreen Underground Water Conservation District	-
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Lavaca County Groundwater Conservation District	-
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	-
13	Texana Groundwater Conservation District	Tim Andruss
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to Order

Mr. Andruss called the meeting to order at 9:34 AM on February 14, 2013. A quorum to conduct business was declared present.

Attached to these minutes is a copy of the meeting sign-in sheet.

Agenda Item 2: Welcome guests and introductions

Mr. Andruss welcomed the guests and representatives and guests introduced themselves.

Agenda Item 3: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment provided.

Agenda Item 4: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of October 10, 2012.

MOTION: Mr. Dohmann moved to approve the meeting minutes as drafted. Mr. Van Dresar seconded the motion. The motion passed unanimously.

Agenda Item 5: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Dohmann provided members representatives with several documents relate to activities and issues within Goliad County GCD. The representatives discussed the following topics: water levels, in-situ uranium mining, saltwater contamination, water quality issues.

Mr. Van Dresar submitted a report relate to groundwater level monitoring activities in Fayette County GCD.

Mr. Gertson provided details regarding water level monitoring activities in Coastal Bend GCD.

Ms. Krause provided details regarding water level monitoring activities and rule making efforts in Pecan Valley GCD.

Mr. Clayton provided details regarding efforts to study aquifer storage and recovery within Corpus Christi ASRCD.

No action was taken.

Agenda Item 6: Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

Mr. Dohmann provided a report regarding activities of the South Central Texas Regional Water Planning Group (Region L) including topics of population projections related to the Eagle Ford Shale Play.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Ms. Backhouse provided an update on TWDB's efforts to update Chapter 356 rules.

Agenda Item 8: Consideration of and possible action on the review of management plans of member districts of Groundwater Management Area 15.

Mr. Andruss presented information on the requirements of GMA 15 related to reviewing management plans of member districts of GMA 15 as established under TWC 36.108(c).

MOTION: Mr. Gertson moved to request that member district consider the management plans of districts within Groundwater Management Area 15 as required by TWC 36.108(b) and submit a statement to the GMA 15 Administrator regarding their assessment of the management plans as described in TWC 36.108(c). Mr. Dohmann seconded the motion. The motion passed unanimously.

Agenda Item 9: Consideration of and possible action on the review of accomplishments of the member districts of Groundwater Management Area 15.

Mr. Andruss presented information on the requirements of GMA 15 related to the review of accomplishments of member districts of Groundwater Management Area 15 as established under TWC 36.108(c).

MOTION: Mr. Dohmann moved to request that the member districts submit to the GMA-15 Administrator by March 31, 2013 a copy of the district's most-recently approved annual report and summary of specific accomplishments directly related to joint planning in GMA 15. Ms. Krause seconded the motion. The motion passed unanimously.

Agenda Item 10: Consideration of and possible action on the review of proposals of member districts of Groundwater Management Area 15 to adopt new or amend existing desired future conditions.

MOTION: Mr. Dohmann moved to request any member district proposing to adopt a new or amended DFC provide at least 60-day notice prior to the next GMA 15 meeting to the GMA-15 Administrator. Mr. Van Dresar seconded the motion. The motion passed unanimously.

Agenda Item 11: Consideration of and possible action on requests for proposal for technical support and administrative support to GMA-15 Joint Planning Committee.

Mr. Andruss explained that at the previous GMA 15 meeting, a draft RFP for technical and administrative support was presented to the member districts for consideration. Mr. Dohmann of Goliad County GCD provided suggested revisions to the draft RFP. Based on the input from Mr. Dohmann, the draft RFP was revised. The revisions incorporated into the RFP mainly clarified the terms within the document and updated the time schedule associated with the RFP.

MOTION: Mr. Van Dresar moved to authorize the GMA-15 Administrator to solicit proposals to the Request for Proposals for Professional Services, as revised, related to Development and Adoption of Desired Future Conditions for Aquifers within Groundwater Management Area 15. Mr. Gertson seconded the motion. The motion passed unanimously.

Agenda Item 12: Consideration of and possible action on potential interlocal agreement between GMA-15 Joint Planning Committee member districts to financially support joint planning activities.

Mr. Andruss explained that at the last GMA 15 meeting, the member districts requested that an interlocal agreement be drafted that would allow for the funding of joint planning activities. Based on the instruments used by GMA 16 for establishing a planning committee and jointly funding planning activities, a set of by-laws, resolutions, and an interlocal agreement were drafted and reviewed by VCGCD legal counsel. The draft documents were sent to GMA 15 representatives prior to the meeting.

MOTION: Mr. Gertson moved to accept the by-laws, resolutions, and interlocal agreement as revised and request that each member district approve the by-laws and interlocal agreement by adoption of the related resolutions at the next board meeting of each GCD. Mr. Sugarek seconded the motion. The motion passed unanimously.

Agenda Item 13: Consideration of and possible action on the use of an alternate groundwater availability model for joint planning purposes within Groundwater Management Area 15.

Mr. Andruss explained that at the last GMA 15 meeting, Mr. Hudgins inquired into the procedure for requesting authorization to utilize an alternative groundwater availability model for a portion of GMA 15. Ms. Backhouse of TWDB explained that a formal request from GMA 15 would be necessary for TWDB to begin the process of evaluating the use of an alternate model.

MOTION: Mr. Dohmann moved to authorize the GMA-15 Administrator to modify the Request for Proposals for Professional Services to include an item related to evaluating feasibility of using the URS-LSWP groundwater availability model as an alternate model for a portion of GMA 15. Mr. Gertson seconded the motion. The motion passed unanimously.

Agenda Item 14: Consideration of and possible action on identification and scheduling of future agenda items.

Mr. Andruss explained that the next, regularly meeting was scheduled for April 11, 2013.

Mr. Gertson requested that the agenda item 13 be placed on the next agenda for GMA 15.

Agenda Item 15: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment provided.

Agenda Item 16: Adjournment

MOTION: At 11:45 AM, Mr. Van Dresar moved to adjourn the meeting. Mr. Sugarek seconded the motion. The motion passed unanimously.

Record Index ID

20772

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 11th day of April a.d. 2013

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on October 10, 2012.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Lonnie Stewart
2	Calhoun County Groundwater Conservation District	
3	Coastal Bend Groundwater Conservation District	Neil Hudgins
4	Coastal Plains Groundwater Conservation District	Neil Hudgins
5	Colorado County Groundwater Conservation District	
6	Corpus Christi ASR Conservation District	Brent Clayton
7	Evergreen Underground Water Conservation District	Diane Savage
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Lavaca County Groundwater Conservation District	
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	
13	Texana Groundwater Conservation District	Michael Skalicky
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to Order.

Mr. Andruss called the meeting to order at 9:31 AM on October 10, 2012. A quorum to conduct business was declared present.

Agenda Item 2: Welcome guests and introductions.

Mr. Andruss welcomed the guests to the meeting and asked that they provide their names on the sign-in sheet. A copy of the meeting sign-in sheet is attached to the meeting minutes.

Mr. Brent Clayton provided a letter from Mr. Oscar Martinez, Board Chairman of Corpus Christi Aquifer Storage and Recovery Conservation District appointing Mr. Clayton as an alternate representative for the District at GMA 15.

Agenda Item 3: Receive public comment.

Mr. Andruss offer to accept any public comments.

Ms. Backhouse of Texas Water Development Board (TWDB) asked that her email address and Mr. Robert Bradley's email address be added to the GMA 15 email notification list. Ms. Backhouse explained that TWDB had recently sent a message to GMA administrators announcing the development of a GCD management plan summary spreadsheet.

Agenda Item 4: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of June 20, 2012.

MOTION: Mr. Dohmann moved to approve the meeting minutes. Mr. Van Dresar seconded the motion. The motion passed unanimously.

Agenda Item 5: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Andruss requested that GMA 15 representatives provide written comments for inclusion in future meeting minutes.

Mr. Andruss informed the GMA 15 representatives of Victoria County GCD's plans regarding it expansion of the aquifer monitoring system to approximately 80 wells within Victoria County based on a report developed by Dr. Uddameri. In addition, Mr. Andruss informed the GMA 15 representatives that Victoria County GCD would be receiving final reports related to investigations concerning (1) approaches to production limitations by Dr. Uddameri and (2) scientific data gaps and potential research projects by Dr. Young.

Mr. Dohmann provided written comments to the GMA 15 representatives regarding (1) water levels, (2) in-situ uranium exploration and mining, (3) salt water contamination in Goliad County GCD. A copy of the written comments is attached to these minutes.

Mr. Hudgins commented on activities of Coastal Bend GCD and Coastal Plains GCD related to aquifer monitoring. No written comments provided.

Mr. Van Dresar commented on the activities of Fayette County GCD related to management plan and rules re-adoption. No written comments provided.

No action was taken.

Agenda Item 6: Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

The GMA 15 representatives received reports regarding the following Regional Water Planning Groups: Region K, Region P, Region L, and Region N. The reports and associated discussion generally concerned the various approaches and methods used to estimate groundwater usage for use in the regional water planning process.

No action was taken.

Agenda Item 7: Consideration of and possible action on reports from Texas Water Development Board representatives to Groundwater Management Area 15.

Ms. Backhouse informed the GMA of TWDB activities related to Chapter 356 rule changes, GCD management plan summary speadsheets, TWDB guidance documents, and estimated recoverable storage factor. In addition, Ms. Backhouse provided recommended procedure for seeking approval to use an alternate groundwater availability model for planning purposes. A copy of the Ms. Backhouse's report is attached to these minutes.

No action was taken.

Agenda Item 8: Consideration of and possible action on administrative procedures for Groundwater Management Area 15.

The GMA 15 representatives discussed the draft administrative procedures for GMA 15.

MOTION: Mr. Van Dresar moved to strike the phrase "at which at least two-thirds of the Member Districts are in attendance" from the fourth paragraph of page 1 of the draft administrative produce and to adopt the procedures as revised. Mr. Hudgins seconded the motion. The motion passed unanimously.

Agenda Item 9: Consideration of and possible action on election of GMA-15 Joint Planning Committee Officers.

Mr. Andruss explained that the previously approved administrative procedures require the election of officers of the GMA-15 Joint Planning Committee require the GMA to elect officers.

The GMA 15 representatives discussed the officer positions of the GMA-15 Joint Planning Committee.

Motion: Mr. Hudgins moved to appoint Mr. Andruss as the Chair, Mr. Hudgins as the Vice Chair, and Ms. Krause as Treasurer. Mr. Dohmann seconded the motion. The motion passed unanimously.

Agenda Item 10: Consideration of and possible action on selection of a GMA-15 Joint Planning Committee Administrator.

The GMA 15 representatives discussed the position of administrator of the GMA-15 Joint Planning Committee.

Motion: Mr. Van Dresar moved to appoint Mr. Andruss to serve as the administrator of GMA-15 Joint Planning Committee. Mr. Dohmann seconded the motion. The motion passed unanimously.

Agenda Item 11: Consideration of and possible action on future meeting schedule for GMA-15 Joint Planning Committee.

The GMA 15 representatives discussed the proposed future meeting schedule.

Motion: Mr. Hudgins moved to set the second Thursday of the first month of each calendar quarter as the regular meeting date of GMA-15 Joint Planning Committee. Mr. Dohmann seconded the motion. The motion passed unanimously.

Agenda Item 12: Consideration of and possible action on requests for proposal for technical support and administrative support to GMA-15 Joint Planning Committee.

Mr. Andruss presented a draft request for proposal for technical and administrative support services to GMA-15 Joint Planning Committee.

The GMA 15 representatives discussed the provisions of the draft RFP.

No action taken.

Agenda Item 13: Consideration of and possible action on potential interlocal agreement between GMA-15 Joint Planning Committee member districts to financially support joint planning activities.

Mr. Allison of Allison, Bass and Associates reviewed provisions and available options related to interlocal agreements and member districts of a groundwater management area.

The GMA 15 representatives discussed approaches to financially supporting joint planning activities.

Motion: Mr. Van Dresar moved to have Mr. Andruss develop a draft interlocal agreement regarding funding for joint planning activities and draft resolution language for use by districts to approve the agreement for review by GMA 15 representatives and member groundwater conservation districts. Ms. Savage seconded the motion. The motion passed unanimously.

Agenda Item 14: Consideration of and possible action on approaches to evaluate achievement of desired future conditions.

The districts discussed their plans regarding their evaluation of DFC achievement.

Motion: Mr. Hudgins moved to have Mr. Andruss gather management plans from each groundwater conservation district within GMA 15 and forward a copy to GMA-15 Joint Planning Committee member districts for the purposes of facilitating member district's review of management plans as required under TWC 36.108. Mr. Dohmann seconded the motion. The motion passed unanimously.

Agenda Item 15: Consideration of and possible action on groundwater level monitoring within Groundwater Management Area 15.

The districts discussed their efforts to monitor groundwater levels within their respective districts.

No action taken.

Agenda Item 16: Receive public comment.

Ms. Backhouse explained that the use of an alternate groundwater availability model would require the Administrator to formally request the review and approval by the TWDB Board. She suggested the GMA consider the matter at its next meeting.

Agenda Item 17: Adjournment

MOTION: At 11:45 AM, Mr. Stewart moved to adjourn the meeting. Mr. Hudgins seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 14th day of FEBRUARY a.d. 2013.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Groundwater Management Area 15
Meeting Minutes

The Groundwater Management Area 15 meeting convened in the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas, Classroom 108 at 9:30 AM on June 20, 2012.

Members GCD Representatives Present:

1	Bee Groundwater Conservation District	Mark Sugarek
2	Calhoun County Groundwater Conservation District	Frank Anzaldua
3	Coastal Bend Groundwater Conservation District	Ronald Gertson
4	Coastal Plains Groundwater Conservation District	
5	Colorado County Groundwater Conservation District	Jim Brasher
6	Corpus Christi ASR Conservation District	
7	Evergreen Underground Water Conservation District	Diane Savage
8	Fayette County Groundwater Conservation District	David Van Dresar
9	Goliad County Groundwater Conservation District	Art Dohmann
10	Lavaca County Groundwater Conservation District	
11	Pecan Valley Groundwater Conservation District	Charlotte Krause
12	Refugio Groundwater Conservation District	Shana Niemann
13	Texana Groundwater Conservation District	Michael Skalicky
14	Victoria County Groundwater Conservation District	Tim Andruss

Agenda Item 1: Call to Order

Mr. Andruss called the meeting to order at 9:35 AM on June 20, 2012. A quorum to conduct business was declared present.

Attached to these minutes is a copy of the meeting sign-in sheet.

Agenda Item 2: Welcome guests and introductions

Mr. Andruss welcomed the following individuals to the meeting: Sarah Backhouse of Texas Water Development Board, Barbara Smith of Goliad County Groundwater Conservation District, Kenneth Eller of Victoria County Groundwater Conservation District, Leo J. Wick of Fayette County Groundwater Conservation District, Lonnie Stewart of Bee Groundwater Conservation District, and Kelly Bernal of Refugio Groundwater Conservation District.

Agenda Item 3: Receive public comment.

Mr. Andruss offer to accept any public comments. No public comment was offered.

Groundwater Management Area 15
Meeting Minutes

Agenda Item 4: Consideration of and possible action on minutes of the previous meeting.

The GMA 15 representatives discussed the draft meeting minutes of December 8, 2011. Mr. Dohmann suggested a correction of the minutes to specify the time of adjournment to 10:54 AM.

MOTION: Mr. Dohmann moved to approve the meeting minutes with the corrected time of adjournment. Mr. Skalicky seconded the motion. The motion passed unanimously.

Agenda Item 5: Consideration of and possible action on reports and communication from Groundwater Management Area 15 member districts.

Mr. Dohmann provided information related to comparisons of water level measurements in Goliad County, USGS scientific investigation report on streamflow gains and losses of the Lower San Antonio River Watershed, and Non-Municipal Groundwater Demands of Goliad County. The GMA 15 representatives discussed the information provided. It was suggested that the GMA consider field monitoring activities and the evaluation of compliance with the GMA-15 Desired Future Condition (DFC) at a future meeting.

No action was taken.

Agenda Item 6: Reports from Groundwater Management Area 15 representatives to Regional Water Planning Groups.

The GMA 15 representatives received reports regarding the following Regional Water Planning Groups: Region K, Region P, Region L, and Region N. The reports and associated discussion generally concerned the present activities and status of the regional water planning groups in the current planning cycle.

No action was taken.

Agenda Item 7: Consideration of and possible action on administrative procedures for Groundwater Management Area 15.

Mr. Andruss presented a document of draft administrative procedures for Groundwater Management Area 15 to the GMA 15 representatives for the purposes of initiating the discussion and eventual approval of standard procedures addressing the administration of Groundwater Management Area 15. Mr. Andruss explained that the topic of administrative procedures would be considered at the next GMA 15 meeting.

Ms. Krause agreed to gather information regarding representative's schedules for the purposes of identifying future meeting dates on a quarterly schedule.

The GMA 15 representatives discussed the technical and administrative requirements to be addressed in the present GMA planning cycle including the potential need to retain professional services by GMA 15 to support the consideration of a Desired Future Condition. Levels of funding and varying contribution levels were discussed.

Mr. Andruss explained that topics related to the procurement of professional services and funding of the GMA 15 planning process would be placed on a future agenda.

No action was taken.

Agenda Item 8: Consideration of and possible action on impacts on joint planning and Groundwater Management Area 15 caused by changes in Texas Water Code.

The GMA 15 representatives discussed the joint planning requirements established under Texas Water Code 36.108.

No action was taken.

Agenda Item 9: Receive public comment.

Ms. Krause informed the GMA 15 representatives that Pecan Valley Groundwater Conservation District had initiated a study related to the impacts associated with permitting of groundwater production for hydro-fracturing purposes.

Ms. Backhouse informed the GMA 15 representatives that the Texas Water Development Board was targeting a release of proposed rule changes for the Summer of 2012.

Agenda Item 10: Adjournment

MOTION: At 11:20 AM, Mr. Dohmann moved to adjourn the meeting. Mr. Skalicky seconded the motion. The motion passed.

Groundwater Management Area 15
Meeting Minutes

Prepared by: Tim Andruss

The above and foregoing minutes were considered and approved on this the 10th day of October a.d. 2012.

Groundwater Management Area 15 Representative

ATTEST:

Groundwater Management Area 15 Representative

Appendix B

GMA 15 Resolution for Proposed DFCs Dated January 15, 2015

RESOLUTION TO ADOPT DESIRED FUTURE CONDITIONS

FOR GROUNDWATER MANAGEMENT AREA 15 AQUIFERS

STATE OF TEXAS	§	
	§	**RESOLUTION # 2016-01**
GROUNDWATER	§	
MANAGEMENT AREA 15	§	

WHEREAS, Texas Water Code § 36.108 requires the Groundwater Conversation Districts located 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 15 ("GMA 15"), as designated by the Texas Water Development Board, as of the date of this resolution are as follows:
Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District ;

WHEREAS, the Board Presidents or their Designated Representatives of districts in GMA 15 have met at various meetings and conducted joint planning in accordance with Chapter 36.108, Texas Water Code since September 2005 and;

WHEREAS, GMA 15, having given proper and timely notice, held an open meeting of the GMA 15 Member Districts on April 29, 2016 and;

WHEREAS, GMA 15 has solicited and considered public comment at specially called Public Meetings, including the meeting on April 29, 2016 and;

WHEREAS, the GMA 15 Member Districts received and considered technical advice regarding local aquifers, hydrology, geology, recharge characteristics, local groundwater demands and usage, population projections, ground and surface water inter-relationships, and other considerations that affect groundwater conditions and;

WHEREAS, following public discussion and due consideration of the current and future needs and conditions of the aquifers in question, the current and projected groundwater demands, and the potential effects on springs, surface water, habitat, and waterdependent species through the year 2069, GMA 15 Member Districts have analyzed drawdown estimations from numerous pumping scenarios using the Central Gulf Coast Groundwater Availability Model and have voted on a motion made and seconded to adopt a Desired Future Condition (DFC) stated as follows:

> Groundwater Management Area 15 adopts Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:
>
> Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).
>
> Chicot and Evangeline Aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).
>
> Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).
>
> Groundwater Management Area 15 adopts Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and adopts a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.
>
> Table A-1. Desired Future Conditions for GMA 15 expressed as an Average Drawdown between January 2000 and December 2069.
>
> Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;
> Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
> Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
> Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
> Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
> Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
> Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
> Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
> Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
> Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
> Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;

Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

NOW THEREFORE BE IT RESOLVED, that the Groundwater Management Area 15 Member Districts do hereby document, record and confirm a Desired Future Condition stated above was adopted by all member districts present.

AND IT IS SO ORDERED.

PASSED AND ADOPTED on this 29th day of April 2016.

ATTEST:

Tom Callen

Aransas County Groundwater Conservation District

Lonnie Stewart Lonnie Stewart

Bee County Groundwater Conservation District

Tim Andruss

Calhoun County Groundwater Conservation District

Neil Hudgins

Coastal Bend Groundwater Conservation District

Neil Hudgins

Coastal Plains Groundwater Conservation District

James E. Brasher - James E. Brasher

Colorado County Groundwater Conservation District

Corpus Christi Aquifer Storage and Recovery Conservation District

Russell Labus, Russell Labus

Evergreen Underground Water Conservation District

DAVID A. VAN DRESAR

Fayette County Groundwater Conservation District

ART A. DOHMANN

Goliad County Groundwater Conservation District

Charlotte Krause

Pecan Valley Groundwater Conservation District

, TIM ANDRUSS

Refugio Groundwater Conservation District

, TIM ANDRUSS

Texana Groundwater Conservation District

K. ELLER

Victoria County Groundwater Conservation District

Appendix C

GCD Summary Reports of Public Hearings on DFCs

Victoria County Groundwater Conservation District
Board of Directors

Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Victoria County Groundwater Conservation District Board of Directors will conduct a public meeting and public hearing on April 15, 2016 at 9:00 AM at the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas 77901. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

<u>Gulf Coast Aquifer System</u> – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Chicot and Evangeline aquifers</u> – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Jasper Aquifer</u>- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;

Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Victoria County Groundwater Conservation District at 361-579-6863, 2805 N. Navarro St, Ste 210, Victoria, Texas 77901, or admin@vcgcd.org

Victoria County Groundwater Conservation District

April 28, 2016

Groundwater Management Area 15
c/o Tim Andruss, GMA 15 Chair and Administrator
2805 N. Navarro St. Suite 210
Victoria, Texas 77901

RE: Public Comment Period Summary for the Proposed Desired Future Conditions of Groundwater Management Area 15.

GMA 15 Representatives,

The Victoria County Groundwater Conservation District made the Proposed Desired Future Conditions of Groundwater Management Area 15 as approved by the member districts of Groundwater Management Area 15 on January 14, 2016, as well as supporting documentation, available to the public for the purpose of accepting public comment.

The District held a public hearing on April 15, 2016, after posting notice as required by Section 36.063 of the Texas Water Code, to receive verbal or written comment from the public regarding the Proposed Desired Future Conditions of Groundwater Management Area 15. The District accepted public comments until April 19, 2016.

The District received no public comments during the public comment period regarding the Proposed Desired Future Conditions of Groundwater Management Area 15.

The District does not suggest any revisions to the Proposed Desired Future Conditions of Groundwater Management Area 15.

Regards,

Tim Andruss
General Manager

2805 N. Navarro St. Suite 210, Victoria, TX 77901, Phone (361) 579-6863, Fax (361) 579-0041

Victoria County Groundwater Conservation District
Board of Directors

Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Victoria County Groundwater Conservation District Board of Directors will conduct a public meeting and public hearing on April 15, 2016 at 9:00 AM at the Pattie Dodson Health Center, 2805 N. Navarro St., Victoria, Texas 77901. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

<u>Gulf Coast Aquifer System</u> – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Chicot and Evangeline aquifers</u> – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Jasper Aquifer</u>- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;

Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Victoria County Groundwater Conservation District at 361-579-6863, 2805 N. Navarro St, Ste 210, Victoria, Texas 77901, or admin@vcgcd.org

Texana Groundwater Conservation District
Board of Directors

Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Texana Groundwater Conservation District Board of Directors will conduct a public meeting and public hearing on April 14, 2016 at 8:30 AM at the County Services Building, 411 N. Wells, Edna, Texas. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

<u>Gulf Coast Aquifer System</u> – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Chicot and Evangeline aquifers</u> – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Jasper Aquifer</u>- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;

Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Texana Groundwater Conservation District at 361-781-0624, P.O. Box 1098, Edna, Texas 77957, or admin@texanagcd.org.

FILED 3/23/2016 @ 9:20 a.m.
BARBARA EARL, Clerk of County Court
JACKSON COUNTY, TEXAS
BY [signature]

Texana Groundwater Conservation District

April 28, 2016

Groundwater Management Area 15
c/o Tim Andruss, GMA 15 Chair and Administrator
2805 N. Navarro St. Suite 210
Victoria, Texas 77901

RE: Public Comment Period Summary for the Proposed Desired Future Conditions of Groundwater Management Area 15.

GMA 15 Representatives,

The Texana Groundwater Conservation District made the Proposed Desired Future Conditions of Groundwater Management Area 15 as approved by the member districts of Groundwater Management Area 15 on January 14, 2016, as well as supporting documentation, available to the public for the purpose of accepting public comment.

The District held a public hearing on April 14, 2016, after posting notice as required by Section 36.063 of the Texas Water Code, to receive verbal or written comment from the public regarding the Proposed Desired Future Conditions of Groundwater Management Area 15. The District accepted public comments until April 19, 2016.

The District received public comments during the public comment period regarding the Proposed Desired Future Conditions of Groundwater Management Area 15. The following comments were received from Mr. Brzozowski of the Lavaca-Navidad River Authority:

1. Given the modeling done to date by the GMA, what is the current volume of groundwater estimated as being available for permit in Jackson, Lavaca, Wharton, Colorado and Fayette counties?

2. Given the 13-foot GMA average drawdown and the 15-foot proposed drawdown specifically for Jackson County, what is the volume that would need to be permitted to achieve the proposed drawdown in Jackson County? Is this in addition the volume currently permitted? How does this achievement volume correlate with the current allowable landowner limit of 0.5 acre-feet per acre under control?

3. Given the 13-foot GMA 15 average drawdown and the 15-foot proposed drawdown specifically for Jackson County, what is the predicted impact of subsidence on a county-wide basis. If the information is available, what about on a localized scale? (I asked this not knowing nor understanding the success of the well registration process and/or permitting effort that has been undertaken by the GCD.) What about subsidence on a GMA 15 scale?

411 N. Wells St. Rm 118, P.O. Box 1098, Edna, Texas 77957, Phone (361)781-0624, Fax (361)781-0453

4. Given the natural connectivity of our surface and groundwater supplies, what is the impact of a 15-foot groundwater drawdown on surface waters in GMA 15? When the proposed drawdown limits were being considered by the GMA, were potential impacts to surface waters perceived and if so, how were these addressed?

The District does not suggest any revisions to the Proposed Desired Future Conditions of Groundwater Management Area 15.

Regards,

Tim Andruss
General Manager

Texana Groundwater Conservation District
Board of Directors

Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Texana Groundwater Conservation District Board of Directors will conduct a public meeting and public hearing on April 14, 2016 at 8:30 AM at the County Services Building, 411 N. Wells, Edna, Texas. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

<u>Gulf Coast Aquifer System</u> – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Chicot and Evangeline aquifers</u> – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

<u>Jasper Aquifer</u>- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;

Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Texana Groundwater Conservation District at 361-781-0624, P.O. Box 1098, Edna, Texas 77957, or admin@texanagcd.org.

FILED 3/23/2016 @ 9:20 a.m.
BARBARA EARL, Clerk of County Court
JACKSON COUNTY, TEXAS
BY Maria Garcia

Refugio Groundwater Conservation District

Board of Directors

Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Refugio Groundwater Conservation District Board of Directors will conduct a public meeting and public hearing on April 18, 2016 at 6:00 PM at the Refugio County Court House, 808 Commerce St, Refugio, Texas 78377. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;

Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Refugio Groundwater Conservation District at 361-526-1483, 604 Commerce St., Refugio Texas 78377, or admin@rgcd.org.

Certificate of Posting

The above Notice of Meeting was posted March 23, 2016.
at a place convenient to the public on a bulletin board in the Refugio County Courthouse at Refugio, Texas.
WITNESS MY HAND AND SEAL of office on above date.

Ida Ramirez, Clerk County Court
Refugio County, Texas

By Krista Wiginton Deputy
Krista Wiginton

Refugio Groundwater Conservation District

April 28, 2016

Groundwater Management Area 15
c/o Tim Andruss, GMA 15 Chair and Administrator
2805 N. Navarro St. Suite 210
Victoria, Texas 77901

RE: Public Comment Period Summary for the Proposed Desired Future Conditions of Groundwater Management Area 15.

GMA 15 Representatives,

The Refugio Groundwater Conservation District made the Proposed Desired Future Conditions of Groundwater Management Area 15 as approved by the member districts of Groundwater Management Area 15 on January 14, 2016, as well as supporting documentation, available to the public for the purpose of accepting public comment.

The District held a public hearing on April 18, 2016, after posting notice as required by Section 36.063 of the Texas Water Code, to receive verbal or written comment from the public regarding the Proposed Desired Future Conditions of Groundwater Management Area 15. The District accepted public comments until April 19, 2016.

The District received no public comments during the public comment period regarding the Proposed Desired Future Conditions of Groundwater Management Area 15.

The District does not suggest any revisions to the Proposed Desired Future Conditions of Groundwater Management Area 15.

Regards,

Tim Andruss
General Manager

Refugio Groundwater Conservation District
604 Commerce Street, P.O. Box 116, Refugio, TX 78377, Phone (361) 526-1483, Fax (361) 526-1294

Refugio Groundwater Conservation District

Board of Directors

Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Refugio Groundwater Conservation District Board of Directors will conduct a public meeting and public hearing on April 18, 2016 at 6:00 PM at the Refugio County Court House, 808 Commerce St, Refugio, Texas 78377. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;

Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Refugio Groundwater Conservation District at 361-526-1483, 604 Commerce St., Refugio Texas 78377, or admin@rgcd.org.

Certificate of Posting

The above Notice of Meeting was posted March 23, 2016.
at a place convenient to the public on a bulletin board in the Refugio County Courthouse at Refugio, Texas.
WITNESS MY HAND AND SEAL of office on above date.

Ida Ramirez, Clerk County Court
Refugio County, Texas

By Krista Wiginton Deputy
Krista Wiginton

PECAN VALLEY GROUNDWATER CONSERVATION DISTRICT
107 N. Gonzales, Cuero, Texas 77954
(361) 275-8188 Fax:(361) 275-9635
E-Mail: director@pvgcd.org Website: www.pvgcd.org

April 22, 2016

Tim Andruss
GMA 15 Chairman
2805 N. Navarro Street, Ste. 210
Victoria, TX 77901

RE: Proposed Desired Future Conditions

Mr. Andruss,

Pecan Valley GCD held a public hearing on the proposed DFC for the GMA 15 on Tuesday April 19, 2016. There were no public comments at the hearing. The board closed the hearing and approved the proposed DFC for the GMA.

Sincerely,

CKrause

Charlotte Krause
General Manager

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
www.goliadcogcd.org

April 27, 2016

Tim Andruss, Administrator
Groundwater Management Area 15
Victoria County Groundwater Conservation District
2805 N. Navarro St., Ste 210
Victoria, TX 77901

Dear Mr. Andruss,

The Goliad County Groundwater Conservation District Board of Directors met on April 18, 2016 at 5:00 p.m. to hear public testimony on the Desired Future Conditions of the Gulf Coast Aquifer in Goliad County and GMA 15. The notice for this hearing was legally posted and published as required by Chapter 36 of the Texas Water Code.

There was no public testimony at the hearing or in the period preceding the hearing. The only person in attendance at the hearing was County Judge Pat Calhoun and he expressed concern about the availability of groundwater for economic development and asked if there is water available in Goliad County to accomplish growth. There are no revisions to be made to the desired future conditions for Goliad County.

Goliad County Groundwater Conservation District Board of Directors voted 7-0 to adopt the desired future condition of the Gulf Coast for Goliad County of 1-11-16 not to exceed an average of 10 feet of drawdown of the Gulf Coast Aquifer in the year 2070 relative to the water levels of the aquifer at year 1999.

Sincerely, *Barbara Smith*

Barbara Smith, General Manager, GCGCD

Fayette County Groundwater Conservation District

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

April 28, 2016

To: Member Districts of GMA 15
From: Fayette County Groundwater Conservation District
Re: Public Comments Regarding Proposed Desired Future Conditions for GMA 15

After duly posting and noticing the public, the Fayette County Groundwater Conservation District made available for public comment the Proposed Desired Future Conditions for GMA 15, which were approved by the member districts of GMA 15 on January 14, 2016, and all supporting documentation.

A duly posted and noticed public hearing was held on March 7, 2016 to receive verbal or written comment from the public regarding the Proposed Desired Future Conditions for GMA 15.

The Fayette County Groundwater Conservation District accepted public comments until April 18, 2016.

No public comments, either written or verbal, were received by the district during the public comment period or at the public hearing regarding the Proposed Desired Future Conditions for GMA 15.

__________________________________ ________________________________

David A. Van Dresar, General Manager Date

EUWCD

Evergreen Underground Water Conservation District

110 Wyoming Blvd

Pleasanton, TX 78064

April 27, 2016

Tim Andruss
GMA 15 President
2805 N. Navarro St. STE 210
Victoria, TX 77901

RE: Public comments and adoption of the DFC's for Groundwater Management Area 15

Dear Mr. Andruss:

The purpose of this letter is to inform you that the Evergreen Underground Water Conservation District has completed the public comment period on the proposed DFC's for GMA 15. The District posted notice of a public hearing on the proposed DFC's on April 12, 2016 (copy of which is attached). The District then held the public hearing on April 22, 2016 in conjunction with its normally scheduled monthly Board meeting. There were no written or verbal comments received during the 90 day comment period. There was one public comment during the public hearing, however, it was a broad question on DFC's in general and not relevant to the GMA 15 DFC specifically. After a brief response by the Board members and the GMA 15 technical consultant, the public hearing was adjourned. The Evergreen Board then re-convened into its regular meeting and voted unanimously to adopt the DFC's as presented in the public hearing notice. As a result, the Evergreen UWCD does not have any suggested revision to the GMA 15 DFC's.

Sincerely,

Russell Labus

Russell Labus
General Manager
Evergreen UWCD

Phone: 830-569-4186
Fax: 830-569-4238
Email: info@evergreenuwcd.org
Website: Evergreenuwcd.org

Evergreen Underground Water Conservation District
Board of Directors
Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Evergreen Underground Water Conservation District Board ofDirectors will conduct a public meeting and public hearing on April 22, 2016 at 9:00 a.m. at the District Office at 110 Wyoming Blvd in Pleasanton, Texas. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of The Evergreen Underground Water Conservation District and Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS
Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others,2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in TableA-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;
Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System; Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System; Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System; Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System; Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System; Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers; Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System; Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Russell Labus, General Manager, Evergreen Underground Water Conservation District at 830-569-4186, 110 Wyoming Blvd., Pleasanton, TX or russell.labus@evergreenuwcd.org

Evergreen Underground Water Conservation District
Board of Directors
Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Evergreen Underground Water Conservation District Board of Directors will conduct a public meeting and public hearing on April 22, 2016 at 9:00 a.m. at the District Office at 110 Wyoming Blvd in Pleasanton, Texas. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of The Evergreen Underground Water Conservation District and Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in TableA-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;
Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System; Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System; Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System; Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System; Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System; Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers; Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System; Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Russell Labus, General Manager, Evergreen Underground Water Conservation District at 830-569-4186, 110 Wyoming Blvd., Pleasanton, TX or russell.labus@evergreenuwcd.org

FILED
At 9:20 o'clock A M
APR 12 2016
CAROL SWIZE, COUNTY CLERK
KARNES COUNTY, TEXAS

Transmission Report

Date/Time	04-12-2016	08:23:28 a.m.	Transmit Header Text	
Local ID 1	8305694238		Local Name 1	Evergreen Underground Water

This document : Confirmed
(reduced sample and details below)
Document size : 8.5"x11"

Evergreen Underground Water Conservation District
Board of Directors
Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Evergreen Underground Water Conservation District Board of Directors will conduct a public meeting and public hearing on April 22, 2016 at 9:00 a.m. at the District Office at 110 Wyoming Blvd in Pleasanton, Texas. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of The Evergreen Underground Water Conservation District and Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS
Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004)

Jasper Aquifer – represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in TableA-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;
Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer,
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System; Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System; Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System; Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System, Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System; Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers; Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System; Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Russell Labus, General Manager, Evergreen Underground Water Conservation District at 830-569-4186, 110 Wyoming Blvd., Pleasanton, TX or russell.labus@evergreenuwcd.org

Total Pages Scanned : 1 Total Pages Confirmed : 1

No.	Job	Remote Station	Start Time	Duration	Pages	Line	Mode	Job Type	Results
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Abbreviations:

HS: Host send	PL: Polled local	MP: Mailbox print	CP: Completed	TS: Terminated by system
HR: Host receive	PR: Polled remote	RP: Report	FA: Fail	G3: Group 3
WS: Waiting send	MS: Mailbox save	FF: Fax Forward	TU: Terminated by user	EC: Error Correct

AGENDA

EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF MEETING

Notice is hereby given that a Regular Called Meeting of the Board of Directors which includes a Public Hearing on the Proposed Desired Future Conditions of The Evergreen Underground Water Conservation District and Groundwater Management Area 15 will be held on **Friday, April 22, 2016 at 09:00 a.m.** at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Russell Labus

Russell Labus, General Manager

1. Declaration of Quorum and Call to Order.
2. Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING- Proposed Desired Future Conditions of the Evergreen UWCD and Groundwater Management Area 15

a. Call to Order.
b. Receive Public Comments.
c. Adjourn.

Reconvene to Meeting.

CONSIDER AND/OR ACTION ON:

3. Receive Public Comments on Agenda Items.
4. Possible Action on Adoption of the Proposed Desired Future Conditions of the Evergreen UWCD and Groundwater Management Area 15.
5. Minutes of the March 24, 2016 Board of Directors' Meeting.
6. Report of Bills Paid for March 2016.
7. Budget and Bookkeeping Reports for March 2016.
8. Discussion and Possible Action on Management Zones.
9. Approval for the Polly Mansion Property in the Name of "Eagle Ford Investments and Advisors LLC." Historical Exemption Application Received by the Wilson County Appraisal District.
10. Uncontested Water Well Drilling and Production Permits.
11. Staff Reports/Directors' Discussion.
12. Set Date and Time for Next Board Meeting.
13. Public Comments
14. Adjourn.

The Board of Directors for the Evergreen Underground Water Conservation District reserves the right to adjourn into executive session at any time during the course of this meeting to discuss any of the matters listed above, as authorized by Texas Government Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberations about Real Property), 551.073 (Deliberations about Gifts and Donations), 551.074 (Personnel Matters), 551.076 (Deliberations about Security Devices) and 551.087 (Deliberations Regarding Economic Development Negotiations).

THE STATE OF TEXAS
COUNTY OF KARNES

Received in duplicate originals, this the ______ day of April 2016, and posted according to laws by posting a duplicate original hereof on a bulletin board convenient to the public 72 hours prior to the scheduled meeting.

COUNTY CLERK'S OFFICE
KARNES COUNTY
Carol Swize by Jay Vasquez
Authorized Signature

FILED
At 10:45 o'clock A M

APR 21 2016

CAROL SWIZE, COUNTY CLERK
KARNES COUNTY, TEXAS
Deputy

AGENDA

EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
NOTICE OF MEETING

Notice is hereby given that a Regular Called Meeting of the Board of Directors which includes a Public Hearing on the Proposed District Management Plan will be held on **Friday, January 29, 2016 at 09:00 a.m.** at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Russell Labus

Russell Labus, General Manager

1. Declaration of Quorum and Call to Order.
2. Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING-PROPOSED DISTRICT MANAGEMENT PLAN

FILED 4:25 o'clock P M

JAN 25 2016

CAROL SWIZE, COUNTY CLERK
KARNES COUNTY, TEXAS
Deputy

- a. *Call to Order.*
- b. *Receive Public Comments on the District Management Plan.*
- c. *Adjourn.*

Reconvene to Meeting.

CONSIDER AND/OR ACTION ON:

3. Receive Public Comments on Agenda Items.
4. Resolution Number 2016-01 Adopting the Management Plan of the Evergreen Underground Water Conservation District.
5. Minutes of the December 18, 2015 Board of Directors' Meeting.
6. Report of Bills Paid for December 2015.
7. Budget and Bookkeeping Reports for December 2015.
8. Resolution Number 2016-02 Adoption of the Annual Public Funds Investment Policy.
9. Approval to Re-Allocate Certain Funds from Existing Certificates of Deposit Upon Their Maturity into other Certificates of Deposit by Recommendation of the Evergreen UWCD Finance Committee.
10. Discussion and Action on Approval of H2O4 Texas Invoice.
11. Resolution Number 2016-03 to designate Russell Labus as the Evergreen UWCD Representative to GMA 15.
12. Resolution Number 2016-04 to Designate Diane Savage as the Evergreen UWCD Alternate Representative to GMA 15.
13. Discussion and Review of the Proposed Desired Future Conditions of GMA 15.
14. Discussion and Consideration of the 9 Factors as Required by Chapter 36.108(d) Of the Texas Water Code for Adopting Desired Future Conditions for GMA 15.
15. Uncontested Water Well Drilling and Production Permits.
16. Staff Reports/Directors' Discussion.
17. Set Date and Time for Next Board Meeting.
18. Public Comments
19. Adjourn.

The Board of Directors for the Evergreen Underground Water Conservation District reserves the right to adjourn into executive session at any time during the course of this meeting to discuss any of the matters listed above, as authorized by Texas Government Code Sections 551.071 (Consultation with Attorney), 551.072 (Deliberations about Real Property), 551.073 (Deliberations about Gifts and Donations), 551.074 (Personnel Matters), 551.076 (Deliberations about Security Devices) and 551.087 (Deliberations Regarding Economic Development Negotiations).

THE STATE OF TEXAS
COUNTY OF KARNES

Received in duplicate originals, this the 25th day of January 2016, and posted according to laws by posting a duplicate original hereof on a bulletin board convenient to the public 72 hours prior to the scheduled meeting.

COUNTY CLERK'S OFFICE
Karnes ~~ATASCOSA~~ COUNTY
Carol Swize by Deb

Authorized Signature

MINUTES
EVERGREEN UNDERGROUND WATER CONSERVATION DISTRICT
JANUARY 29, 2016 – REGULARLY SCHEDULED BOARD MEETING

The Meeting of the Board of Directors of the Evergreen Underground Water Conservation District, pursuant to notice, at the District Office, 110 Wyoming Blvd., Pleasanton, Atascosa County, Texas.

Directors Present:	Steve Snider, President Clifton L. Stacy, Vice-President Blaine Schorp, Secretary/Treasurer Diane Savage Jay Troell Frank Kruciak Larry Fox Craig Nieschwietz
Directors Absent:	Jason Peeler
Employees Present:	Russell Labus, General Manager Melissa Gonzalez, District Secretary/Bookkeeper Christopher McFarlane, Assistant Manager Matthew Pope, Field Technician
Guests Present:	Attached
Agenda:	Attached.

Declaration of Quorum and Call to Order:

President Snider declared a quorum present and called the meeting to order at 09:06 a.m. The meeting was posted and filed as required by law.

Pledge of Allegiance.

Recess to Public Hearing

PUBLIC HEARING-PROPOSED DISTRICT MANAGEMENT PLAN

a. Call to Order.

President Snider called the Public Hearing to order at 9:07 a.m.

b. Receive Public Comments on the District Management Plan.

Alan Cockerell questioned whether the Management Plan was posted according to the districts rules and said that he had some trouble downloading and printing a copy of the Management Plan from our website.

General Manager, Russell Labus said that we posted the Notice of Public Hearing and Agenda according to the checklist of requirements provided by the Texas Water Development Board.

c. Adjourn.

President Snider declared the Public Hearing adjourned at 9:17 a.m.

Reconvene to Meeting

CONSIDER AND/OR ACTION ON:

Public Comment on Agenda Items:

None.

Resolution #2016-01 Adopting the Management Plan of the Evergreen Underground Water Conservation District:

Director Stacy move to adopt Resolution Number 2016-01 adopting the Management Plan of the Evergreen Underground Water Conservation District. Director Schorp seconded the motion, and there being no further discussion the motion carried unanimously.

Minutes of the December 18, 2015 Board of Directors' Meeting:

The minutes of the December 18th meeting were presented to the Board. Director Stacy moved to approve the minutes with a minor correction. Director Savage seconded the motion, and there being no further discussion the motion carried unanimously.

Report of Bills Paid for December 2015:

The report of bills paid for December was presented to the Board. Director Schorp moved to receive and file the report. Director Nieschwietz seconded the motion, and there being no further discussion the motion carried unanimously.

Bookkeeping and Budget Reports for December 2015:

The bookkeeping and budget reports for December were presented to the Board. Director Schorp moved to receive and file the reports. Director Savage seconded the motion, and there being no further discussion the motion carried unanimously.

Resolution #2016-02 Adoption of the Annual Public Funds Investment Policy:

Director Schorp moved to adopt Resolution #2016-02 adopting the Public Funds Investment Policy. Director Fox seconded the motion, and there being no further discussion the motion carried unanimously.

Approval to Re-Allocate Certain Funds from Existing Certificates of Deposit upon Their Maturity into other Certificates of Deposit by Recommendation of the Evergreen UWCD Finance Committee:

Director Nieschwietz spoke in behalf of the Finance Committee and said the recommendation is to let all certificates of deposit expire and to transfer the funds to the corresponding bank accounts. Once this has been done then reallocate the monies into different banks. The Board gave General Manager, Russell Labus direction to let the certificates of deposit expire, to transfer the funds, and buy other certificates of deposit in other banks.

Discussion and Action on Approval of H2O4 Texas Invoice:

Director Kruciak made the motion to not pay the H2O4 Texas Invoice for the amount of $1,000.00. Director Troell seconded the motion, and there being no further discussion the motion carried unanimously.

Resolution #2016-03 to Designate Russell Labus as the Evergreen UWCD Representative to GMA 15:

Director Troell made the motion to designate Russell Labus as the Evergreen UWCD representative to GMA 15. Director Schorp seconded the motion, and there being no further discussion the motion carried unanimously.

Resolution #2016-04 to Designate Diane Savage as the Evergreen UWCD Alternate Representative to GMA 15:

Director Troell made the motion to designate Diane Savage as the Evergreen UWCD alternate representative to GMA 15. Director Kruciak seconded the motion, and there being no further discussion the motion carried unanimously.

Discussion and Review of the Proposed Desired Future Conditions of GMA 15:

The Board reviewed the proposed desired future conditions for GMA 15 provided by Tim Andruss, GMA 15 Chairman.

Discussion and Consideration of the 9 Factors as Required by Chapter 36.108(d) of the Texas Water Code for Adopting Desired Future Conditions for GMA 15:

The Board considered the 9 factors for desired future conditions taken from the Texas Water Code Chapter 36.108(d).

Uncontested Water Well Drilling and Production Permits:

The Board was presented with one drilling and one production permit application from City of Kenedy for a new well to be located in Karnes County. Director Troell moved to approve the drilling and production permits. Director Kruciak seconded the motion and there being no further discussion the motion carried unanimously.

The Board was presented with two drilling and two production permit applications from J&B Farms for new wells to be located in Frio County. Director Stacy moved to approve the drilling and production permits. Director Savage seconded the motion, Director Schorp abstained, and there being no further discussion the motion carried unanimously.

The Board was presented with one drilling permit application from Jennifer Ross for a well to be located in Frio County. Director Stacy moved to approve the drilling permit. Director Kruciak seconded the motion, and there being no further discussion the motion carried unanimously.

The Board was presented with three production permit applications for the City of Kenedy, for existing wells located in Karnes County. Director Schorp moved to approve the production permits. Director Savage seconded the motion, and there being no further discussion the motion carried unanimously.

Staff Reports/Directors' Discussion:

Director Savage mentioned that she will be attending a Sunko meeting and provide those attending copies of the Scholarship notice. Director Savage said that there will be a Region L meeting on February 11, 2016.

General Manager, Russell Labus stated as far as meetings for the month there was a GMA 13 meeting last week on January 22nd, a TAGD meeting this week on January 27th and 28th and a meeting put on by the Texas Farm Bureau Austin. Mr. Labus mentioned that Chris McFarlane and Matthew Pope will be attending GIS Workshop in March. Mr. Labus said that there will be a Desalination Conference in San Antonio, which Director Troell said he will be attending. Mr. Labus stated that injection well activity in the newspapers is almost nonexistent. Mr. Labus said that there will be a hearing on March 4, 2016 for one injection well located in Karnes County. Mr. Labus said he spoke to Ron Green with Southwest Research and he mentioned that they have completed their technical review and found that there is no technical reason for Evergreen to continue with its protest. Mr. Labus mentioned that he received a letter yesterday stating that there will be a hearing in April for a different injection well also located in Karnes County. Mr. Labus said that Intera had their workshop on January 12th with the Rules Committee. Mr. Labus said the main point of the workshop was to talk about management zones. Gary Westbrook and Greg Sengelmann also attended the workshop and explained how they do their management zones for their districts. Mr. Labus said that Steve Young asked to be on the agenda for February's meeting and asked that if the Board has any questions to please let him know so that they can be answered during his presentation.

Assistant Manager, Christopher McFarlane mentioned that he along with Matthew Pope have attended a couple of presentations given by the Nueces River Authority and feels that it was a great decision for the board to approve and expand the education program. Mr. McFarlane recommended placing the scholarship notice in all four newspapers within the district in order to reach all those who qualify to participate.

Field Technician, Matthew Pope said that Layne Christensen Co., who will be drilling the well for the City of Kenedy, will be drilling a monitor well beforehand to check the quality of the water. The City of Kenedy has given us permission to use that as a new monitor well for the district which is great since we do not have any monitor wells in that location.

Set Date and Time for Next Board Meeting:

The Board agreed to set the next meeting date for Friday, February 19, 2016 at 09:00 a.m. at the District Office in Pleasanton, TX 78064.

Public Comments:

None.

Adjourn:

There being no further business to come before the Board, President Snider declared the meeting adjourned at 10:37 a.m.

Steve Snider

Steve Snider, President

ATTEST:

Blaine Schorp

Blaine Schorp, Secretary/Treasurer

MINUTES
OF THE SPECIAL MEETING/PUBLIC HEARING
OF THE BOARD OF DIRECTORS OF
CORPUS CHRISTI AQUIFER STORAGE AND RECOVERY
CONSERVATION DISTRICT
February 4, 2016

The Board of Directors of the Corpus Christi Aquifer Storage and Recovery Conservation District met in special session on Thursday, February 4, 2016, in the ACM Conference Room, 5th floor, City Hall, 1201 Leopard Street, Corpus Christi, Texas, with the following in attendance:

Members:	In Attendance: (non-members)
Fred Segundo	Brent Clayton, Project Manager
Gus Gonzalez	Lisa Aguilar, Assistant City Attorney
Tom Tagliabue	Jeannie Holland, Legal Assistant
Dan McGinn	James Dodson

Absent:
Margie Rose

(1) **Call Meeting to Order**: The meeting was called to order by Board Chair Fred Segundo at 1:31 p.m. Roll was called. A quorum was present.

(2) Motion was made by Board member Tom Tagliabue to open the Public Hearing. The Motion was seconded by Dan McGinn. Discussion was had regarding the Proposed Desired Future Conditions (DFCs) for Groundwater Management Area 15 and Groundwater Management Area 16 regarding projected aquifer drawdowns and pumping values. It was reported that although published in required newspapers and advertised, no comments have been received to date. The Board was provided with a copy of the nine (9) factors identified in Texas Water Code §36.108 (d) and the explanatory report was discussed and considered. It was determined and agreed that there will be no significant impact of any of the items that would present a threat to our resources. The Board has no revisions for consideration. Motion was made by Board member Tom Tagliabue to close the Public Hearing, and the Motion was seconded by Board member Dan McGinn. The Public Hearing was so closed.

(3) **Adjournment:** Motion was made by Board member Tom Tagliabue to adjourn the meeting. It was seconded by Board member Gus Gonzalez. The meeting was adjourned.

Tom Tagliabue for
Gus Gonzalez, Secretary

Factors identified in Texas Water Code §36.108 (d) that are to be discussed in the explanatory report include:

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 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

Factors identified in Texas Water Code §36.108 (d) that are to be discussed in the explanatory report include:

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 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

16

Bar-W GROUNDWATER EXPLORATION

GMA-16 Gulf Coast Aquifer Projected Drawdown and Pumping Values for DFC Consideration

from GMA-16 GAM Scenario 1.8

Area	Layer 1 Chicot average draw-down (feet) **Scenario 1.8**	Layer 2 Evangeline average draw-down (feet) **Scenario 1.8**	Layer 3 Burkeville average-draw down (feet) **Scenario 1.8**	Layer 4 Jasper average draw-down (feet) **Scenario 1.8**	Area-Weighted Gulf Coast Aquifer average draw-down (feet) **Scenario 1.8**	Gulf Coast Aquifer Total Pumping for Year 2060 (ac-ft/year) **Scenario 1.8**
Bee GCD	106	84	73	60	76	12,200
Live Oak UWCD	79	64	60	19	34	10,300
McMullen GCD	0	0	0	9	9	510
Red Sands GCD	0	29	30	30	29	650
Kenedy County GCD	15	99	21	21	39	55,000
Brush Country GCD***	47	76	68	69	69	14,200[1] + 5,840[2]
Duval County GCD	78	142	95	85	107	27,000
San Patricio Co. GCD	88	60	23	22	48	57,450
Starr County GCD	0	83	74	55	69	7,800
Cameron County	62	122	48	48	70	65,800
Hidalgo County*	139	144	93	91	113	109,000
Kleberg County**	8	105	11	11	34	4,825
Nueces County**	22	39	11	11	21	10,040
Webb County	0	151	0	71	112	1,300
Willacy County**	28	85	23	23	40	3,200
GMA 16 as a Whole	**61**	**92**	**48**	**42**	**62**	**385,115**

Scenario 1.8 2010-2060 Average Draw Down (in feet) by Layer in Gulf Coast Aquifer Subdivisions and Pumping (in ac-ft per year) by Geographically Defined Areas

* not in Brush Country GCD, Kenedy County GCD or Red Sands GCD

** not in Kenedy County GCD; *** includes City of Alice area and pumping in a portion of central Jim Wells County not within but otherwise surrounded by Brush Country GCD

[1] Brush Country GCD pumping; [2] City of Alice pumping in Jim Wells County

STATE OF TEXAS
CHARLES R. WILLIAMS
GEOLOGY
No. 526
LICENSED
PROFESSIONAL GEOSCIENTIST

Charles Williams

BAR-W Groundwater Exploration LLC
3050 Tamarron Blvd #9205 Austin, Texas 78746 T: 512.585-8880 barw.groundwater@gmail.com

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

INTERA Incorporated
1812 Centre Creek Drive, Suite 300
Austin, Texas, USA 78754
512.425.2000

ATTACHMENT A
GMA 15 PROVISIONAL DESIRED FUTURE CONDITIONS

GMA 15 has identified Provisional Desired Future Conditions (PDFCs) defined in terms of average drawdowns as of December 2070 for the following:

Gulf Coast Aquifer System – this drawdown represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline Aquifers – this drawdown represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Jasper Aquifer- this drawdown represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

An overarching PDFC for the counties in GMA 15 is a drawdown of 13 feet for the Gulf Coast Aquifer System. Table A-1 lists additional PDFCs that are county specific.

Table A-1. Provisional Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

County	Chicot and Evangeline	Jasper	Gulf Coast Aquifer System
ARANSAS[1]	NPDFC	NPDFC	0
BEE	NPDFC	NPDFC	7
CALHOUN	NPDFC	NPDFC	5
COLORADO	17	23	NPDPC
DEWITT	NPDFC	NPDFC	17
FAYETTE	NPDFC	NPDFC	16
GOLIAD	NPDFC	NPDFC	10
JACKSON	NPDFC	NPDFC	15
KARNES[2]	NPDFC	NPDFC	22
LAVACA	NPDFC	NPDFC	18
MATAGORDA[1]	11	NPDFC	NPDFC
REFUGIO	NPDFC	NPDFC	5
VICTORIA	NPDFC	NPDFC	5
WHARTON[1]	15	NPDFC	NPDFC
GMA 15	NPDFC	NPDFC	**13**

NPDFC - No Provisional DFC
[1] Burkeville and Jasper are not relevant
[2] Chicot is not relevant

Among the information used by GMA 15 to establish the PDFCs are drawdowns predicted from the Central Gulf Coast GAM (Chowdhury and others, 2004). One of the reasons that GMA 15 performed the predictive

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Austin, Texas, USA 78754
512.425.2000

simulations was to demonstrate that the PDFCs are compatible and physically possible. Table A-2 presents average drawdowns simulated using the Central Gulf Coast GAM (Chowdhury and others, 2004) and a MODFLOW pumping file created by GMA 15 called Baseline_Run1.

Table A-2. Average Drawdown between January 2000 and December 2069 for Counties in GMA 15 Predicted by the Central Gulf Coast GAM and Pumping File Baseline_Run1

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System
ARANSAS	-0.1	5.9	0.0	NA	NA	0.0
BEE	1.4	8.7	6.2	7.7	5.7	6.6
CALHOUN	-0.6	10.7	2.7	2.9	NA	2.7
COLORADO	12.9	26.0	20.1	22.8	25.1	22.1
DEWITT	1.2	6.1	5.4	17.0	26.2	17.3
FAYETTE	NA	5.6	5.6	17.8	18.2	16.2
GOLIAD	-3.4	0.7	-0.1	7.2	10.6	5.2
JACKSON	15.2	20.3	17.7	14.6	22.2	17.6
KARNES	NA	0.4	0.4	18.2	24.1	20.5
LAVACA	7.2	6.8	6.9	16.3	31.4	17.7
MATAGORDA	4.0	17.2	8.0	16.9	NA	8.9
REFUGIO	-0.4	7.3	3.2	2.8	NA	3.1
VICTORIA	-4.3	6.0	1.0	5.1	9.6	3.6
WHARTON	14.7	12.4	13.5	25.8	28.7	20.2
Average	5.5	11.4	8.5	15.3	22.2	13.3

NA - Not Applicable because the Unit is not represented in the Central Gulf Coast GAM

GMA 15 considers the PDFCs in Table A-1 to be compatible and physically possible if the difference between the PDFCs in Table A-1 and the simulated drawdowns in Table A-2 are within 3.5 feet except in the case of Goliad County. Factors considered for determining tolerance criteria of 3.5 feet include:

- Residuals and root-mean square error (RSME) between the measured and simulated values for historical water levels produced by the Central Gulf Coast GAM;
- Sensitivity of the simulated drawdown to the recharge rate used in the predictive simulation and estimates of uncertainty in the magnitude and distribution of historical and predicted recharge rates;
- Sensitivity of the simulated drawdown to the hydraulic properties of the aquifer properties in the predicted simulation and observed differences between measured hydraulic aquifer properties and modeled aquifer hydraulic properties in the Central Gulf Coast GAM;
- Uncertainty in the temporal and spatial distribution of historical and future pumping in the GMA 15 counties.

GMA 15 considers the PDFC for Goliad County to be compatible and physically possible if the difference between the PDFCs in Table A-1 and the simulated drawdowns in Table A-2 are within 5.0 feet. Factors considered by GMA 15 for determining the tolerance criteria of 5.0 feet have been documented by Goliad County GCD and include:

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512.425.2000

- an evaluation of water level change in sixty Evangeline wells from 2003 to 2015, which indicates that the GAM underpredicts drawdown in the Evangeline Aquifer underlying Goliad County
- an evaluation of water level change in fifteen Chicot wells from 2003 to 2015, which indicates that the GAM underpredicts drawdown in the Chicot Aquifer underlying Goliad County
- an evaluation of gain-loss studies performed by the USGS that indicates that the GAM overpredicts leakage from the streams in areas of pumping
- evidence suggesting that the GAM's average recharge rate for Goliad County is too high

References:

Chowdhury, A. Wade, S., Mace, R.E., and Ridgeway, C., 2004, Groundwater Availability of the Central Gulf Coast Aquifer System: Numerical Simulations through 1999: Texas Water Development Board, unpublished report.

From: **Bill Green** BillG@cctexas.com
Subject: RE: GMA 15 Meeting
Date: April 29, 2016 at 8:41 AM
To: Tim Andruss, VCGCD tim.andruss@vcgcd.org
Cc: Daniel McGinn DanielMc@cctexas.com, Fred Segundo FredS@cctexas.com, Bill Green BillG@cctexas.com

BG

April 29, 2016

Dear Mr. Andruss (Tim):

No representative from the City of Corpus Christi (City) or the Corpus Christi Aquifer Storage and Recovery Conservation District (CCASRCD) will be able to attend today GMA 15 meeting and consideration of the proposed DFC for GMA 15. Attached, however, for your records are the approved minutes of a special meeting held by the CCASRCD on February 4, 2016 for discussion and public input concerning proposed DFC for GMA 15 and GMA 16. As can be construed, no revision or comment was given to the GMA 15 DFC as proposes.

Concerning CCASRCD appointment as the voting representative at the GMA 15 meeting, a separate action will be taken in the future to secure this appointment. We regret that we are unable to attend today's proceedings but do appreciate the opportunity to participate in these important affairs of the GMA 15.

Best regards,

Bill
Wm J. Green, P.E.
Water Resource Management
Development Services
City of Corpus Christi
2406 Leopard Street
Corpus Christi, TX 78408
(361) 826-3268 (direct)
(361) 816-4916 (mobile)
(361) 826-3590 (facsimile)

From: Tim Andruss, VCGCD [mailto:tim.andruss@vcgcd.org]
Sent: Friday, April 29, 2016 8:27 AM
To: Bill Green <BillG@cctexas.com>
Subject: Fwd: GMA 15 Meeting

Bill: below is the message I sent last yesterday to Mr. McGill. Thank you for your support. Tim Andruss.

Tim Andruss
General Manager
Victoria County Groundwater Conservation District
2805 N. Navarro St., Ste 210
Victoria, Texas 77901
Office: 361.579.6863
FAX: 361.579.0041
email: tim.andruss@vcgcd.org

Begin forwarded message:

From: "Tim Andruss, VCGCD" <tim.andruss@vcgcd.org>
Subject: GMA 15 Meeting
Date: April 28, 2016 at 5:07:50 PM CDT
To: Corpus Christi ASRCD - Representative <DanielMc@cctexas.com>
Cc: Corpus Christi ASRCD - Presiding Officer <gustavog@cctexas.com>

Mr. McGinn: I am hopeful you will be attending the GMA 15 meeting tomorrow in Victoria. If you will be attending the meeting and intend to serve as the voting representative for Corpus Christi ASRCD, please provide a copy of a letter or official record of your designation as an voting alternate of the presiding officer of Corpus Christi ASRCD. At the meeting, GMA 15 will consider the summaries of the public comment period from each district during the meeting and possible adoption of the proposed DFCs of GMA 15. I have not received a summary from Corpus Christi ASRCD. I have take the liberty of including a generic letter that could be used to transmit the summary of the public comment period at CCASRCD. I recognize that this message is being sent "last-minute" so should you have any questions, please feel free to contact after normal working hours at 361-648-9762. Regard, Tim Andruss

Colorado County Groundwater
Conservation District
P.O. Box 667
Columbus, TX 78934
979 732 9300 Office
979 732 9301 Fax

April 28, 2016

Tim Andruss – GMA 15 Administrator
Victoria County Groundwater Conservation District
2805 N. Navarro St.
Victoria, TX 77901

Dear Mr. Andruss,

On April 27, 2016 at 7:00 pm, the Colorado County Groundwater Conservation District (CCGCD) held a public hearing at the CCGCD office for the purpose of receiving public comment on the proposed Desired Future Conditions (DFC) for GMA 15. No public comment was received during this hearing or during the public comment period.

Regards,

James E. Brasher

James E. Brasher
General Manager
Colorado County Groundwater Conservation District

TX Result Report

04/12/2016 04:03
Serial No. A5C0011022263
TC: 70773

Addressee	Start Time	Time	Prints	Result	Note
9792447688	04-12 04:02	00:00:56	002/002	OK	CALL

Note TMR:Timer TX, POL:Polling, ORG:Original Size Setting, FME:Frame Erase TX, DPG:Page Separation TX, MIX:Mixed Original TX, CALL:Manual TX, CSRC:CSRC, FWD:Forward, PC:PC-FAX, BND:Double-Sided Binding Direction, SP:Special Original, FCODE:F-code, RTX:Re-TX, RLY:Relay, MBX:Confidential, BUL:Bulletin, SIP:SIP Fax, IPADR:IP Address Fax, I-FAX:Internet Fax

Result OK: Communication OK, S-OK: Stop Communication, PW-OFF: Power Switch OFF, TEL: RX from TEL, NG: Other Error, Cont: Continue, No Ans: No Answer, Refuse: Receipt Refused, Busy: Busy, M-Full:Memory Full, LOVR:Receiving length Over, POVR:Receiving page Over, FIL:File Error, DC:Decode Error, MDN:MDN Response Error, DSN:DSN Response Error, PRINT:Compulsory Memory Document Print, DEL:Compulsory Memory Document Delete, SEND:Compulsory Memory Document Send.

2200 7th St., Ste 303
Bay City, TX 77414
Phone: 979-323-9170
Fax: 979-245-5661

COASTAL PLAINS GCD

Fax

To:	Matagorda County Courthouse	**From:**	Sandra
Fax:	979-244-7688	**Date:**	April 12, 2016
Phone:		**Pages:**	2 INCLUDING COVER
Re:	Public Hearing GMA15	**CC:**	

☐ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

•Comments:

Notice:

Please post the following Public Hearing Notice for April 25th, 2016 by 5:OO pm today.

Thank you,

Sandra Horris

COASTAL PLAINS GROUNDWATER CONSERVATION DISTRICT
Location: Matagorda County Office Bldg, 2200 7th St. 4th floor Conference Rm., Bay City, TEXAS 77414
Phone: 979-323-9170 Fax: 979-245- www.coastalplainsgcd.com

NOTICE OF PUBLIC HEARING
04/25/2016
1:30p.m.

AGENDA

I. Open Public Hearing for Comments on the Proposed Desired Future Condition of Groundwater Management Area 15.
II. Public Comments / Announcements.
III. Adjournment.

NOTICE OF HEARING

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Coastal Plains Groundwater Conservation District will conduct a hearing on April 25, 2016 at 1:30 pm at the Matagorda County Office Building, 2200 7th St. 4th floor Conference Room, Bay City, Matagorda County, Texas. The purpose of the hearing is to hear public comments on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).
Chicot and Evangeline aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).
Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;
Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
Dewitt County: 17 feet of drawdown of the Gulf Coast Aquifer System;
Fayette County: 16 feet of drawdown of the Gulf Coast Aquifer System;
Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Neil Hudgins, General Manager, Coastal Plains Groundwater Conservation District at 979-323-9170, 2200 7th St. Suite 301, Bay City, Texas 77414, or nhudgins@cbgcd.com.

MEHOP raises funds to help people's lives

By Jessica Shepard
bcsentinelnews@gmail.com

Over 350 people filled the Bay City Civic Center for MEHOP's annual fundraising event.

This year, attendees were transported to a masquerade affair in the garden district of New Orleans.

"Thousands of dollars were raised that will support MEHOP's goals to increase transportation services for patients, create an onsite day care, and renovate antiquated facilities in order to teach patients how to lead healthier lives," said Jessica Russell, Director of Employee and Public Affairs.

Masks were sold for attendees with proceeds going to MEHOP.

"Several masks were sold the best part was that there was an overwhelming amount of guests that came in their own!" she said.

Guests dined on a meal of prime rib, blackened shrimp, and bourbon bread pudding while bidding on silent and live auction items.

Of the live auction items, the Argentinian Dove hunt brought the most money.

The night opened with a saxophone soloist named Edmund Baker.

Easy Money, from Houston, played for the dance portion of the evening.

"They play Rock and Roll, Country, R&B, and Easy Listening," said Russell.

Dancing began shortly after 8:30 and went well into the night, she said.

The evening concluded with the 50/50 and workin' wagon raffle drawings and a coffee bar complete with homemade pralines.

"MEHOP would like to thank all of our guests whose generosity ensures MEHOP's future in the community for years to come – without donors such as you MEHOP would be unable to complete our mission to improve the health status of our clients in a medical home environment, provide quality Primary Health Care services along with spiritual care to the people in the communities in which we serve," said Russell.

BCHS readies students for work

By Dr. Dianne Farrar
BCHS Teacher
CTE Dept. Co-Chair

Twenty-three Bay City High School students recently passed the Excel 2010 Microsoft Office Specialist Exam.

Microsoft Office Specialist (MOS) certification is the leading IT certification in the world. More than one million MOS exams are taken every year in over 140 countries.

Students at BCHS who recently earned the certification that will be listed on their transcripts, are: Autumn Ayala, Matthew Carter, Madison Cooley, Katie Daniels, Noah Downs, Hannah Eidelbach, Lisette Guevara, Sierra Havel, Natalie Hernandez, Zachary Hestand, Allison Johnson, Hannah Johnson, William Johnson, Ashley Lara, Miguel Lara, Marc Medina, Otensha Milimo, Madison Nixon, Andy Pham, Hunter Powell, Carlos Reyes, Noel Solis and Thomas Valdez.

Their BCHS Business Information Management teachers are Jenifer Townsend, Sandra Watson and Dr. Dianne Farrar.

In academia, MOS promotes success in the classroom for students (and instructors), builds individual distinction, and prepares students for an increasingly competitive workforce.

For business, MOS maximizes office productivity and efficiency for the organization and increases job satisfaction and heightens career achievement among employees.

In workforce development, MOS prepares and places job candidates, ensuring they possess the skills employers require.

See www.Certiport.com to learn more about MOS Certifications.

J.C. Lewis tree sale this Friday

By Jessica Shepard
bcsentinelnews@gmail.com

What would be a better way to celebrate Earth Day than to purchase and plant a tree?

Earth Day occurs annually every April 22, but, the chance to buy a Live Oak, Crepe Myrtle or Sago Palm starts this Friday.

The Bay City Chamber of Commerce and Agriculture is hosting their 52nd Annual J. C. Lewis Live Oak Memorial Tree Sale starting Friday, April 15 from 1 - 5 p.m. at the HEB Green Space on Fifth and Sixth Street.

Saturday, April 16 the tree sale will be from 9:30 a.m. – 4 p.m. on the Downtown Square in Bay City during Market Days.

Trees can be pre-ordered and also planted for a minimal fee.

Five gallon Live Oaks cost $27, 15 gallon trees are $65 and 30 gallon trees are $150.

Crepe Myrtles are $25 per five gallon tree and come in: red, purple, white and pink flowers.

Five gallon Sago Palms are $35 each.

Contact the Bay City Chamber of Commerce and Agriculture at 979-245-8333 for more information.

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PUBLIC INFORMATION

Public Notice of Meeting

The Coastal Plains Groundwater Conservation District is currently receiving public comments on the proposed desired future conditions for the area aquifers that were proposed by Groundwater Management Area 15 under §36.108, Texas Water Code. Groundwater Management Area 15 includes the groundwater conservation district as follows: Aransas County, Bee, Calhoun County, Coastal Bend, Coastal Plains, Colorado County, Corpus Christi ASR, Evergreen, Fayette County, Goliad County, Pecan Valley, Refugio, Texana and Victoria County. The proposed desired future conditions and supporting materials for the area aquifers are available at the District's office at 2200 7th St. Suite 301, Bay City, TX 77414. The District will hold a public hearing on the proposed desired future conditions on April 25, 2016 at 1:30 p.m., at the Matagorda County Office Building 4th Floor Conference Room. Public comments will be accepted by the District through April 25, 2016, at the District office by mail or email or at the public hearing. For more information, please call Neil Hudgins at (979)323-9170.

Shop Local

COASTAL PLAINS GROUNDWATER CONSERVATION DISTRICT

2200 7TH Street, #301
Bay City, TX 77414
979-323-9170 Fax: 979-245-5661
shorris@co.matagorda.tx.us

April 26, 2016

Mr. Tim Andruss
GMA 15 Administrator
2805 N. Navarro St., Ste 210
Victoria, Texas 77901

Dear Mr. Andruss,

This purpose of this letter is to inform you that the Coastal Plains Groundwater Conservation District made available a copy of the proposed Desired Future Conditions of Groundwater Management Area 15 and supporting materials in our office during the public comment period, and has held a public hearing to receive public comment in accordance with Texas Water Code Section 36.108(d-2).

CPGCD did not receive any public comments during the comment period, nor did we have any comments made at the Public Hearing. The public hearing was held on April 25, 2016 at 1:30p.m. at the County of Matagorda Office Building, 2200 7th St. 4th floor Conference Room, Bay City, TX 77414.

I have attached posting verifications if needed.

Best Regards,

Neil Hudgins
CPGCD General Manager

133 CATTLE, HOGS, HORSES

2 HORSES FOR SALE. 1 MARE and 1 stud. Call 979-543-6087.

135 Seeds, Plants

KALINA'S NURSERY. Vegetable and Bedding plants are ready. Thursday, Friday, Saturday, 9am-3pm. Call 979-532-1719 any other time. 1408 CR428, Wharton.

151 Misc. For Sale

1-LARGE WEIGHT STATION, $500. 1-Treadmill, $300. 2-Stationary Bikes, $50/each. 979-282-9660 or 979-282-9640 ask for Kandace Nasis.

ROAD GRAVEL FOR SALE. New pit open 1418 Ramsey Rd., Eagle Lake, TX. 979-543-4346 or 979-541-2452. Owner: Chris Dettling.

CRAWFISH FOR SALE. LOCALLY raised, extra clean, purged, ready to cook crawfish. Call 979-541-3858 or 979-541-3002.

VINTAGE AIRCRAFT!! 1950 Cessna 170A. In excellent condition, same owner 49 years. Very clean & well kept aircraft, current annual, new battery & muffler. Only interested inquiries. Call 325-773-3489 or 325-773-5226.

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172 SPECIAL NOTICES

NOTICE

The following persons, being delinquent in rent on storage spaces rented at **The Storage Place** from Carlson Development Company, are hereby notified that belongings contained therein will be sold at a Garage Sale or Auction 15 days after publication of this notice; proceeds of sale to be applied to indebtedness to **Carlson Development Co**:

CANDACE LIMAS
PAT LOGUE
PAULA WILLEYU
BILLIE PHILLIPS

Classified Deadlines

Word/Line Ads and Classified Display

Mon. 4 p.m. for Wed. Edition

Thurs. 4 p.m. for Sat. Edition

MOORE'S HILLJE AUCTION

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VIEWING 10:30 A.M. AUCTION 12:30 P.M.

SUNDAY APRIL 17, 2016

GLASSWARE: Fenton, Shawnee Corn, Cherry—Bowls, Carnival
MEN'S CORNER: Craftsman –Saw, Drills with Charger, Hunting Knives, Original Lipper
FURNITURE: Simplicity Pattern Cabinets, Wicker Patio Table/4 Chairs, Large Glass Display, Chest of Drawers, Hutch, Dresser, Recliners, Love Seats, Lift Chair
MISCELLANEOUS: Windbergs, Signs, Coins and more

Moore's Hillje Auction AUCTIONEERS: Archie Foegelle 9271, Kirk Moore 17619, Chris Burrow 16983, Mark Van Gorp 16366
Phone: 979-543-5340 (Home) 979-541-6227 (Cell) 979-648-2176 (Hillje)
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Sat • Apr 16 • 7am-Noon
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206 Neal Rd.

MULTI FAMILY GARAGE SALE
Sat Only • Apr 16 • 8am-?
Light fixtures, bikes, games, toys, all sizes clothes, furniture & much more!
103 Greenbriar Dr.

CLASSIFIEDS GET RESULTS

SELL IT IN THE CLASSIFIEDS!

175 Public Notices

PUBLIC NOTICE

The Coastal Bend 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 15 under §36.108, Texas Water Code. Groundwater Management Area 15 includes the groundwater conservation district as follows: Aransas County, Bee, Calhoun County, Coastal Bend, Coastal Plains, Colorado County, Corpus Christi ASR, Evergreen, Fayette County, Goliad County, Pecan Valley, Refugio, Texana and Victoria County. The proposed desired future conditions and supporting materials for the area aquifers are available at the District's office at 109 E. Milam St.,Wharton, TX 77488. The District will hold a public hearing on the proposed desired future conditions on April 25, 2016 at 8 a.m., at the District office. Public comments will be accepted by the District through April 25, 2016, at the District office by mail or email or at the public hearing. For more information, please call District staff or Neil Hudgins at (979)531-1412

175 Public Notices

PUBLIC NOTICE

The Coastal Bend 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 15 under §36.108, Texas Water Code. Groundwater Management Area 15 includes the groundwater conservation district as follows: Aransas County, Bee, Calhoun County, Coastal Bend, Coastal Plains, Colorado County, Corpus Christi ASR, Evergreen, Fayette County, Goliad County, Pecan Valley, Refugio, Texana and Victoria County. The proposed desired future conditions and supporting materials for the area aquifers are available at the District's office at 109 E. Milam St., Wharton, TX 77488. The District will hold a public hearing on the proposed desired future conditions on April 25, 2016 at 8 a.m., at the District office. Public comments will be accepted by the District through April 25, 2016, at the District office by mail or email or at the public hearing. For more information, please call District staff or Neil Hudgins at 979-0531-1412.

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COASTAL BEND
GROUNDWATER
CONSERVATION DISTRICT

Fax

To:	Sandra K. Sanders	From:	Neil Hudgins
Fax:	979 532-8426	Pages:	2 (Including cover page)
Phone:		Date:	April 11, 2016
Re:		CC:	

☑ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

• Comments:

Please post the following notice.

Thank you,

Neil Hudgins

CBGCD Manager

P.O. Box 341
109 E. Milam
Wharton, Texas 77488
(979) 531-1412 Fax (979) 531-1002
thedistrict@cbgcd.com

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HR: Host receive	PR: Polled remote	RP: Report	FA: Fail	G3: Group 3
WS: Waiting send	MS: Mailbox save	FF: Fax Forward	TU: Terminated by user	EC: Error Correct

COASTAL BEND GROUNDWATER CONSERVATION DISTRICT

Fax

To:	Sandra K. Sanders	**From:**	Neil Hudgins
Fax:	979-532-8426	**Pages:**	2 (Including cover page)
Phone:		**Date:**	April 11, 2016
Re:		**CC:**	

☑ **Urgent** ☐ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

● **Comments:**

Please post the following notice.

Thank you,

Neil Hudgins

CBGCD Manager

P.O. Box 341
109 E. Milam
Wharton, Texas 77488
(979) 531-1412 Fax: (979) 531-1002
thedistrict@cbgcd.com

COASTAL BEND GROUNDWATER CONSERVATION DISTRICT
Location: Coastal Bend GCD Office, 109 East Milam, WHARTON, TEXAS 77488
Phone: 979-531-1412 Fax: 979-531-1002 www.cbgcd.com

NOTICE OF PUBLIC HEARING
04/25/2016
8:00am

AGENDA

I. Open Public Hearing for Comments on the Proposed Desired Future Condition of Groundwater Management Area 15.
II. Public Comments / Announcements.
III. Adjournment.

NOTICE OF HEARING

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Coastal Bend Groundwater Conservation District will conduct a hearing on April 25, 2016 at 8:00 AM at the Coastal Bend GCD District Office, 109 E. Milam, Wharton, Wharton County, Texas. The purpose of the hearing is to hear public comments on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

GROUNDWATER MANAGEMENT AREA 15 PROPOSED DESIRED FUTURE CONDITIONS

Groundwater Management Area 15 proposes Desired Future Conditions (DFCs) as average drawdowns that occur between January 2000 and December 2069 for the following:

Gulf Coast Aquifer System – represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).
Chicot and Evangeline aquifers – represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).
Jasper Aquifer- represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Groundwater Management Area 15 proposes Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) and proposes a Desired Future Condition for the counties in the groundwater management area (gma-specific DFC). The Desired Future Condition for the counties in the groundwater management area shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2069. Desired Future Conditions for each county within the groundwater management area (county-specific DFCs) shall not exceed the values specified in Table A-1 at December 2069.

Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;
Bee County: 7 feet of drawdown of the Gulf Coast Aquifer System;
Calhoun County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Colorado County: 17 feet of drawdown of the Chicot and Evangeline Aquifers and 23 feet of drawdown of the Jasper Aquifer;
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Goliad County: 10 feet of drawdown of the Gulf Coast Aquifer System;
Jackson County: 15 feet of drawdown of the Gulf Coast Aquifer System;
Karnes County: 22 feet of drawdown of the Gulf Coast Aquifer System;
Lavaca County: 18 feet of drawdown of the Gulf Coast Aquifer System;
Matagorda County: 11 feet of drawdown of the Chicot and Evangeline Aquifers;
Refugio County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Victoria County: 5 feet of drawdown of the Gulf Coast Aquifer System;
Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Neil Hudgins, General Manager, Coastal Bend Groundwater Conservation District at 979-531-1412, P.O. Box 341, Wharton, Texas 77488, or thedistrict@cbgcd.com.

COASTAL BEND GROUNDWATER CONSERVATION DISTRICT
Location: Coastal Bend GCD Office, 109 East Milam, WHARTON, TEXAS 77488
Phone: 979-531-1412 Fax: 979-531-1002 www.cbgcd.com

NOTICE OF PUBLIC HEARING
04/25/2016
8:00am

POSTED
04/11/16

AGENDA

I. Open Public Hearing for Comments on the Proposed Desired Future Condition of Groundwater Management Area 15.
II. Public Comments / Announcements.
III. Adjournment.

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COASTAL BEND GROUNDWATER CONSERVATION DISTRICT

109 E. Milam
P.O. Box 341
Wharton, TX 77488

(979) 531-1412
(979) 531-1002 Fax

thedistrict@cbgcd.com
www.cbgcd.com

April 26, 2016

Mr. Tim Andruss
GMA 15 Administrator
2805 N. Navarro St., Ste 210
Victoria, Texas 77901

Dear Mr. Andruss,

This purpose of this letter is to inform you that the Coastal Bend Groundwater Conservation District made available a copy of the proposed Desired Future Conditions of Groundwater Management Area 15 and supporting materials in our office during the public comment period, and has held a public hearing to receive public comment in accordance with Texas Water Code Section 36.108(d-2).

CBGCD did not receive any public comments during the comment period, nor did we have any comments made at the Public Hearing. The public hearing was held on April 25, 2016 at 8:00a.m. at our District Office at 109 E. Milam St, Wharton, TX 77488.

I have attached posting verifications if needed.

Best Regards,

Neil Hudgins
CBGCD General Manager

Calhoun County Groundwater Conservation District

Board of Directors

Notice of Hearing and Public Meeting

Notice is given in accordance with Chapter 551, Government Code (V.T.C.A.) Texas Open Meeting Act and Sections 36.063 and 36.108 of the Texas Water Code, that the Calhoun County Groundwater Conservation District Board of Directors will conduct a public meeting and public hearing on April 18, 2016 at 9:00 AM at the Calhoun County Appraisal District, 426 West Main Street, Port Lavaca, Calhoun County, Texas. The purpose of the meeting and hearing is to hear public comment and consider possible action on the Proposed Desired Future Conditions of Groundwater Management Area 15.

Groundwater Management Area 15 is comprised of Aransas County Groundwater Conservation District, Bee Groundwater Conservation District, Calhoun County Groundwater Conservation District, Coastal Bend Groundwater Conservation District, Coastal Plains Groundwater Conservation District, Colorado County Groundwater Conservation District, Corpus Christi Aquifer Storage and Recovery Conservation District, Evergreen Underground Water Conservation District, Fayette County Groundwater Conservation District, Goliad County Groundwater Conservation District, Pecan Valley Groundwater Conservation District, Refugio Groundwater Conservation District, Texana Groundwater Conservation District, and Victoria County Groundwater Conservation District.

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Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

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Wharton County: 15 feet of drawdown of the Chicot and Evangeline Aquifers.

Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Calhoun County Groundwater Conservation District at 361-648-9762, P.O. Box 1395, Port Lavaca, Texas 77979, or admin@calhouncountygcd.org.

Calhoun County Groundwater Conservation District

President:
Frank Anzaldua,
Precinct 1

Treasurer:
Mike Hahn,
Precinct 4

Secretary:
Galen Johnson,
Precinct 3

Director:
Richard Meyer,
Precinct 2

Director:
Danny May,
At large

April 28, 2016

Groundwater Management Area 15
c/o Tim Andruss, GMA 15 Chair and Administrator
2805 N. Navarro St. Suite 210
Victoria, Texas 77901

RE: Public Comment Period Summary for the Proposed Desired Future Conditions of Groundwater Management Area 15.

GMA 15 Representatives,

The Calhoun County Groundwater Conservation District made the Proposed Desired Future Conditions of Groundwater Management Area 15 as approved by the member districts of Groundwater Management Area 15 on January 14, 2016, as well as supporting documentation, available to the public for the purpose of accepting public comment.

The District held a public hearing on April 18, 2016, after posting notice as required by Section 36.063 of the Texas Water Code, to receive verbal or written comment from the public regarding the Proposed Desired Future Conditions of Groundwater Management Area 15. The District accepted public comments until April 19, 2016.

The District received no public comments during the public comment period regarding the Proposed Desired Future Conditions of Groundwater Management Area 15.

The District does not suggest any revisions to the Proposed Desired Future Conditions of Groundwater Management Area 15.

Regards,

Tim Andruss
General Manager

P.O. Box 1395, Port Lavaca, TX 77979 | admin@CalhounCountyGCD.org
Phone: 361-648-9762

Calhoun County Groundwater Conservation District
Board of Directors

Notice of Hearing and Public Meeting

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Table A-1. Proposed Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

FILED
AT 2:35 O'CLOCK P M

MAR 30 2016

ANNA GOODMAN
COUNTY CLERK, CALHOUN COUNTY, TEXAS
BY: Amanda Rodriguez

Aransas County: 0 feet of drawdown of the Gulf Coast Aquifer System;
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Submit comments, questions, or requests for additional information regarding the Proposed Desired Future Condition of Groundwater Management Area 15 to Tim Andruss, General Manager, Calhoun County Groundwater Conservation District at 361-648-9762, P.O. Box 1395, Port Lavaca, Texas 77979, or admin@calhouncountygcd.org.

Bee GCD

P.O. Box 682

Beeville, TX 78104

April 25, 2016

Tim Andruss
GMA 15 President
2805 N. Navarro St. STE 210
Victoria, TX 77901

RE: Letter regarding public comments

Dear Sir:

The purpose of this letter is to inform you that the Bee Groundwater Conservation District has completed the public comment period on the proposed draft DFCs for GMA 15 and received no comments. The District published notice on March 2, 2016. The District held a public hearing on March 23, 2016. The comment period ended on April 13, 2016.

The District does not have any suggested revision to the DFCs.

Sincerely,

Lonnie Stewart, Manager

Aransas County
Groundwater Conservation District
301 North Live Oak
Rockport, TX 78382

April 21, 2016

Mr. Tim Andrus
General Manager
Groundwater Management Area 15
2805 N. Navarro St., Ste 210
Victoria, Texas 77901

Subject: Public Comment to Desired Future Conditions

Dear Mr. Andrus:

ACGCD has conducted a public review and hearing of the desired future conditions as recommended by Groundwater Management Area 15. There were no comments of substance received either during a meeting duly noticed and held at the normal meeting place of the district nor in writing by any of our constituents.

Enclosed for record are:

1. A copy of the meeting notices and notice of special election, published and posted;
2. A copy of the adopted minutes of the Board meeting/public hearing of 3/23/2016;
3. A summary of the Board's consideration of the nine issues under Sec. 36.108(d) contained in Board minutes of 4/13/2016;
4. A copy of the Resolution adopted at the Board meeting of 4/13/2016.

Also, per the attached resolution, the Board does not suggest any revisions to the proposed Desired Future Conditions.

Best regards,

Tom Callan by L Garcia

Tom Callan
Chairman

Copy: Director John Alexander
Director Ed Hegen
Director Robert Walls
Director Ed Hegen

PAGE 6B - THE ROCKPORT PILOT - SATURDAY, MARCH 5, 2016

Legal

Legal

NOTICE OF PUBLIC HEARING

Aransas County Groundwater Conservation District (ACGCD) is conducting a public hearing to receive public comments/input on the Proposed Desired Future Conditions for Groundwater Management Area (GMA) 15. **The hearing will be held at 5:30 p.m. on Wednesday, March 23, 2016, at the Aquarium Education Center,** 706 Navigation Circle, Rockport, Texas. Further information about the ACGCD can be found at Aransas County's website: http://www.aransascountytx.gov/groundwater-comm/

E 12A, THE COASTAL BEND HERALD, *Thursday, March 10, 2016*

CLAS

Public Notice

Public Notice

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SATURDAY, MARCH 12, 2016 - THE ROCKPORT PILOT - PAGE 7B

Legal

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Legal Legal Legal Legal

PUBLIC NOTICE OF TEST OF AUTOMATIC TABULATING EQUIPMENT

Notice is hereby given that the automatic tabulating equipment that will be used in the Special Election held on May 7, 2016 will be tested on Wednesday, April 20, 2016 at 9:00 a.m. at 602 East Concho St., Rockport, TX to ascertain that it will accurately count the votes cast for all offices and on all measures.

Michele Bennett
Aransas County Elections Administrator
Early Voting Clerk

AVISO PUBLICO DE PROBAR EL EQUIPO PARA TABULAR AUTOMATICAMENTE

Por lo presente se da aviso que el equipo para tabular automáticamente que se usará en la Elección Especial que se llevará a cabo el 7 de mayo 2016 se probará el 20 de abril 2016 a las 9:00 de la mañana en 602 East Concho St., Rockport, TX para determinar si el equipo contará con exactitud los votos para todos los puestos oficiales y sobre todas los proyectos de ley.

Michele Bennett
Condado de Aransas Administrador de Elecciones
Secretaria de votación adelantada

Legal

NOTICE OF SPECIAL ELECTION
AVISO DE ELECCION ESPECIAL

To the registered voters of the County of Aransas, Texas:
a los votantes registrados del Condado de Aransas, Texas:

Notice is hereby given that the polling places listed below will be open from 7:00 a.m. to 7:00 p.m., May 7, 2016, for voting in a Special Election for the purpose of "The creation of the Aransas County Groundwater Conservation District and the imposition of an ad valorem tax in the district at a rate not to exceed one cent for each $100 of assessed valuation."

Notifíquese, por las presente, que las casillas electorales sitados abajo se abrirán desde las 7:00 a.m. hasta las 7:00 p.m. el 7 de mayo de 2016, para votar en una elección especial con el propósito de "La creación del Distrito de Conservación de Agua Subterránea del Condado de Aransas y la imposición de un impuesto ad valorem en el distrito a una tasa que no sea más de un centavo por cada $100 de tasación."

ARANSAS COUNTY VOTE CENTER LOCATIONS
Centro de Voto Condado de Aransas

Elections & Voter Registration Bldg 602 E Concho Street Rockport, Texas	Compton Hall 704 W. Yoakum Aransas Pass, Texas

Early voting by personal appearance will be conducted at
La votación anticipada en persona se llevará a cabo en

Elections & Voter Registration Bldg 602 E. Concho Street Rockport, Texas	Compton Hall 704 W. Yoakum Aransas Pass, Texas

HOURS OF EARLY VOTING: *Horas de Votación Temprano*	Monday, April 25, 2016	8:00 a.m. to 5:00 p.m.
	Tuesday, April 26, 2016	7:00 a.m. to 7:00 p.m.
	Wednesday, April 27, 2016	8:00 a.m. to 5:00 p.m.
	Thursday, April 28, 2016	7:00 a.m. to 7:00 p.m.
	Friday, April 29, 2016	8:00 a.m. to 5:00 p.m.
	Monday, May 2, 2016	8:00 a.m. to 5:00 p.m.
	Tuesday, May 3, 2016	8:00 a.m. to 5:00 p.m.

Applications for ballot by mail shall be mailed to:
Las solicitudes para boletas que se votaran adelantada por correo deberan enviarse a:

MICHELE M. BENNETT, EARLY VOTING CLERK
602 E CONCHO STREET
ROCKPORT, TEXAS 78382

Applications for ballots by mail must be received no later than the close of business on April 27, 2016.
Las solicitudes para boletas que se votaran adelantada por correo deberan recibirse para el fin de las horas de negocio 13 de mayo, 2016.

Issued this the 13th day of April, 2016
Emitada este dia 13 de abril, 2016

THOMAS CALLAN
Temporary Board Member

Aransas County Groundwater Conservation District
Public Hearing & Regular Meeting Minutes
5:30 PM, March 23, 2016
Aquarium at Rockport Harbor Education Center
706 Navigation Circle, Rockport, TX

Directors Present	**Directors Absent**
Director Tom Callan	Director Lynn Wildman
Director Ed Hegen	
Director John Alexander	
Director Robert Walls	

Staff Members Present	**Elected Officials Present**	**Guests Present**
Linda Garcia	Commissioner Betty Stiles	Michael Hynes
James Dodson	Commissioner-Elect Pct. 3, Brian Olsen	M/M William Williams

Opening Agenda

1. **Call to order.**

With a quorum of Directors present, the public hearing of the Aransas County Groundwater Conservation District (ACGCD) was called to order by Chairman, Tom Callan at 5:30 PM on Wednesday, March 23, 2016 at the Aquarium at Rockport Harbor Education Center, 706 Navigation Circle, Rockport, TX.

2. **Public Hearing/Citizens to Be Heard.**

Public comments were taken from the audience on Aransas County Groundwater Conservation District Formation Issues.

Mr. Michael Hynes asked about rules, regulations and standards. Director Alexander explained that another public hearing with two readings have to occur before the same become rules/ordinances and then have to be passed by the elected Board (directors will have staggered terms). Chairman Callan replied that it was too early to speculate on any regulations, but they should be fair to all with grandfathering to take into consideration and pros/cons of same. Mr. Hynes discussed/questioned water removed process for landowners, and Director Callan replied that most wells used 25,000 gallons or less and, therefore, would be exempt. There would be more concern with big users or those coming from outside county to sell water, or those too close to neighbors, and, of course, those wasting water. Those that are farming would be exempt. Director Alexander said it would be best if a good set of rules were set in place. Those with wells would not have to pay for meters placed on them. Chairman Callan said the district needed to know consumption but doesn't necessarily need to do anything about it. Director Hegen said our area is getting ready to develop a plan, and our values will be pulled together to determine DFCs. Mr. Hynes also talked about how much cheaper it would be to have a new well put in place rather than getting water pipes under the highway.
Public guests were invited to visit the county's website under Groundwater Conservation District for further information and reference sites.

3. **Public Hearing/Citizens to Be Heard.**

Public comments were taken from the audience on Proposed Desired Future Conditions (PDFC's) for Groundwater Management Area (GMA) 15.

Commissioner Stiles asked about the Dunes Ridge Aquifer (covered in old dunes ridge sands) and its effect on trees in the Live Oak Peninsula. Mr. Dodson explained that it is shallow very fresh water which doesn't support large scale production and during drought will draw down. It is a dynamic fragile system and presents management challenges and really isn't part of the large aquifer system.
Mr. Dodson then explained that GMA 15 wants to put water levels in all aquifers over the next 50 years. We need to establish water levels in aquifers on the Gulf Coast.

On motion of Director Alexander and second by Director Hegen, the public hearing was adjourned and regular meeting convened at 6:00 pm.

4. **Citizens to Be Heard on Other Items.**

At this time, comments will be taken from the audience on any subject matter that is not on the agenda. In accordance with the Open Meetings Act, the ACGCD Board may not discuss or take action on any item which has not been posted on the agenda.

There were none.

5. **Approval of Minutes.**

On motion of Director Alexander and second by Director Hegen, workshop minutes of January 27, 2016, were tabled, and minutes of regular meeting of March 9, 2016, were unanimously approved.

6. **Update Remaining Speaker Schedule as of March 23rd.**

Chairman Callan went over the Schedule and a few speaker scheduling changes were made.

7. **Feedback, if any, from Prior Talks with Organizations.**

Chairman Callan reported nothing but enthusiastic remarks from the presentations he made. Director Hegen said the approximate 60 people at Master Gardeners were also enthusiastic. Director Walls reported feedback of good presentations.

8. **Additional Information Which Might Be Required Prior to Election Day.**

Nothing extra required.

9. **Confirm Election Notices, etc., Have Been Properly Posted in Accordance with Election Law.**

Will need to copy any notices published.

10. **Begin Consideration of Proposed Budget Line Items and Forecast for the County Treasurer.**

Passed on this item at this time.

11. Deliberate Regarding Publication of Summary of Comments Received and Transmittal to GMA 15 by April 27, 2016.

Passed on this item till next meeting.

12. Discussion of Next Meeting Agenda Items.

1) Workshop Minutes of January 27 and Public Hearing/Regular Minutes of March 23
2) Update Speaker's Schedule as of April 13th
3) Review Feedback from Organization Presentations
4) Publish another newspaper article
5) Confirm election notices, etc., have been properly posted in accordance with election law
6) Deliberate regarding publication of summary of comments received both at the public hearing and afterwards for transmittal to GMA 15 by April 27, 2016
7) Recommend approval of Resolution regarding Proposed Desired Future Conditions for GMA 15
8) Discuss attendance at upcoming GMA 15 meetings
9) Discussion of next meeting agenda items

13. Adjourn.

On motion by Director Hegen and second by Director Walls, the meeting adjourned at 6:25 PM.

Respectfully submitted,
Linda Garcia

Approved

Aranssas County Groundwater Conservation District
Meeting Minutes
5:30 PM, April 13, 2016
Aquarium at Rockport Harbor Education Center
706 Navigation Circle, Rockport, TX

Directors Present
Director Tom Callan
Director Ed Hegen
Director Lynn Wildman

Directors Absent
Director Robert Walls
Director John Alexander

Staff Members Present
Linda Garcia
James Dodson

Elected Officials Present
Commissioner Betty Stiles

Guests Present

Opening Agenda

1. **Call to order.**

With a quorum of Directors present, the regular meeting of the Aransas County Groundwater Conservation District (ACGCD) was called to order by Chairman, Tom Callan at 5:30 PM on Wednesday, April 13, 2016 at the Aquarium at Rockport Harbor Education Center, 706 Navigation Circle, Rockport, TX.

2. **Approval of Minutes**

On motion of Director Hegen and second by Director Wildman, workshop minutes of January 27, 2016, were tabled, and minutes of public hearing and regular meeting of March 23, 2016, were unanimously approved.

3. **Citizens to be Heard**

At this time, comments will be taken from the audience on any subject matter that is not on the agenda. In accordance with the Open Meetings Act, the ACGCD Board may not discuss or take action on any item which has not been posted on the agenda.
There were none.

4. **Update Speakers' Schedule of 4/13.**

Chairman Callan went over Speaker's Schedule and some additional dates were finalized. Commissioner Stiles questioned the Chamber's inserts, but was told Chamber would be putting out a separate bulletin.

5. **Review Feedback from Organization Presentations.**

With one or two rare exceptions, most all feedback has been positive.

6. Discuss Publication of Another Newspaper Article.

No discussion or action taken.

7. Confirm Election Notices, etc., have been Properly Posted in Accordance with Election Law.

Notice of election will be in the Saturday, April 16th and Wednesday, April 20th editions of the Rockport Pilot. Copy of proofs will be obtained. Public Hearing notice proofs have already been obtained.

8. Deliberate Regarding Publication of Summary of Comments Received Both at the Public Hearing and Afterwards and Transmittal to GMA 15 by April 27, 2016.

Under Section 36.108(d) of the Texas Water Code, GMA 15 Representatives are required to consider nine specific factors before voting to adopt any proposed desired future condition. These nine specific factors are: (1) aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another; (2) the water supply needs and water management strategies included in the state water plan; (3) hydrological conditions, including for each aquifer in the management area the total estimated recoverable storage as provided by the executive administrator, 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.

The Aransas County Groundwater Conservation District (ACGCD) Board of Directors reviewed these nine factors during a regular called meeting on April 13, 2016, basing their review on the following previously compiled summary of potential GMA 15 comments on these nine factors. ACGCD comments, if any, arising from consideration of these nine factors are noted after the GMA 15 comments. After further input from GMA 15 member districts, final comments on these nine factors will be provided in the GMA 15 DFC Explanatory Report.

1) Under 36.108(d)(1), member district are required to consider aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another.
GMA 15 Response: The aquifer uses and conditions differ substantially across Groundwater Management Area 15. Groundwater production is generally greater in the northeastern portions of GMA 15 in Colorado, Wharton, Matagorda, and Jackson Counties. Groundwater in northeastern portion of GMA 15 is predominately used for irrigation purposes. Groundwater production in the central portion of GMA 15 in Victoria County is predominately used for irrigation, municipal, and industrial uses. Groundwater production in the north central portion of GMA 15 in DeWitt County and Karnes County is predominately used for domestic and livestock purposes as well as supporting oil and gas production in the Eagle Ford Shale. Groundwater production in the southwestern portions of GMA 15 is predominately used for domestic, livestock, and agricultural uses. The condition of the Gulf Coast Aquifer differs significantly geographically. Generally, the capacity of the Gulf Coast Aquifer to produce groundwater increases to the northeast and decreases to the southwest as well as increase down dip relative to up dip portions of the Gulf Coast Aquifer. The adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact aquifer uses or conditions during the planning horizon and would 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.

ACGCD Comments: In addition to the Gulf Coast Aquifer underlying Aransas County, there is a very unique, local aquifer unit, the "Dune Ridge Aquifer" overlying much of the Live Oak Peninsula area of Aransas County. This water table aquifer system is shallow, relatively fresh and highly transmissive. In addition to supporting the extensive stands of Live Oaks found growing in the sandy soils associated with this ancient dune ridge system, this unique aquifer supports numerous shallow freshwater wetlands, small scale residential irrigation and livestock/wildlife watering. Since the GMA 15 DFC's are only proposed for aquifer systems within the Gulf Coast Aquifer, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact aquifer uses or conditions for the local "Dune Ridge Aquifer" during the planning horizon.

2) Under 36.108(d)(2), member district are required to consider the water supply needs and water management strategies included in the state water plan.
   GMA 15 Response: Based on a review of the a summary of the water supply needs and water management strategies of the 2012 Texas State Water Plan, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact the water supplies, water supply needs, or water management strategies of the 2012 Texas State Water Plan during the planning horizon and would 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.
   ACGCD Comments: No exception in response to GMA comments

3) Under 36.108(d)(3), member districts are required to consider 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.
   GMA 15 Response: The Texas Water Development Board published total estimated recoverable storage for aquifers within GMA 15 in a report titled GAM Task 13-038: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 15. The total estimated recoverable storage for the Gulf Coast Aquifer within GMA 15 ranges between 92,200,000 acre-feet and 276,600,000 acre-feet. Based on a review of the total estimated recoverable storage and simulated water budgets associated with the Baseline (Option 1) and High Production (Option 1) model runs, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact the hydrological conditions within GMA 15 during the planning horizon and would 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.
   ACGCD Comments: No exception in response to GMA comments

4) Under 36.108(d)(4), member districts are required to consider other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water.
   GMA 15 Response: Based on a review of the simulated water budgets associated with the Baseline (Option 1) and High Production (Option 1) model runs, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact environmental conditions during the planning horizon and would 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.
   ACGCD Comments: No exception in response to GMA comments

5) Under 36.108(d)(5), member districts are required to consider the impact on subsidence.
   GMA 15 Response: Based on a reports developed by INTERA for member districts related to subsidence within GMA 15, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact subsidence during the planning horizon and would 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.
ACGCD Comments: No exception in response to GMA comments

6) Under 36.108(d)(6), member districts are required to consider socioeconomic impacts reasonably expected to occur.
GMA 15 Response: Based on a review of the water management strategies of the 2012 Texas State Water Plan associate with supplies from the Gulf Coast Aquifer within GMA 15 and the anticipated impact on groundwater resources caused by groundwater production in the future, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact socioeconomic conditions within GMA 15 during the planning horizon and would 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.
ACGCD Comments: No exception in response to GMA comments

7) Under 36.108(d)(7), member districts are required to consider the impact on the interests and rights in private property.
GMA 15 Response: The member district recognize that the regulation of groundwater production, including the adoption of desired future conditions, could significantly impact interests and rights in private property. Based on estimations of existing groundwater production, existing groundwater regulations, and the proposed water management strategies of the 2012 Texas State Water Plan, the adoption of the desired future conditions of GMA 15 are not anticipated to significantly impact interests and rights in private property within GMA 15 during the planning horizon and would 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.
ACGCD Comments: No exception in response to GMA comments

8) Under 36.108(d)(8), member districts are required to consider the feasibility of achieving the desired future condition.
GMA 15 Response: Based on predictive groundwater availability modeling conducted by GMA 15, the achievement of the desired future conditions are considered feasible and physically compatible.
ACGCD Comments: No exception in response to GMA comments

9) Under 36.108(d)(9), member districts are required to consider any other information relevant to the specific desired future conditions –
GMA 15 Response: No additional comments
ACGCD Comments: No exception in response to GMA comments

9. Approval of Resolution that Aransas County Groundwater Conservation District Board of Directors is in Agreement with the Proposed Desired Future Conditions (DFCs) for Groundwater Management Area 15 and Recommending Approval of Such by the Groundwater Management Area 15 Member District.

On motion of Director Hegen and second by Director Wildman, Resolution (#R-01-2016) was passed and approved. (Copy attached hereto.)

11. Discussion of Next Meeting Agenda Items.

1) Workshop Minutes of January 27 and Regular Minutes of April 13
2) Update Speaker's Schedule as of April 27th
3) Review Feedback from Organization Presentations
4) Confirm election notices, etc., have been properly posted in accordance with election law
5) Review of Regional Water Planning Meeting and GMA 15 Regional Meeting
6) Begin consideration of proposed budget line items and forecast for County Treasurer
7) Old Business
8) New Business
9) Discussion of next meeting agenda items.

12. Adjourn.

On motion by Director Hegen and second by Chairman Callan, the meeting adjourned at 6:30 PM.

Respectfully submitted,
Linda Garcia

Tom Callan
Approved subject to Board Confirmation
Tom Callan, Chairman

ARANSAS COUNTY GROUNDWATER CONSERVATION DISTRICT
301 N. Live Oak, Rockport, TX 78382

ACGWCD RESOLUTION #R-01-2016

WHEREAS, the Groundwater Conservation Districts (Districts) within the Groundwater Management Area have contributed to the development of the proposed Desired Future Conditions and discussed the nine factors in *Chapter 36.108(d)(1) thru Chapter 36.108(d)(9)*; and

WHEREAS, Districts in Groundwater Management Area 15 obtained and utilized the best available information and modeling to develop the proposed Desired Future Conditions for Groundwater Management Area 15; and

WHEREAS, all public comments were taken into consideration by the Groundwater Management Area 15 to determine the proposed Desired Future Conditions; and

WHEREAS, a designated representative of the Aransas County Groundwater Conservation District Board of Directors participated in Groundwater Management Area 15 meetings and voted to approve the Proposed Desired Future Conditions; and

WHEREAS, the Aransas County Groundwater Conservation District Board of Directors, after publishing and posting notice, held a public hearing on March 23, 2016, to receive oral and written public comments on the Proposed Desired Future Conditions; and

WHEREAS, the Aransas County Groundwater Conservation District Board of Directors received no comments on the Proposed Desired Future Conditions.

NOW, THEREFORE, BE IT RESOLVED, that a majority of the Aransas County Groundwater Conservation District Board of Directors is in agreement with the Proposed Desired Future Conditions for Groundwater Management Area 15 and recommends approval of such by the Groundwater Management Area 15 member Districts.

TOM CALLAN, President

LYNN WILDMAN, Secretary

DATE: 4/20/2016

Appendix D

Water Budgets Predicted by the Central Gulf Coast GAM for 1999 by County

Aransas	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	149	0	-	-	93	0	-	-	47	0	-	-
Net Stream Leakage	4,443	0	-	-	630	0	-	-	265	0	-	-
Vertical Leakage Lower	50	0	-	-	62	0	-	-	63	0	-	-
Net Lateral Flow From Refugio	2,554	58	-	-	1,938	61	-	-	2,136	62	-	-
Net Lateral Flow From San Patricio	184	-	-	-	169	-	-	-	217	-	-	-
Net Lateral Inflow From Other Areas	-	-	-	-	264	-	-	-	200	-	-	-
Total Inflow	*7,380*	*58*	-	-	*3,156*	*61*	-	-	*2,928*	*62*	-	-
Outflow												
Wells	1,119	0	-	-	1,409	0	-	-	1,611	0	-	-
Drains	13	0	-	-	5	0	-	-	7	0	-	-
Evapotranspiration	857	0	-	-	686	0	-	-	753	0	-	-
Net Head Dep Bounds	3,474	0	-	-	1,046	0	-	-	1,658	0	-	-
Vertical Leakage Upper	-	50	-	-	-	62	-	-	-	63	-	-
Net Lateral Flow To Calhoun	43	-	-	-	28	-	-	-	34	-	-	-
Net Lateral Outflow To Other Areas	156	-	-	-	-	-	-	-	-	-	-	-
Total Outflow	5,662	50	-	-	3,174	62	-	-	4,063	63	-	-
Inflow - Outflow	1,718	8	-	-	-18	-1	-	-	-1,135	-1	-	-
Storage Change	1,716	7	-	-	-18	-1	-	-	-1,137	-1	-	-
Model Error	2	1	-	-	0	0	-	-	2	0	-	-
Model Error (percent)	0.03%	1.74%	-	-	0.00%	0.00%	-	-	0.05%	0.00%	-	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (1981, 1990, 1999)

Bee	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	26,818	6,932	2	32	19,391	5,236	1	20	2,583	238	1	16
Net Stream Leakage	-	-	63	-	-	-	21	-	136	158	43	-
Net Vertical Leakage Upper	-	4,446	989	1,381	-	3,627	619	1,047	-	1,758	582	836
Net Lateral Flow From Goliad	164	769	8	90	169	588	8	107	161	922	8	83
Net Lateral Flow From Karnes	-	108	1	169	-	104	1	167	-	108	-	159
Total Inflow	*26,982*	*12,255*	*1,063*	*1,672*	*19,560*	*9,555*	*650*	*1,341*	*2,880*	*3,184*	*634*	*1,094*
Outflow												
Wells	705	3,014	71	1,803	1,188	3,725	81	183	1,195	2,570	66	225
Drains	0	1	0	0	0	0	0	0	0	0	0	0
Evapotranspiration	1,533	516	45	0	178	1	0	0	159	1	0	0
Net Stream Leakage	9,354	1,301	-	155	3,903	597	-	124	-	-	-	96
Net Vertical Leakage Lower	4,446	989	1,381	-	3,627	619	1,047	-	1,758	582	836	-
Net Lateral Flow To Karnes	-	-	-	-	-	-	-	-	-	-	1	-
Net Lateral Flow To Live Oak	35	881	35	225	79	797	40	246	5	686	36	247
Net Lateral Flow To Refugio	5,929	2,979	17	-	5,892	2,891	17	-	5,933	2,864	17	-
Net Lateral Flow To San Patricio	2,427	1,186	11	83	2,309	1,010	11	76	2,265	961	11	71
Total Outflow	*24,429*	*10,867*	*1,560*	*2,266*	*17,176*	*9,640*	*1,196*	*629*	*11,315*	*7,664*	*967*	*639*
Inflow - Outflow	2,553	1,388	-497	-594	2,384	-85	-546	712	-8,435	-4,480	-333	455
Storage Change	2,553	1,387	-497	-594	2,383	-84	-545	710	-8,435	-4,481	-332	455
Model Error	0	1	0	0	1	-1	-1	2	0	1	-1	0
Model Error (percent)	0.00%	0.01%	0.00%	0.00%	0.00%	0.01%	0.08%	0.11%	0.00%	0.01%	0.09%	0.00%

Calhoun	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	3,418	0	0	-	3,280	0	0	-	3,154	0	0	-
Recharge	3,910	0	0	-	2,505	0	0	-	1,214	0	0	-
Net Stream Leakage	5,991	0	0	-	879	0	0	-	737	0	0	-
Net Vertical Leakage Upper	-	1,355	-	-	-	438	-	-	-	-	-	-
Net Vertical Leakage Lower	-	6	0	-	-	5	0	-	46	4	0	-
Net Lateral Flow From Aransas	43	-	-	-	28	-	-	-	34	-	-	-
Net Lateral Flow From Jackson	242	-	-	-	-	-	-	-	2,389	-	-	-
Net Lateral Flow From Matagorda	131	-	-	-	97	-	-	-	63	-	-	-
Net Lateral Flow From Refugio	1,060	478	-	-	901	316	-	-	870	265	-	-
Net Lateral Flow From Victoria	-	8	1	-	1,297	129	1	-	2,548	165	1	-
Net Lateral Inflow From Other Areas	1,009	-	-	-	403	-	-	-	-	-	-	-
Total Inflow	*15,804*	*1,847*	*1*	-	*9,390*	*888*	*1*	-	*11,055*	*434*	*1*	-
Outflow												
Wells	9,586	812	0	-	2,805	163	0	-	1,374	27	0	-
Drains	547	0	0	-	509	0	0	-	560	0	0	-
Evapotranspiration	1,170	0	0	-	1,118	0	0	-	1,222	0	0	-
Net Head Dep Bounds	831	0	0	-	2,809	0	0	-	6,440	0	0	-
Net Vertical Leakage Upper	-	-	6	-	-	-	5	-	-	46	4	-
Net Vertical Leakage Lower	1,355	-	-	-	438	-	-	-	-	-	-	-
Net Lateral Flow To Jackson	-	710	-	-	49	441	-	-	-	150	-	-
Net Lateral Flow To Victoria	405	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Outflow To Other Areas	-	210	-	-	-	210	-	-	2,001	160	-	-
Total Outflow	*13,894*	*1,732*	*6*	-	*7,728*	*814*	*5*	-	*11,597*	*383*	*4*	-
Inflow - Outflow	1,910	115	-5	-	1,662	74	-4	-	-542	51	-3	-
Storage Change	1,910	115	-6	-	1,665	72	-4	-	-541	51	-4	-
Model Error	0	0	1	-	-3	2	0	-	-1	0	1	-
Model Error (percent)	0.00%	0.00%	15.38%	-	0.03%	0.22%	0.00%	-	0.01%	0.00%	22.22%	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (1981, 1990, 1999)

Colorado	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,408	0	0	0	1,408	0	0	0	1,408	0	0	0
Recharge	41,227	2,995	0	0	26,047	1,858	0	0	3,196	357	0	0
Net Stream Leakage	49,276	3,678	0	0	23,038	3,549	0	0	20,493	3,111	0	0
Net Vertical Leakage Upper	-	28,557	-	-	-	24,040	-	-	-	21,942	-	101
Net Vertical Leakage Lower	-	1,324	219	-	-	755	83	-	-	355	-	-
Net Lateral Flow From Austin	525	1,813	2	20	1,010	1,230	3	23	1,139	1,323	3	24
Net Lateral Flow From Fayette	-	799	25	373	-	708	21	325	-	514	19	354
Net Lateral Flow From Jackson	103	86	-	-	171	95	-	-	121	166	-	-
Net Lateral Flow From Lavaca	5,721	4,351	8	46	5,927	3,638	8	49	4,890	3,478	7	47
Total Inflow	*98,260*	*43,603*	*254*	*439*	*57,601*	*35,873*	*115*	*397*	*31,247*	*31,246*	*29*	*526*
Outflow												
Wells	31,072	29,746	0	679	24,027	23,843	0	629	16,932	15,667	0	624
Drains	14	0	0	0	14	0	0	0	13	0	0	0
Evapotranspiration	905	63	0	0	77	1	0	0	71	1	0	0
Net Vertical Leakage Upper	-	-	1,324	219	-	-	755	83	-	-	355	-
Net Vertical Leakage Lower	28,557	-	-	-	24,040	-	-	-	21,942	-	101	-
Net Lateral Flow To Jackson	-	-	-	1	-	-	-	1	-	-	-	-
Net Lateral Flow To Wharton	13,674	12,160	35	165	16,524	12,760	38	171	19,253	17,339	41	178
Total Outflow	*74,222*	*41,969*	*1,359*	*1,064*	*64,682*	*36,604*	*793*	*884*	*58,211*	*33,007*	*497*	*802*
Inflow - Outflow	24,038	1,634	-1,105	-625	-7,081	-731	-678	-487	-26,964	-1,761	-468	-276
Storage Change	24,040	1,633	-1,105	-623	-7,081	-730	-678	-486	-26,967	-1,761	-468	-276
Model Error	-2	1	0	-2	0	-1	0	-1	3	0	0	0
Model Error (percent)	0.00%	0.00%	0.00%	0.19%	0.00%	0.00%	0.00%	0.11%	0.01%	0.00%	0.00%	0.00%

De Witt	**1981**				**1990**				**1999**			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	3,693	5,151	13	219	3,010	3,982	10	168	3,036	3,693	10	164
Net Stream Leakage	3,088	1,620	384	-	559	-	156	-	2,223	87	266	-
Net Vertical Leakage Upper	-	4,153	1,151	1,192	-	3,757	918	1,294	-	3,659	1,576	1,765
Net Lateral Flow From Goliad	-	71	-	-	-	13	-	-	-	-	-	-
Net Lateral Flow From Gonzales	-	-	-	178	-	-	-	164	-	-	-	162
Net Lateral Flow From Lavaca	-	-	-	71	-	-	-	126	-	-	-	173
Total Inflow	*6,781*	*10,995*	*1,548*	*1,660*	*3,569*	*7,752*	*1,084*	*1,752*	*5,259*	*7,439*	*1,852*	*2,264*
Outflow												
Wells	155	1,355	159	2,077	112	1,203	159	2,853	98	969	169	2,675
Evapotranspiration	784	615	416	2	0	27	0	1	9	31	0	0
Net Stream Leakage	-	-	-	494	-	1,886	-	435	-	-	-	480
Net Vertical Leakage Lower	4,153	1,151	1,192	-	3,757	918	1,294	-	3,659	1,576	1,765	-
Net Lateral Flow To Goliad	-	-	5	80	-	-	3	70	-	58	5	79
Net Lateral Flow To Karnes	-	179	12	310	-	161	12	346	-	146	12	328
Net Lateral Flow To Lavaca	49	1,270	2	-	116	1,810	3	-	167	1,288	2	-
Net Lateral Flow To Victoria	1,461	5,732	21	380	1,459	4,675	19	379	1,357	4,704	19	373
Total Outflow	*6,602*	*10,302*	*1,807*	*3,343*	*5,444*	*10,680*	*1,490*	*4,084*	*5,290*	*8,772*	*1,972*	*3,935*
Inflow - Outflow	179	693	-259	-1,683	-1,875	-2,928	-406	-2,332	-31	-1,333	-120	-1,671
Storage Change	180	692	-258	-1,685	-1,874	-2,927	-408	-2,332	-30	-1,332	-120	-1,670
Model Error	-1	1	-1	2	-1	-1	2	0	-1	-1	0	-1
Model Error (percent)	0.01%	0.01%	0.05%	0.06%	0.02%	0.01%	0.13%	0.00%	0.02%	0.01%	0.00%	0.03%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (1981, 1990, 1999)

Fayette	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	-	0	183	222	-	0	174	103	-	0	159	98
Recharge	-	2,322	5	491	-	1,429	3	311	-	894	2	201
Net Stream Leakage	-	147	45	492	-	16	-	531	-	-	-	460
Net Vertical Leakage Upper	-	0	287	-	-	0	338	114	-	0	340	196
Net Vertical Leakage Lower	-	-	191	-	-	-	-	-	-	-	-	-
Net Lateral Flow From Austin	-	3	-	-	-	7	-	-	-	-	-	-
Net Lateral Flow From Lavaca	-	-	-	-	-	-	2	-	-	-	2	-
Net Lateral Flow From Washington	-	-	-	-	-	-	-	2	-	-	-	3
Total Inflow	-	*2,472*	*711*	*1,205*	-	*1,452*	*517*	*1,061*	-	*894*	*503*	*958*
Outflow												
Wells	-	258	245	2,367	-	232	213	2,684	-	289	230	3,096
Evapotranspiration	-	539	668	832	-	0	20	35	-	0	20	25
Net Stream Leakage	-	-	-	-	-	-	50	-	-	124	76	-
Net Vertical Leakage Upper	-	-	-	191	-	-	-	-	-	-	-	-
Net Vertical Leakage Lower	-	287	-	-	-	338	114	-	-	340	196	-
Net Lateral Flow To Austin	-	-	-	15	-	-	-	16	-	7	-	24
Net Lateral Flow To Colorado	-	799	25	373	-	708	21	325	-	514	19	354
Net Lateral Flow To Lavaca	-	44	-	54	-	32	-	35	-	34	-	17
Net Lateral Flow To Washington	-	-	-	5	-	-	-	-	-	-	-	-
Total Outflow	-	*1,927*	*938*	*3,837*	-	*1,310*	*418*	*3,095*	-	*1,308*	*541*	*3,516*
Inflow - Outflow	-	545	-227	-2,632	-	142	99	-2,034	-	-414	-38	-2,558
Storage Change	-	545	-225	-2,632	-	142	96	-2,036	-	-413	-39	-2,557
Model Error	-	0	-2	0	-	0	3	2	-	-1	1	-1
Model Error (percent)	-	0.00%	0.21%	0.00%	-	0.00%	0.52%	0.06%	-	0.08%	0.18%	0.03%

Goliad	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,534	0	0	0	1,523	0	0	0	1,566	0	0	0
Recharge	16,937	12,666	0	0	9,419	7,457	0	0	263	386	0	0
Net Stream Leakage	-	3,609	0	0	-	-	0	0	-	-	0	0
Net Vertical Leakage Upper	-	948	-	-	-	989	-	-	-	360	-	-
Net Vertical Leakage Lower	-	21	164	-	-	719	176	-	-	356	144	-
Net Lateral Flow From De Witt	-	-	5	80	-	-	3	70	-	58	5	79
Net Lateral Flow From Karnes	-	418	19	149	-	377	16	134	-	435	17	128
Total Inflow	*18,471*	*17,662*	*188*	*229*	*10,942*	*9,542*	*195*	*204*	*1,829*	*1,595*	*166*	*207*
Outflow												
Wells	125	1,069	0	0	122	1,243	0	0	129	1,105	0	0
Drains	19	2	0	0	5	1	0	0	3	1	0	0
Evapotranspiration	1,308	124	0	0	191	32	0	0	163	34	0	0
Net Stream Leakage	7,710	-	-	-	6,091	4,735	-	-	4,027	957	-	-
Net Vertical Leakage Upper	-	-	21	164	-	-	719	176	-	-	356	144
Net Vertical Leakage Lower	948	-	-	-	989	-	-	-	360	-	-	-
Net Lateral Flow To Bee	164	769	8	90	169	588	8	107	161	922	8	83
Net Lateral Flow To De Witt	-	71	-	-	-	13	-	-	-	-	-	-
Net Lateral Flow To Refugio	3,199	3,006	12	-	3,012	2,500	12	-	3,022	2,543	12	-
Net Lateral Flow To Victoria	381	3,448	16	199	588	3,584	17	205	468	3,266	17	213
Total Outflow	*13,854*	*8,489*	*57*	*453*	*11,167*	*12,696*	*756*	*488*	*8,333*	*8,828*	*393*	*440*
Inflow - Outflow	4,617	9,173	131	-224	-225	-3,154	-561	-284	-6,504	-7,233	-227	-233
Storage Change	4,615	9,173	130	-224	-225	-3,153	-561	-283	-6,505	-7,231	-228	-232
Model Error	2	0	1	0	0	-1	0	-1	1	-2	1	-1
Model Error (percent)	0.01%	0.00%	0.45%	0.00%	0.00%	0.01%	0.00%	0.21%	0.01%	0.02%	0.25%	0.23%

Water Budget for the Central Portion of the
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Jackson	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	4,218	0	0	0	4,215	0	0	0	4,077	0	0	0
Net Head Dep Bounds	364	0	0	0	172	0	0	0	-	0	0	0
Recharge	13,201	0	0	0	7,291	0	0	0	7,546	0	0	0
Net Stream Leakage	183,031	0	0	0	44,492	0	0	0	32,423	0	0	0
Net Vertical Leakage Upper	-	19,063	-	-	-	13,146	-	-	-	13,375	-	-
Net Vertical Leakage Lower	-	2,982	784	-	-	1,733	734	-	-	879	630	-
Net Lateral Flow From Calhoun	-	710	-	-	49	441	-	-	-	150	-	-
Net Lateral Flow From Colorado	-	-	-	1	-	-	-	1	-	-	-	-
Net Lateral Flow From Lavaca	13,736	11,074	21	149	10,660	8,726	22	155	8,072	7,810	21	158
Net Lateral Flow From Matagorda	3,549	1,676	-	-	2,354	1,077	-	-	104	555	-	-
Net Lateral Flow From Victoria	7,384	2,977	-	-	3,485	2,300	-	-	2,787	1,241	2	-
Net Lateral Flow From Wharton	1,613	-	2	23	-	-	2	20	-	-	-	17
Net Lateral Inflow From Other Areas	-	906	-	-	-	559	-	-	-	213	-	-
Total Inflow	*227,096*	*39,388*	*807*	*173*	*72,718*	*27,982*	*758*	*176*	*55,009*	*24,223*	*653*	*175*
Outflow												
Wells	96,430	34,297	0	0	71,635	24,977	0	0	39,022	14,416	0	0
Drains	16	0	0	0	42	0	0	0	123	0	0	0
Evapotranspiration	411	0	0	0	429	0	0	0	688	0	0	0
Net Head Dep Bounds	-	-	-	-	-	-	-	-	840	-	-	-
Net Vertical Leakage Upper	-	-	2,982	784	-	-	1,733	734	-	-	879	630
Net Vertical Leakage Lower	19,063	-	-	-	13,146	-	-	-	13,375	-	-	-
Net Lateral Flow To Calhoun	242	-	-	-	-	-	-	-	2,389	-	-	-
Net Lateral Flow To Colorado	103	86	-	-	171	95	-	-	121	166	-	-
Net Lateral Flow To Victoria	-	-	1	25	-	-	-	21	-	-	-	9
Net Lateral Flow To Wharton	-	3,231	-	-	993	4,182	-	-	5,267	9,354	-	-
Net Lateral Outflow To Other Areas	1,010	-	-	-	136	-	-	-	2,428	-	-	-
Total Outflow	*117,275*	*37,614*	*2,983*	*809*	*86,552*	*29,254*	*1,733*	*755*	*64,253*	*23,936*	*879*	*639*
Inflow - Outflow	109,821	1,774	-2,176	-636	-13,834	-1,272	-975	-579	-9,244	287	-226	-464
Storage Change	109,821	1,774	-2,175	-637	-13,835	-1,272	-975	-580	-9,241	286	-225	-464
Model Error	0	0	-1	1	1	0	0	1	-3	1	-1	0
Model Error (percent)	0.00%	0.00%	0.03%	0.12%	0.00%	0.00%	0.00%	0.13%	0.00%	0.00%	0.10%	0.00%

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Karnes	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	-	1,225	4	562	-	741	2	347	-	480	2	276
Net Stream Leakage	-	-	251	155	-	-	-	-	-	-	-	-
Net Vertical Leakage Upper	-	0	59	17	-	0	11	-	-	0	62	143
Net Vertical Leakage Lower	-	-	-	-	-	-	17	-	-	-	-	-
Net Lateral Flow From Bee	-	-	-	-	-	-	-	-	-	-	1	-
Net Lateral Flow From De Witt	-	179	12	310	-	161	12	346	-	146	12	328
Total Inflow	-	*1,404*	*326*	*1,044*	-	*902*	*42*	*693*	-	*626*	*77*	*747*
Outflow												
Wells	-	154	124	1,984	-	283	297	2,566	-	104	91	2,325
Drains	-	0	0	7	-	0	0	6	-	0	0	5
Evapotranspiration	-	408	272	643	-	0	2	164	-	0	2	161
Net Stream Leakage	-	166	-	-	-	109	73	473	-	89	4	790
Net Vertical Leakage Upper	-	-	-	-	-	-	-	17	-	-	-	-
Net Vertical Leakage Lower	-	59	17	-	-	11	-	-	-	62	143	-
Net Lateral Flow To Bee	-	108	1	169	-	104	1	167	-	108	-	159
Net Lateral Flow To Goliad	-	418	19	149	-	377	16	134	-	435	17	128
Net Lateral Flow To Gonzales	-	-	-	17	-	-	-	15	-	-	-	15
Net Lateral Flow To Live Oak	-	-	-	127	-	-	-	127	-	-	-	124
Total Outflow	-	*1,313*	*433*	*3,096*	-	*884*	*389*	*3,669*	-	*798*	*257*	*3,707*
Inflow - Outflow	-	91	-107	-2,052	-	18	-347	-2,976	-	-172	-180	-2,960
Storage Change	-	90	-108	-2,050	-	19	-347	-2,977	-	-171	-181	-2,958
Model Error	-	1	1	-2	-	-1	0	1	-	-1	1	-2
Model Error (percent)	-	0.07%	0.19%	0.06%	-	0.10%	0.00%	0.03%	-	0.13%	0.37%	0.05%

Lavaca	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	21,934	7,363	2	207	11,258	3,742	1	104	11,584	3,852	1	107
Net Stream Leakage	31,021	18,486	273	572	10,203	4,109	170	483	5,274	5,289	170	363
Net Vertical Leakage Upper	-	9,461	-	-	-	7,892	-	16	-	6,459	139	209
Net Vertical Leakage Lower	-	743	55	-	-	677	-	-	-	-	-	-
Net Lateral Flow From De Witt	49	1,270	2	-	116	1,810	3	-	167	1,288	2	-
Net Lateral Flow From Fayette	-	44	-	54	-	32	-	35	-	34	-	17
Net Lateral Flow From Gonzales	-	-	-	212	-	-	-	198	-	-	-	194
Net Lateral Flow From Victoria	346	324	-	-	121	362	1	-	327	311	1	1
Total Inflow	*53,350*	*37,691*	*332*	*1,045*	*21,698*	*18,624*	*175*	*836*	*17,352*	*17,233*	*313*	*891*
Outflow												
Wells	4,694	19,497	139	3,847	2,937	11,967	137	3,078	1,728	6,927	149	2,404
Evapotranspiration	293	262	154	70	1	0	0	35	3	4	0	30
Net Vertical Leakage Upper	-	-	743	55	-	-	677	-	-	-	-	-
Net Vertical Leakage Lower	9,461	-	-	-	7,892	-	16	-	6,459	139	209	-
Net Lateral Flow To Colorado	5,721	4,351	8	46	5,927	3,638	8	49	4,890	3,478	7	47
Net Lateral Flow To De Witt	-	-	-	71	-	-	-	126	-	-	-	173
Net Lateral Flow To Fayette	-	-	-	-	-	-	2	-	-	-	2	-
Net Lateral Flow To Jackson	13,736	11,074	21	149	10,660	8,726	22	155	8,072	7,810	21	158
Net Lateral Flow To Victoria	-	-	-	1	-	-	-	-	-	-	-	-
Total Outflow	*33,905*	*35,184*	*1,065*	*4,239*	*27,417*	*24,331*	*862*	*3,443*	*21,152*	*18,358*	*388*	*2,812*
Inflow - Outflow	19,445	2,507	-733	-3,194	-5,719	-5,707	-687	-2,607	-3,800	-1,125	-75	-1,921
Storage Change	19,444	2,507	-731	-3,192	-5,717	-5,705	-687	-2,607	-3,799	-1,125	-74	-1,923
Model Error	1	0	-2	-2	-2	-2	0	0	-1	0	-1	2
Model Error (percent)	0.00%	0.00%	0.19%	0.05%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.22%	0.07%

Matagorda	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	753	0	0	-	805	0	0	-	794	0	0	-
Recharge	21,931	0	0	-	16,861	0	0	-	26,859	0	0	-
Net Stream Leakage	62,465	0	0	-	34,349	0	0	-	3,530	0	0	-
Net Vertical Leakage Upper	-	10,861	-	-	-	8,325	-	-	-	7,125	-	-
Net Vertical Leakage Lower	-	446	0	-	-	338	0	-	-	267	0	-
Net Lateral Flow From Brazoria	-	857	-	-	-	780	-	-	-	635	-	-
Net Lateral Flow From Wharton	-	-	9	-	2,179	-	7	-	4,486	-	6	-
Total Inflow	*85,149*	*12,164*	*9*	-	*54,194*	*9,443*	*7*	-	*35,669*	*8,027*	*6*	-
Outflow												
Wells	33,156	5,673	0	-	33,045	4,864	0	-	9,046	2,447	0	-
Drains	572	0	0	-	444	0	0	-	503	0	0	-
Evapotranspiration	3,568	0	0	-	3,302	0	0	-	3,783	0	0	-
Net Head Dep Bounds	7,969	0	0	-	6,816	0	0	-	10,095	0	0	-
Net Vertical Leakage Upper	-	-	446	-	-	-	338	-	-	-	267	-
Net Vertical Leakage Lower	10,861	-	-	-	8,325	-	-	-	7,125	-	-	-
Net Lateral Flow To Brazoria	4,913	-	6	-	2,377	-	6	-	4,034	-	6	-
Net Lateral Flow To Calhoun	131	-	-	-	97	-	-	-	63	-	-	-
Net Lateral Flow To Jackson	3,549	1,676	-	-	2,354	1,077	-	-	104	555	-	-
Net Lateral Flow To Wharton	3,883	4,414	-	-	-	3,811	-	-	-	5,291	-	-
Net Lateral Outflow To Other Areas	7,216	-	-	-	6,269	-	-	-	8,442	-	-	-
Total Outflow	*75,818*	*11,763*	*452*	-	*63,029*	*9,752*	*344*	-	*43,195*	*8,293*	*273*	-
Inflow - Outflow	9,331	401	-443	-	-8,835	-309	-337	-	-7,526	-266	-267	-
Storage Change	9,330	401	-443	-	-8,837	-307	-337	-	-7,525	-266	-267	-
Model Error	1	0	0	-	2	-2	0	-	-1	0	0	-
Model Error (percent)	0.00%	0.00%	0.00%	-	0.00%	0.02%	0.00%	-	0.00%	0.00%	0.00%	-

Refugio	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	21,299	0	0	-	13,648	0	0	-	1,864	0	0	-
Net Vertical Leakage Lower	3,012	20	0	-	3,575	48	0	-	3,904	36	0	-
Net Lateral Flow From Bee	5,929	2,979	17	-	5,892	2,891	17	-	5,933	2,864	17	-
Net Lateral Flow From Goliad	3,199	3,006	12	-	3,012	2,500	12	-	3,022	2,543	12	-
Net Lateral Flow From Victoria	179	-	-	-	-	-	-	-	-	-	-	-
Total Inflow	*33,618*	*6,005*	*29*	-	*26,127*	*5,439*	*29*	-	*14,723*	*5,443*	*29*	-
Outflow												
Wells	869	1,000	0	-	762	637	0	-	691	553	0	-
Drains	221	0	0	-	81	0	0	-	105	0	0	-
Evapotranspiration	2,201	0	0	-	1,639	0	0	-	1,812	0	0	-
Head Dep Bounds	5,595	0	0	-	4,573	0	0	-	4,918	0	0	-
Net Stream Leakage	659	0	0	-	6,946	0	0	-	8,616	0	0	-
Net Vertical Leakage Upper	-	3,012	20	-	-	3,575	48	-	-	3,904	36	-
Net Lateral Flow To Aransas	2,554	58	-	-	1,938	61	-	-	2,136	62	-	-
Net Lateral Flow To Calhoun	1,060	478	-	-	901	316	-	-	870	265	-	-
Net Lateral Flow To San Patricio	2,864	629	3	-	2,267	611	3	-	2,451	618	3	-
Net Lateral Flow To Victoria	-	309	-	-	49	217	-	-	14	205	-	-
Net Lateral Outflow To Other Areas	4,372	23	-	-	3,131	24	-	-	3,430	26	-	-
Total Outflow	*20,395*	*5,509*	*23*	-	*22,287*	*5,441*	*51*	-	*25,043*	*5,633*	*39*	-
Inflow - Outflow	13,223	496	6	-	3,840	-2	-22	-	-10,320	-190	-10	-
Storage Change	13,223	496	6	-	3,843	-2	-21	-	-10,320	-189	-10	-
Model Error	0	0	0	-	-3	0	-1	-	0	-1	0	-
Model Error (percent)	0.00%	0.00%	0.00%	-	0.01%	0.00%	1.98%	-	0.00%	0.02%	0.00%	-

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Victoria	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,054	0	0	0	1,056	0	0	0	1,056	0	0	0
Net Head Dep Bounds	201	0	0	0	-	0	0	0	-	0	0	0
Recharge	30,540	678	0	0	19,736	512	0	0	9,306	433	0	0
Net Stream Leakage	31,938	-	0	0	-	-	0	0	-	-	0	0
Net Vertical Leakage Upper	-	13,724	-	-	-	9,480	-	-	-	10,293	-	-
Net Vertical Leakage Lower	-	2,179	1,331	-	-	1,491	1,127	-	-	1,042	890	-
Net Lateral Flow From Calhoun	405	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Flow From De Witt	1,461	5,732	21	380	1,459	4,675	19	379	1,357	4,704	19	373
Net Lateral Flow From Goliad	381	3,448	16	199	588	3,584	17	205	468	3,266	17	213
Net Lateral Flow From Jackson	-	-	1	25	-	-	-	21	-	-	-	9
Net Lateral Flow From Lavaca	-	-	-	1	-	-	-	-	-	-	-	-
Net Lateral Flow From Refugio	-	309	-	-	49	217	-	-	14	205	-	-
Net Lateral Inflow From Other Areas	495	-	-	-	-	-	-	-	-	-	-	-
Total Inflow	*66,475*	*26,070*	*1,369*	*605*	*22,888*	*19,959*	*1,163*	*605*	*12,201*	*19,943*	*926*	*595*
Outflow												
Wells	18,676	21,367	0	0	11,324	15,631	0	0	7,706	16,873	0	0
Drains	251	0	0	0	98	0	0	0	135	0	0	0
Evapotranspiration	1,253	21	0	0	593	18	0	0	626	21	0	0
Net Head Dep Bounds	-	-	-	-	26	-	-	-	144	-	-	-
Net Stream Leakage	-	934	-	-	8,210	1,720	-	-	797	1,644	-	-
Net Vertical Leakage Upper	-	-	2,179	1,331	-	-	1,491	1,127	-	-	1,042	890
Net Vertical Leakage Lower	13,724	-	-	-	9,480	-	-	-	10,293	-	-	-
Net Lateral Flow To Calhoun	-	8	1	-	1,297	129	1	-	2,548	165	1	-
Net Lateral Flow To Jackson	7,384	2,977	-	-	3,485	2,300	-	-	2,787	1,241	2	-
Net Lateral Flow To Lavaca	346	324	-	-	121	362	1	-	327	311	1	1
Net Lateral Flow To Refugio	179	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Outflow To Other Areas	-	44	-	-	58	46	-	-	262	35	-	-
Total Outflow	*41,813*	*25,675*	*2,180*	*1,331*	*34,692*	*20,206*	*1,493*	*1,127*	*25,625*	*20,290*	*1,046*	*891*
Inflow - Outflow	24,662	395	-811	-726	-11,804	-247	-330	-522	-13,424	-347	-120	-296
Storage Change	24,661	395	-811	-726	-11,803	-248	-331	-521	-13,424	-348	-120	-297
Model Error	1	0	0	0	-1	1	1	-1	0	1	0	1
Model Error (percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%	0.09%	0.00%	0.00%	0.00%	0.11%

Wharton	1981				1990				1999			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	537	0	0	0	537	0	0	0	537	0	0	0
Recharge	23,461	0	0	0	15,207	0	0	0	10,999	0	0	0
Net Stream Leakage	177,672	0	0	0	107,907	0	0	0	117,393	0	0	0
Net Vertical Leakage Upper	-	40,206	-	-	-	35,060	-	-	-	43,277	-	-
Net Vertical Leakage Lower	-	4,239	1,185	-	-	3,291	1,184	-	-	3,474	1,172	-
Net Lateral Flow From Austin	215	461	-	7	251	498	-	8	596	835	-	10
Net Lateral Flow From Brazoria	-	-	-	-	-	-	-	-	-	96	-	-
Net Lateral Flow From Colorado	13,674	12,160	35	165	16,524	12,760	38	171	19,253	17,339	41	178
Net Lateral Flow From Fort Bend	-	-	-	-	-	-	-	-	-	1,024	-	-
Net Lateral Flow From Jackson	-	3,231	-	-	993	4,182	-	-	5,267	9,354	-	-
Net Lateral Flow From Matagorda	3,883	4,414	-	-	-	3,811	-	-	-	5,291	-	-
Total Inflow	*219,442*	*64,711*	*1,220*	*172*	*141,419*	*59,602*	*1,222*	*179*	*154,045*	*80,690*	*1,213*	*188*
Outflow												
Wells	114,458	61,909	0	0	103,395	60,011	0	0	132,954	81,192	0	0
Drains	147	0	0	0	130	0	0	0	130	0	0	0
Evapotranspiration	373	0	0	0	351	0	0	0	340	0	0	0
Net Vertical Leakage Upper	-	-	4,239	1,185	-	-	3,291	1,184	-	-	3,474	1,172
Net Vertical Leakage Lower	40,206	-	-	-	35,060	-	-	-	43,277	-	-	-
Net Lateral Flow To Brazoria	274	101	2	11	702	20	2	10	1,426	-	2	10
Net Lateral Flow To Fort Bend	10,522	1,808	7	139	10,492	2,055	6	138	7,144	-	5	130
Net Lateral Flow To Jackson	1,613	-	2	23	-	-	2	20	-	-	-	17
Net Lateral Flow To Matagorda	-	-	9	-	2,179	-	7	-	4,486	-	6	-
Total Outflow	*167,593*	*63,818*	*4,259*	*1,358*	*152,309*	*62,086*	*3,308*	*1,352*	*189,757*	*81,192*	*3,487*	*1,329*
Inflow - Outflow	51,849	893	-3,039	-1,186	-10,890	-2,484	-2,086	-1,173	-35,712	-502	-2,274	-1,141
Storage Change	51,848	894	-3,039	-1,187	-10,891	-2,482	-2,087	-1,174	-35,713	-501	-2,275	-1,140
Model Error	1	-1	0	1	1	-2	1	1	1	-1	1	-1
Model Error (percent)	0.00%	0.00%	0.00%	0.07%	0.00%	0.00%	0.03%	0.07%	0.00%	0.00%	0.03%	0.08%

Appendix E

INTERA July 10, 2015 Presentation Discussing Evidence and Sources of GAM Predictive Uncertainty

Evidence & Sources of GAM Predictive Uncertainty

1. Central Gulf Coast GAM Report (2004)
   a. Calibration statistics between measured and model values
   b. Plots of residuals for different aquifers

2. LCRA-SAWS Water Project (LSWP) Reports (2005 to 2009)
   a. Spatial placement of pumping
   b. Vertical placement of pumping
   c. Temporal and Spatial distribution of recharge
   d. Numerical discretization around streams
   e. Aquifer boundaries
   f. Spatial variability in aquifers
   g. Addition of land subsidence (aquifer storage)

3. DFC Presentation to GMA 15 on Behalf of CCGCD, CBGCD, CPGCD (2010)
   a. Volume-weighted versus area-weighted drawdown averages
   b. Difference in pumping by aquifer between GMA model and reported by district
   c. Incomplete spatial coverage of aquifers by active model grid cells

4. PVGCD Report Regarding the Impacts of Large-scale Pumping (2012)
   a. Catahoula is an important Gulf Coast Geologic Unit
   b. Burkeville is not a low permeability unit for most of DeWitt County

   Jasper and Burkeville transmissivity is too low. Non-uniqueness of Central GAM calibration – can be recalibrated with much high recharge and transmissivity values

5. VCGCD Report discussing Science Development Program (2012)
   a. Aquifer boundaries and hydraulic properties – Burkeville K too low and K distribution for Chicot and Evangeline not consistent with field data
   b. Recharge and GW-SW exchange

6. VCGCD Report discussing Transmissivity values from Aquifer Tests (2014)/ TWDB Regional ASR & OCS Plan for Golden Crescent Region of Texas (2014)
   a. Evangeline modeled transmissivity values are too low in Victoria County
   b. Notable differenced between measured and modeled transmissivity in Jackson County

7. TWDB Report Evaluation of Hydrogeochemical Data regarding Implication to Developing Gulf Coast GAMs (2013)
   a. Implications to Conceptual Model
   b. Considerations for Implementing Recharge and GW-SW Interaction

8. On-going studies by CBGCD, CPGCD, VCGCD, TGCD, RGCD, EUWCD, and PVGCD to Support Development of GAM 15 & 16 (2015)
   a. Groundwater-surface water interaction
   b. Aquifer Hydraulic Properties are spatially variable
   c. Considerable uncertainty in recharge estimates
   d. Land-Subsidence has appear to occurred

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Central Gulf Coast GAM Report (2004)

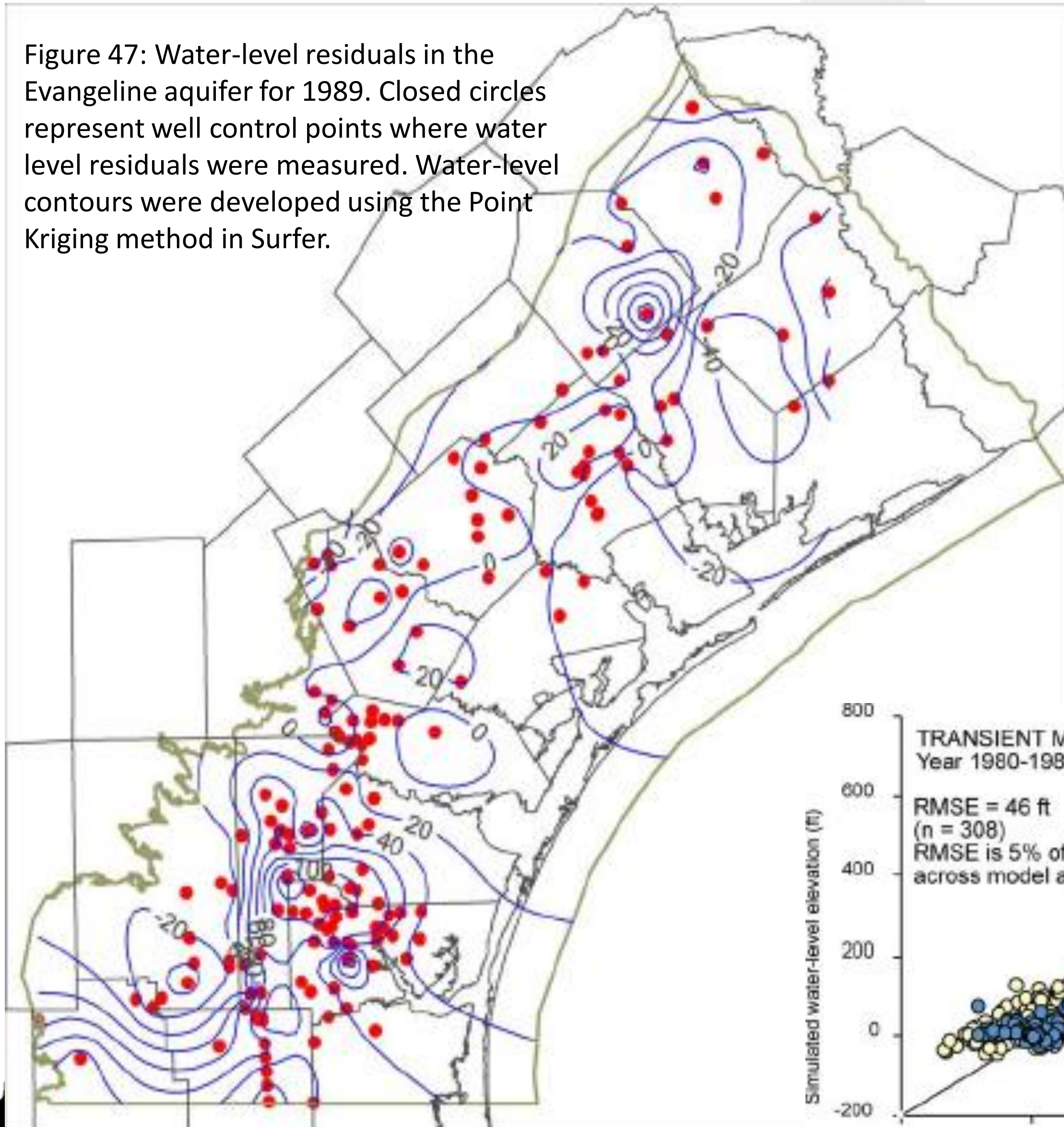

Figure 47: Water-level residuals in the Evangeline aquifer for 1989. Closed circles represent well control points where water level residuals were measured. Water-level contours were developed using the Point Kriging method in Surfer.

Hydraulic Head Residual

Residual = simulated – measured
neg = simulated head too low
pos = simulated head too high
(1989 & 1999 data sets)

Example

simulated = 10 ft
measured = 5 ft
residual = 5 ft

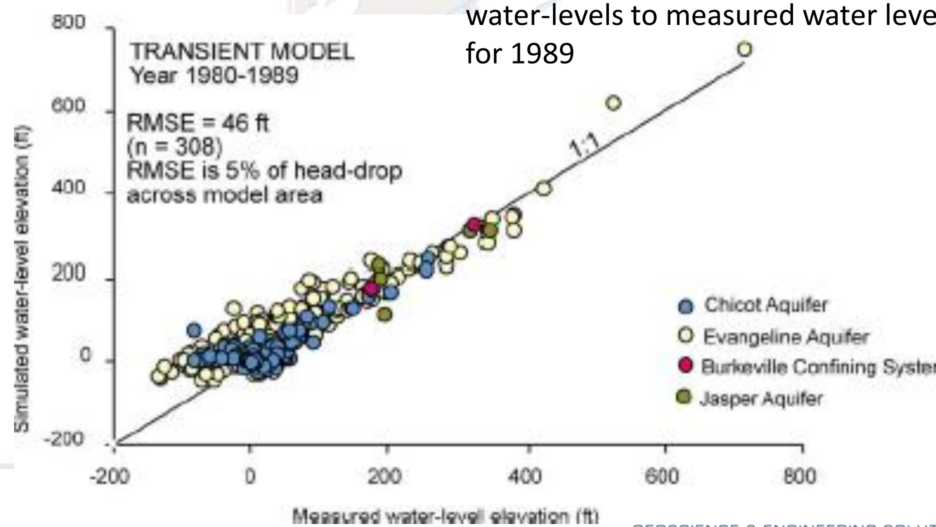

Figure 36: Comparison of simulated water-levels to measured water levels for 1989

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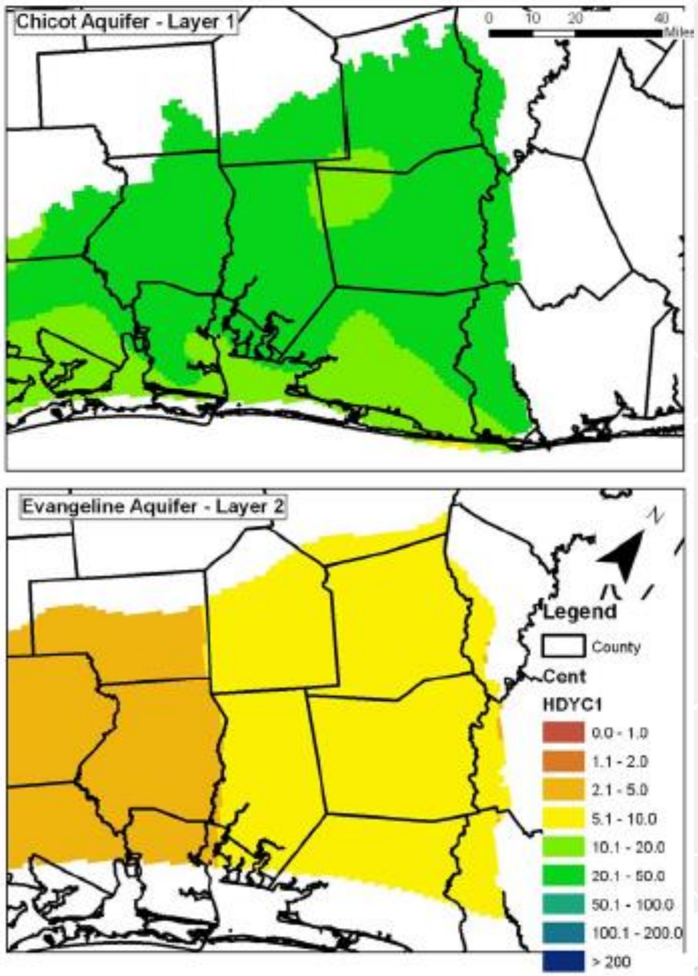
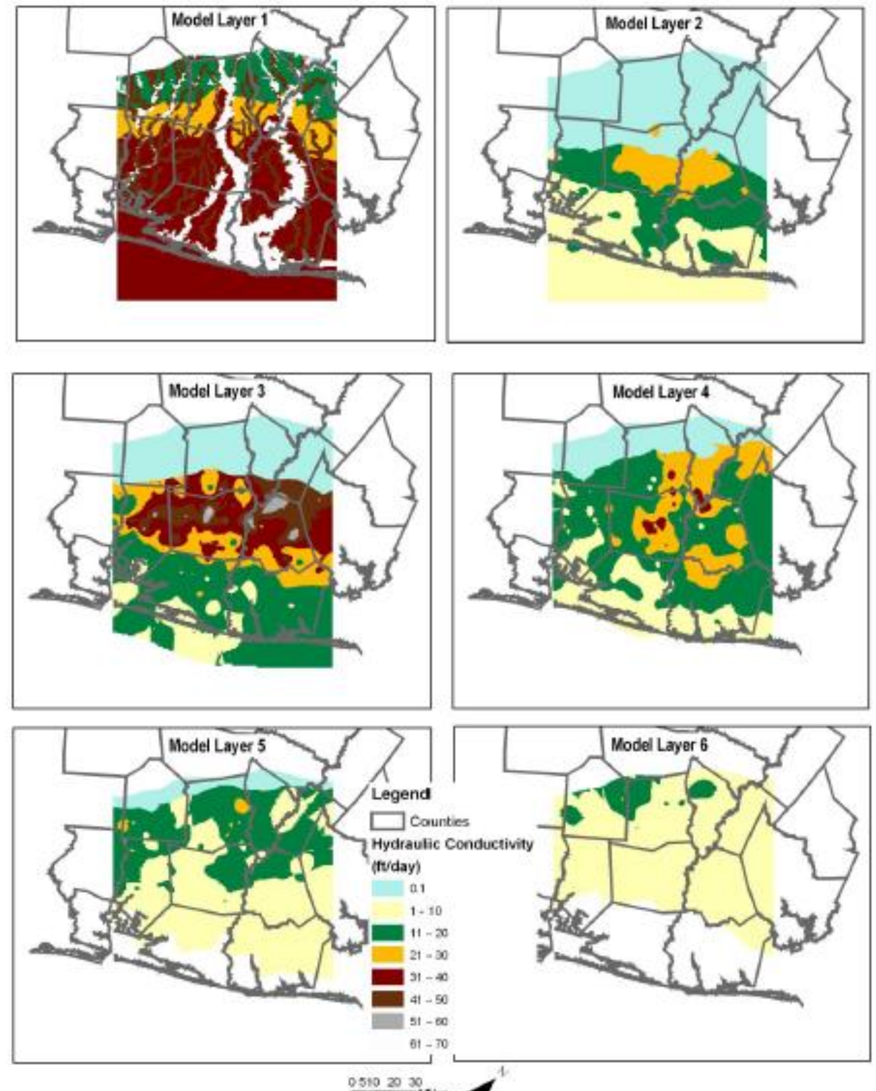
LCRA-SAWS Water Project Reports (2005 to 2009)

Two layers in Central G.C. GAM



GMA 15 Hydraulic Conductivity Distribution for Chicot & Evangeline aquifers

Six layers in LCRB Model



LCRB Hydraulic Conductivity Distribution for Chicot & Evangeline aquifers

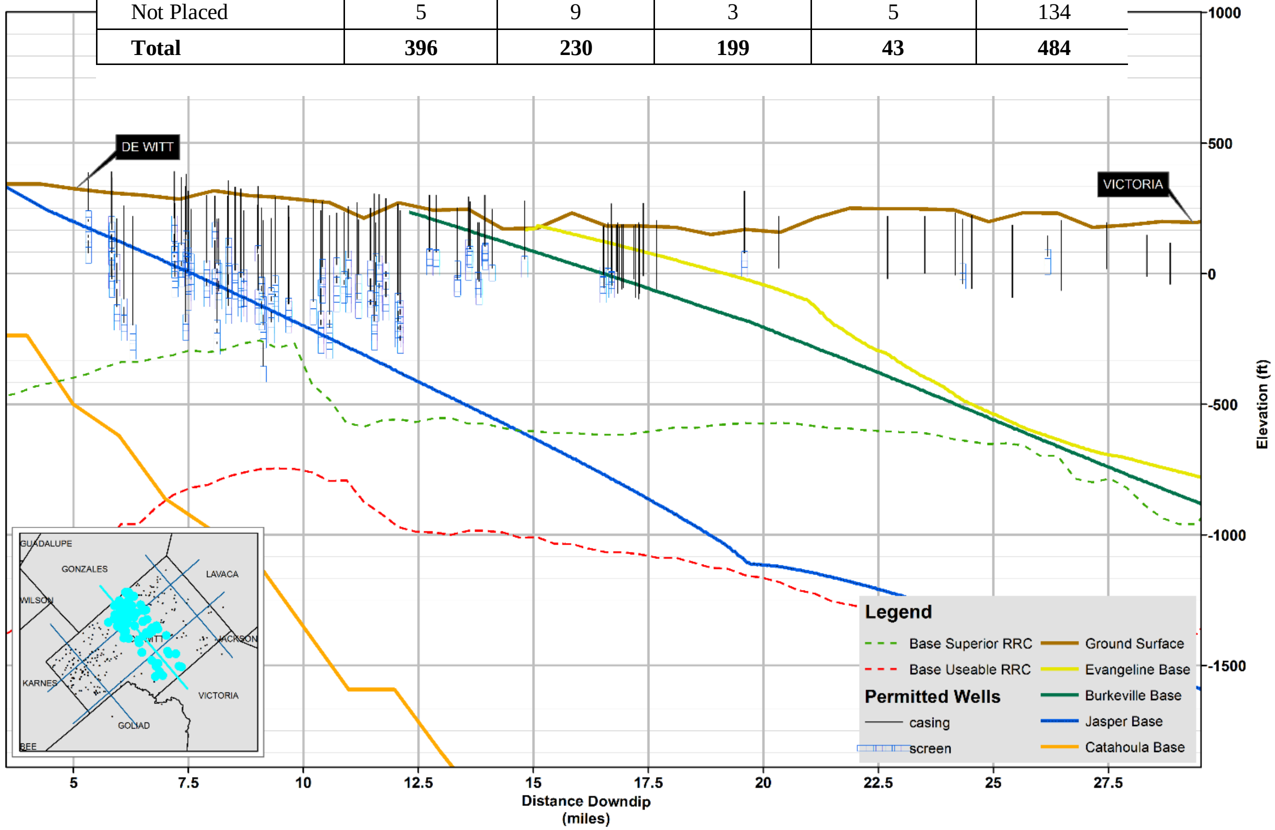
DFC Presentation to GMA 15 on Behalf of CCGCD, CBGCD, CPGCD (2010)

County	Chicot		Evangeline		Burkeville		Jasper	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume
Aransas	-0.1	-0.1	24.7	24.6	[redacted]	[redacted]	[redacted]	[redacted]
Bee	2.9	4.8	13.8	14.7	8.8	8.5	4.1	4.3
Calhoun	-1.0	-0.8	8.7	8.7	2.5	2.5	[redacted]	[redacted]
Colorado	4.8	5.6	8.2	7.3	13.5	13.5	19.9	18.8
Dewitt	0.1	0.1	4.9	3.2	14.0	15.1	21.9	23.4
Fayette	[redacted]	[redacted]	13.2	12.5	38.6	39.4	44.6	49.6
Goliad	-1.4	-0.4	3.3	4.7	7.1	7.4	8.9	8.9
Jackson	11.8	11.9	14.4	14.6	10.9	11.4	18.8	18.0
Karnes	[redacted]	[redacted]	-0.6	0.4	10.4	14.7	15.0	18.4
Lavaca	4.4	6.3	4.8	5.4	13.8	14.6	27.8	27.1
Matagorda	3.1	2.9	16.8	17.0	14.1	14.0	[redacted]	[redacted]
Refugio	0.5	0.4	31.0	31.0	12.3	10.3	[redacted]	[redacted]
Victoria	-9.4	-10.6	3.0	3.2	2.9	4.3	7.2	6.9
Wharton	11.0	11.4	2.5	2.7	17.9	19.0	20.8	20.3
Total	3.1	3.7	9.3	10.7	12.5	11.9	19.9	18.5

Comparison of DFCs based on Weighting Grid Cells based on Area and

PVGCD Report Discussing the Effects of Large-scale Pumping (2012)

Hydrostratigraphic Unit	O & G Wells	Permitted Wells	Permitted and O & G Wells	Monitoring Wells	TWDB Wells
Chicot	1	0	0	2	16
Evangeline	62	12	1	13	162
Burkeville	25	2	3	6	38
Jasper	239	148	136	15	118
Catahoula	64	59	57	2	16
Not Placed	5	9	3	5	134
Total	**396**	**230**	**199**	**43**	**484**



Potential Importance of Pumping in Catahoula

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PVGCD Report discussing the Effects of Large-scale Pumping (2012)

Table 2-7 Average Sand Percentages for the Evangeline Aquifer, the Burkeville Confining Unit, the Jasper Aquifer, and the Catahoula Formation.

Hydrostratigraphic Unit	Average Sand Percentage Calculated from Geophysical Logs
Evangeline Aquifer	53.2%
Burkeville Confining Unit	53.6%
Jasper Aquifer	45.0%
Catahoula Formation	36.4%

*based on sand percentages and transmissivity valu

Table 4-3 Comparison of Hydraulic Properties for DeWitt County in the GAM 15 GAM and the Modified GAM*

Hydrostratigraphic Unit	Average Recharge (inches/yr)		Average Hydraulic Conductivity (ft/day)		Specific Storage		Specific Yield	
	Original	Modified	Original	Modified	Original	Modified	Original	Modified
Aquifer	0.7	0.7	30.2	30.2	8.3E-06	8.3E-06	0.05	0.05
Evangeline Aquifer	0.20	0.24	3.6	4.3	1.0E-06	1.00E-05	0.01	0.015
Burkeville Unit	0.0003	0.03	0.09	2.7	1.0E-06	1.00E-06	0.005	0.005
Jasper Aquifer	0.02	0.5	0.54	2.2	8.3E-06	3.24E-06	0.05	0.075

The GAM and Modified GAM produce very similar matches to measured water level values. Root-mean square error or the Evangeline Aquifer, Burkeville Unit, and Jasper Aquifer are 18 ft, 4 ft, and 41 ft (this is an example of non-uniqueness in model calibration

PVGCD Report Regarding the Impacts of Large-scale Pumping (2012)

Table 4-5 Average Drawdowns Values for Four GAM Model Simulations that Evaluate the Impact of Different Pumping Assumptions on the DFC.

GAM Run	Simulated Year					
	2010	2020	2030	2040	2050	2060
DFC Run	5.25	8.65	11.05	12.82	14.17	15.23
DFC Run - No Pumping	-4.28	-6.30	-7.59	-8.43	-8.99	-9.38
DFC Run - Only DeWitt Pumping	4.12	6.88	8.74	10.05	11.01	11.74
DFC Run - With Fracking	5.24	9.45	12.40	14.00	15.00	15.90

Table 4-6 Average Drawdowns Values for Four Modified GAM Simulations that Evaluate the Impact of Different Pumping Assumptions on the DFC.

GAM Run	Simulated Year					
	2010	2020	2030	2040	2050	2060
DFC Run	3.56	4.91	5.8	6.46	6.97	7.39
DFC Run - No Pumping	-4.53	-5.75	-6.43	-6.89	-7.22	-7.46
DFC Run - Only DeWitt Pumping	2.47	3.24	3.71	4.00	4.19	4.32
DFC Run - With Fracking	3.56	5.5	6.6	6.97	7.32	7.64

VCGCD Report Regarding Science Development Program (2012)

Important Information Gaps in the Literature Search

-historical pumping rates and locations

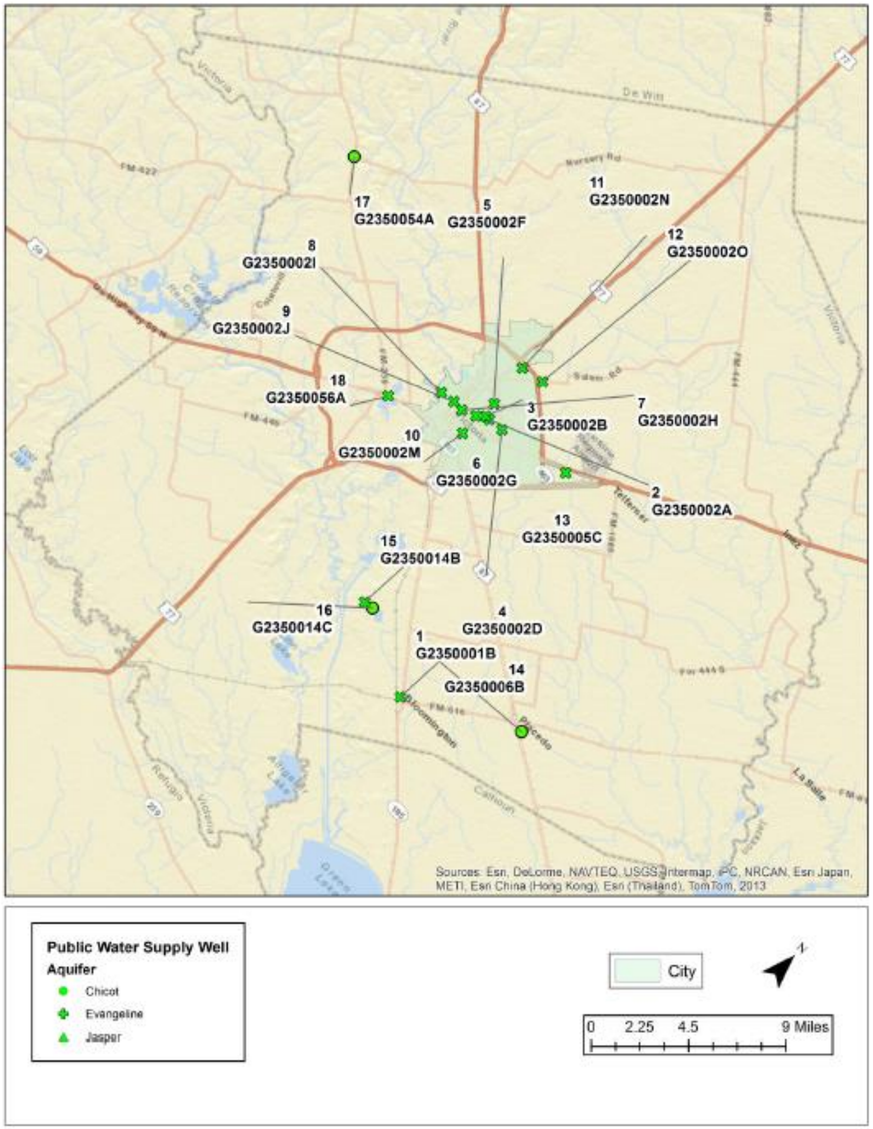
-vertical hydraulic conductivity values

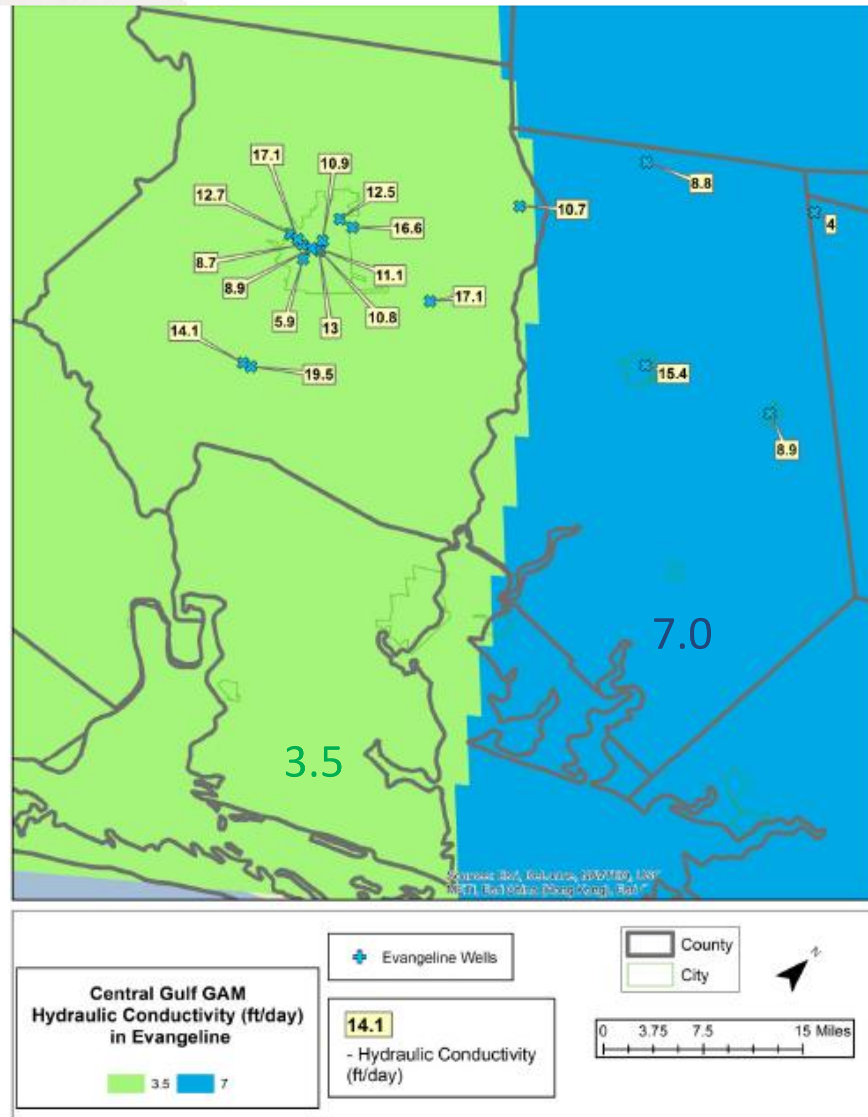
-specific storage coefficients

-groundwater-surface water interaction

-aquifer properties below well screens

VCGCD Report & TWDB ASR/OCR Report Regarding Transmissivity Values from Aquifer Tests (2014)





TWDB Gulf Coast Hydrogeochemical Evaluation Report (2013)

Implication to Conceptual Model

- The up-dip boundary for the regional Gulf Coast Aquifer System flow should be the Catahoula Formation outcrop;
- The downdip boundary for the regional Gulf Coast Aquifer System flow should allow groundwater to discharge across a large area of the ocean bottom;
- The bottom boundary of the regional Gulf Coast Aquifer System flow should be based on where the TDS concentrations are not less than 10,000 ppm
- The numerical representation of the regional groundwater flow system should be constrained by estimates of groundwater age estimated from ^{14}C measurements;
- A conceptual water budget should be developed and be guided by recharge estimates by Scanlon and others (2012) after appropriate uncertainty estimates have been developed;
- Proper conceptualization and representation of groundwater mixing and flow paths requires vertical layering smaller than the thicknesses of the major aquifers;
- A continuous, low permeability “Burkeville” Confining Unit does not exist up dip at the outcrop;

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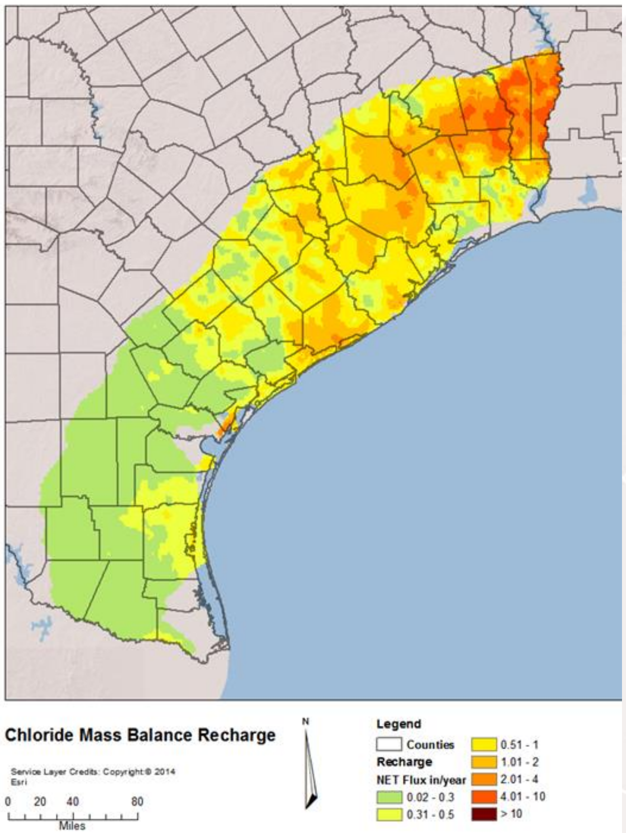
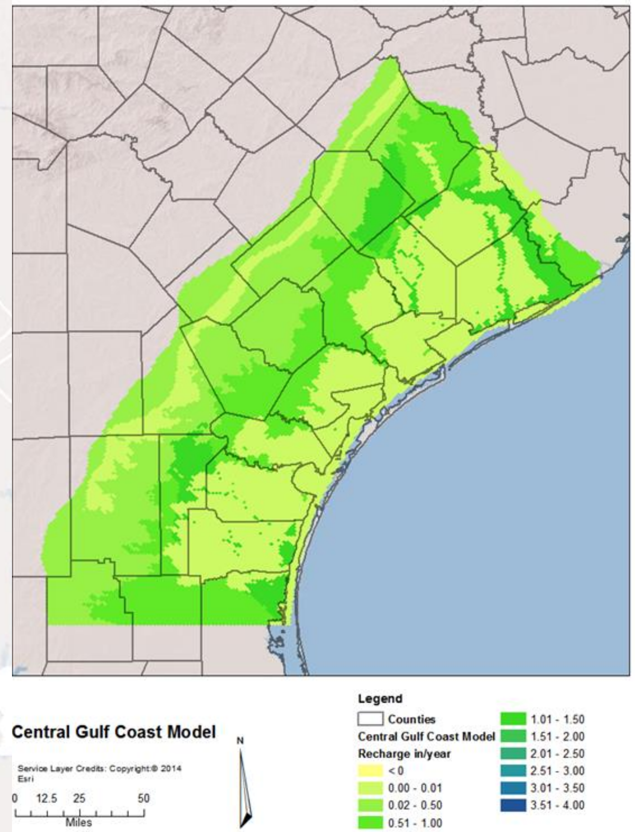
On-going studies by GCDs to Support Development of GAM 15 & 16 (2015)



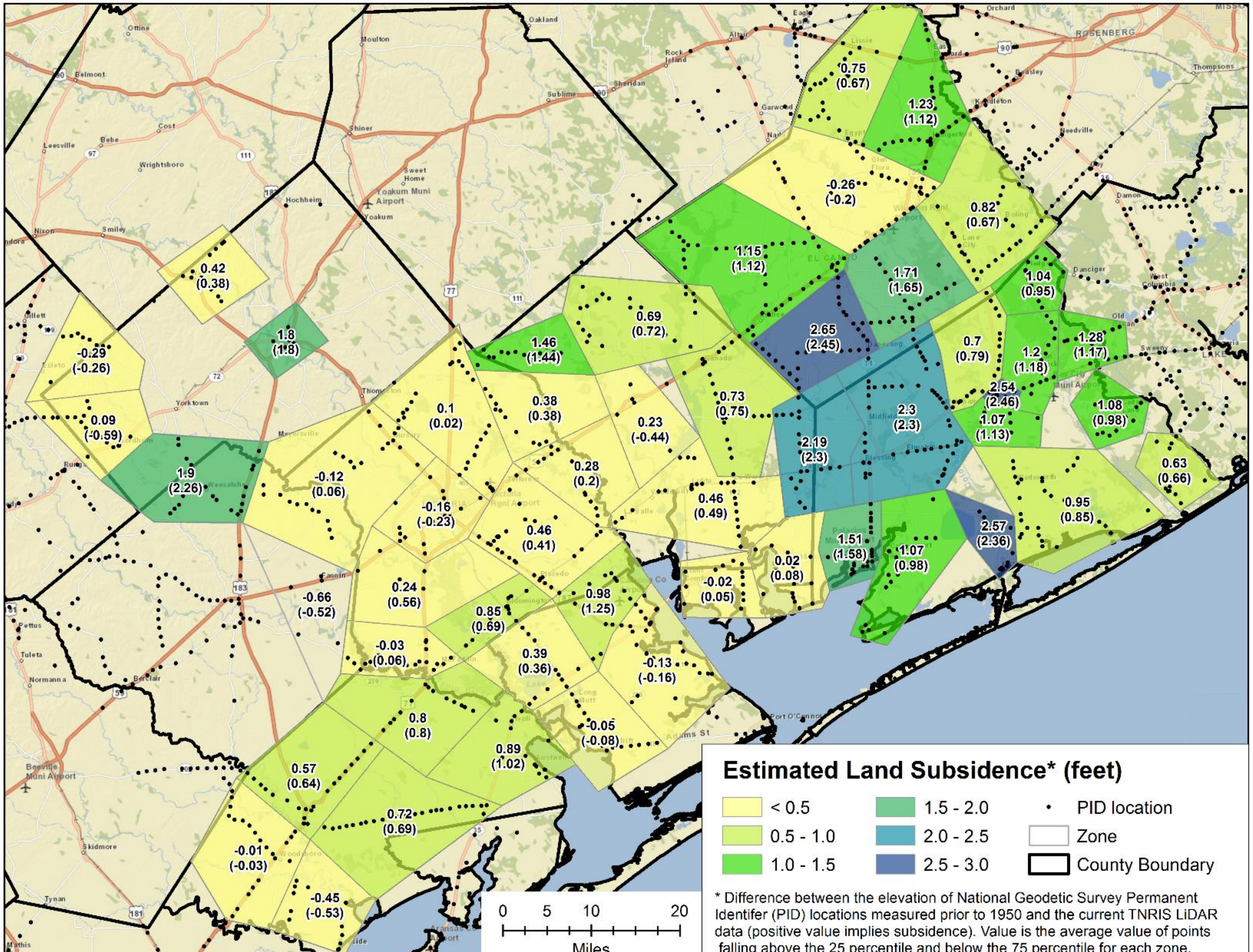


BEG Chloride Mass-Balance Study

County Name	County Area (acres)[A]	Recharge Area (acres)	Recharge (in/year)	Recharge (acre-ft/year)
Matagorda	753,951	718,582	1.08	65,464

	Recharge			Net Gain to Groundwater System			Net Loss to Groundwater System			Net Flux to Groundwater System		
Data Source	Area (acres)[A]	Rate (in/yr)	Flux (af/yr)	Area (acres)	Rate (in/yr)	Flux (af/yr)	Area (acres)	Rate (in/yr)	Flux (afy)	Area (acres)[A]	Rate (in/yr)	Flux (af/yr)
CGC-GAM	698,240	0.395	22,969	632,320	1.10	57,847	177,920	-3.97	-58,850	810,240	-0.01	-1,003
LCRB Model	656,238	2.9	160,415	566,919	2.9	136,131	122,109	-14.2	-144,345	689,028	-0.14	-8,214

On-going studies by GCDs to Support Development of GAM 15 & 16 (2015)



Example of Allowable Difference Between Adopted DFCs and Calculated DFCs

- Per Aquifer (Maximum of two conditions)
  - Up to 2 feet
  - Up to 20% of calculated average drawdown for DFC
  - Greater variance allowed where a District provides evidence to support higher GAM predictive uncertainty
- Group of Aquifers (Maximum of two conditions)
  - Up to 3 feet
  - Up to 20% of calculated average drawdown for DFC
  - Greater variance allowed where a District provides evidence to support higher GAM predictive uncertainty

Example Calculation of Variance

County	Modeled 2070 Average Drawdown DFC						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	4.3	24.1	10.3	18.3	NA	11.1	10.3
GCD #2	-0.4	7.9	3.4	2.9	NA	3.3	3.4
GCD #3	-3.8	10.9	3.8	6.7	10.4	5.7	5.3
GCD #4	14.2	11.6	12.9	25.3	28.0	19.5	17.5

County	Proposed 2070 Average Drawdown DFC						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	6.3	21.0	10.8	18.3	NA	11.5	10.8
GCD #2	1.0	9.0	4.7	1.0	NA	4.1	4.7
GCD #3	-0.8	12.9	6.3	4.7	10.4	6.5	7.2
GCD #4	15.0	9.6	12.3	21.0	28.0	18.1	17.1

County	Proposed DFC - Modeled DFC						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	2.0	3.1	0.4	0.0	NA	0.4	0.4
GCD #2	1.4	1.1	1.3	1.9	NA	0.8	1.3
GCD #3	1.0	2.1	2.5	2.0	0.0	0.8	1.9
GCD #4	0.8	2.0	0.6	4.3	0.0	1.4	0.4

County	Allowed Difference Based on Example Rules						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	2.0	4.8	3.0	3.7	NA	3.0	3.0
GCD #2	2.0	2.0	3.0	2.0	NA	3.0	3.0
GCD #3	2.0	2.2	3.0	2.0	2.1	3.0	3.0
GCD #4	2.8	2.3	3.0	5.1	5.6	3.9	3.5

County	Is Proposed DFC Acceptable Based on Criteria						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	Yes	Yes	Yes	Yes	NA	Yes	Yes
GCD #2	Yes	Yes	Yes	Yes	NA	Yes	Yes
GCD #3	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GCD #4	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Appendix F

Groundwater Planning Datasheets for Counties in GMA 15 Managed by GCDs

Aranpsas County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum			
Gulf Coast Aquifer	483	483	425	589			
Other Aquifer	18	11	1	55			
Unknown	4	3	0	10			
Modeled Available Groundwater	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Gulf Coast Aquifer	1,862	1,862	1,862	1,862	1,862	1,862	
2012 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Groundwater Supplies							
Gulf Coast Aquifer	542	579	596	595	586	579	
Water Demands	4,224	4,682	4,882	4,782	4,526	4,335	
Water Supply Need (-) or Surplus (+)	-72	-86	-97	-107	-1,643	-1,579	
Groundwater Supply Strategies							
Gulf Coast Aquifer	200	200	200	200	200	200	
2017 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Water Demands		3,702	3,675	3,591	3,576	3,577	3,588
Total Estimated Recoverable Storage (acre-feet)	**Total Storage**	**25% of Total Storage**	**75% of Total Storage**				
Gulf Coast Aquifer	5,500,000	1,375,000	4,125,000				

Bee County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum			
Edwards-BFZ Aquifer	105	91	78	178			
Gulf Coast Aquifer	6,568	5,988	5,545	8,916			
Other Aquifer	279	263	157	491			
Unknown	206	205	195	218			
Modeled Available Groundwater	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**Note**
Gulf Coast Aquifer	9,514	9,514	9,490	9,490	9,438	9,438	GMA 15
Gulf Coast Aquifer	10,660	10,660	10,660	10,660	10,660	10,660	GMA 16
2012 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Groundwater Supplies							
Carrizo-Wilcox Aquifer	380	394	394	394	394	394	
Gulf Coast Aquifer	5,223	5,652	6,098	6,553	6,766	6,727	
Water Demands	9,170	9,685	10,162	10,595	11,091	11,578	
Water Supply Need (-) or Surplus (+)	1	1	1	0	-299	-890	
Groundwater Supply Strategies							
Gulf Coast Aquifer	0	0	5,500	5,500	7,516	11,016	
2017 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Water Demands		11,887	12,461	12,967	13,475	14,101	14,995

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage	Note
Gulf Coast	12,000,000	3,000,000	9,000,000	GMA 15
Gulf Coast	85,000,000	21,250,000	63,750,000	GMA 16
Carrizo-Wilcox	4,700,000	1,175,000	3,525,000	GMA 16

Calhoun County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Gulf Coast Aquifer	1,000	618	489	1,854
Other Aquifer	21	14	0	54
Unknown	13	14	2	23

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	2,995	2,995	2,995	2,995	2,995	2,995

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	2,345	2,345	2,345	2,345	2,345	2,345
Water Demands	68,674	72,110	75,265	78,865	82,078	86,370
Water Supply Need (-) or Surplus (+)	25,902	22,466	19,311	15,711	12,498	8,206
Groundwater Supply Strategies						
Gulf Coast Aquifer	0	0	0	0	0	0

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		71,705	74,773	78,299	81,636	86,052	89,788

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Gulf Coast Aquifer	17,000,000	4,250,000	12,750,000

Colorado County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum			
Gulf Coast Aquifer	30,476	26,925	20,397	54,843			
Other Aquifer	742	742	168	1,315			
Trnity Aquifer	2,578	2,578	1,845	3,311			
Unknown	541	645	151	725			
Modeled Available Groundwater	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Gulf Coast Aquifer	48,953	48,953	48,953	48,953	48,953	48,953	
2012 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Groundwater Supplies							
Gulf Coast Aquifer	38,508	38,508	38,508	38,508	38,508	38,508	
Water Demands	226,430	218,619	210,802	203,127	195,787	188,786	
Water Supply Need (-) or Surplus (+)	-50,128	-41,397	-32,460	-23,378	-14,358	-7,357	
Groundwater Supply Strategies							
Gulf Coast Aquifer	4,430	18,750	17,914	16,770	15,347	15,519	
Other Aquifer	4,269	4,269	4,269	4,269	4,269	4,269	
2017 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Water Demands		176,833	172,508	168,281	164,251	160,361	156,585
Total Estimated Recoverable Storage (acre-feet)	**Total Storage**	**25% of Total Storage**	**75% of Total Storage**				
Gulf Coast Aquifer	28,000,000	7,000,000	21,000,000				

DeWitt County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Gulf Coast Aquifer	4,821	4,776	3,889	6,188
Other Aquifer	42	42	4	97
Unknown	595	265	43	1,808

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	14,701	14,636	14,630	14,619	14,616	14,616

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	10,335	10,335	10,335	10,335	10,335	10,335
Water Demands	5,160	5,158	5,116	5,051	4,953	4,907
Water Supply Need (-) or Surplus (+)	6,141	6,143	6,185	6,250	6,348	6,394
Groundwater Supply Strategies						
Gulf Coast Aquifer	0	0	0	0	0	0

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		11,836	11,719	10,961	10,238	8,885	8,615

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Carrizo-Wilcox Aquifer	1,200,000	300,000	900,000
Gulf Coast Aquifer	21,000,000	5,250,000	15,750,000

Fayette County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Carrizo-Wilcox Aquifer	19	14	2	44
Gulf Coast Aquifer	3,082	3,306	1,493	3,911
Other Aquifer	196	117	77	573
Queen City Aquifer	5	1	0	14
Sparta Aquifer	220	138	94	758
Unknown	34	29	20	57
Yegua-Jackson Aquifer	236	111	61	1,150

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060	Note
Carrizo-Wilcox Aquifer	1,000	1,000	1,000	1,000	1,000	1,000	GMA 12
Queen City Aquifer	387	436	478	513	565	570	GMA 12
Sparta Aquifer	3,507	3,592	3,637	3,656	3,711	3,729	GMA 12
Yegua-Jackson Aquifer	5,762	5,762	5,762	5,762	5,762	5,762	GMA 12
Gulf Coast Aquifer	9,204	9,073	8,905	8,895	8,886	8,856	GMA 15

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Carrizo-Wilcox Aquifer	290	290	290	290	290	290
Gulf Coast Aquifer	6,877	6,684	6,558	6,465	6,455	6,455
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
Water Demands	36,895	37,480	41,222	72,409	72,898	79,542
Water Supply Need (-) or Surplus (+)	17,592	16,887	13,108	-18,103	-18,523	-25,054
Groundwater Supply Strategies						
Gulf Coast Aquifer	0	261	495	553	588	632
Other Aquifer	22	22	101	313	570	911
Sparta Aquifer	188	208	129	129	129	129
Yegua-Jackson Aquifer	0	0	0	0	0	9

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		45,685	45,620	47,432	53,436	57,613	62,600

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage	Note
Carrizo-Wilcox Aquifer	95,000,000	23,750,000	71,250,000	GMA 12
Queen City Aquifer	19,000,000	4,750,000	14,250,000	GMA 12
Sparta Aquifer	12,000,000	3,000,000	9,000,000	GMA 12
Yegua-Jackson Aquifer	27,000,000	6,750,000	20,250,000	GMA 12
Carrizo-Wilcox Aquifer	16,000,000	4,000,000	12,000,000	GMA 15
Gulf Coast Aquifer	3,900,000	975,000	2,925,000	GMA 15
Queen City Aquifer	640,000	160,000	480,000	GMA 15
Sparta Aquifer	2,900,000	725,000	2,175,000	GMA 15

Goliad County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum			
Gulf Coast Aquifer	3,395	3,878	1,093	5,272			
Unknown	40	42	30	46			
Modeled Available Groundwater	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Gulf Coast Aquifer	11,699	11,699	11,699	11,699	11,699	11,699	
2012 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Groundwater Supplies							
Gulf Coast Aquifer	4,869	4,791	4,725	4,660	4,596	4,566	
Water Demands	11,682	19,302	19,298	19,266	19,233	19,224	
Water Supply Need (-) or Surplus (+)	12,573	6,875	6,813	6,780	6,749	6,728	
Groundwater Supply Strategies							
Gulf Coast Aquifer	0	0	0	0	0	0	
2017 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Water Demands		23,538	23,711	23,825	23,878	23,404	23,441

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Gulf Coast Aquifer	26,000,000	6,500,000	19,500,000

Jackson County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Gulf Coast Aquifer	46,373	44,056	36,064	90,186
Other Aquifer	624	682	6	1,184
Unknown	40	43	31	43

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	76,386	76,386	76,386	76,386	76,386	76,386

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	57,728	57,728	57,728	57,728	57,728	57,728
Water Demands	63,300	63,409	63,455	63,465	63,481	63,531
Water Supply Need (-) or Surplus (+)	-3,740	-3,849	-3,895	-3,905	-3,921	-3,971
Groundwater Supply Strategies						
Gulf Coast Aquifer	5,053	5,053	5,053	5,054	5,053	5,053

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		63,430	63,447	63,419	63,413	63,452	63,502

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Gulf Coast Aquifer	45,000,000	11,250,000	33,750,000

Karnes County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Carrizo-Wilcox Aquifer	167	153	98	276
Gulf Coast Aquifer	3,457	3,405	2,638	4,408
Unknown	690	218	0	2,326
Yegua-Jackson Aquifer	267	326	48	487

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060	Note
Carrizo-Wilcox Aquifer	1,059	1,117	1,181	1,231	1,260	1,280	GMA 13
Yegua-Jackson Aquifer	774	774	774	774	774	774	GMA 13
Gulf Coast Aquifer	3,243	3,235	3,230	3,226	3,222	3,116	GMA 15

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Carrizo-Wilcox	700	700	700	700	700	700
Gulf Coast Aquifer	4,569	4,569	4,569	4,569	4,569	4,569
Water Demands	5,718	5,850	6,008	6,116	6,163	6,167
Water Supply Need (-) or Surplus (+)	985	853	695	587	540	536
Groundwater Supply Strategies						
Carrizo-Wilcox	323	323	323	323	323	323
Gulf Coast Aquifer	0	0	0	161	161	161

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		8,197	7,573	6,845	6,148	5,304	5,247

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage	Note
Carrizo-Wilcox	46,000,000	11,500,000	34,500,000	GMA 13
Yegua-Jackson	19,000,000	4,750,000	14,250,000	GMA 13
Carrizo-Wilcox	43,000,000	10,750,000	32,250,000	GMA 15
Gulf Coast	6,400,000	1,600,000	4,800,000	GMA 15
Yegua-Jackson	190,000	47,500	142,500	GMA 15

Lavaca County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Gulf Coast Aquifer	9,219	8,573	6,993	13,683
Other Aquifer	999	999	676	1,322
Unknown	74	54	54	133
Yegua-Jackson Aquifer	7	7	6	8

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	20,385	20,385	20,385	20,385	20,378	20,373

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	14,445	14,445	14,445	14,445	14,445	14,445
Water Demands	13,815	13,794	13,735	13,651	13,580	13,550
Water Supply Need (-) or Surplus (+)	630	651	710	794	865	895
Groundwater Supply Strategies						
Gulf Coast Aquifer	0	0	0	0	0	0

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		16,704	15,967	15,487	15,041	14,552	14,364

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Carrizo-Wilcox	9,700,000	2,425,000	7,275,000
Gulf Coast	22,000,000	5,500,000	16,500,000
Yegua-Jackson	620,000	155,000	465,000

Matagorda County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Gulf Coast Aquifer	34,945	32,418	21,060	55,044
Other Aquifer	380	25	14	2,171
Unknown	45	43	38	55

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	45,896	45,896	45,896	45,896	45,896	45,896

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	36,305	36,302	36,301	36,301	36,302	36,302
Water Demands	295,146	341,478	335,570	329,803	324,128	319,162
Water Supply Need (-) or Surplus (+)	-111,082	-159,516	-153,609	-147,842	-142,166	-137,320
Groundwater Supply Strategies						
Gulf Coast Aquifer	56	29,519	29,519	29,519	29,519	29,566

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		337,062	332,169	327,296	322,504	318,308	314,316

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Gulf Coast Aquifer	48,000,000	12,000,000	36,000,000

Refugio County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Gulf Coast Aquifer	2,269	2,077	1,625	3,930
Unknown	47	48	30	62

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	29,328	29,328	29,328	29,328	29,328	29,328

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	2,952	2,952	2,952	2,952	2,952	2,952
Water Demands	1,948	1,987	1,982	1,999	2,012	2,002
Water Supply Need (-) or Surplus (+)	1,316	1,277	1,282	1,265	1,252	1,262
Groundwater Supply Strategies						
Gulf Coast Aquifer	0	0	0	0	0	0

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		3,036	3,038	2,988	2,991	2,507	2,502

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Gulf Coast Aquifer	23,000,000	5,750,000	17,250,000

Victoria County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum
Gulf Coast Aquifer	13,900	11,253	6,430	32,864
Unknown	40	42	32	45

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	35,694	35,694	35,694	35,694	35,694	35,694

2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	34,899	33,856	32,915	32,136	31,504	30,941
Water Demands	62,333	115,059	117,984	120,805	123,511	126,617
Water Supply Need (-) or Surplus (+)	2,967	-50,802	-54,668	-58,268	-61,606	-65,275
Groundwater Supply Strategies						
Gulf Coast Aquifer	0	0	0	0	0	0

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		79,119	108,161	119,083	138,761	159,410	163,073

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Gulf Coast Aquifer	39,000,000	9,750,000	29,250,000

Wharton County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	Average	Median	Minimum	Maximum		
Gulf Coast Aquifer	127,475	130,978	87,380	185,772		
Other Aquifer	1,976	1,976	1,909	2,042		
Unknown	51	55	38	56		

Modeled Available Groundwater	2010	2020	2030	2040	2050	2060
Gulf Coast Aquifer	178,493	178,493	178,493	178,493	178,493	178,493

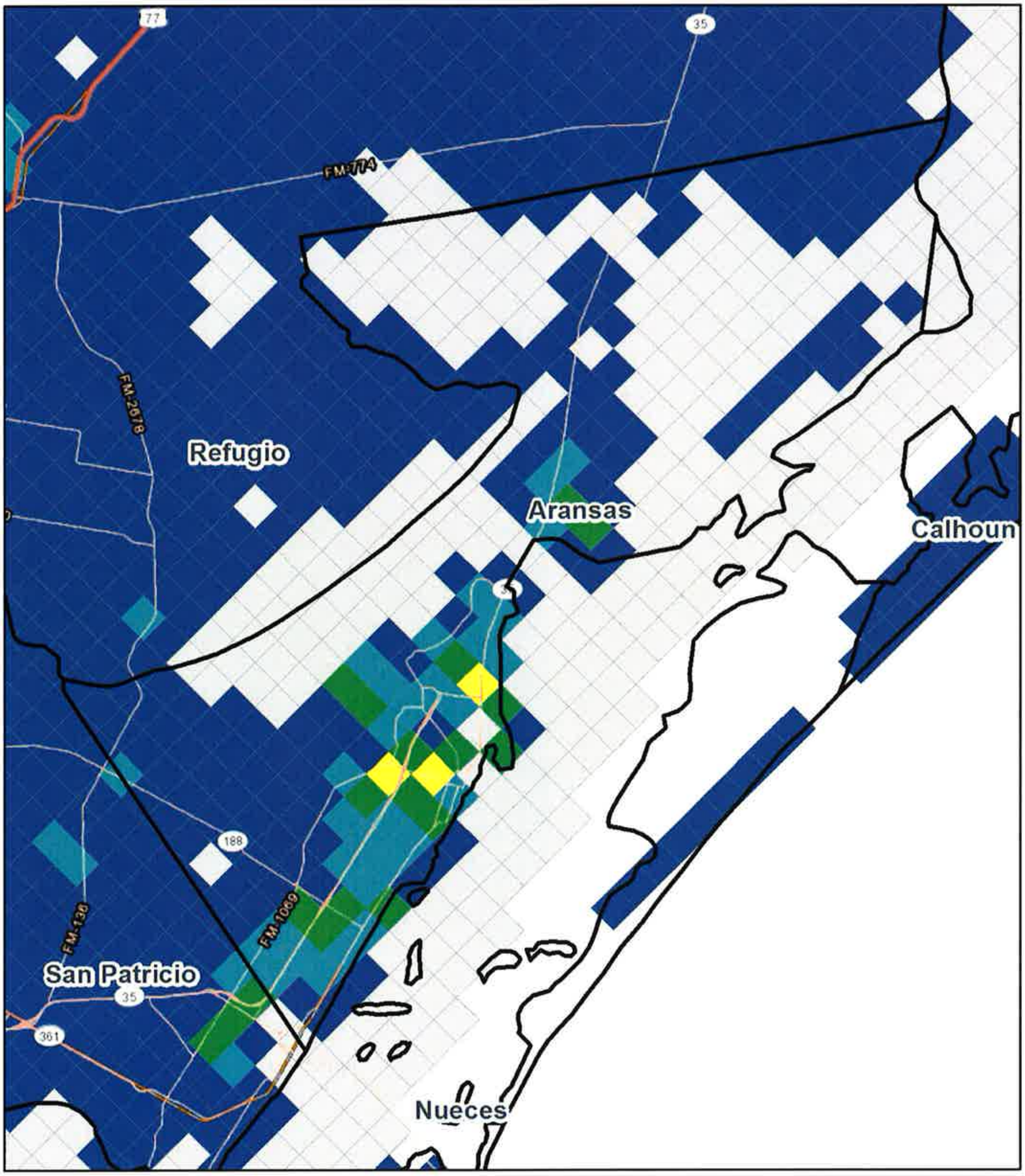
2012 State Water Plan	2010	2020	2030	2040	2050	2060
Groundwater Supplies						
Gulf Coast Aquifer	171,310	171,310	171,310	171,310	171,310	171,310
Water Demands	343,776	337,597	331,453	325,454	319,670	297,503
Water Supply Need (-) or Surplus (+)	-106,959	-100,798	-94,607	-88,557	-82,717	-60,550
Groundwater Supply Strategies						
Gulf Coast Aquifer	62,686	80,417	80,417	80,417	80,417	80,507

2017 State Water Plan	2010	2020	2030	2040	2050	2060	2070
Water Demands		373,794	368,392	363,088	358,020	353,150	348,410

Total Estimated Recoverable Storage (acre-feet)	Total Storage	25% of Total Storage	75% of Total Storage
Gulf Coast Aquifer	72,000,000	18,000,000	54,000,000

Appendix G

Spatial Distribution of Pumping by County and Geological Unit for 1999 in the CGC GAM (Chowdhury and others, 2014)



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

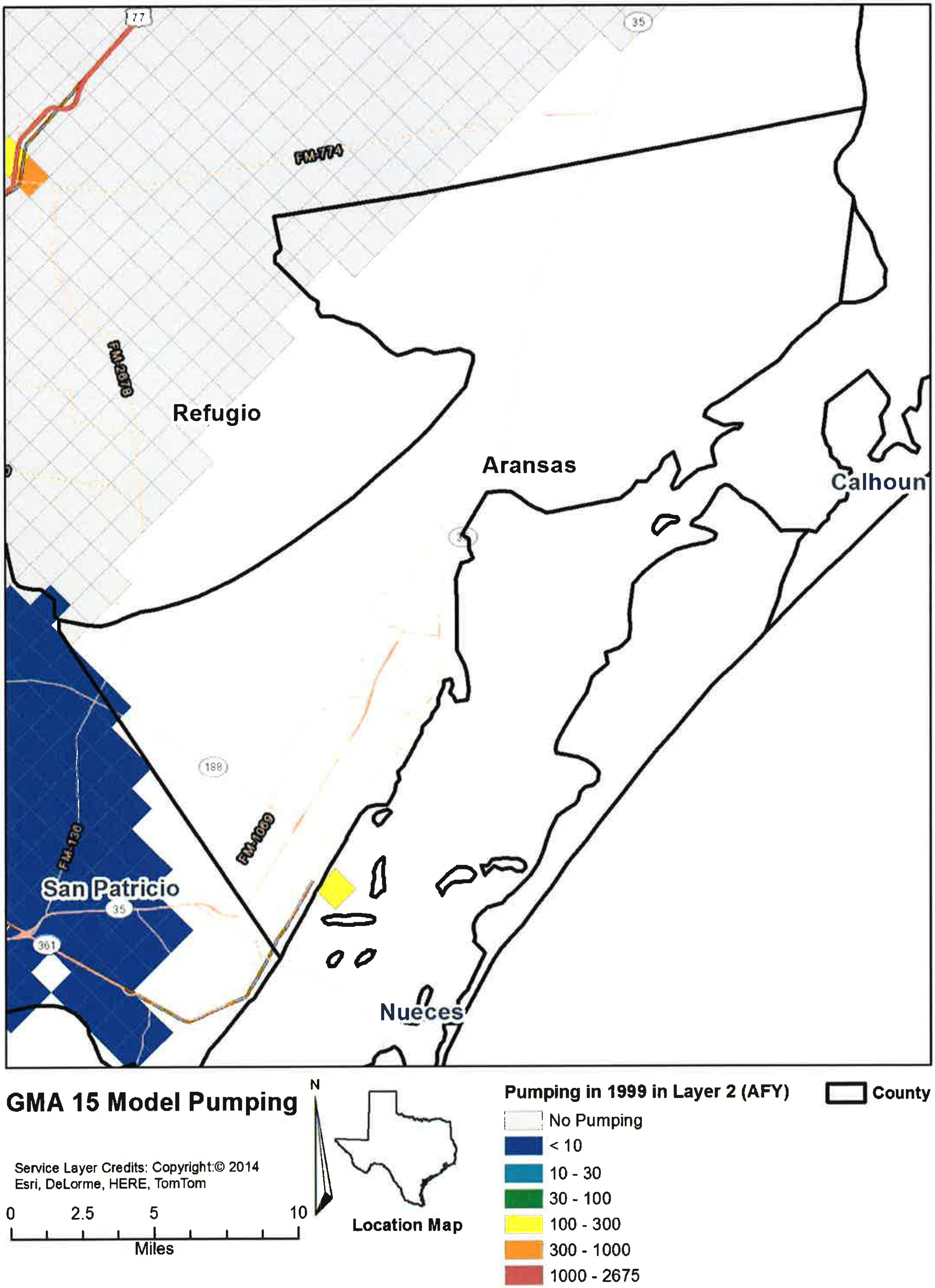
N

Location Map

Pumping in 1999 in Layer 1 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County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Refugio
Aransas
Calhoun
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188
FM-1069
FM-136
San Patricio
35
361
Nueces
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
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Miles
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Location Map
Pumping in 1999 in Layer 2 (AFY)
No Pumping
< 10
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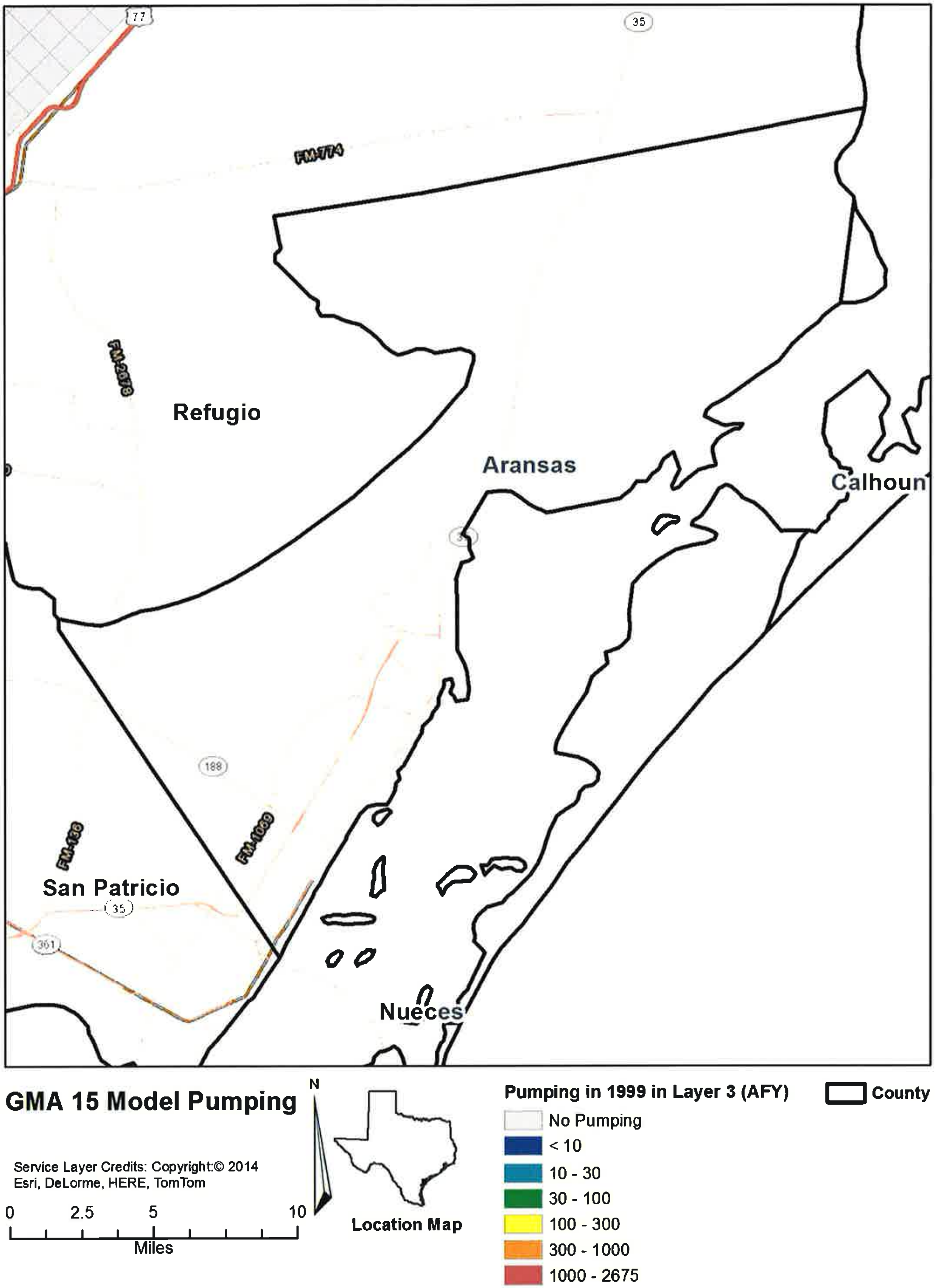
1000 - 2675
County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San Patricio
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361
Nueces
GMA 15 Model Pumping
N
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0
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Miles
Location Map
Pumping in 1999 in Layer 3 (AFY)
No Pumping
< 10
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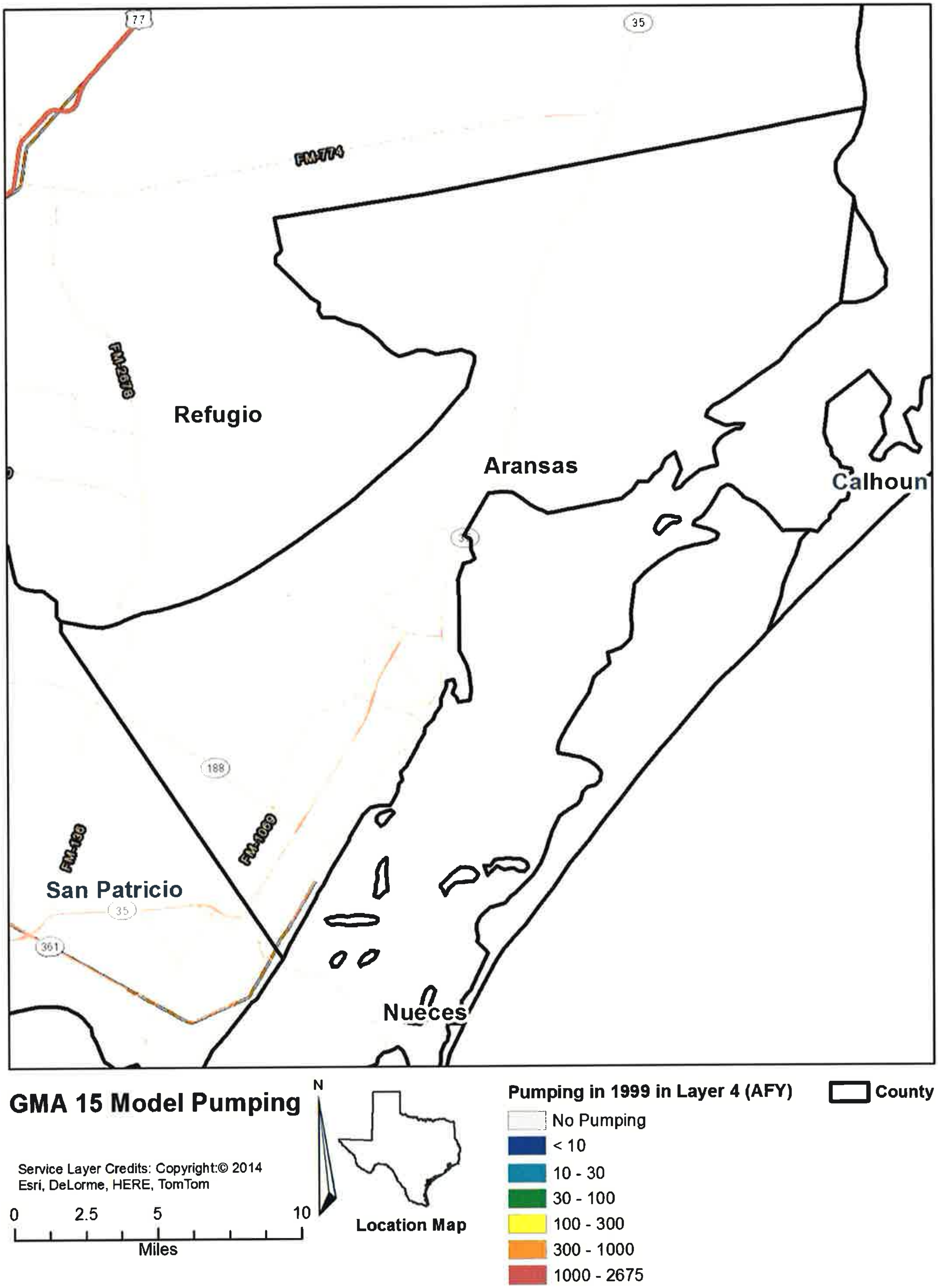
30 - 100
100 - 300
300 - 1000
1000 - 2675
County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Refugio
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San Patricio
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361
Nueces
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0
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10
Miles
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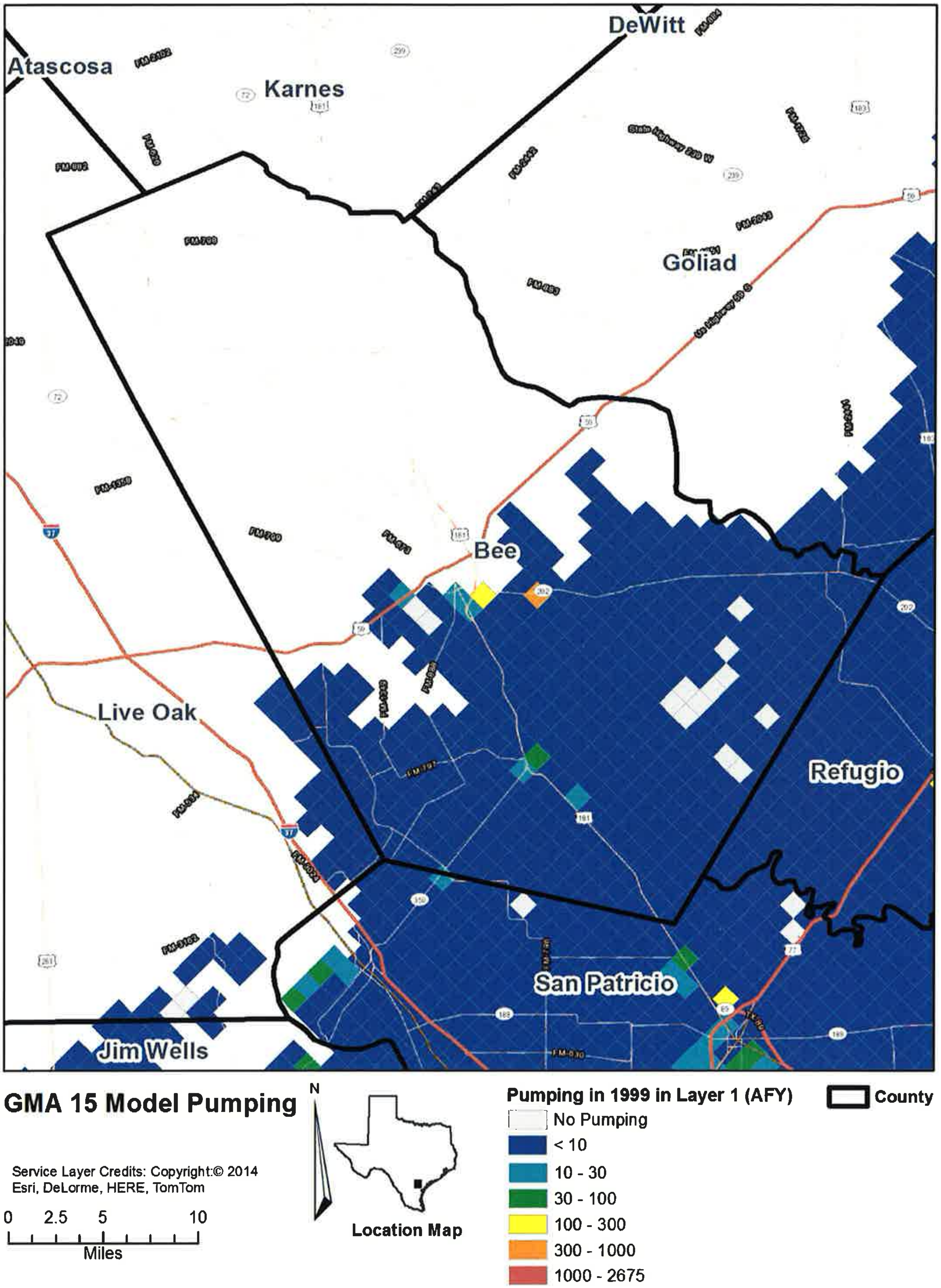
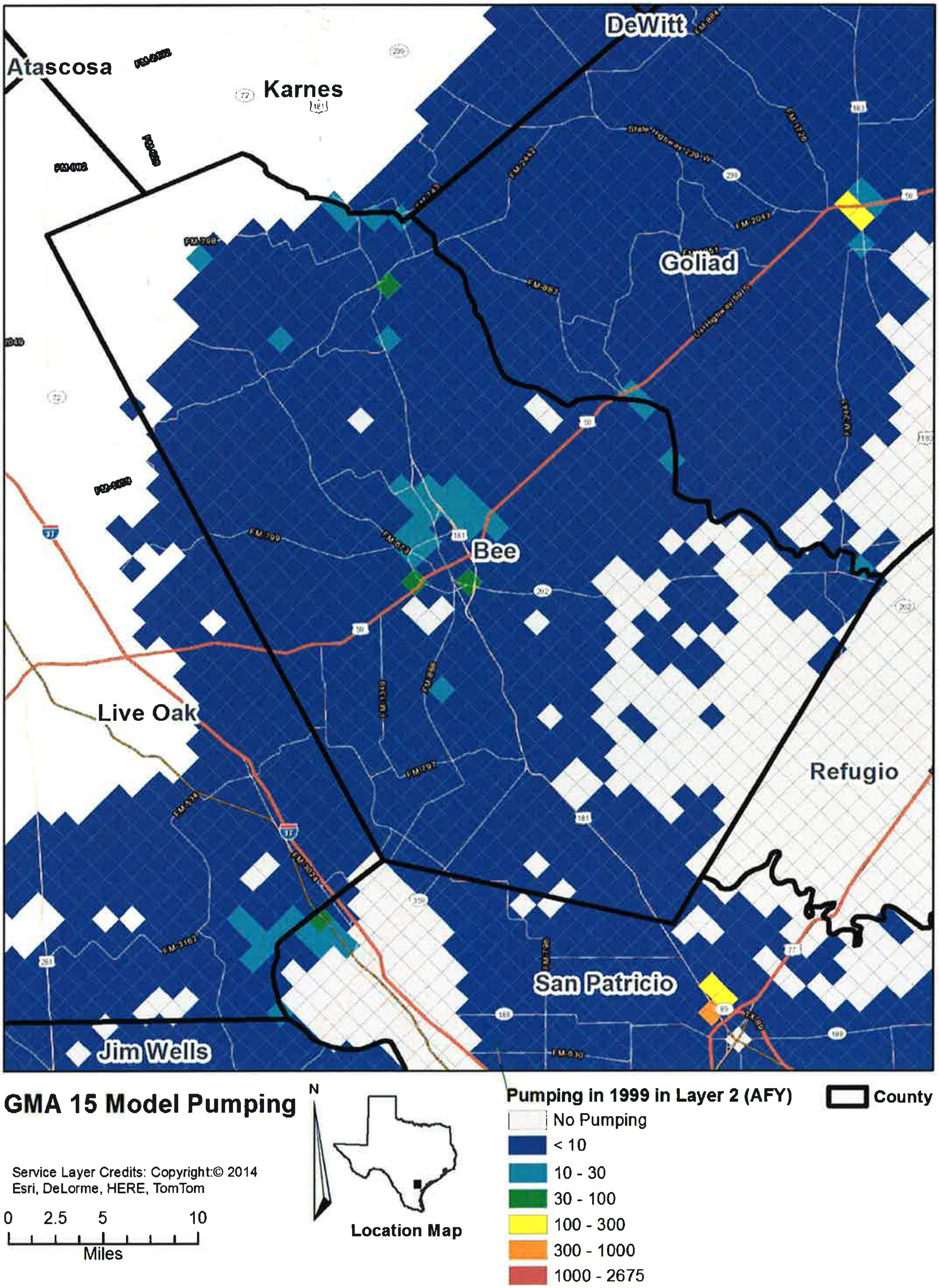
Location Map
Pumping in 1999 in Layer 4 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County


Atascosa
Karnes
DeWitt
Goliad
Bee
Live Oak
Refugio
San Patricio
Jim Wells
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



Atascosa
Karnes
DeWitt
Goliad
Bee
Live Oak
Refugio
San Patricio
Jim Wells
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
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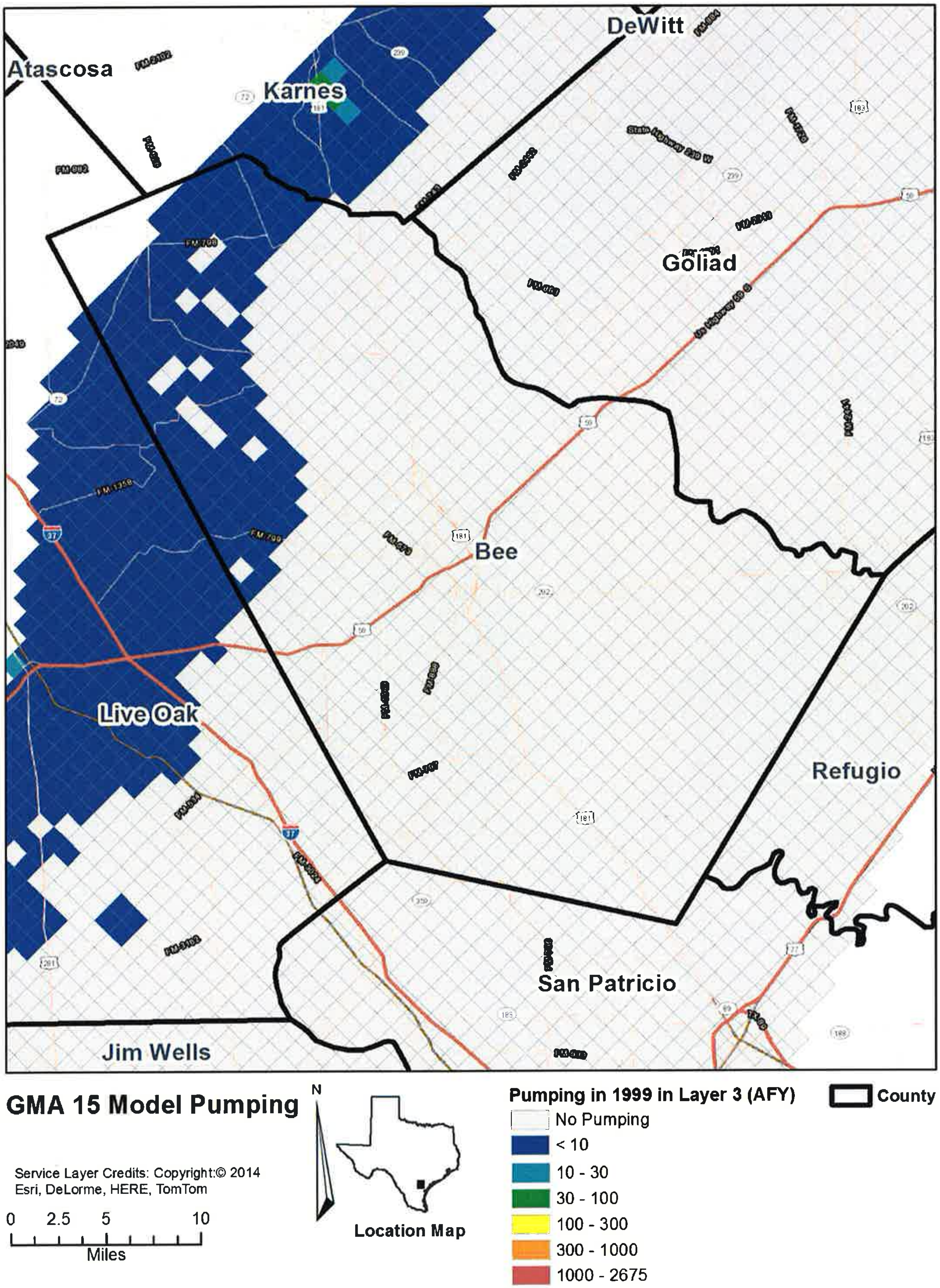
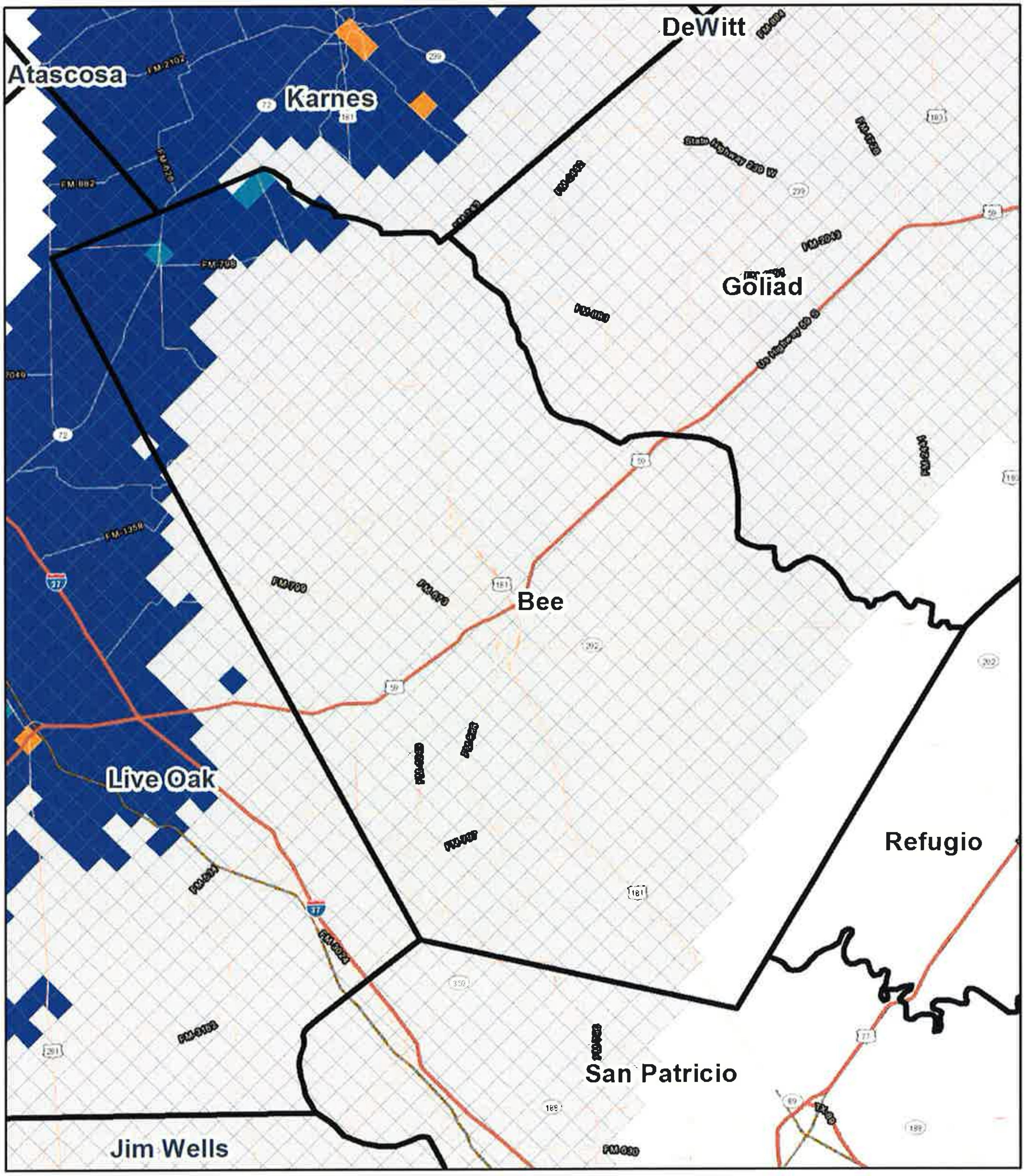
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 2 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County


DeWitt
Atascosa
Karnes
Goliad
Bee
Live Oak
Refugio
San Patricio
Jim Wells
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 3 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

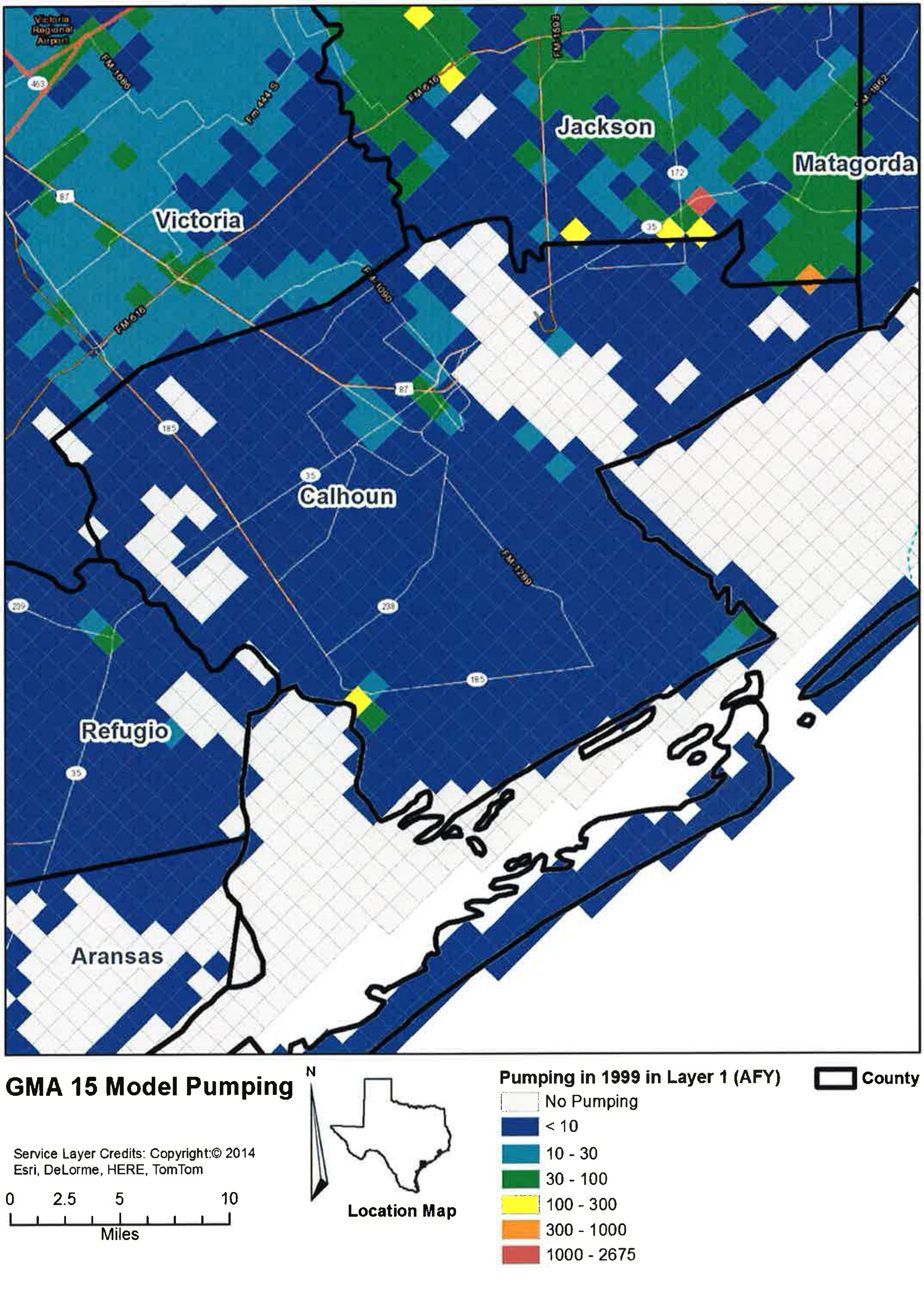
0 2.5 5 10
Miles

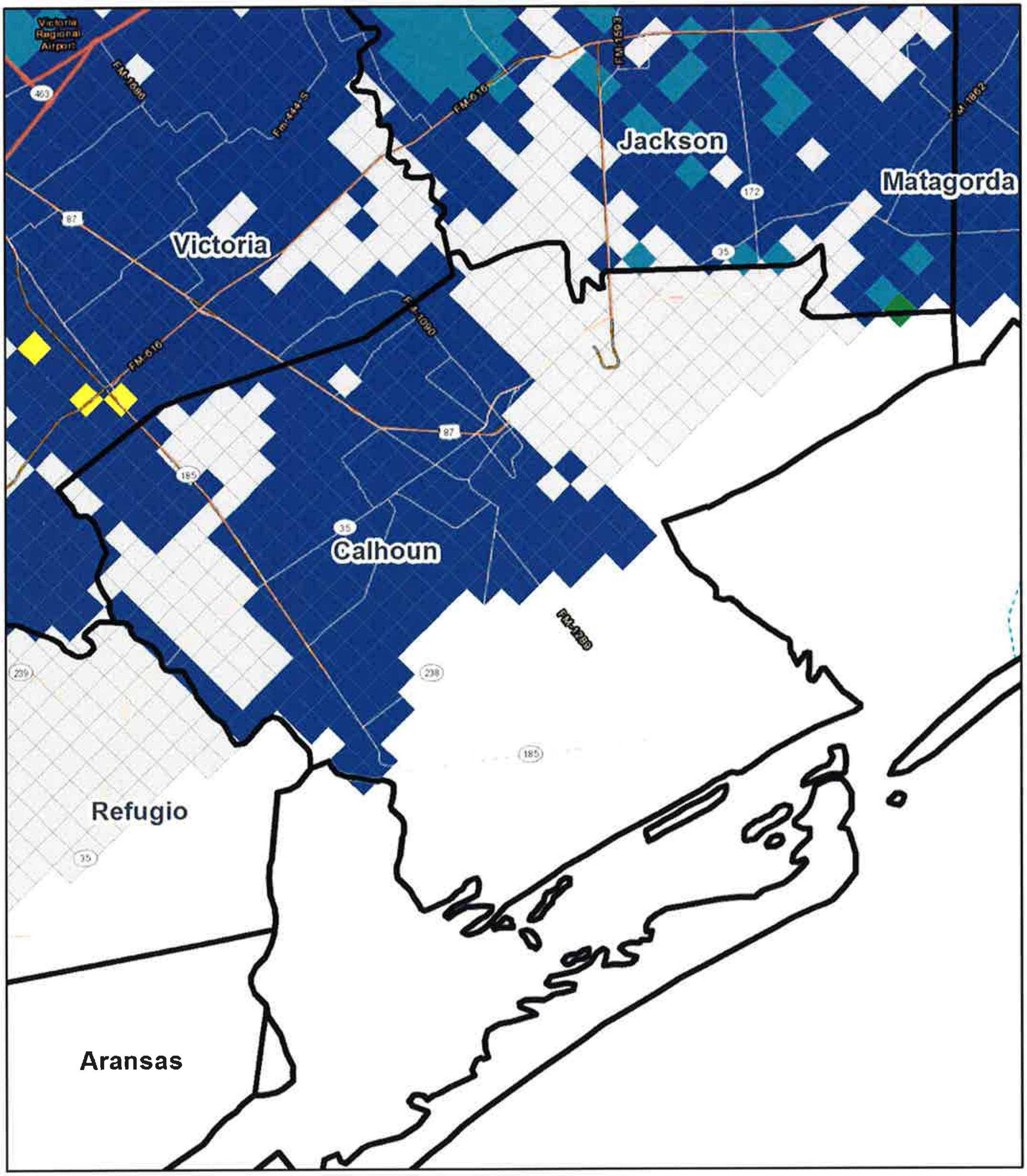
N

Location Map

Pumping in 1999 in Layer 4 (AFY)
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County


Victoria Regional Airport
FM 1686
FM 444 S
FM 616
FM 1593
FM 1862
Jackson
Matagorda
Victoria
Calhoun
Refugio
Aransas
FM 1090
FM 1289
463
87
172
35
185
239
238
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

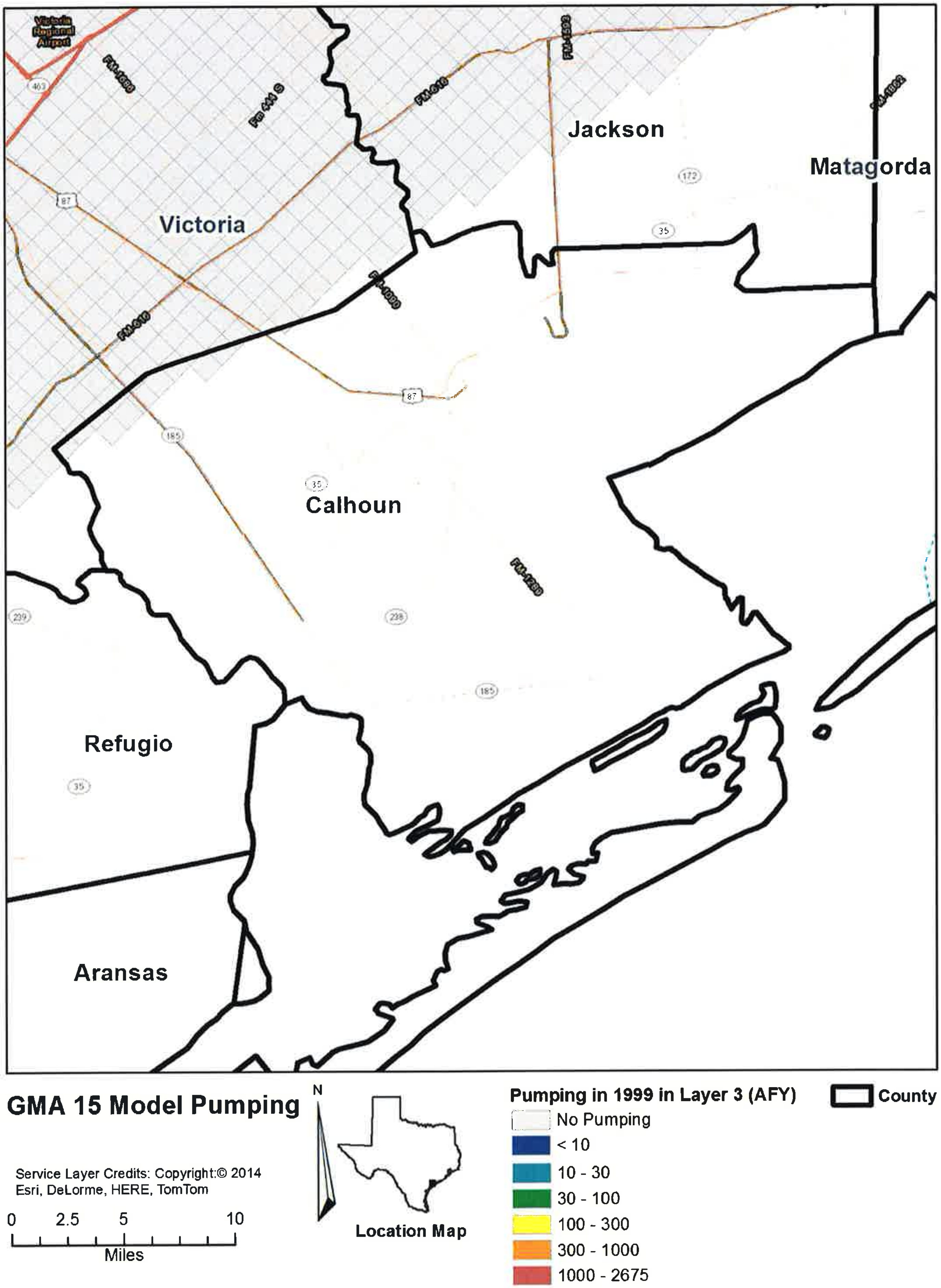
N

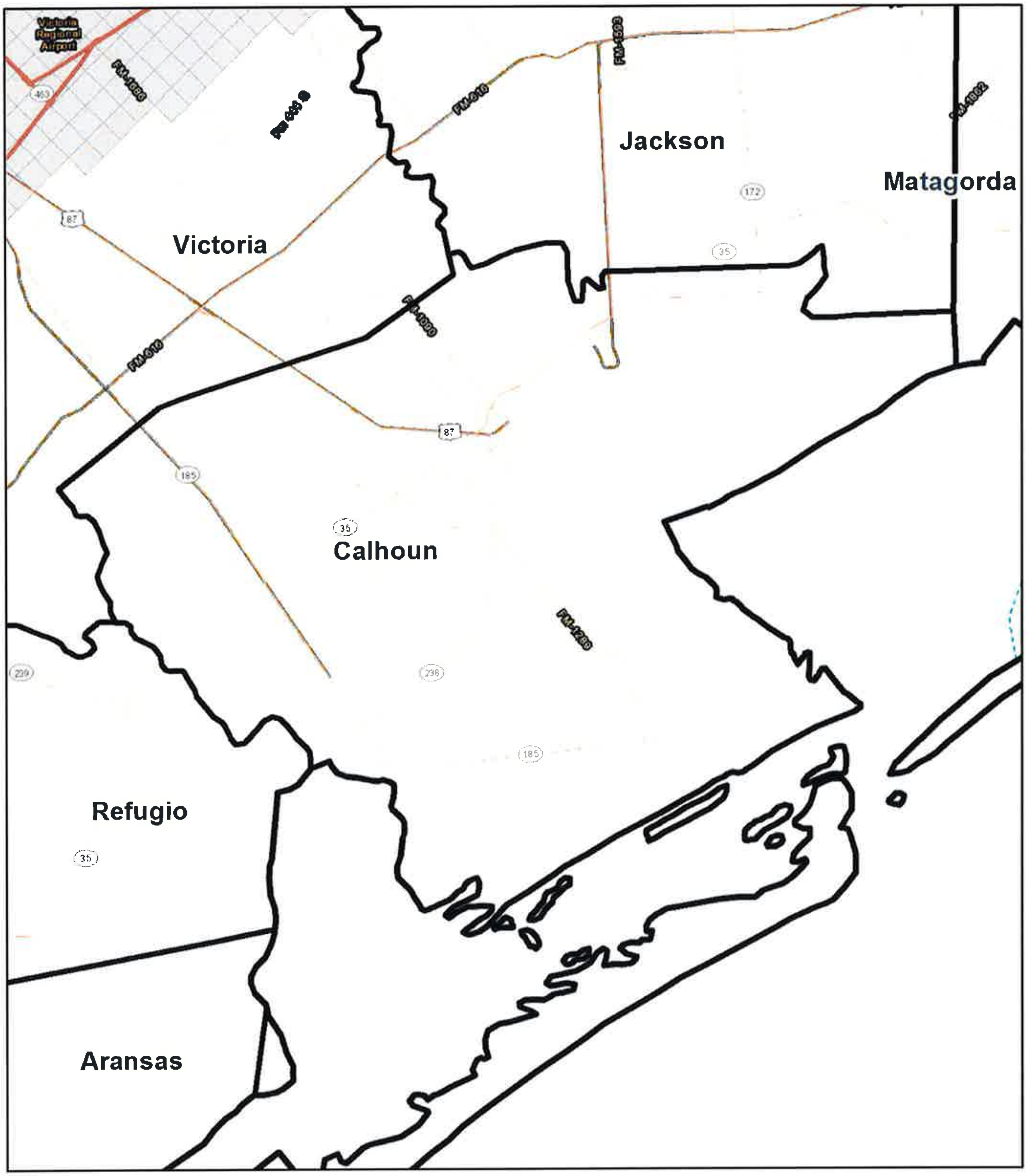
Location Map

Pumping in 1999 in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County


Jackson
Matagorda
Victoria
Calhoun
Refugio
Aransas
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 3 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10 Miles

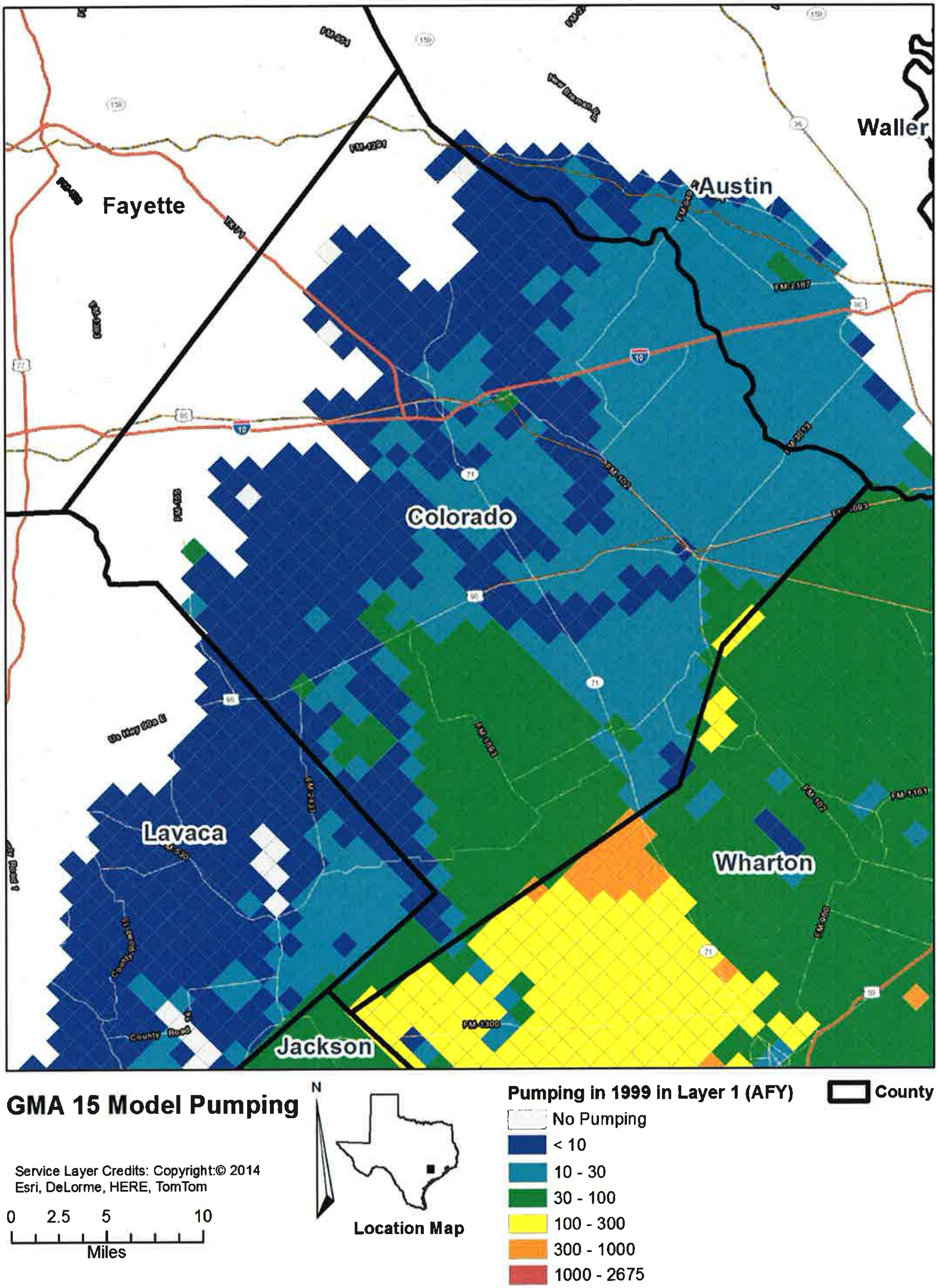
N

Location Map

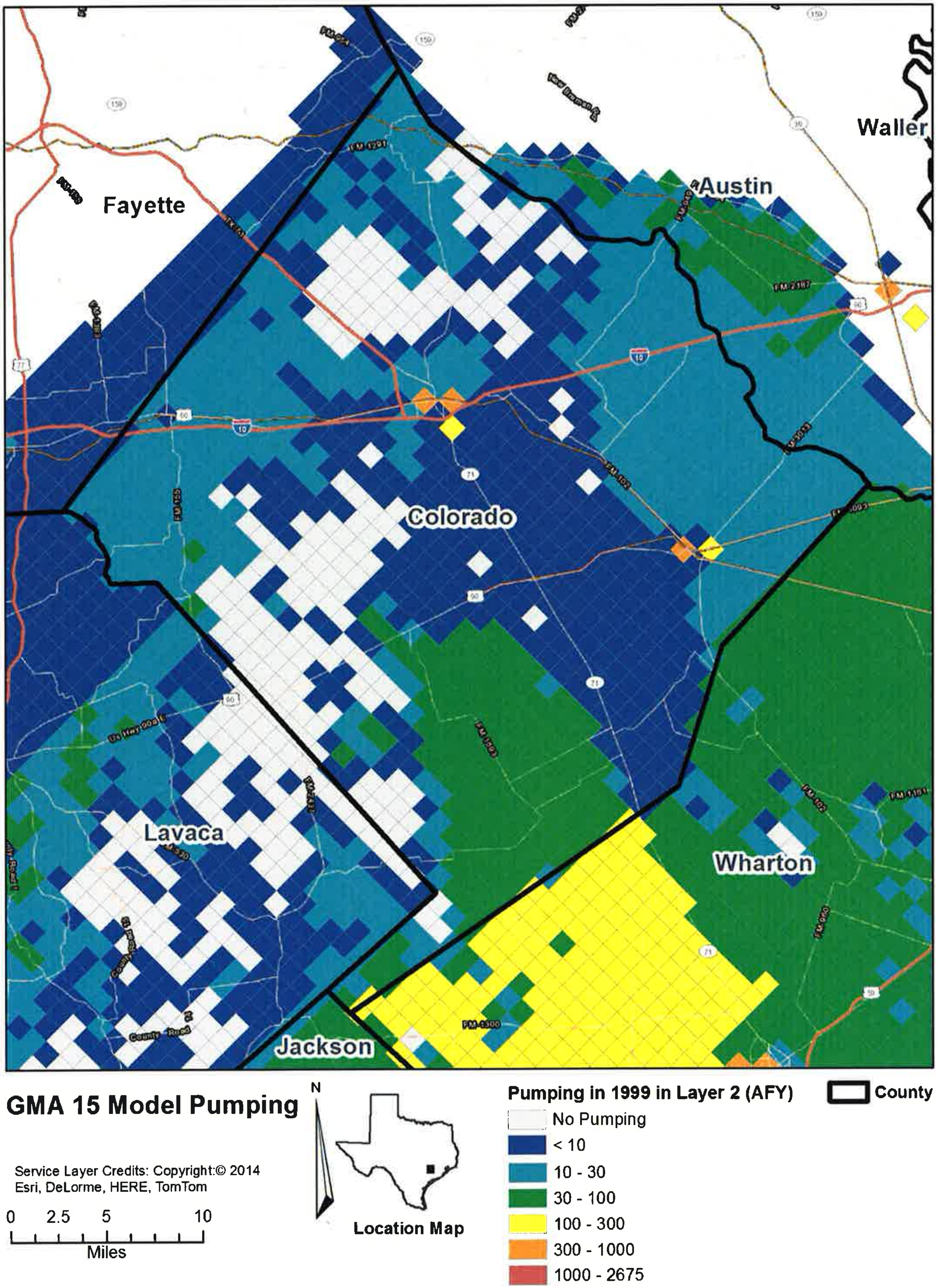
Pumping in 1999 in Layer 4 (AFY)

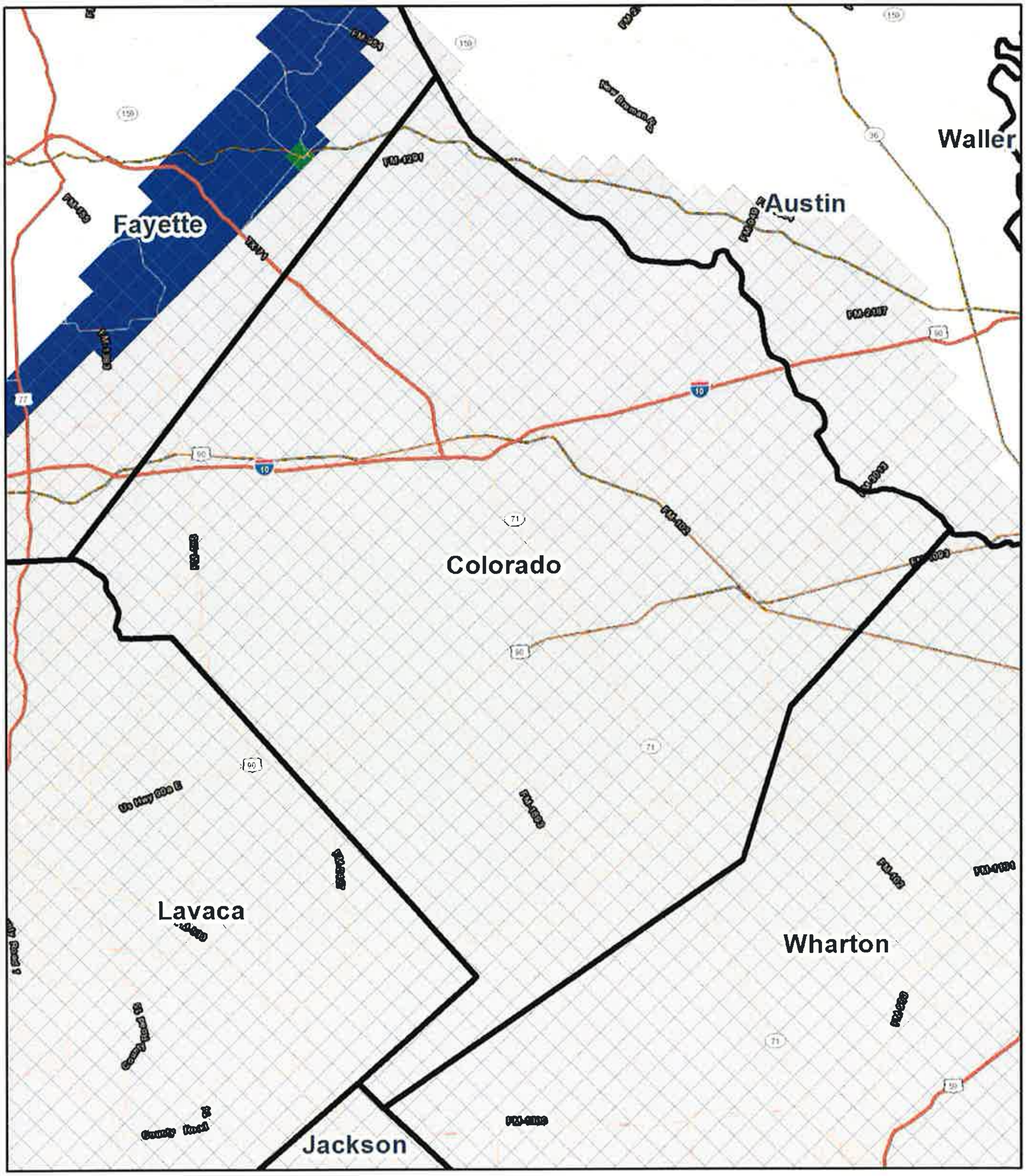
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



Fayette
Waller
Austin
Colorado
Lavaca
Wharton
Jackson
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County


Fayette
Austin
Waller
Colorado
Lavaca
Wharton
Jackson
GMA 15 Model Pumping
N
Location Map
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
Pumping in 1999 in Layer 2 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

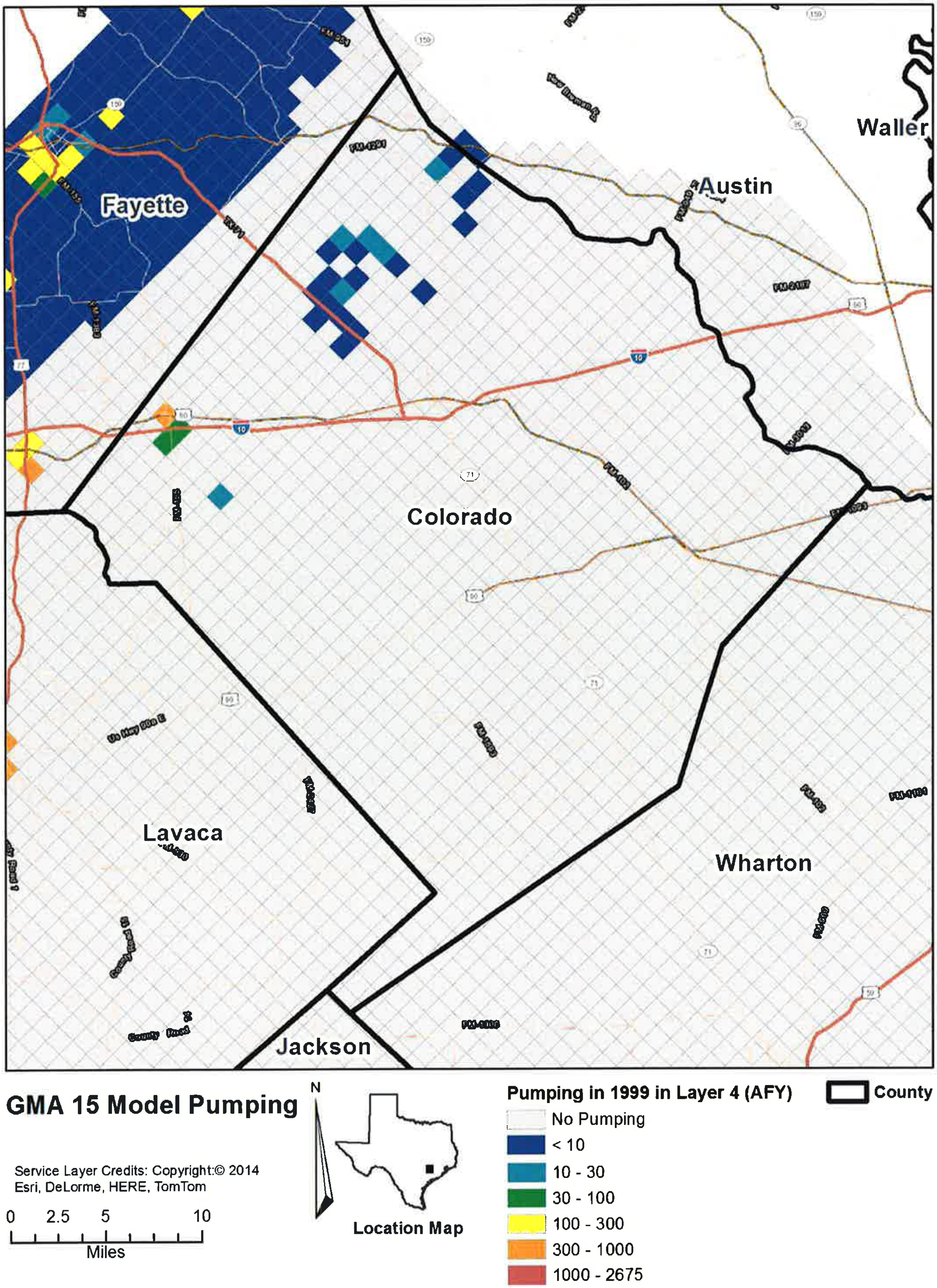
N

Location Map

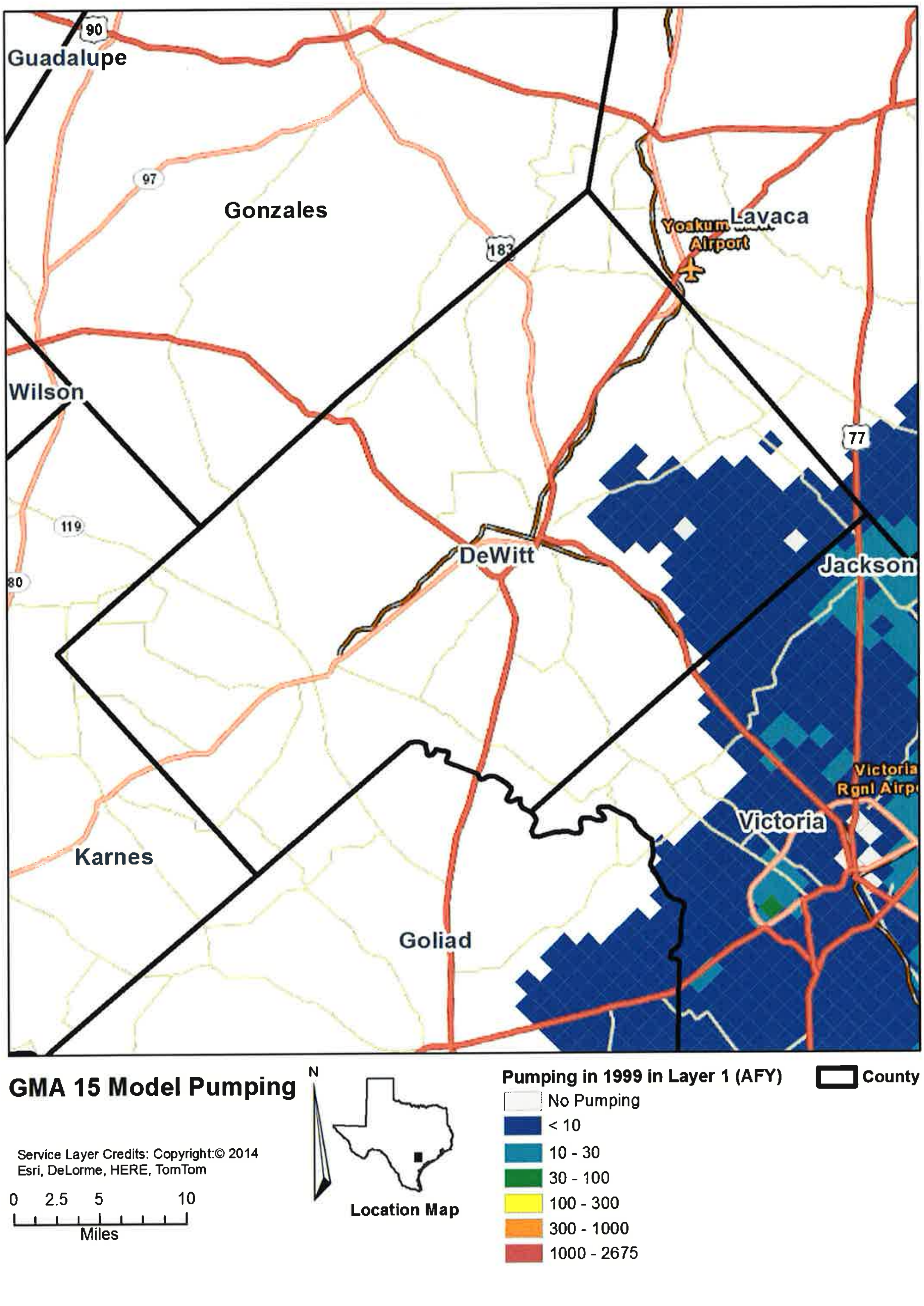
Pumping in 1999 in Layer 3 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

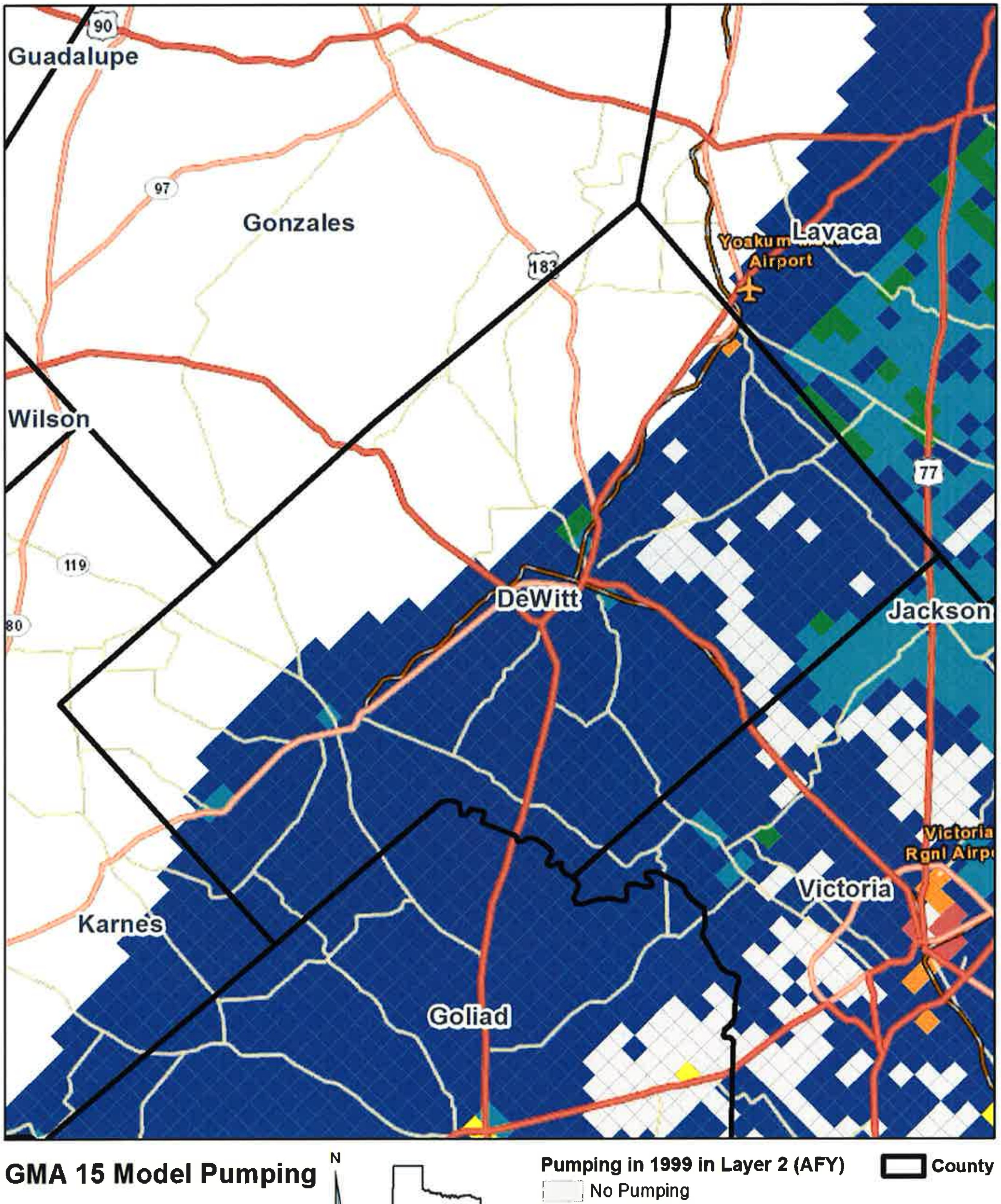
County



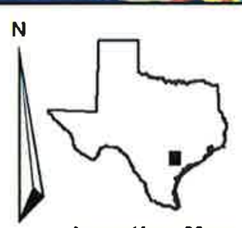
Fayette
Austin
Waller
Colorado
Lavaca
Wharton
Jackson
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 4 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



Guadalupe
Gonzales
Lavaca
Yoakum Airport
Wilson
DeWitt
Jackson
Victoria
Victoria Rgnl Airp
Karnes
Goliad
90
97
183
77
119
80
GMA 15 Model Pumping
N
Location Map
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping



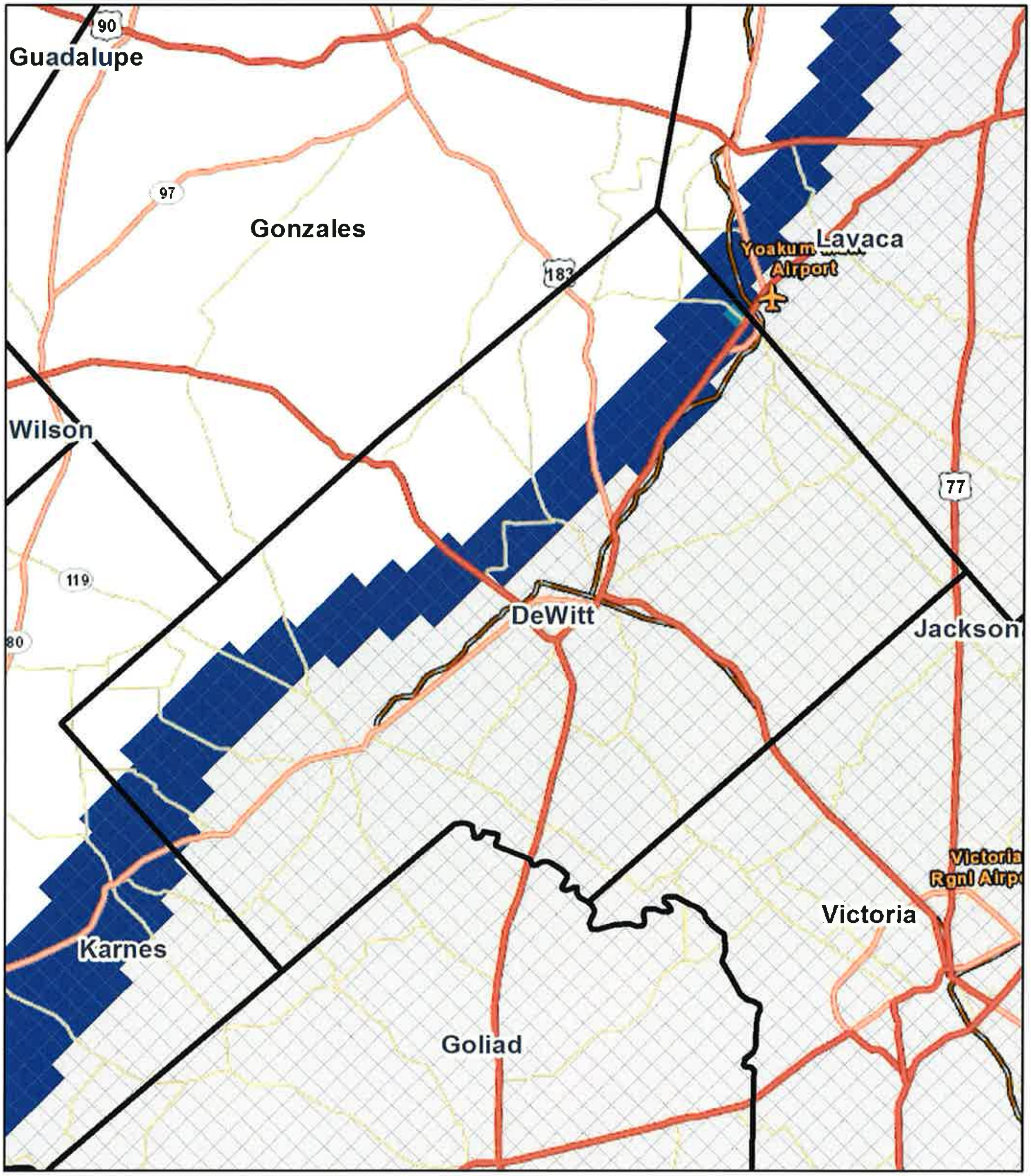
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

Pumping in 1999 in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

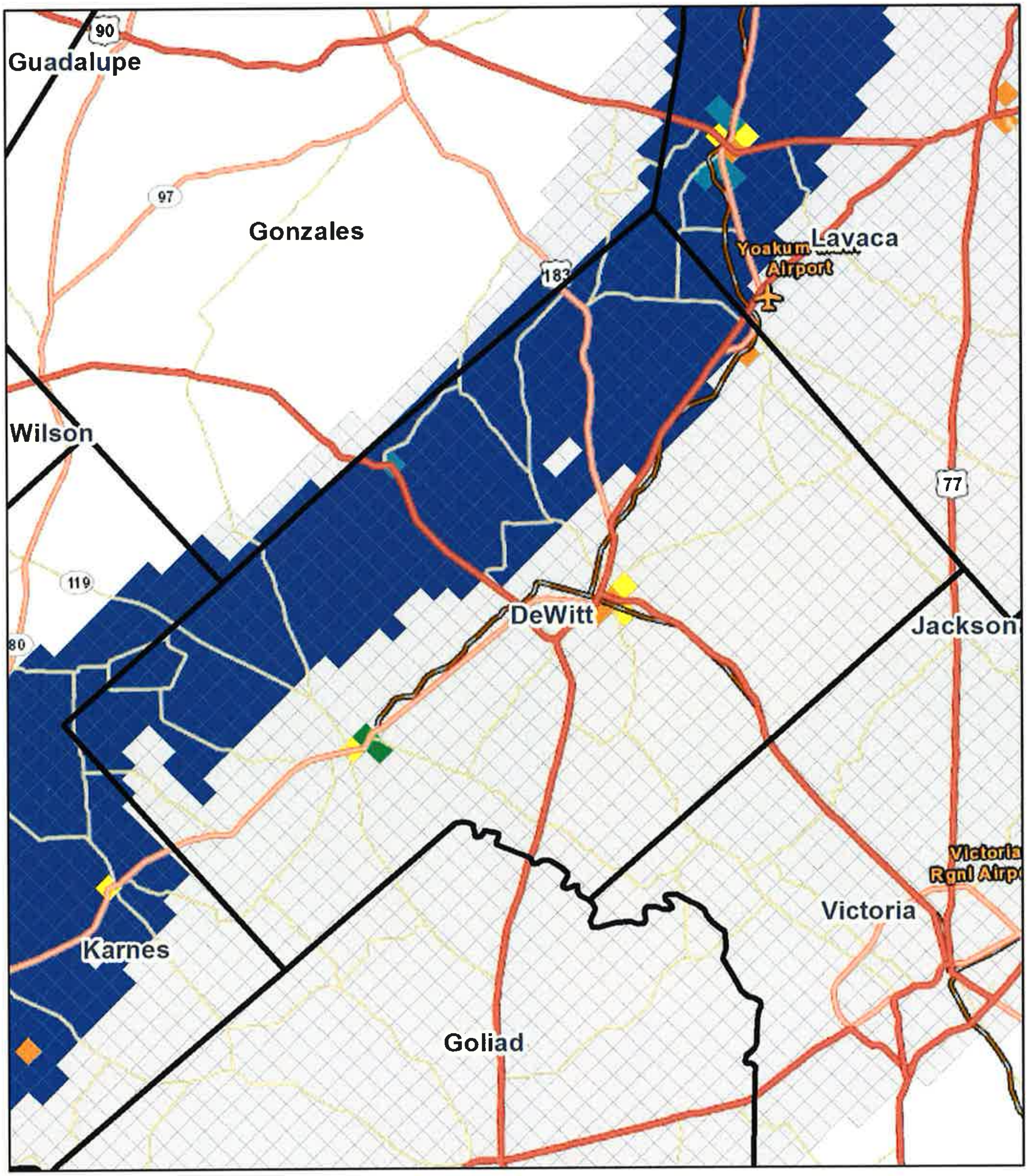
N

Location Map

Pumping in 1999 in Layer 3 (AFY)

No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675

County



GMA 15 Model Pumping

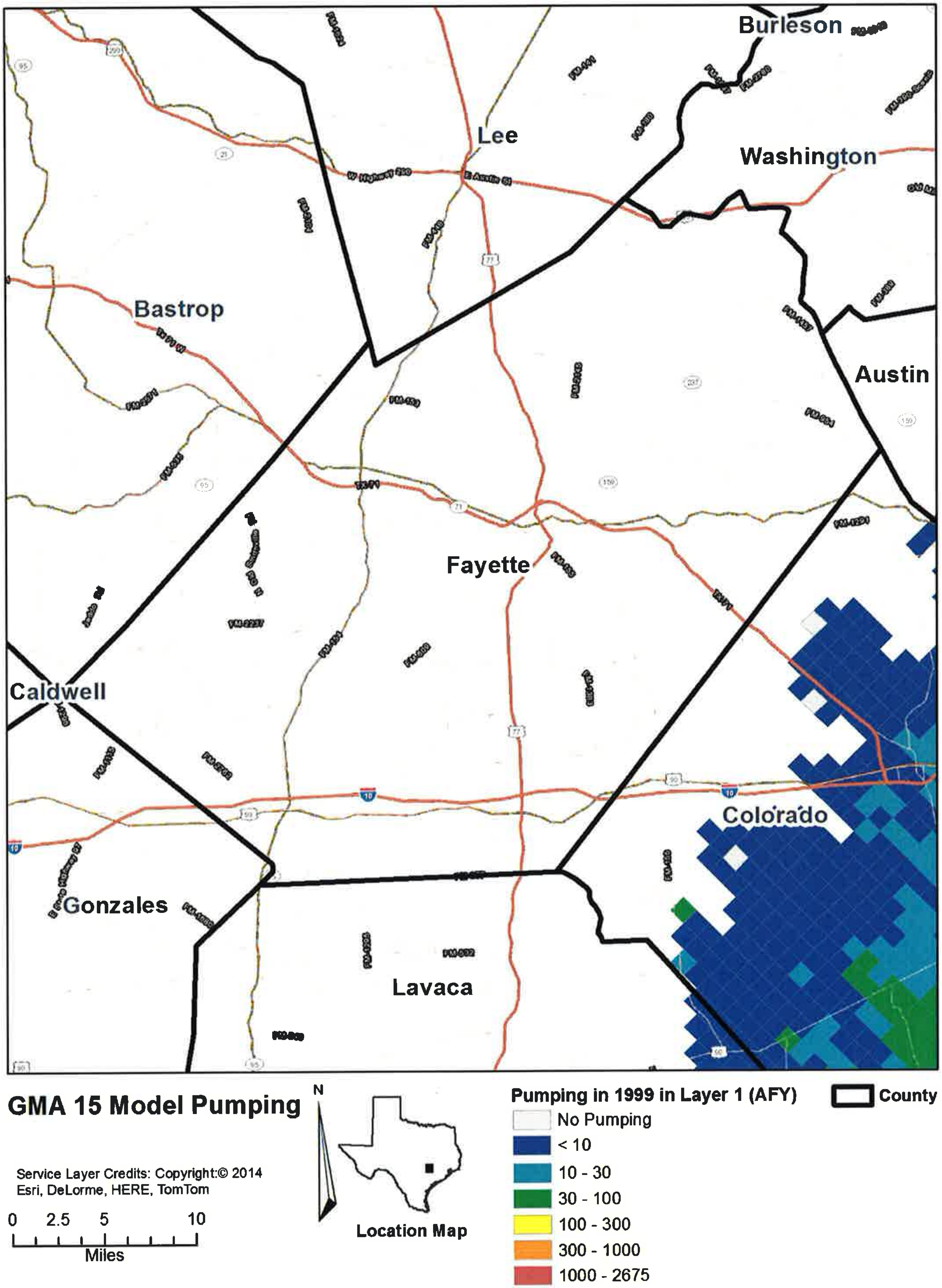
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

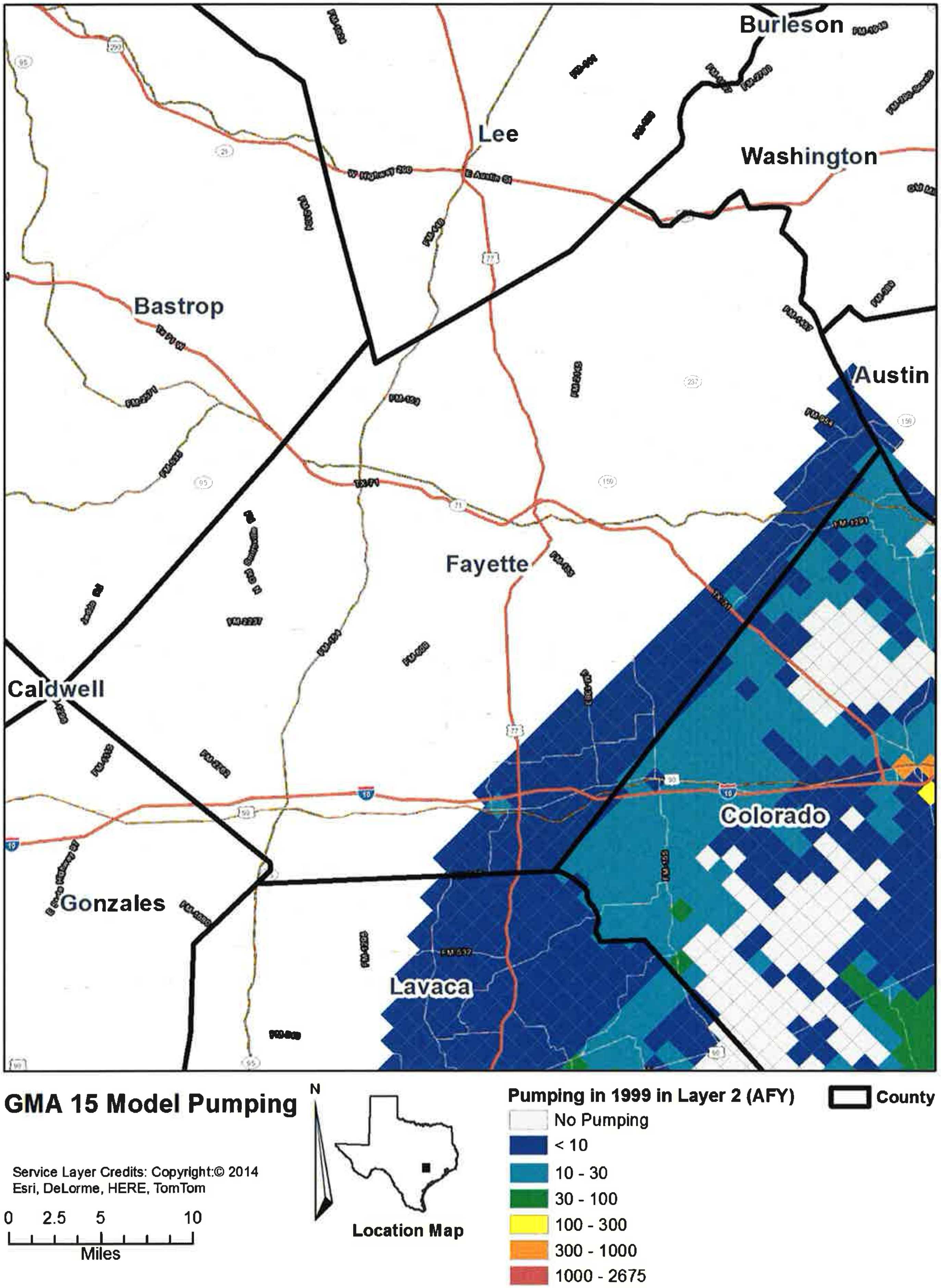
0 2.5 5 10 Miles

Pumping in 1999 in Layer 4 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

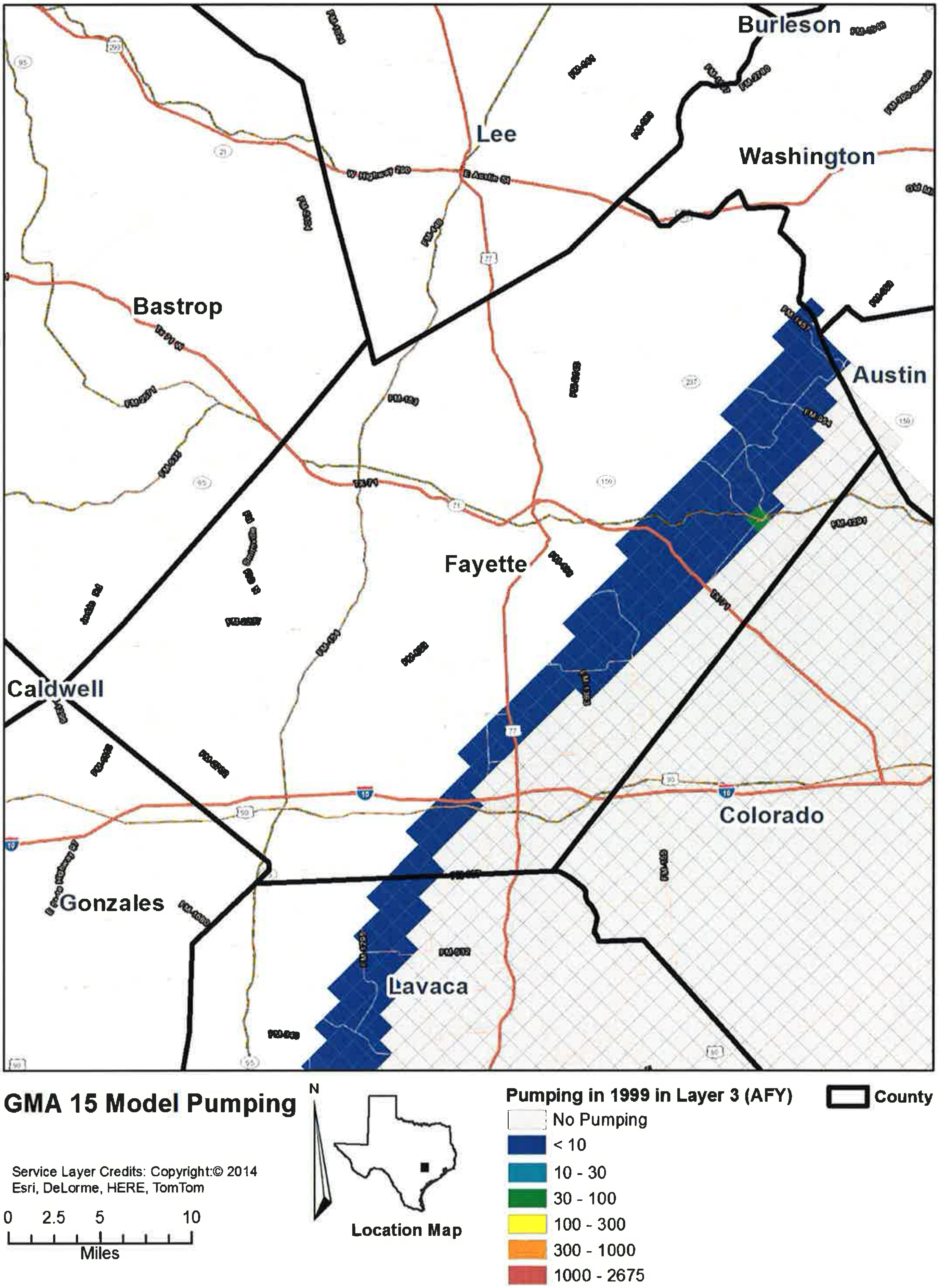
County


Burleson
Lee
Washington
Bastrop
Austin
Fayette
Caldwell
Colorado
Gonzales
Lavaca
GMA 15 Model Pumping
N
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
Location Map
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County

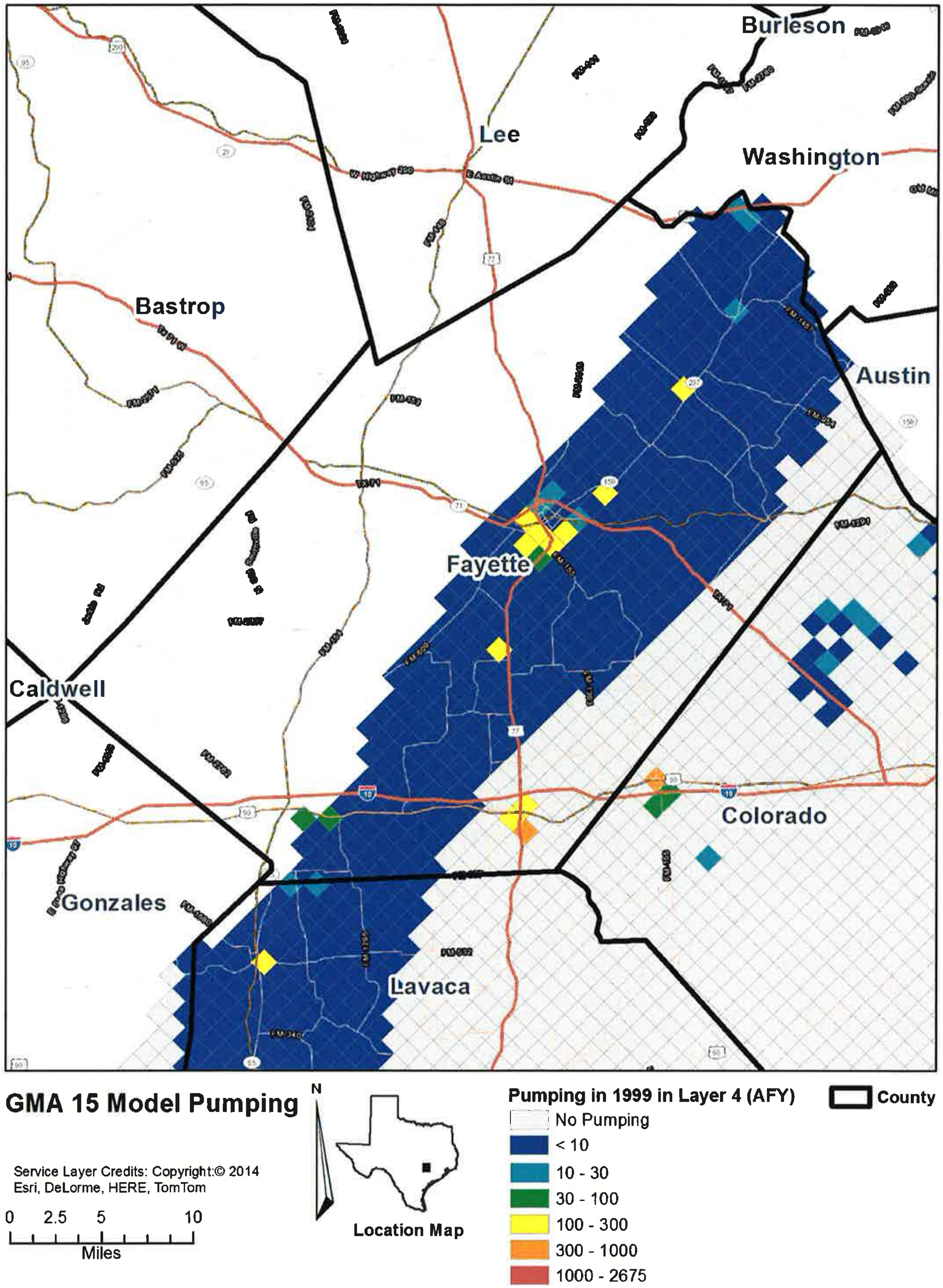


GMA 15 Model Pumping

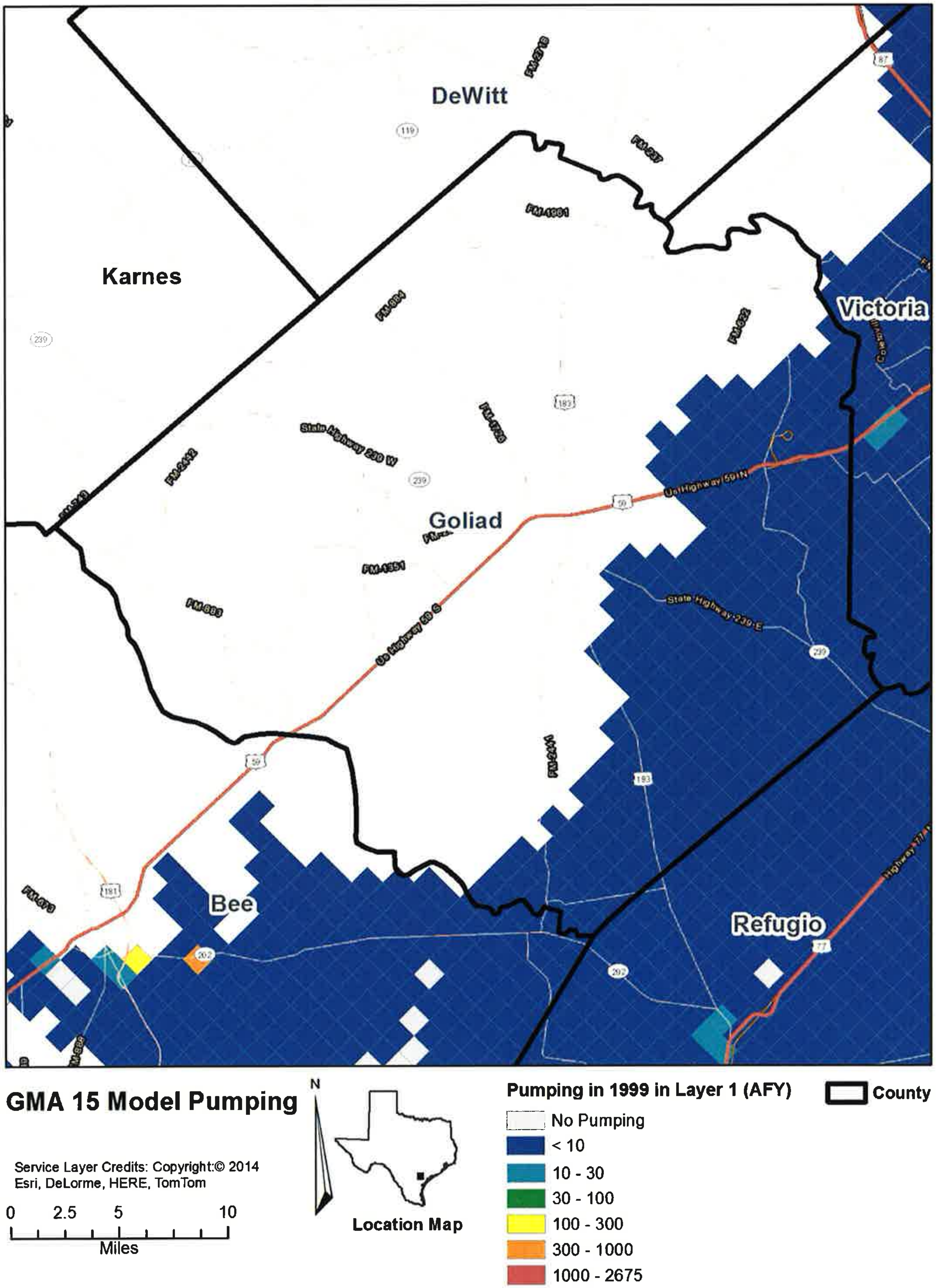
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

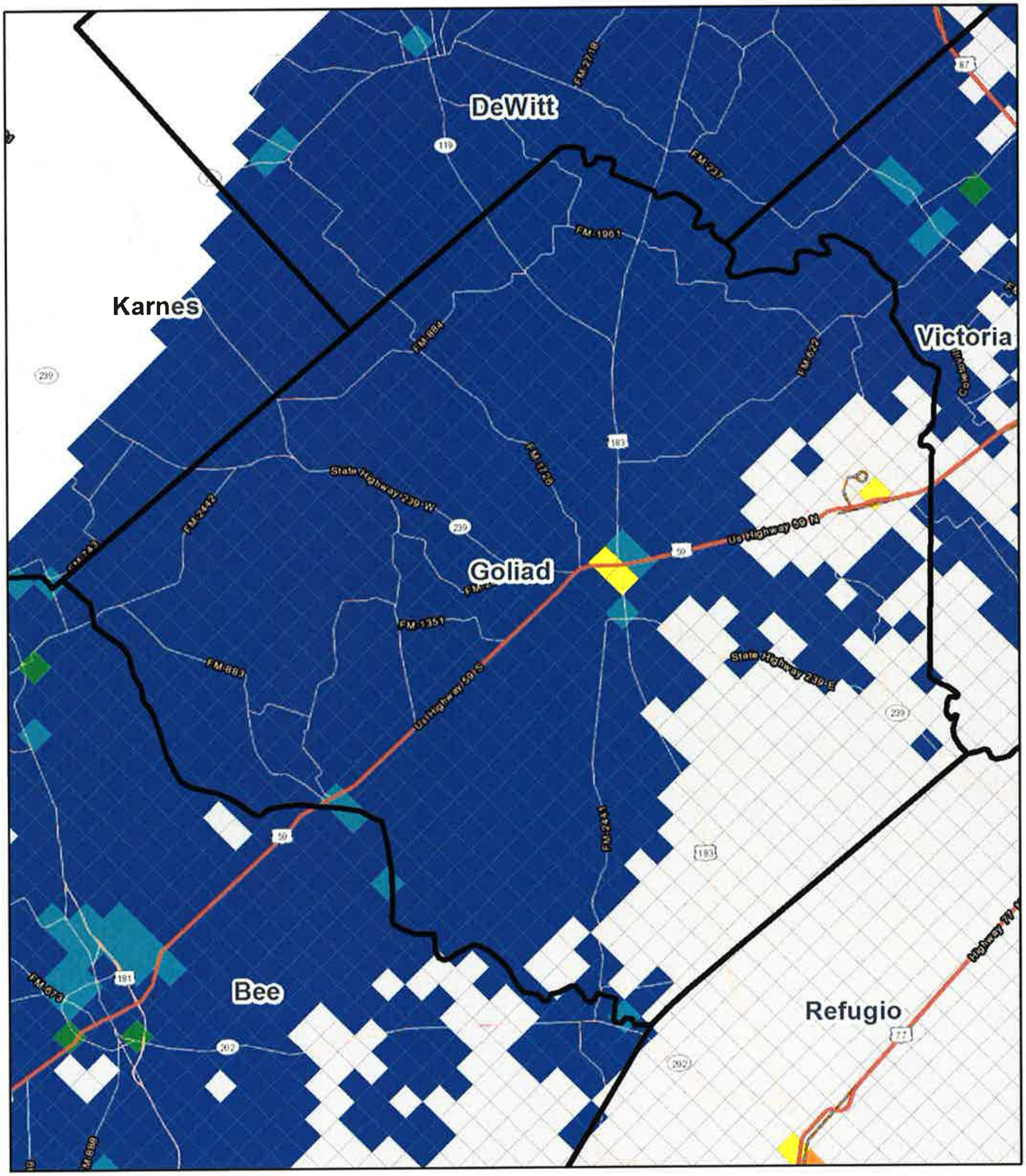


GMA 15 Model Pumping



Burleson
Lee
Washington
Bastrop
Austin
Fayette
Caldwell
Colorado
Gonzales
Lavaca
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 4 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County


DeWitt
Karnes
Goliad
Victoria
Bee
Refugio
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

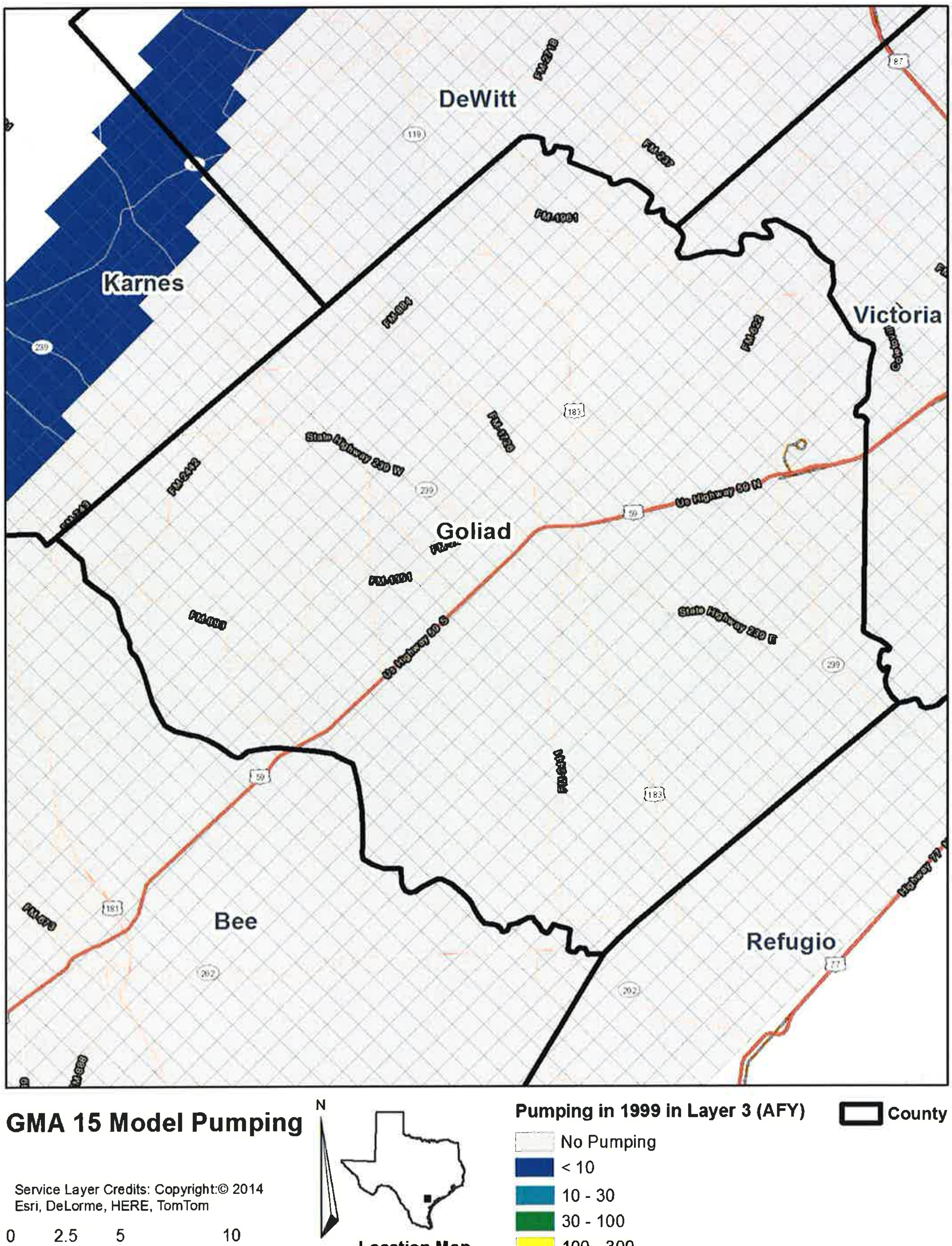
N

Location Map

Pumping in 1999 in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping

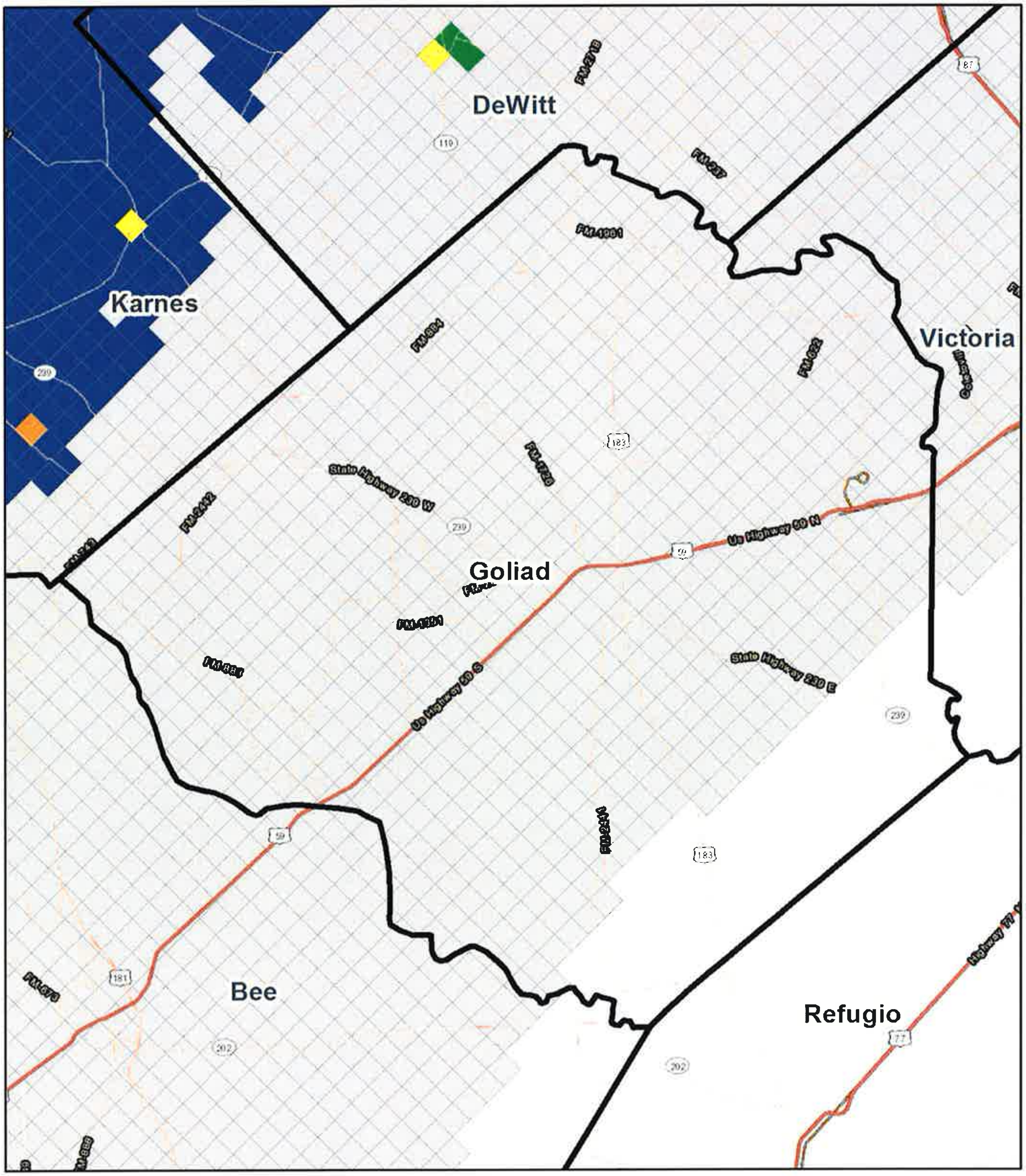
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

Pumping in 1999 in Layer 3 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10

Miles

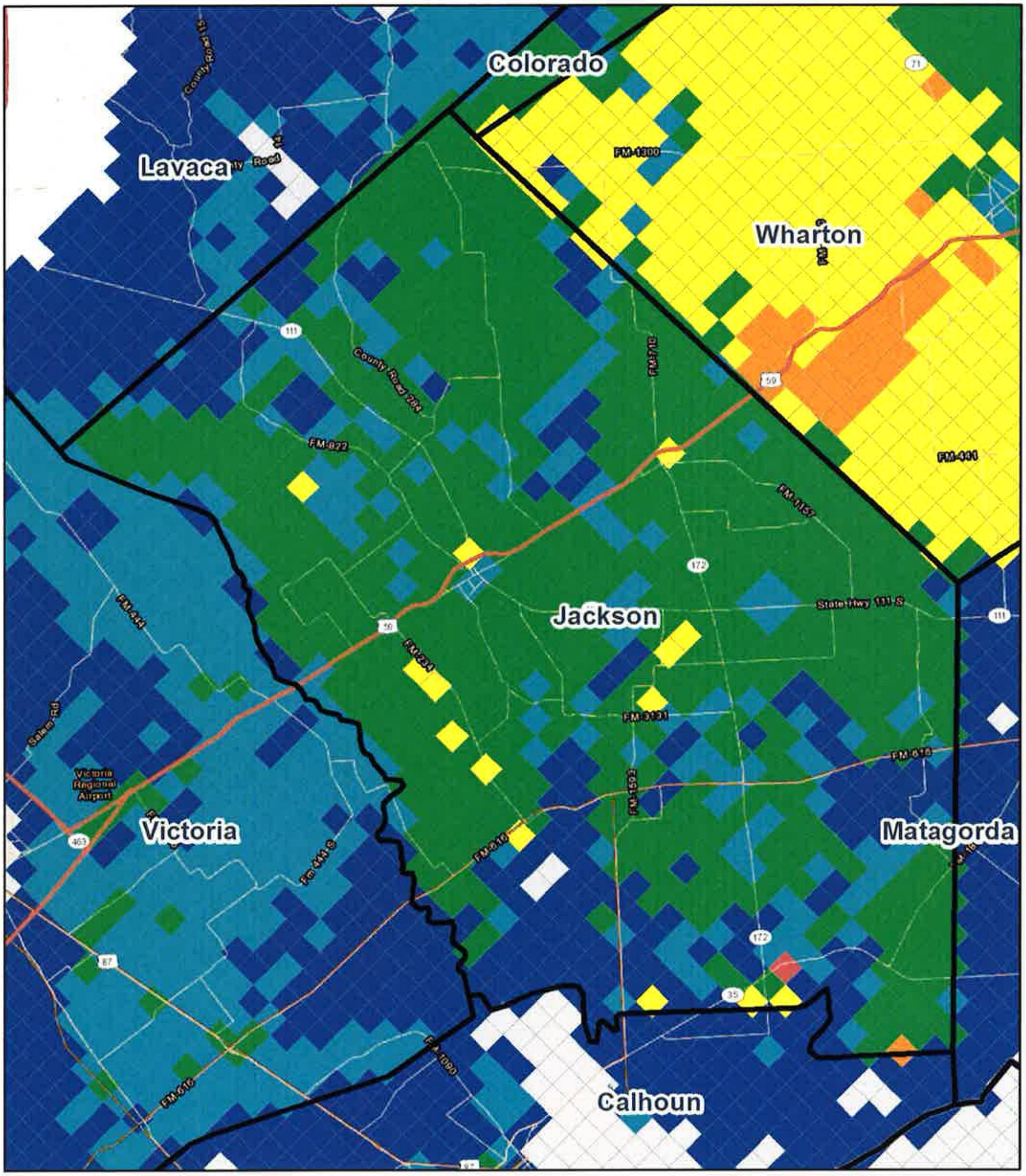
N

Location Map

Pumping in 1999 in Layer 4 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

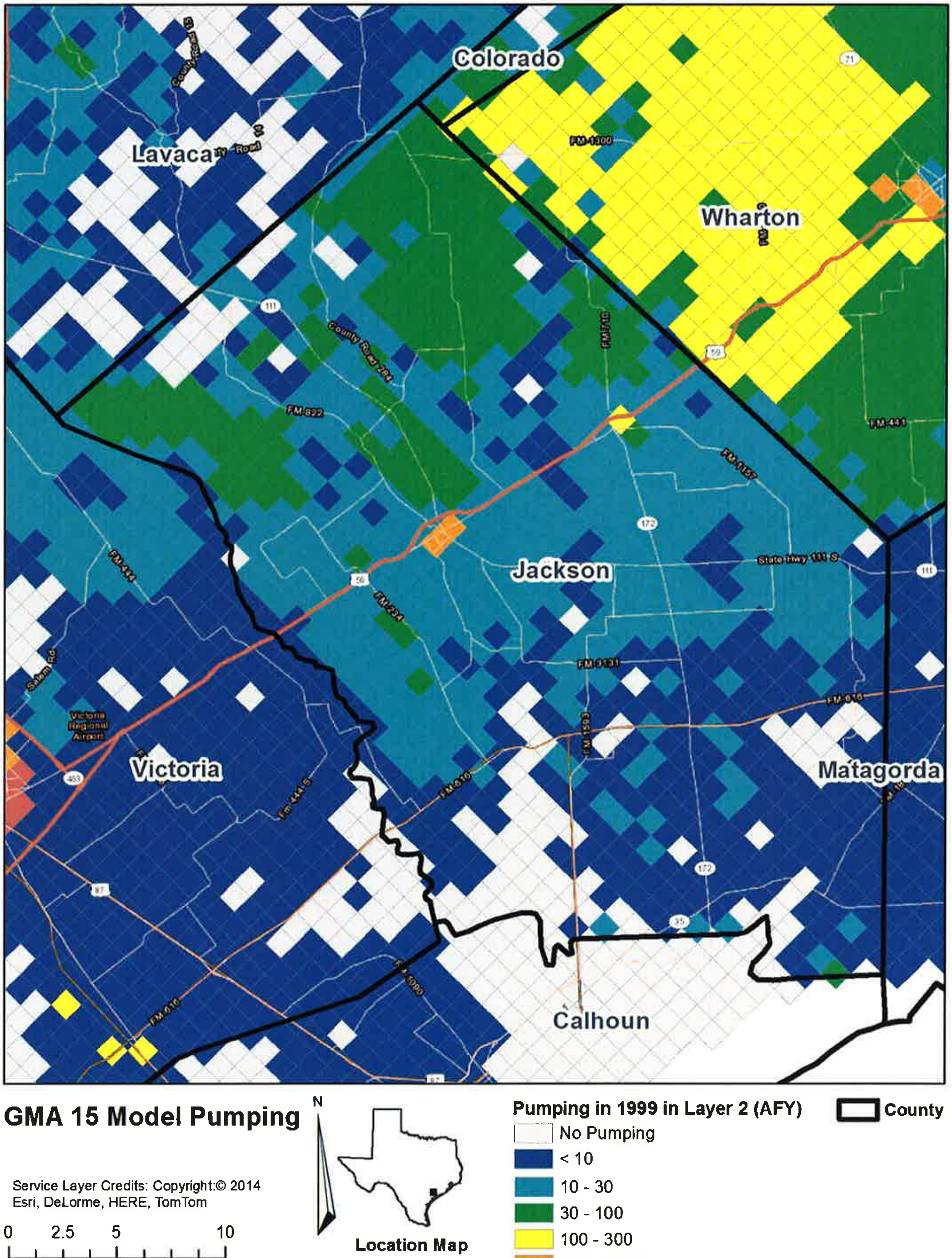
N

Location Map

Pumping in 1999 in Layer 1 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



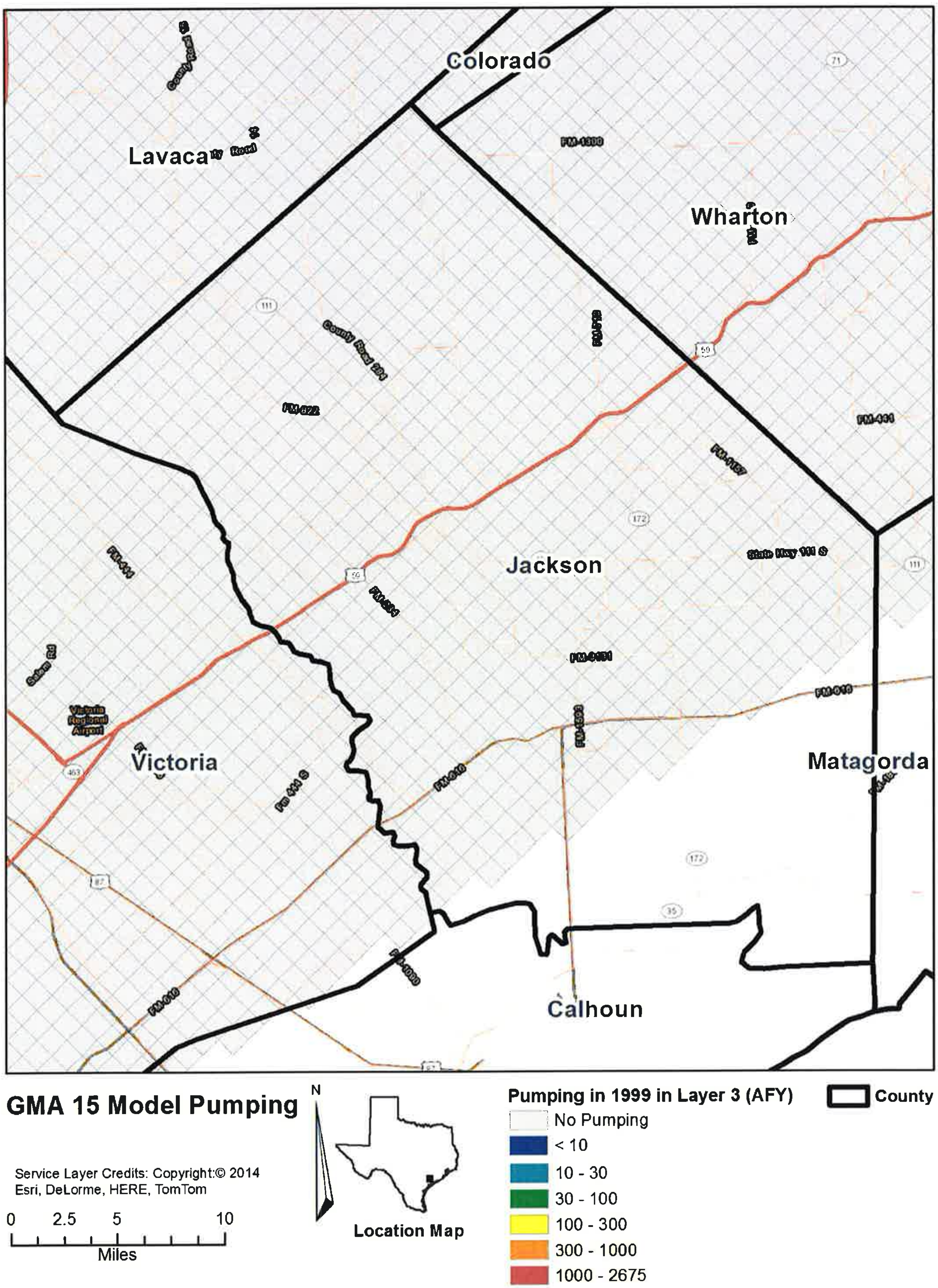
GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

Pumping in 1999 in Layer 2 (AFY)

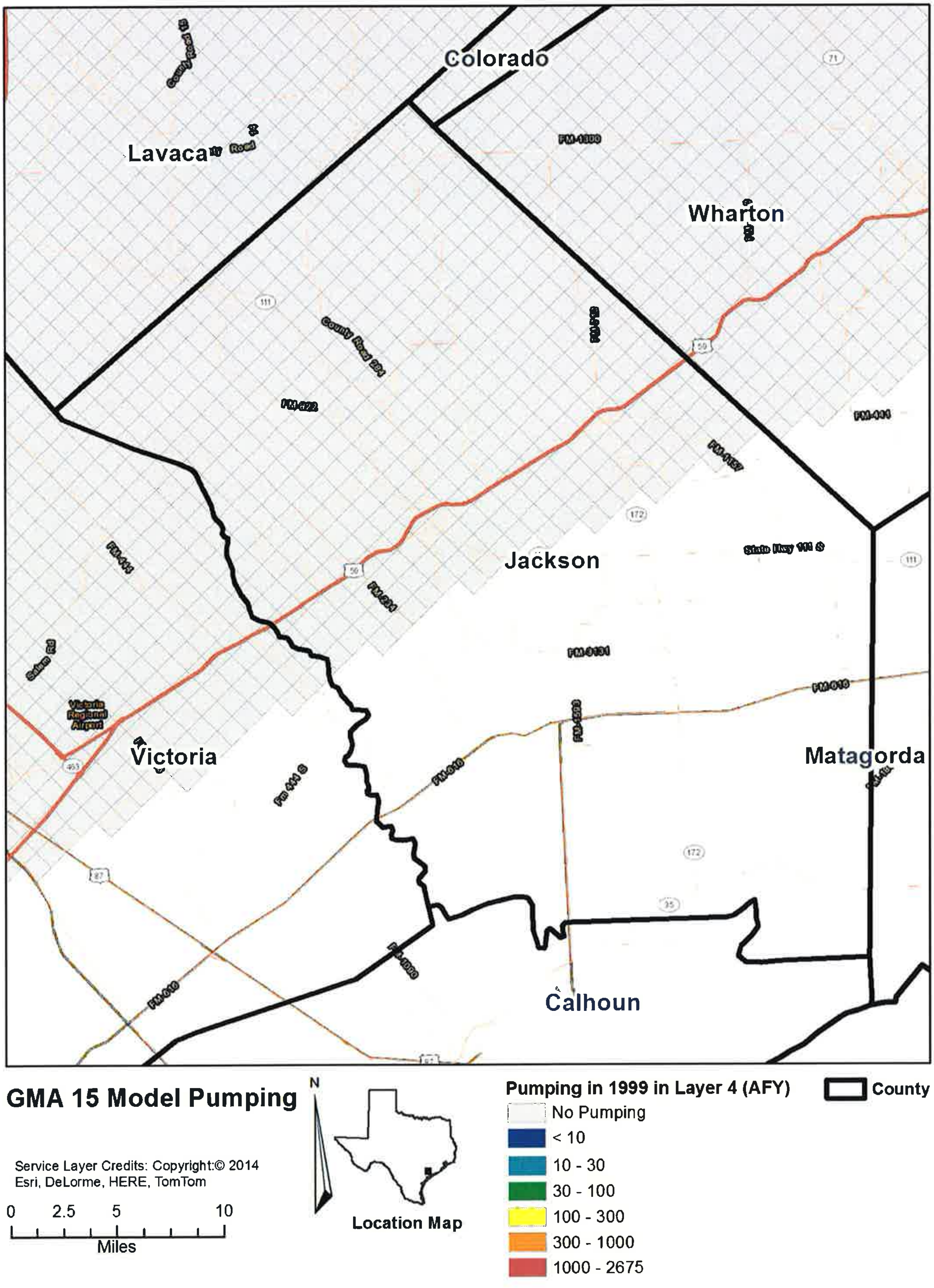
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County

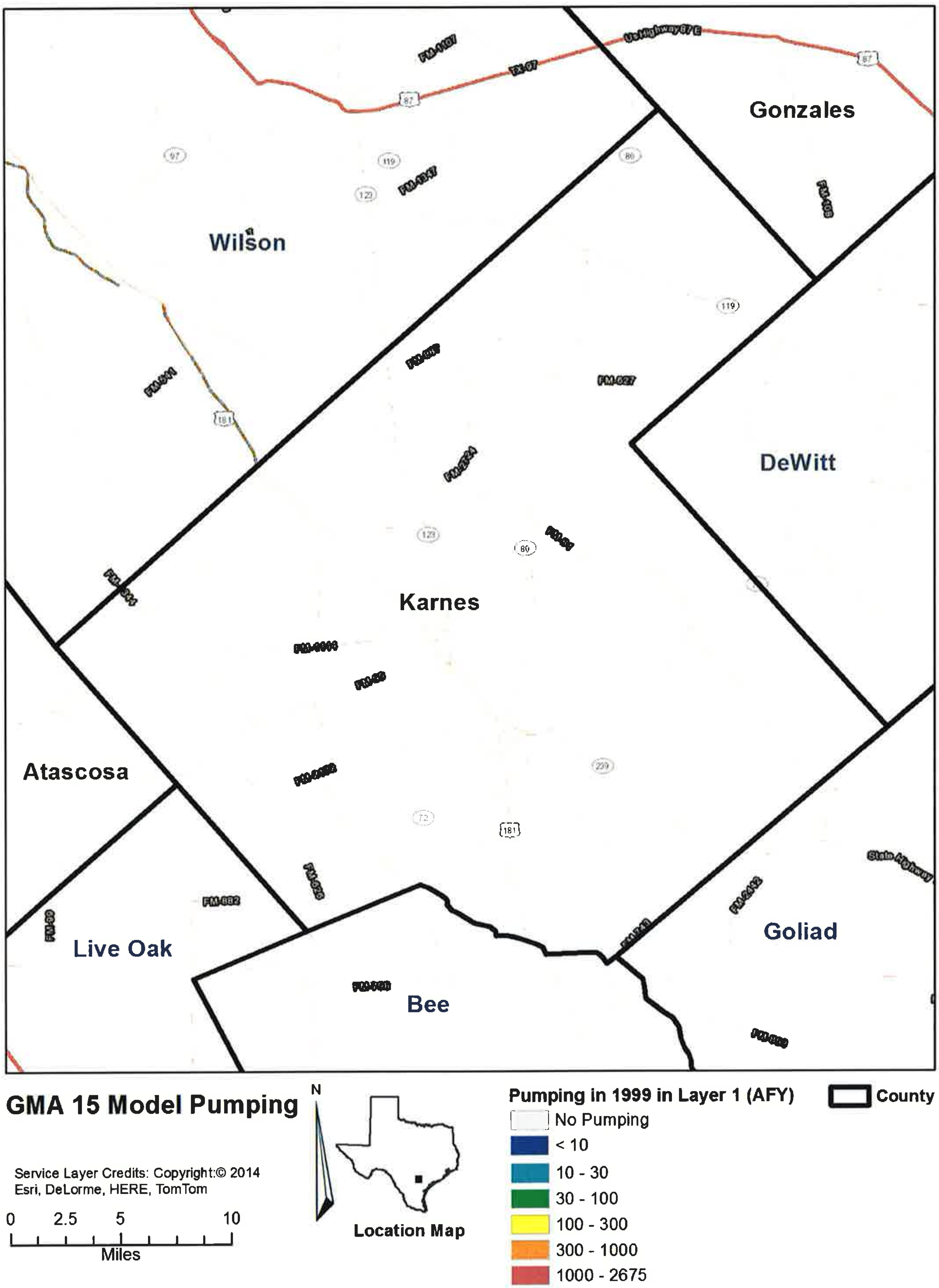


GMA 15 Model Pumping

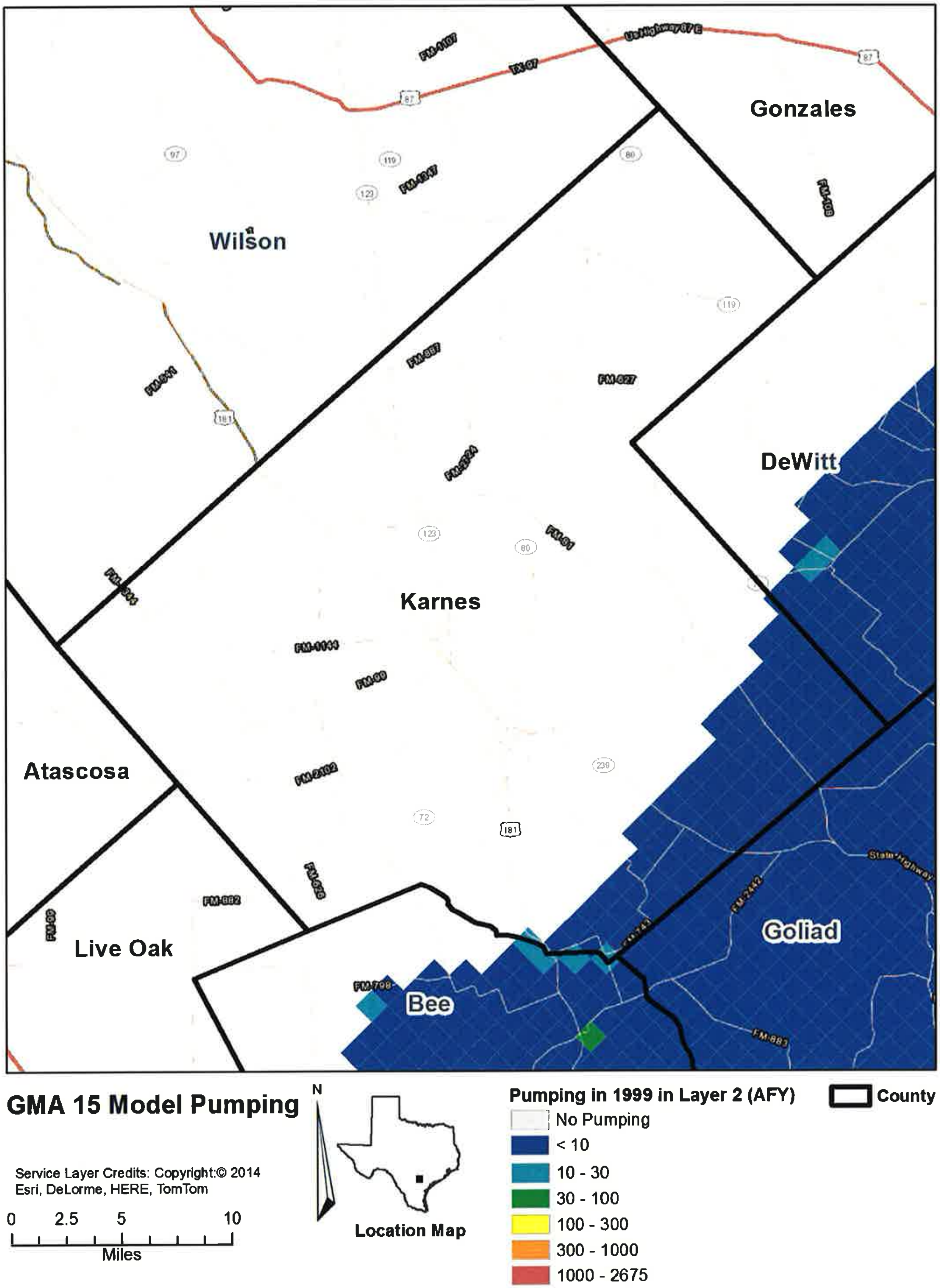
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



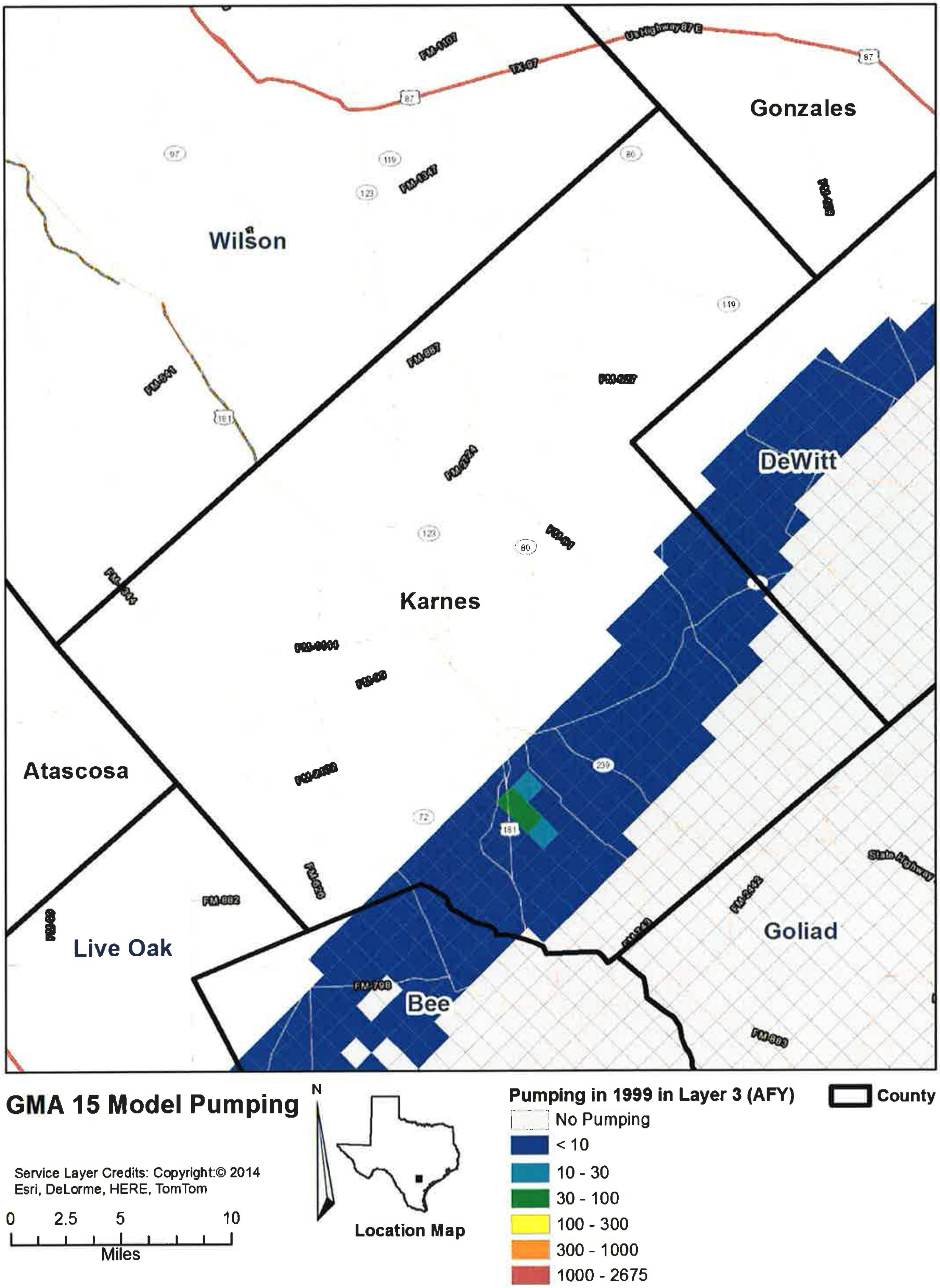
Colorado
Lavaca
Wharton
Jackson
Victoria
Matagorda
Calhoun
Victoria Regional Airport
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 4 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



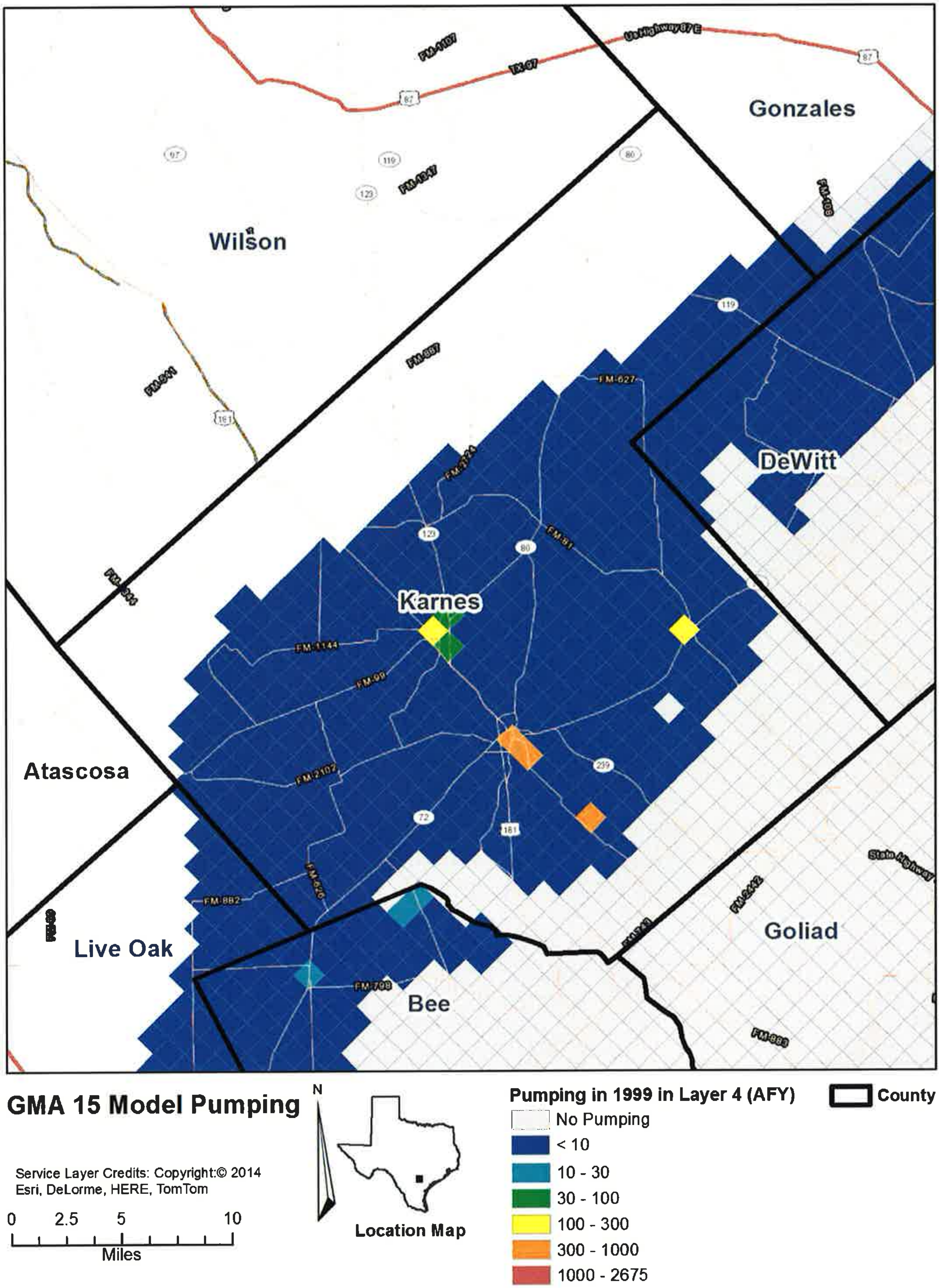
GMA 15 Model Pumping



GMA 15 Model Pumping



Gonzales
Wilson
Karnes
DeWitt
Atascosa
Live Oak
Bee
Goliad
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 3 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



Gonzales
Wilson
DeWitt
Karnes
Atascosa
Live Oak
Goliad
Bee
FM-627
FM-1144
FM-99
FM-2102
FM-882
FM-798
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 4 (AFY)
No Pumping
< 10
10 - 30
30 - 100
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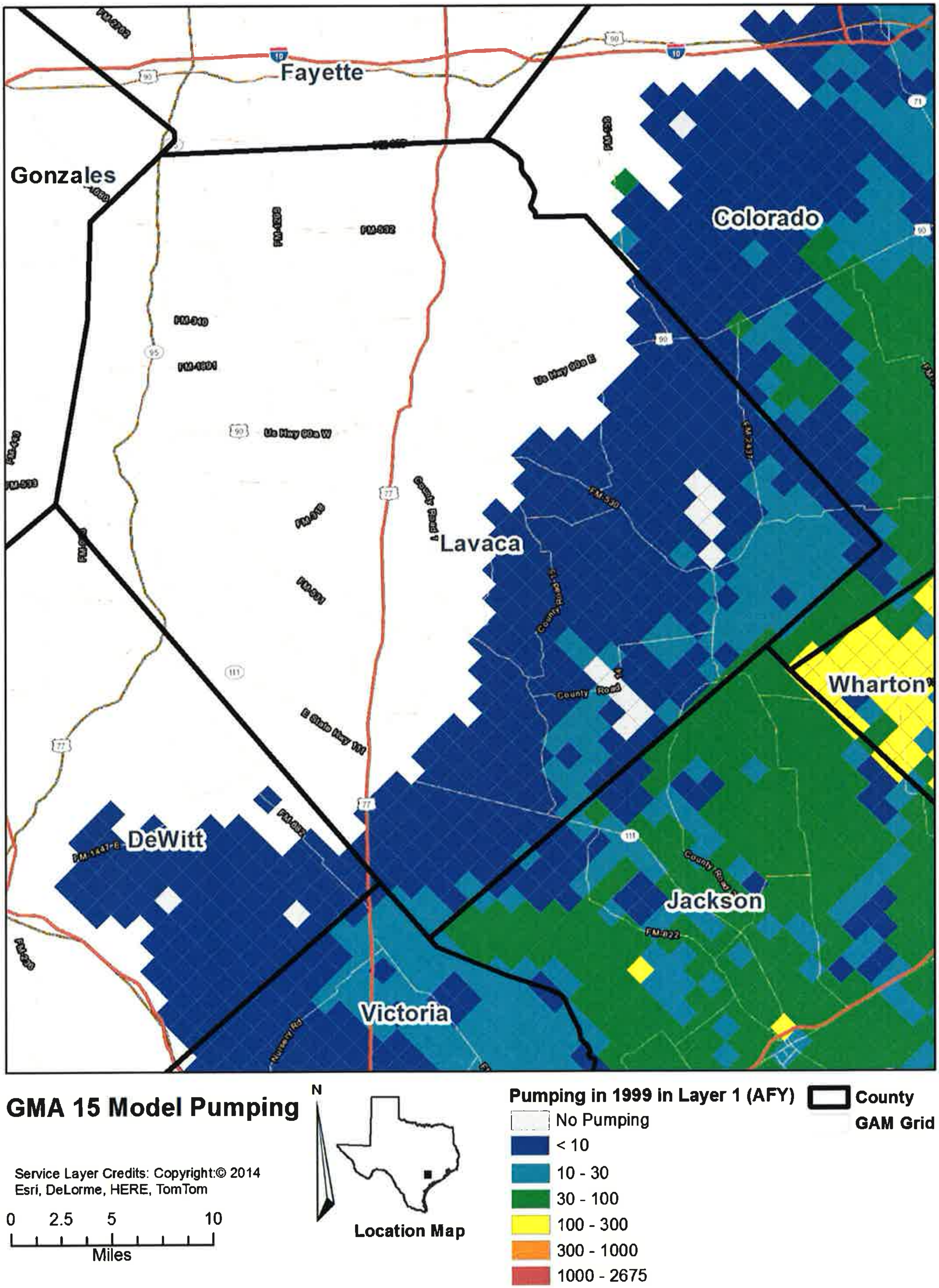
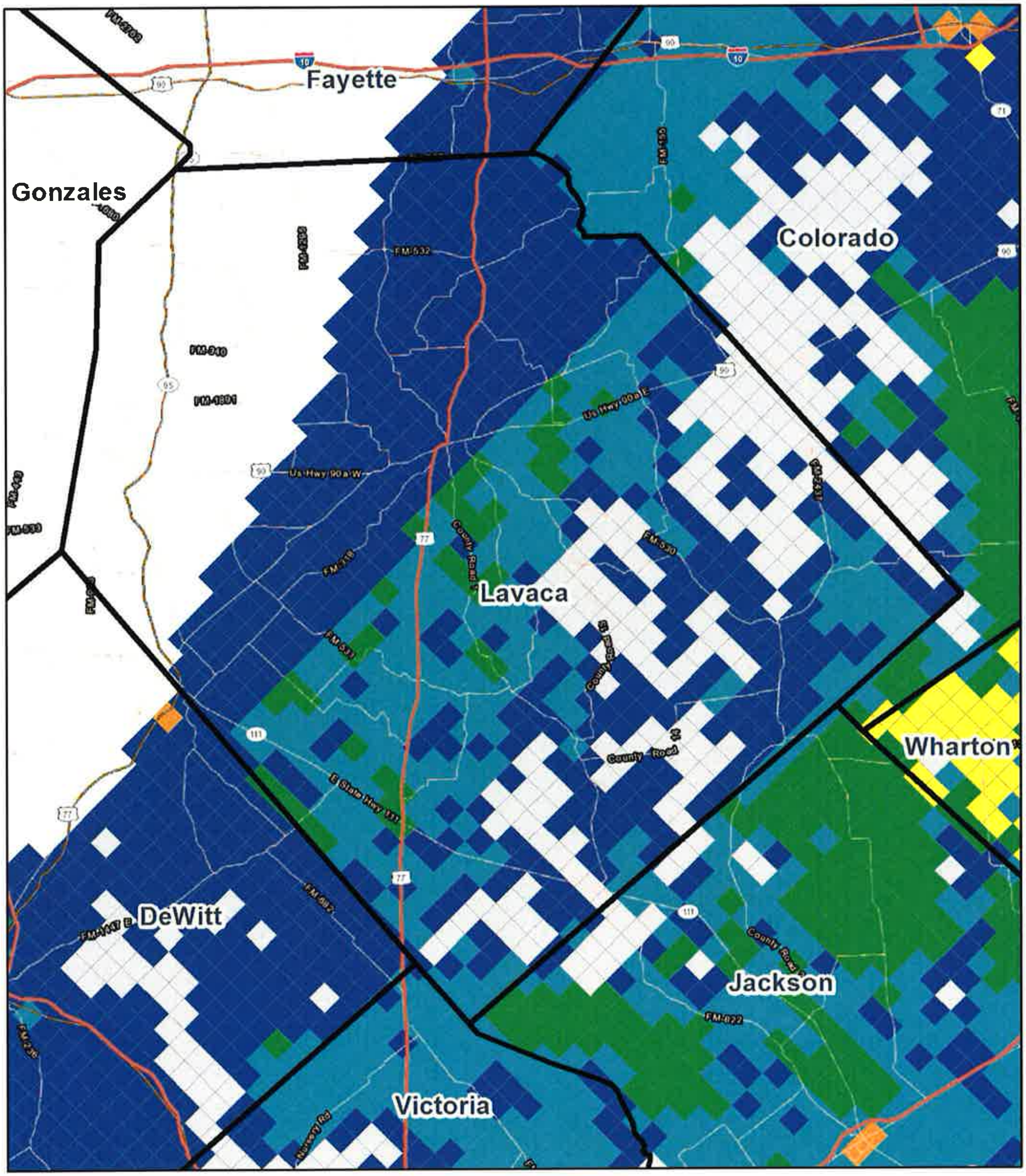
300 - 1000
1000 - 2675
County


Fayette
Gonzales
Colorado
Lavaca
Wharton
DeWitt
Jackson
Victoria
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County
GAM Grid



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

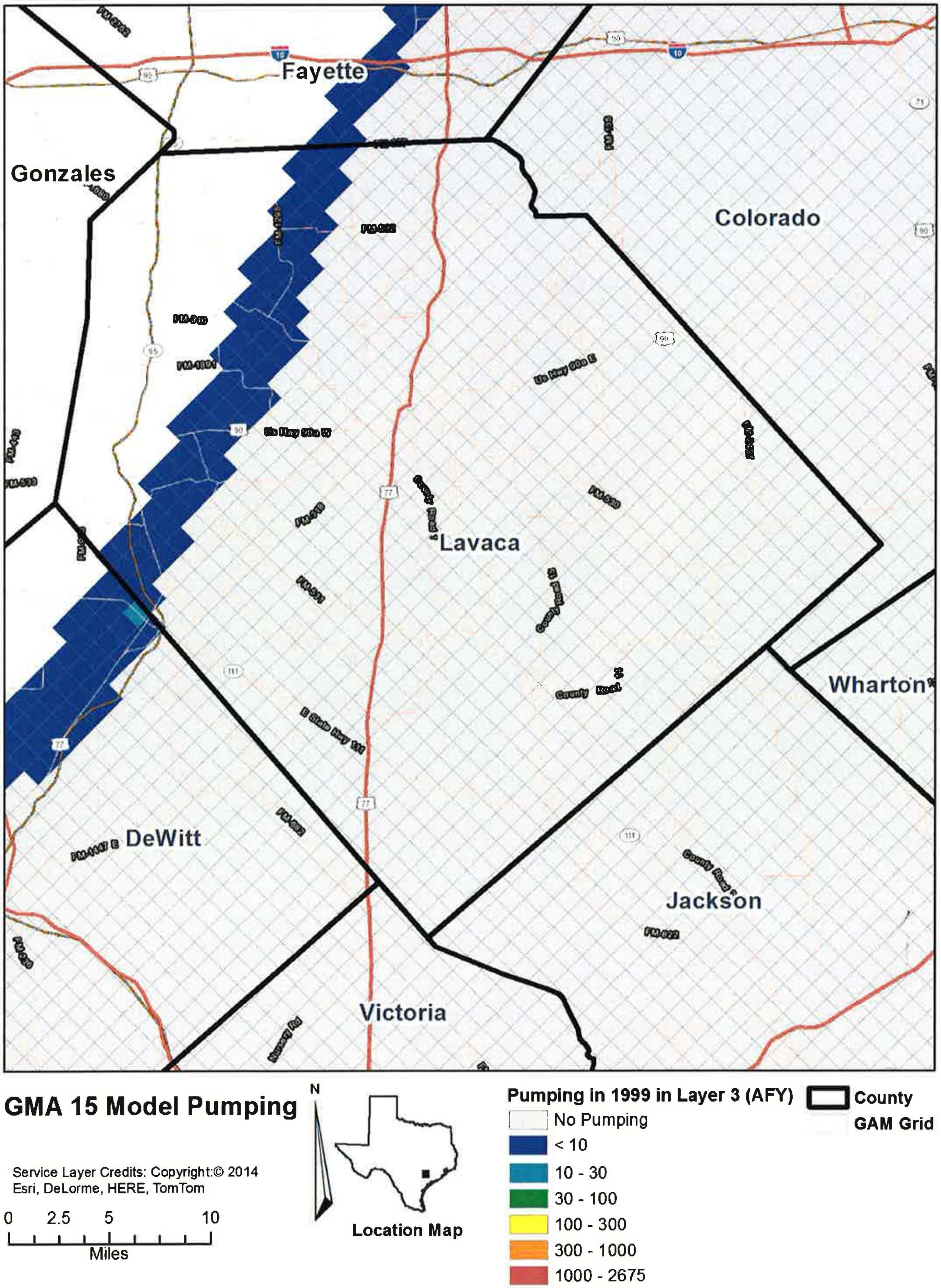
0 2.5 5 10
Miles

N

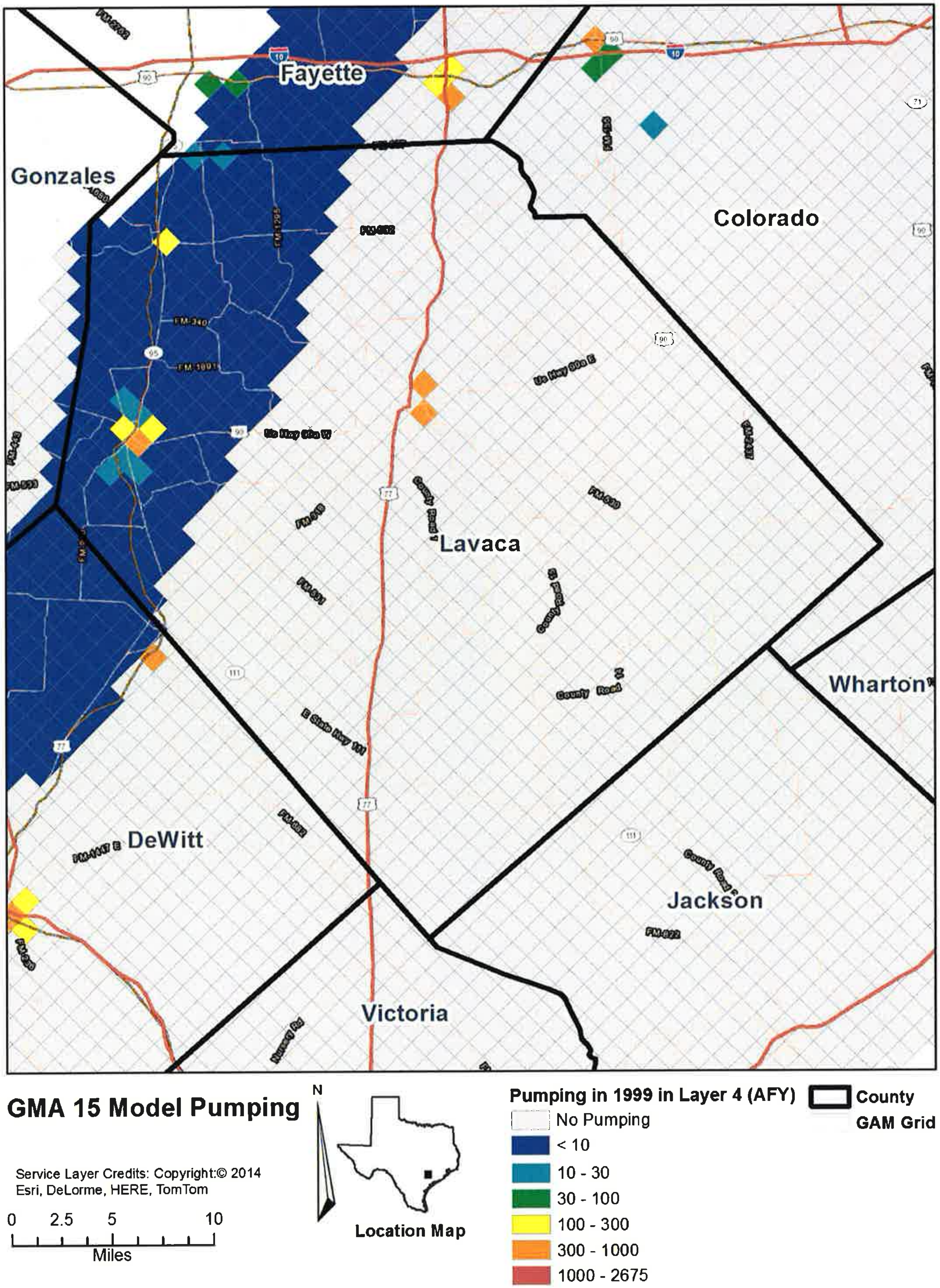
Location Map

Pumping in 1999 in Layer 2 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675

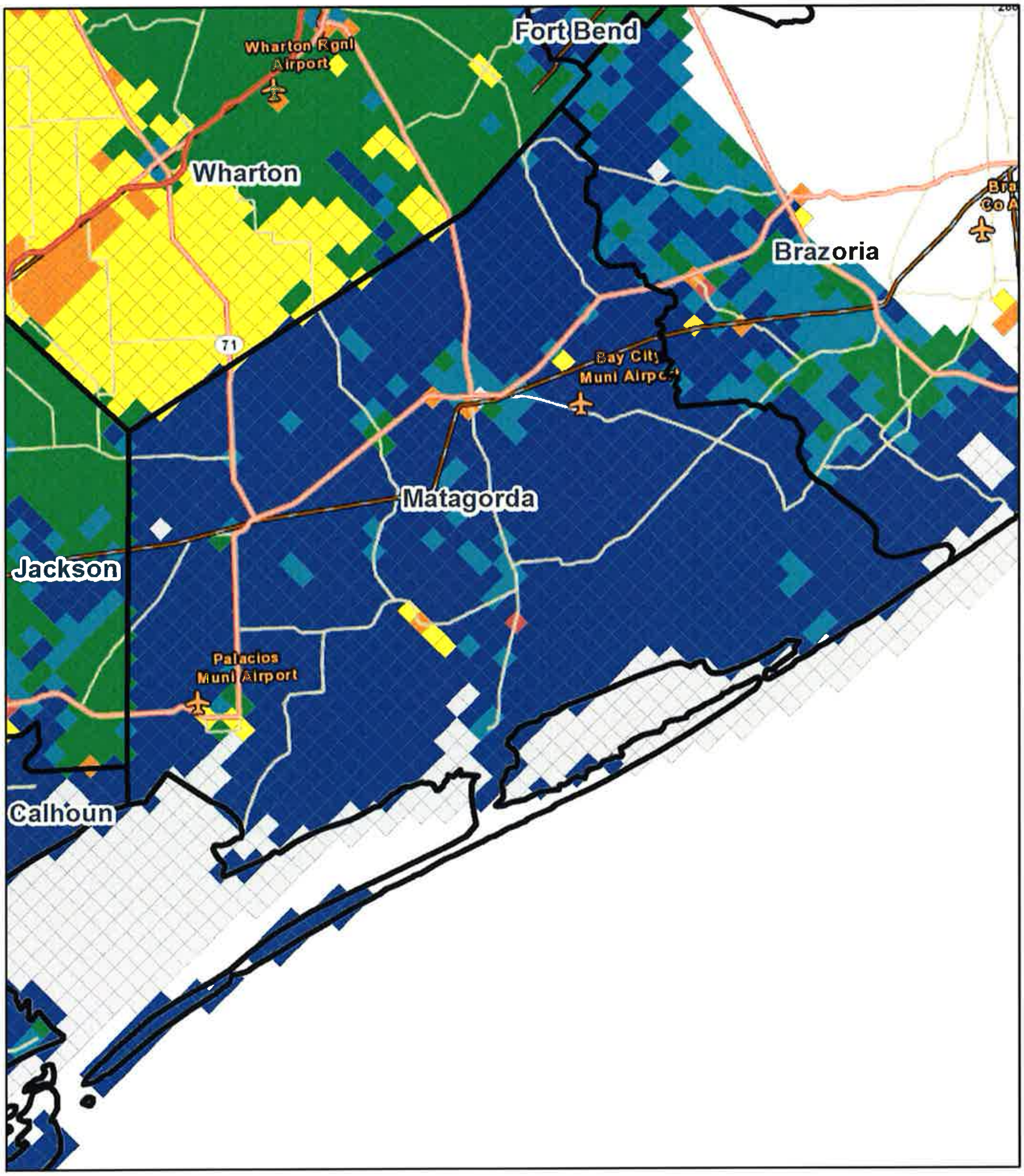
County
GAM Grid



GMA 15 Model Pumping

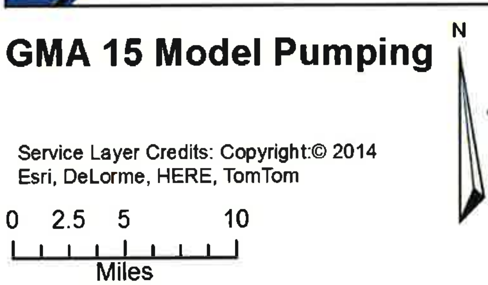


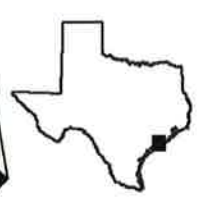
GMA 15 Model Pumping



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



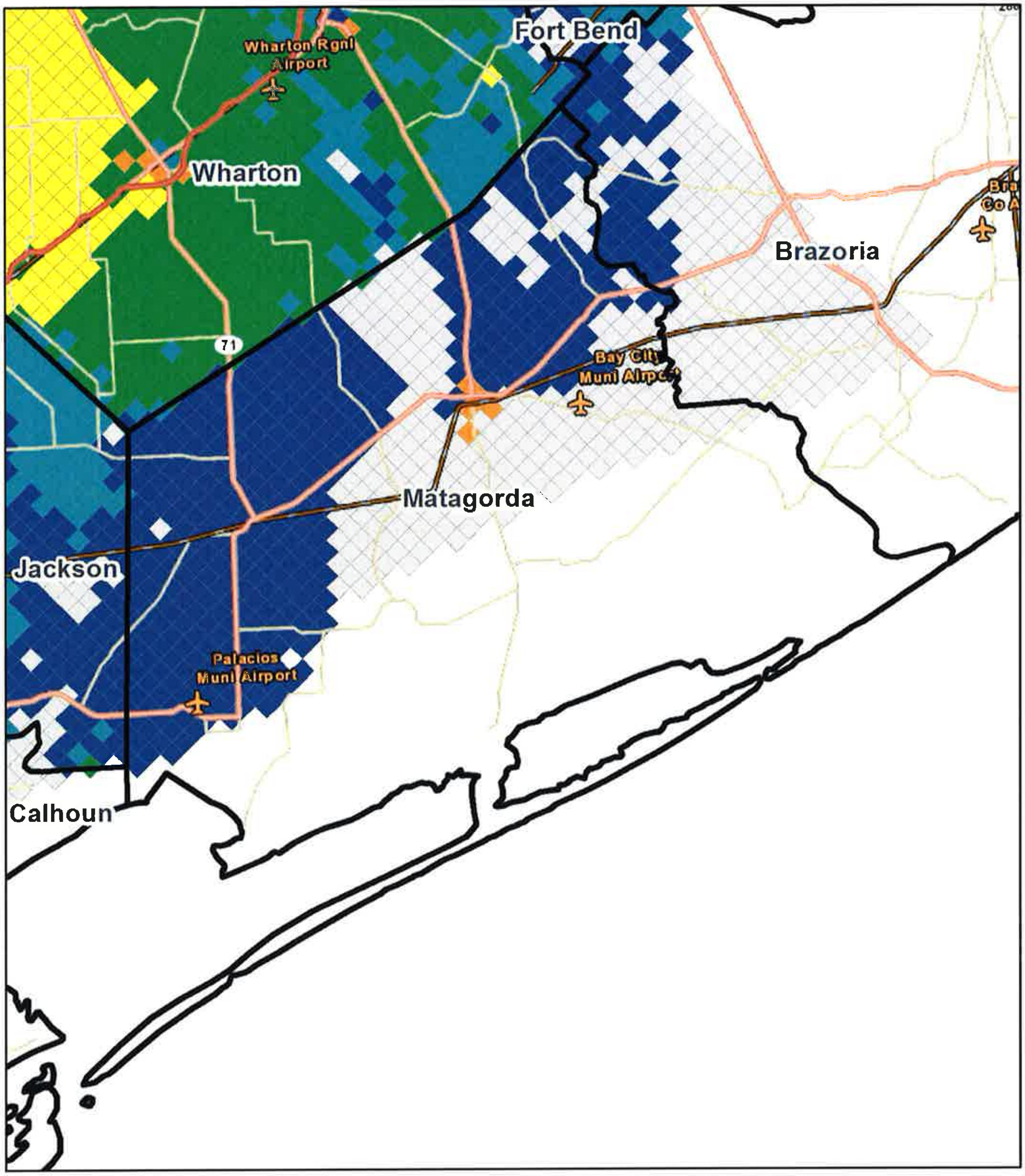


Location Map

Pumping in 1999 in Layer 1 (AFY)

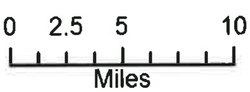
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

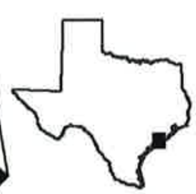
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



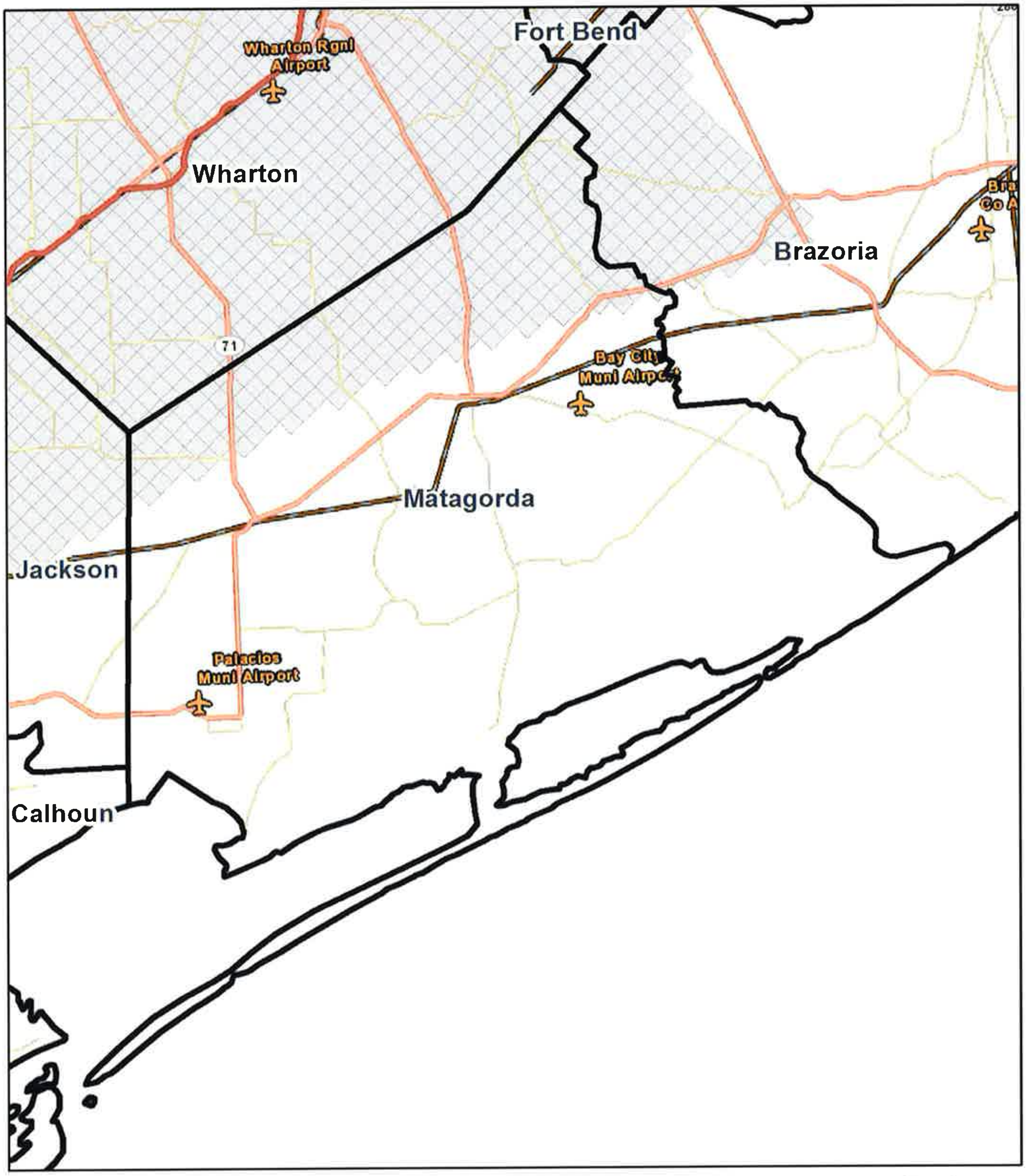


Location Map

Pumping in 1999 in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

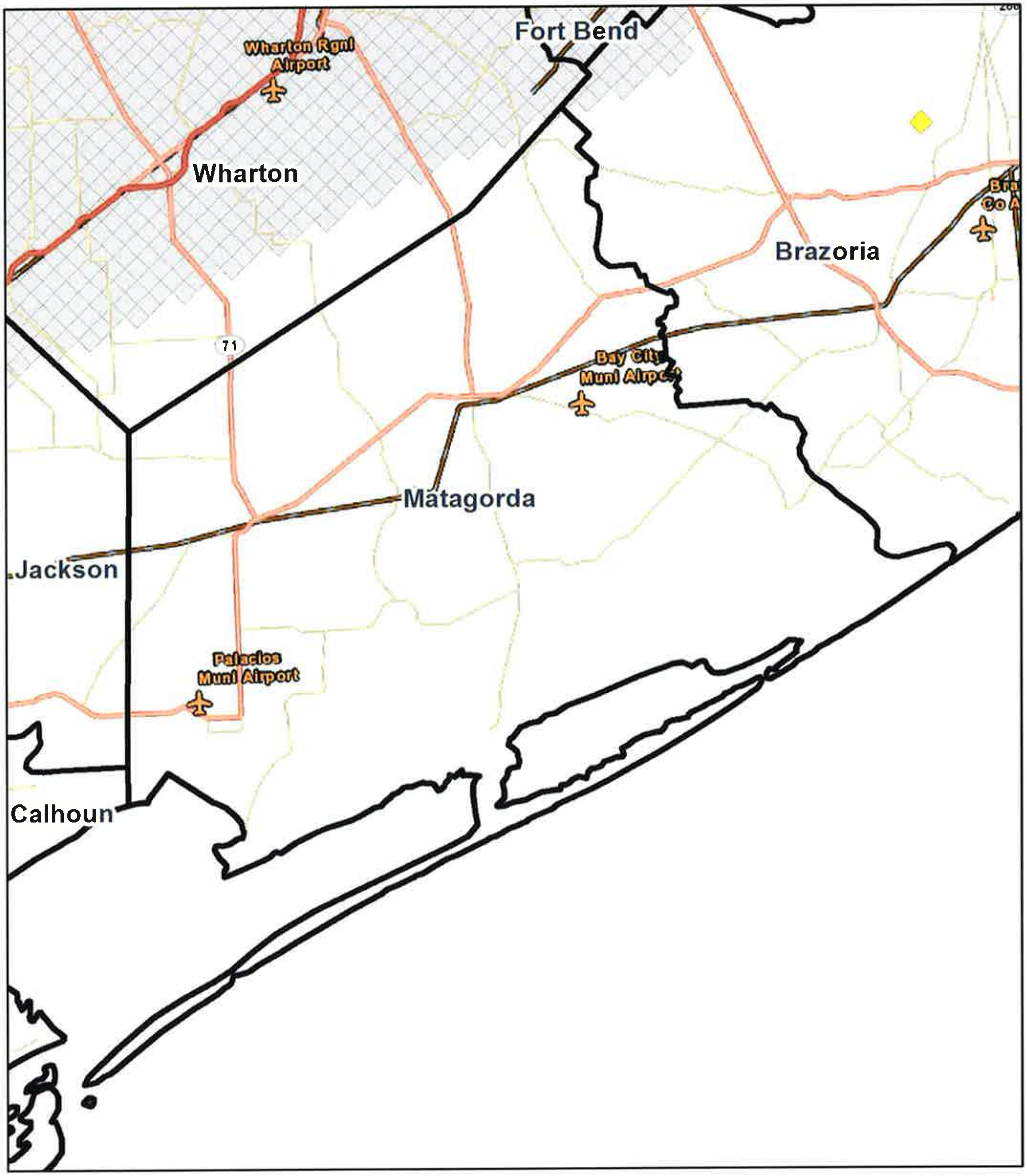
N

Location Map

Pumping in 1999 in Layer 3 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

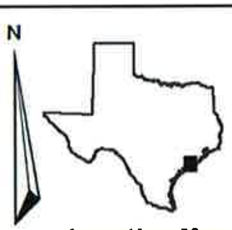
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

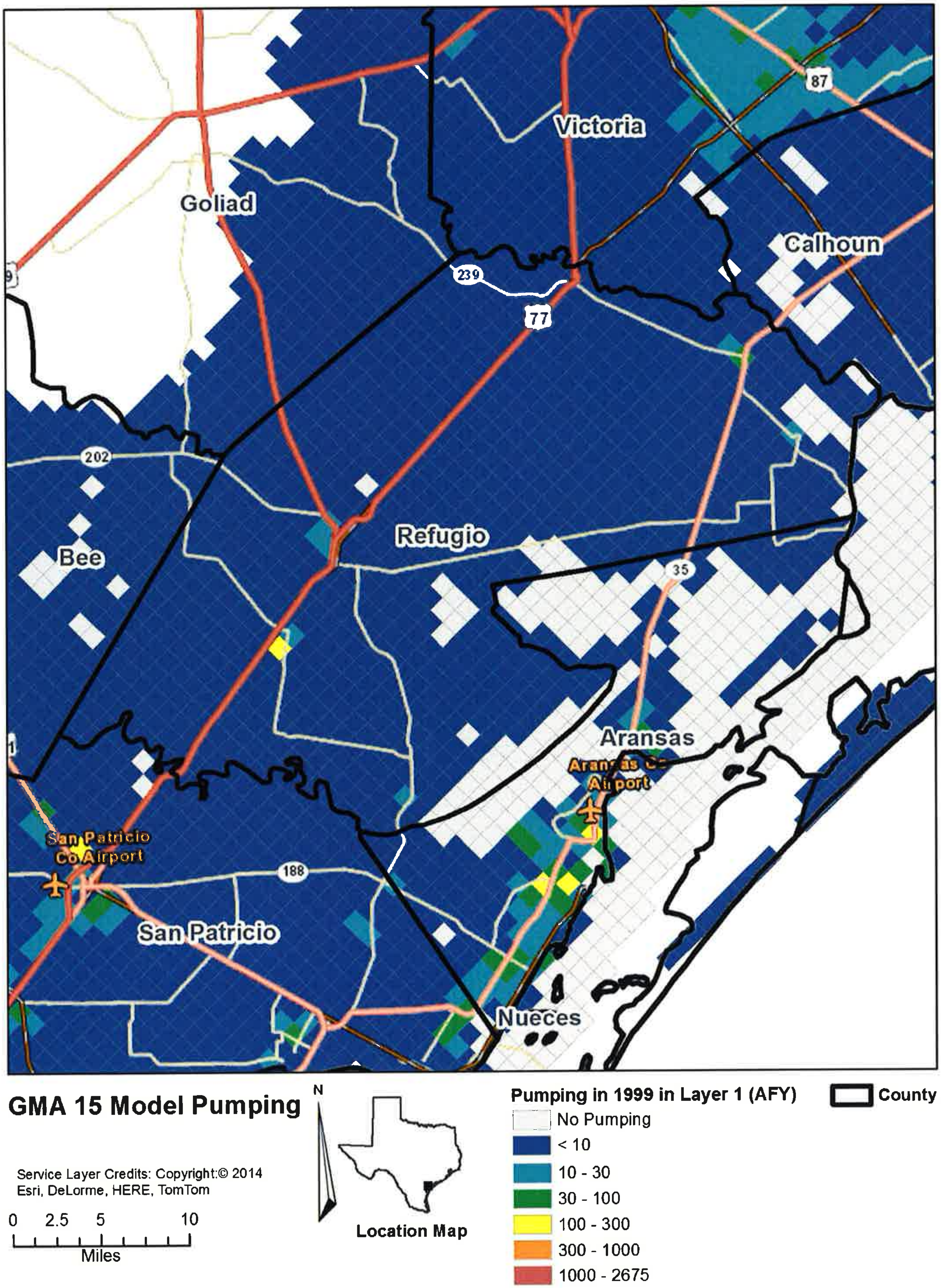


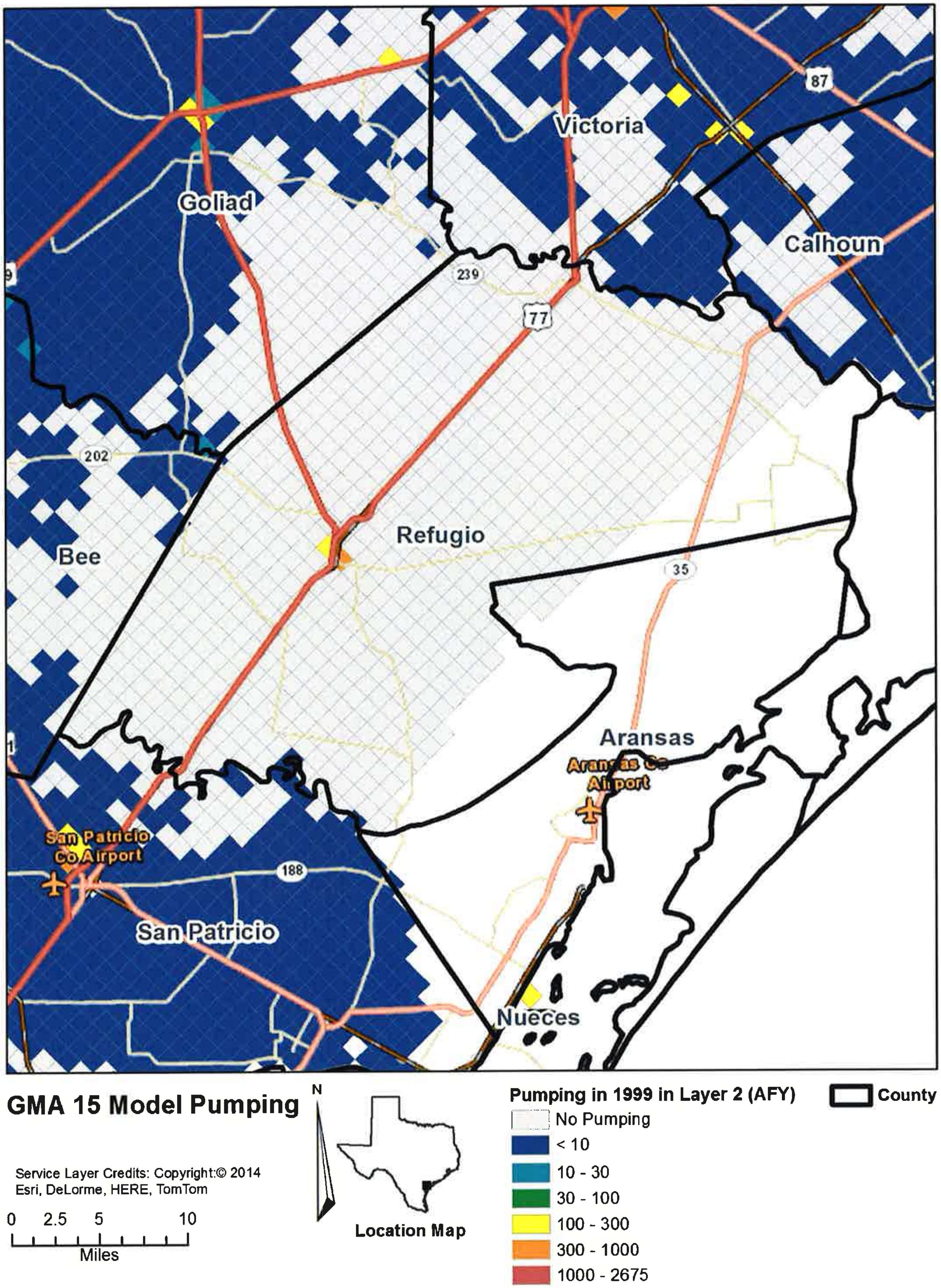
Location Map

Pumping in 1999 in Layer 4 (AFY)

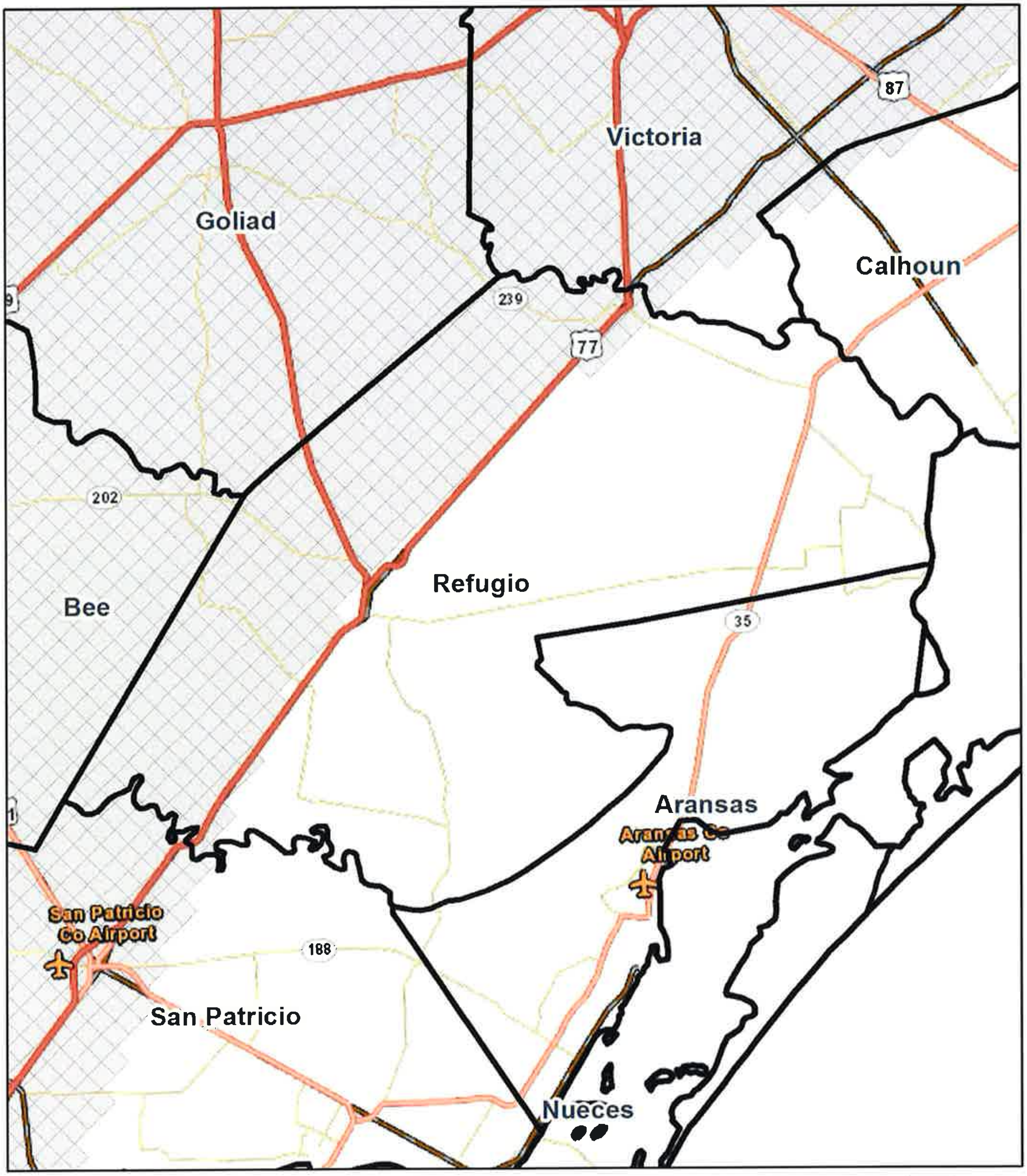
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County


Victoria
87
Goliad
Calhoun
239
77
202
Refugio
Bee
35
Aransas
Aransas Co Airport
San Patricio Co Airport
188
San Patricio
Nueces
GMA 15 Model Pumping
N
Location Map
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



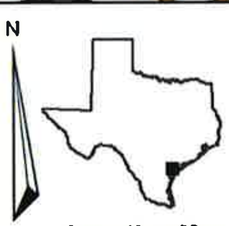
Goliad
Victoria
Calhoun
Bee
Refugio
Aransas
Aransas Co Airport
San Patricio Co Airport
San Patricio
Nueces
239
77
87
202
35
188
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 2 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

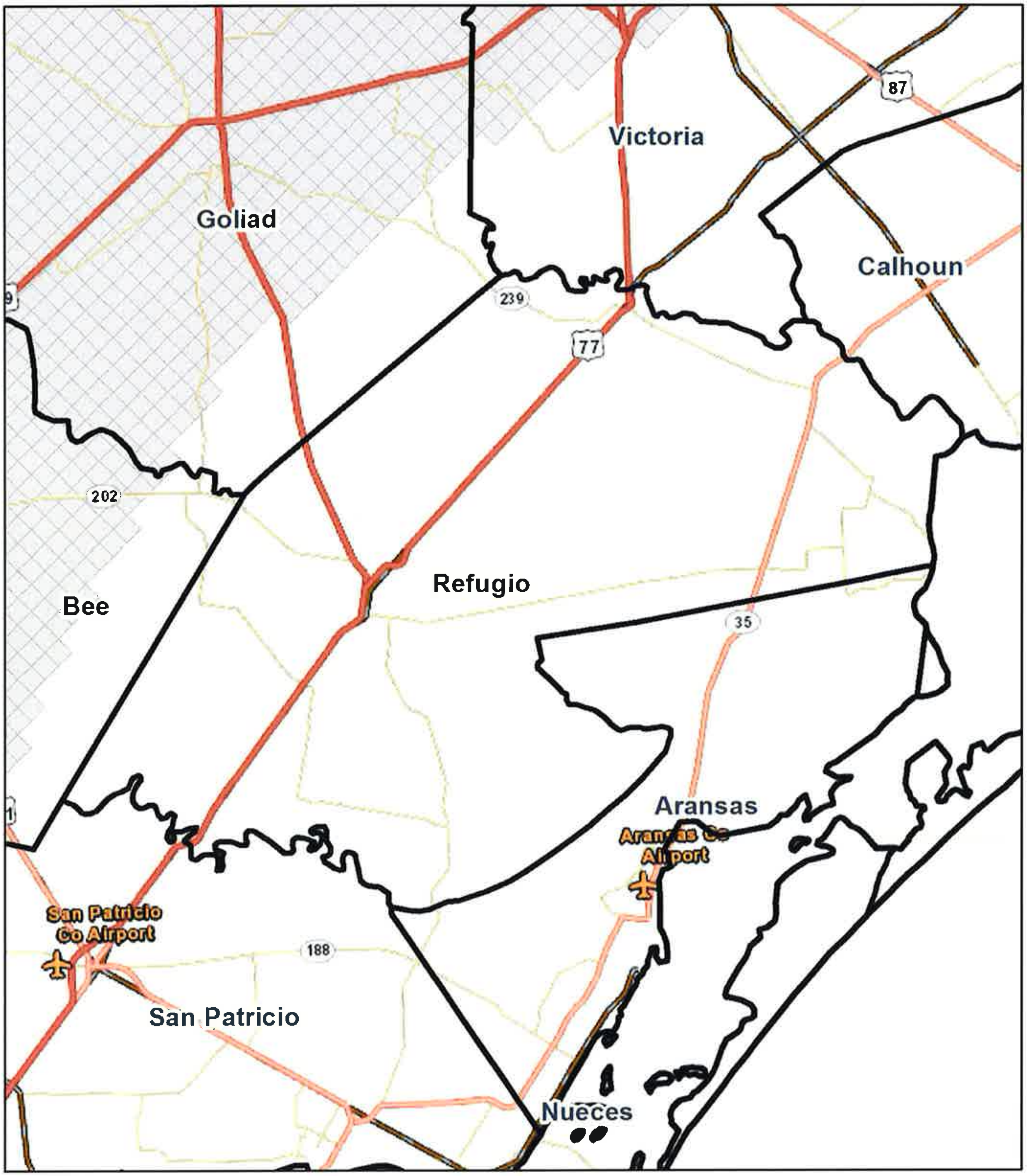


Location Map

Pumping in 1999 in Layer 3 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County

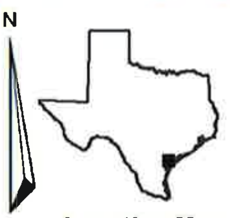


GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

N

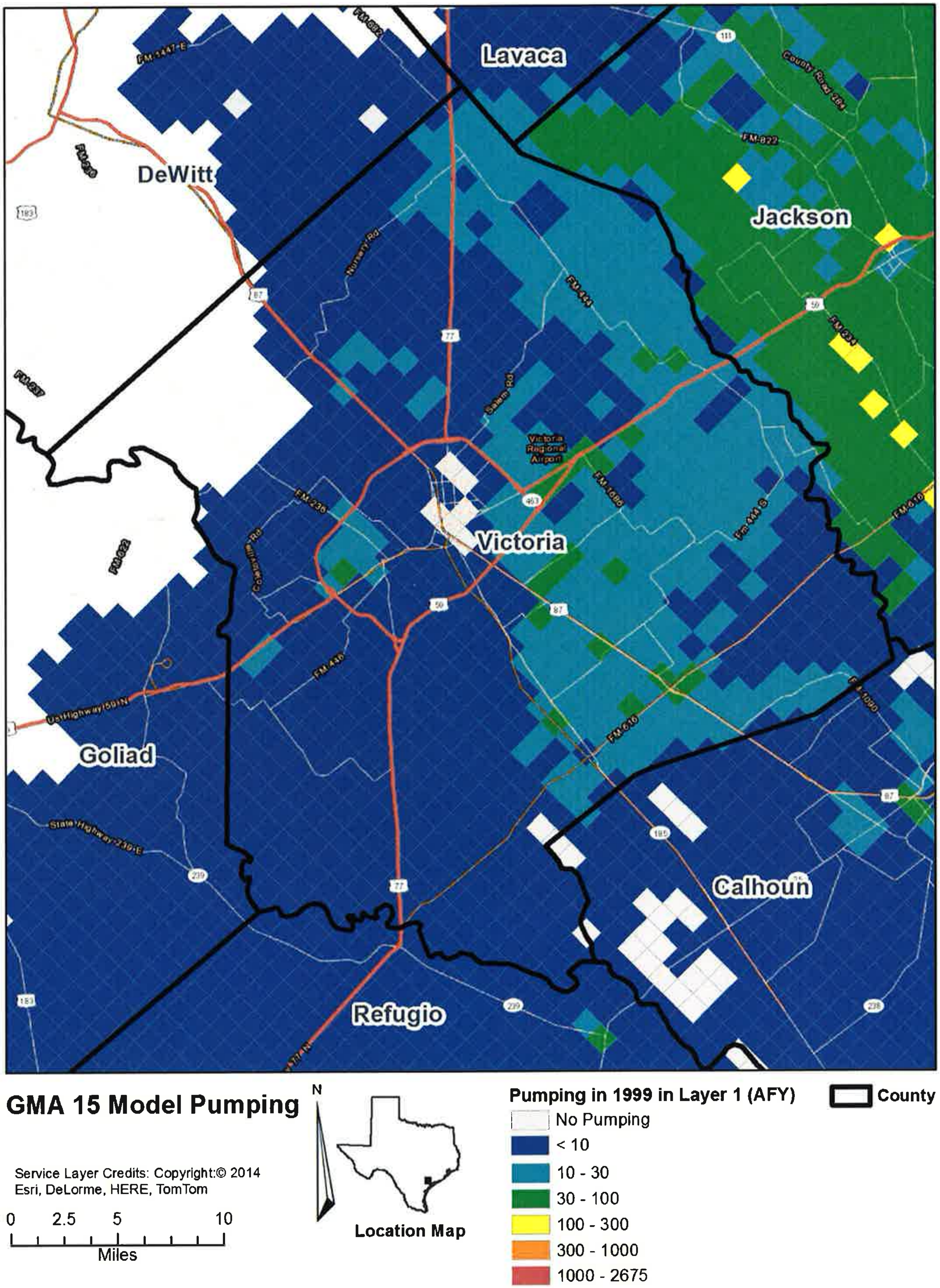


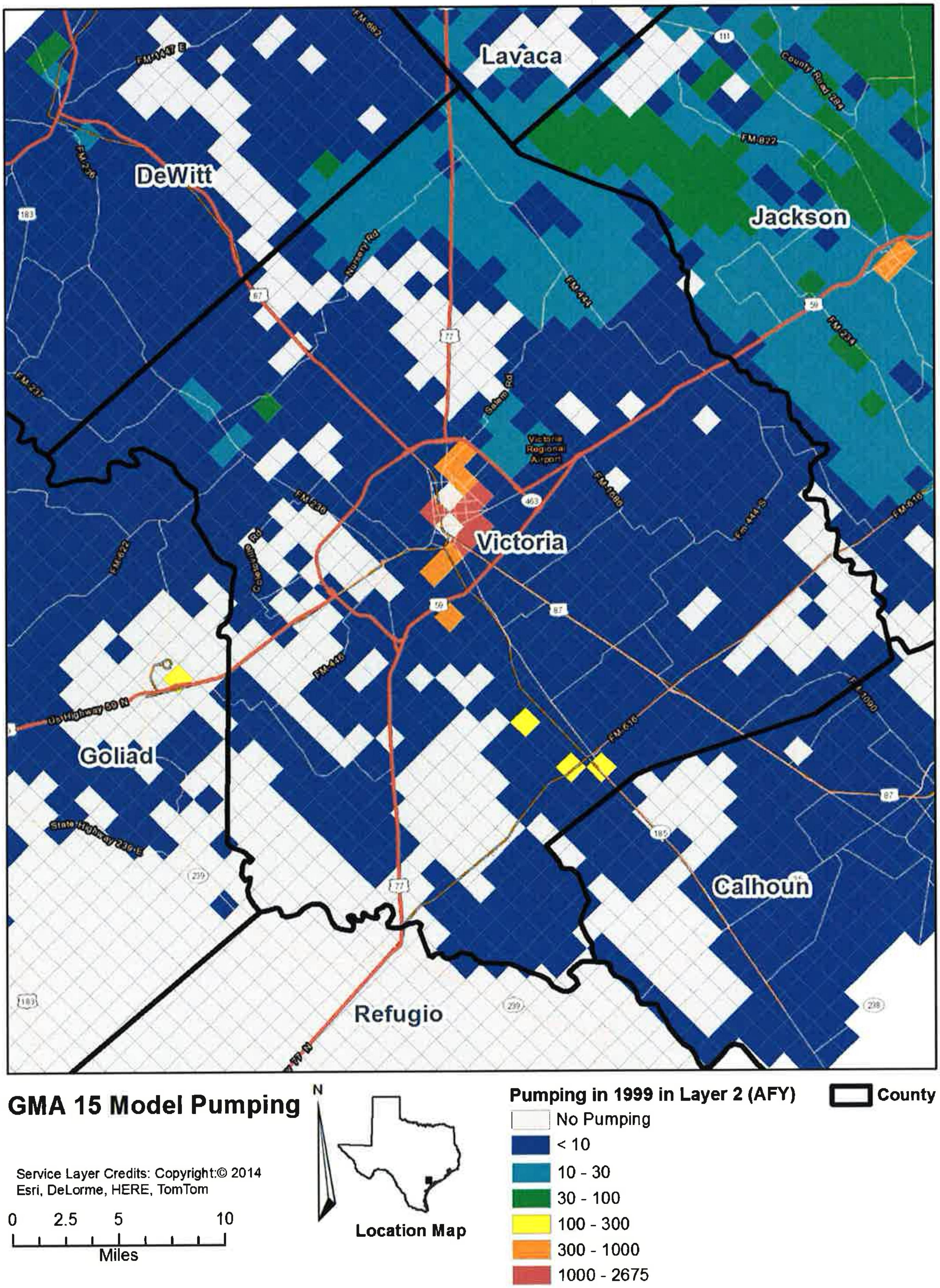
Location Map

Pumping in 1999 in Layer 4 (AFY)

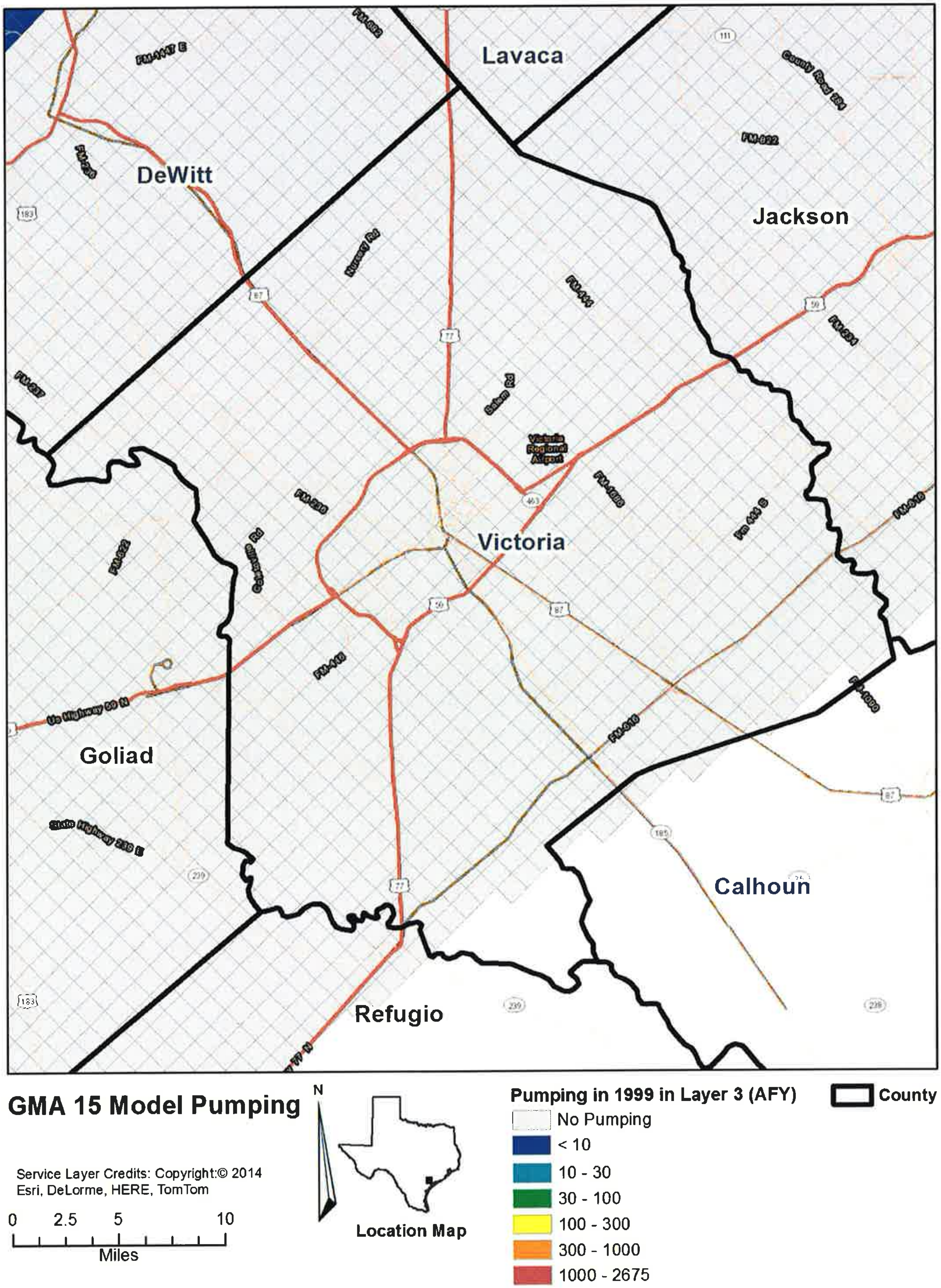
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County

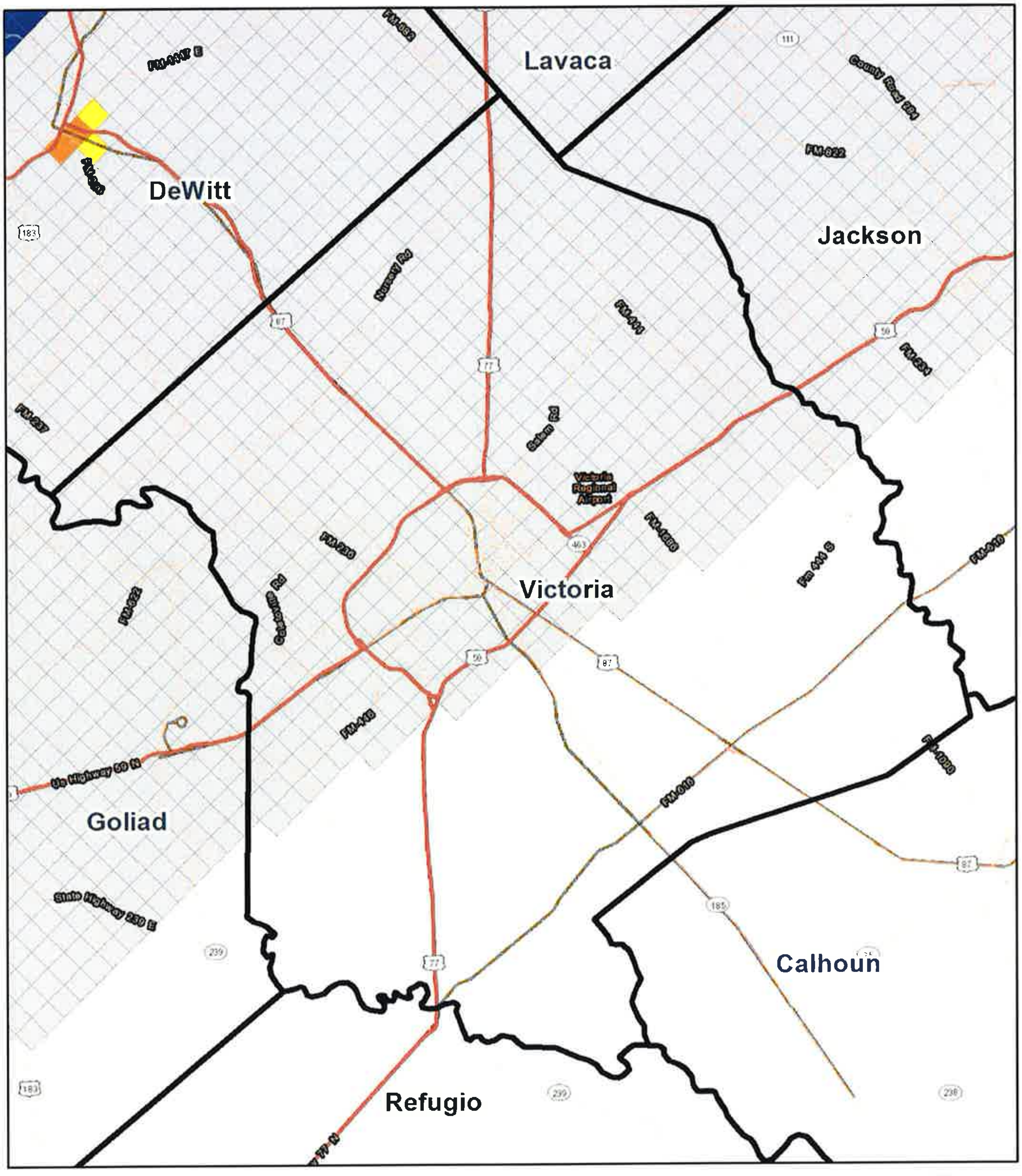

Lavaca
DeWitt
Jackson
Victoria
Goliad
Calhoun
Refugio
Victoria Regional Airport
FM-1447-E
FM-682
County Road 284
FM-822
FM-236
FM-444
Nursery Rd
Salem Rd
FM-237
FM-234
FM-1686
FM-444 S
FM-616
FM-622
Coleto Rd
FM-446
Us Highway 59 N
State Highway 239 E
FM-1090
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



Lavaca
DeWitt
Jackson
Victoria
Goliad
Calhoun
Refugio
Victoria Regional Airport
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 2 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



Lavaca
DeWitt
Jackson
Victoria
Goliad
Calhoun
Refugio
Victoria Regional Airport
FM-444
FM-1686
FM-616
Us Highway 59 N
State Highway 239 E
GMA 15 Model Pumping
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in 1999 in Layer 3 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 2675
County



GMA 15 Model Pumping

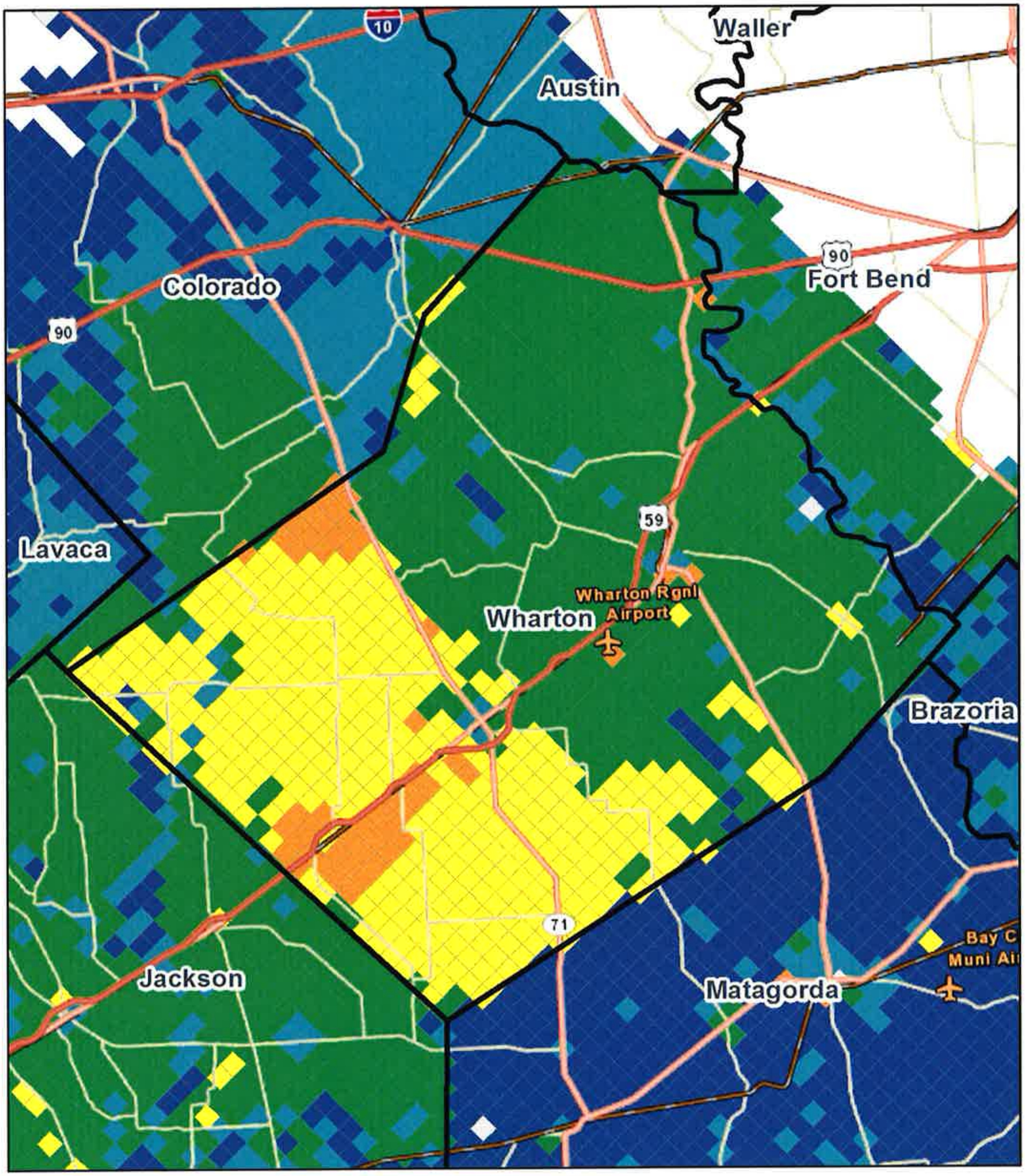
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

Pumping in 1999 in Layer 4 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

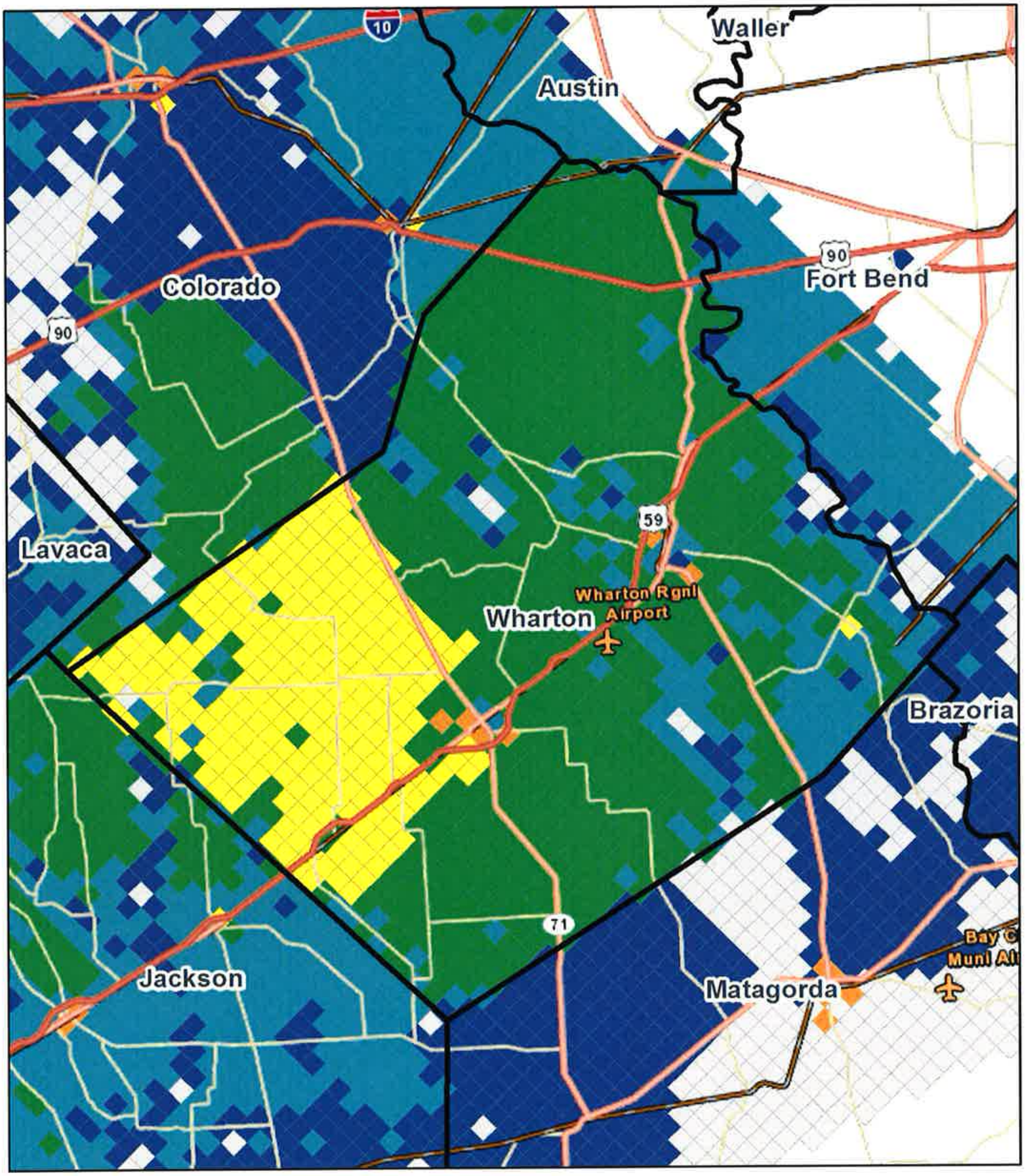
N

Location Map

Pumping in 1999 in Layer 1 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

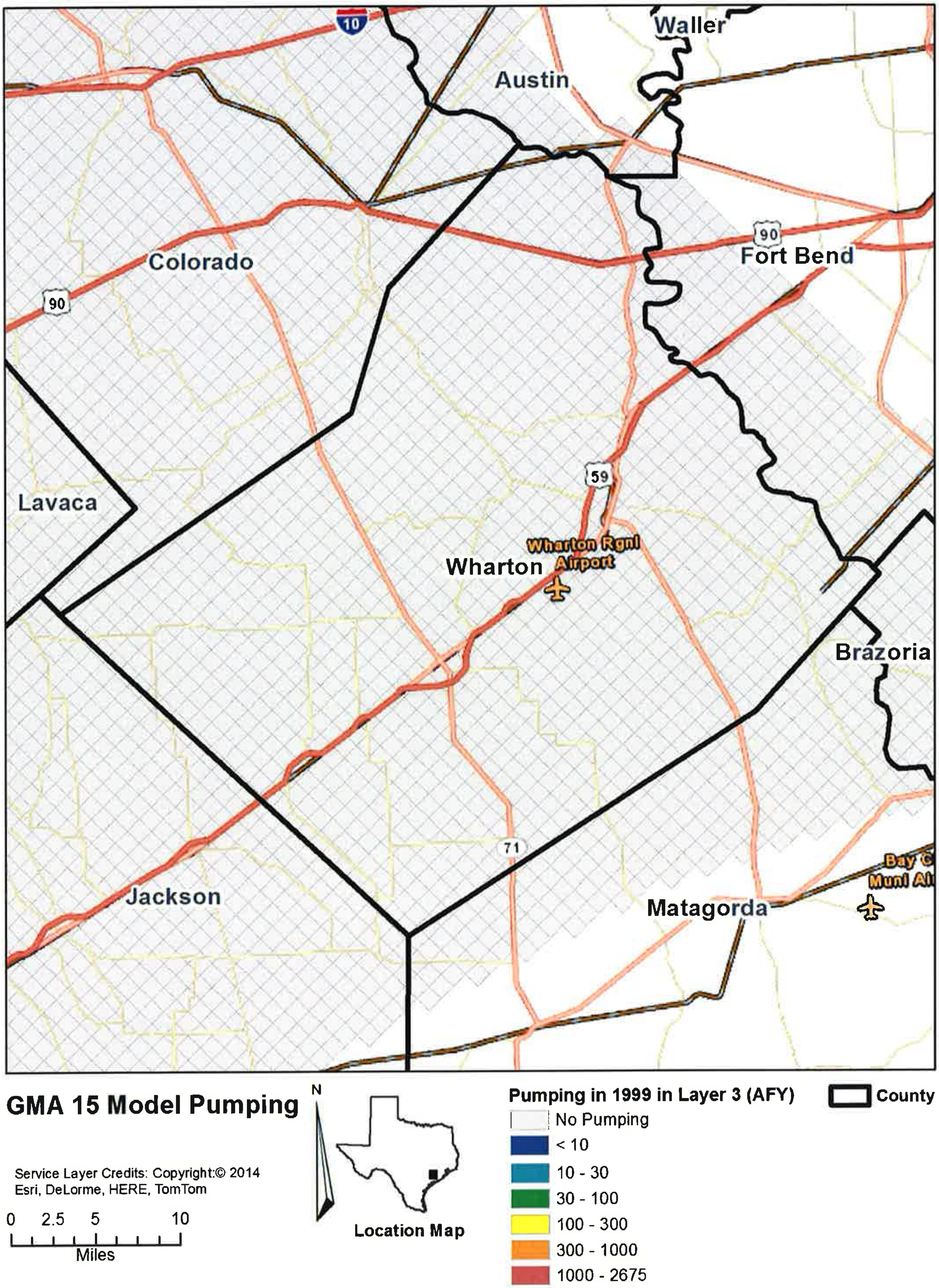
0 2.5 5 10
Miles

Location Map

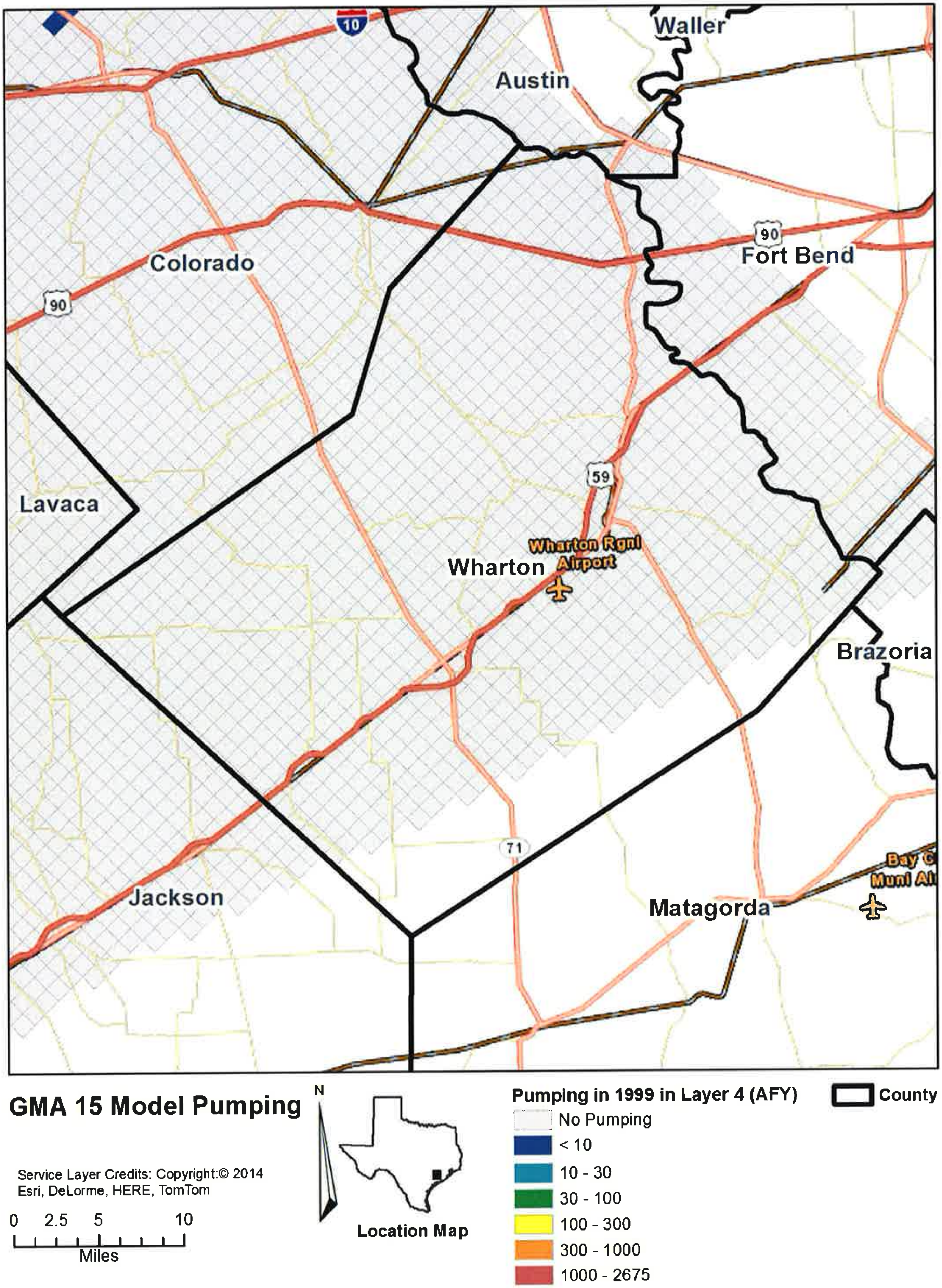
Pumping in 1999 in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 2675

County



GMA 15 Model Pumping



GMA 15 Model Pumping

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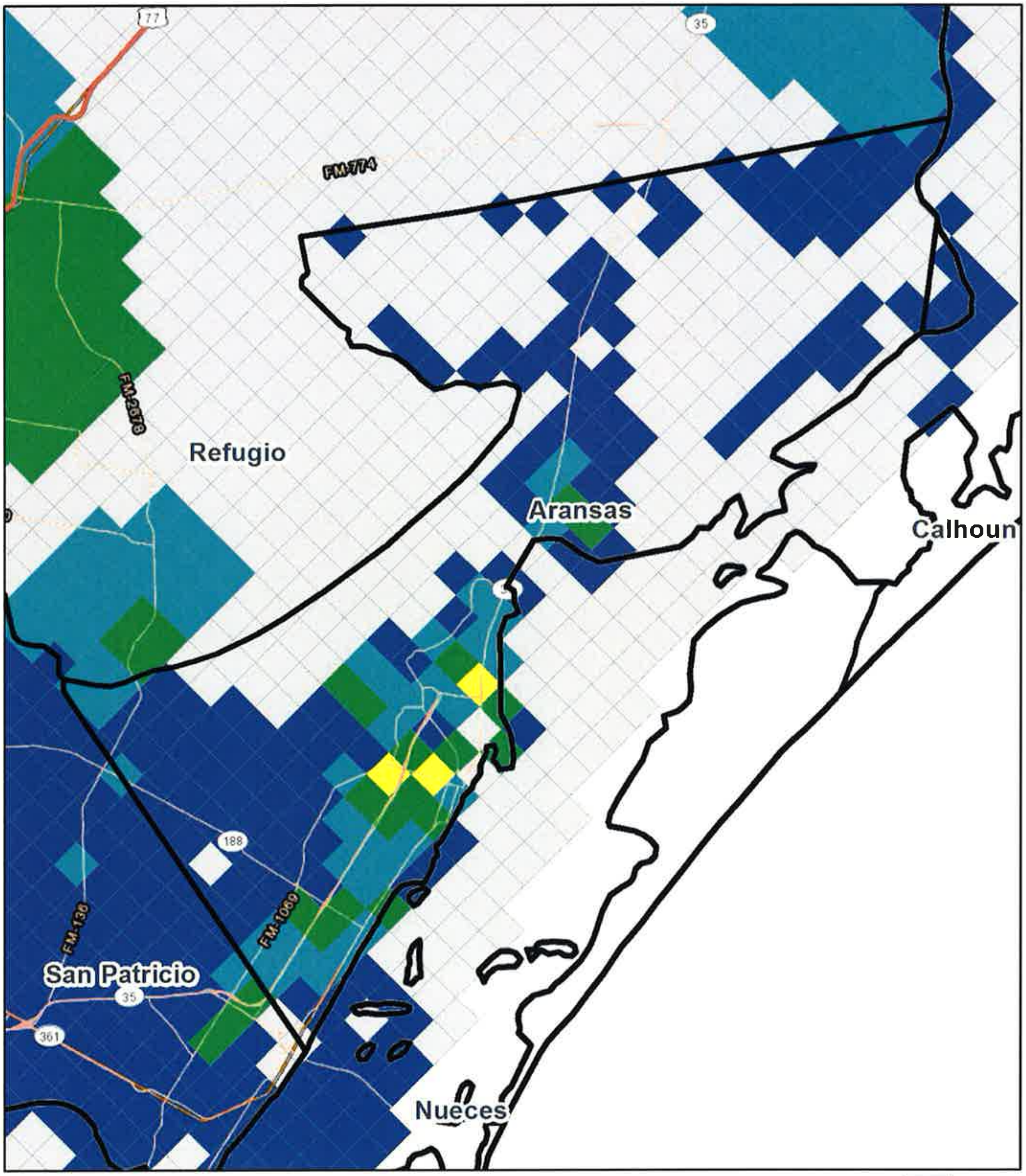
Appendix H

Spatial Distribution of Pumping by County and Geological Unit for 2000 to 2060 in the CGC GAM for establishing the MAG (Hill and Oliver, 2014)



County

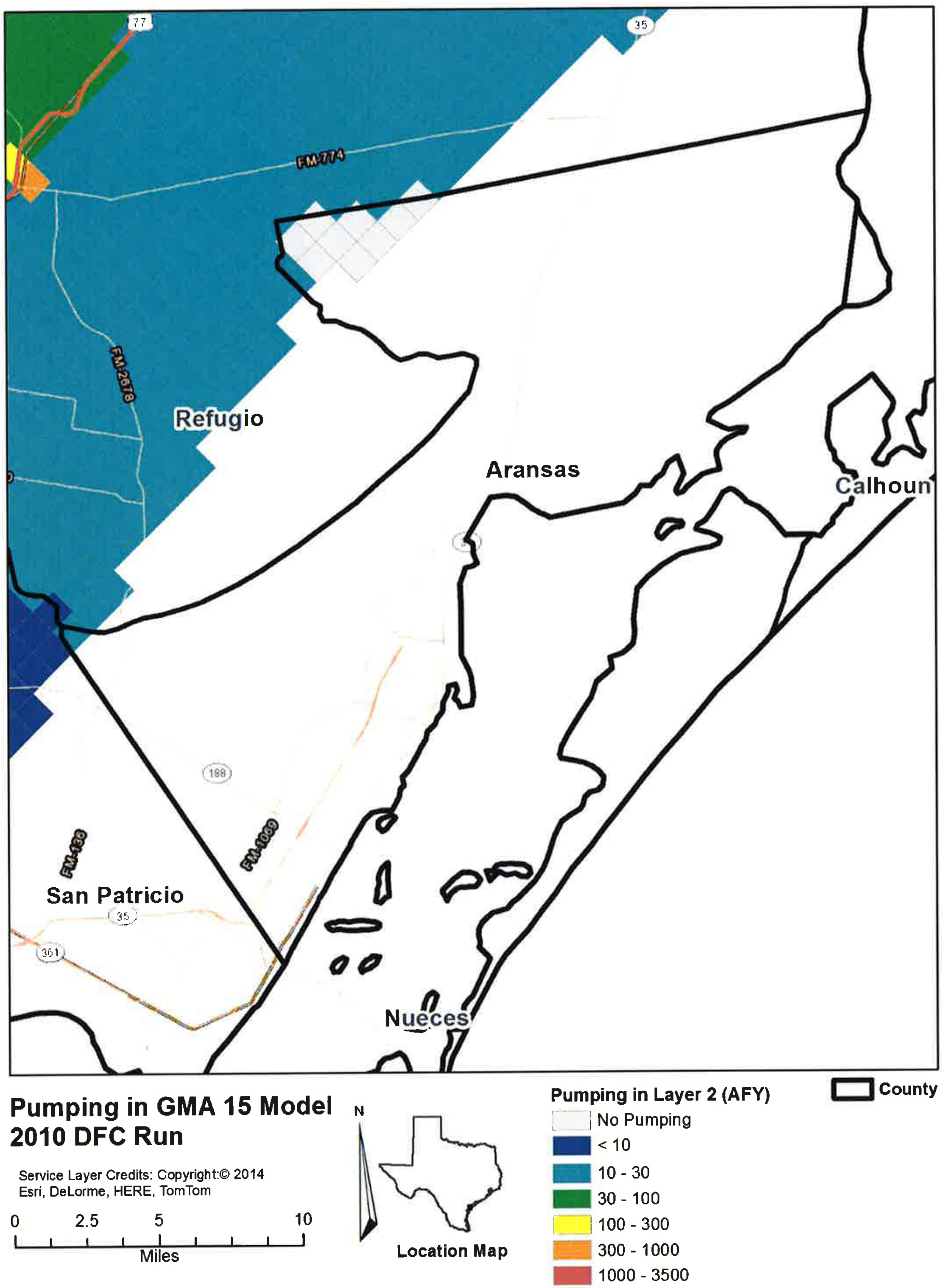
Pumping in GMA 15 Model 2010 DFC Run

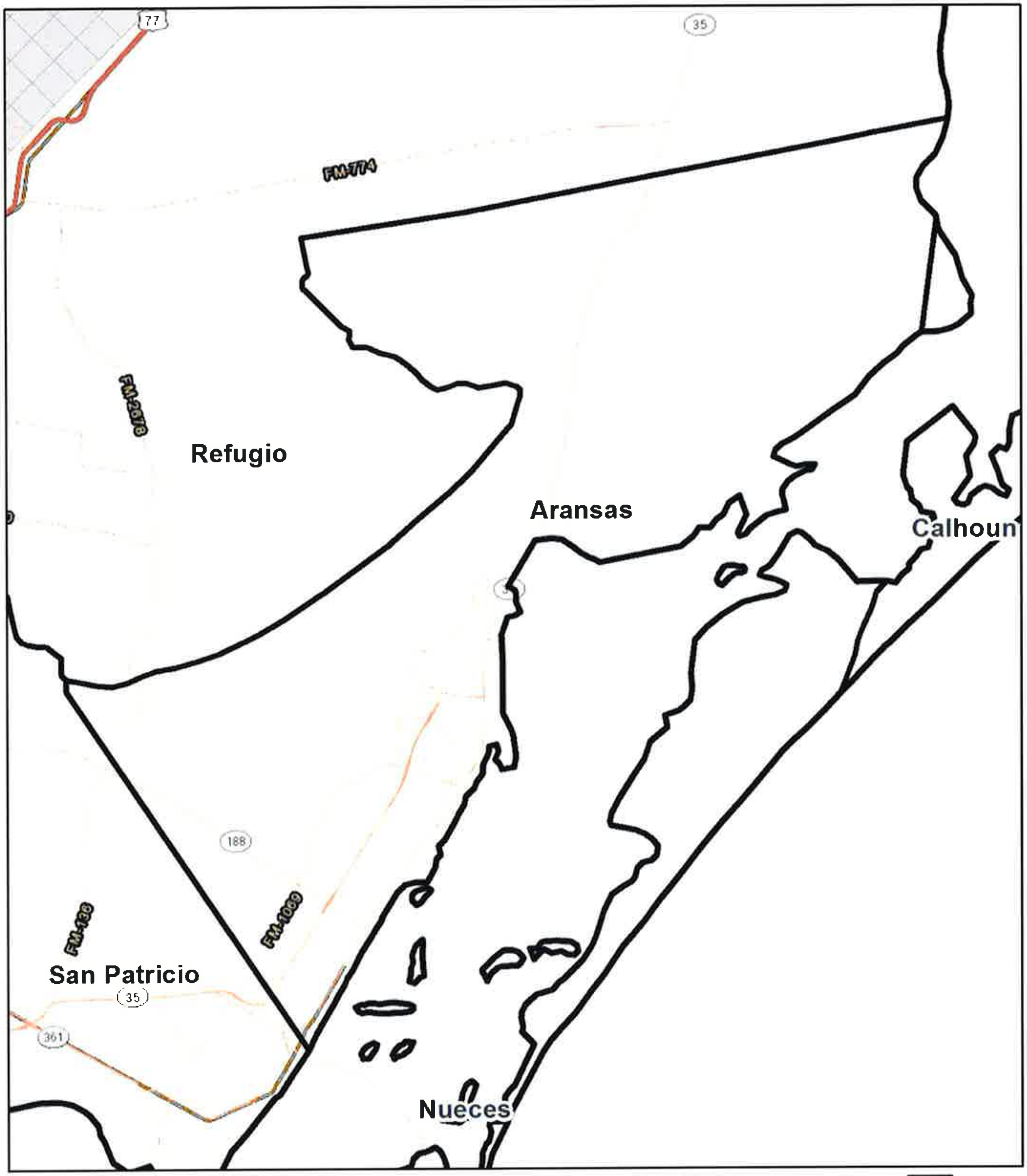
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

Pumping in Layer 1 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500


77
35
FM-774
FM-2678
Refugio
Aransas
Calhoun
188
FM-1069
FM-136
San Patricio
35
361
Nueces
County
Pumping in GMA 15 Model
2010 DFC Run
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in Layer 2 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 3500



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

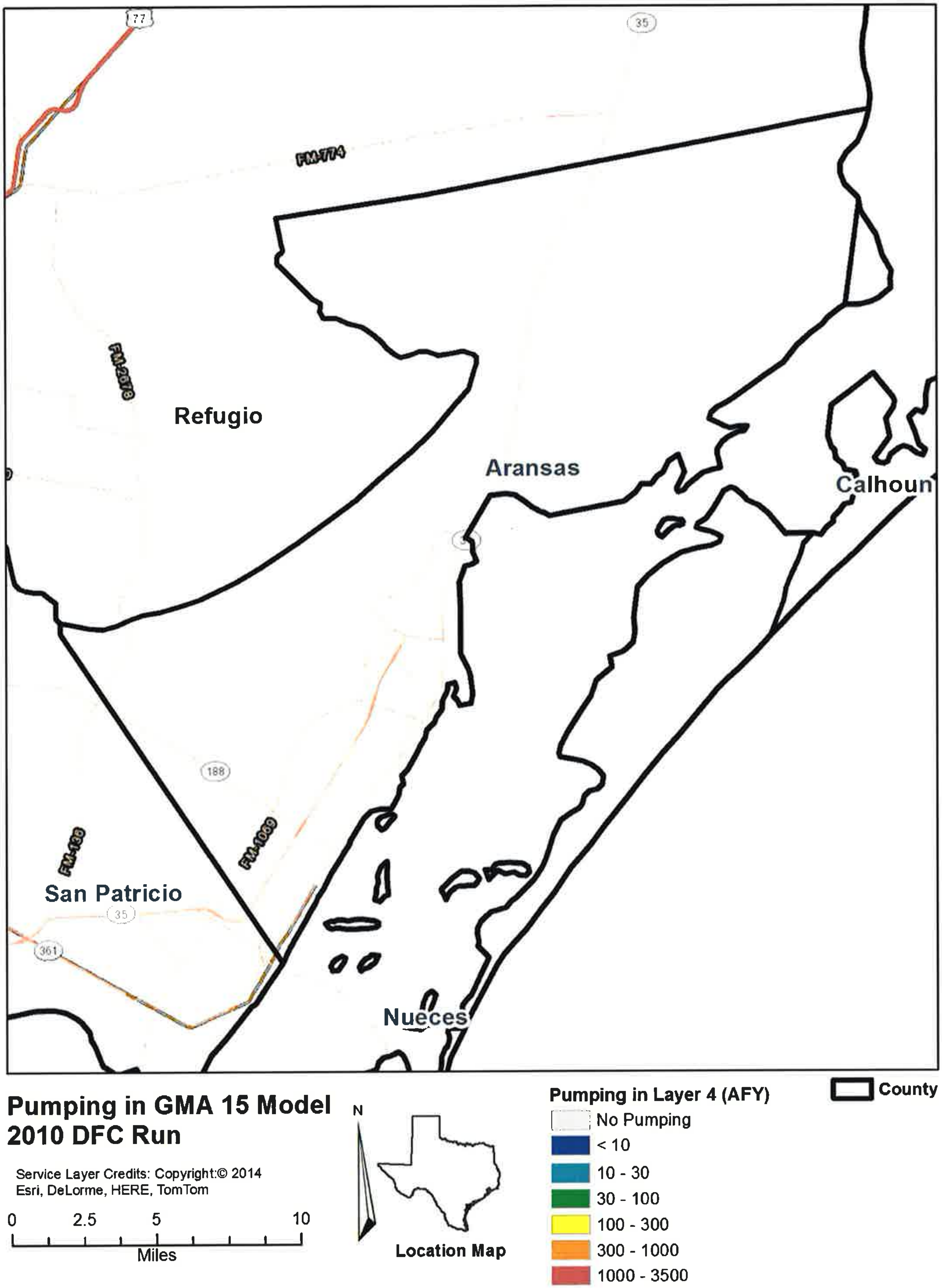
N

Location Map

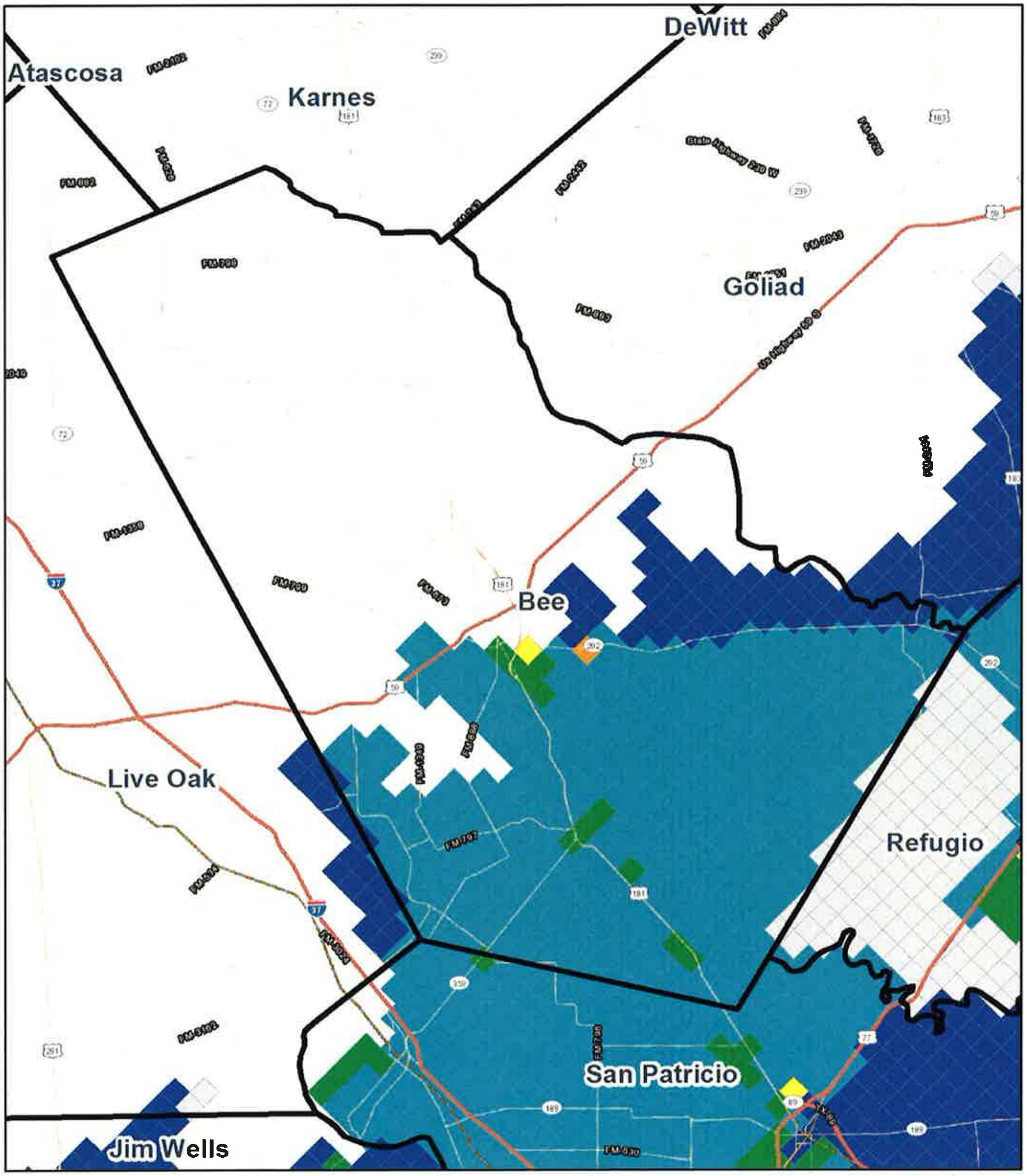
Pumping in Layer 3 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



77
35
FM-774
FM-2678
Refugio
Aransas
Calhoun
188
FM-1069
FM-136
San Patricio
35
361
Nueces
Pumping in GMA 15 Model
2010 DFC Run
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in Layer 4 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 3500
County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

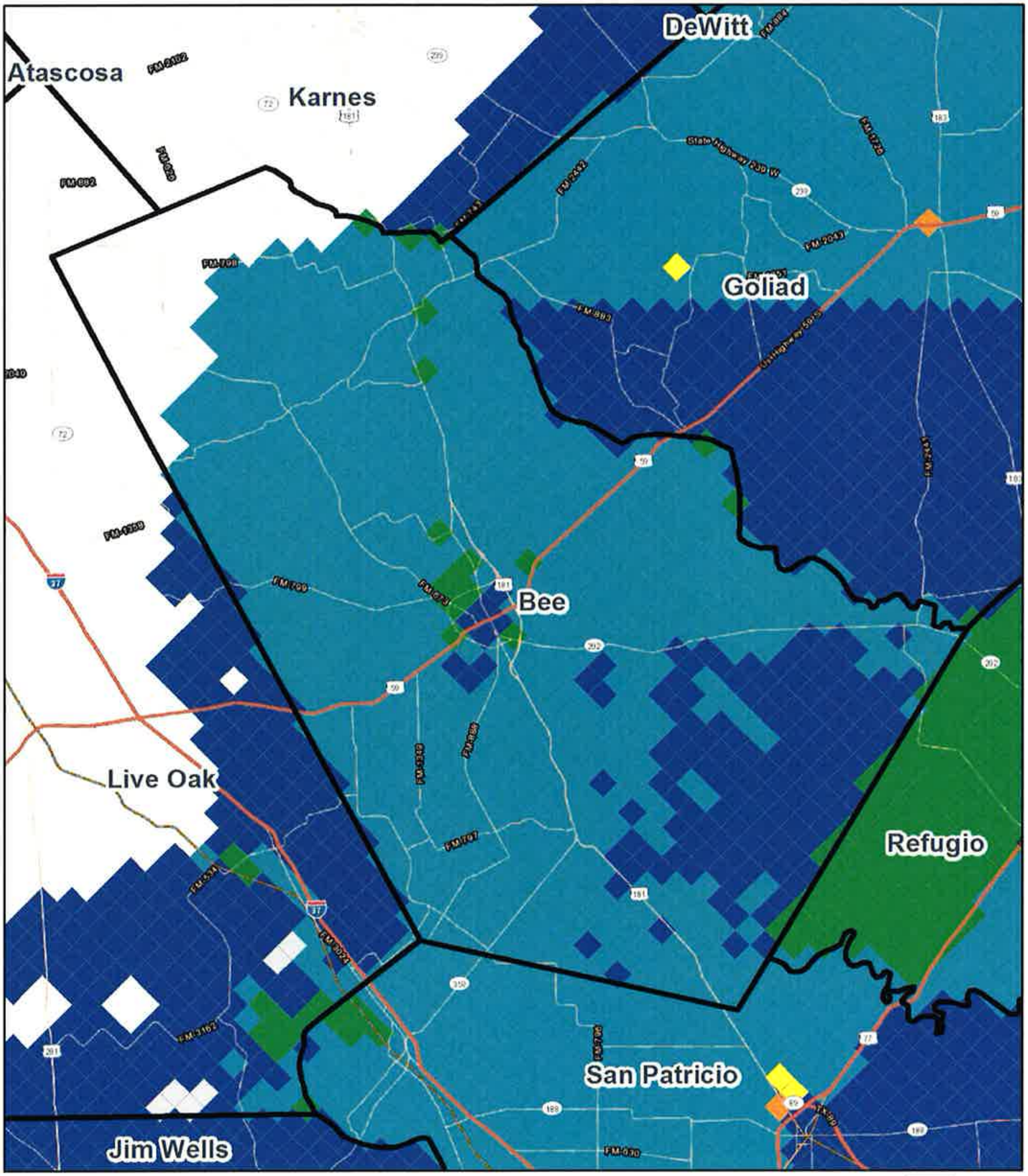
0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

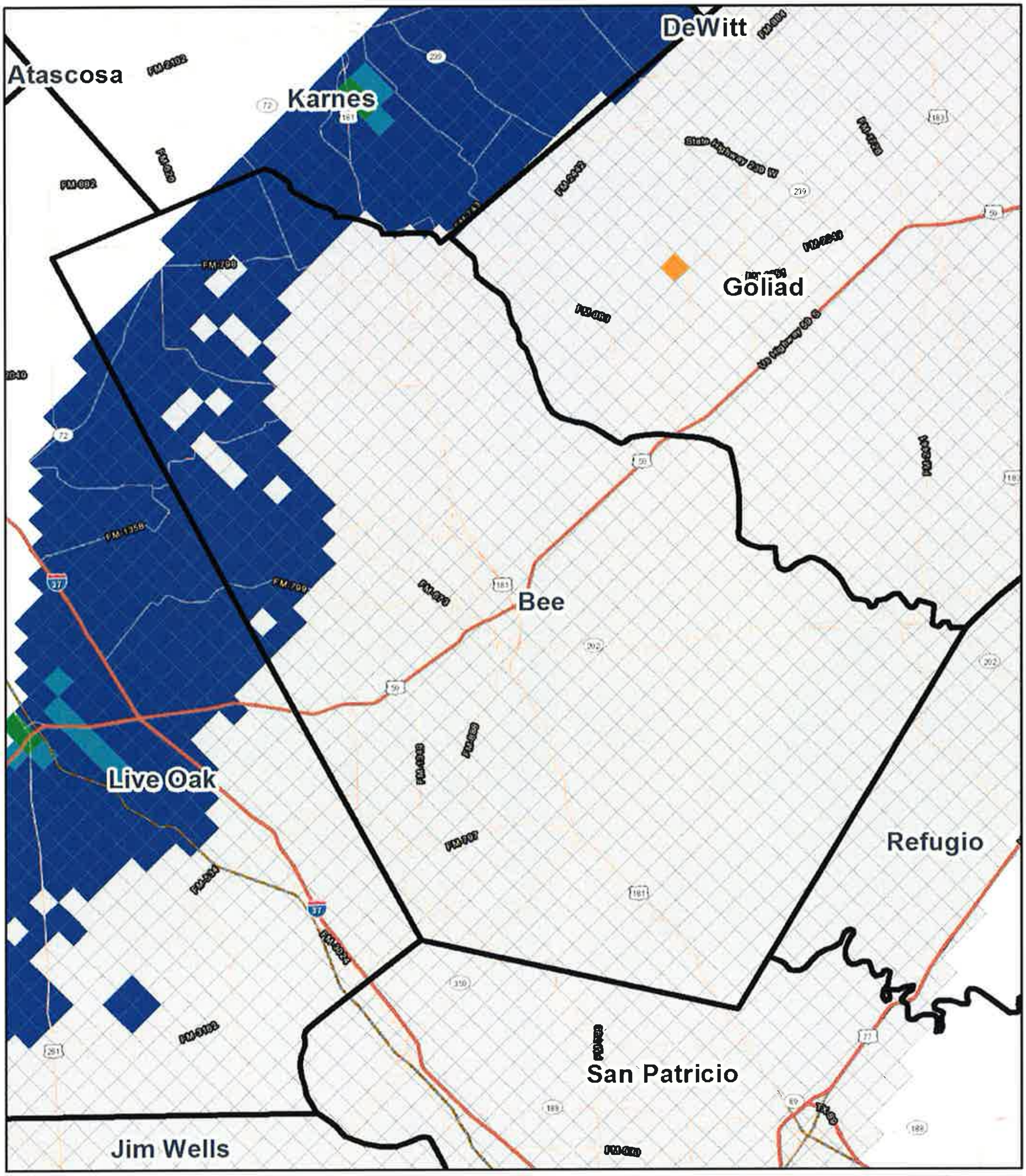
0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 2 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10 Miles

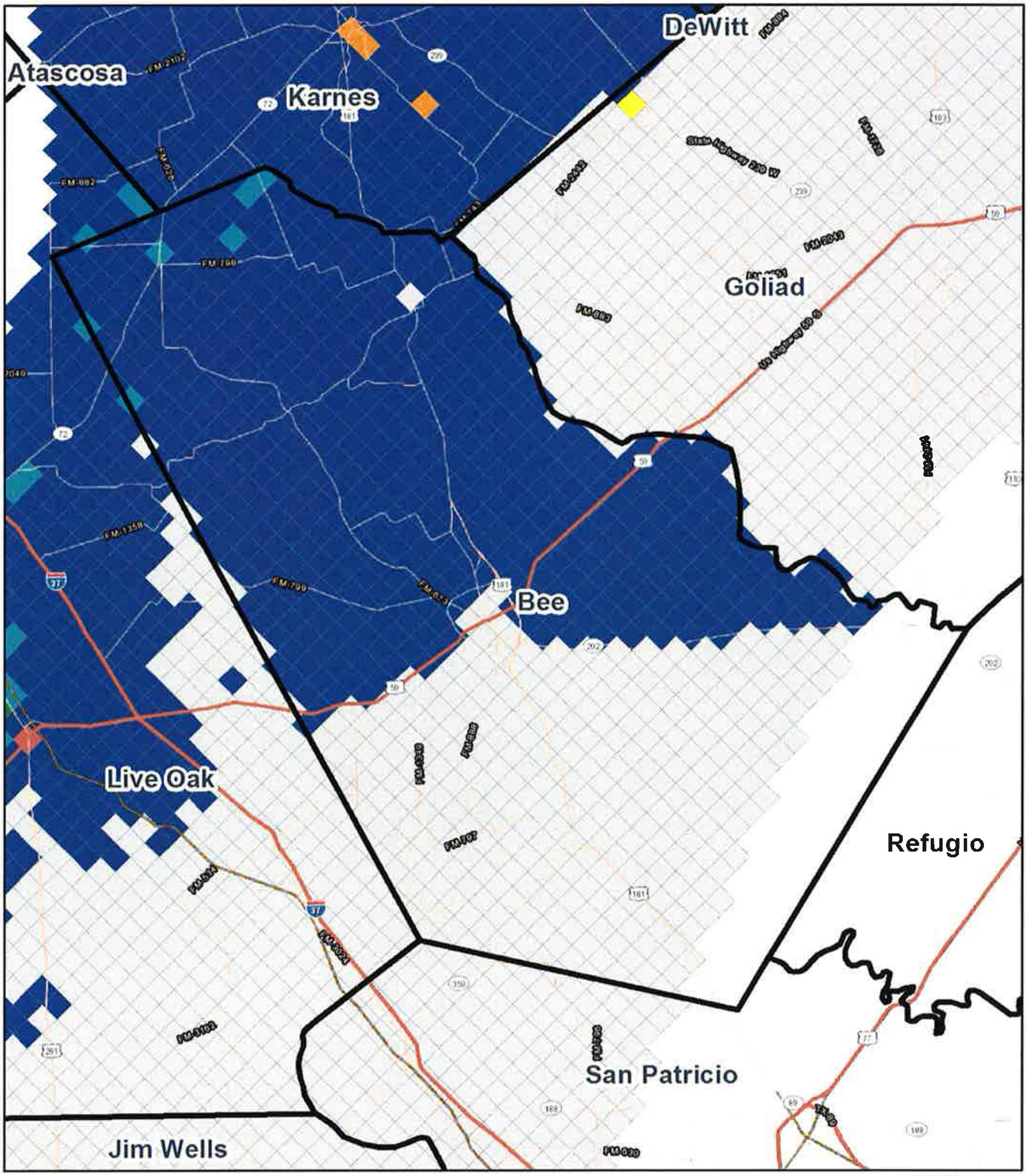
N

Location Map

Pumping in Layer 3 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



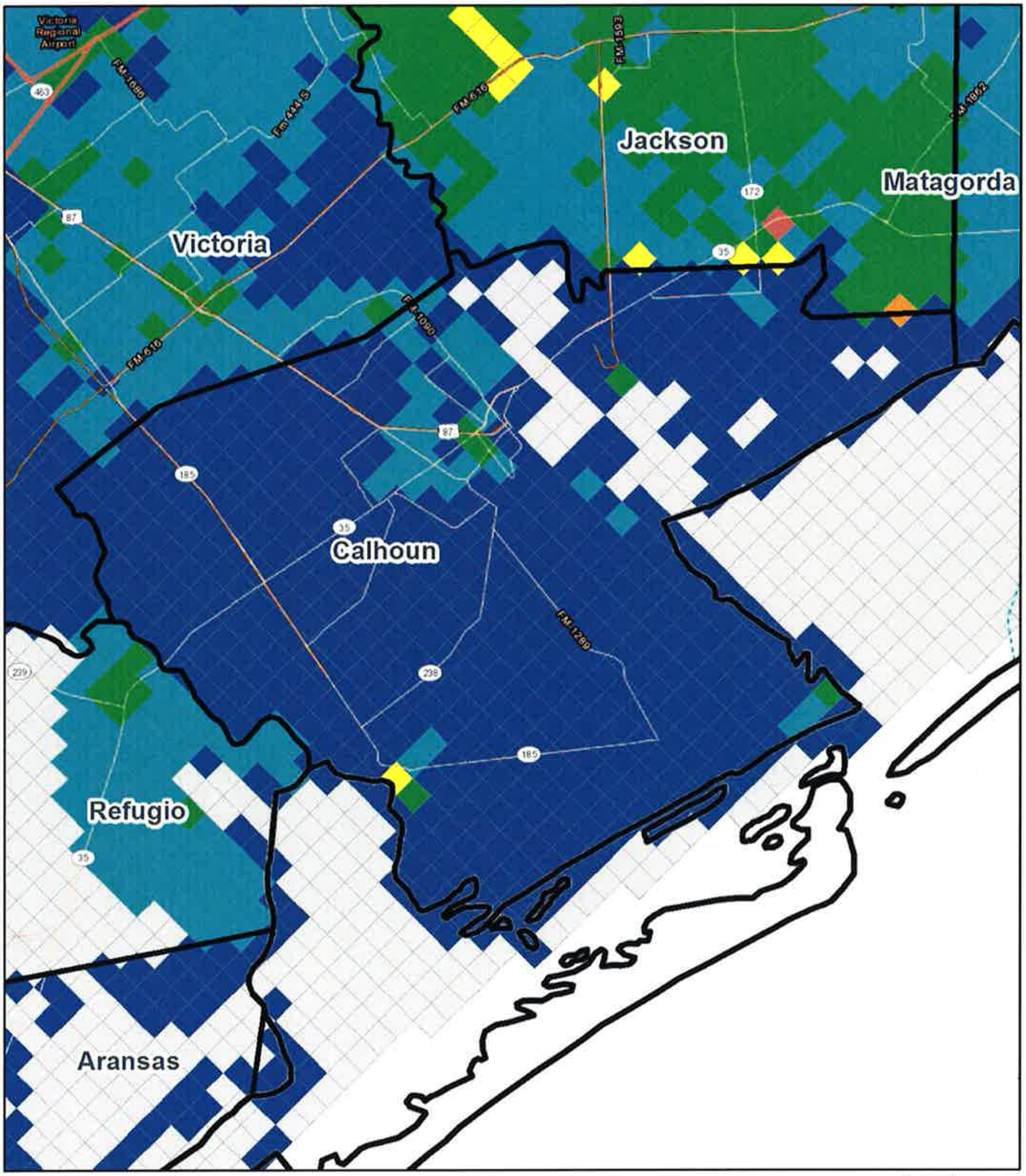
Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

Pumping in Layer 4 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
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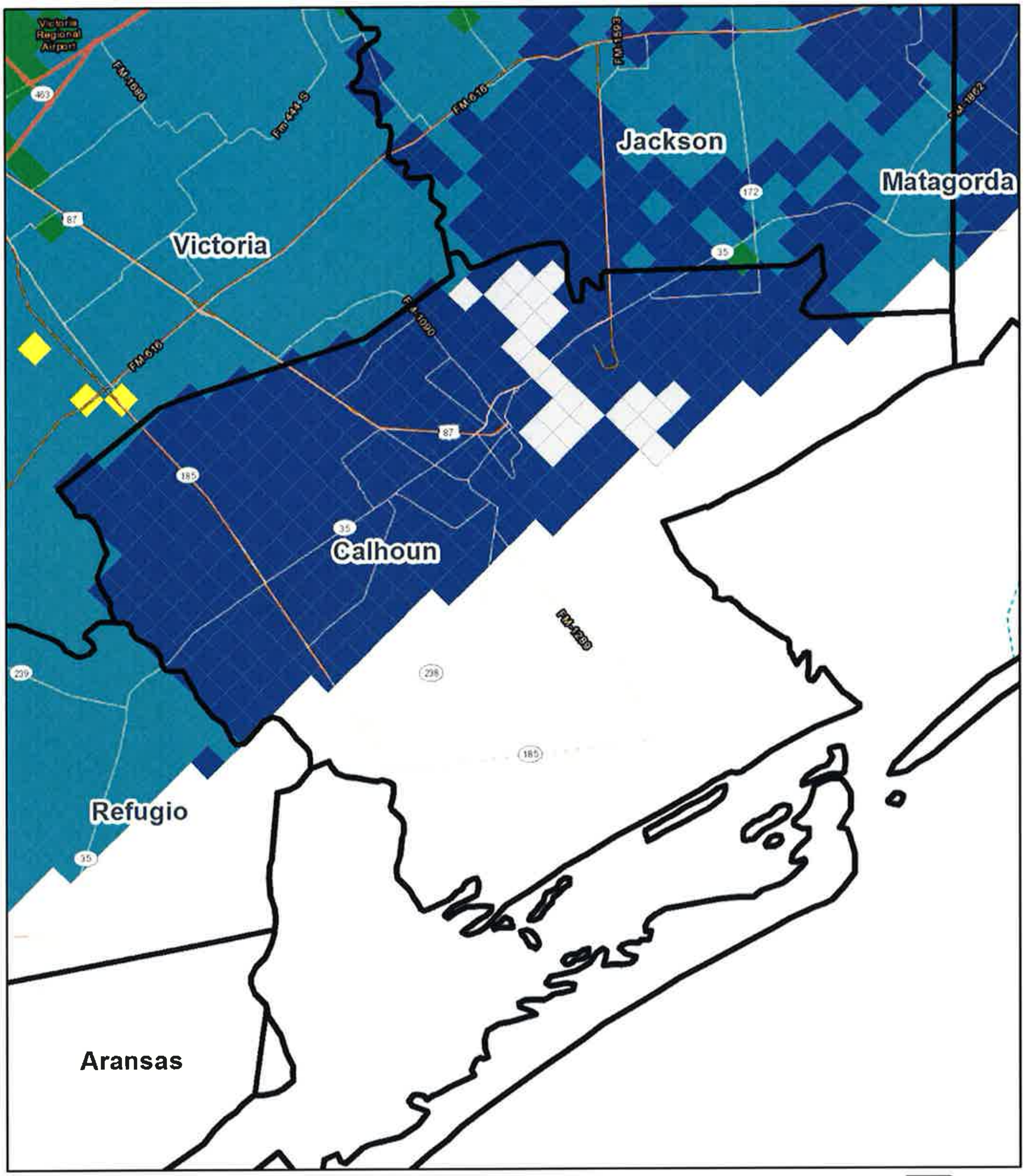
0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 1 (AFY)
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County

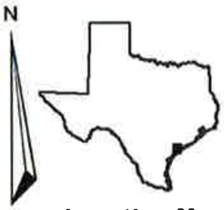


Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

N

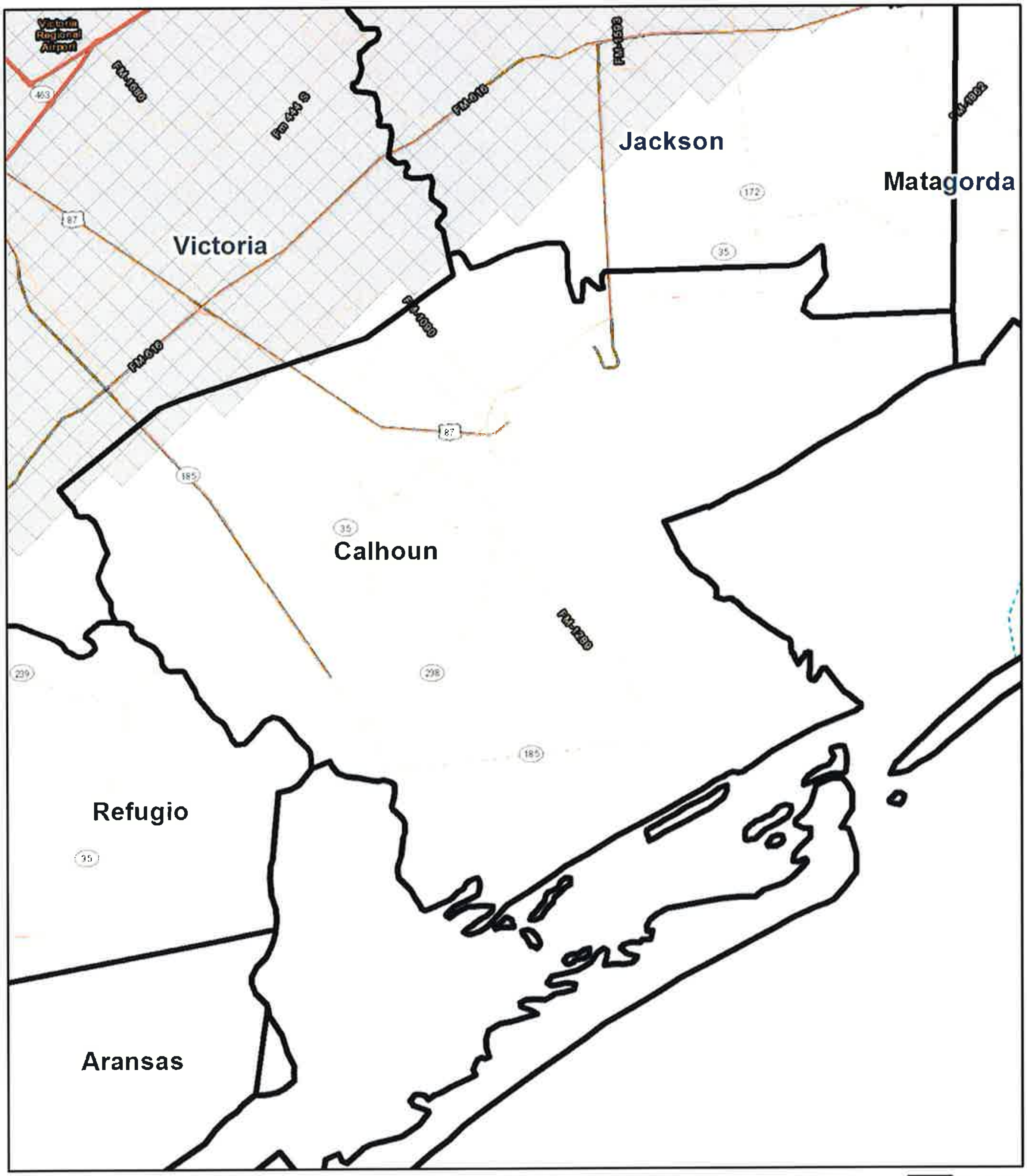


Location Map

Pumping in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County

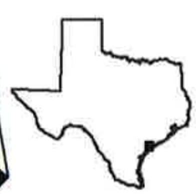


Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

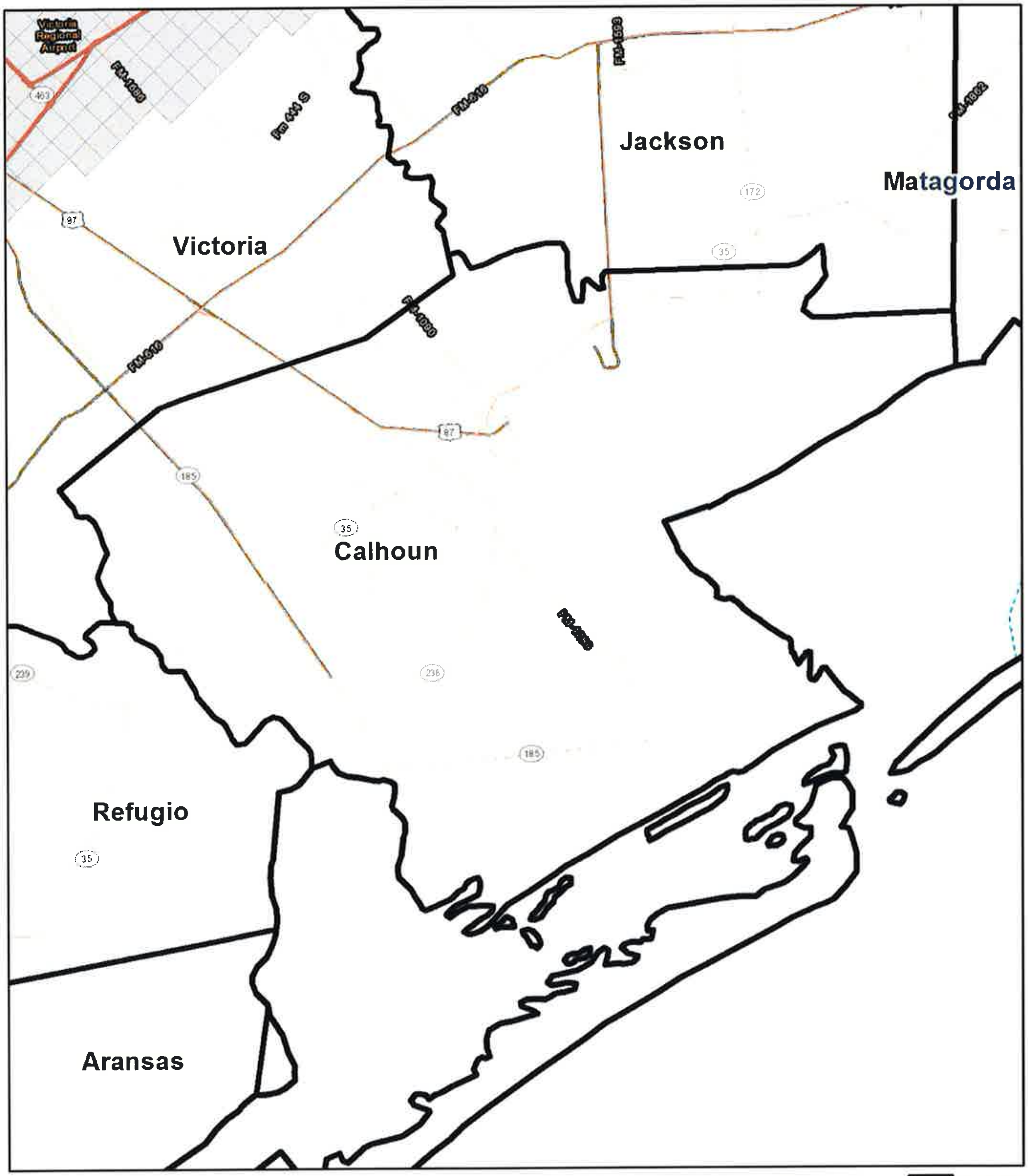
N



Pumping in Layer 3 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County

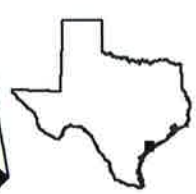


Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

N

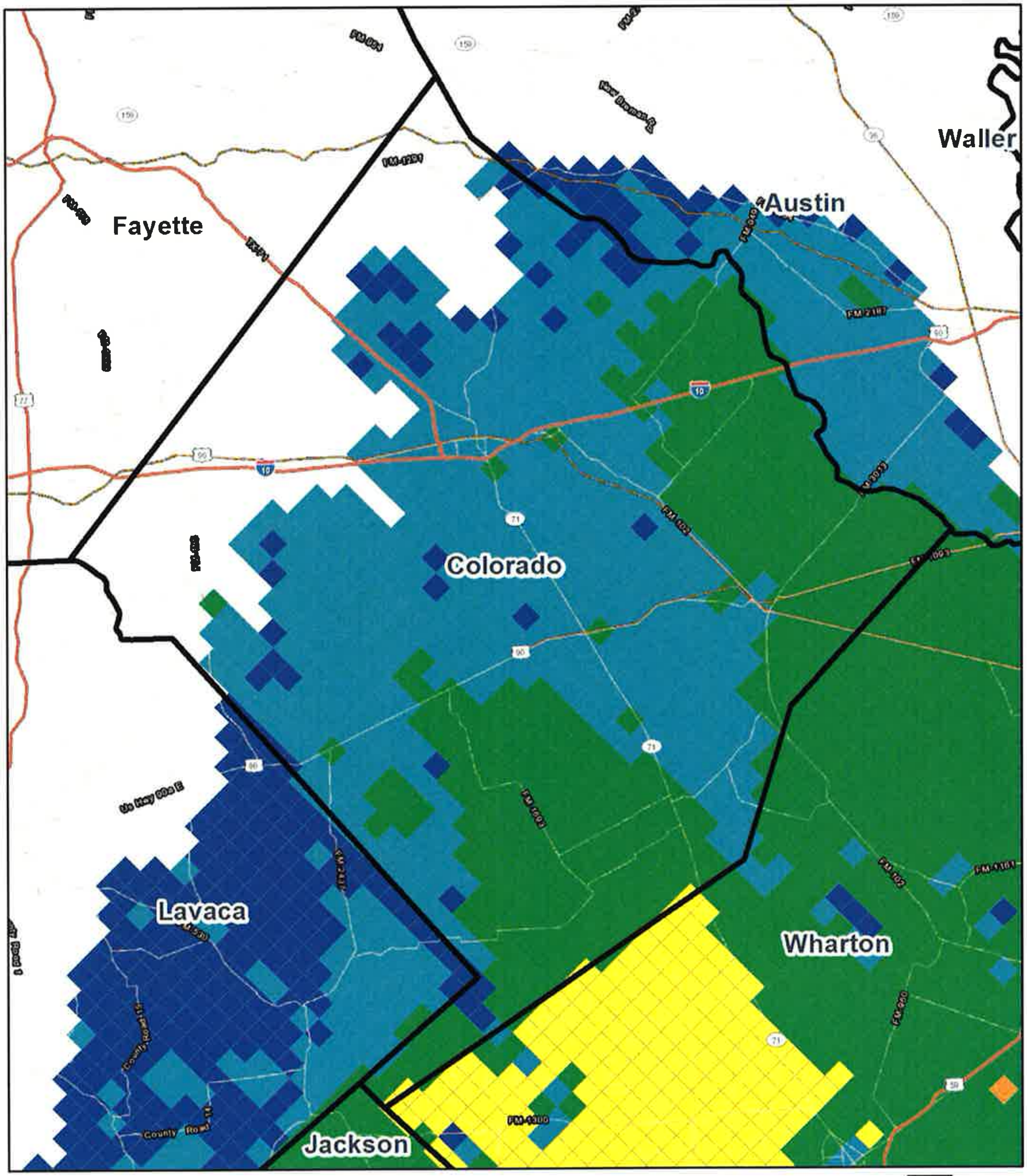


Location Map

Pumping in Layer 4 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

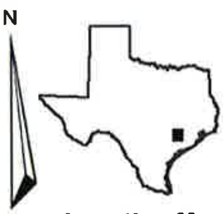
County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

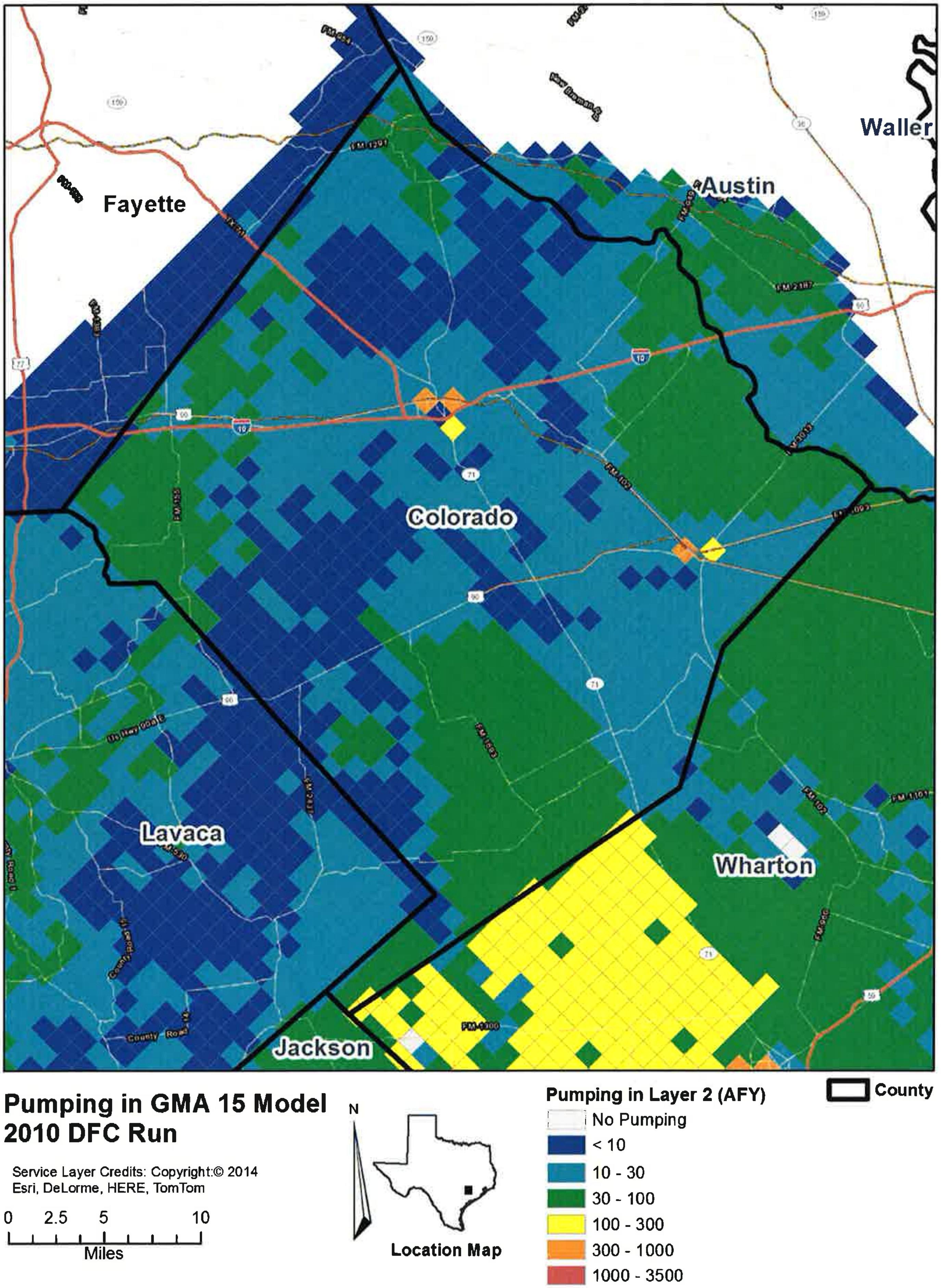


Location Map

Pumping in Layer 1 (AFY)

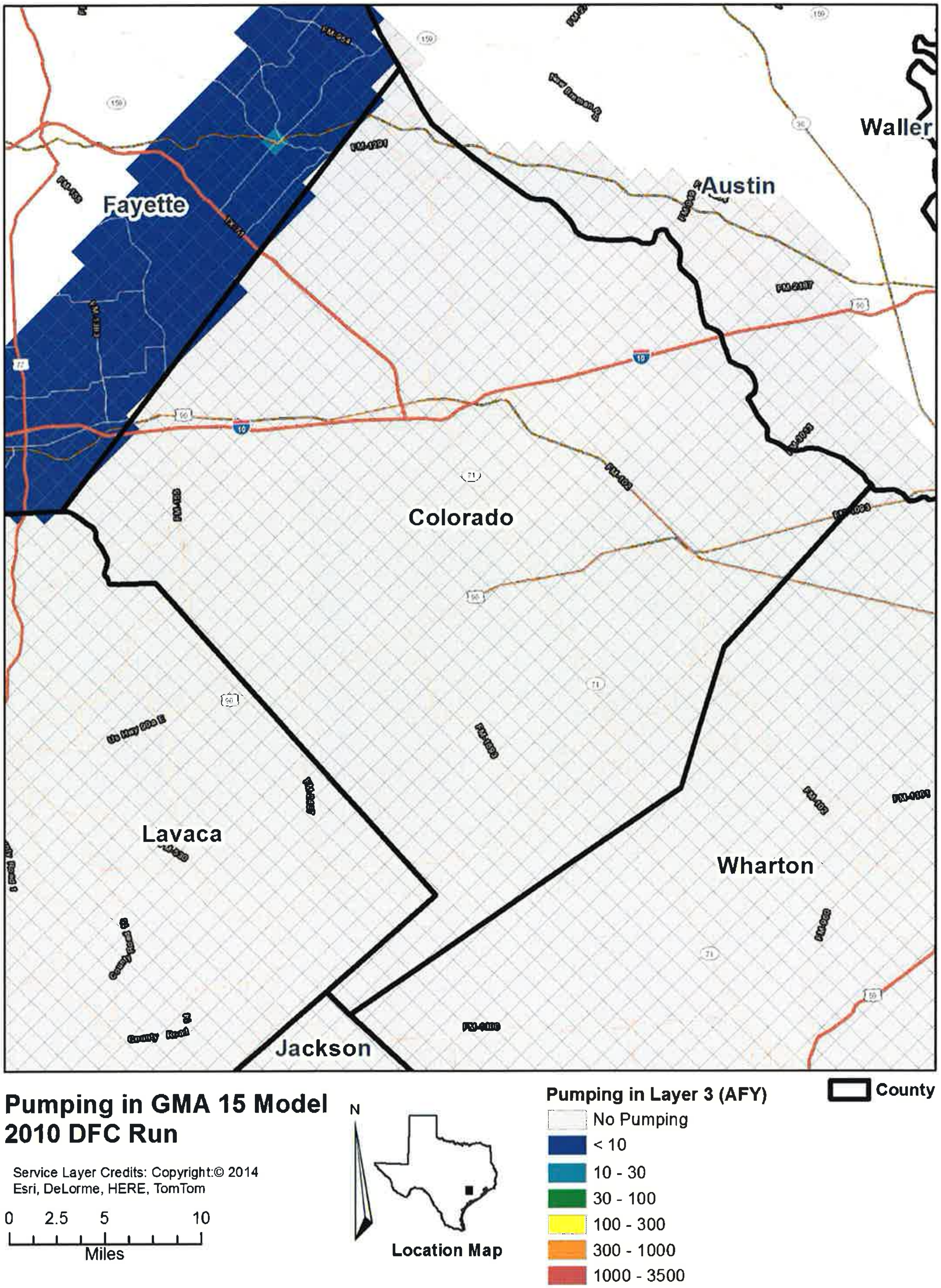
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



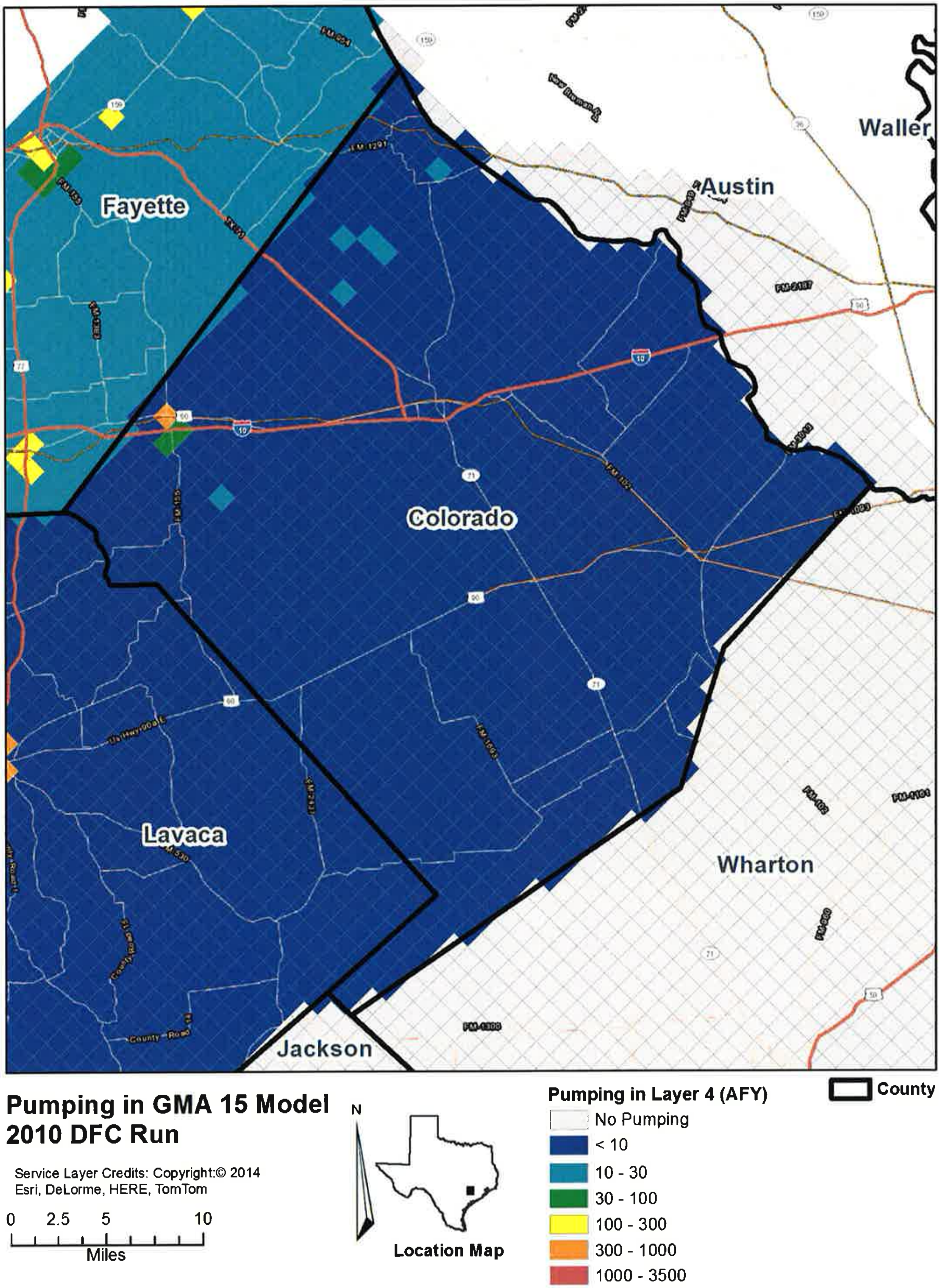
Pumping in GMA 15 Model 2010 DFC Run

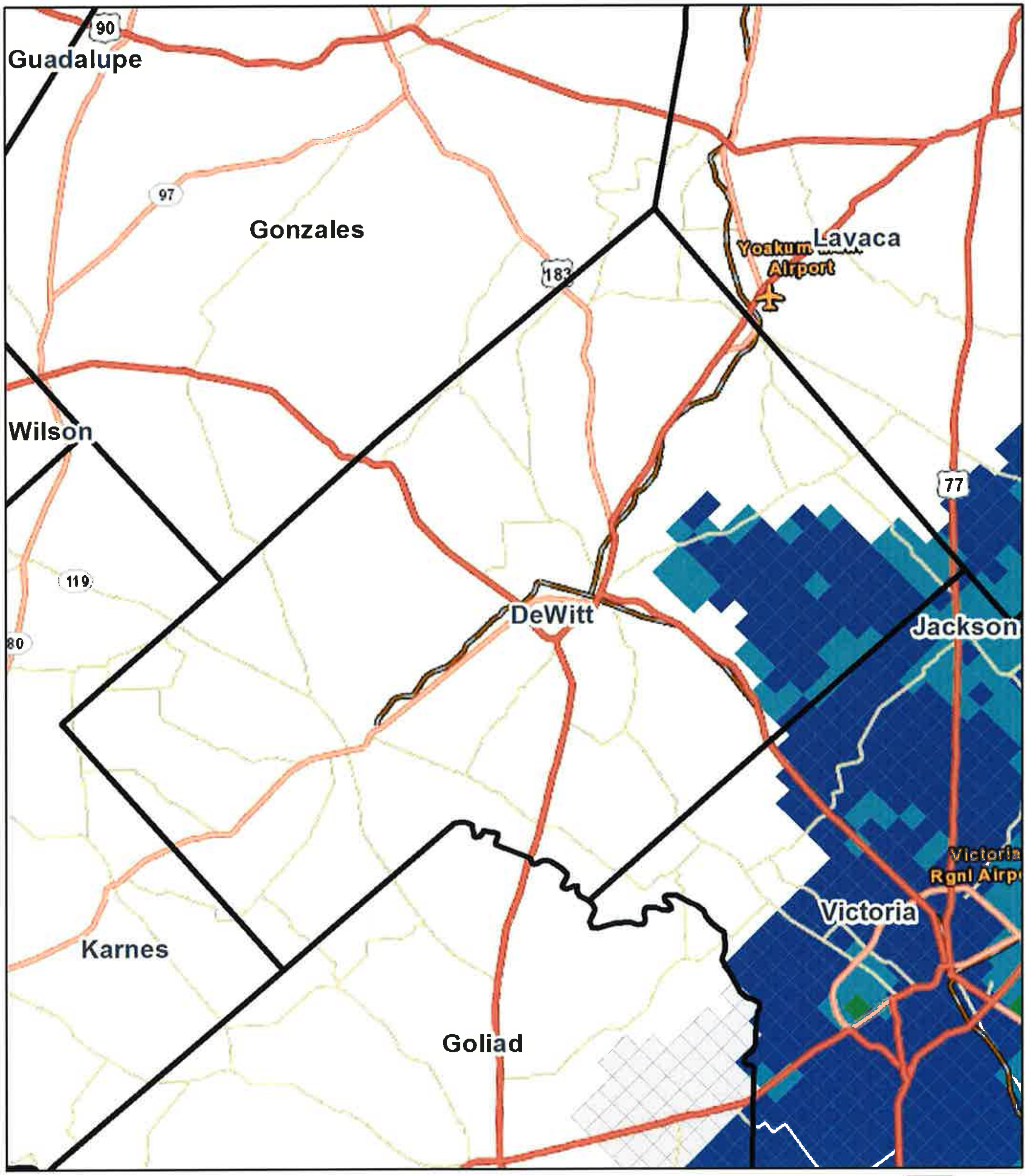
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom


Fayette
Colorado
Lavaca
Austin
Waller
Wharton
Jackson
County
Pumping in GMA 15 Model
2010 DFC Run
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0 2.5 5 10
Miles
N
Location Map
Pumping in Layer 4 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 3500



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

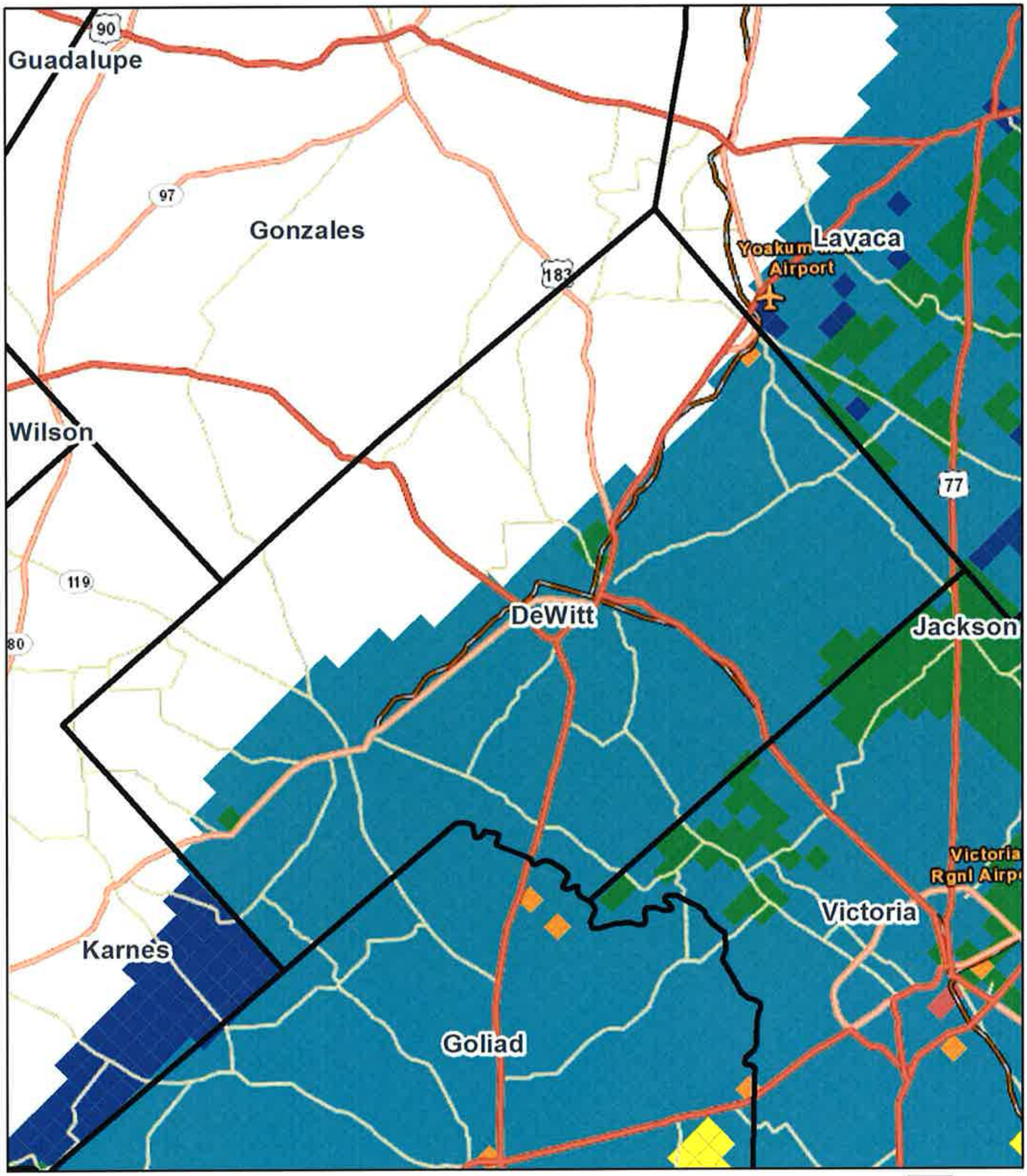
0 2.5 5 10
Miles

N

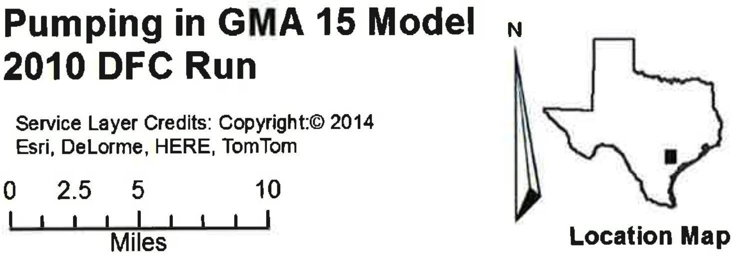
Location Map

Pumping in Layer 1 (AFY)
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



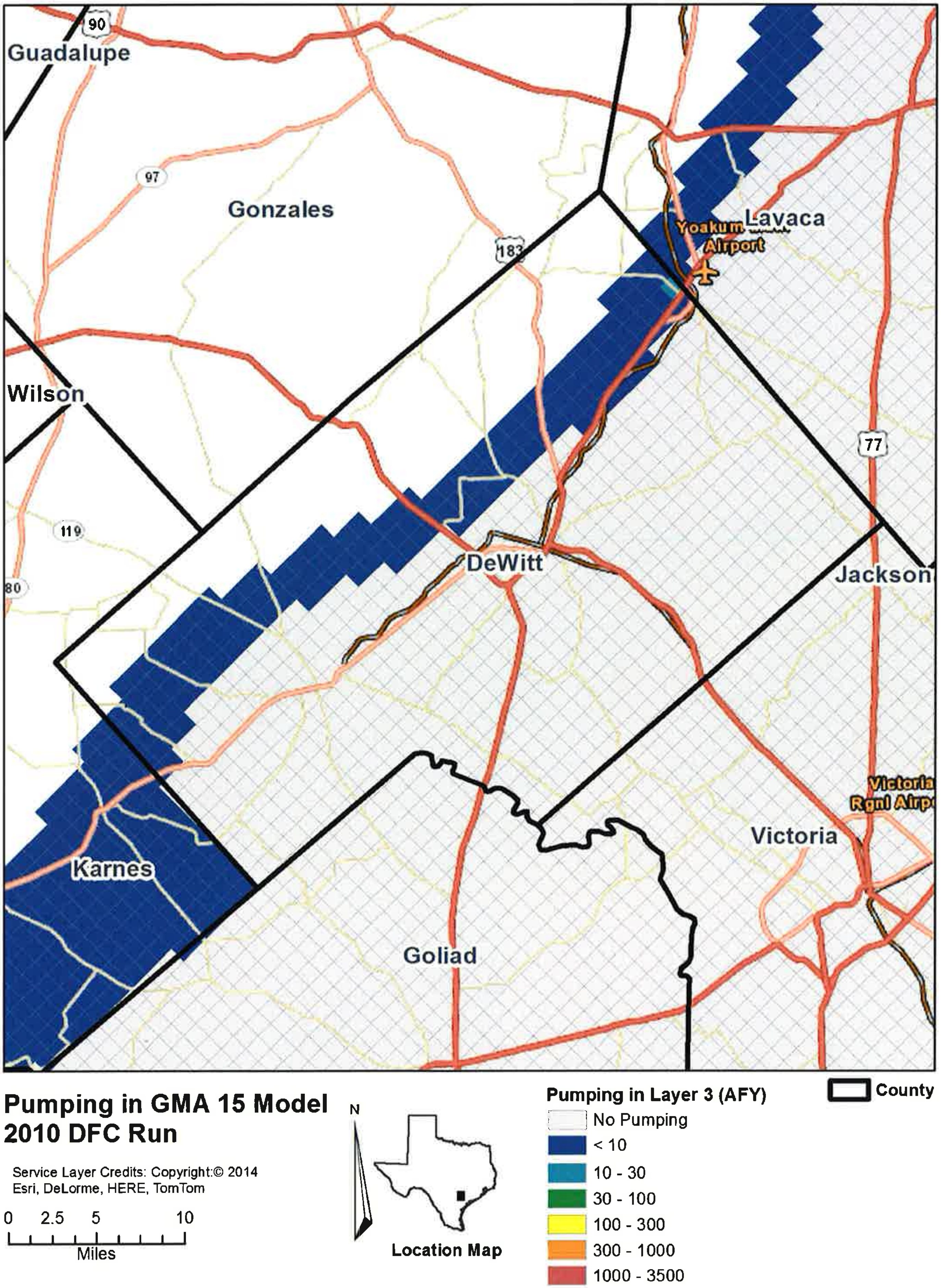
Pumping in GMA 15 Model 2010 DFC Run



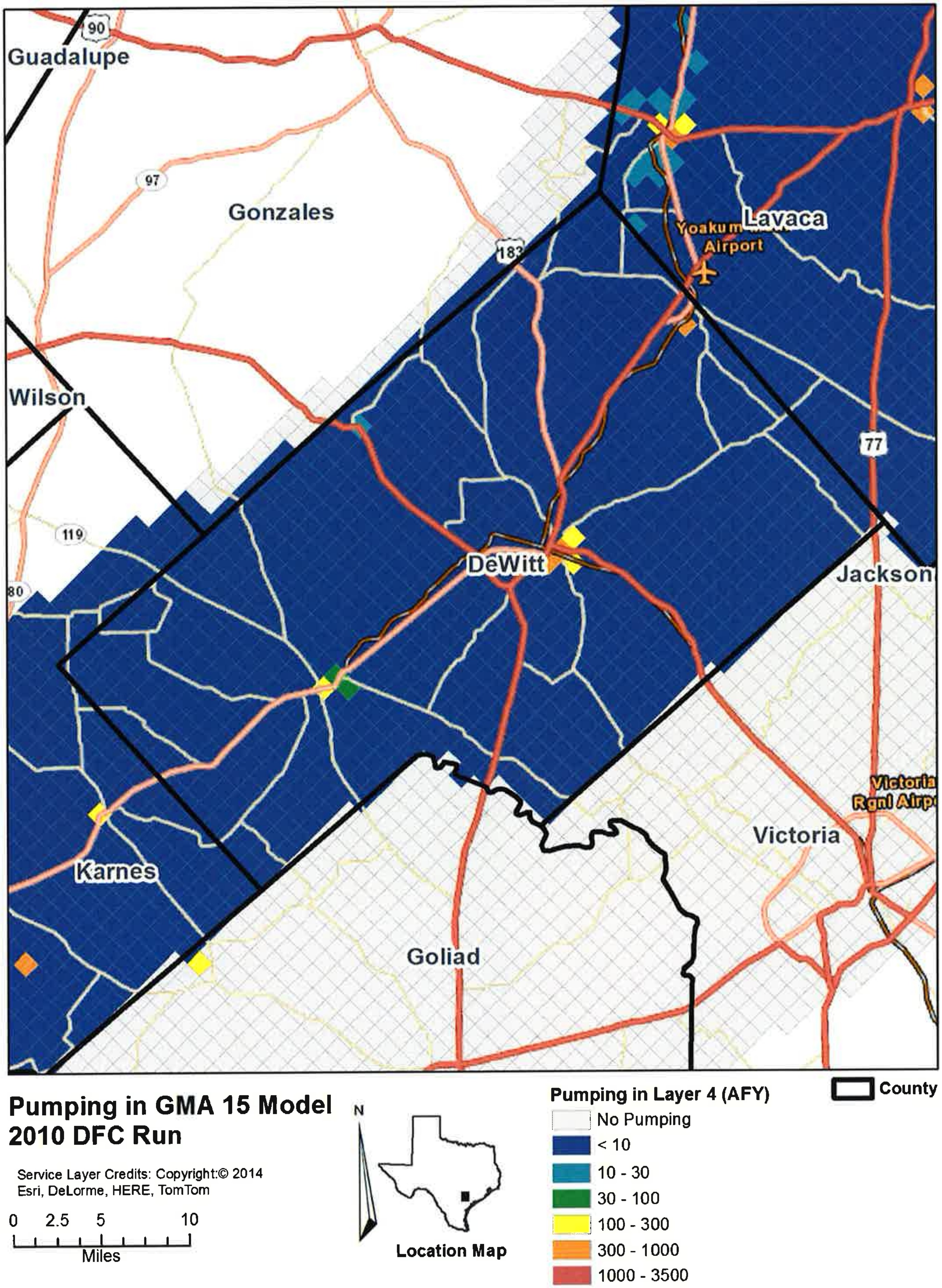
Pumping in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

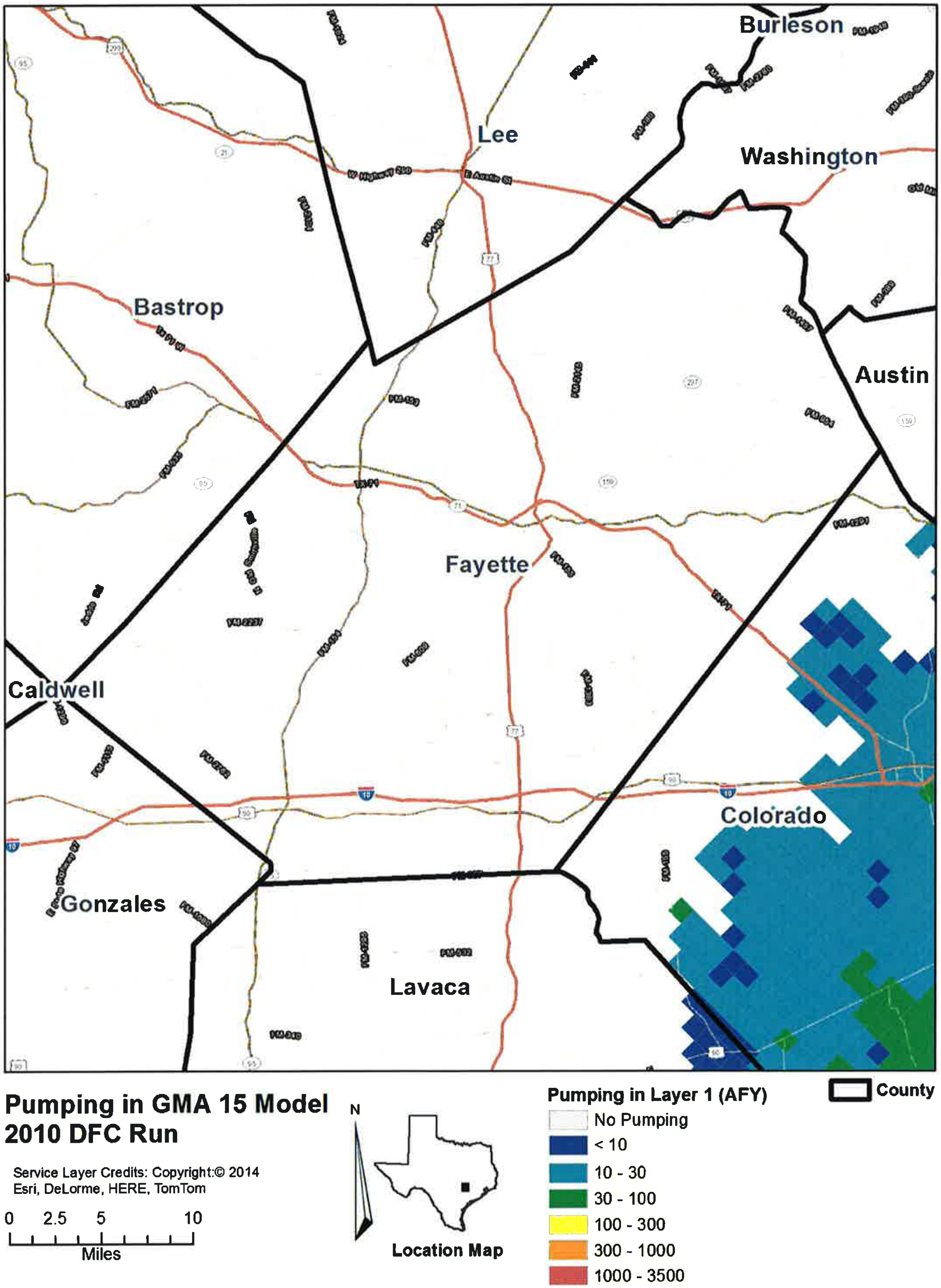
County



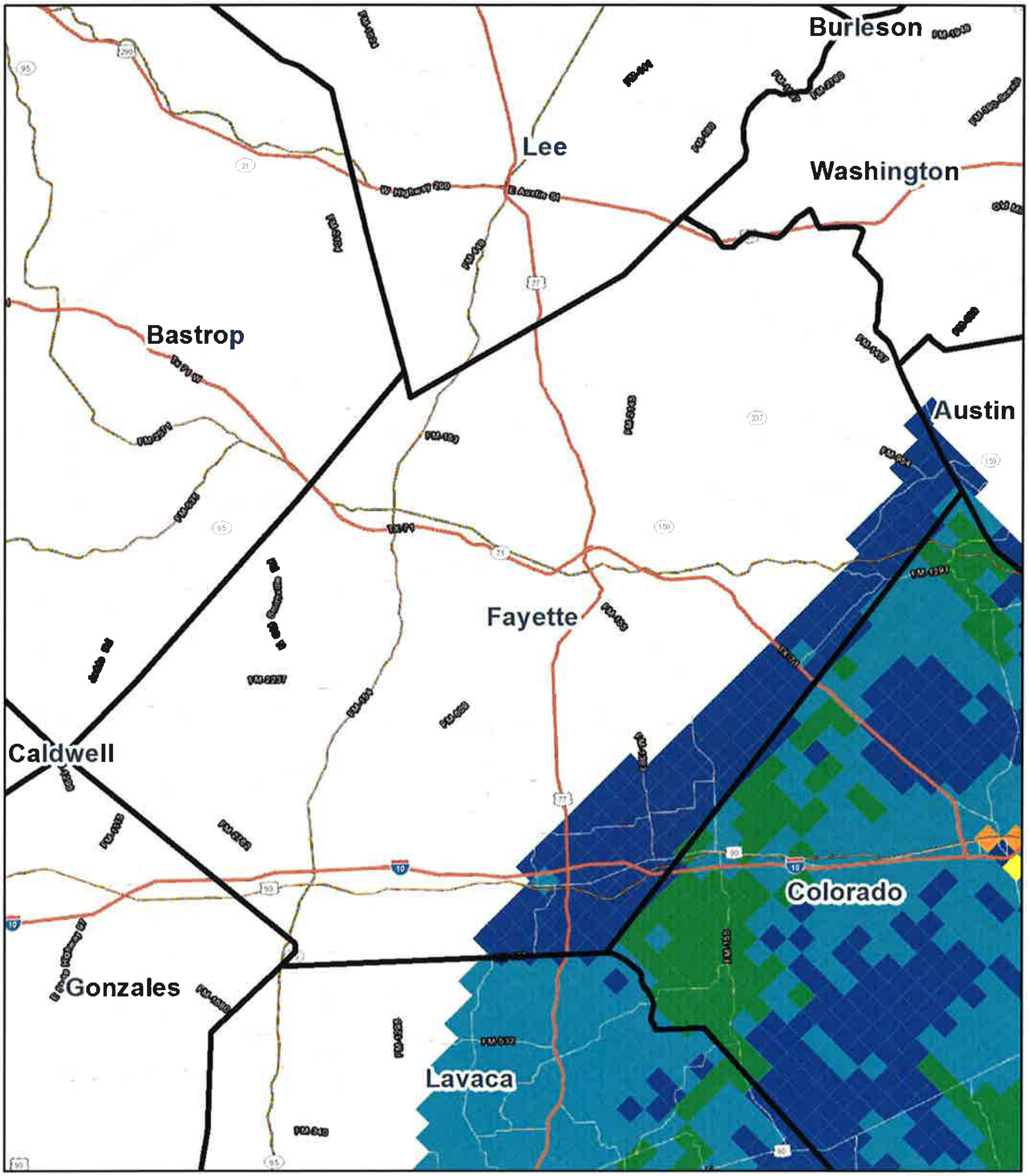
Pumping in GMA 15 Model
2010 DFC Run



Pumping in GMA 15 Model 2010 DFC Run



Pumping in GMA 15 Model
2010 DFC Run



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
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0 2.5 5 10
Miles

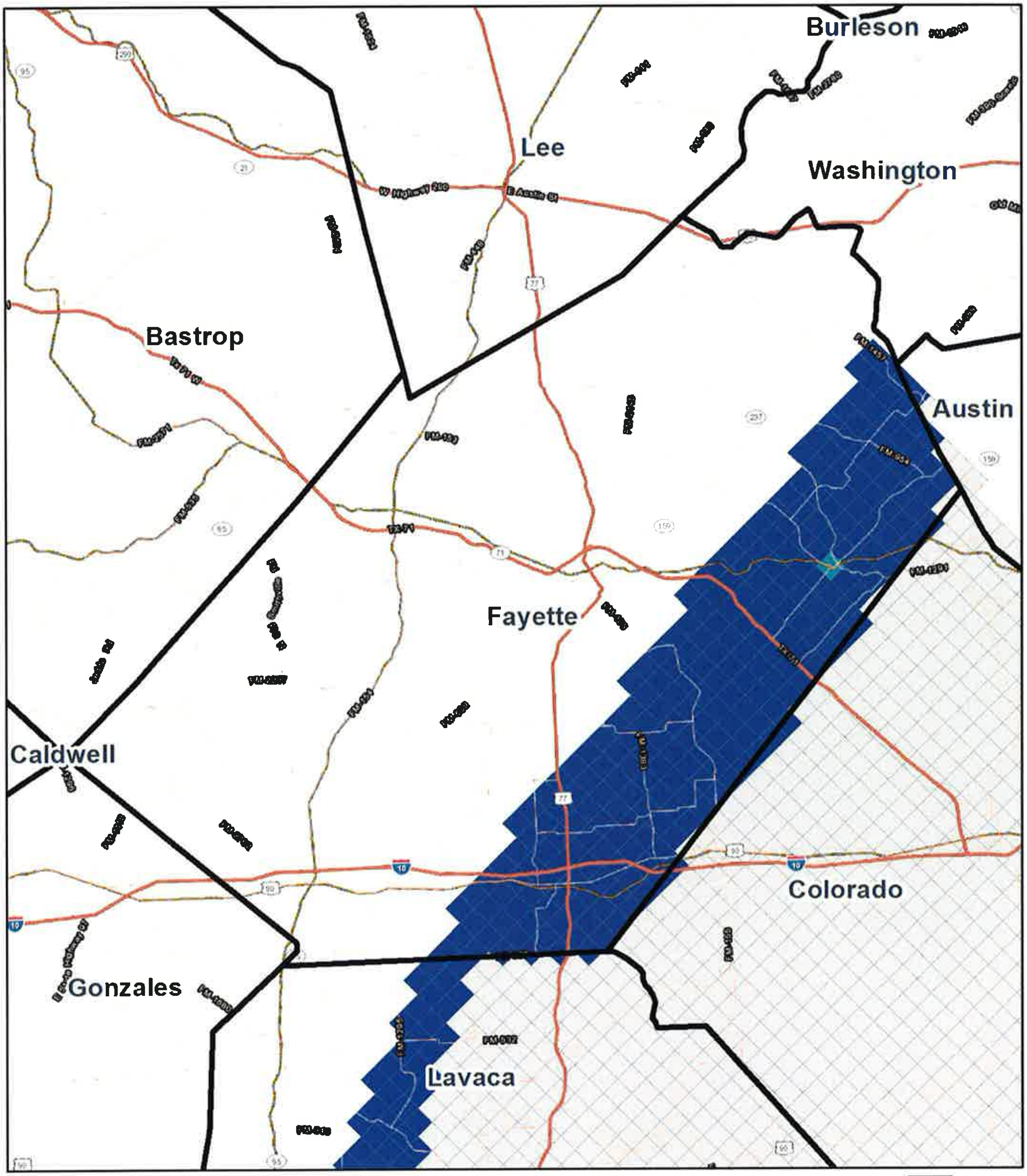
N

Location Map

Pumping in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
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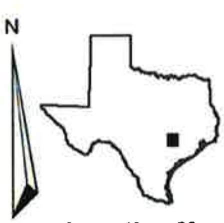
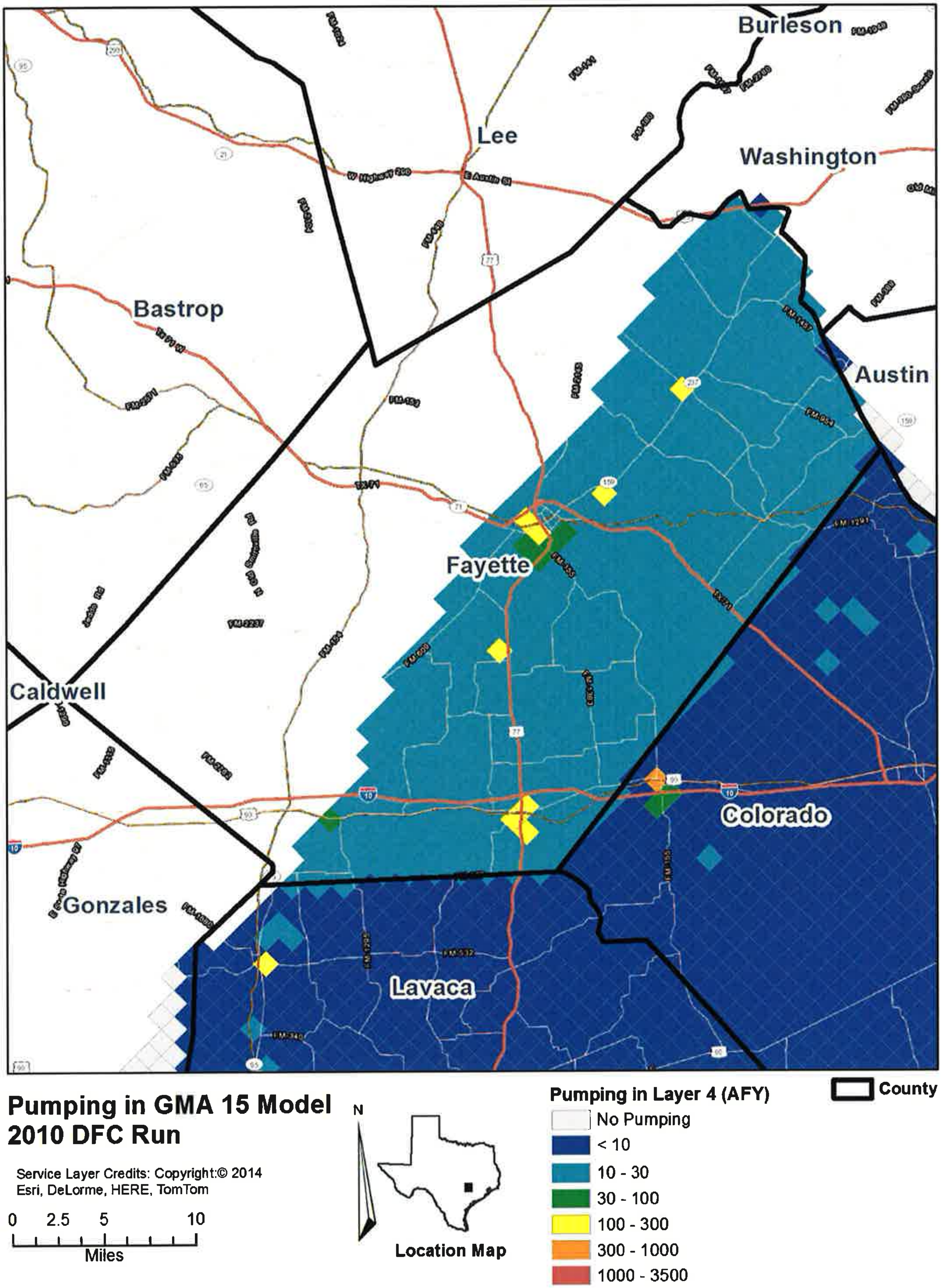
0 2.5 5 10
Miles



Pumping in Layer 3 (AFY)

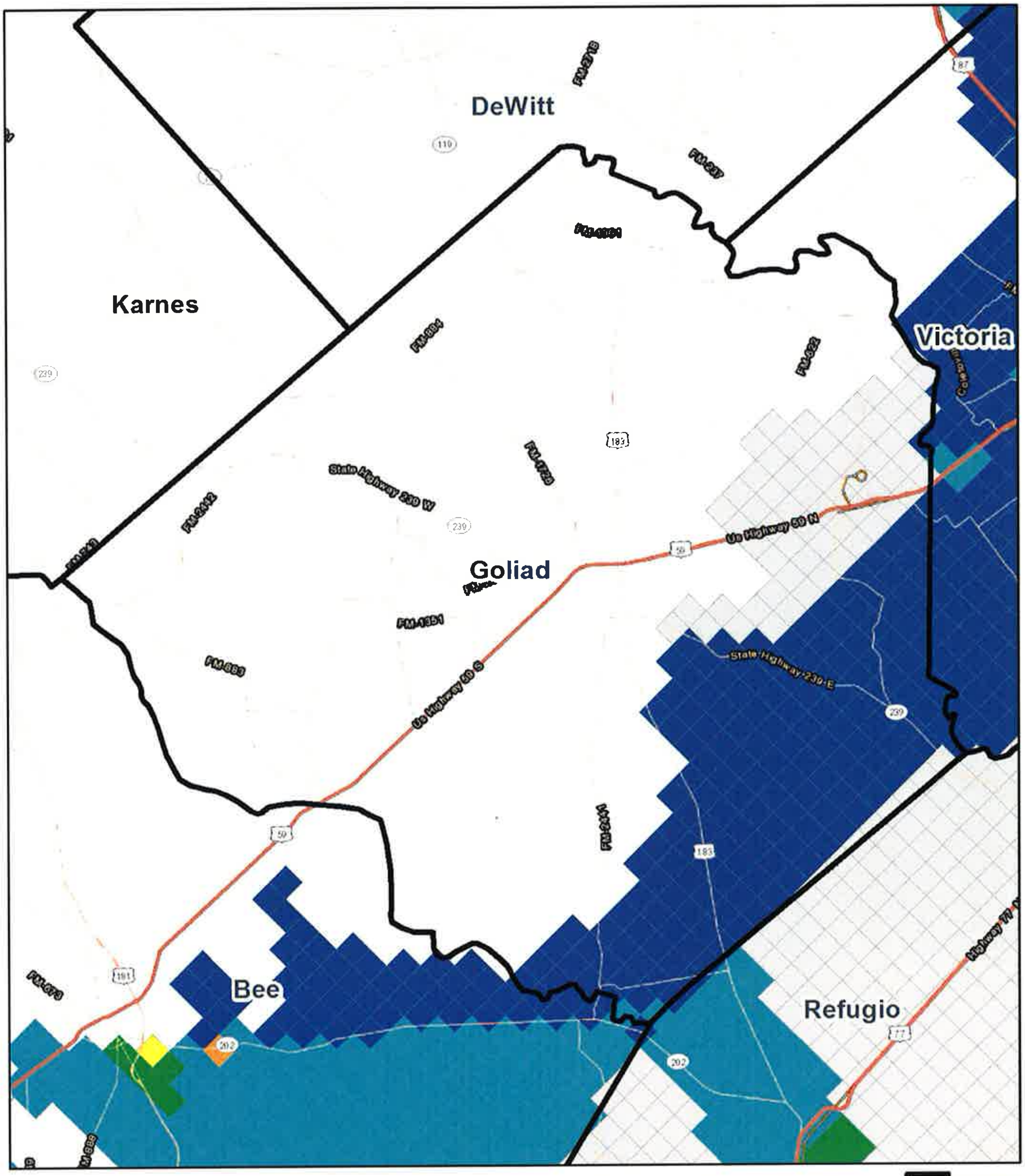
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

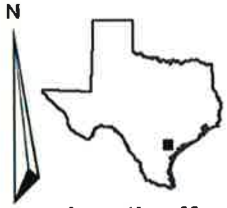
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

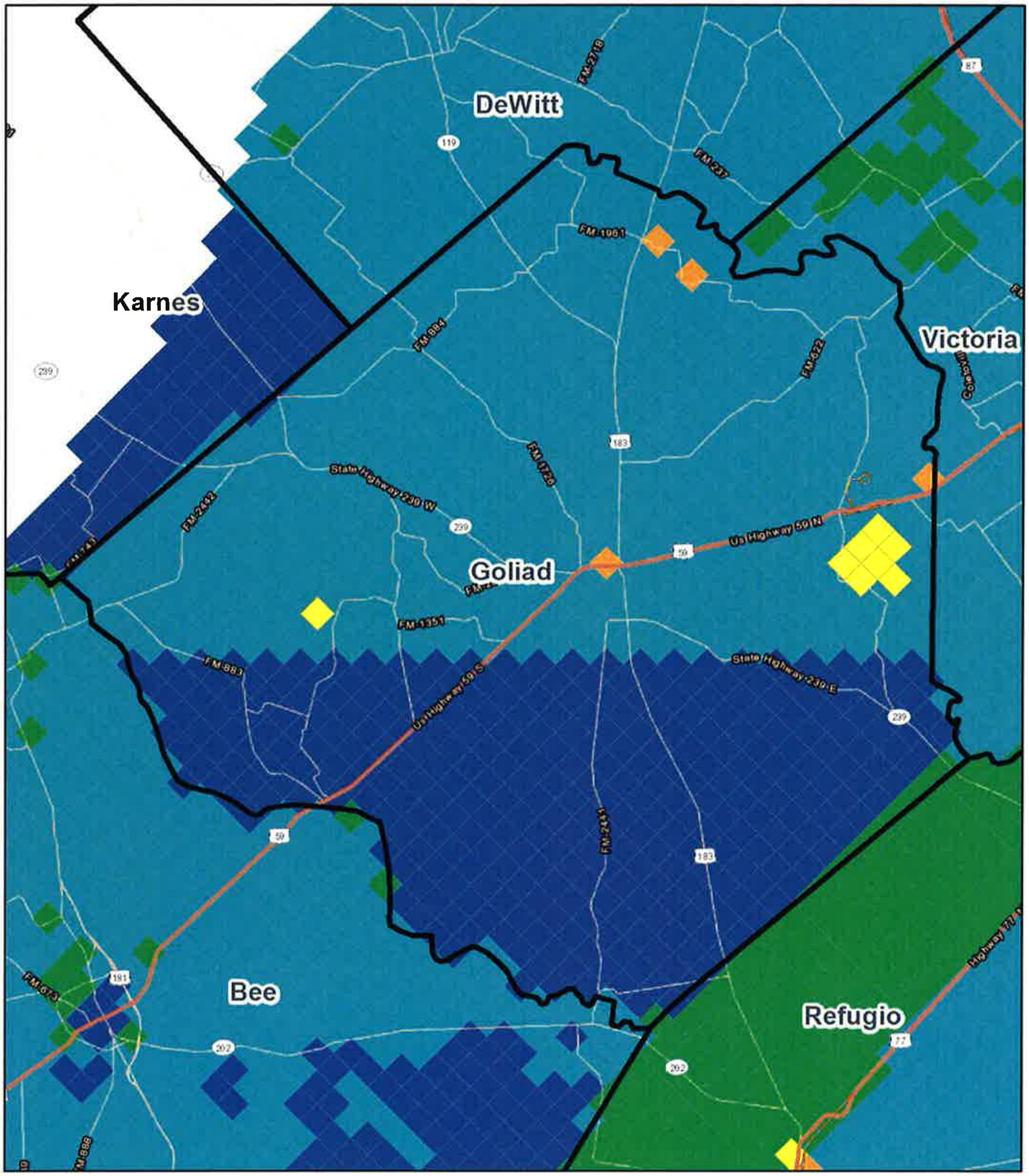
0 2.5 5 10
Miles



Pumping in Layer 1 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

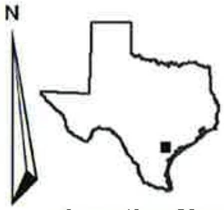
County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles



Pumping in Layer 2 (AFY)

- No Pumping
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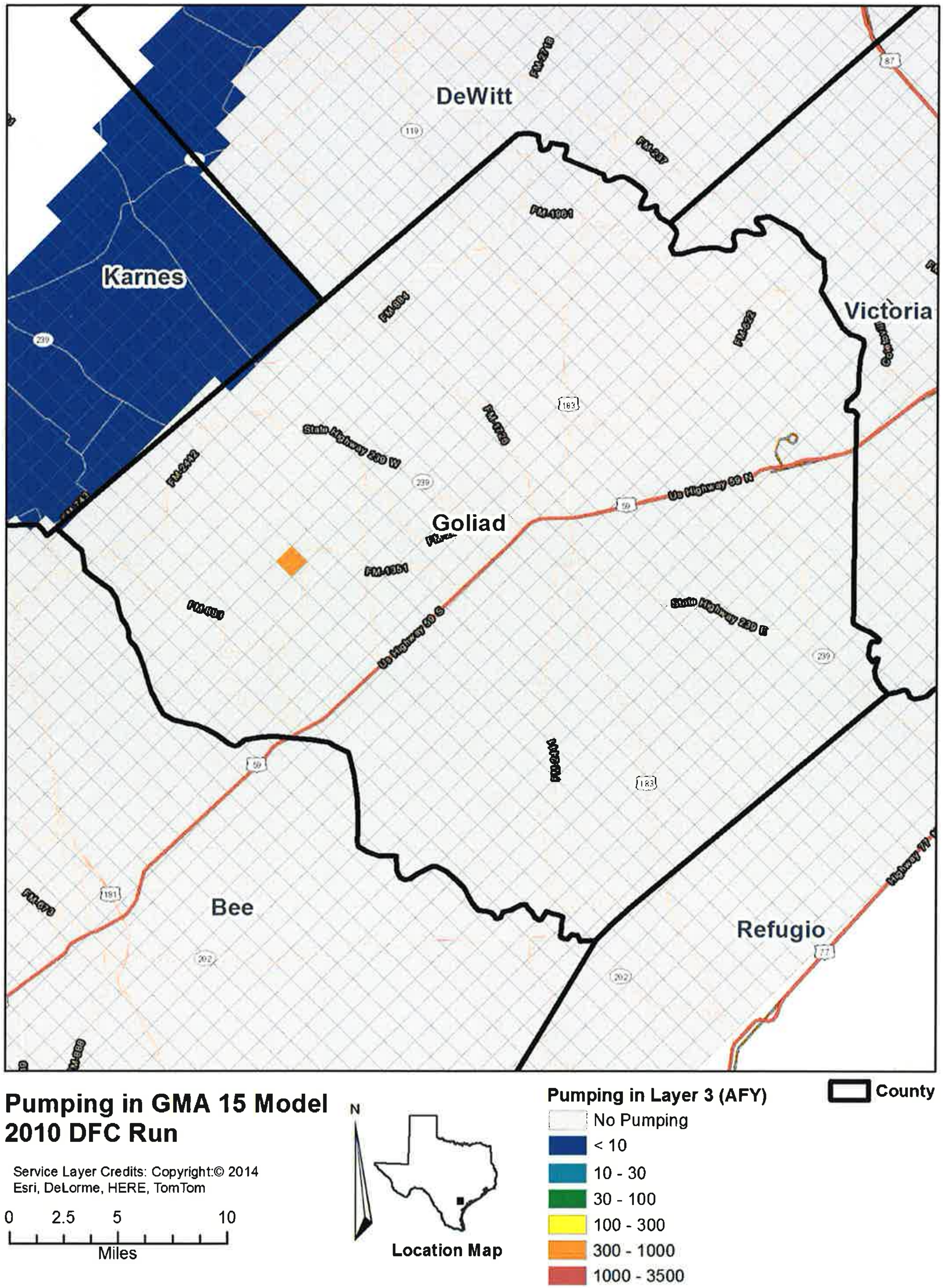
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



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Victoria
Goliad
Bee
Refugio
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FM-237
FM-1961
FM-884
FM-622
FM-1726
State Highway 239 W
FM-2442
Us Highway 59 N
FM-1351
State Highway 239 E
Us Highway 59 S
FM-2441
FM-673
Highway 77
119
239
183
59
181
202
87
77
Pumping in GMA 15 Model
2010 DFC Run
Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom
0
2.5
5
10
Miles
N
Location Map
Pumping in Layer 3 (AFY)
No Pumping
< 10
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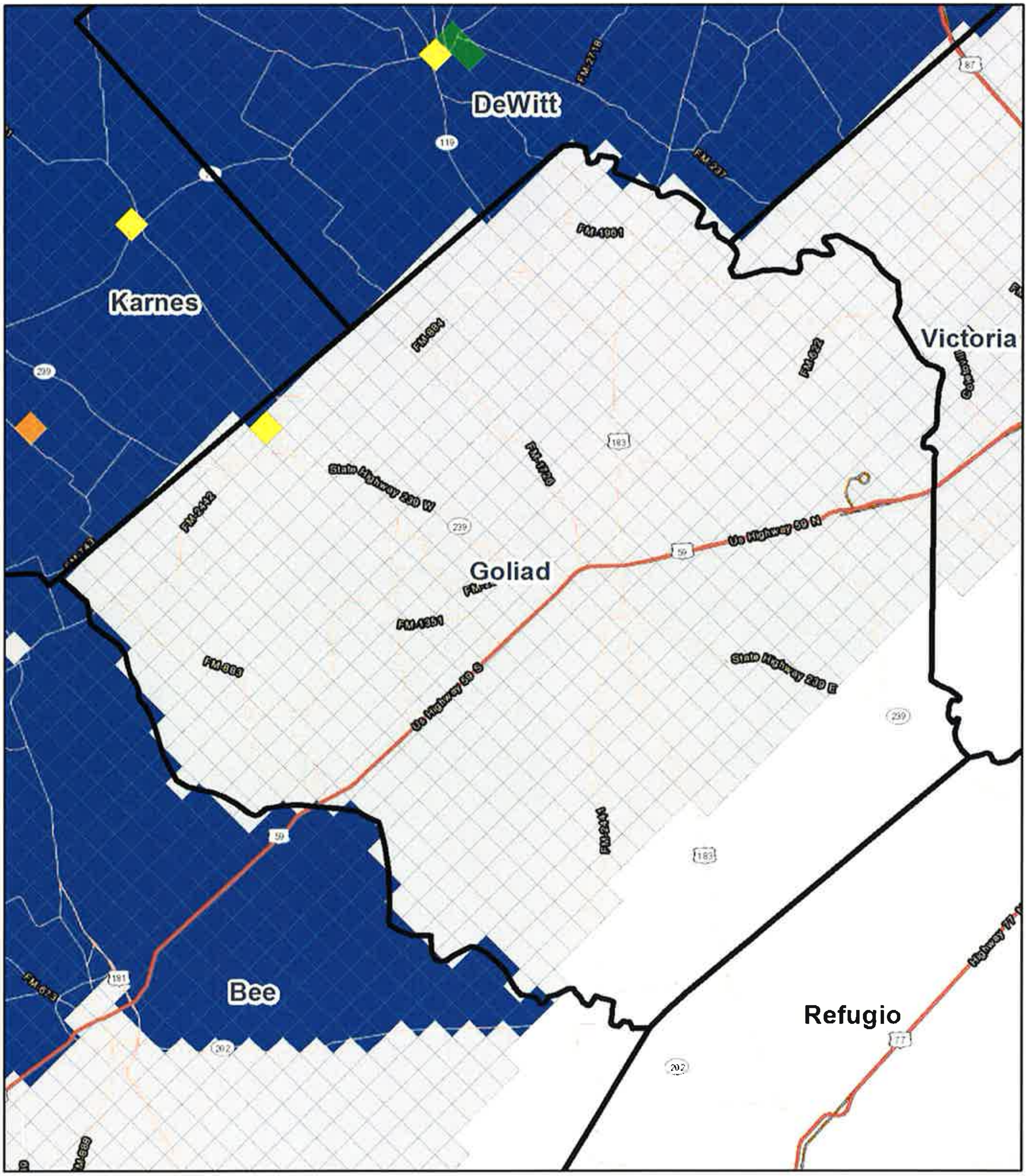
30 - 100
100 - 300
300 - 1000
1000 - 3500
County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 4 (AFY)

- No Pumping
- < 10
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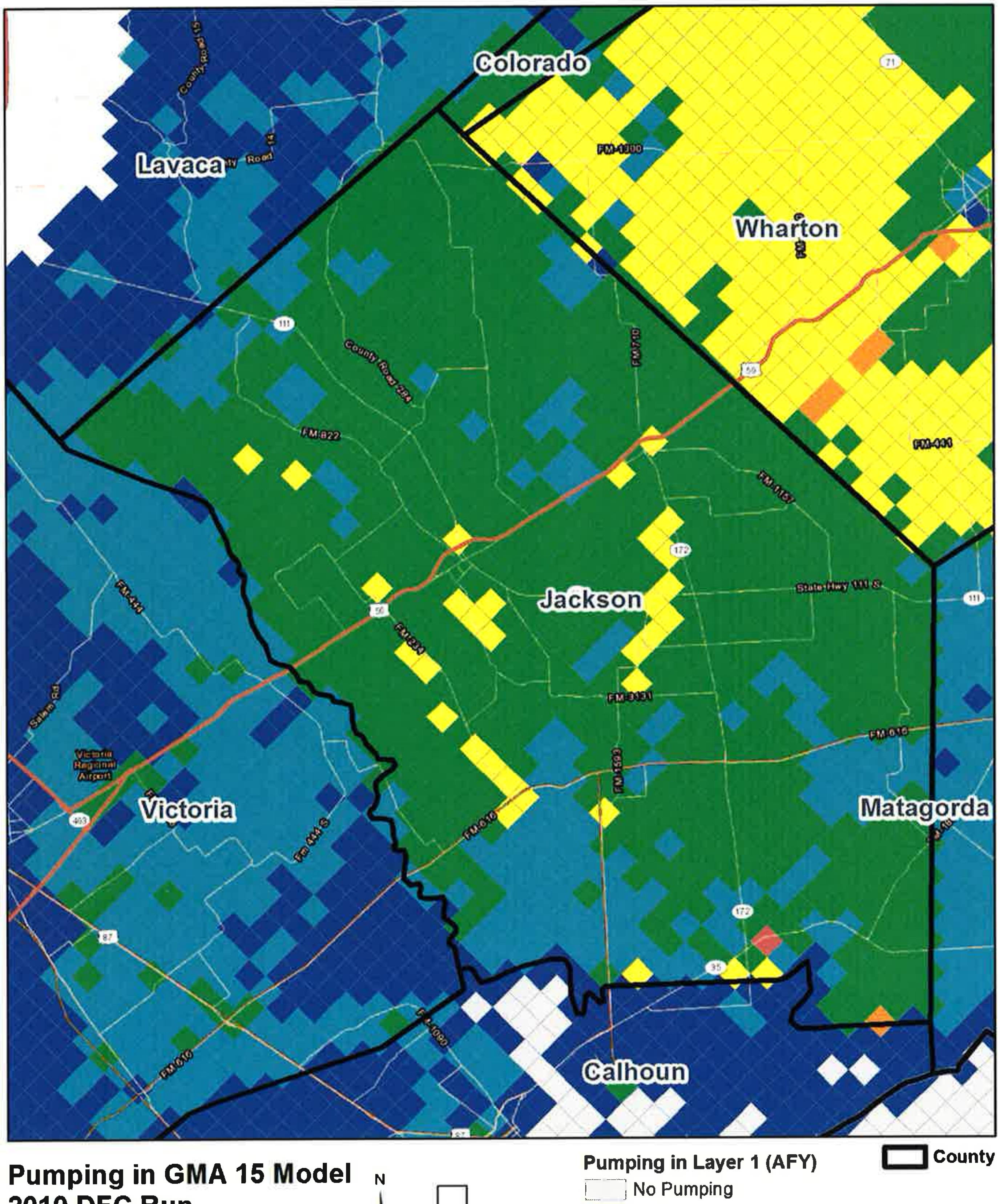
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

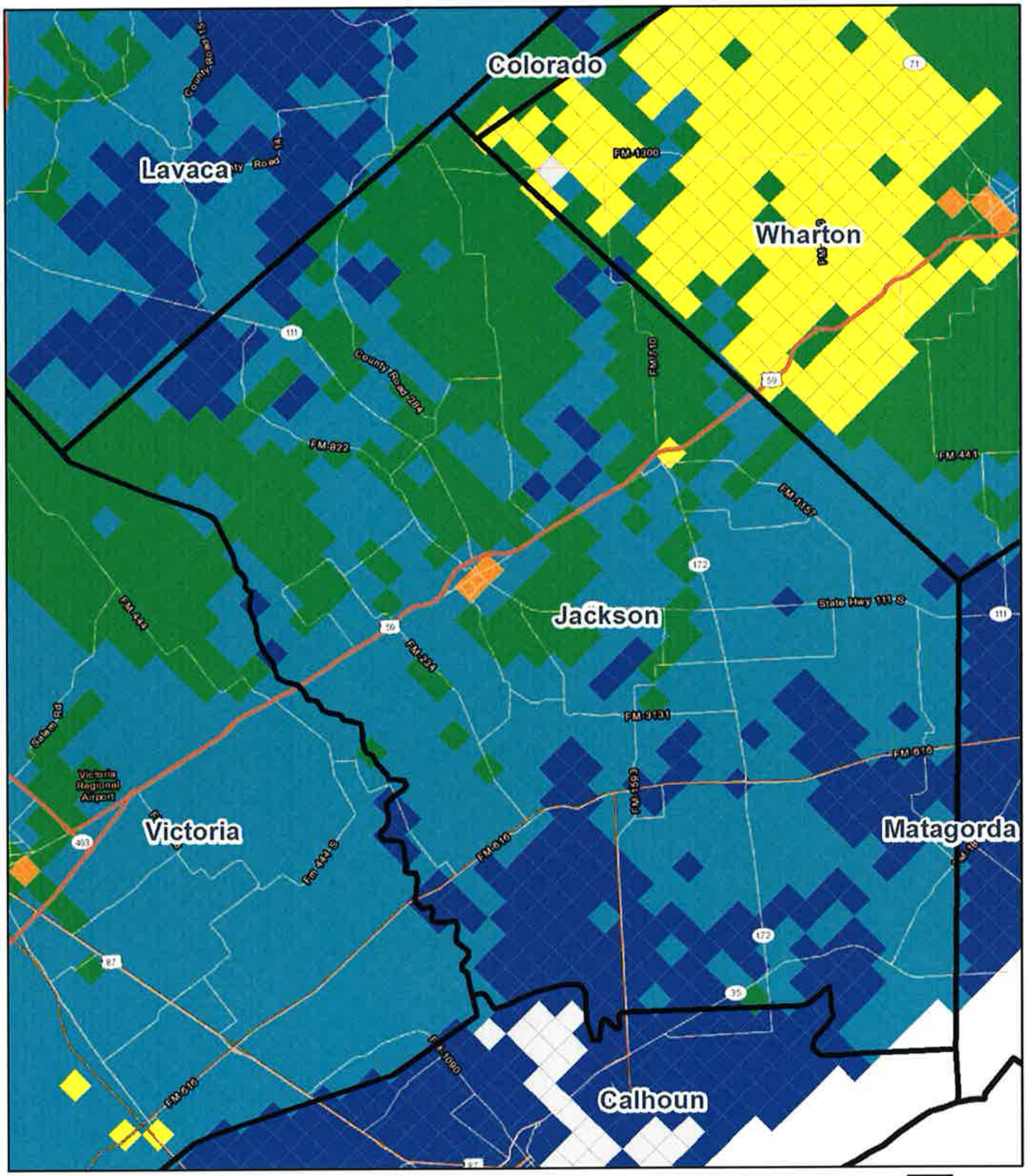
N

Location Map

County

Pumping in Layer 1 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
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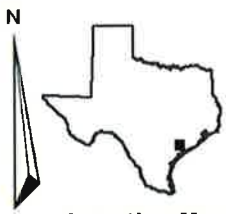
0 2.5 5 10
Miles

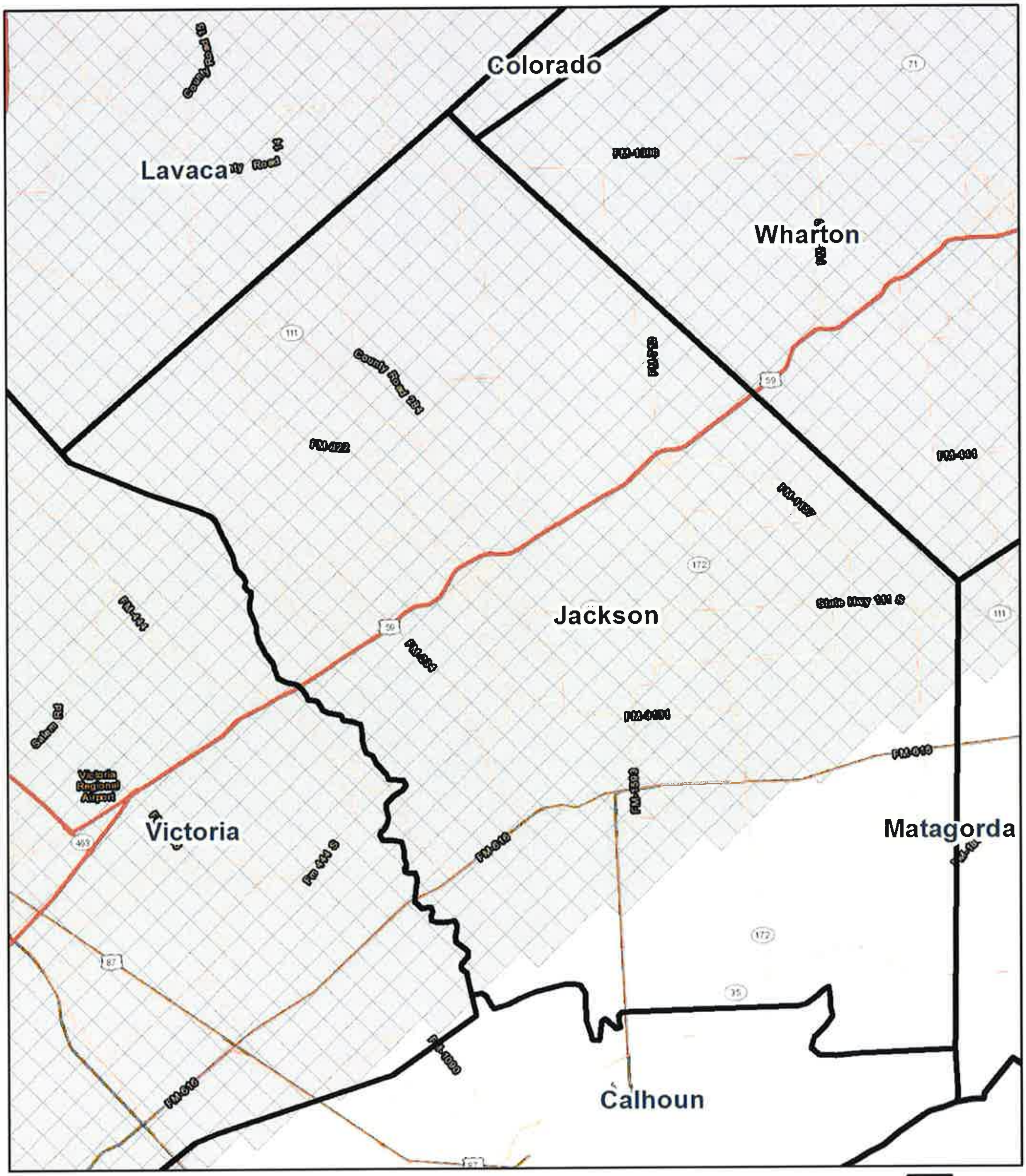


Location Map

Pumping in Layer 2 (AFY)

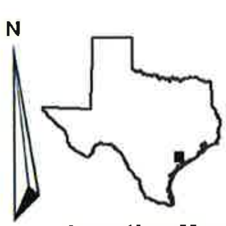
- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



0 2.5 5 10
Miles

Pumping in Layer 3 (AFY)

- No Pumping
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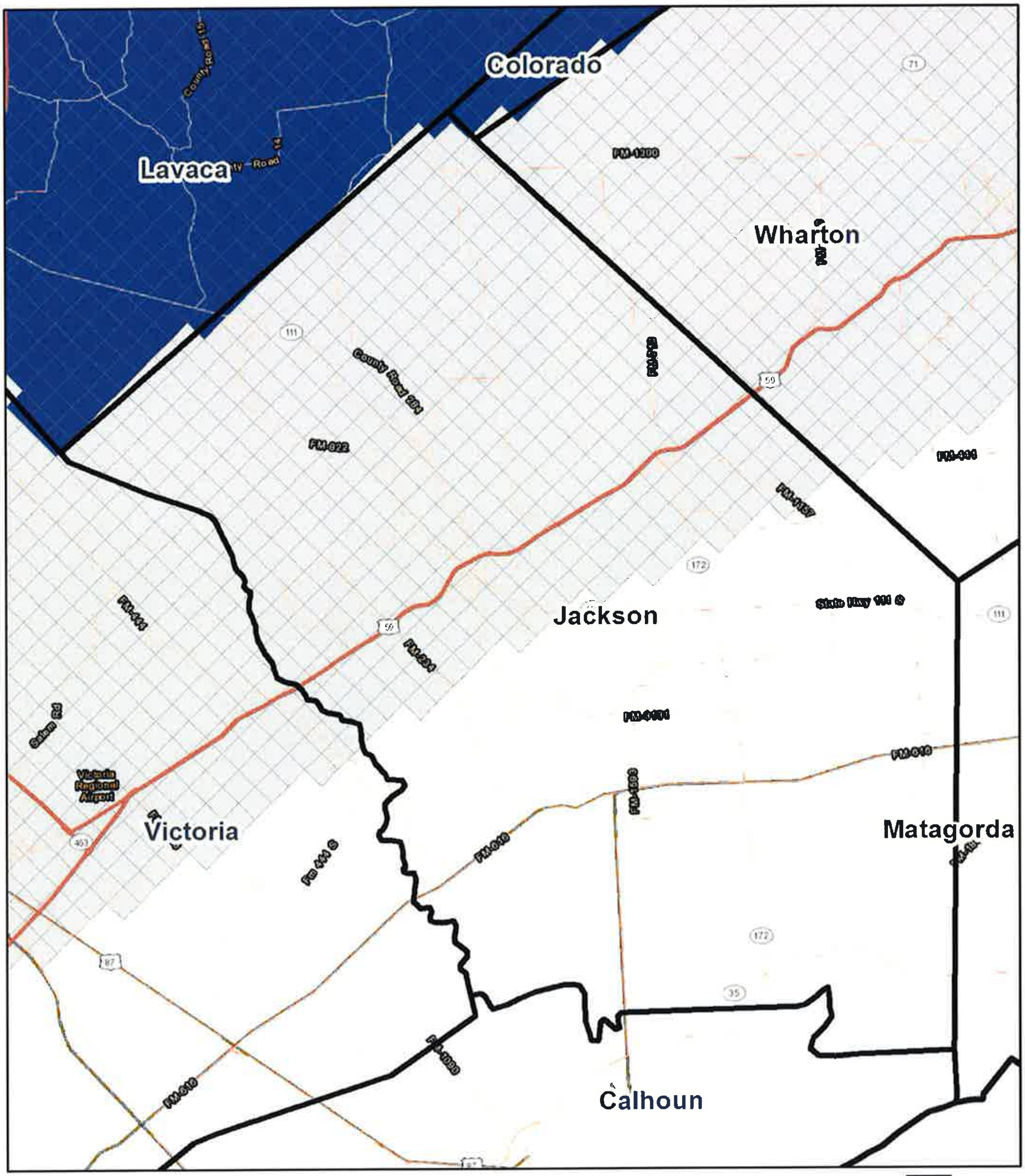
- 300 - 1000
- 1000 - 3500

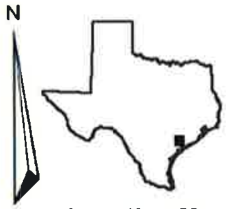
County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles



Location Map

Pumping in Layer 4 (AFY)

- No Pumping
- < 10
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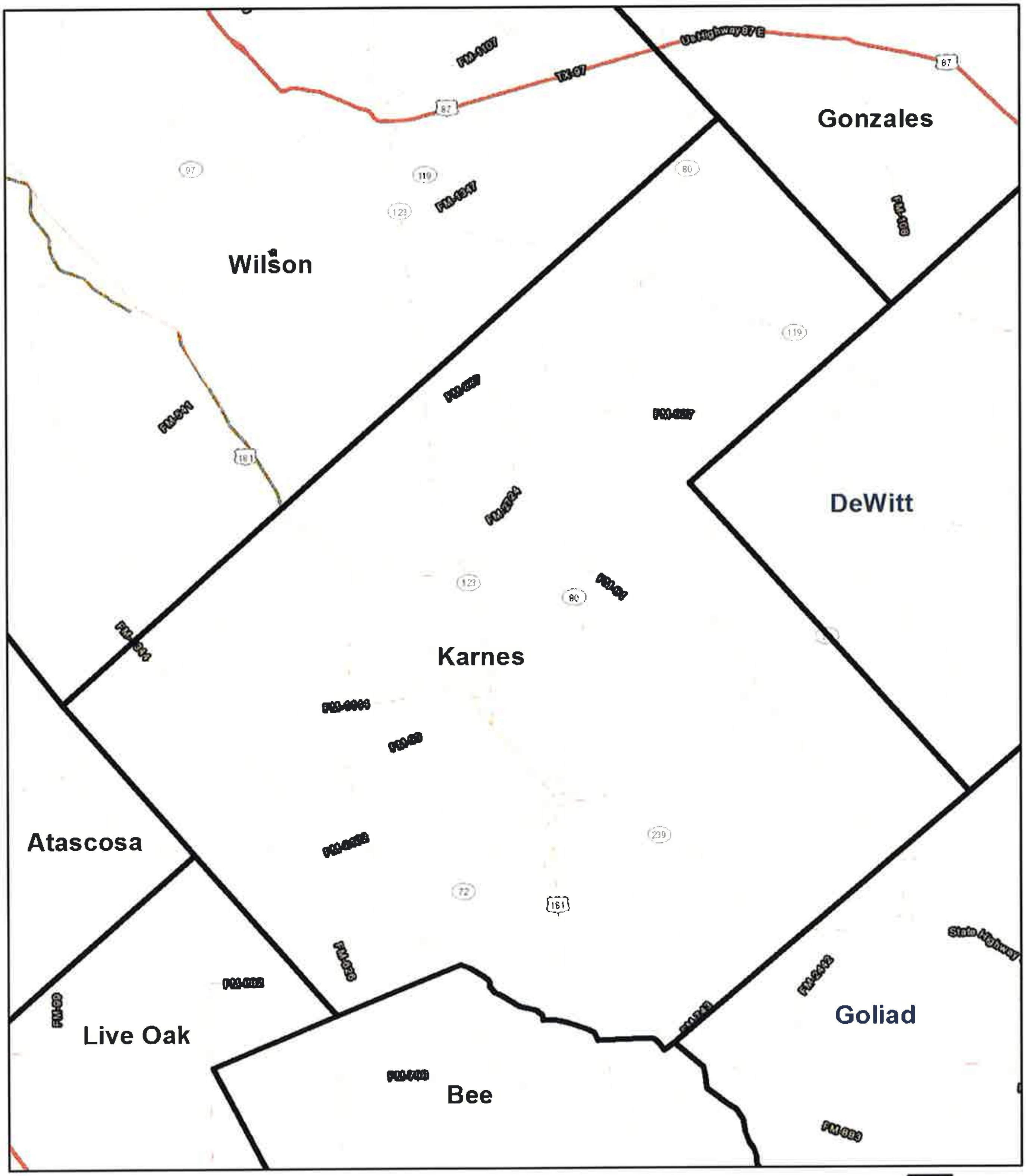
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
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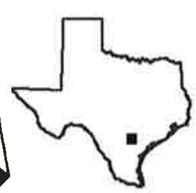
0 2.5 5 10
Miles

N

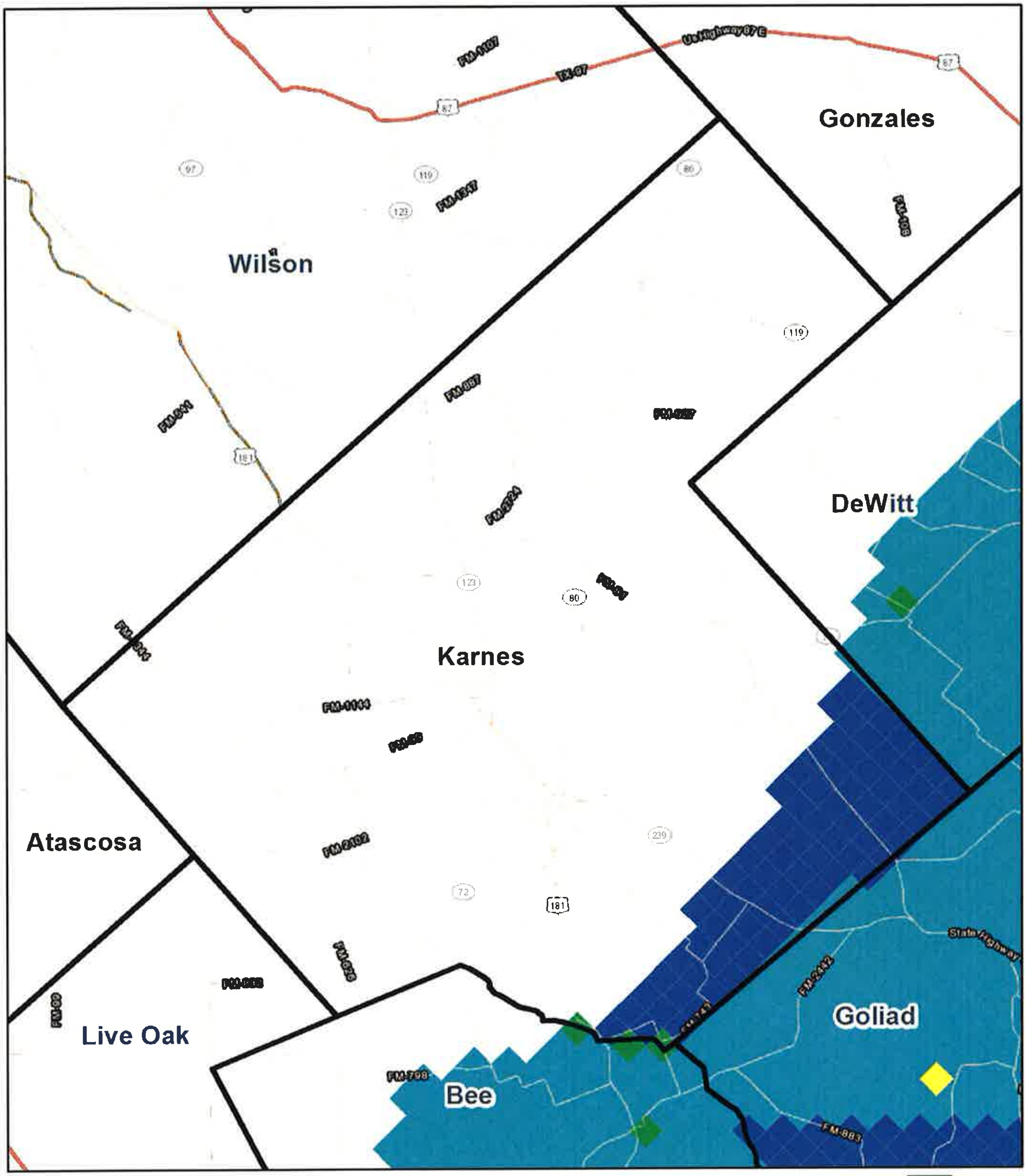


Location Map

County

Pumping in Layer 1 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
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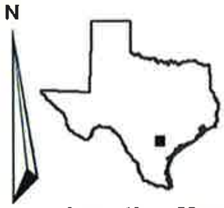
0 2.5 5 10
Miles



Pumping in Layer 2 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
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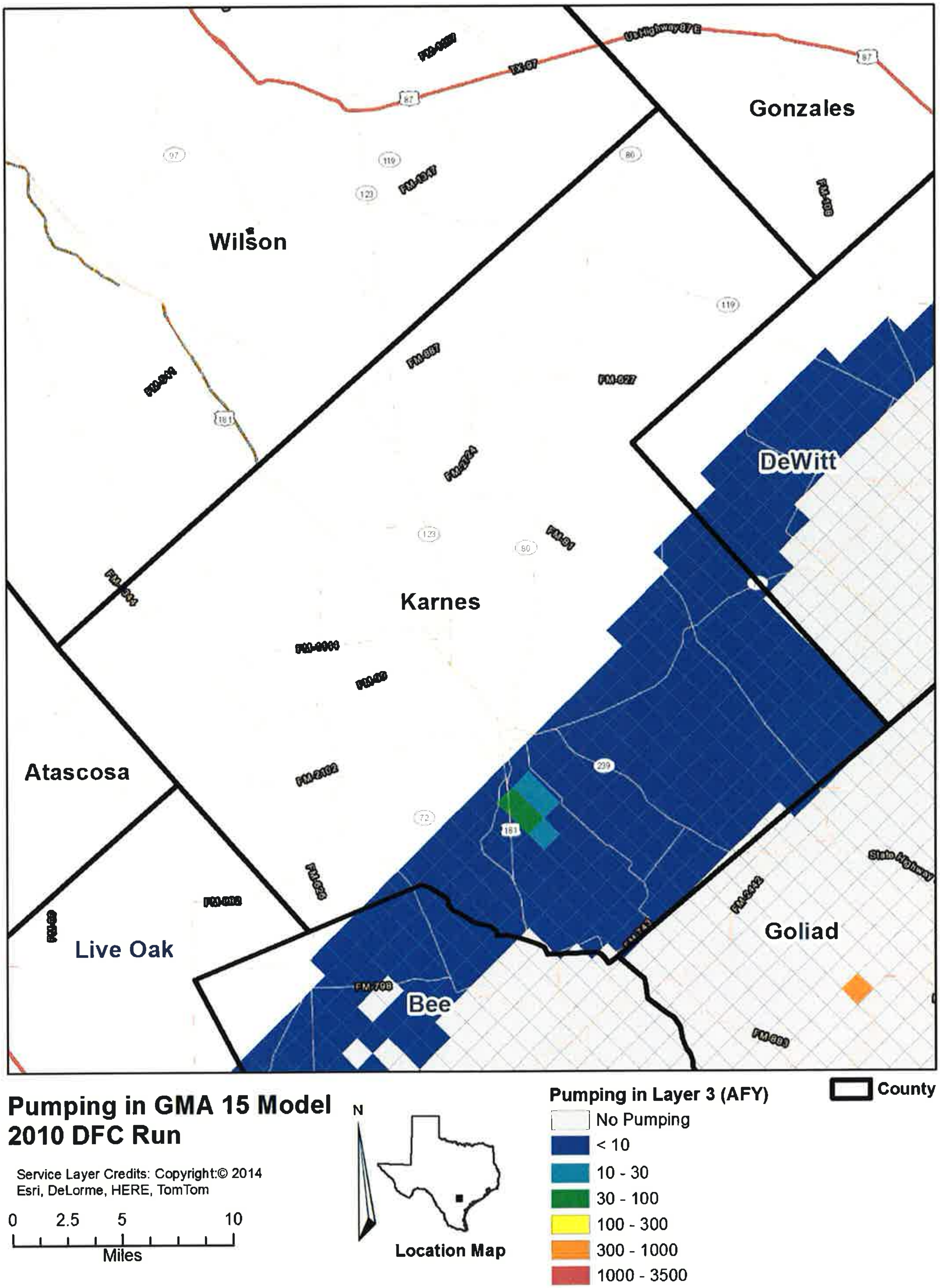
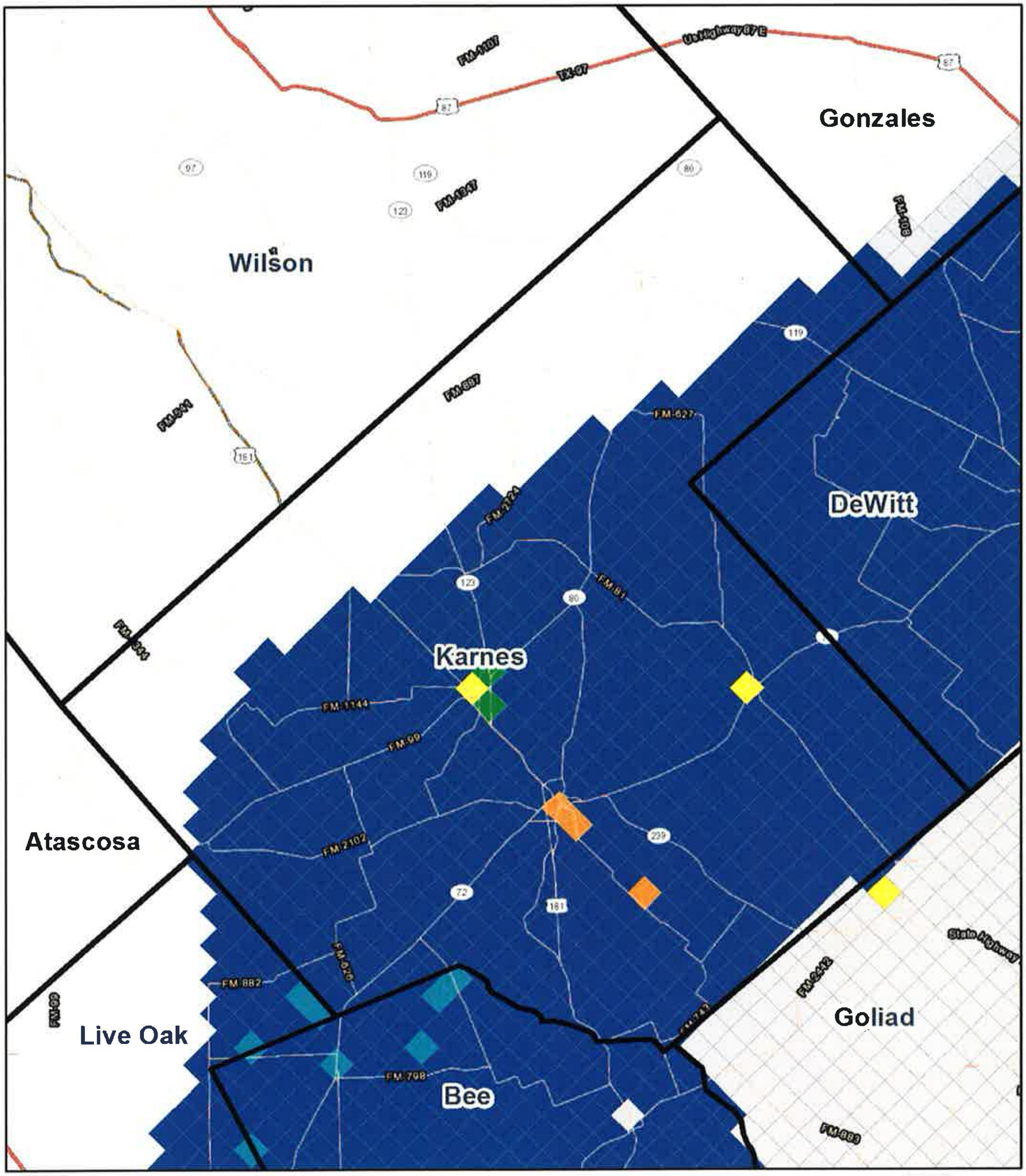
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

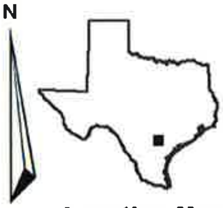
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

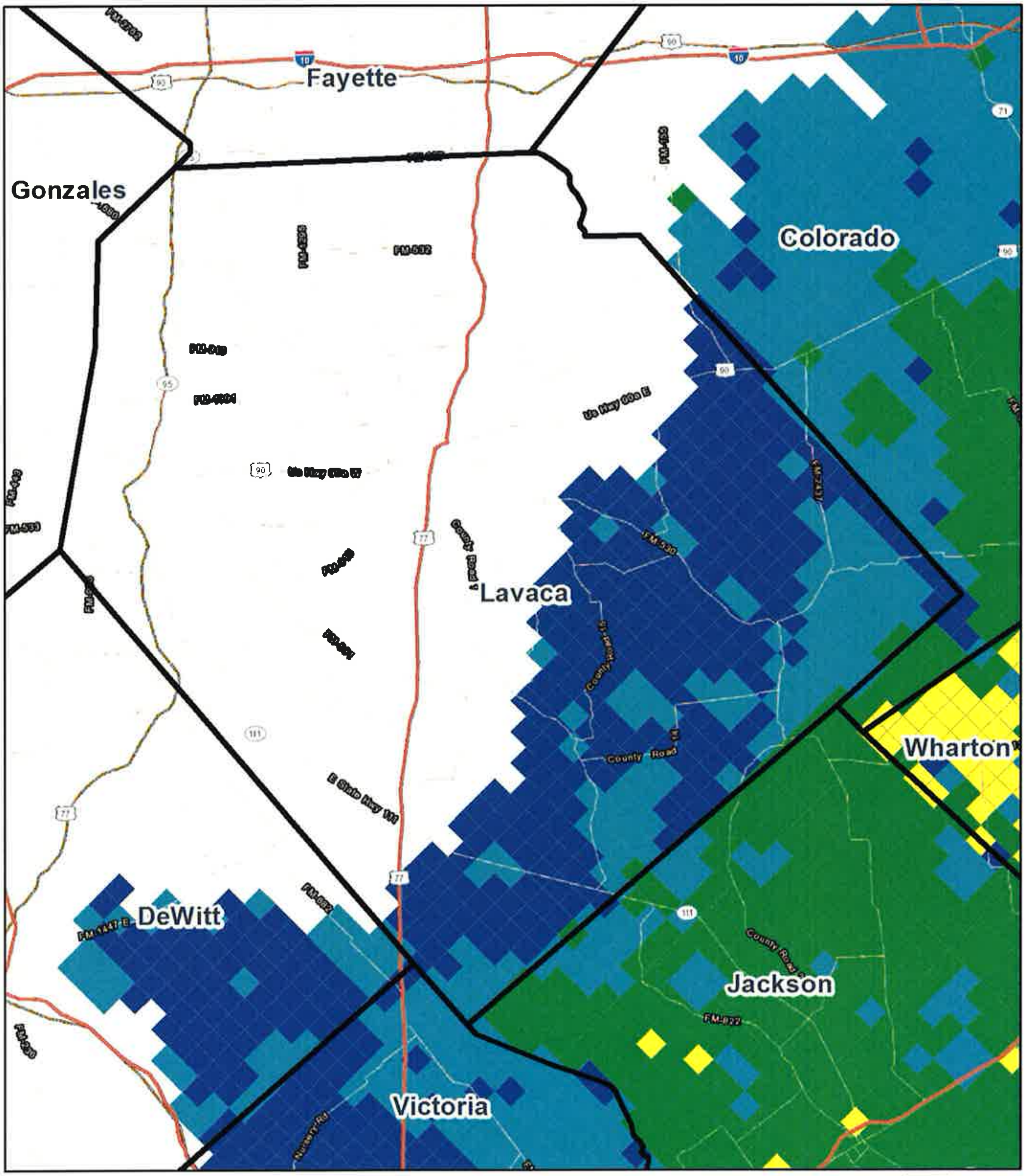


Location Map

Pumping in Layer 4 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

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Pumping in Layer 1 (AFY)

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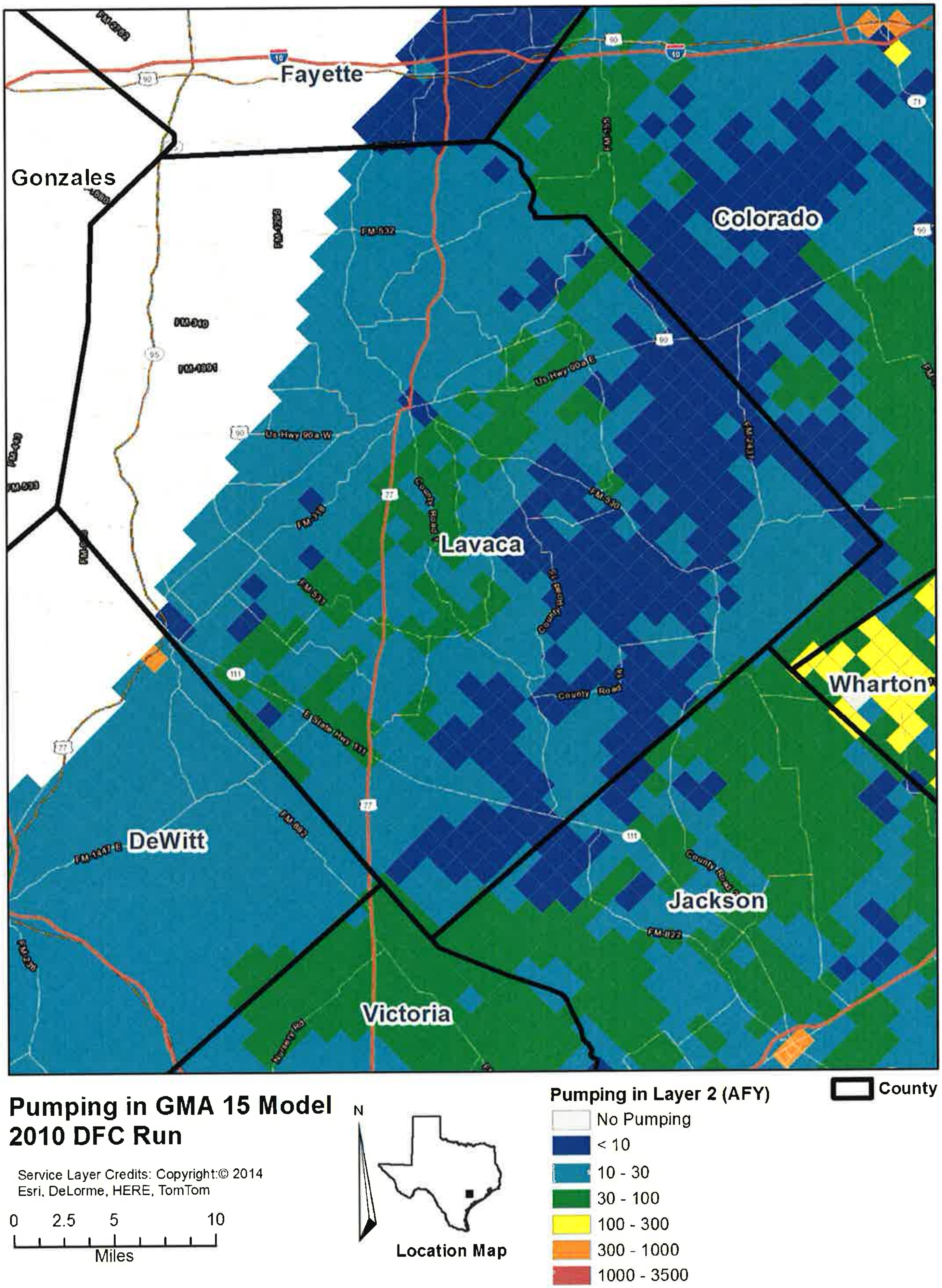
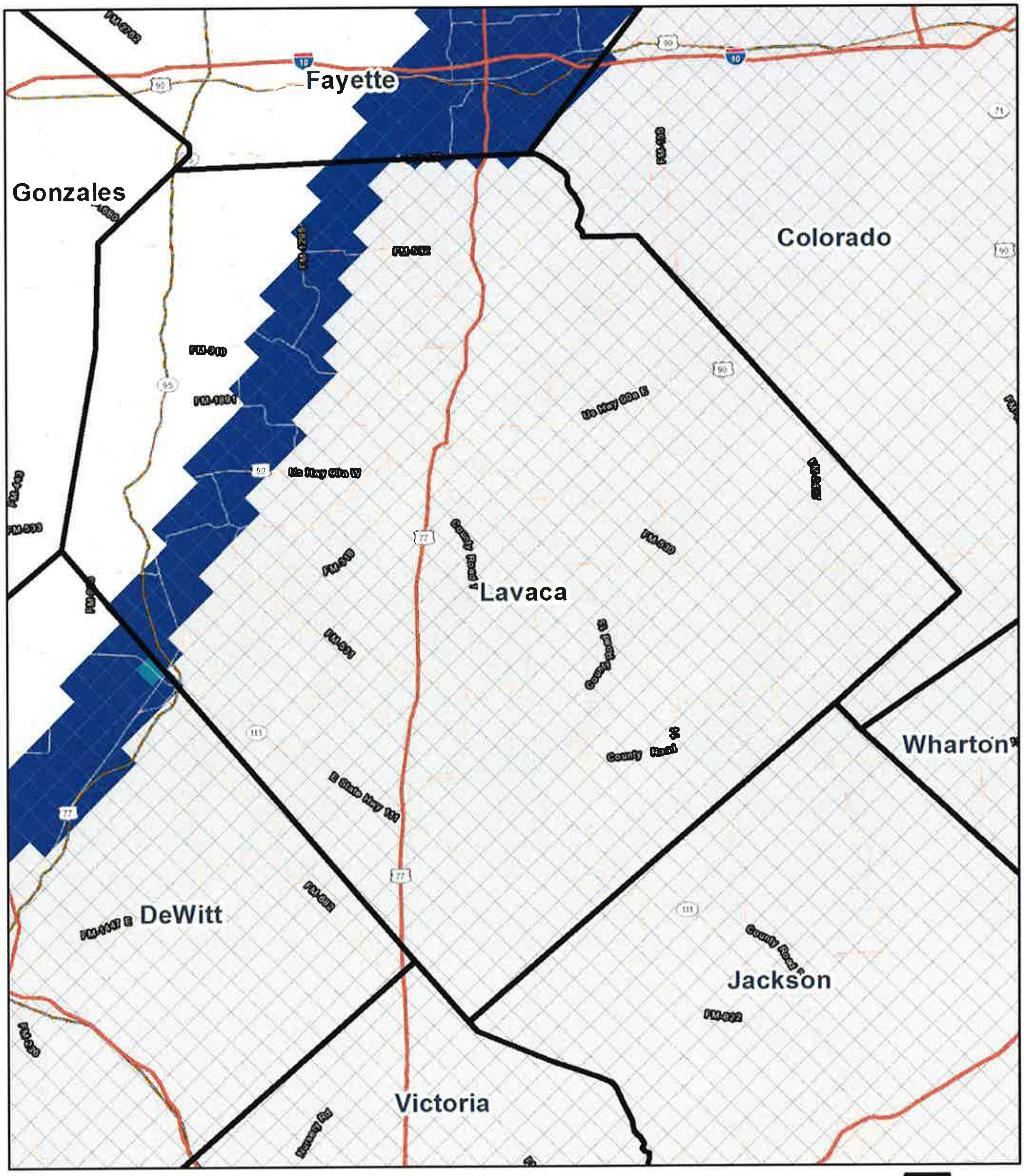
County



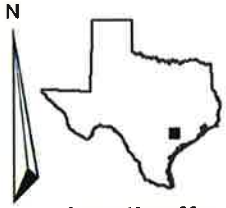
Pumping in GMA 15 Model 2010 DFC Run



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles



Pumping in Layer 3 (AFY)

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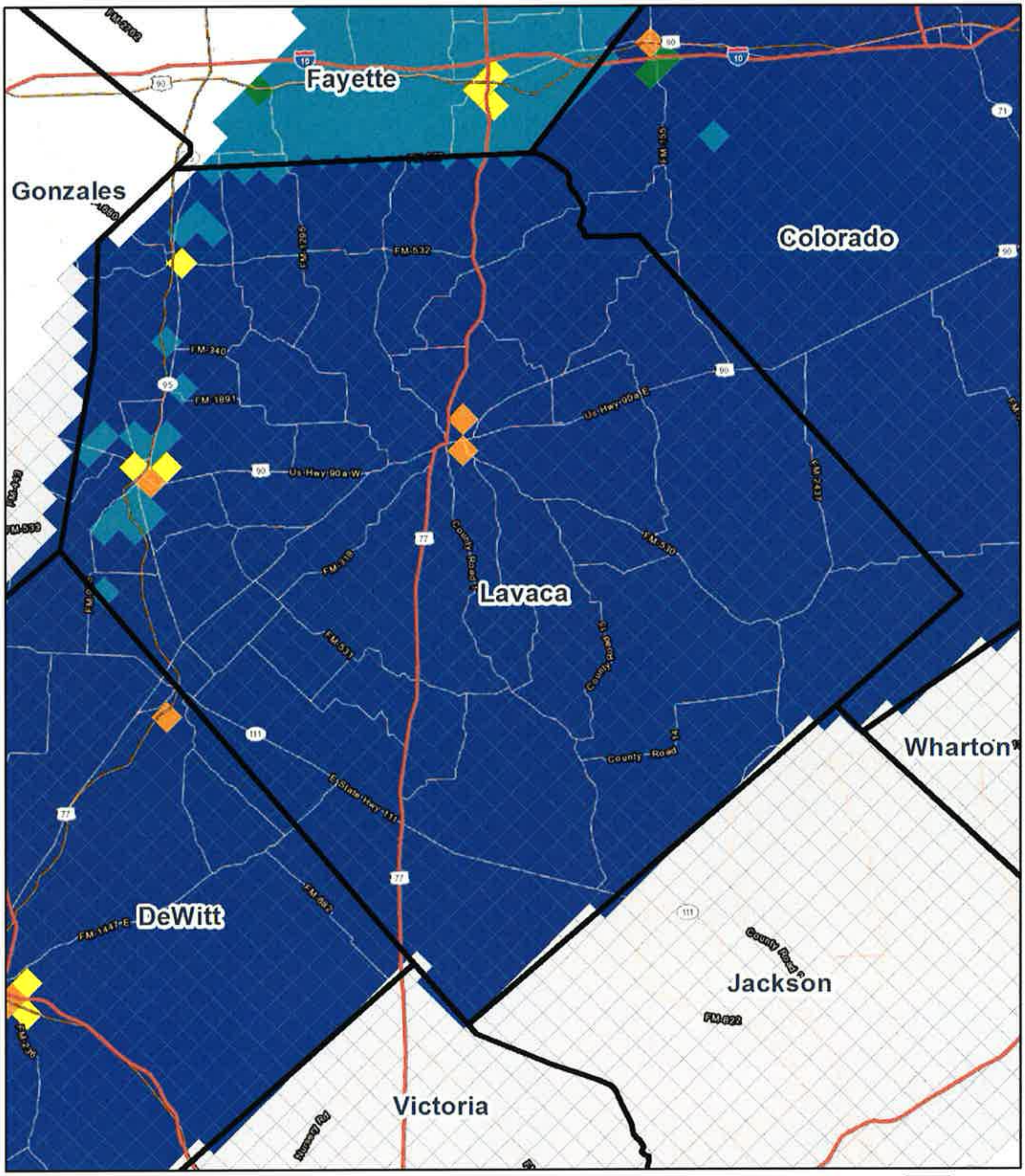
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 4 (AFY)

- No Pumping
- < 10
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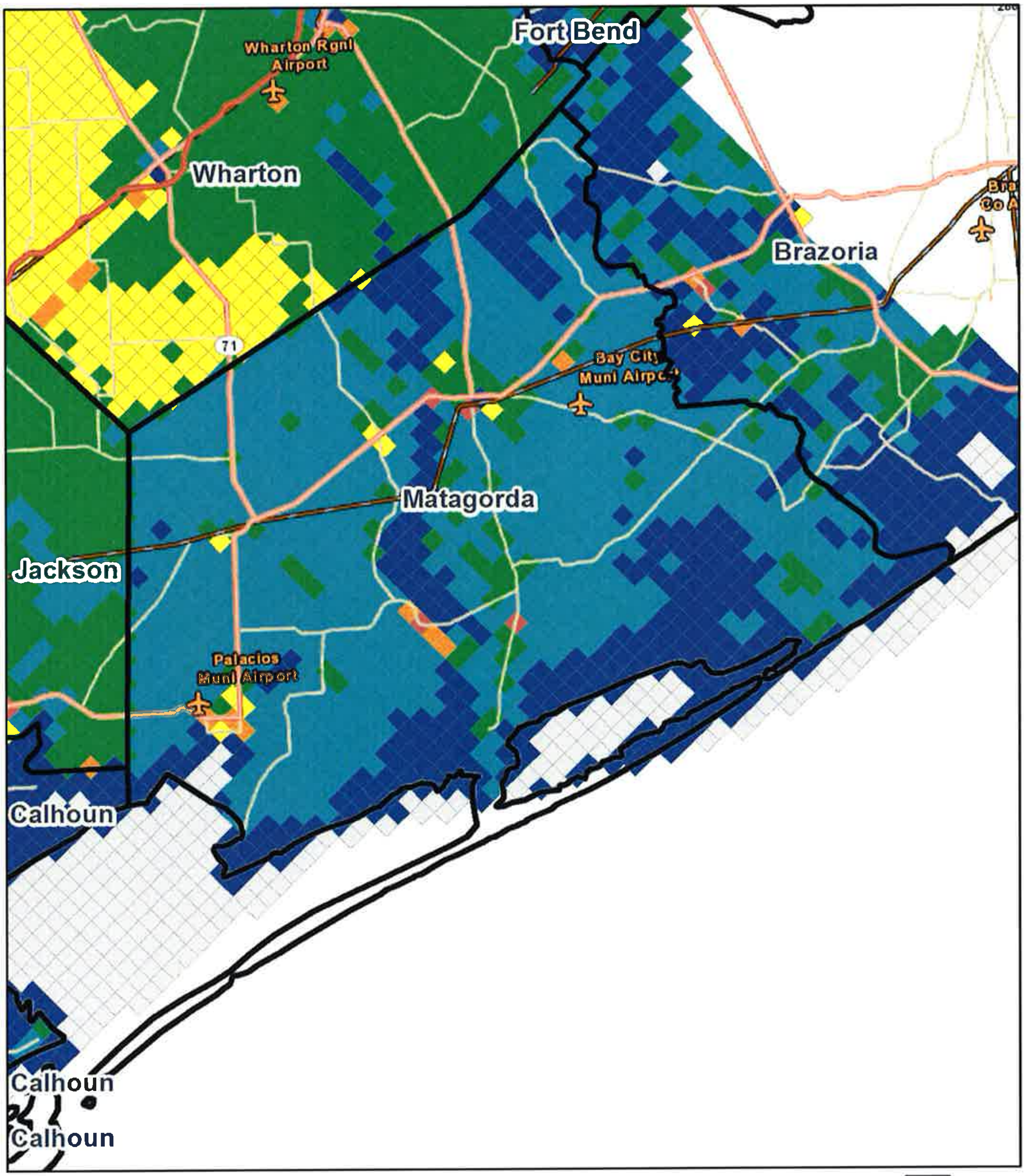
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

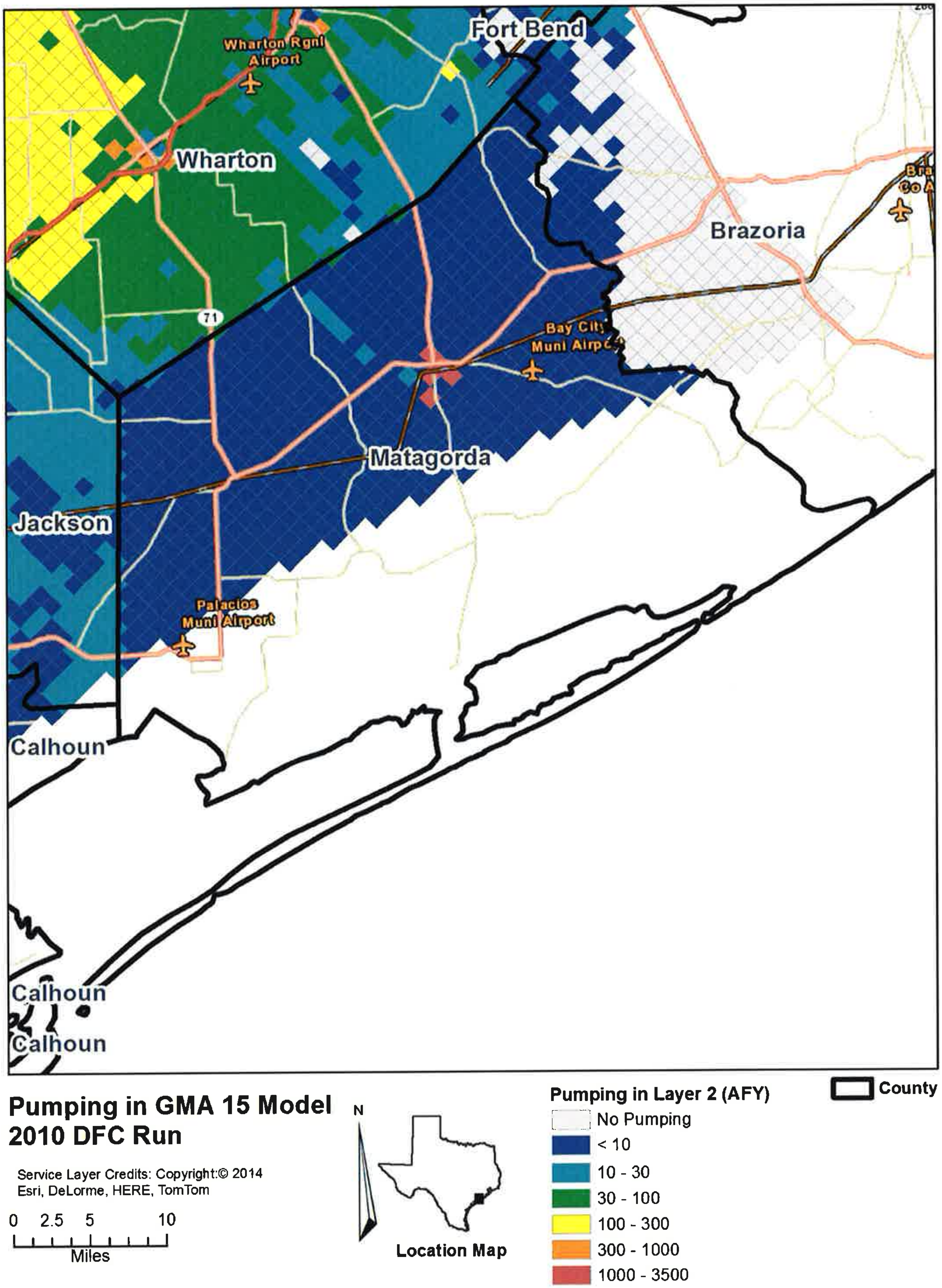
0 2.5 5 10
Miles

N

Location Map

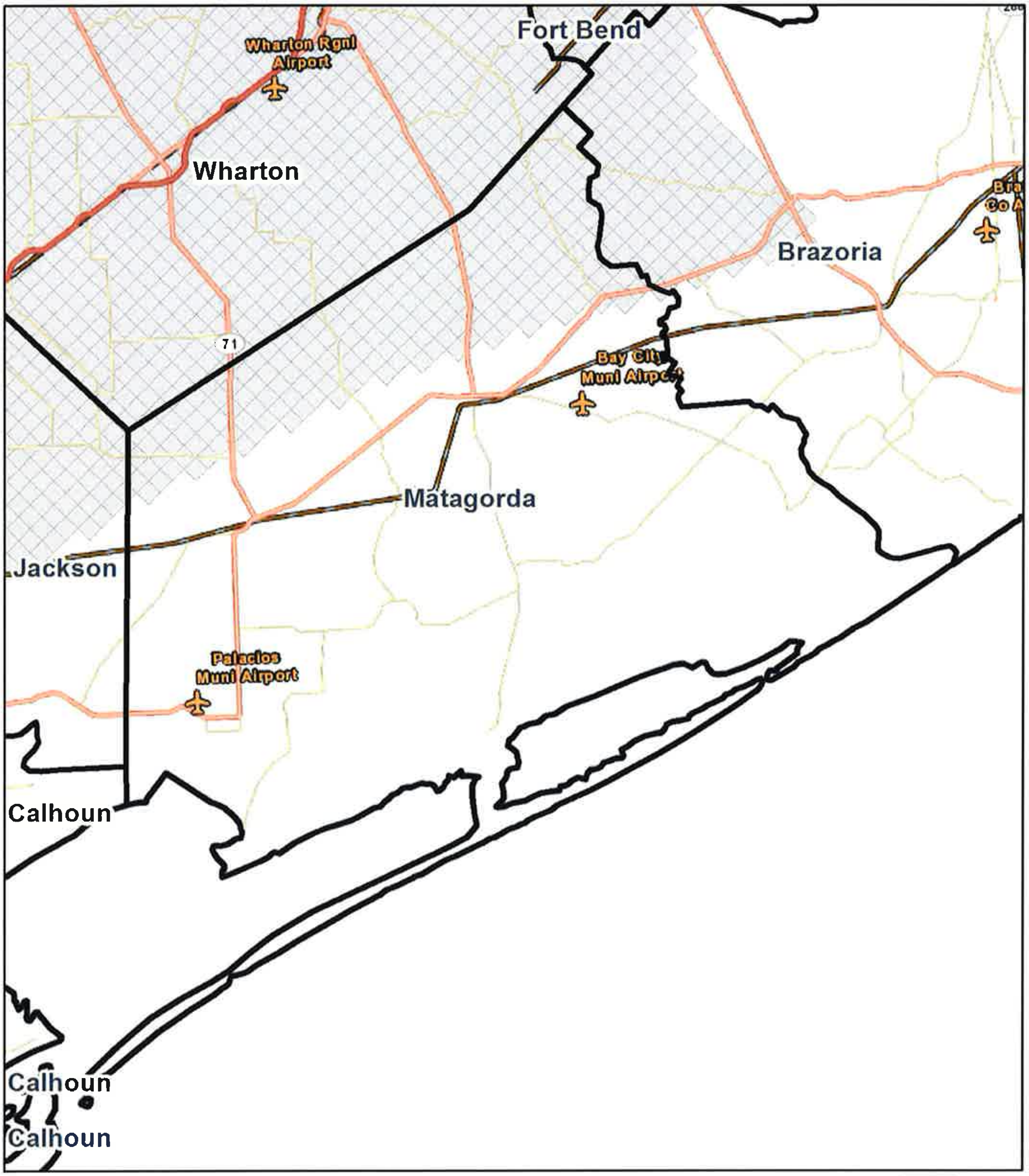
Pumping in Layer 1 (AFY)
No Pumping
< 10
10 - 30
30 - 100
100 - 300
300 - 1000
1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

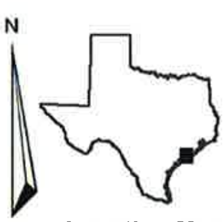
Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles



Location Map

Pumping in Layer 3 (AFY)

- No Pumping
- < 10
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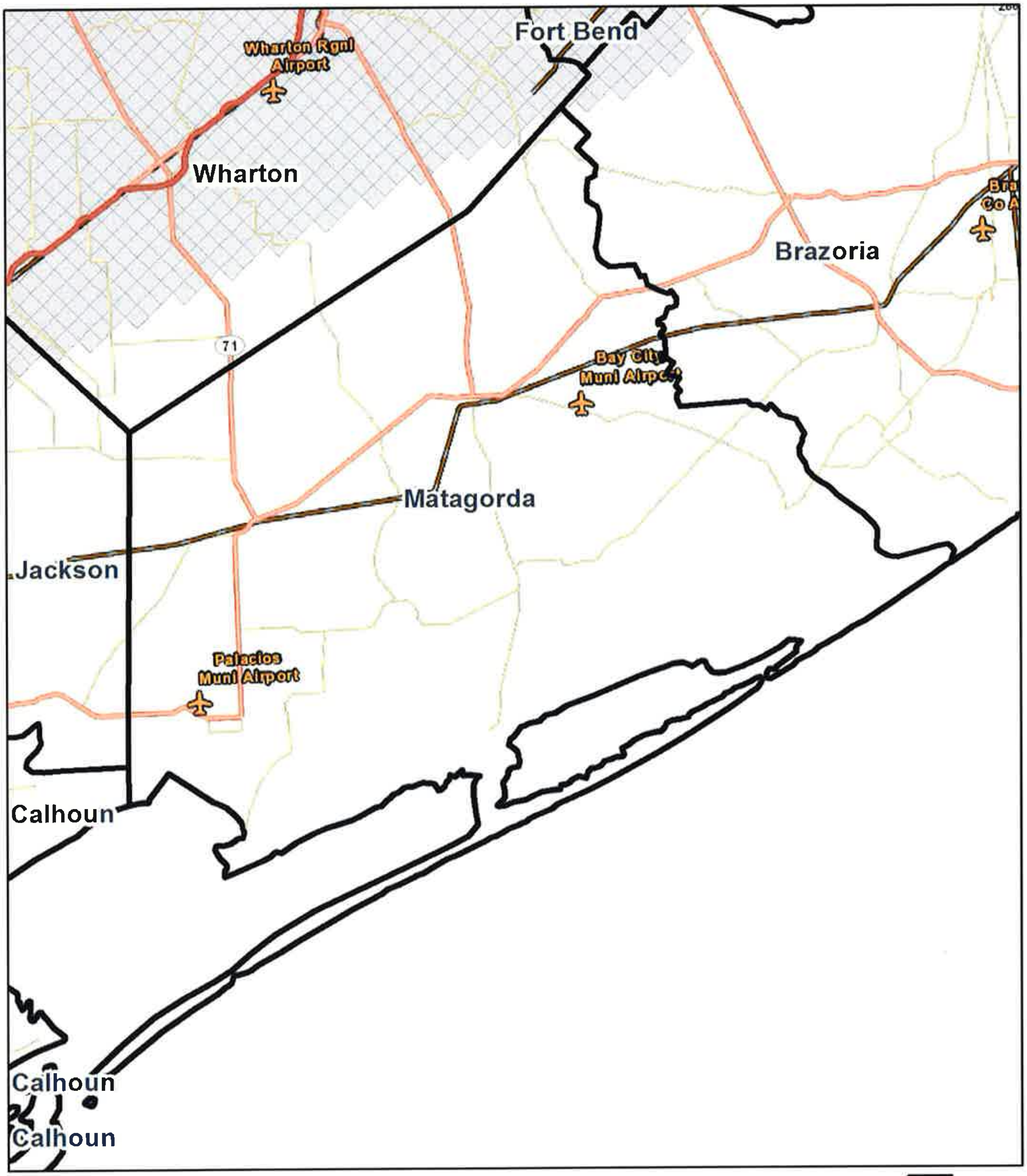
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

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0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 4 (AFY)

- No Pumping
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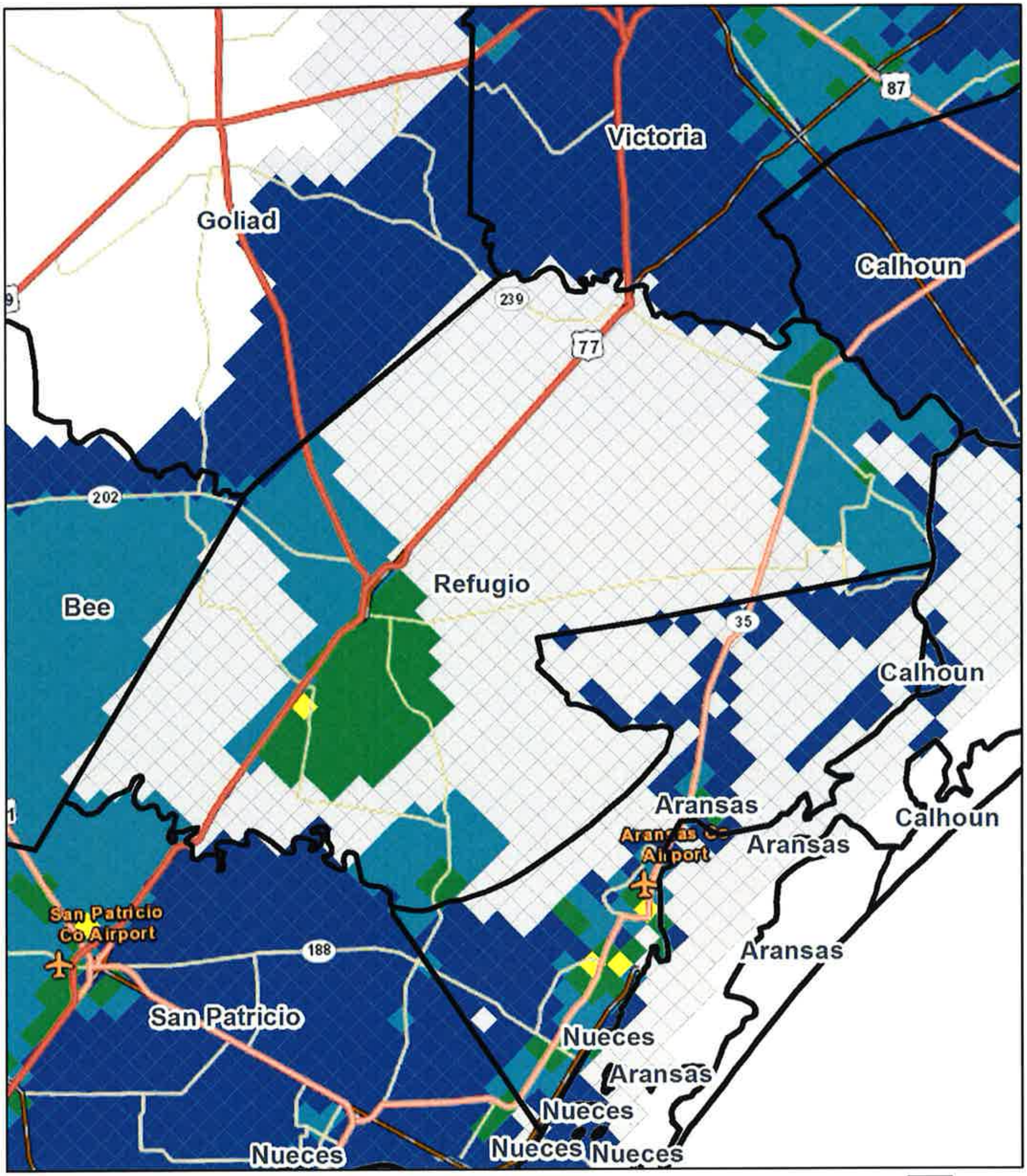
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 1 (AFY)

- No Pumping
- < 10
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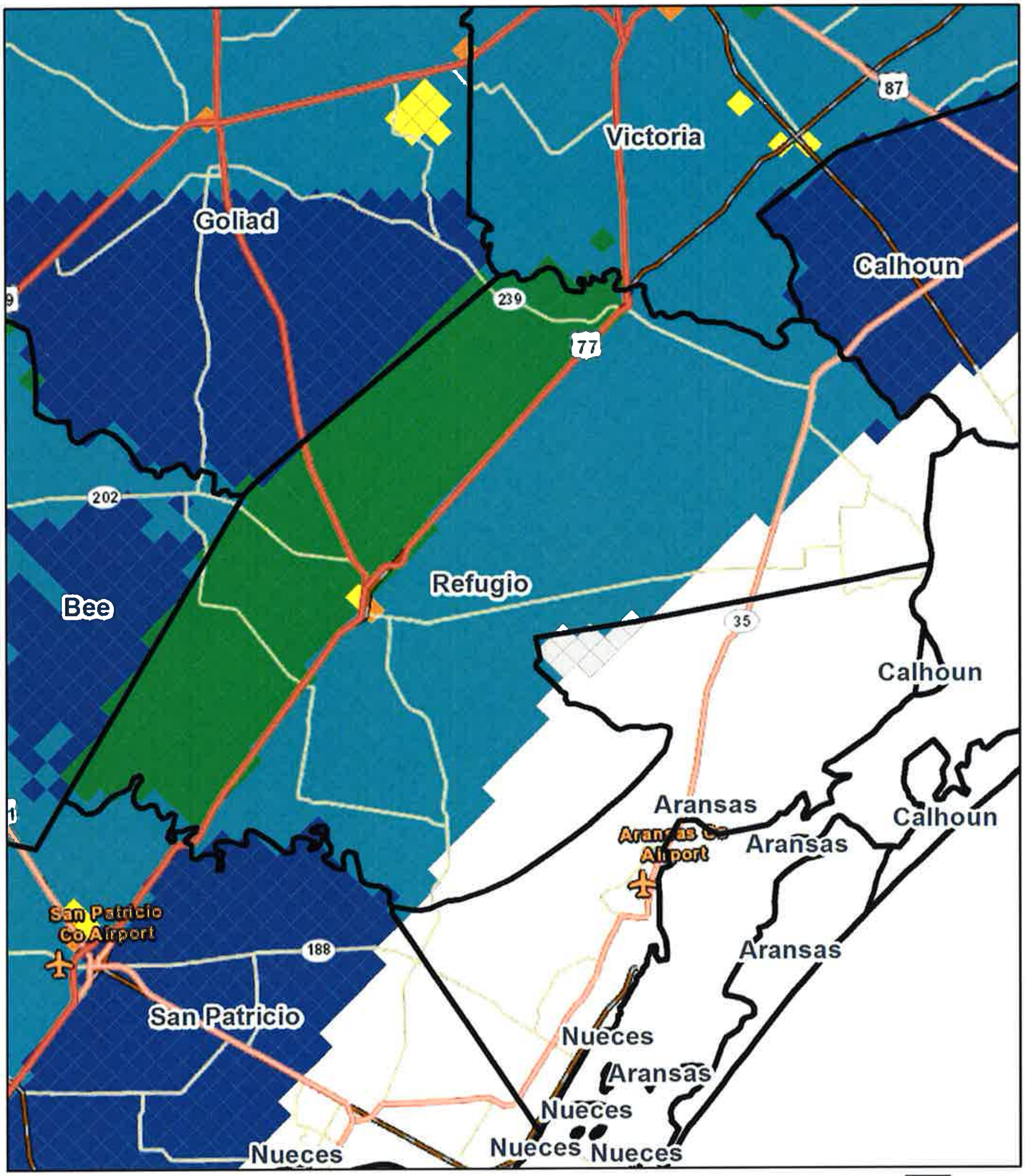
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 2 (AFY)

- No Pumping
- < 10
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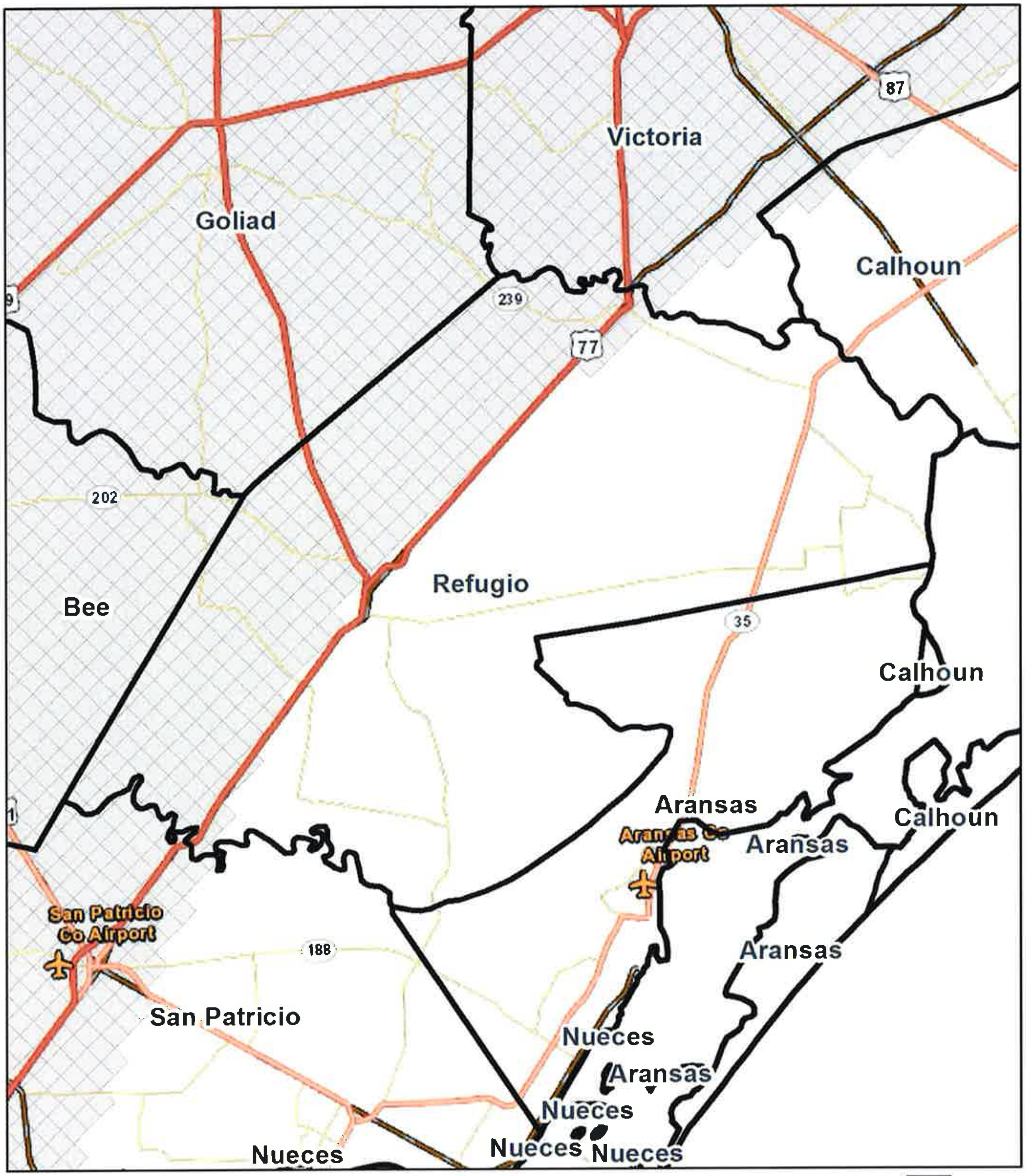
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

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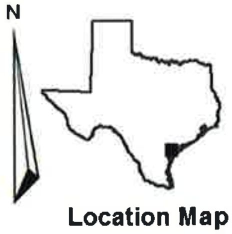
Esri, DeLorme, HERE, TomTom



Pumping in Layer 3 (AFY)

- No Pumping
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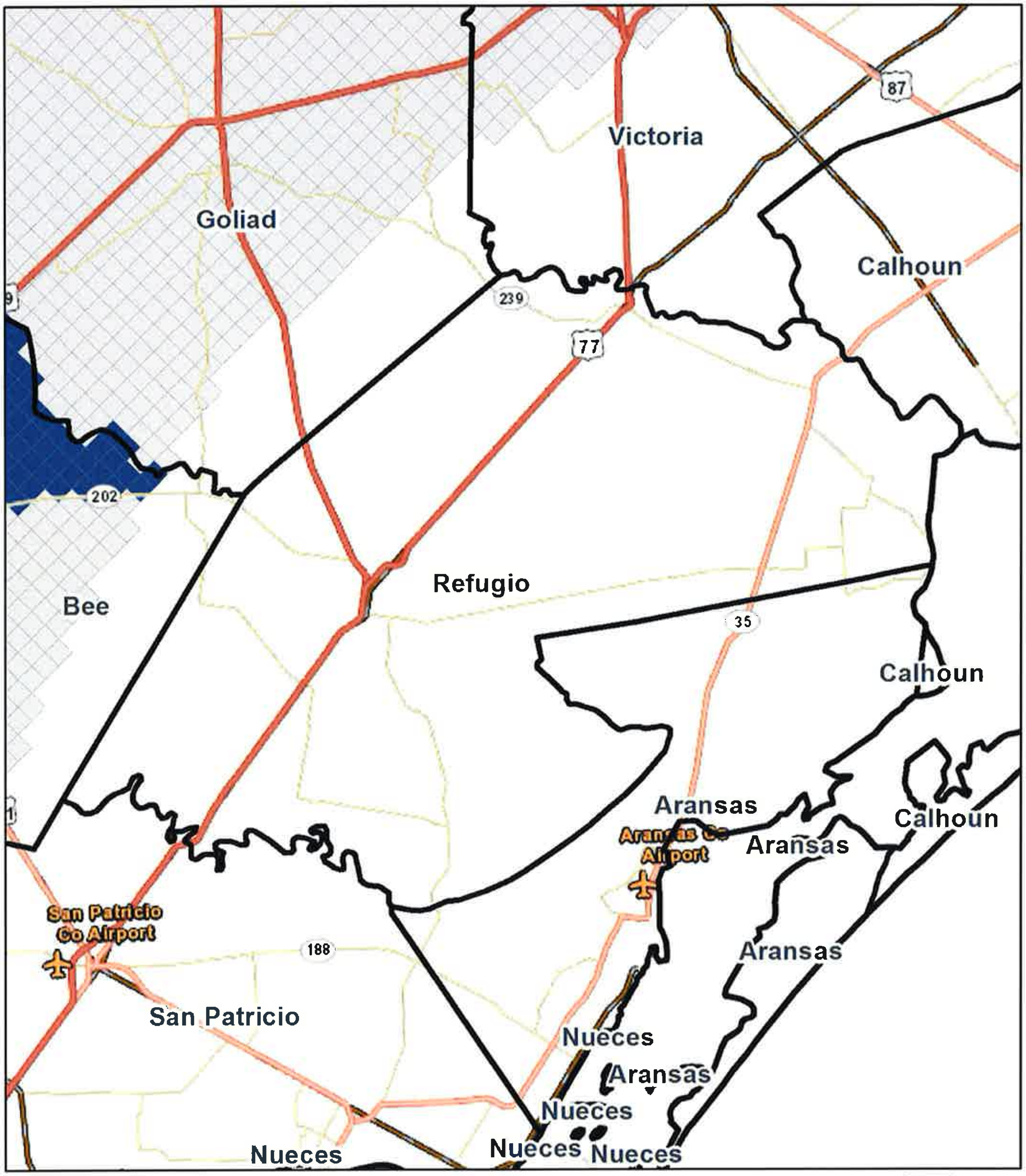
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
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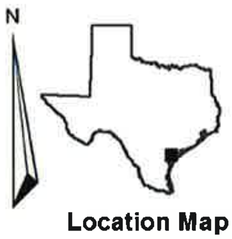
0 2.5 5 10
Miles



Pumping in Layer 4 (AFY)

- No Pumping
- < 10
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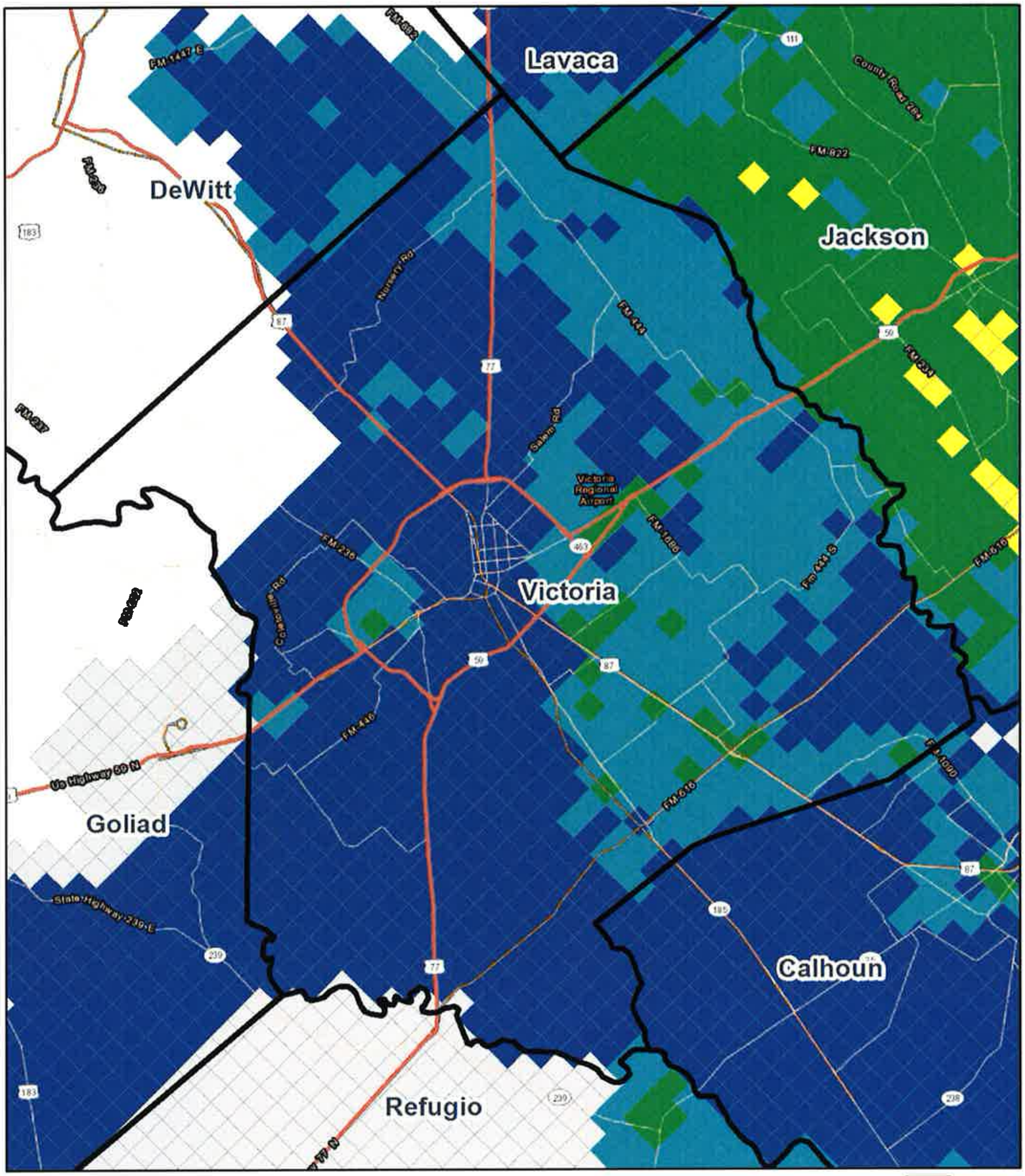
- 1000 - 3500

County



Pumping in GMA 15 Model
2010 DFC Run

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0 2.5 5 10
Miles

N

Location Map

Pumping in Layer 1 (AFY)

- No Pumping
- < 10
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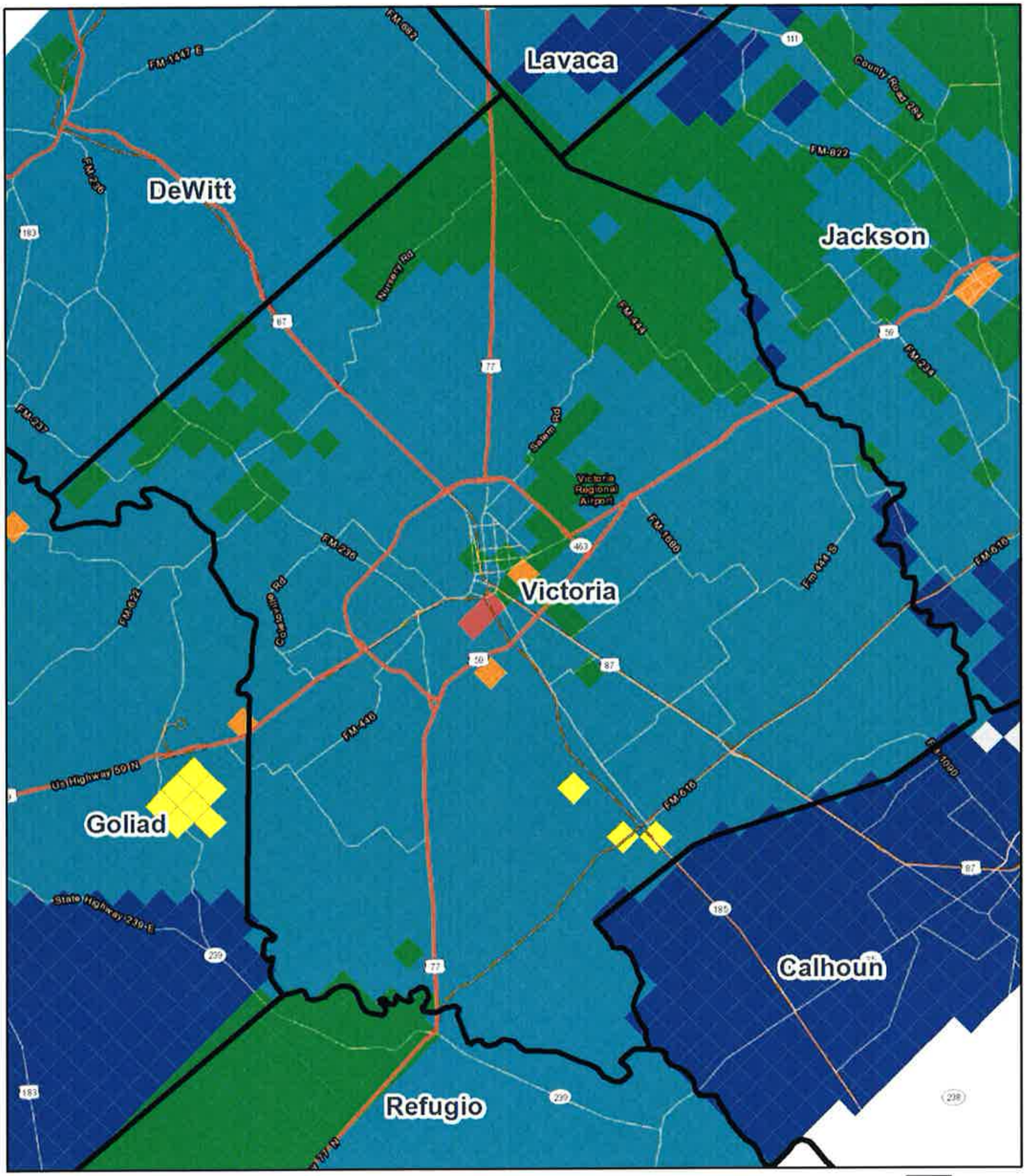
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

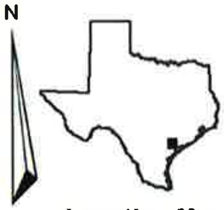
County



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles



Location Map

Pumping in Layer 2 (AFY)

- No Pumping
- < 10
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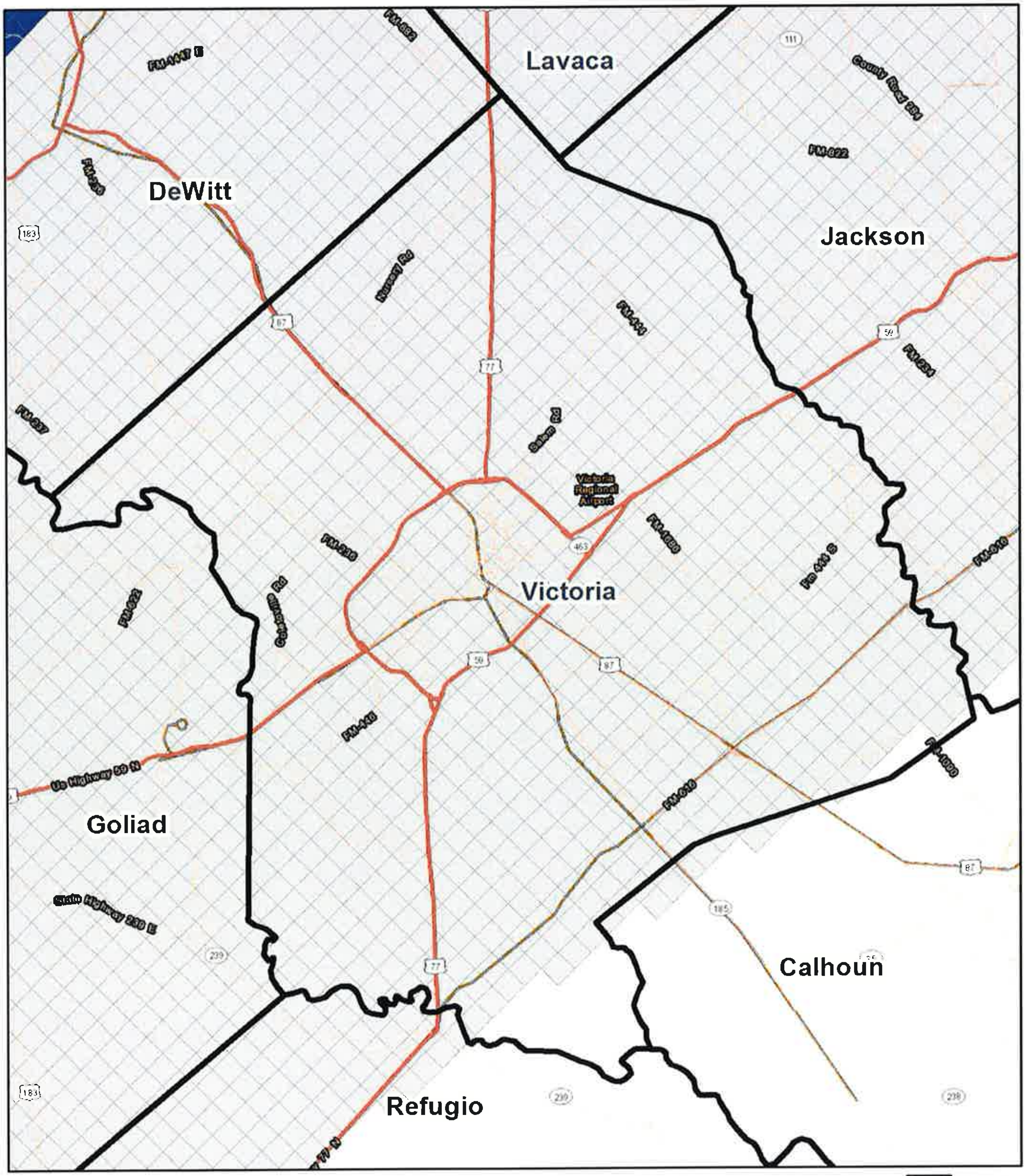
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

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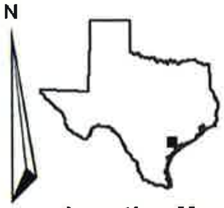
0 2.5 5 10
Miles



Location Map

Pumping in Layer 3 (AFY)

- No Pumping
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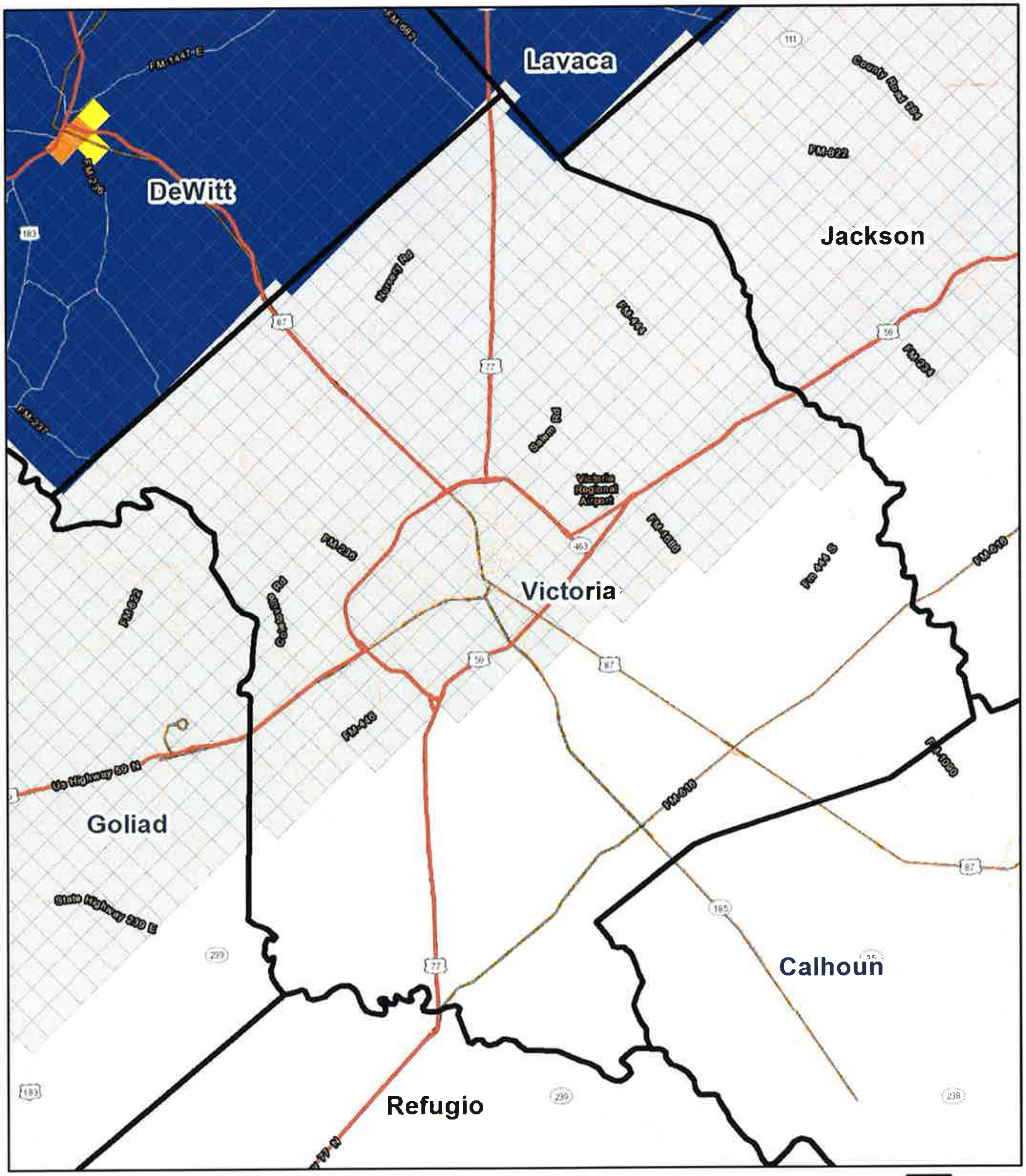
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

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Pumping in Layer 4 (AFY)

- No Pumping
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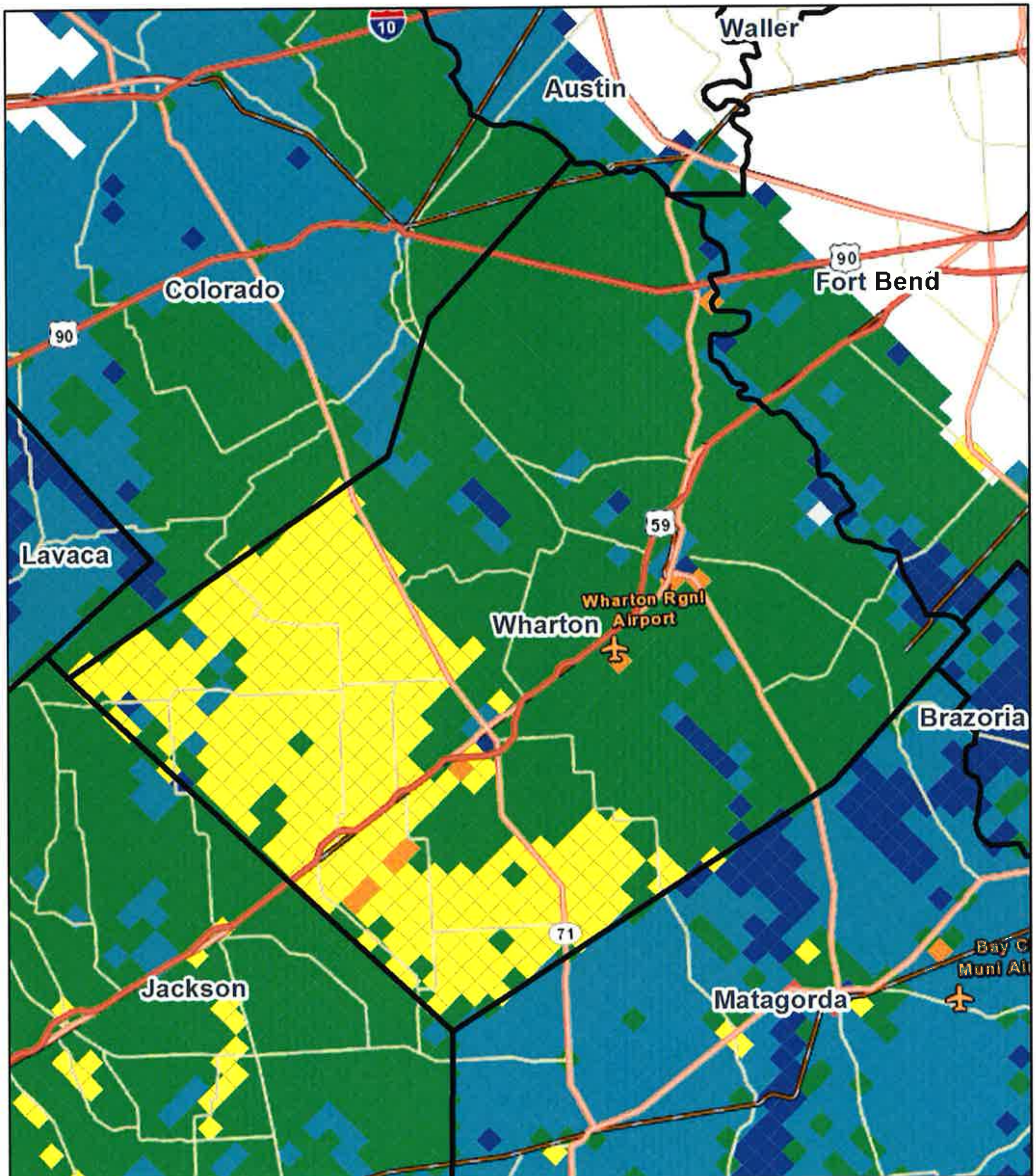
- 1000 - 3500

County



Pumping in GMA 15 Model 2010 DFC Run

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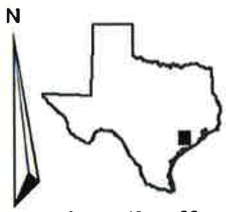
0 2.5 5 10
Miles



Location Map

Pumping in Layer 1 (AFY)

- No Pumping
- < 10
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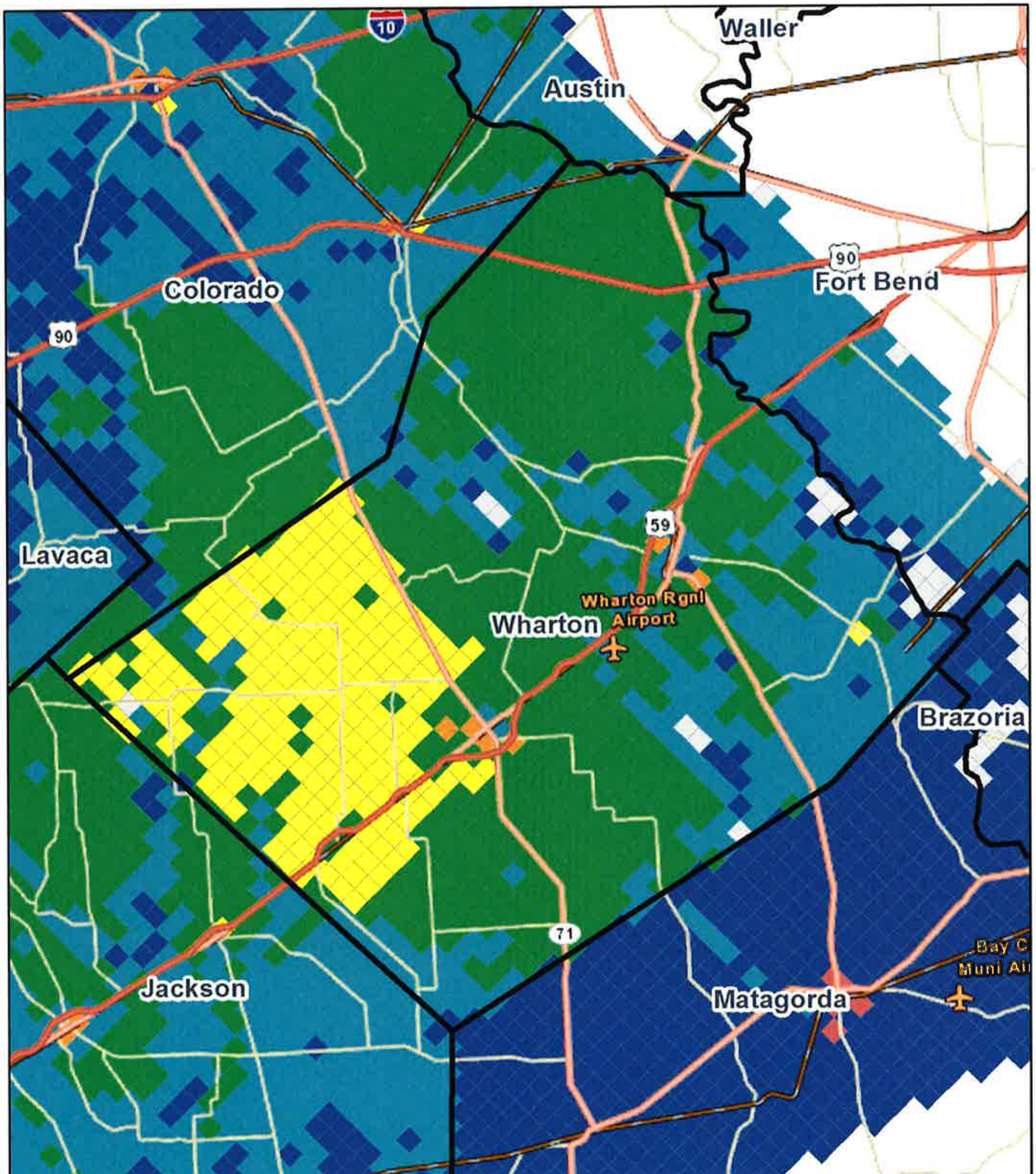
- 1000 - 3500

County



County

Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

0 2.5 5 10

Miles

N

Location Map

Pumping in Layer 2 (AFY)

No Pumping

< 10

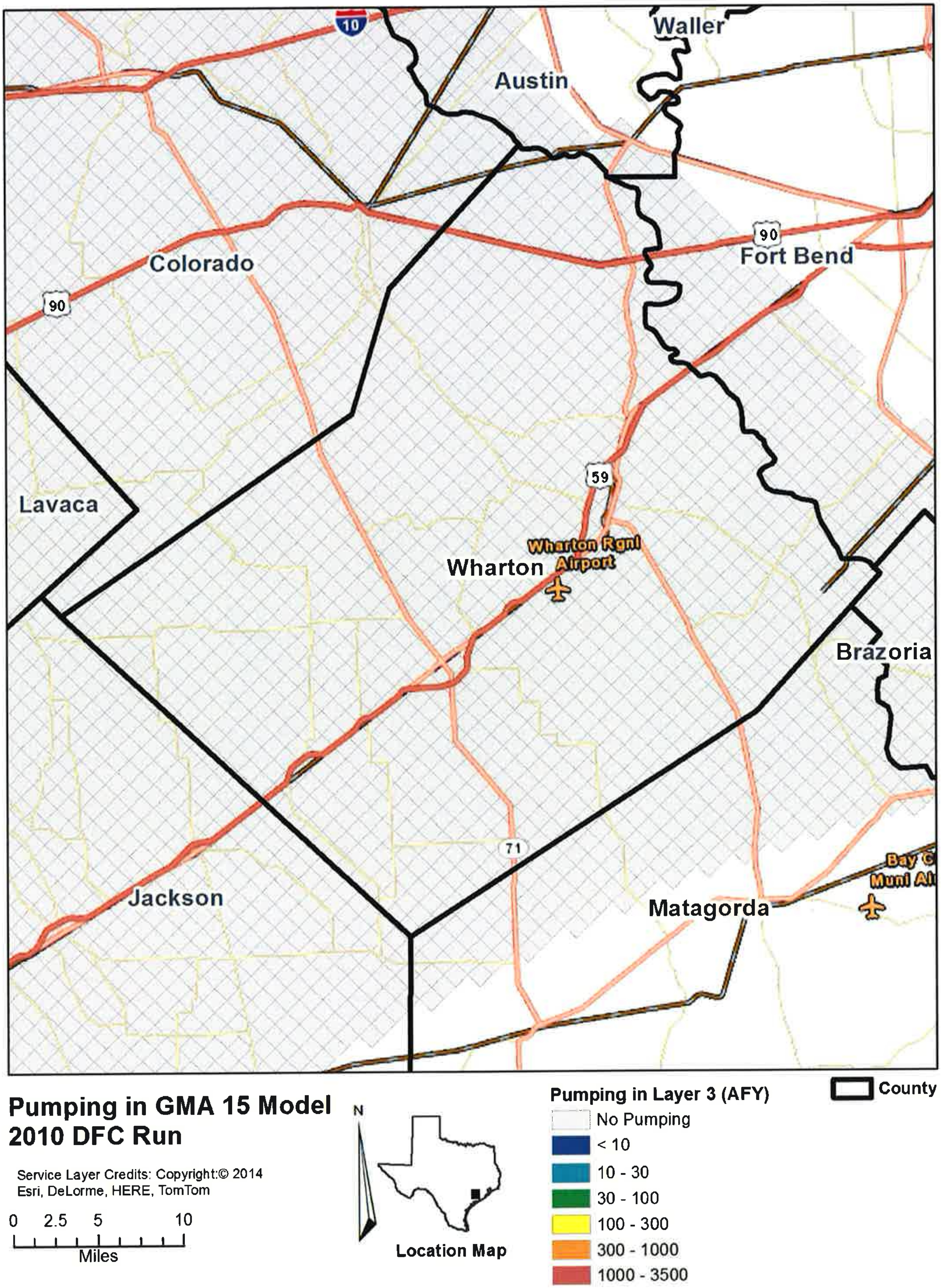
10 - 30

30 - 100

100 - 300

300 - 1000

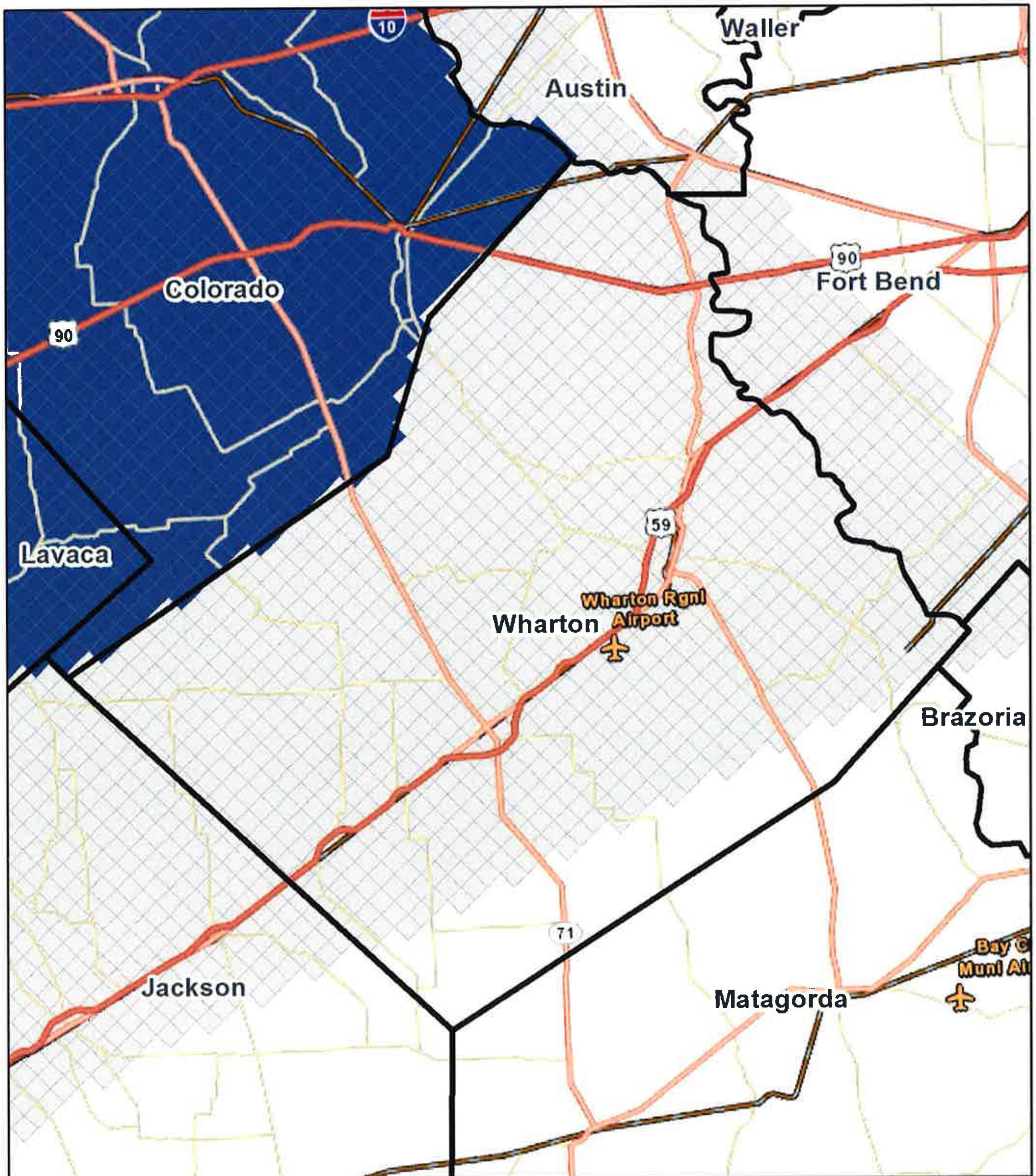
1000 - 3500



Pumping in GMA 15 Model 2010 DFC Run

Service Layer Credits: Copyright:© 2014 Esri, DeLorme, HERE, TomTom

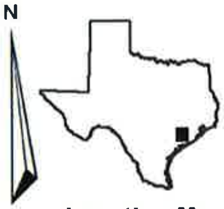
0 2.5 5 10
Miles



Pumping in GMA 15 Model
2010 DFC Run

Service Layer Credits: Copyright:© 2014
Esri, DeLorme, HERE, TomTom

0 2.5 5 10
Miles



Location Map

Pumping in Layer 4 (AFY)

- No Pumping
- < 10
- 10 - 30
- 30 - 100
- 100 - 300
- 300 - 1000
- 1000 - 3500

County

Appendix I

GAM Task 13-038: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 15 (Wade and Anaya, 2014)

GAM Task 13-038: Total Estimated Recoverable Storage for Aquifers in Groundwater Management Area 15

by Shirley Wade, Ph.D., P.G. and Roberto Anaya, P.G.
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January 15, 2014

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The seals appearing on this document were authorized by Shirley C. Wade, P.G. 525, and Roberto Anaya, P.G. 480 on January 15, 2014.

The total estimated recoverable storage in this report was calculated as follows: the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers (Shirley Wade) and the Gulf Coast Aquifer System (Roberto Anaya).

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GAM TASK 13-038: TOTAL ESTIMATED RECOVERABLE STORAGE FOR AQUIFERS IN GROUNDWATER MANAGEMENT AREA 15

by Shirley Wade, Ph.D., P.G. and Roberto Anaya, P.G.
Texas Water Development Board
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(512) 936-0883
January 15, 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 Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Gulf Coast aquifers within Groundwater Management Area 15. Tables 1 through 10 summarize the total estimated recoverable storage required by the statute. Figures 2 through 7 indicate the official extent of the aquifers in Groundwater Management Area 15 used to estimate the total recoverable storage.

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 aquifers within Groundwater Management Area 15 that lie 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)

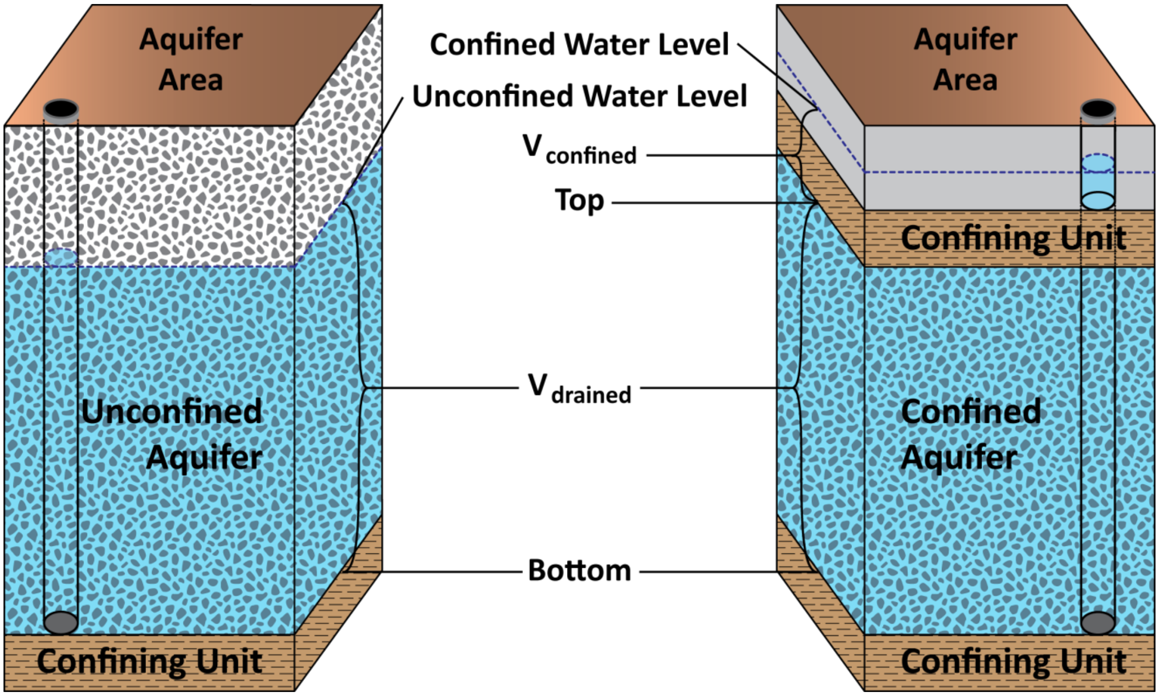

FIGURE 1. SCHEMATIC GRAPH SHOWING THE DIFFERENCE BETWEEN UNCONFINED AND CONFINED AQUIFERS.

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 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.

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:

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 and version 2.01 of the groundwater availability model for the southern 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 Deeds and others (2003), Dutton and others (2003), and

Kelley and others (2004) for assumptions and limitations of these groundwater availability models.

- We used the central model to estimate Carrizo-Wilcox Aquifer storage volumes for Fayette and Lavaca counties and we used the southern model to estimate Carrizo-Wilcox Aquifer storage volumes for DeWitt and Karnes counties.
- We used the central model to estimate Queen City Aquifer and Sparta Aquifer storage volumes for Fayette County.
- These groundwater availability models 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 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 models are 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 storages of the Yegua-Jackson Aquifer and parts of the Catahoula Formation. 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

- Version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer System was used for this analysis. See Chowdhury and others (2004) and Waterstone and Parsons (2003) for assumptions and limitations of the groundwater availability model.
- 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 near the outcrop (Layer 4).
- The down-dip boundary of the model is based on contours of 10,000 parts per million of total dissolved solids (Waterstone and Parsons, 2003). Consequently, the model extends into zones of brackish groundwater.

RESULTS:

Tables 1 through 10 summarize the total estimated recoverable storage required by statute. 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 15 for the Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Gulf Coast aquifers from which the storage information was extracted.

TABLE 1. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE CARRIZO-WILCOX AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
De Witt	1,200,000	300,000	900,000
Fayette	16,000,000	4,000,000	12,000,000
Karnes	43,000,000	10,750,000	32,250,000
Lavaca	9,700,000	2,425,000	7,275,000
Total	69,900,000	17,475,000	52,425,000

TABLE 2. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT FOR THE CARRIZO-WILCOX AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Evergreen UWCD[1]	43,000,000	10,750,000	32,250,000
Fayette County GCD	16,000,000	4,000,000	12,000,000
Lavaca County GCD	9,700,000	2,425,000	7,275,000
Pecan Valley GCD	1,200,000	300,000	900,000
Total	69,900,000	17,475,000	52,425,000

[1] Underground Water Conservation District

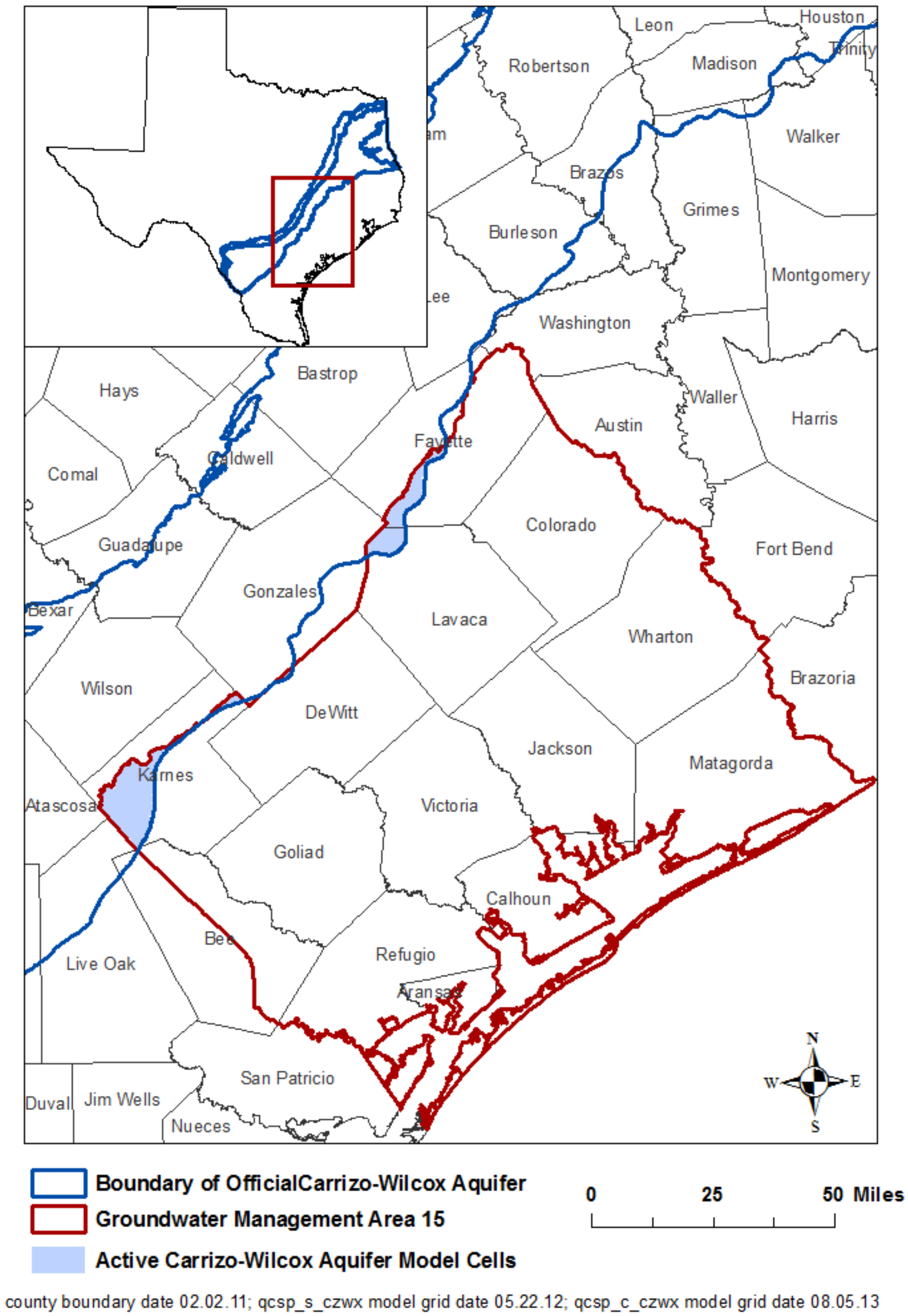

FIGURE 2. EXTENT OF THE GROUNDWATER AVAILABILITY MODELS FOR THE CENTRAL AND SOUTHERN PARTS OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE CARRIZO-WILCOX AQUIFER (TABLES 1 AND 2) WITHIN GROUNDWATER MANAGEMENT AREA 15.

TABLE 3. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE QUEEN CITY AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Fayette	640,000	160,000	480,000
Total	640,000	160,000	480,000

TABLE 4. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT FOR THE QUEEN CITY AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Fayette County GCD	640,000	160,000	480,000
Total	640,000	160,000	480,000

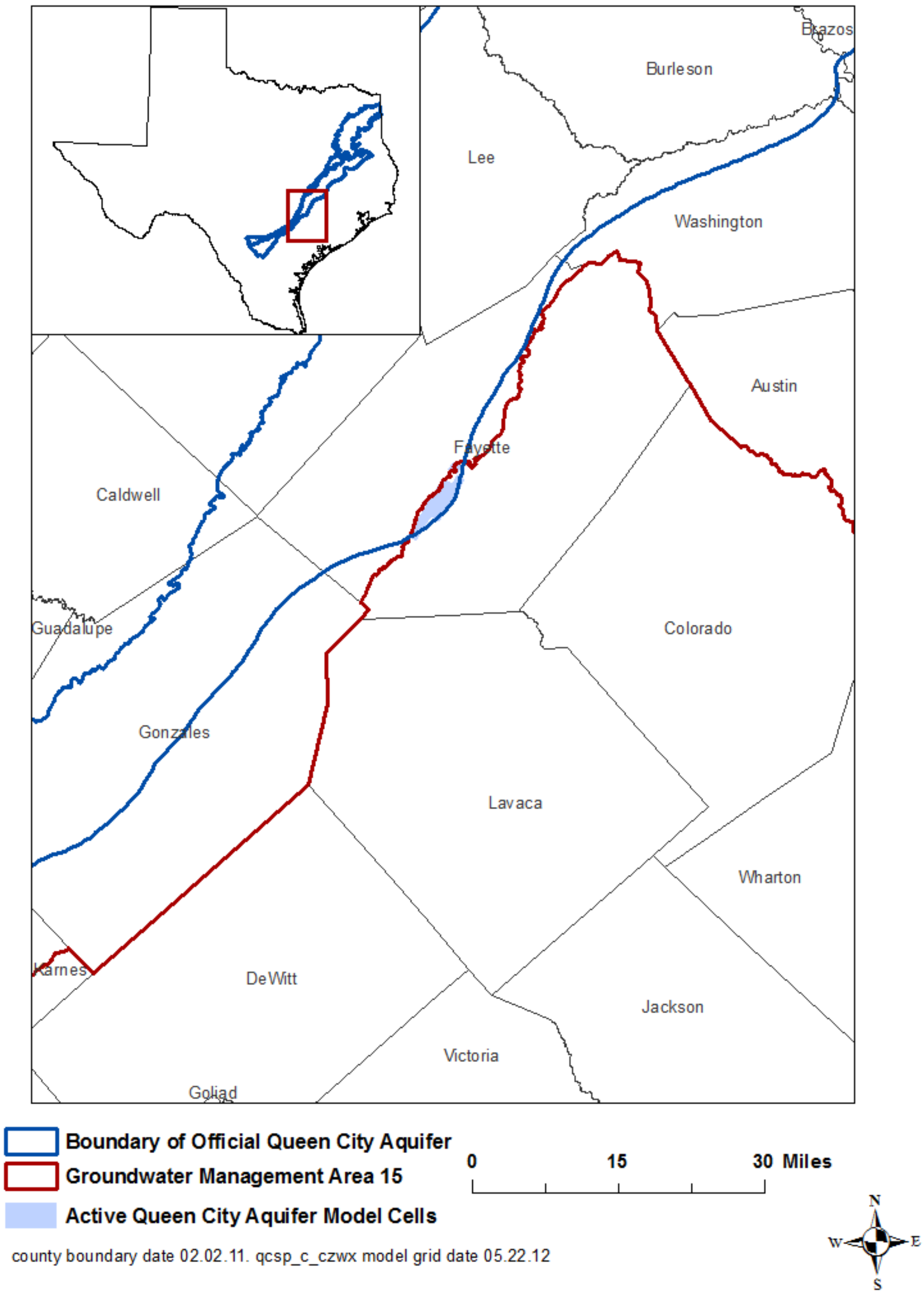

FIGURE 3. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE QUEEN CITY AQUIFER (TABLES 3 AND 4) WITHIN GROUNDWATER MANAGEMENT AREA 15.

TABLE 5. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE SPARTA AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Fayette	2,900,000	725,000	2,175,000
Total	2,900,000	725,000	2,175,000

TABLE 6. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT FOR THE SPARTA AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Fayette County GCD	2,900,000	725,000	2,175,000
Total	2,900,000	725,000	2,175,000

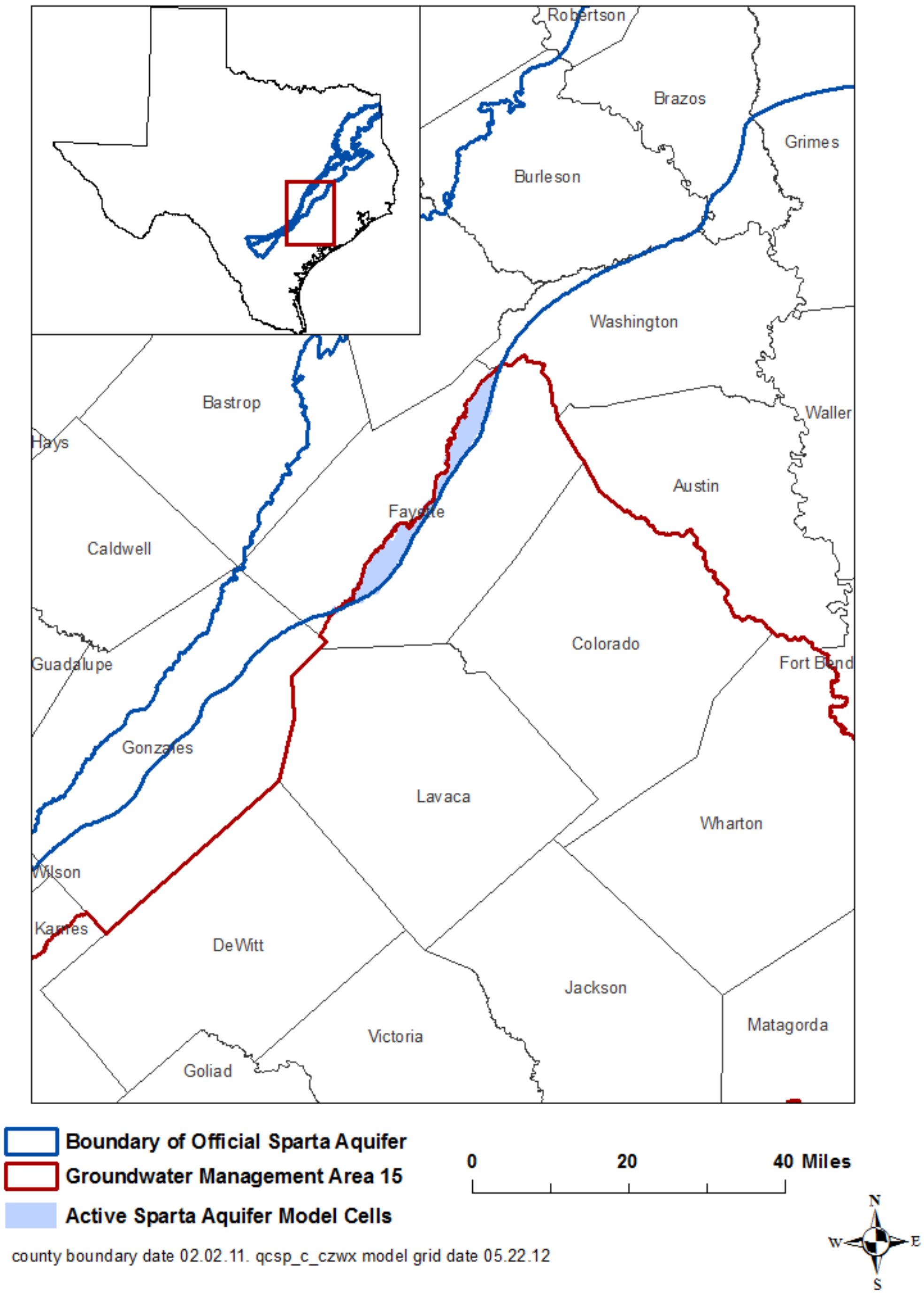

FIGURE 4. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PART OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS USED TO ESTIMATE TOTAL RECOVERABLE STORAGE FOR THE SPARTA AQUIFER (TABLES 5 AND 6) WITHIN GROUNDWATER MANAGEMENT AREA 15.

TABLE 7. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE YEGUA-JACKSON AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Lavaca	620,000	155,000	465,000
Karnes	190,000	47,500	142,500
Total	810,000	202,500	607,500

TABLE 8. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT FOR THE YEGUA-JACKSON AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Lavaca County GCD	620,000	155,000	465,000
Evergreen UWCD[2]	190,000	47,500	142,500
Total	810,000	202,500	607,500

[2] Underground Water Conservation District

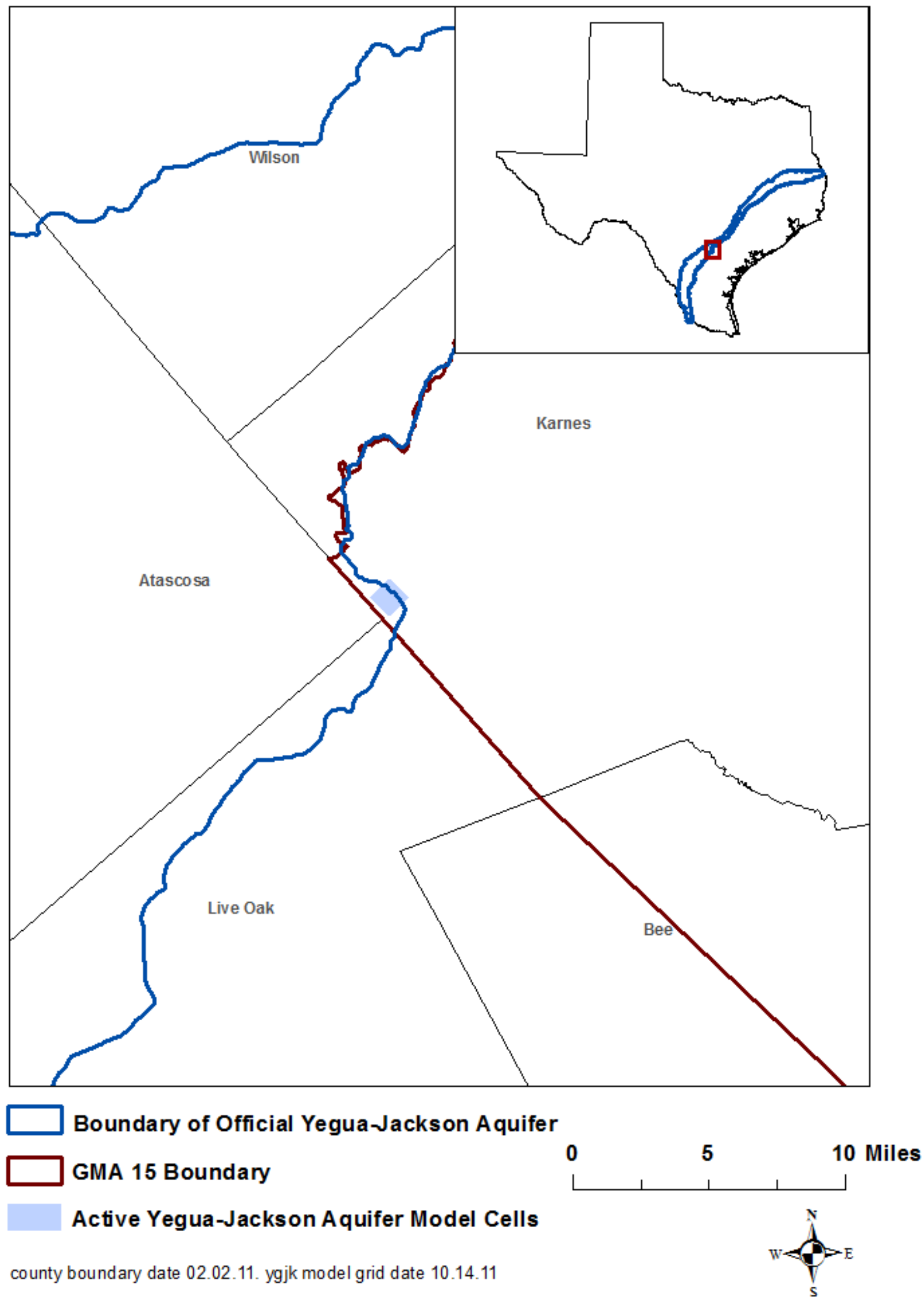

FIGURE 5. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER IN KARNES COUNTY USED TO ESTIMATE TOTAL RECOVERABLE STORAGE (TABLES 7 AND 8) FOR THE YEGUA-JACKSON AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15.

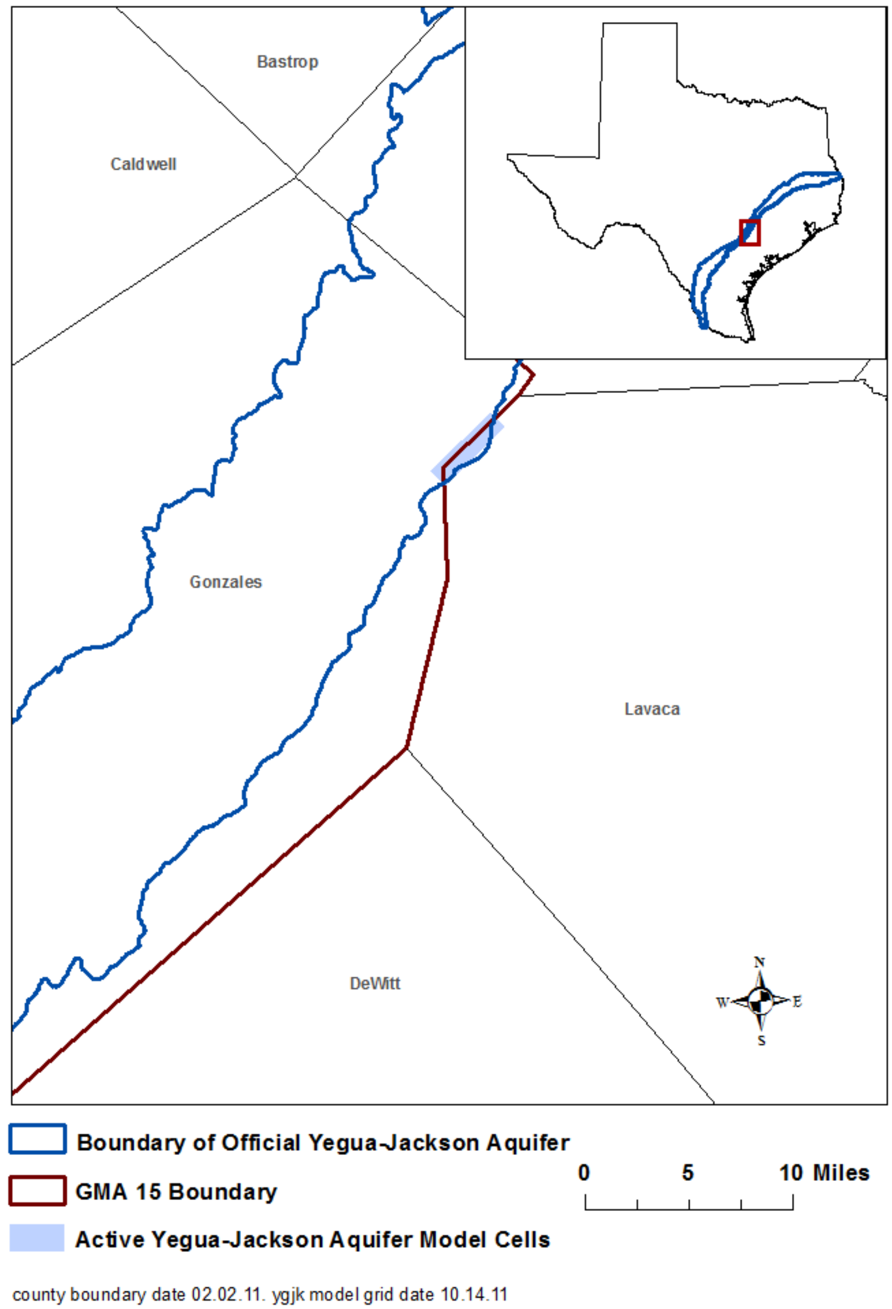

FIGURE 6. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER IN LAVACA COUNTY USED TO ESTIMATE TOTAL RECOVERABLE STORAGE (TABLES 7 AND 8) FOR THE YEGUA-JACKSON AQUIFER WITHIN GROUNDWATER MANAGEMENT AREA 15.

TABLE 9. TOTAL ESTIMATED RECOVERABLE STORAGE BY COUNTY FOR THE GULF COAST AQUIFER SYSTEM WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Aransas	5,500,000	1,375,000	4,125,000
Bee	12,000,000	3,000,000	9,000,000
Calhoun	17,000,000	4,250,000	12,750,000
Colorado	28,000,000	7,000,000	21,000,000
De Witt	21,000,000	5,250,000	15,750,000
Fayette	3,900,000	975,000	2,925,000
Goliad	26,000,000	6,500,000	19,500,000
Jackson	45,000,000	11,250,000	33,750,000
Karnes	6,400,000	1,600,000	4,800,000
Lavaca	22,000,000	5,500,000	16,500,000
Matagorda	48,000,000	12,000,000	36,000,000
Refugio	23,000,000	5,750,000	17,250,000
Victoria	39,000,000	9,750,000	29,250,000
Wharton	72,000,000	18,000,000	54,000,000
Total	**368,800,000**	**92,200,000**	**276,600,000**

TABLE 10. TOTAL ESTIMATED RECOVERABLE STORAGE BY GROUNDWATER CONSERVATION DISTRICT FOR THE GULF COAST AQUIFER SYSTEM WITHIN GROUNDWATER MANAGEMENT AREA 15. 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)*
Non-GCD	5,500,000	1,375,000	4,125,000
Bee GCD	12,000,000	3,000,000	9,000,000
Calhoun County GCD	17,000,000	4,250,000	12,750,000
Coastal Bend GCD	72,000,000	18,000,000	54,000,000
Coastal Plains GCD	48,000,000	12,000,000	36,000,000
Colorado County GCD	28,000,000	7,000,000	21,000,000
Evergreen UWCD[3]	6,400,000	1,600,000	4,800,000
Fayette County GCD	3,900,000	975,000	2,925,000
Goliad County GCD	26,000,000	6,500,000	19,500,000
Lavaca County GCD	22,000,000	5,500,000	16,500,000
Pecan Valley GCD	21,000,000	5,250,000	15,750,000
Refugio GCD	23,000,000	5,750,000	17,250,000
Texana GCD	45,000,000	11,250,000	33,750,000
Victoria County GCD	39,000,000	9,750,000	29,250,000
Total	**368,800,000**	**92,200,000**	**276,600,000**

[3] Underground Water Conservation District

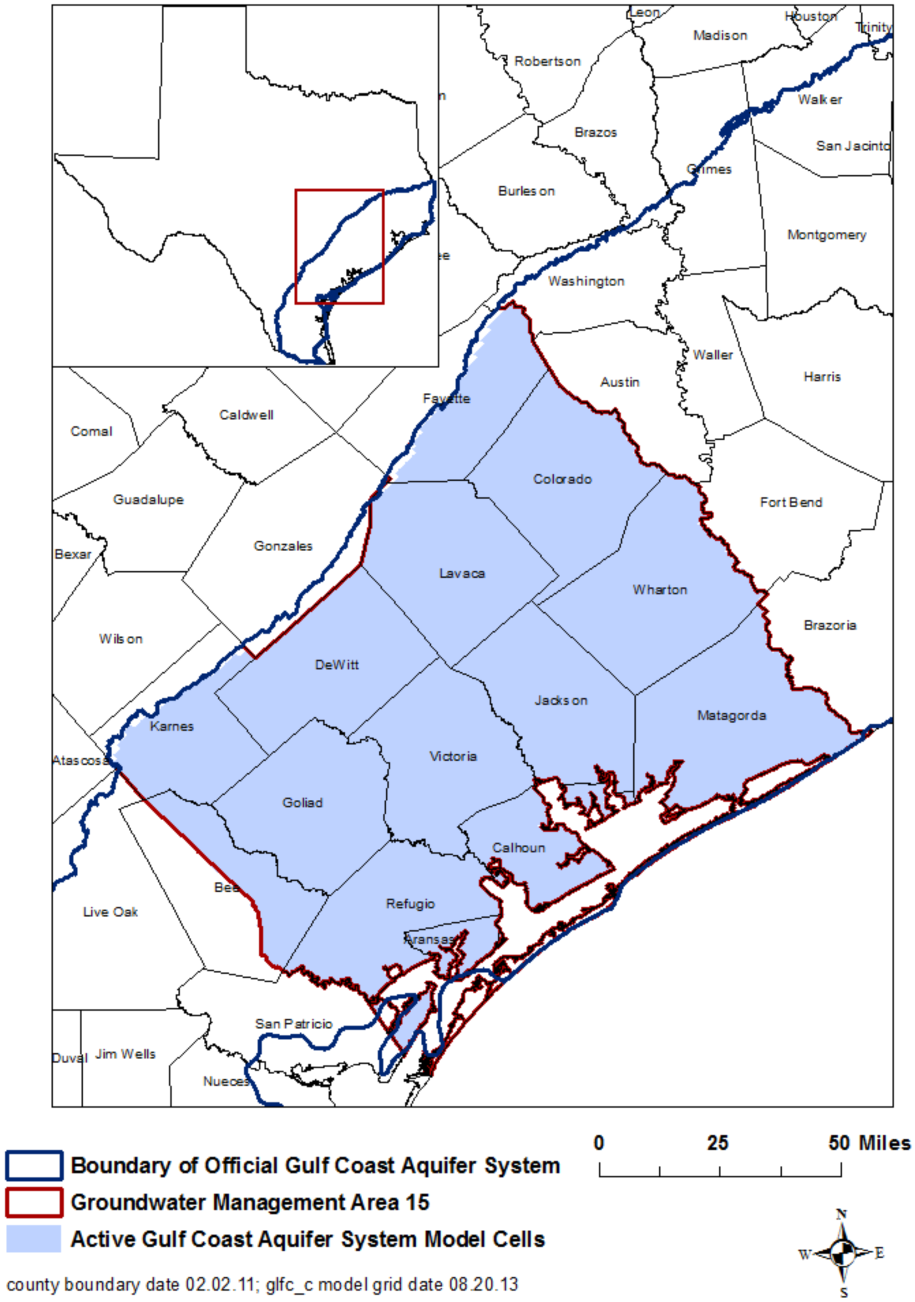

FIGURE 7. EXTENT OF THE GROUNDWATER AVAILABILITY MODEL FOR THE GULF COAST AQUIFER SYSTEM USED TO ESTIMATE TOTAL RECOVERABLE STORAGE (TABLES 9 AND 10) FOR THE GULF COAST AQUIFER SYSTEM WITHIN GROUNDWATER MANAGEMENT AREA 15.

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 J

INTERA's Presentation to GMA 15 on April 10, 2014

Groundwater Management Area 15
Joint Planning: Round 2

Victoria, TX
April 10, 2014

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Meeting Objectives

- Deliver information relevant to DFC considerations
- Understand process for delivering pumping adjustments for model run scenarios
- Make key decisions necessary to proceed with model run scenario development
  - Marked slides require a decision:

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New Joint Planning Requirements

- Balancing Test
  - DFCs 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"*

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New Joint Planning Requirements

- Consideration of 9 “factors” (paraphrased)
  - **Aquifer uses or conditions**
  - **Water supply needs and management strategies…**
  - **Hydrological conditions**
  - Other environmental impacts
  - Impact on subsidence
  - Socioeconomic impacts
  - Impact on private property rights
  - Feasibility of achieving the DFC
  - Any other relevant information

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New Joint Planning Requirements

- Process and Timeline
  - **GMA considers 9 "factors" to develop proposed DFC**
  - GMA adopts Proposed DFC
  - GCDs hold public hearings during 90-day public comment period
  - GCDs submit Public Hearing Summary to GMA
  - GMA considers public comment and may then adopt DFC
  - GMA finalizes Explanatory Report
  - DFC statement(s) and Explanatory Report submitted to TWDB and all GCDs
  - GCDs adopt final DFCs

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TWDB Explanatory Report Checklist

- ✓ identify each desired future condition;
- ✓ provide the policy and technical justifications for each desired future condition;
- ✓ 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;
- ✓ list other desired future condition options considered, if any, and the reasons why those options were not adopted; and
- ✓ 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.

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Survey Results

- Received responses from 12 of 13 districts
- Full responses are on the CD
- Takeaways
  - Differing opinions on scale of DFCs including 5 responses for 1 DFC per county/district
  - Drawdown out to 2065 okay with most districts, but desire expressed by some to extend base year past 1999
  - Most districts desire to update pumping and are okay with the proposed format

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DFC Considerations/Factors for Today

- **Aquifer uses or conditions** within a management area, including conditions that differ substantially from one geographic area to another
- **Water supply needs and management strategies** included in the state water plan
- **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

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Groundwater Planning Datasheet

Lavaca County Groundwater Planning Datasheet

(all values in acre-feet per year unless otherwise noted)

TWDB Pumping Estimates (2000-2011)	**Average**	**Median**	**Minimum**	**Maximum**			
Gulf Coast Aquifer	9,219	8,573	6,993	13,683			
Other Aquifer	999	999	676	1,322			
Unknown	74	54	54	133			
Yegua-Jackson Aquifer	7	7	6	8			
Modeled Available Groundwater	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Gulf Coast Aquifer	20,385	20,385	20,385	20,385	20,378	20,373	
2012 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	
Groundwater Supplies							
Gulf Coast Aquifer	14,445	14,445	14,445	14,445	14,445	14,445	
Water Demands	13,815	13,794	13,735	13,651	13,580	13,550	
Water Supply Need (-) or Surplus (+)	630	651	710	794	865	895	
Groundwater Supply Strategies							
Gulf Coast Aquifer	0	0	0	0	0	0	
2017 State Water Plan	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Water Demands		16,704	15,967	15,487	15,041	14,552	14,364
Total Estimated Recoverable Storage (acre-feet)	**Total Storage**	**25% of Total Storage**	**75% of Total Storage**				
Carrizo-Wilcox	9,700,000	2,425,000	7,275,000				
Gulf Coast	22,000,000	5,500,000	16,500,000				
Yegua-Jackson	620,000	155,000	465,000				

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Historical Water Budgets

- Tables have been developed for each county for 1981, 1990, and 1999 representing the beginning, middle, and end of the transient/calibrated period in the GAM
- Management plan GAM runs are available through TWDB and have averages between 1981 and 1999 for the Gulf Coast Aquifer System as a whole by district

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Historical Water Budgets

Lavaca	1981			
	Chicot	Evangeline	Burkeville	Jasper
Inflow				
Recharge	21,934	7,363	2	207
Net Stream Leakage	31,021	18,486	273	572
Net Vertical Leakage Upper	-	9,461	-	-
Net Vertical Leakage Lower	-	743	55	-
Net Lateral Flow From De Witt	49	1,270	2	-
Net Lateral Flow From Fayette	-	44	-	54
Net Lateral Flow From Gonzales	-	-	-	212
Net Lateral Flow From Victoria	346	324	-	-
Total Inflow	*53,350*	*37,691*	*332*	*1,045*
Outflow				
Wells	4,694	19,497	139	3,847
Evapotranspiration	293	262	154	70
Net Vertical Leakage Upper	-	-	743	55
Net Vertical Leakage Lower	9,461	-	-	-
Net Lateral Flow To Colorado	5,721	4,351	8	46
Net Lateral Flow To De Witt	-	-	-	71
Net Lateral Flow To Fayette	-	-	-	-
Net Lateral Flow To Jackson	13,736	11,074	21	149
Net Lateral Flow To Victoria	-	-	-	1
Total Outflow	*33,905*	*35,184*	*1,065*	*4,239*
Inflow - Outflow	19,445	2,507	-733	-3,194
Storage Change	19,444	2,507	-731	-3,192
Model Error	1	0	-2	-2
Model Error (percent)	0.00%	0.00%	0.19%	0.05%

Inflows

Outflows

Storage Change

Total Estimated Recoverable Storage

- Recent presentation at Texas Alliance of Groundwater Districts available on CD (Feb. 2014) as well as guidance from TWDB
- Calculated as:
  - Total Volume = Saturated Thickness x Specific Yield x Area (plus a little for depletion of confined head)
  - “Recoverable” defined in TWDB rules as somewhere between 25% and 75% of the total volume
  - Total volume is 443 million acre-feet for GMA 15
- Does not consider water quality; well yields, locations and depths; or the practicality/economics of development
- Highly sensitive to specific yield with very little information available in confined portion of aquifer

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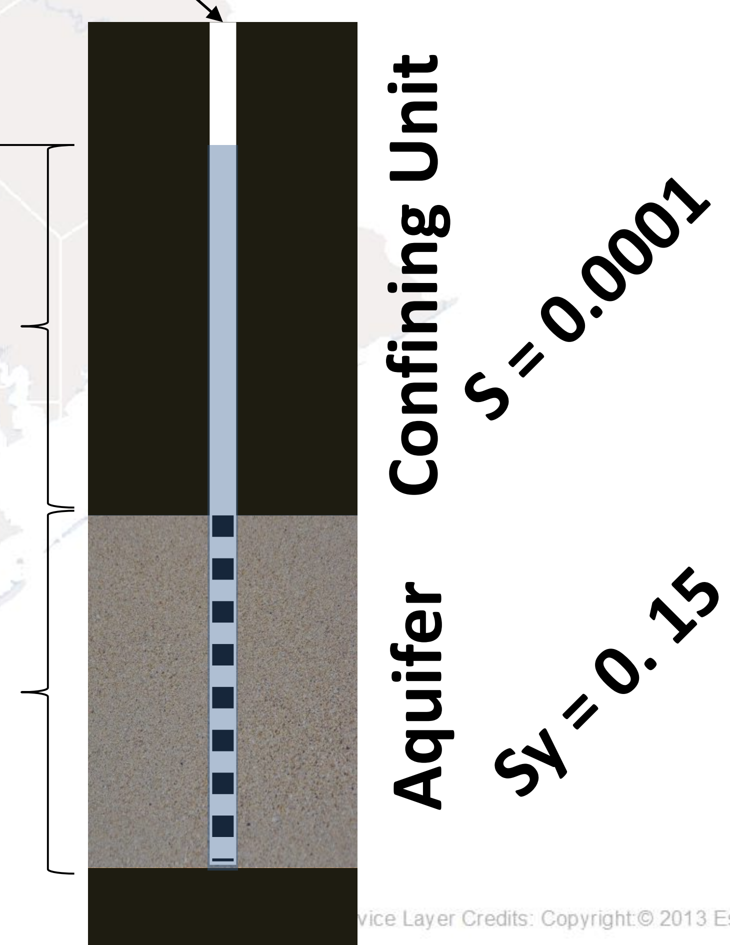
Example Depletion of Confined Aquifer

Fully Penetrating Well

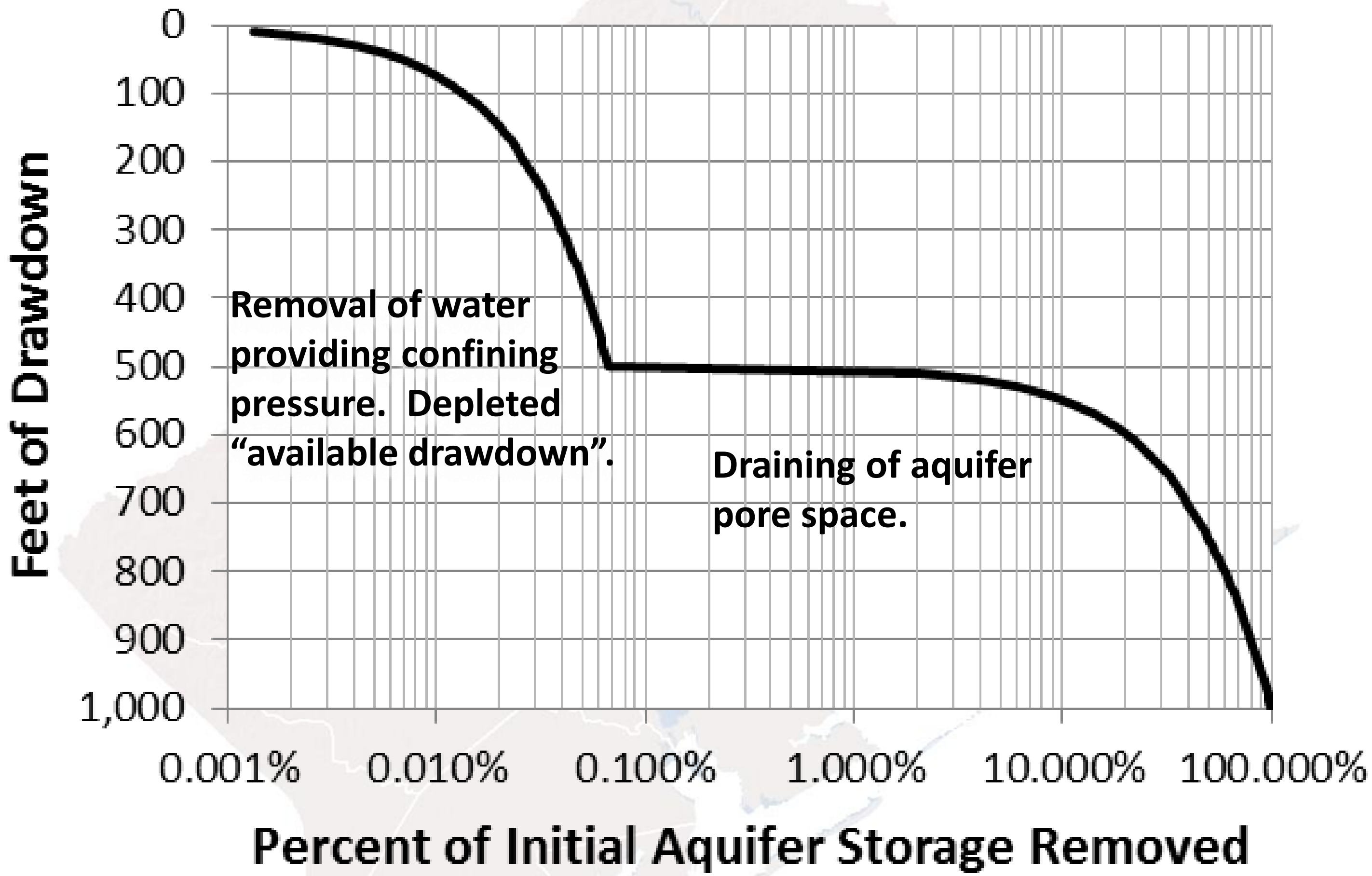
Initial Water Level

500 feet of confined pressure head

500 feet of saturated thickness and well screen



Example Depletion of Confined Aquifer



Exact shape of curve is aquifer specific and depends on initial water levels, aquifer thickness, and storage properties (storativity and specific yield). Idealized curve developed using a 500 ft thick aquifer with 500 feet of confined head. Storativity set to 0.0001 and specific yield set to 0.15.

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Total Estimated Recoverable Storage

- **What it does mean:**
  - How much water is in the aquifer
- **What it doesn't mean:**
  - That the water is available for production
  - That using small fractions of the total volume cannot seriously harm the aquifer and its users
  - That it is a useful tool in the planning and management of a particular aquifer
- **What it might mean:**
  - That you'll need to understand it well enough to explain to your boards, permit applicants, and the public if – and to what extent – it is relevant in your district

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Groundwater Availability Model Runs

- Limitations and capabilities of Central Gulf Coast Aquifer GAM
- **Decisions to be made:**
  - How to address non-district and non-GMA 15 areas
  - Predictive timeframe
  - Scale to report results

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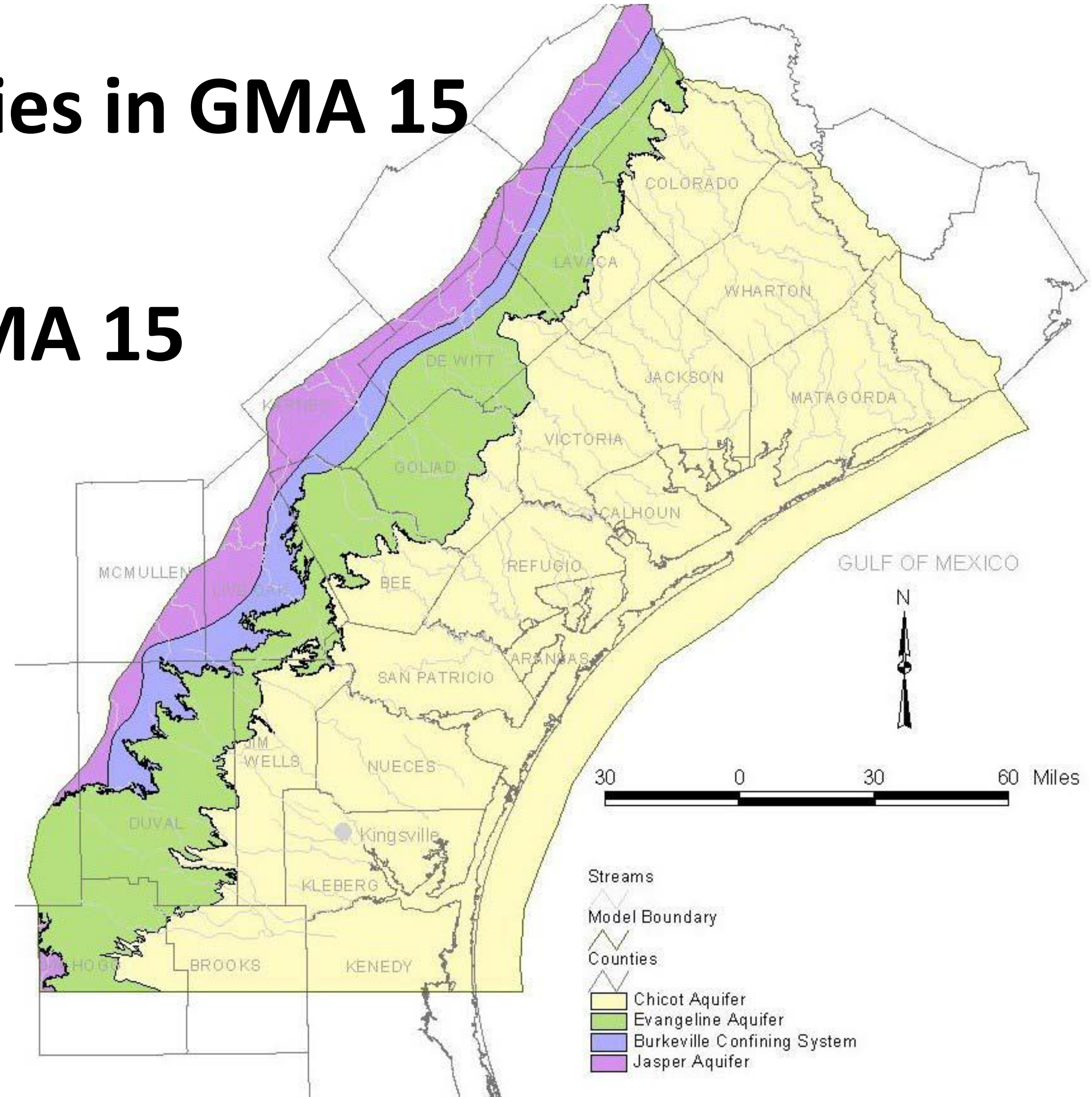
Groundwater Availability Model Coverage

- **Non-District Counties in GMA 15**
  - Lavaca County
- **Area Outside of GMA 15**
  - Nueces County
  - San Patricio County
  - Kleberg County
  - Jim Wells County
  - Kenedy County
  - Brooks County



Groundwater Availability Model Issues Relevant to Interpretation of Output

- Groundwater-Surface water interaction
- Land Subsidence
- Well equations
- Distribution of Historical Pumping (vertical and areal)
- Aquifer Hydraulic Properties (modeled versus from pumping tests or sand maps)
- Grid Dimensions (thickness and size)
- Recharge Distribution and Amounts

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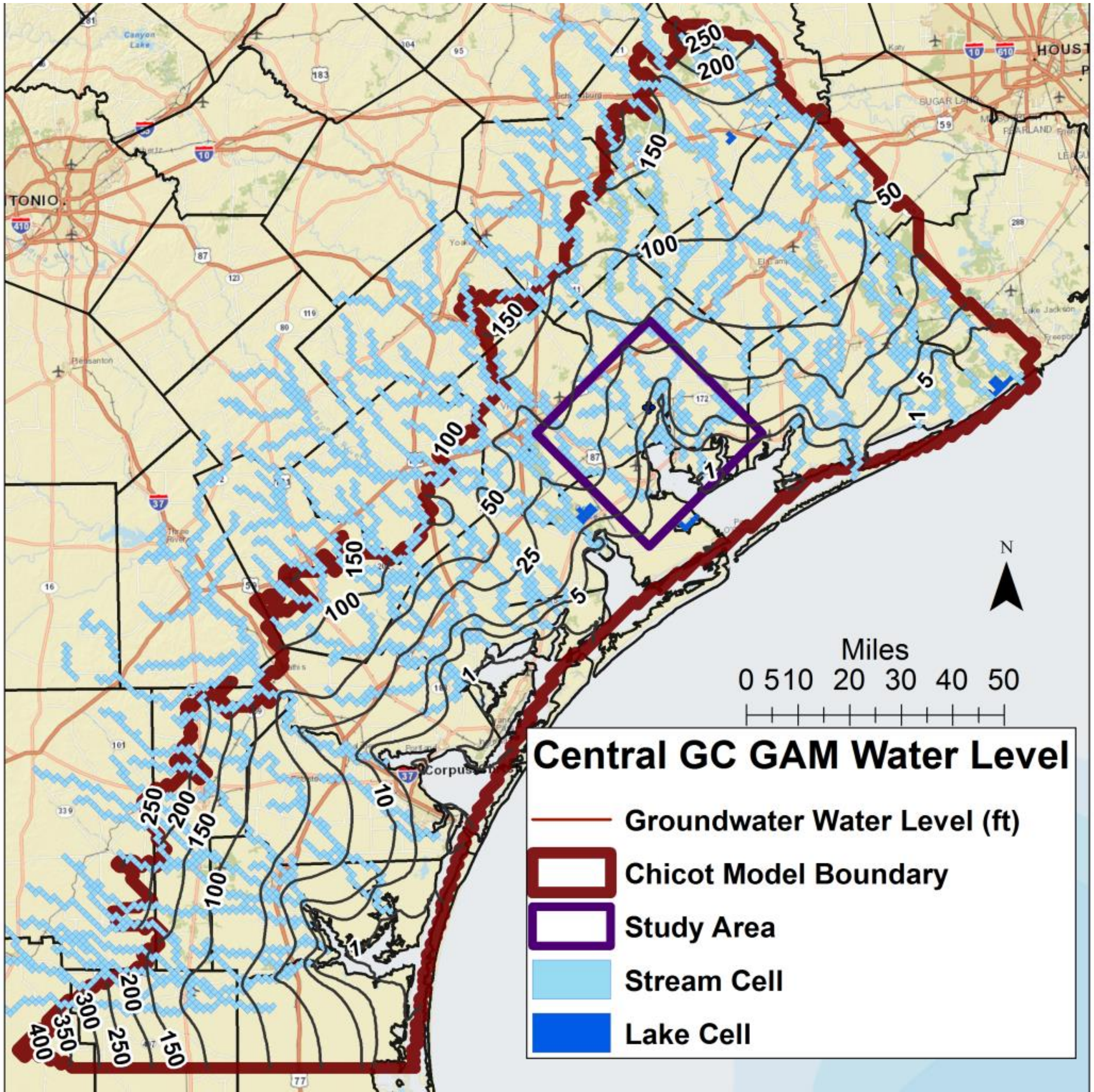
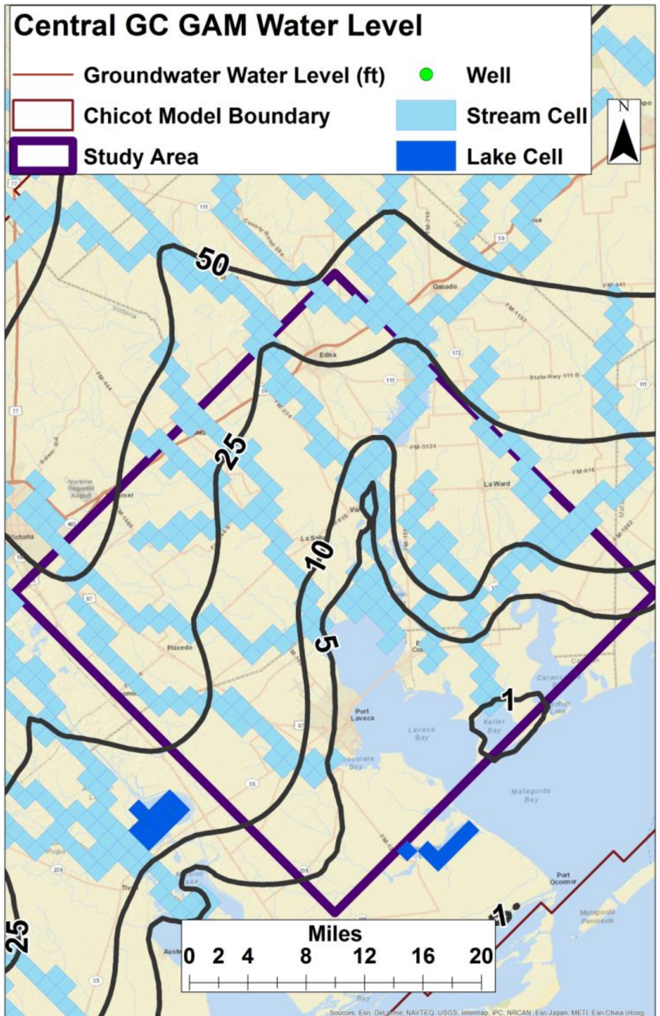
Hypothetical Study Using the Gulf Coast GAM

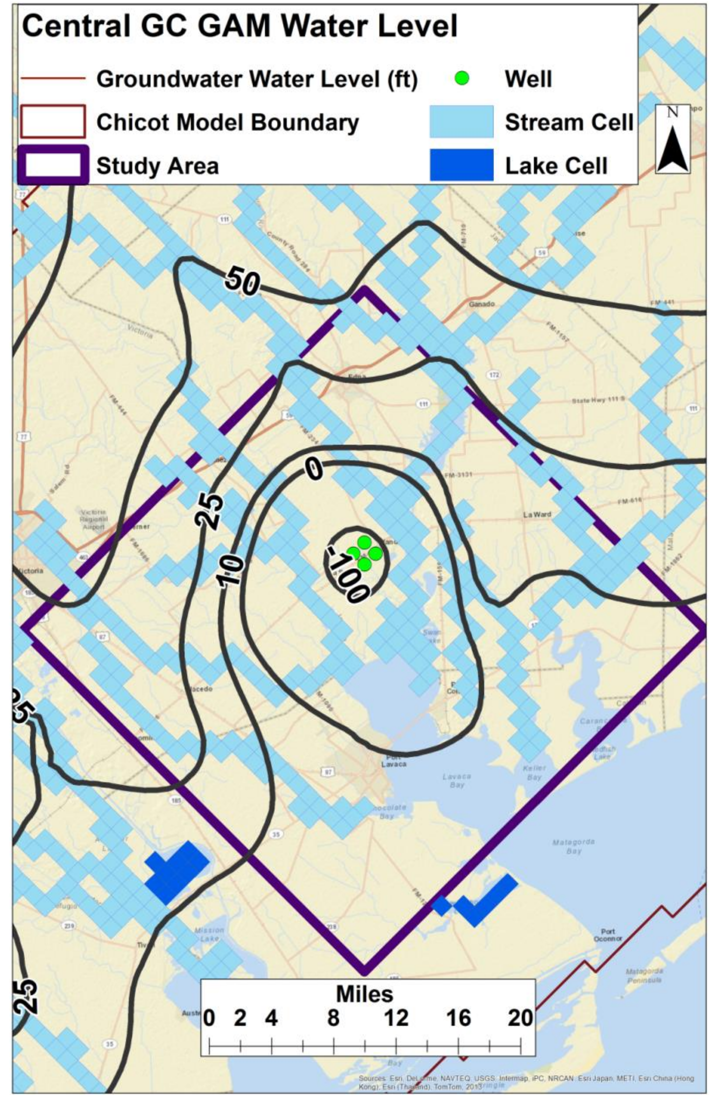


Hypothetical Study: Simulated Water Levels in Chicot

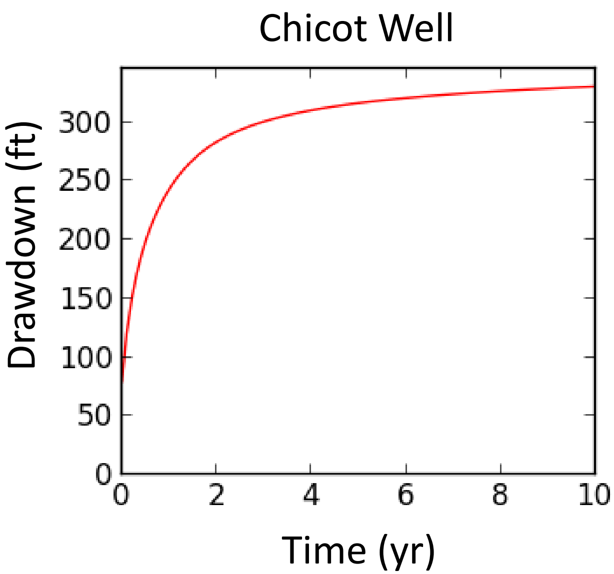
Predevelopment

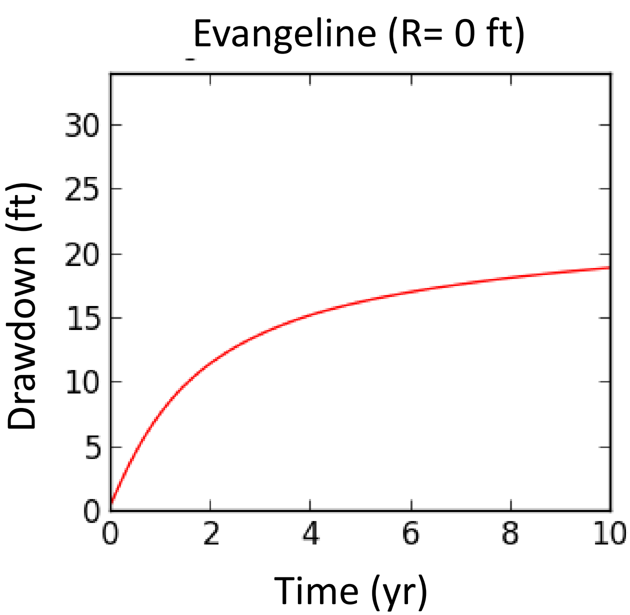


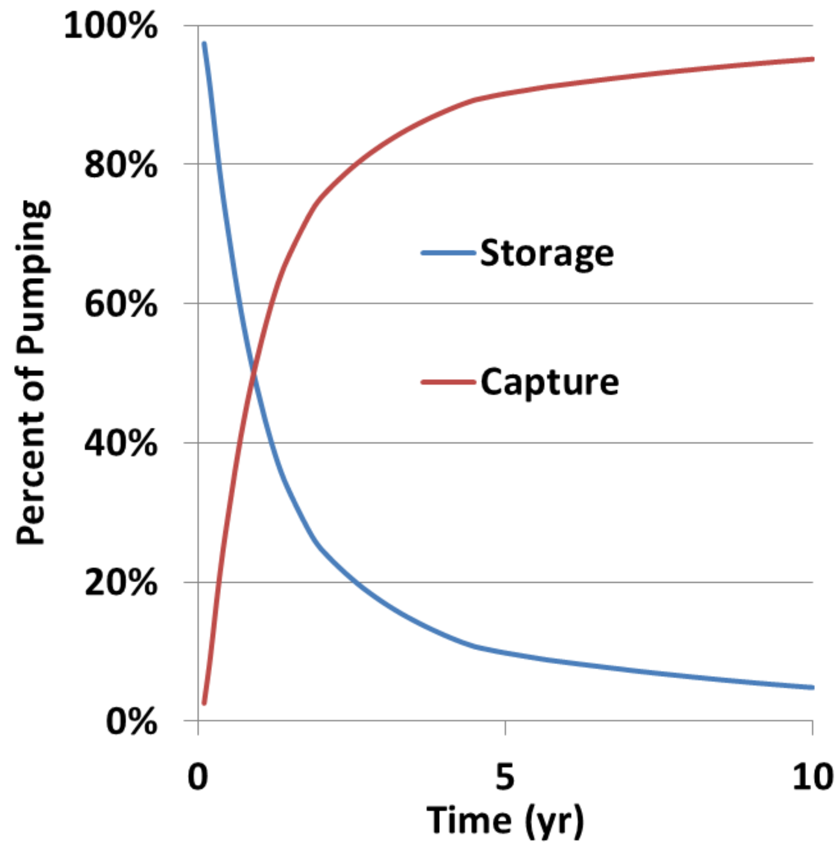
Post development



Hypothetical Study: Aquifer Dynamics







Hypothetical Study: Water Budget

	Pre-Development	Post-Development (10 yrs)	Change (Post-Pre)
INFLOW (AFY)			
Recharge	9,304	9,304	0
Stream Leakage	0	131,378	131,378
Vertical Flow	5,935	8,088	2,153
Lateral Inflow	9,513	12,136	2,623
Storage	0	8,168	8,168
Total	24,752	169,074	144,322
OUTFLOW (AFY)			
Wells	0	167,695	167,695
Drains	289	147	-142
Ocean	16,201	1,232	-14,969
Stream Leakage	8,260	0	-8,260
Total	24,750	169,074	144,324

Note: 167,695 AFY = 150 MGD = 104,000 gpm = 5,500 cfs

Recharge and Sustainable Pumping

"Sustainable ground-water developments have almost nothing to do with recharge ……Capture from natural discharge is usually what determines the size of a sustainable development (Bredehoeft, 1997, Groundwater, Vol 35, 6)

Based on the statement above and the hypothetical study, a major consideration in using the predictions from the GAMs for long-term groundwater development is how accurately the GAM predicts/ represents the processes responsible for captured groundwater by pumping

Groundwater Availability Model Runs

- **Non-District and Non-GMA 15 Areas**
  - Proposed approach:
    - For non-district areas within GMA 15: include greater of pumping in 2012 State Water Plan, last round of joint planning, or **demands for 2016 regional plans** if no surface water supplies
    - For areas outside GMA 15: assume pumping in last round of joint planning
  - Other options to consider?

Groundwater Availability Model Runs

- **Predictive Timeframe**
  – Base year: 1999, 2010, 2012, 2013?
  – Change in base year ?
    - Pumping estimates
    - Updates to the GAM
    - TWDB review and approval of modified GAM
    - Additional funding
  – End year: 2060, 2065, 2070?

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Groundwater Availability Model Runs

- **Scale(s) to Report Model Run Results**
  - Average for whole Gulf Coast Aquifer System
  - Average for each unit in Gulf Coast Aquifer System
  - Average by county/district for Gulf Coast Aquifer
  - Average by county/district for each unit of the Gulf Coast Aquifer (Chicot, Evangeline, Burkeville, Jasper)
  - Separate outcrop from down-dip (approximates unconfined and confined areas)
  - Other?

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Pumping Distribution for GAM Runs

- In survey, most districts indicated desire to submit updated pumping information
- Most districts were okay with proposed approach for submitting updated pumping information
- To facilitate new pumping distributions, we have developed:
  - Pumping distribution in GAM in 1999 by county by layer
  - Pumping distribution in GAM for 2010 DFCs by county by layer
  - Maps of model grid cells in each county for defining pumping zones
  - MS Excel-based format for specifying input pumping amounts and timing for each zone

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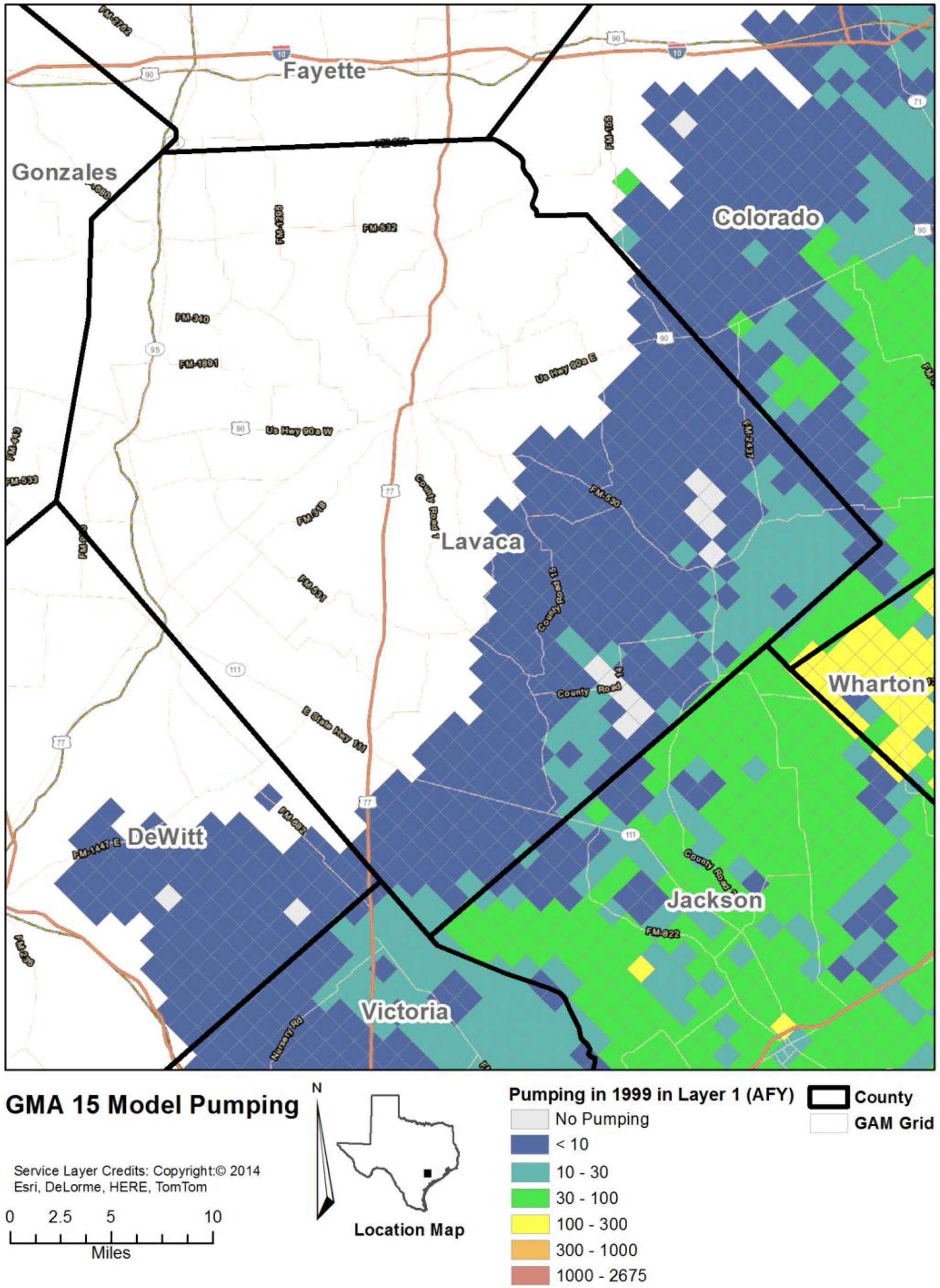
Lavaca County Pumping for Layer 1 in 1999 (Chicot)



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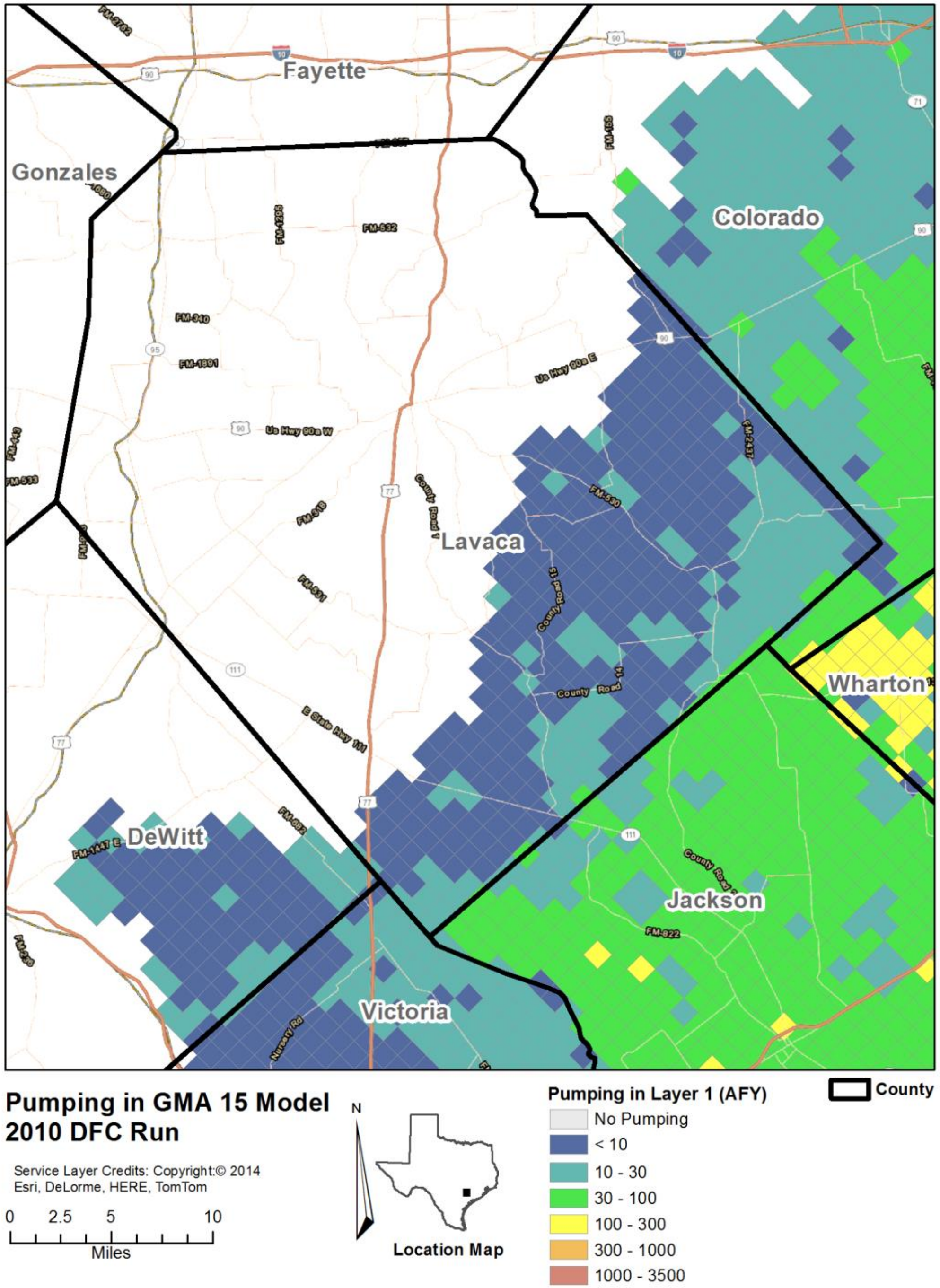
Lavaca County Pumping for Layer 1 for DFCs (Chicot)



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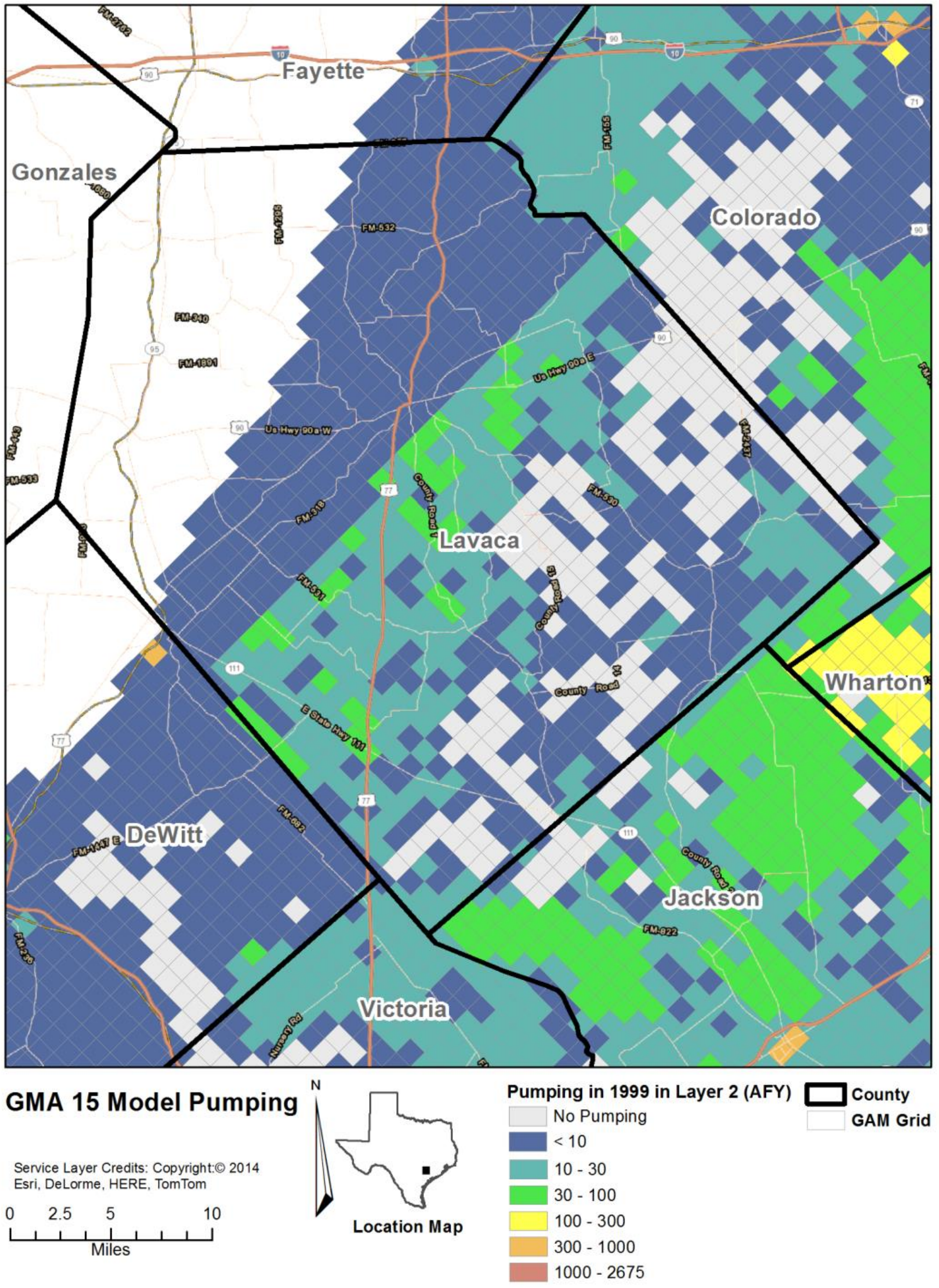
Lavaca County Pumping for Layer 2 in 1999 (Evangeline)



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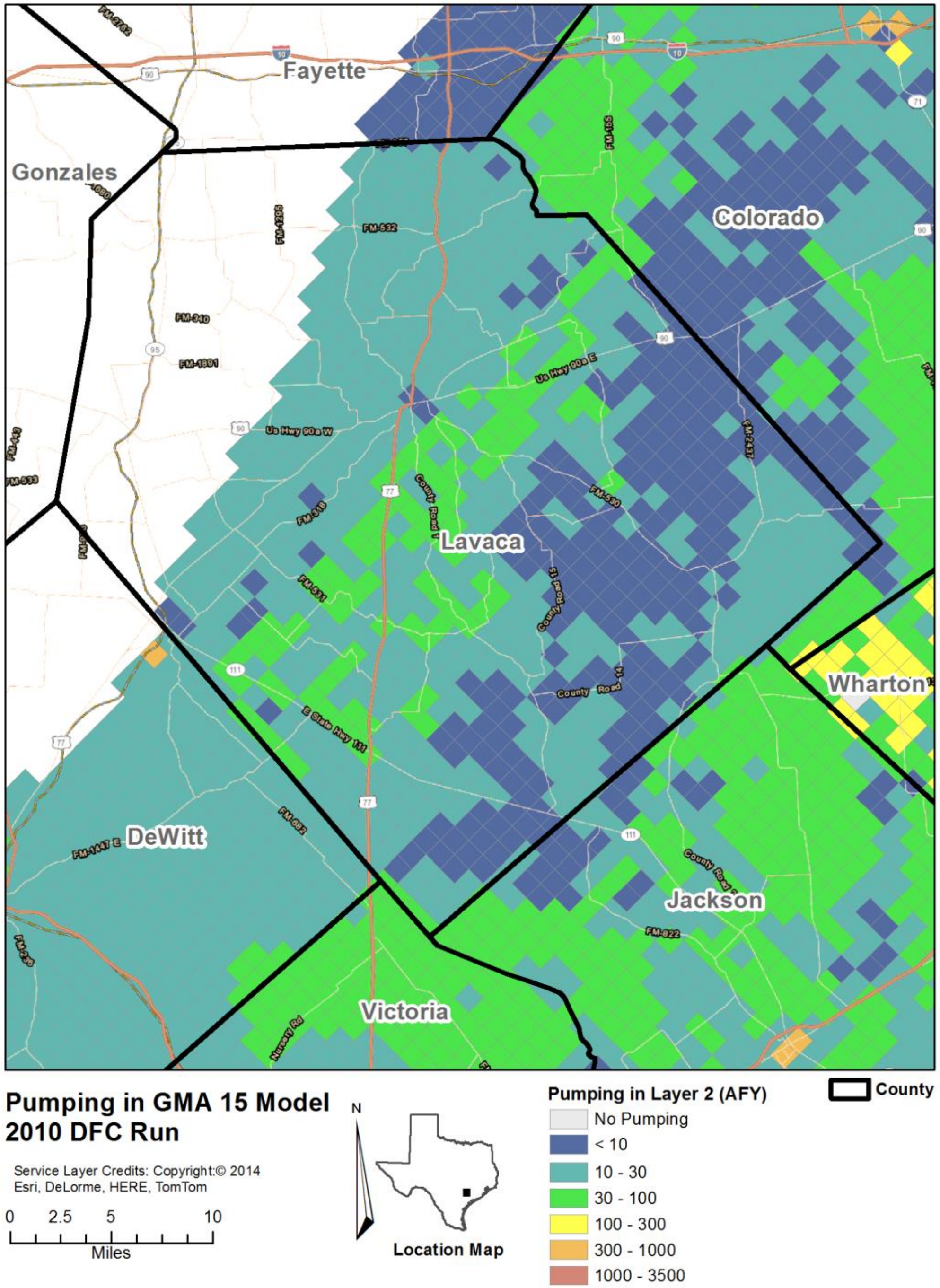
Lavaca County Pumping for Layer 2 for DFCs (Evangeline)



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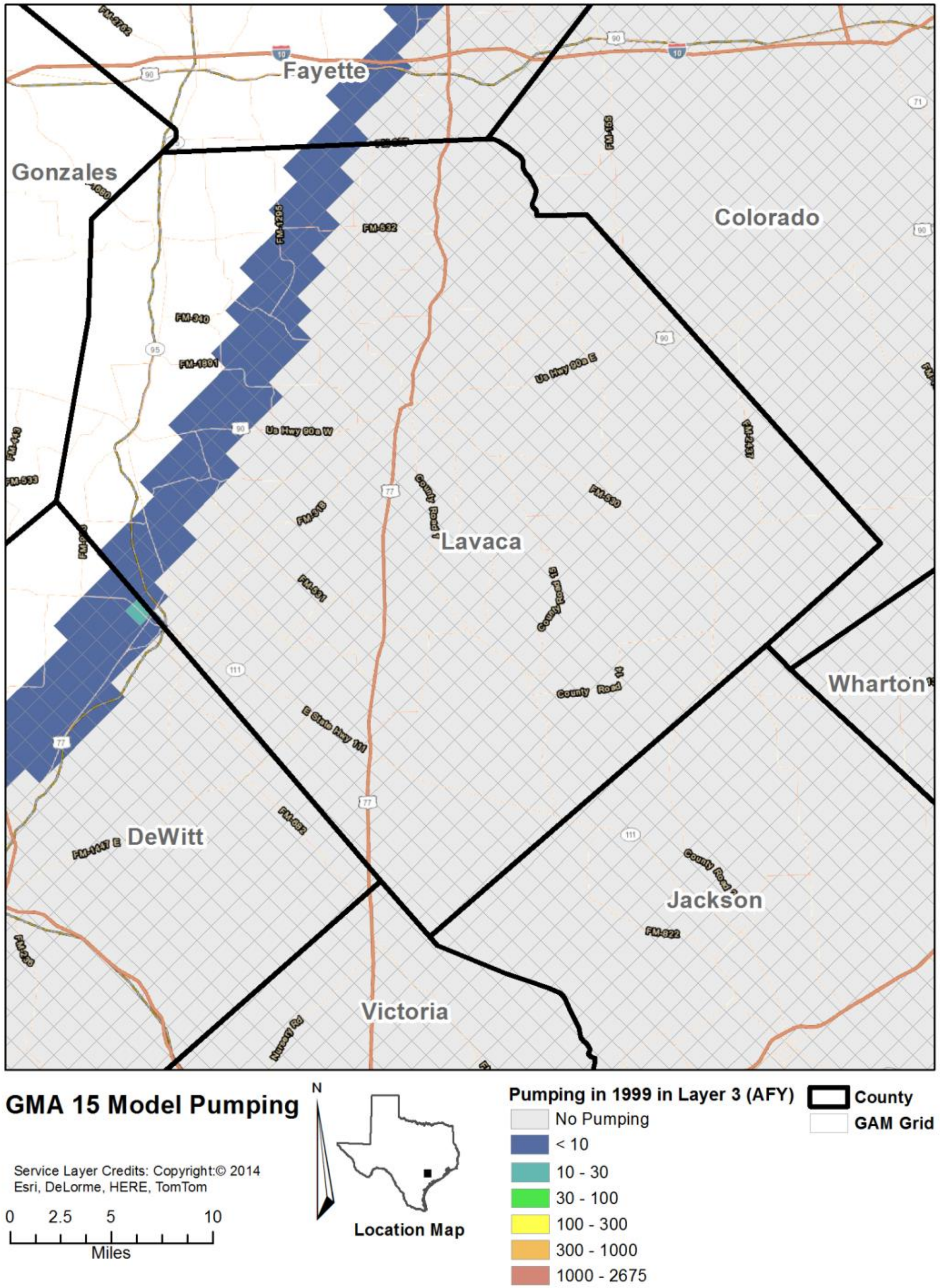
Lavaca County Pumping for Layer 3 in 1999 (Burkeville)



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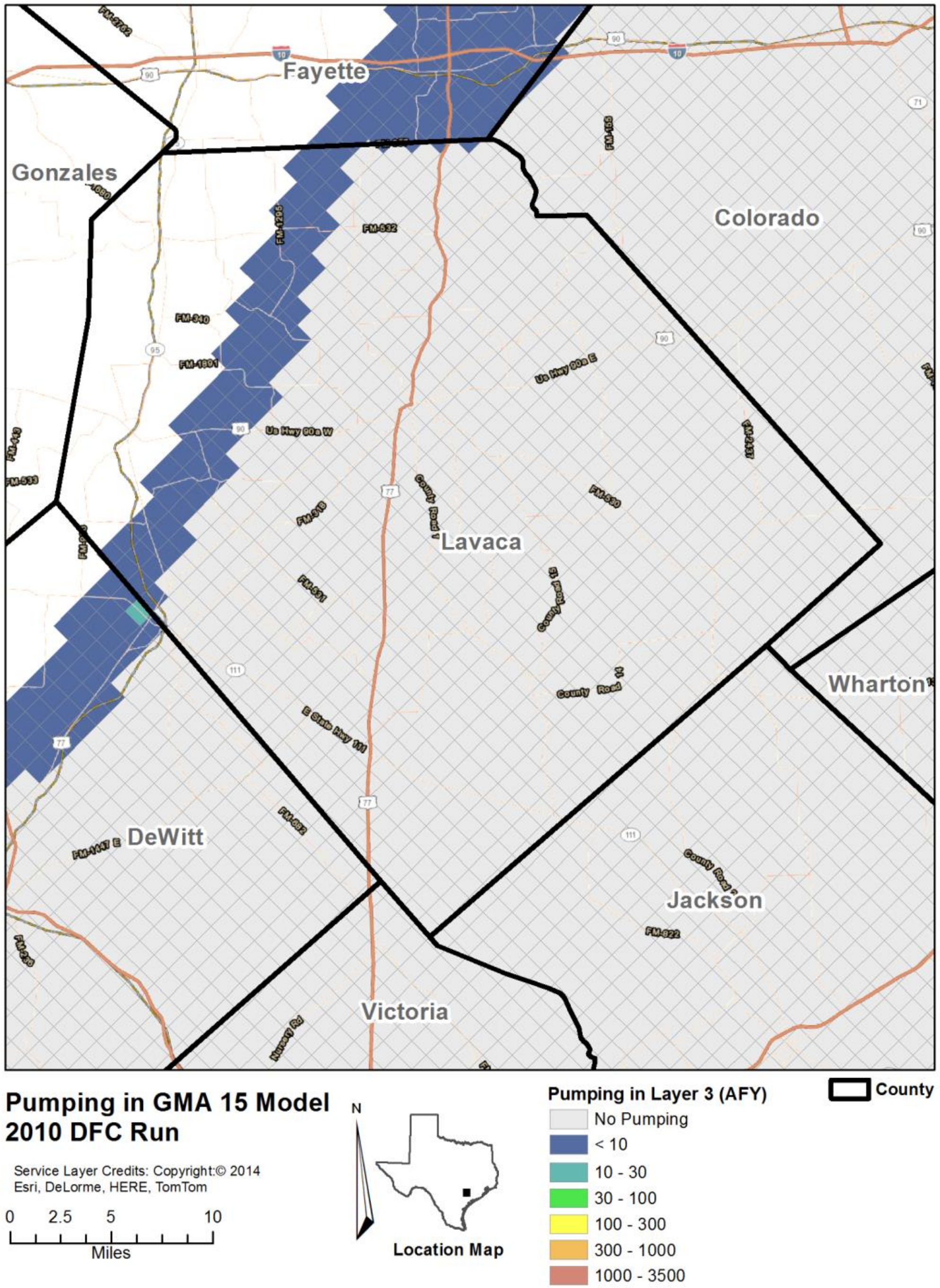
Lavaca County Pumping for Layer 3 for DFCs (Burkeville)



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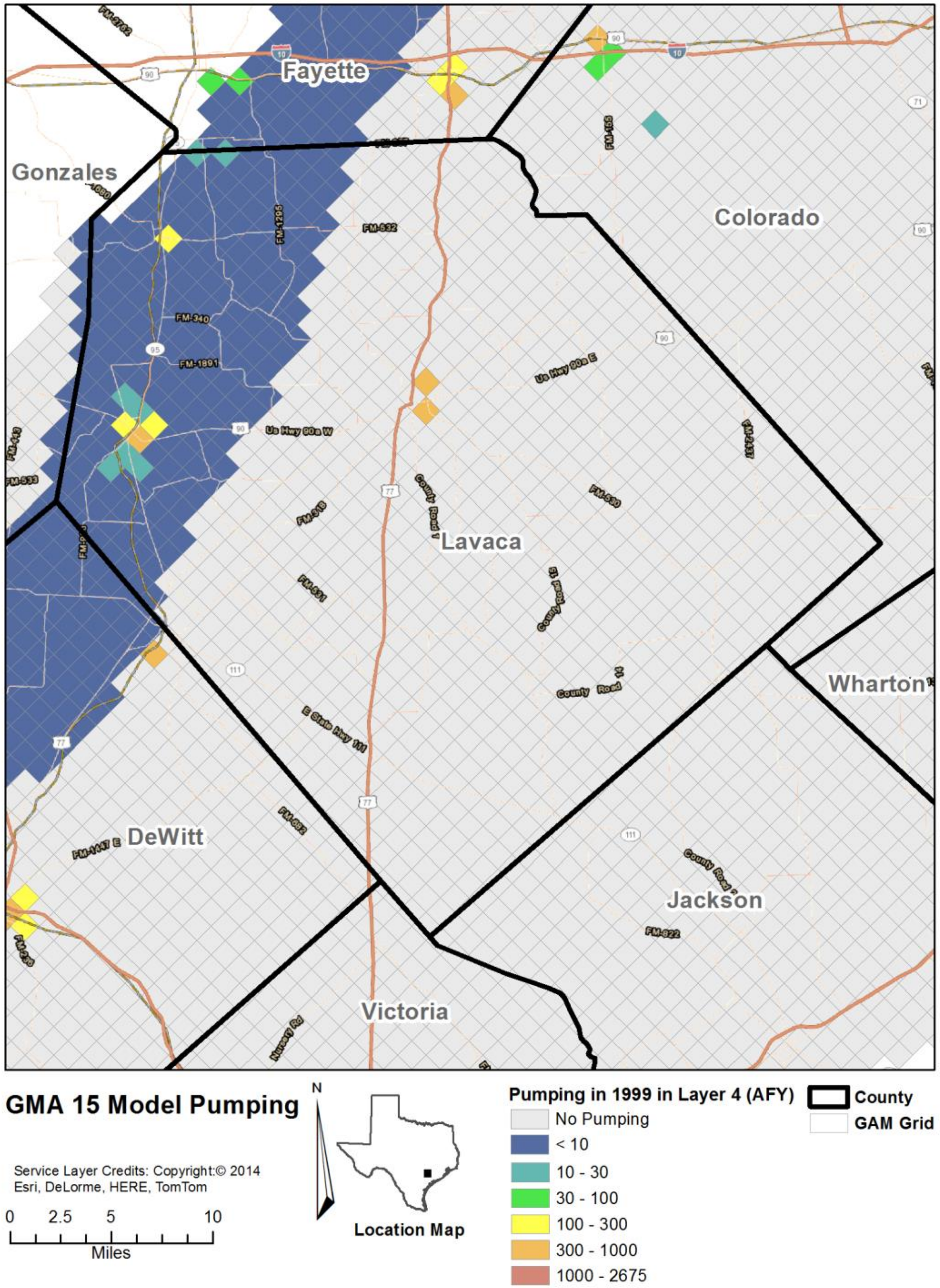
Lavaca County Pumping for Layer 4 in 1999 (Jasper)



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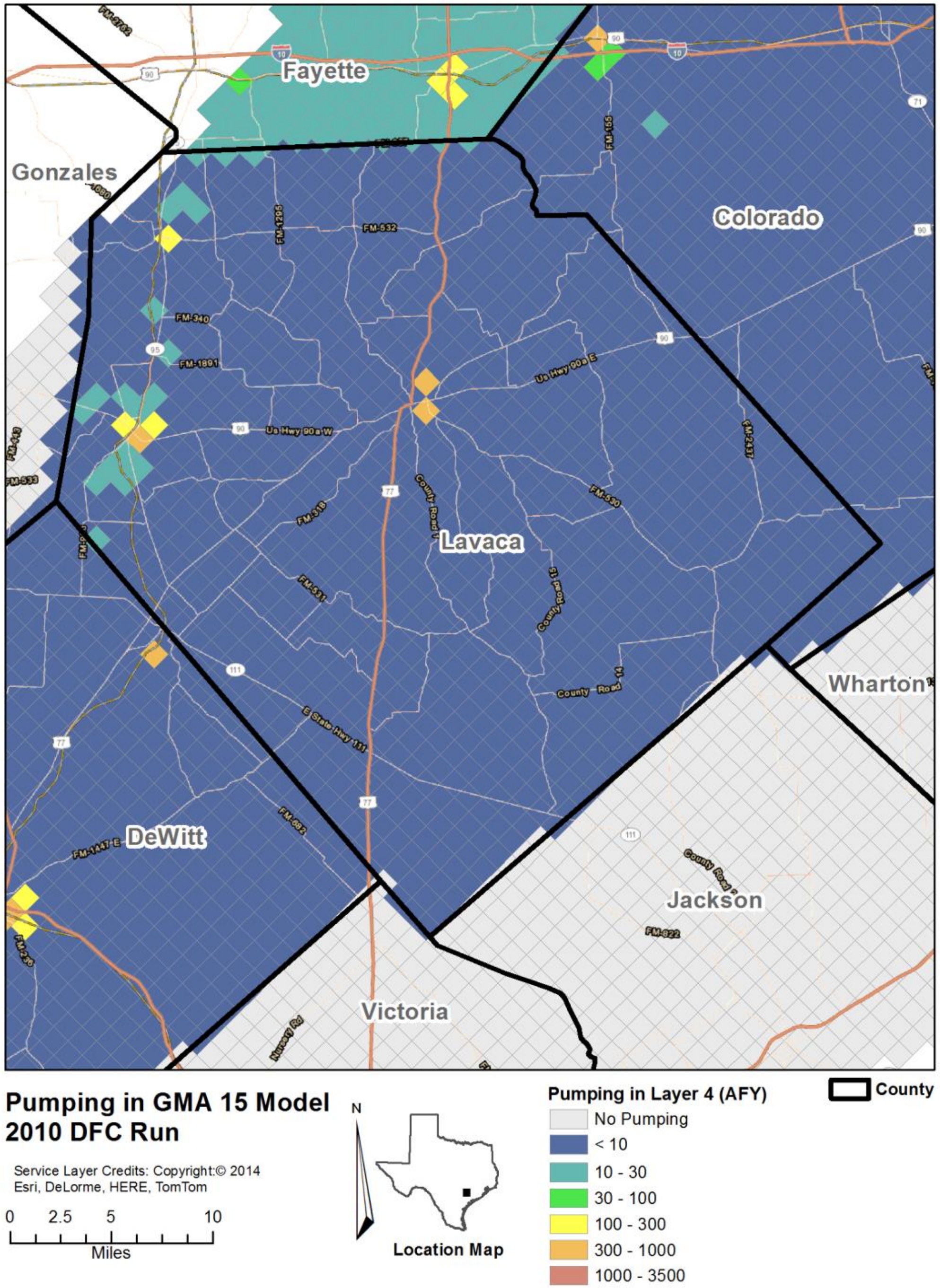
Lavaca County Pumping for Layer 4 for DFCs (Jasper)



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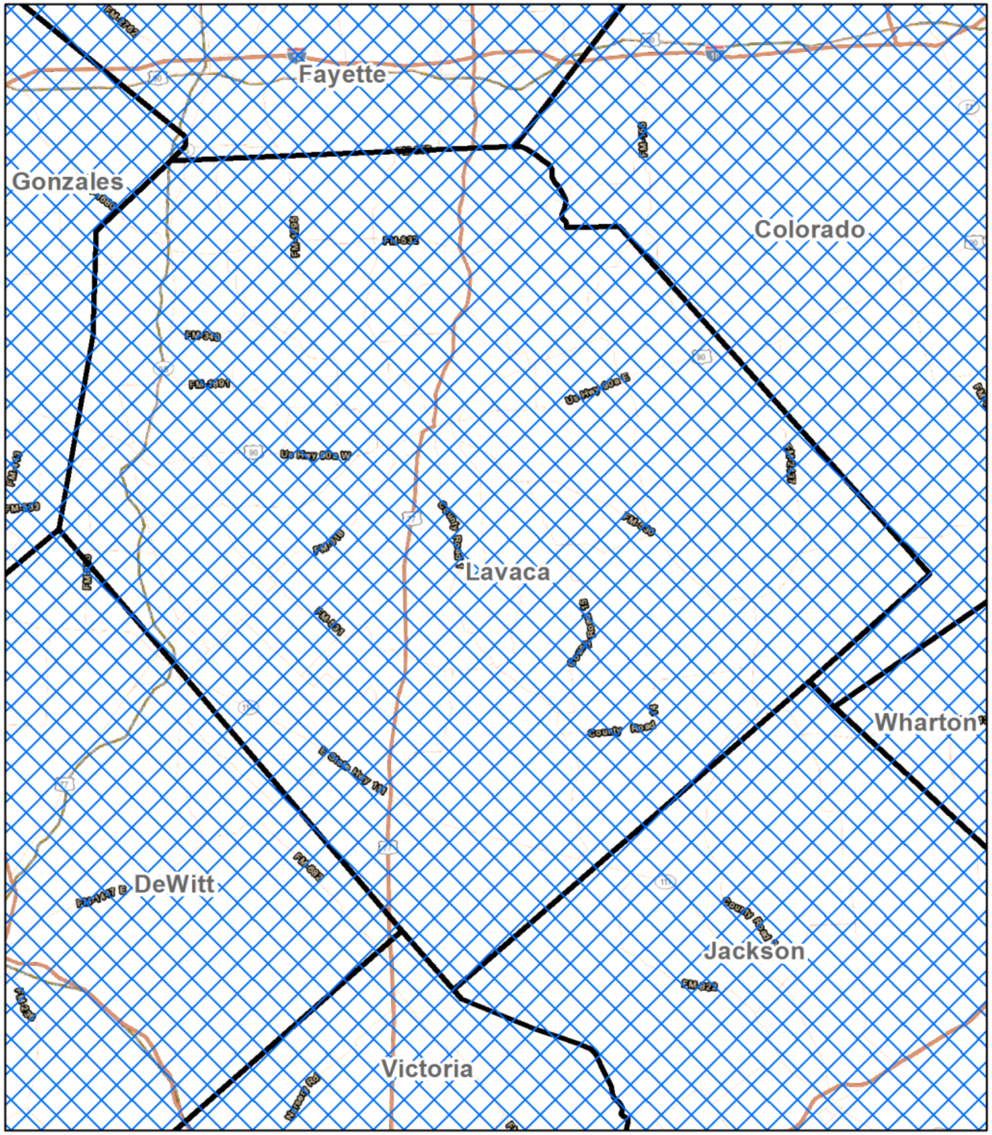
Lavaca County Blank Grid for Pumping Zones



Lavaca County GAM Grid Cells

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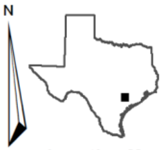
0 2.5 5 10
Miles



Location Map

GAM Grid
County

Instructions:

Clearly identify the cells to be included in the zone named below. Rmember to also fill out the Excel sheet showing the pumping rate, timing and distribution into model layers.

Zone Name: ______________________

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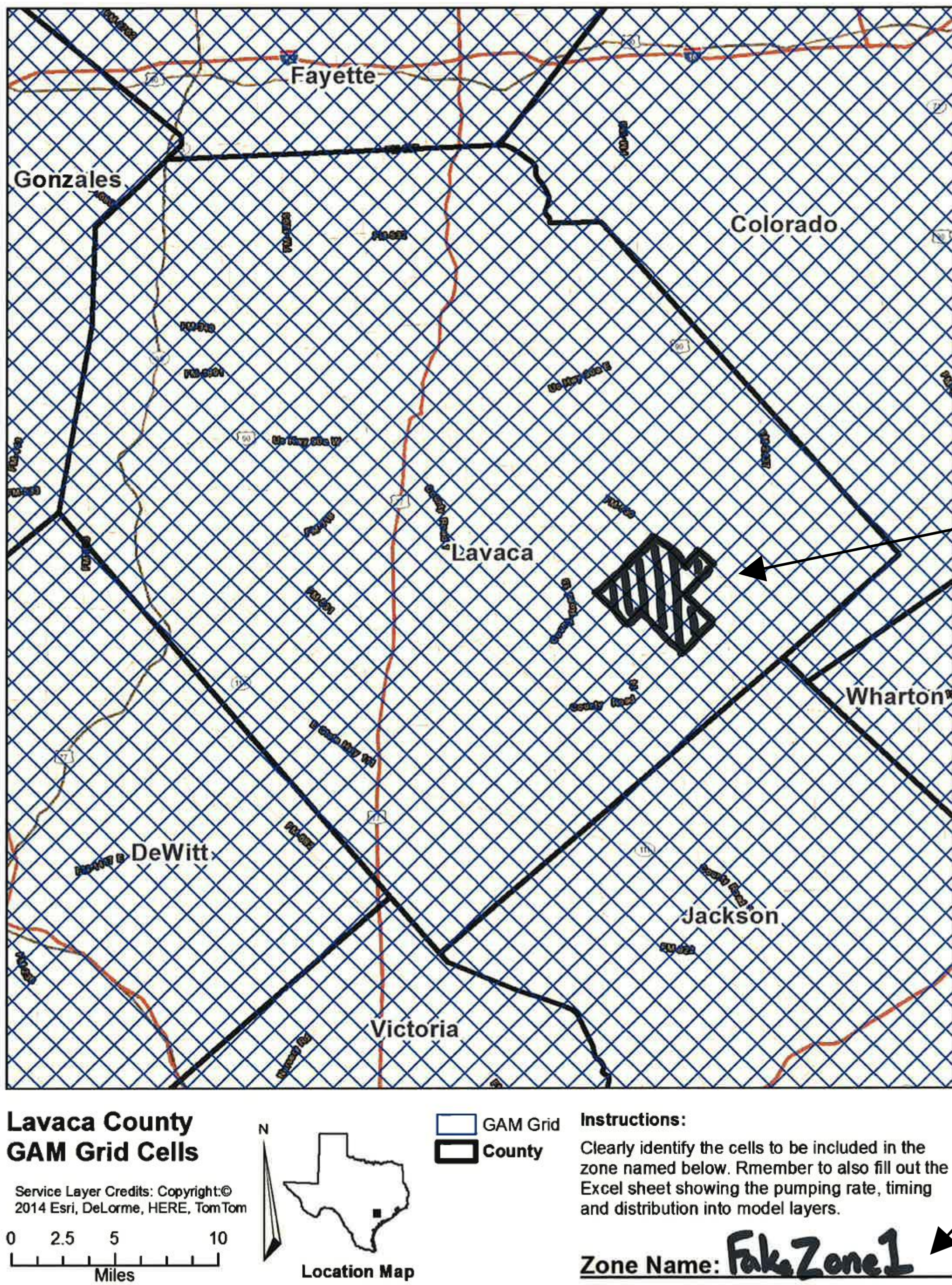
Lavaca County Pumping Zones



Draw in zone along cell boundaries

Name zone

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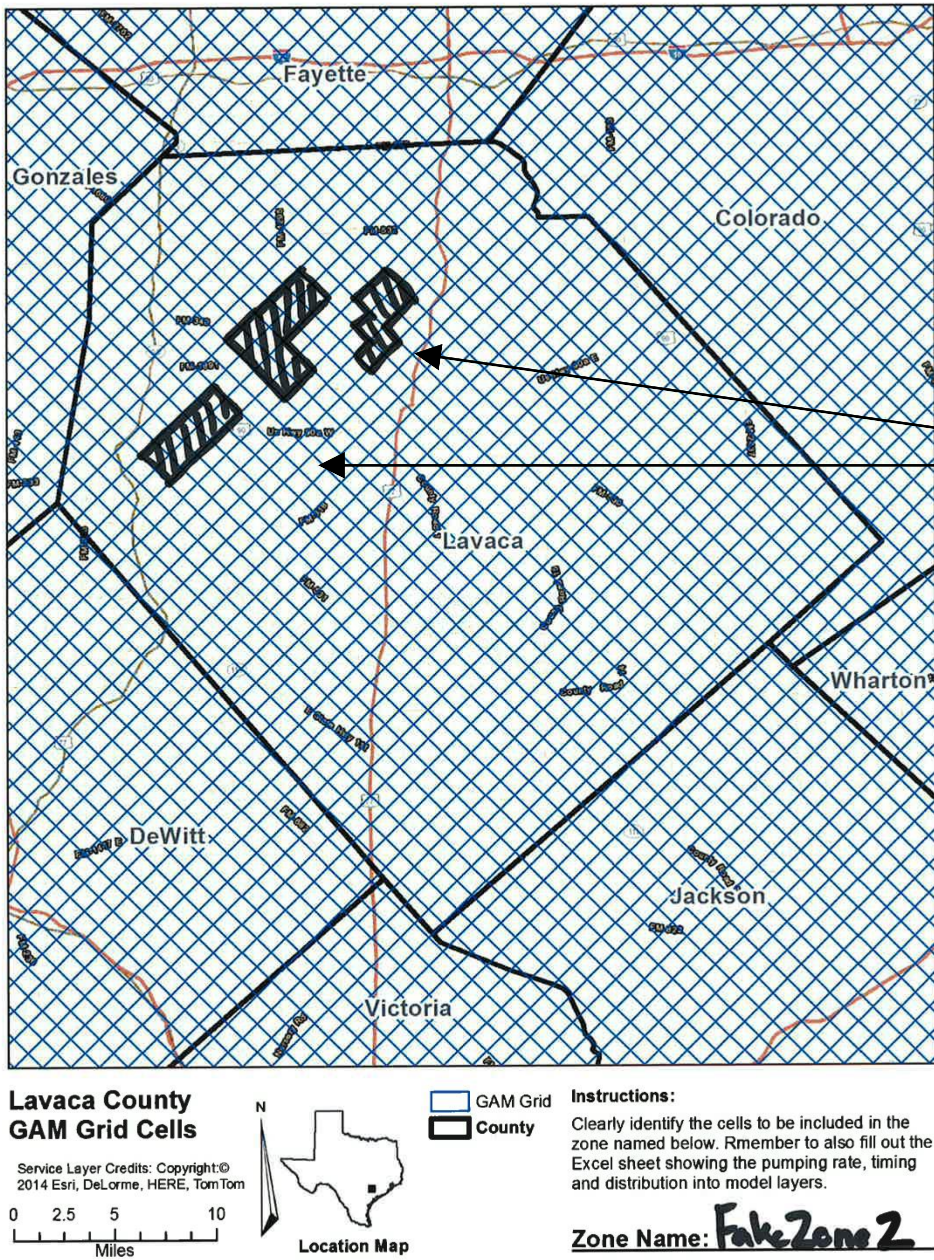
Lavaca County Pumping Zones



Zones can be discontinuous

Pumping Distribution for GAM Runs

Zone Name	County(s)	Start Year	Stop Year	Pumping Rate (ac-ft per year)	Replace or in addition to existing pumping	Percent of Pumping in Each Layer			
						Layer 1	Layer 2	Layer 3	Layer 4
FakeZone1	Lavaca	2000	2065	1200	Replace	33.3%	33.3%	0.0%	33.3%
FakeZone2	Lavaca	2020	2030	2000	Addition	50.0%	50.0%	0.0%	0.0%
FakeZone2	Lavaca	2031	2065	4000	Addition	50.0%	50.0%	0.0%	0.0%

Specify timing

(years are inclusive)

Specify amount

Replace or add

Distribution across layers

Must add up to 100% and have layer present in the zone

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Generation of Pumping Scenarios

- If multiple pumping scenarios are desired by the GMA 15 districts, the pumping inputs must be given separately for each scenario
- Assigning a philosophy or specific objective for each scenario may aid in developing pumping distributions (e.g. baseline, drought, state water plan, etc.)
- Specify different pumping for different scenarios in pumping file?
- Must select a deadline for submitting GCD pumping?

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Submission of Final DFCs to TWDB

- Packet must include
  - Copy of DFCs and the Explanatory Report
  - Copy of DFC adoption resolution
  - Copy of public notice showing when DFC adoption took place
  - Name of designated GMA representative
  - Any GAM files used in DFC development
  - Any other relevant information

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Explanatory Report

- TWDB guidance document included on CD
- Draft explanatory report should be developed prior to proposing DFCs for adoption
- Explanatory report must:
  - Identify each DFC
  - Provide policy and technical justifications for each DFC
  - Include documentation that 9 factors were considered and discussion of how DFCs impact each factor
  - List other DFCs considered and why those options were or were not adopted
  - Discuss reasons why recommendations of advisory committee and relevant public comments were or were not incorporated into DFCs

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Explanatory Report

- Policy and technical justifications for DFCs
  - Within the given scope of work, INTERA's role is to provide technical guidance and assistance in joint planning process
  - Justifications of DFCs are largely policy decisions that must be articulated by the GCDs, not the GMA consultant.
  - We recommend a DFC justification be developed and submitted by each GCD.

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Responsibilities of INTERA and GMA 15 Districts

- INTERA responsibilities within revised/adopted scope:
  - Attend up to 3 GMA 15 meetings
  - Provide brief progress reports for meetings not attended
  - Provide guidance and develop format for submitting updated pumping
  - Run and report 2-4 pumping scenarios
  - Document aquifer uses and conditions using TWDB pumping estimates
  - Document water supply needs and management strategies in state water plan
  - Document hydrological conditions using GAM run results and GCD management plans
  - Estimate land surface subsidence using drawdown relationships
  - Compile public comments from hearings documented by GCDs

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Responsibilities of INTERA and GMA 15 Districts

- GCD responsibilities within revised/adopted scope:
  - Provide updated pumping for model run scenario(s) in accepted format
  - Responsible for justifying spatial, vertical or temporal distribution of pumping
  - Responsible for developing policy and technical justifications of DFCs
  - Provide most recent management plans and rules
  - Provide documentation on impact of DFCs on property rights
  - Organize and conduct public hearings following proposal of DFCs for adoption
  - Document and summarize public hearings for compilation by INTERA
  - Develop responses to relevant public comments

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GMA Meetings Attended by INTERA

Meeting	Activities and Topics of Discussion
1st Quarterly	▪ Establishment of terms and conditions of contract ▪ Definition and agreement on final scope of work ▪ Schedule and payment terms
2nd Quarterly	Status report on the following tasks: ▪ Task 3 –Document aquifer uses or conditions in GMA 15 ▪ Task 4 –Document water supply needs and water management strategies in the SWP ▪ Task 5 –Document GMA 15 hydrological conditions
3rd Quarterly	Status report on the following task: ▪ Task 2 –Model groundwater availability associated with proposed DFCs (initial round of model runs)
4th Quarterly	Status report on the following tasks: ▪ Task 2 –Model groundwater availability associated with proposed DFCs (follow-up round of model runs) ▪ Task 6 –Document environmental impacts ▪ Task 7 –Document impacts on subsidence ▪ Task 8 –Document socioeconomic impacts ▪ Task 9 –Document impacts on private property ▪ Task 10 –Document feasibility of achieving DFCs ▪ Task 11 –Document other relevant information
5th Quarterly	Drafting of DFCs for adoption and status report on following task: ▪ Task 12 –Document public comments
6th Quarterly	Status report on following task: ▪ Task 13 –Prepare explanatory report
7th Quarterly	Preparation of DFC packet to TWDB and status report on following task: ▪ Task 14 –Technical support in event of petition

Today

Two additional meetings within scope

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Proposed Schedule

- **April 2014:** Distribute information on aquifer uses and conditions, water supply needs and management strategies, and hydrological conditions to develop pumping distributions.
- **Late Summer 2014:** Report on results of model run scenarios
- **Late Fall 2014:** Report on results of any follow-up model run scenarios and documentation of 9 factors.
- **Spring 2015:** Propose DFCs for adoption and begin public hearing process
- **Summer 2015:** Discuss public comments and compile into final explanatory report. Formally adopt DFCs at GMA and GCD levels. Submit DFC adoption materials including explanatory report to TWDB.

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Review of Meeting Decisions

- How to address non-district and non-GMA 15 areas
- Timeframe for predictive model scenarios
- Scale(s) to report model scenario results
- Philosophy behind model scenario(s)
- Deadline for GCDs submitting updated pumping
- Scale of policy and technical justification for DFCs
- Remaining GMA 15 meetings attended by INTERA

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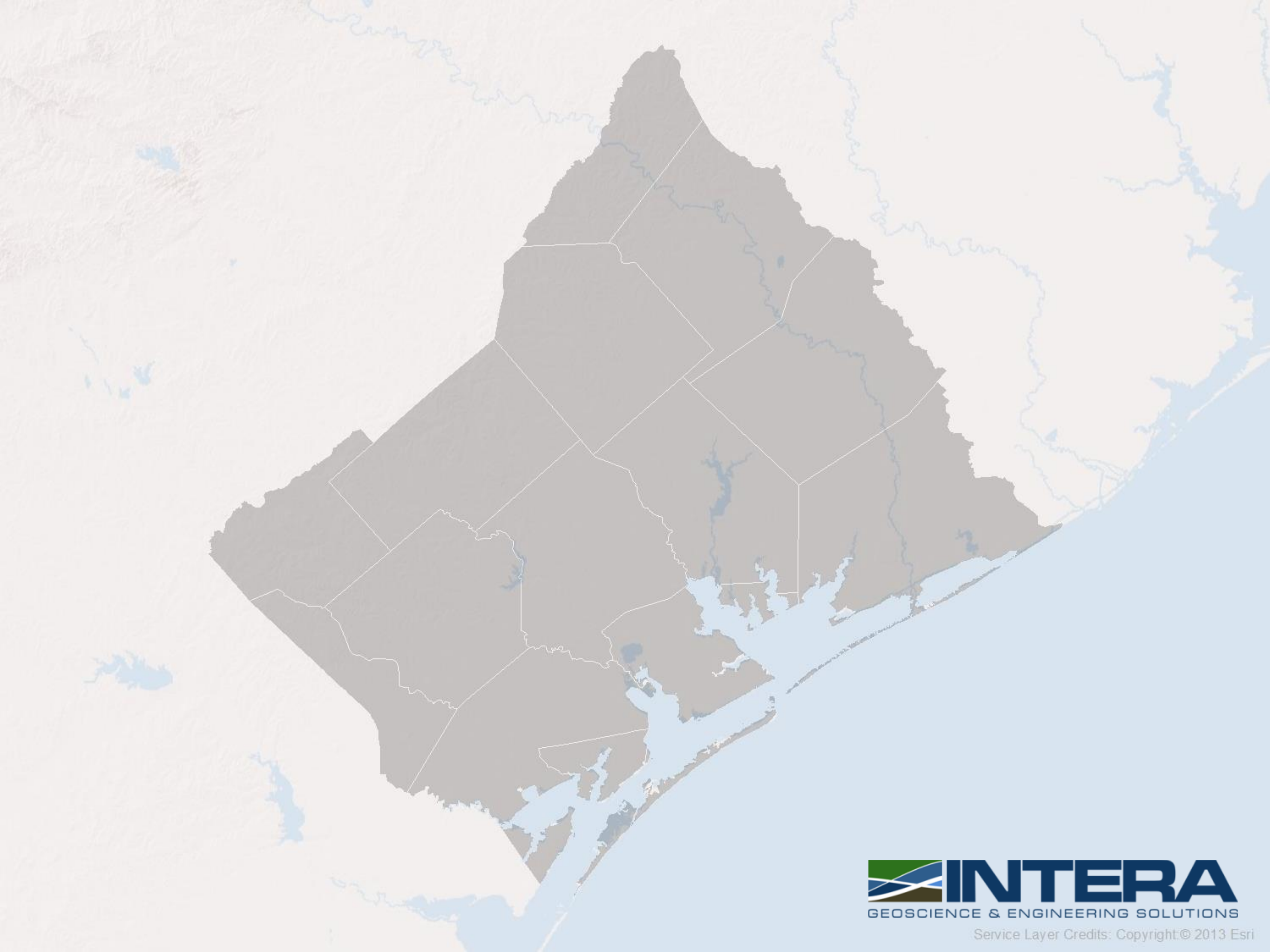
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Appendix K

Letter from INTERA to Tim Andruss Dated December 2, 2015 Providing GAM Modelling Results from the Baseline Option 1 and the High-Production Option 1 Pumping Files

INTERA Incorporated
1812 Centre Creek Drive, Suite 300
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INTERA GEOSCIENCE & ENGINEERING SOLUTIONS

December 2, 2015

Mr. Tim Andruss
General Manager
Victoria County Groundwater Conservation District
2805 N. Navarro St, Suite 210
Victoria, TX 77901

Subject: GAM Modeling Results Generated from the Baseline Option 1 and High-Production Option 1 Pumping Files

Dear Tim:

The purpose of this letter is to transmit results from GAM runs that used pumping files named Baseline Option 1 and High-Production Option 1. These runs were documented in a memo from me to you dated September 30, 2015 and were discussed in a GMA 15 meeting on October 8, 2015. In addition, the Baseline Option 1 Run were used to help develop provisional DFCs in a memo submitted to the TWDB on October 21, 2015.

On October 23, 2015 the TWDB confirmed that they reproduced the average drawdowns for Baseline Run 1 with minor and acceptable differences for Calhoun and Matagorda Counties. The differences in INTERA's and TWDB calculated average drawdown are attributed to slightly different assignment of grid cells to counties. Table 1 lists eight Exhibits that presents modeling results that GMA 15 may find useful. The eight Exhibits are attached to this cover letter.

Table 1. List of Exhibits

Exhibit A	Average Drawdowns and Pumping Rates Associated with the Option 1 Results for the Baseline Run, Baseline Run with 50% Recharge, and High Production Run
Exhibit B	Memo to the TWDB from INTERA dated October 21, 2015 Listing Provisional DFCs based on Baseline Option 1 Run
Exhibit C:	Baseline Option 1 Run Simulated Water Budgets
Exhibit D:	Baseline Option 1 Run Simulated Average Drawdown versus Time
Exhibit E:	Baseline Option 1 Run Simulated Contours of Hydraulic Head
Exhibit F:	High-Production Option 1 Run Simulated Water Budgets
Exhibit G:	High-Production Option 1 Run Simulated Average Drawdown versus Time
Exhibit H:	High-Production Option 1 Run Simulated Contours of Hydraulic Head

Sincerely,

Steven C Young

Steven C. Young, P.G., P.E.

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APPENDIX A
Average Drawdowns and Pumping Rates Associated with the Option 1 Results for the Baseline Run, Baseline Run with 50% Recharge, and High Production Run

Average drawdown from Jan. 2000 to Dec. 2069 in the Baseline Run Based on Option 1*

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System	Overall (without Burkeville)
ARANSAS	-0.1	5.8	0.0	NA	NA	0.0	0.0
BEE	1.3	8.7	6.2	7.7	5.6	6.5	6.0
CALHOUN	-0.6	10.7	2.6	2.8	NA	2.6	2.6
COLORADO	12.8	26.0	20.1	22.6	24.8	22.0	21.8
DEWITT	1.2	6.1	5.4	17.0	26.1	17.3	17.4
FAYETTE	NA	5.6	5.6	17.7	18.1	16.1	15.5
GOLIAD	-3.4	0.7	-0.1	7.2	10.5	5.2	4.2
JACKSON	15.2	20.2	17.7	14.4	22.0	17.5	18.5
KARNES	NA	0.3	0.3	18.2	24.0	20.4	21.0
LAVACA	7.2	6.8	6.9	16.1	31.1	17.6	18.2
MATAGORDA	4.0	17.2	8.0	16.7	NA	8.8	8.0
REFUGIO	-0.4	7.3	3.2	2.8	NA	3.1	3.2
VICTORIA	-4.4	6.0	1.0	5.0	9.5	3.5	3.0
WHARTON	14.6	12.4	13.5	25.5	28.4	20.0	18.1
Average	5.5	11.4	8.5	15.1	22.0	13.2	12.6

***option 1 ignores the zero pumping condition for the replace modification and keeps existing pumping**

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Average drawdown from Jan. 2000 to Dec. 2069 in the High Production Run Based on Option 1*

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System	Overall (without Burkeville)
ARANSAS	0.0	46.0	1.1	NA	NA	1.1	1.1
BEE	3.8	15.4	11.5	11.1	6.5	10.1	9.7
CALHOUN	4.5	108.4	34.1	7.9	NA	33.9	34.1
COLORADO	30.4	54.3	43.6	36.7	36.6	40.0	41.1
DEWITT	4.0	9.5	8.7	27.0	53.3	32.4	34.5
FAYETTE	NA	15.0	15.0	40.5	50.4	42.6	43.2
GOLIAD	4.5	13.1	11.3	12.9	19.6	14.2	14.7
JACKSON	65.4	143.6	104.4	52.8	42.0	82.2	92.0
KARNES	NA	1.6	1.6	21.3	32.8	27.2	28.7
LAVACA	25.0	19.1	20.9	21.2	35.6	25.9	27.7
MATAGORDA	8.2	65.2	25.5	27.3	NA	25.7	25.5
REFUGIO	1.6	67.7	32.0	20.0	NA	30.2	32.0
VICTORIA	27.0	81.3	55.1	68.3	180.1	79.5	83.8
WHARTON	38.4	60.7	49.6	43.6	38.3	45.5	46.1
Average	20.7	56.2	38.7	34.9	46.7	39.6	41.1

***option 1 ignores the zero pumping condition for the replace modification and keeps existing pumping**

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Average drawdown from Jan. 2000 to Dec. 2069 in the Baseline Run With 50% Recharge Based on Option 1*

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System	Overall (without Burkeville)
ARANSAS	-0.1	7.0	0.1	NA	NA	0.1	0.1
BEE	14.7	19.8	18.0	13.4	9.6	14.4	14.9
CALHOUN	-0.4	12.2	3.2	2.9	NA	3.2	3.2
COLORADO	27.4	38.8	33.7	29.8	30.0	31.7	32.4
DEWITT	9.6	8.9	9.0	19.7	28.1	20.1	20.2
FAYETTE	NA	12.6	12.6	21.7	20.8	19.9	19.1
GOLIAD	3.0	5.0	4.6	9.9	12.7	8.5	7.9
JACKSON	23.8	27.4	25.6	17.2	23.8	23.2	25.2
KARNES	NA	12.2	12.2	22.6	25.6	23.6	23.9
LAVACA	24.0	13.4	16.6	19.4	33.4	23.0	24.4
MATAGORDA	4.5	19.4	9.0	17.3	NA	9.8	9.0
REFUGIO	0.6	9.9	4.9	4.2	NA	4.8	4.9
VICTORIA	-0.3	9.4	4.8	7.0	11.7	6.5	6.4
WHARTON	21.4	19.2	20.3	28.4	30.4	24.7	23.4
Average	10.4	17.6	14.1	18.8	24.7	17.6	17.2

***option 1 ignores the zero pumping condition for the replace modification and keeps existing pumping**

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Baseline Pumping Rates in 2069 for Option 1*

County	Chicot	Evangeline	Burkeville	Jasper	Total
ARANSAS	1,863	0	0	0	1,863
AUSTIN	3,180	4,006	5	22	7,214
BEE	3,707	5,505	17	289	9,518
BRAZORIA	8,901	289	0	0	9,189
CALHOUN	7,950	68	0	0	8,018
COLORADO	31,602	40,066	0	919	72,587
DEWITT	1,019	7,818	166	6,408	15,411
FAYETTE	0	264	405	1,878	2,546
FORTBEND	6,248	5,381	0	0	11,629
GOLIAD	714	10,702	306	102	11,824
JACKSON	66,147	24,529	0	0	90,676
KARNES	0	105	627	3,262	3,993
LAVACA	3,095	12,647	151	4,692	20,585
MATAGORDA	33,898	7,121	0	0	41,020
REFUGIO	3,383	2,636	0	0	6,019
VICTORIA	32,170	27,873	0	0	60,043
WHARTON	114,878	66,575	0	0	181,452
Total	318,755	215,584	1,676	17,572	553,587

***option 1 ignores the zero pumping condition for the replace modification and keeps existing pumping**

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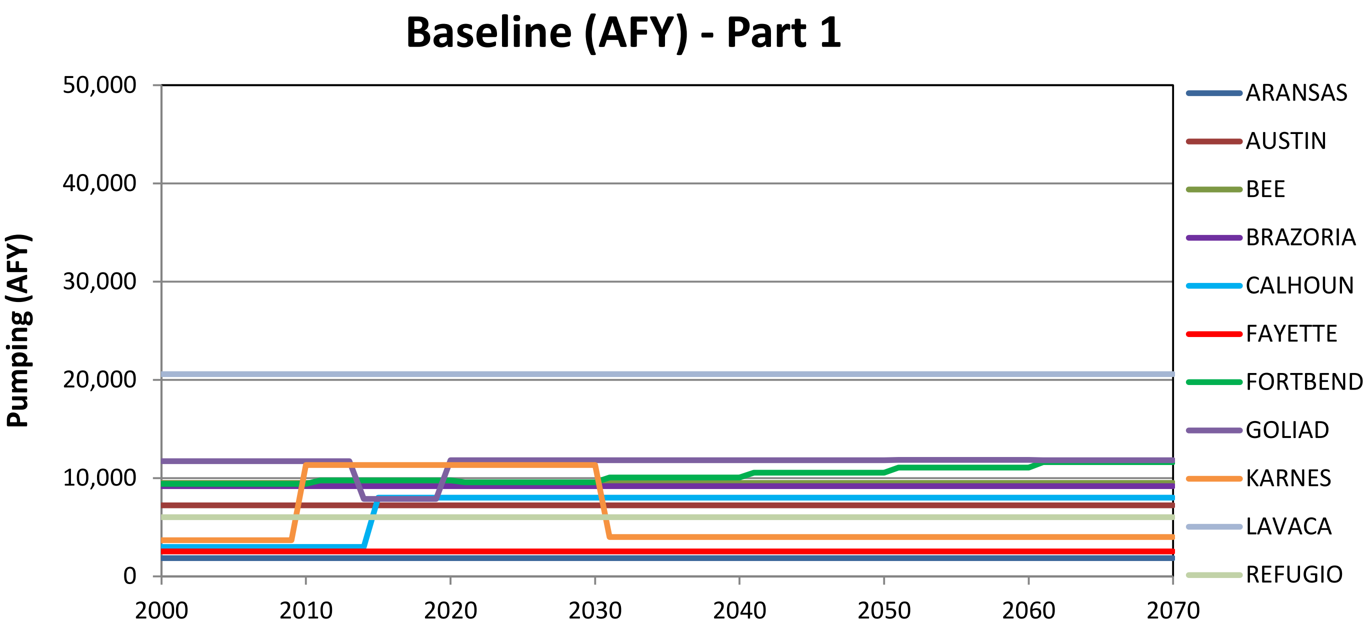
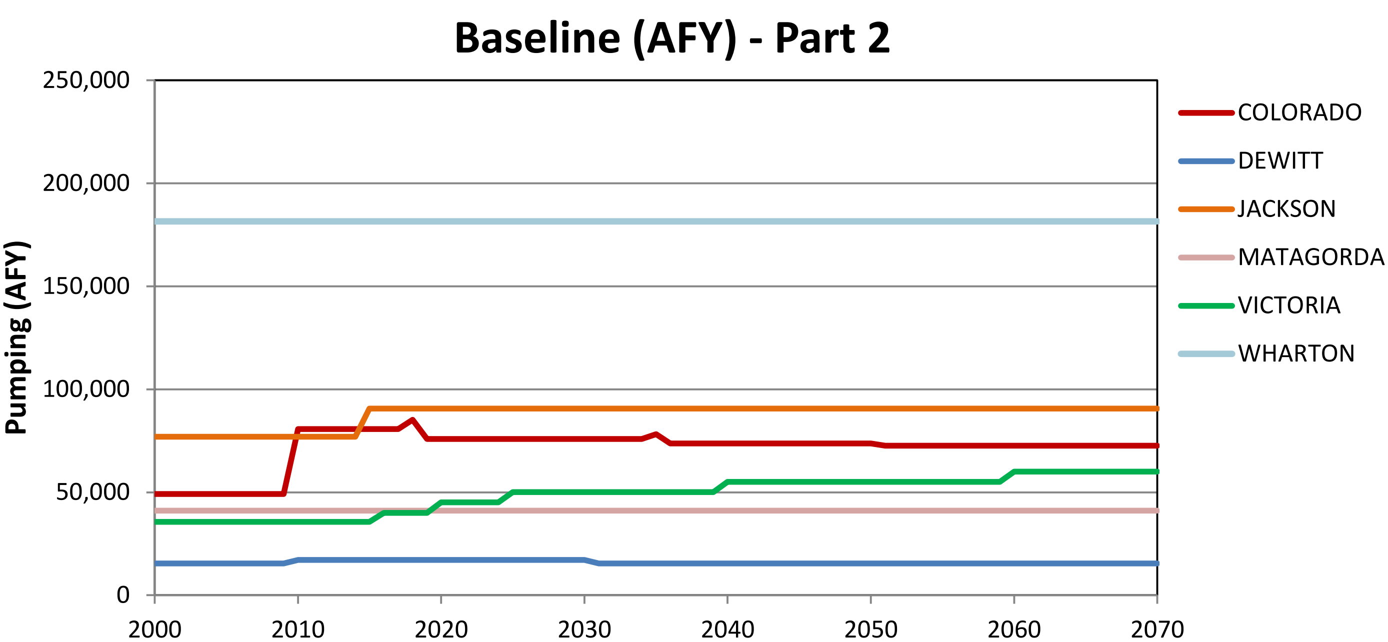
High Production Pumping Rates in 2069 for Option 1*

County	Chicot	Evangeline	Burkeville	Jasper	Total
ARANSAS	1,863	0	0	0	1,863
AUSTIN	3,180	4,006	5	22	7,214
BEE	3,707	5,505	17	289	9,518
BRAZORIA	8,901	289	0	0	9,189
CALHOUN	12,456	10,070	0	0	22,526
COLORADO	48,419	62,874	0	919	112,211
DEWITT	1,019	7,813	165	19,178	28,176
FAYETTE	0	914	1,380	6,664	8,958
FORTBEND	6,286	5,381	0	0	11,667
GOLIAD	724	12,288	311	286	13,609
JACKSON	92,308	85,452	0	0	177,760
KARNES	0	105	737	4,485	5,327
LAVACA	3,095	12,647	151	4,692	20,585
MATAGORDA	42,732	9,063	0	0	51,795
REFUGIO	6,379	37,951	0	0	44,331
VICTORIA	104,670	70,373	0	50,000	225,043
WHARTON	135,864	78,713	0	0	214,577
Total	**471,604**	**403,442**	**2,766**	**86,536**	**964,348**

***option 1 ignores the zero pumping condition for the replace modification and keeps existing pumping**

Baseline Pumping Rates from 2000 to 2007 for Option 1*





***option 1 ignores the zero pumping condition for the replace modification and keeps existing pumping**

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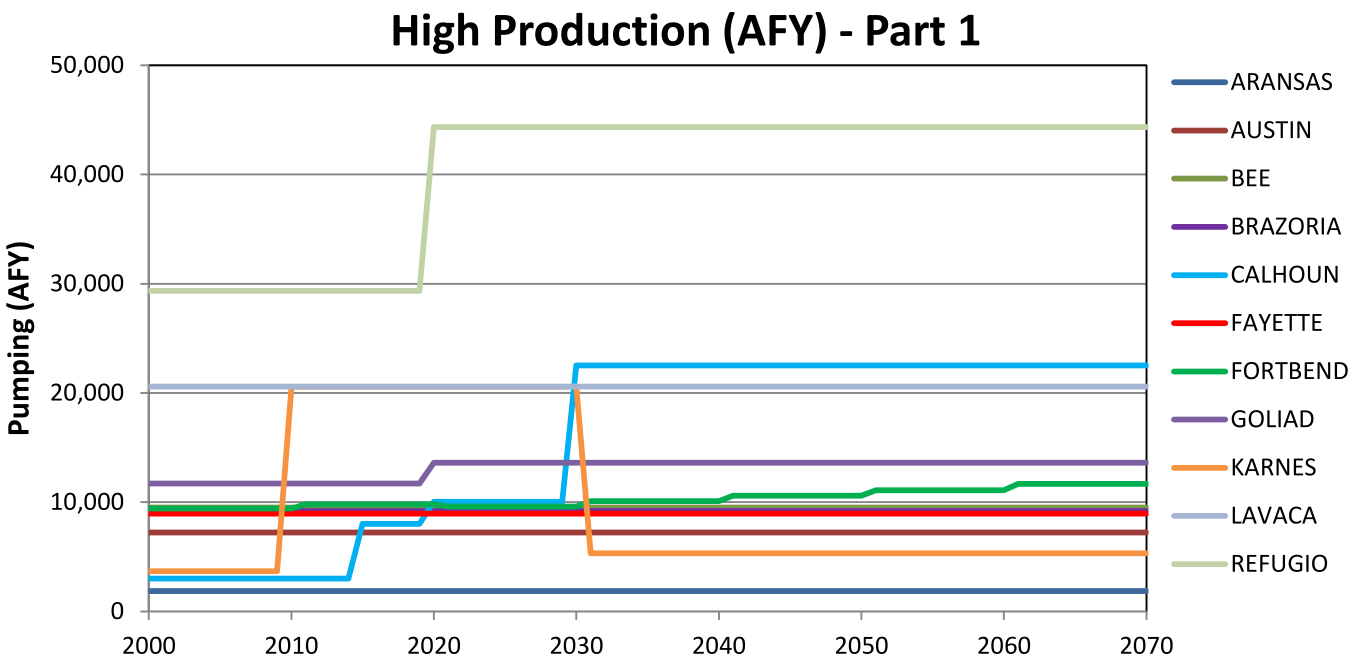
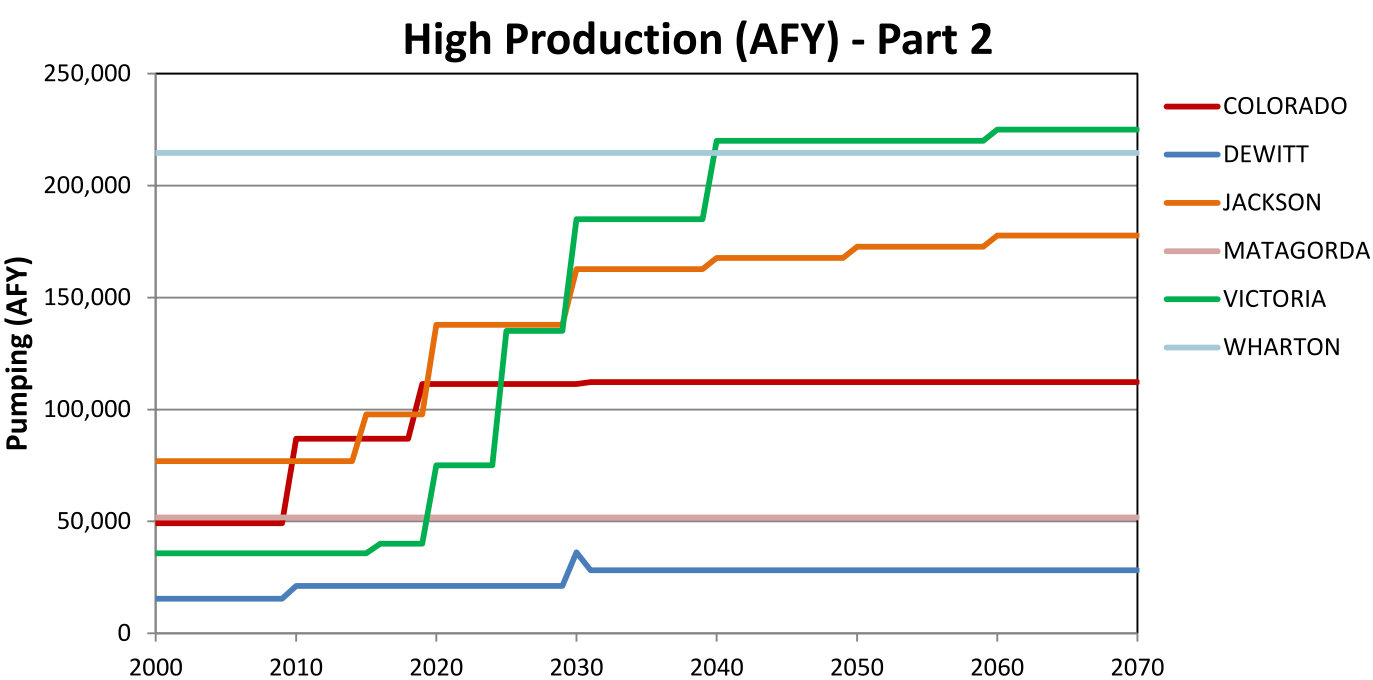
High Production Pumping Rates from 2000 to 2007 for Option 1*





*option 1 ignores the zero pumping condition for the replace modification and keeps existing pumping

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Exhibit B

Memo to the TWDB from INTERA dated October 21, 2015
Listing Provisional DFCs based on Baseline Option 1 Run

INTERA Incorporated
1812 Centre Creek Drive, Suite 300
Austin, Texas, USA 78754
512.425.2000

October 21, 2015

Cindy Ridgeway
Texas Water Development Board
1700 North Congress Avenue
Austin, Texas 78711-3231

Re: Evaluation of Provisional Desired Future Condition for GMA 15 based on GAM Simulations

Dear Cindy:

On behalf of GMA 15, INTERA is submitting a provisional DFC and supporting GAM files for TWDB's review and comment.

Attachment A is the provisional DFC. The language has been reviewed and approved by the GCDs in GMA 15. GMA 15 emphasizes that this is draft language and that the language and parameters may be adjusted as a result of updated information generated from GMA 15's continual review of the nine considerations listed in TAC §36.108. To emphasis the point that GMA 15 DFC language remains a work in progress, Attachment A has labeled all DFCs as provisional.

Along with the provisional DFC, GMA 15 is submitting on a DVD a GAM simulation that GMA 15 to demonstrate that the DFCs are compatible and physically possible. The GAM simulation was created by modifying the set of GAM input files used by TWDB to generate Model Available Groundwater (MAGs) for the districts in GMA 15 based on the 2010 DFCs. The key modifications were to extend the model simulation from 2060 to 2070 and to replace the pumping rates after the year 1999.

GMA 15 and INTERA appreciate TWDB's offer to review and comment on the provisional DFC language.

At the GMA 15 meeting of October 8, 2015, the member GCDs authorized INTERA to submit this request to TWDB.

GMA 15 appreciates the continual support that the TWDB has provided GMA 15 since the start of joint planning.
Sincerely,

Steven C Young

Steve Young, PG, PE. Ph.D

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ATTACHMENT A
GMA 15 PROVISIONAL DESIRED FUTURE CONDITIONS

GMA 15 has identified Provisional Desired Future Conditions (PDFCs) defined in terms of average drawdowns as of December 2070 for the following:

Gulf Coast Aquifer System – this drawdown represents an average drawdown for the Chicot Aquifer, the Evangeline Aquifer, the Burkeville Confining Unit, and the Jasper aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Chicot and Evangeline Aquifers – this drawdown represents an average drawdown for the Chicot Aquifer and the Evangeline Aquifer that is weighted by the area of each hydrogeological unit in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

Jasper Aquifer- this drawdown represents an average drawdown for the area of the Jasper Aquifer in the Central Gulf Coast Aquifer GAM (Chowdhury and others, 2004).

An overarching PDFC for the counties in GMA 15 is a drawdown of 13 feet for the Gulf Coast Aquifer System. Table A-1 lists additional PDFCs that are county specific.

Table A-1. Provisional Desired Future Conditions for GMA 15 Expressed as an Average Drawdown between January 2000 and December 2069.

County	Chicot and Evangeline	Jasper	Gulf Coast Aquifer System
ARANSAS[1]	NPDFC	NPDFC	0
BEE	NPDFC	NPDFC	7
CALHOUN	NPDFC	NPDFC	5
COLORADO	17	23	NPDPC
DEWITT	NPDFC	NPDFC	17
FAYETTE	NPDFC	NPDFC	16
GOLIAD	NPDFC	NPDFC	10
JACKSON	NPDFC	NPDFC	15
KARNES[2]	NPDFC	NPDFC	22
LAVACA	NPDFC	NPDFC	18
MATAGORDA[1]	11	NPDFC	NPDFC
REFUGIO	NPDFC	NPDFC	5
VICTORIA	NPDFC	NPDFC	5
WHARTON[1]	15	NPDFC	NPDFC
GMA 15	NPDFC	NPDFC	**13**

NPDFC - No Provisional DFC

[1] Burkeville and Jasper are not relevant

[2] Chicot is not relevant

Among the information used by GMA 15 to establish the PDFCs are drawdowns predicted from the Central Gulf Coast GAM (Chowdhury and others, 2004). One of the reasons that GMA 15 performed the predictive simulations was to demonstrate that the PDFCs are compatible and physically possible. Table A-2 presents average drawdowns simulated using the Central Gulf Coast GAM (Chowdhury and others, 2004) and a MODFLOW pumping file created by GMA 15 called Baseline_Run1.

Table A-2. Average Drawdown between January 2000 and December 2069 for Counties in GMA 15 Predicted by the Central Gulf Coast GAM and Pumping File Baseline_Run1

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Gulf Coast Aquifer System
ARANSAS	-0.1	5.8	0.0	NA	NA	0.0
BEE	1.3	8.7	6.2	7.7	5.6	6.5
CALHOUN	-0.6	10.7	2.6	2.8	NA	2.6
COLORADO	12.8	26.0	20.1	22.6	24.8	22.0
DEWITT	1.2	6.1	5.4	17.0	26.1	17.3
FAYETTE	NA	5.6	5.6	17.7	18.1	16.1
GOLIAD	-3.4	0.7	-0.1	7.2	10.5	5.2
JACKSON	15.2	20.2	17.7	14.4	22.0	17.5
KARNES	NA	0.3	0.3	18.2	24.0	20.4
LAVACA	7.2	6.8	6.9	16.1	31.1	17.6
MATAGORDA	4.0	17.2	8.0	16.7	NA	8.8
REFUGIO	-0.4	7.3	3.2	2.8	NA	3.1
VICTORIA	-4.4	6.0	1.0	5.0	9.5	3.5
WHARTON	14.6	12.4	13.5	25.5	28.4	20.0
Average	5.5	11.4	8.5	15.1	22.0	13.2

NA - Not Applicable because the Unit is not represented in the Central Gulf Coast GAM

GMA 15 considers the PDFCs in Table A-1 to be compatible and physically possible if the difference between the PDFCs in Table A-1 and the simulated drawdowns in Table A-2 are within 3.5 feet except in the case of Goliad County. Factors considered for determining tolerance criteria of 3.5 feet include:

- Residuals and root-mean square error (RSME) between the measured and simulated values for historical water levels produced by the Central Gulf Coast GAM;
- Sensitivity of the simulated drawdown to the recharge rate used in the predictive simulation and estimates of uncertainty in the magnitude and distribution of historical and predicted recharge rates;
- Sensitivity of the simulated drawdown to the hydraulic properties of the aquifer properties in the predicted simulation and observed differences between measured hydraulic aquifer properties and modeled aquifer hydraulic properties in the Central Gulf Coast GAM;
- Uncertainty in the temporal and spatial distribution of historical and future pumping in the GMA 15 counties.

GMA 15 considers the PDFC for Goliad County to be compatible and physically possible if the difference between the PDFCs in Table A-1 and the simulated drawdowns in Table A-2 are within 5.0 feet. Factors considered by GMA 15 for determining the tolerance criteria of 5.0 feet have been documented by Goliad County GCD and include:

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- an evaluation of water level change in sixty Evangeline wells from 2003 to 2015, which indicates that the GAM underpredicts drawdown in the Evangeline Aquifer underlying Goliad County
- an evaluation of water level change in fifteen Chicot wells from 2003 to 2015, which indicates that the GAM underpredicts drawdown in the Chicot Aquifer underlying Goliad County
- an evaluation of gain-loss studies performed by the USGS that indicates that the GAM overpredicts leakage from the streams in areas of pumping
- evidence suggesting that the GAM's average recharge rate for Goliad County is too high

References:

Chowdhury, A. Wade, S., Mace, R.E., and Ridgeway, C., 2004, Groundwater Availability of the Central Gulf Coast Aquifer System: Numerical Simulations through 1999: Texas Water Development Board, unpublished report.

Exhibit C

Baseline Option 1 Run Simulated Water Budgets

Water Budget for the Central Portion of the
Gulf Coast Aquifer by County in the GAM
(2030, 2050, 2070)

Aransas	**2030**				**2050**				**2070**			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	110	0	-	-	110	0	-	-	110	0	-	-
Net Stream Leakage	1,748	0	-	-	1,750	0	-	-	1,750	0	-	-
Vertical Leakage Lower	34	0	-	-	33	0	-	-	33	0	-	-
Net Lateral Flow From Refugio	2,195	34	-	-	2,193	33	-	-	2,193	33	-	-
Net Lateral Flow From San Patricio	218	-	-	-	205	-	-	-	198	-	-	-
Net Lateral Inflow From Other Areas	137	-	-	-	140	-	-	-	141	-	-	-
Total Inflow	*4,442*	*34*	-	-	*4,431*	*33*	-	-	*4,425*	*33*	-	-
Outflow												
Wells	1,642	0	-	-	1,642	0	-	-	1,642	0	-	-
Drains	9	0	-	-	9	0	-	-	9	0	-	-
Et	739	0	-	-	739	0	-	-	739	0	-	-
Net Head Dep Bounds	2,019	0	-	-	2,005	0	-	-	1,998	0	-	-
Vertical Leakage Upper	-	34	-	-	-	33	-	-	-	33	-	-
Net Lateral Flow To Calhoun	37	-	-	-	37	-	-	-	37	-	-	-
Total Outflow	*4,446*	*34*	-	-	*4,432*	*33*	-	-	*4,425*	*33*	-	-
Inflow - Outflow	-4	0	-	-	-1	0	-	-	0	0	-	-
Storage Change	-4	0	-	-	-1	0	-	-	0	0	-	-
Model Error	0	0	-	-	0	0	-	-	0	0	-	-
Model Error (percent)	0.00%	0.00%	-	-	0.00%	0.00%	-	-	0.00%	0.00%	-	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Bee	**2030**				**2050**				**2070**			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	18,826	5,053	26	23	18,826	5,019	60	23	18,826	5,007	72	23
Net Stream Leakage	2,228	4,387	91	10	2,506	4,566	95	41	2,413	4,658	97	65
Net Vertical Leakage Upper	-	5,541	149	482	-	5,533	178	460	-	5,536	224	472
Net Lateral Flow From Goliad	167	1,200	9	38	166	1,210	8	19	166	1,222	7	11
Net Lateral Flow From Karnes	-	120	-	204	-	119	-	199	-	119	-	194
Net Lateral Flow From Live Oak	186	-	-	-	195	-	-	-	198	-	-	-
Total Inflow	*21,407*	*16,301*	*275*	*757*	*21,693*	*16,447*	*341*	*742*	*21,603*	*16,542*	*400*	*765*
Outflow												
Wells	8,938	12,266	76	611	8,938	12,213	76	611	8,938	12,196	76	611
Et	119	0	0	0	110	0	0	0	104	0	0	0
Net Vertical Leakage Lower	5,541	149	482	-	5,533	178	460	-	5,536	224	472	-
Net Lateral Flow To Karnes	-	-	3	-	-	-	4	-	-	-	5	-
Net Lateral Flow To Live Oak	-	215	41	327	-	171	40	323	-	155	41	317
Net Lateral Flow To Refugio	5,130	2,573	16	-	5,077	2,549	15	-	4,944	2,530	15	-
Net Lateral Flow To San Patricio	2,640	1,545	13	98	2,754	1,582	14	109	2,575	1,596	14	114
Total Outflow	*22,368*	*16,748*	*631*	*1,036*	*22,412*	*16,693*	*609*	*1,043*	*22,097*	*16,701*	*623*	*1,042*
Inflow - Outflow	-961	-447	-356	-279	-719	-246	-268	-301	-494	-159	-223	-277
Storage Change	-963	-453	-357	-279	-721	-250	-270	-299	-494	-163	-223	-275
Model Error	2	6	1	0	2	4	2	-2	0	4	0	-2
Model Error (percent)	0.01%	0.04%	0.15%	0.00%	0.01%	0.02%	0.32%	0.19%	0.00%	0.02%	0.00%	0.19%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Calhoun	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	2,567	0	0	-	2,590	0	0	-	2,610	0	0	-
Recharge	2,778	0	0	-	2,778	0	0	-	2,778	0	0	-
Net Stream Leakage	1,242	0	0	-	1,049	0	0	-	1,303	0	0	-
Net Vertical Leakage Upper	-	1,452	-	-	-	1,513	-	-	-	1,564	-	-
Net Vertical Leakage Lower	-	5	0	-	-	5	0	-	-	5	0	-
Net Lateral Flow From Aransas	37	-	-	-	37	-	-	-	37	-	-	-
Net Lateral Flow From Jackson	1,950	-	-	-	1,738	-	-	-	1,658	-	-	-
Net Lateral Flow From Matagorda	57	-	-	-	56	-	-	-	56	-	-	-
Net Lateral Flow From Refugio	489	108	-	-	494	115	-	-	497	122	-	-
Net Lateral Flow From Victoria	5,449	-	-	-	5,574	-	-	-	5,029	-	-	-
Net Lateral Inflow From Other Areas	289	-	-	-	445	-	-	-	534	-	-	-
Total Inflow	*14,858*	*1,565*	-	-	*14,761*	*1,633*	-	-	*14,502*	*1,691*	-	-
Outflow												
Wells	7,512	58	0	-	7,512	58	0	-	7,512	58	0	-
Drains	1,016	0	0	-	1,003	0	0	-	990	0	0	-
Et	1,208	0	0	-	1,203	0	0	-	1,199	0	0	-
Net Head Dep Bounds	3,867	0	0	-	3,572	0	0	-	3,406	0	0	-
Net Vertical Leakage Upper	-	-	5	-	-	-	5	-	-	-	5	-
Net Vertical Leakage Lower	1,452	-	-	-	1,513	-	-	-	1,564	-	-	-
Net Lateral Flow To Jackson	-	519	-	-	-	547	-	-	-	564	-	-
Net Lateral Flow To Victoria	-	729	-	-	-	746	-	-	-	788	-	-
Net Lateral Outflow To Other Areas	-	277	-	-	-	287	-	-	-	289	-	-
Total Outflow	*15,055*	*1,583*	*5*	-	*14,803*	*1,638*	*5*	-	*14,671*	*1,699*	*5*	-
Inflow - Outflow	-197	-18	-5	-	-42	-5	-5	-	-169	-8	-5	-
Storage Change	-198	-18	-5	-	-42	-4	-5	-	-171	-7	-5	-
Model Error	1	0	0	-	0	-1	0	-	2	-1	0	-
Model Error (percent)	0.01%	0.00%	0.00%	-	0.00%	0.06%	0.00%	-	0.01%	0.06%	0.00%	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Colorado	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,408	0	0	0	1,408	0	0	0	1,408	0	0	0
Recharge	35,125	2,501	0	0	35,125	2,501	0	0	35,125	2,501	0	0
Net Stream Leakage	41,338	3,040	0	0	42,643	3,229	0	0	43,365	3,335	0	0
Net Vertical Leakage Upper	-	39,672	-	95	-	38,119	-	212	-	37,971	-	317
Net Vertical Leakage Lower	-	1,212	-	-	-	787	-	-	-	469	-	-
Net Lateral Flow From Austin	1,669	2,934	4	51	1,734	2,922	5	60	1,850	2,920	5	65
Net Lateral Flow From Fayette	-	706	20	318	-	701	20	322	-	698	21	324
Net Lateral Flow From Jackson	93	119	-	-	118	126	-	1	122	126	-	1
Net Lateral Flow From Lavaca	6,543	4,504	6	-	6,865	4,617	6	-	6,863	4,512	7	-
Total Inflow	*86,176*	*54,688*	*30*	*464*	*87,893*	*53,002*	*31*	*595*	*88,733*	*52,532*	*33*	*707*
Outflow												
Wells	32,268	42,746	0	919	32,048	40,766	0	919	31,601	40,065	0	919
Drains	4	0	0	0	4	0	0	0	4	0	0	0
Et	44	0	0	0	43	0	0	0	43	0	0	0
Net Vertical Leakage Upper	-	-	1,212	-	-	-	787	-	-	-	469	-
Net Vertical Leakage Lower	39,672	-	95	-	38,119	-	212	-	37,971	-	317	-
Net Lateral Flow To Lavaca	-	-	-	62	-	-	-	61	-	-	-	55
Net Lateral Flow To Wharton	19,148	12,073	42	157	19,478	12,307	42	156	19,830	12,505	41	155
Total Outflow	*91,136*	*54,819*	*1,349*	*1,138*	*89,692*	*53,073*	*1,041*	*1,136*	*89,449*	*52,570*	*827*	*1,129*
Inflow - Outflow	-4,960	-131	-1,319	-674	-1,799	-71	-1,010	-541	-716	-38	-794	-422
Storage Change	-4,968	-141	-1,317	-675	-1,800	-75	-1,009	-542	-718	-41	-794	-421
Model Error	8	10	-2	1	1	4	-1	1	2	3	0	-1
Model Error (percent)	0.01%	0.02%	0.15%	0.09%	0.00%	0.01%	0.10%	0.09%	0.00%	0.01%	0.00%	0.09%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

De Witt	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	4,570	5,773	15	245	4,570	5,760	28	245	4,570	5,760	28	245
Net Stream Leakage	2,412	5,248	566	1,177	2,507	5,986	463	1,184	2,550	6,138	467	1,317
Net Vertical Leakage Upper	-	4,446	3,356	3,492	-	4,512	3,303	3,729	-	4,547	3,378	3,799
Net Lateral Flow From Goliad	-	161	-	74	-	155	-	95	-	151	-	88
Net Lateral Flow From Gonzales	-	-	-	179	-	-	-	165	-	-	-	155
Net Lateral Flow From Lavaca	-	-	2	238	-	-	2	218	-	-	2	199
Total Inflow	*6,982*	*15,628*	*3,939*	*5,405*	*7,077*	*16,413*	*3,796*	*5,636*	*7,120*	*16,596*	*3,875*	*5,803*
Outflow												
Wells	1,019	6,385	901	8,083	1,019	7,076	120	6,401	1,019	7,076	118	6,401
Et	9	56	0	0	8	56	0	0	8	56	0	0
Net Vertical Leakage Lower	4,446	3,356	3,492	-	4,512	3,303	3,729	-	4,547	3,378	3,799	-
Net Lateral Flow To Goliad	-	-	2	-	-	-	2	-	-	-	2	-
Net Lateral Flow To Karnes	-	129	11	368	-	130	12	242	-	133	12	223
Net Lateral Flow To Lavaca	169	954	-	-	165	915	-	-	162	895	-	-
Net Lateral Flow To Victoria	1,342	4,941	15	139	1,374	5,029	15	120	1,384	5,096	15	128
Total Outflow	*6,985*	*15,821*	*4,421*	*8,590*	*7,078*	*16,509*	*3,878*	*6,763*	*7,120*	*16,634*	*3,946*	*6,752*
Inflow - Outflow	-3	-193	-482	-3,185	-1	-96	-82	-1,127	0	-38	-71	-949
Storage Change	-4	-194	-483	-3,188	-1	-97	-81	-1,129	-1	-38	-71	-949
Model Error	1	1	1	3	0	1	-1	2	1	0	0	0
Model Error (percent)	0.01%	0.01%	0.02%	0.03%	0.00%	0.01%	0.03%	0.03%	0.01%	0.00%	0.00%	0.00%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Fayette	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	-	0	194	115	-	0	203	128	-	0	209	138
Recharge	-	1,737	3	356	-	1,737	3	356	-	1,737	3	355
Net Stream Leakage	-	-	8	-	-	-	43	-	-	-	67	-
Net Vertical Leakage Upper	-	0	508	363	-	0	564	433	-	0	601	482
Net Lateral Flow From Austin	-	5	-	-	-	3	-	-	-	1	-	-
Net Lateral Flow From Lavaca	-	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Flow From Washington	-	-	-	2	-	-	-	4	-	-	-	4
Total Inflow	-	1,742	713	836	-	1,740	813	921	-	1,738	880	979
Outflow												
Wells	-	264	402	1,612	-	264	402	1,612	-	264	402	1,461
Et	-	0	19	16	-	0	19	10	-	0	19	7
Net Stream Leakage	-	263	-	364	-	191	-	261	-	147	-	186
Net Vertical Leakage Lower	-	508	363	-	-	564	433	-	-	601	482	-
Net Lateral Flow To Austin	-	-	-	15	-	-	-	17	-	-	-	17
Net Lateral Flow To Colorado	-	706	20	318	-	701	20	322	-	698	21	324
Net Lateral Flow To Lavaca	-	46	-	56	-	46	-	47	-	45	-	38
Total Outflow	-	*1,787*	*804*	*2,381*	-	*1,766*	*874*	*2,269*	-	*1,755*	*924*	*2,033*
Inflow - Outflow	-	-45	-91	-1,545	-	-26	-61	-1,348	-	-17	-44	-1,054
Storage Change	-	-45	-90	-1,545	-	-25	-59	-1,349	-	-15	-42	-1,056
Model Error	-	0	-1	0	-	-1	-2	1	-	-2	-2	2
Model Error (percent)	-	0.00%	0.12%	0.00%	-	0.06%	0.23%	0.04%	-	0.11%	0.22%	0.10%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Goliad	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,521	0	0	0	1,526	0	0	0	1,527	0	0	0
Recharge	10,511	8,004	0	0	10,511	8,004	0	0	10,511	8,004	0	0
Net Stream Leakage	-	6,490	0	0	-	6,803	0	0	-	6,956	0	0
Net Vertical Leakage Upper	-	2,609	51	36	-	2,646	189	102	-	2,666	296	151
Net Lateral Flow From De Witt	-	-	2	-	-	-	2	-	-	-	2	-
Net Lateral Flow From Karnes	-	535	12	92	-	522	12	88	-	514	12	91
Total Inflow	*12,032*	*17,638*	*65*	*128*	*12,037*	*17,975*	*203*	*190*	*12,038*	*18,140*	*310*	*242*
Outflow												
Wells	714	10,729	306	104	714	10,729	306	104	714	10,729	306	104
Drains	5	1	0	0	5	1	0	0	5	1	0	0
Et	192	34	0	0	190	33	0	0	189	33	0	0
Net Stream Leakage	4,962	-	-	-	4,830	-	-	-	4,806	-	-	-
Net Vertical Leakage Lower	2,609	51	36	-	2,646	189	102	-	2,666	296	151	-
Net Lateral Flow To Bee	167	1,200	9	38	166	1,210	8	19	166	1,222	7	11
Net Lateral Flow To De Witt	-	161	-	74	-	155	-	95	-	151	-	88
Net Lateral Flow To Refugio	3,118	2,809	12	-	3,101	2,806	12	-	3,098	2,807	12	-
Net Lateral Flow To Victoria	383	2,778	16	229	395	2,894	16	232	398	2,926	16	231
Total Outflow	*12,150*	*17,763*	*379*	*445*	*12,047*	*18,017*	*444*	*450*	*12,042*	*18,165*	*492*	*434*
Inflow - Outflow	-118	-125	-314	-317	-10	-42	-241	-260	-4	-25	-182	-192
Storage Change	-120	-125	-314	-316	-10	-43	-241	-259	-4	-24	-183	-191
Model Error	2	0	0	-1	0	1	0	-1	0	-1	1	-1
Model Error (percent)	0.02%	0.00%	0.00%	0.22%	0.00%	0.01%	0.00%	0.22%	0.00%	0.01%	0.20%	0.23%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Jackson	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	4,182	0	0	0	4,189	0	0	0	4,193	0	0	0
Net Head Dep Bounds	742	0	0	0	900	0	0	0	963	0	0	0
Recharge	11,758	0	0	0	11,758	0	0	0	11,758	0	0	0
Net Stream Leakage	47,249	0	0	0	48,339	0	0	0	48,517	0	0	0
Net Vertical Leakage Upper	-	15,656	-	-	-	15,574	-	-	-	15,719	-	-
Net Vertical Leakage Lower	-	1,329	473	-	-	1,251	444	-	-	1,144	417	-
Net Lateral Flow From Calhoun	-	519	-	-	-	547	-	-	-	564	-	-
Net Lateral Flow From Lavaca	9,225	8,483	19	71	10,669	8,717	19	63	12,023	8,860	18	60
Net Lateral Flow From Matagorda	346	595	-	-	579	610	-	-	682	620	-	-
Net Lateral Flow From Victoria	6,671	1,858	2	23	6,376	1,875	2	35	6,022	1,693	3	43
Net Lateral Flow From Wharton	-	-	-	7	-	-	-	-	-	-	-	-
Net Lateral Inflow From Other Areas	*717*	*641*	-	-	*945*	*682*	-	-	*1,036*	*703*	-	-
Total Inflow	80,890	29,081	494	101	83,755	29,256	465	98	85,194	29,303	438	103
Outflow												
Wells	66,010	24,532	0	0	66,010	24,532	0	0	66,010	24,532	0	0
Drains	69	0	0	0	60	0	0	0	56	0	0	0
Et	407	0	0	0	388	0	0	0	380	0	0	0
Net Vertical Leakage Upper	-	-	1,329	473	-	-	1,251	444	-	-	1,144	417
Net Vertical Leakage Lower	15,656	-	-	-	15,574	-	-	-	15,719	-	-	-
Net Lateral Flow To Calhoun	1,950	-	-	-	1,738	-	-	-	1,658	-	-	-
Net Lateral Flow To Colorado	93	119	-	-	118	126	-	1	122	126	-	1
Net Lateral Flow To Wharton	2,071	4,570	1	-	2,407	4,666	2	-	2,536	4,696	3	5
Total Outflow	*86,256*	*29,221*	*1,330*	*473*	*86,295*	*29,324*	*1,253*	*445*	*86,481*	*29,354*	*1,147*	*423*
Inflow - Outflow	-5,366	-140	-836	-372	-2,540	-68	-788	-347	-1,287	-51	-709	-320
Storage Change	-5,372	-125	-836	-373	-2,543	-62	-790	-345	-1,291	-41	-710	-319
Model Error	6	-15	0	1	3	-6	2	-2	4	-10	1	-1
Model Error (percent)	0.01%	0.05%	0.00%	0.21%	0.00%	0.02%	0.16%	0.45%	0.00%	0.03%	0.09%	0.24%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Karnes	2030				2050				2070			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	-	884	2	418	-	884	2	415	-	884	2	414
Net Stream Leakage	-	-	392	1,643	-	-	248	618	-	-	252	615
Net Vertical Leakage Upper	-	0	217	430	-	0	254	348	-	0	274	364
Net Lateral Flow From Bee	-	-	3	-	-	-	4	-	-	-	5	-
Net Lateral Flow From De Witt	-	129	11	368	-	130	12	242	-	133	12	223
Total Inflow	-	*1,013*	*625*	*2,859*	-	*1,014*	*520*	*1,623*	-	*1,017*	*545*	*1,616*
Outflow												
Wells	-	105	357	10,155	-	105	226	2,818	-	105	215	2,651
Et	-	0	1	52	-	0	1	39	-	0	1	33
Net Stream Leakage	-	48	-	-	-	19	-	-	-	8	-	-
Net Vertical Leakage Lower	-	217	430	-	-	254	348	-	-	274	364	-
Net Lateral Flow To Bee	-	120	-	204	-	119	-	199	-	119	-	194
Net Lateral Flow To Goliad	-	535	12	92	-	522	12	88	-	514	12	91
Net Lateral Flow To Gonzales	-	-	-	12	-	-	-	11	-	-	-	10
Net Lateral Flow To Live Oak	-	-	-	143	-	-	-	143	-	-	-	143
Total Outflow	-	*1,025*	*800*	*10,658*	-	*1,019*	*587*	*3,298*	-	*1,020*	*592*	*3,122*
Inflow - Outflow	-	-12	-175	-7,799	-	-5	-67	-1,675	-	-3	-47	-1,506
Storage Change	-	-12	-175	-7,800	-	-5	-65	-1,674	-	-2	-45	-1,505
Model Error	-	0	0	1	-	0	-2	-1	-	-1	-2	-1
Model Error (percent)	-	0.00%	0.00%	0.01%	-	0.00%	0.34%	0.03%	-	0.10%	0.34%	0.03%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Lavaca	**2030**				**2050**				**2070**			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	18,332	6,107	2	171	18,332	6,107	2	171	18,332	6,107	2	170
Net Stream Leakage	6,980	10,099	234	604	9,559	10,849	261	678	11,375	11,225	278	735
Net Vertical Leakage Upper	-	8,565	505	1,268	-	8,584	842	1,507	-	8,559	1,108	1,676
Net Lateral Flow From Colorado	-	-	-	62	-	-	-	61	-	-	-	55
Net Lateral Flow From De Witt	169	954	-	-	165	915	-	-	162	895	-	-
Net Lateral Flow From Fayette	-	46	-	56	-	46	-	47	-	45	-	38
Net Lateral Flow From Gonzales	-	-	-	*191*	-	-	-	*186*	-	-	-	*183*
Net Lateral Flow From Victoria	403	303	1	12	366	291	1	12	351	281	1	13
Total Inflow	*25,884*	*26,074*	*742*	*2,364*	*28,422*	*26,792*	*1,106*	*2,662*	*30,220*	*27,112*	*1,389*	*2,870*
Outflow												
Wells	3,115	12,655	151	4,496	3,115	12,655	144	4,496	3,115	12,655	119	4,483
Et	2	3	0	9	2	3	0	3	2	3	0	1
Net Vertical Leakage Lower	8,565	505	1,268	-	8,584	842	1,507	-	8,559	1,108	1,676	-
Net Lateral Flow To Colorado	6,543	4,504	6	-	6,865	4,617	6	-	6,863	4,512	7	-
Net Lateral Flow To De Witt	-	-	2	238	-	-	2	218	-	-	2	199
Net Lateral Flow To Jackson	9,225	8,483	19	71	10,669	8,717	19	63	12,023	8,860	18	60
Total Outflow	*27,450*	*26,150*	*1,446*	*4,814*	*29,235*	*26,834*	*1,678*	*4,780*	*30,562*	*27,138*	*1,822*	*4,743*
Inflow - Outflow	-1,566	-76	-704	-2,450	-813	-42	-572	-2,118	-342	-26	-433	-1,873
Storage Change	-1,566	-80	-704	-2,454	-813	-45	-572	-2,118	-340	-25	-433	-1,870
Model Error	0	4	0	4	0	3	0	0	-2	-1	0	-3
Model Error (percent)	0.00%	0.02%	0.00%	0.08%	0.00%	0.01%	0.00%	0.00%	0.01%	0.00%	0.00%	0.06%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Matagorda	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	792	0	0	-	792	0	0	-	792	0	0	-
Recharge	22,372	0	0	-	22,372	0	0	-	22,372	0	0	-
Net Stream Leakage	32,163	0	0	-	33,575	0	0	-	34,247	0	0	-
Net Vertical Leakage Upper	-	9,009	-	-	-	9,306	-	-	-	9,533	-	-
Net Vertical Leakage Lower	-	318	0	-	-	291	0	-	-	262	0	-
Net Lateral Flow From Brazoria	-	1,218	-	-	-	1,212	-	-	-	1,180	-	-
Net Lateral Flow From Wharton	2,288	-	3	-	1,731	-	2	-	1,466	-	-	-
Total Inflow	*57,615*	*10,545*	*3*	-	*58,470*	*10,809*	*2*	-	*58,877*	*10,975*	-	-
Outflow												
Wells	31,733	7,121	0	-	31,733	7,121	0	-	31,733	7,121	0	-
Drains	243	0	0	-	241	0	0	-	240	0	0	-
Et	3,023	0	0	-	3,011	0	0	-	3,005	0	0	-
Net Head Dep Bounds	5,277	0	0	-	5,118	0	0	-	5,053	0	0	-
Net Vertical Leakage Upper	-	-	318	-	-	-	291	-	-	-	262	-
Net Vertical Leakage Lower	9,009	-	-	-	9,306	-	-	-	9,533	-	-	-
Net Lateral Flow To Brazoria	2,791	-	6	-	2,807	-	6	-	2,819	-	6	-
Net Lateral Flow To Calhoun	57	-	-	-	56	-	-	-	56	-	-	-
Net Lateral Flow To Jackson	346	595	-	-	579	610	-	-	682	620	-	-
Net Lateral Flow To Wharton	-	2,914	-	-	-	3,122	-	-	-	3,267	-	-
Net Lateral Outflow To Other Areas	6,176	-	-	-	6,014	-	-	-	5,948	-	-	-
Total Outflow	*58,655*	*10,630*	*324*	-	*58,865*	*10,853*	*297*	-	*59,069*	*11,008*	*268*	-
Inflow - Outflow	-1,040	-85	-321	-	-395	-44	-295	-	-192	-33	-268	-
Storage Change	-1,045	-70	-321	-	-395	-38	-295	-	-191	-24	-267	-
Model Error	5	-15	0	-	0	-6	0	-	-1	-9	-1	-
Model Error (percent)	0.01%	0.14%	0.00%	-	0.00%	0.06%	0.00%	-	0.00%	0.08%	0.37%	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Refugio	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	14,562	0	0	-	14,562	0	0	-	14,562	0	0	-
Net Vertical Leakage Lower	397	98	0	-	305	92	0	-	250	85	0	-
Net Lateral Flow From Bee	5,130	2,573	16	-	5,077	2,549	15	-	4,944	2,530	15	-
Net Lateral Flow From Goliad	3,118	2,809	12	-	3,101	2,806	12	-	3,098	2,807	12	-
Net Lateral Flow From Victoria	223	-	-	-	166	-	-	-	163	-	-	-
Total Inflow	*23,430*	*5,480*	*28*	-	*23,211*	*5,447*	*27*	-	*23,017*	*5,422*	*27*	-
Outflow												
Wells	3,226	2,624	0	-	3,226	2,624	0	-	3,226	2,624	0	-
Drains	111	0	0	-	110	0	0	-	110	0	0	-
Et	1,846	0	0	-	1,843	0	0	-	1,842	0	0	-
Head Dep Bounds	4,905	0	0	-	4,888	0	0	-	4,882	0	0	-
Net Stream Leakage	4,419	0	0	-	3,985	0	0	-	3,707	0	0	-
Net Vertical Leakage Upper	-	397	98	-	-	305	92	-	-	250	85	-
Net Lateral Flow To Aransas	2,195	34	-	-	2,193	33	-	-	2,193	33	-	-
Net Lateral Flow To Calhoun	489	108	-	-	494	115	-	-	497	122	-	-
Net Lateral Flow To San Patricio	2,883	789	3	-	3,026	809	3	-	3,108	820	4	-
Net Lateral Flow To Victoria	-	1,520	-	-	-	1,540	-	-	-	1,551	-	-
Net Lateral Outflow To Other Areas	3,477	24	-	-	3,473	25	-	-	3,472	24	-	-
Total Outflow	*23,551*	*5,496*	*101*	-	*23,238*	*5,451*	*95*	-	*23,037*	*5,424*	*89*	-
Inflow - Outflow	-121	-16	-73	-	-27	-4	-68	-	-20	-2	-62	-
Storage Change	-123	-20	-73	-	-30	-4	-68	-	-21	-4	-62	-
Model Error	2	4	0	-	3	0	0	-	1	2	0	-
Model Error (percent)	0.01%	0.07%	0.00%	-	0.01%	0.00%	0.00%	-	0.00%	0.04%	0.00%	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

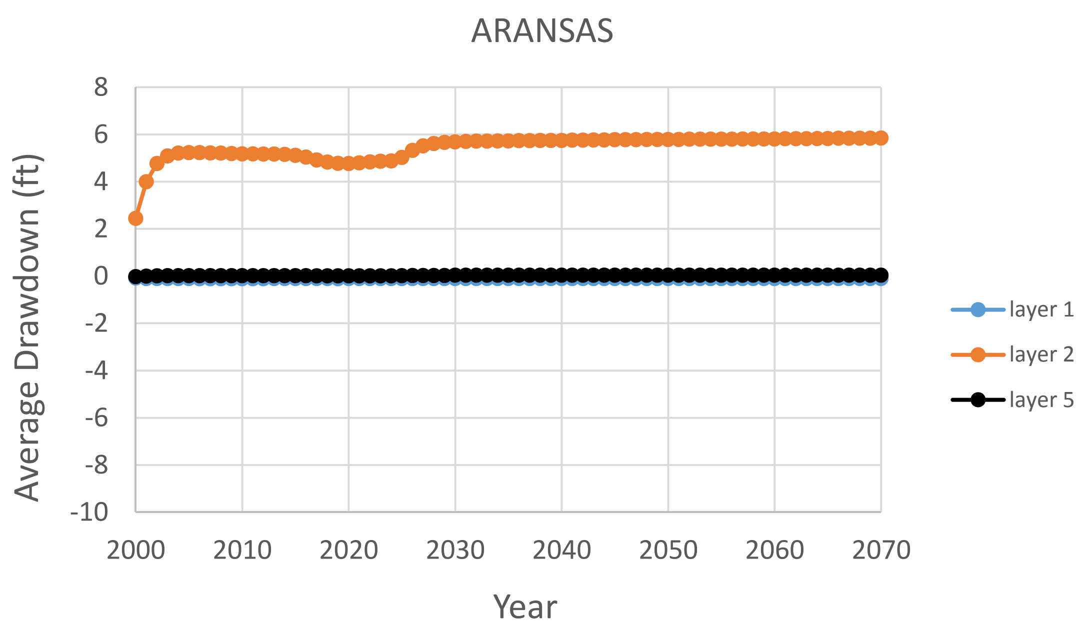
Victoria	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
River Leakage	1056	0	0	0	1056	0	0	0	1056	0	0	0
Recharge	24,838	743	0	0	24,838	743	0	0	24,838	743	0	0
Net Stream Leakage	25,510	162	0	0	31,815	707	0	0	34,412	869	0	0
Net Vertical Leakage Upper	-	15,682	-	-	-	16,218	-	-	-	16,915	-	-
Net Vertical Leakage Lower	-	940	574	-	-	918	545	-	-	942	545	-
Net Lateral Flow From Calhoun	-	729	-	-	-	746	-	-	-	788	-	-
Net Lateral Flow From De Witt	1,342	4,941	15	139	1,374	5,029	15	120	1,384	5,096	15	128
Net Lateral Flow From Goliad	383	2,778	16	229	395	2,894	16	232	398	2,926	16	231
Net Lateral Flow From Refugio	-	1,520	-	-	-	1,540	-	-	-	1,551	-	-
Total Inflow	53,129	27,495	605	368	59,478	28,795	576	352	62,088	29,830	576	359
Total Inflow	*105,645*	*64,384*	*828*	*319*	*132,962*	*71,553*	*38*	*5,089*	*142,941*	*73,508*	*916*	*5,630*
Outflow												
Wells	24,651	25,352	0	0	28,401	26,602	0	0	32,151	27,852	0	0
Drains	1,397	0	0	0	1,370	0	0	0	1,333	0	0	0
Et	875	26	0	0	860	26	0	0	845	26	0	0
Head Dep Bounds	236	0	0	0	228	0	0	0	220	0	0	0
Net Vertical Leakage Upper	-	-	940	574	-	-	918	545	-	-	942	545
Net Vertical Leakage Lower	15,682	-	-	-	16,218	-	-	-	16,915	-	-	-
Net Lateral Flow To Calhoun	5,449	-	-	-	5,574	-	-	-	5,029	-	-	-
Net Lateral Flow To Jackson	6,671	1,858	2	23	6,376	1,875	2	35	6,022	1,693	3	43
Net Lateral Flow To Lavaca	403	303	1	12	366	291	1	12	351	281	1	13
Net Lateral Flow To Refugio	223	-	-	-	166	-	-	-	163	-	-	-
Net Lateral Outflow To Other Areas	539	10	-	-	535	12	-	-	525	8	-	-
Total Outflow	*56,126*	*27,549*	*943*	*609*	*60,094*	*28,806*	*921*	*592*	*63,554*	*29,860*	*946*	*601*
Inflow - Outflow	-2,997	-54	-338	-241	-616	-11	-345	-240	-1,466	-30	-370	-242
Storage Change	-3,001	-66	-337	-242	-615	-18	-345	-241	-1,468	-36	-369	-242
Model Error	4	12	-1	1	-1	7	0	1	2	6	-1	0
Model Error (percent)	0.01%	0.04%	0.10%	0.16%	0.00%	0.02%	0.00%	0.17%	0.00%	0.02%	0.11%	0.00%

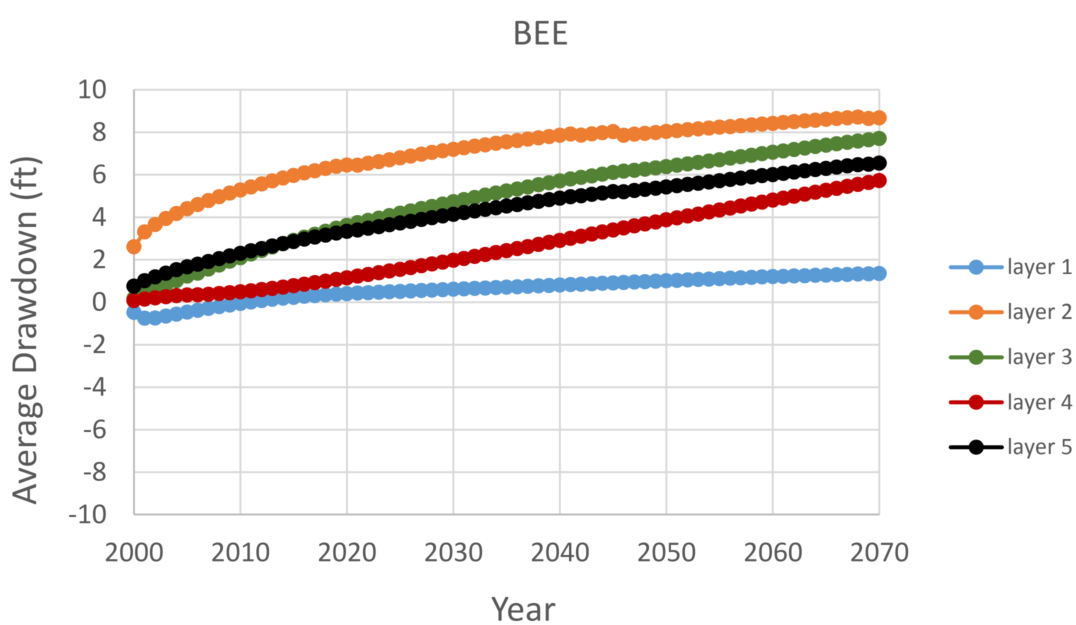
Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

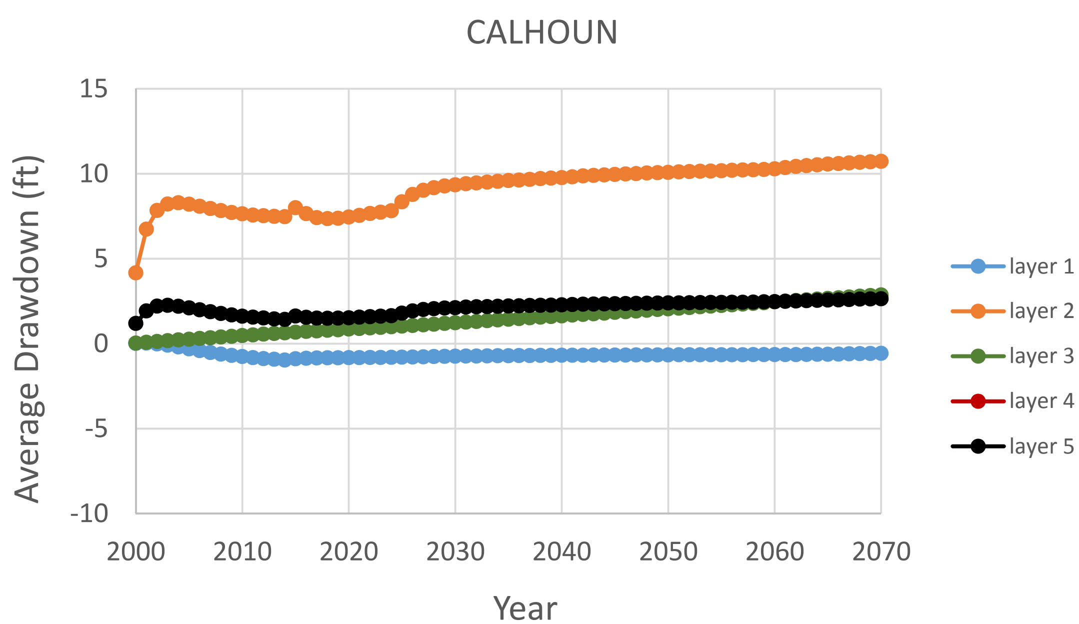
Wharton	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	537	0	0	0	537	0	0	0	537	0	0	0
Recharge	21,618	0	0	0	21,618	0	0	0	21,618	0	0	0
Net Stream Leakage	113,512	0	0	0	116,205	0	0	0	117,142	0	0	0
Net Vertical Leakage Upper	-	41,132	-	-	-	41,512	-	-	-	42,043	-	-
Net Vertical Leakage Lower	-	3,123	1,213	-	-	2,827	1,136	-	-	2,545	1,059	-
Net Lateral Flow From Austin	1,685	1,237	1	13	1,589	1,239	1	15	1,940	1,241	1	17
Net Lateral Flow From Brazoria	-	101	-	-	-	122	-	-	-	141	-	-
Net Lateral Flow From Colorado	19,148	12,073	42	157	19,478	12,307	42	156	19,830	12,505	41	155
Net Lateral Flow From Fort Bend	-	1,175	-	-	-	611	-	-	-	-	-	-
Net Lateral Flow From Jackson	2,071	4,570	1	-	2,407	4,666	2	-	2,536	4,696	3	5
Net Lateral Flow From Matagorda	-	2,914	-	-	-	3,122	-	-	-	3,267	-	-
Total Inflow	*158,571*	*66,325*	*1,257*	*170*	*161,834*	*66,406*	*1,181*	*171*	*163,603*	*66,438*	*1,104*	*177*
Outflow												
Wells	114,787	66,501	0	0	114,787	66,501	0	0	114,787	66,501	0	0
Drains	8	0	0	0	8	0	0	0	8	0	0	0
Et	193	0	0	0	190	0	0	0	188	0	0	0
Net Vertical Leakage Upper	-	-	3,123	1,213	-	-	2,827	1,136	-	-	2,545	1,059
Net Vertical Leakage Lower	41,132	-	-	-	41,512	-	-	-	42,043	-	-	-
Net Lateral Flow To Brazoria	648	-	2	7	643	-	2	6	640	-	2	5
Net Lateral Flow To Fort Bend	5,688	-	3	111	5,963	-	3	99	6,068	7	3	92
Net Lateral Flow To Jackson	-	-	-	7	-	-	-	-	-	-	-	-
Net Lateral Flow To Matagorda	2,288	-	3	-	1,731	-	2	-	1,466	-	-	-
Total Outflow	*164,744*	*66,501*	*3,131*	*1,338*	*164,834*	*66,501*	*2,834*	*1,241*	*165,200*	*66,508*	*2,550*	*1,156*
Inflow - Outflow	-6,173	-176	-1,874	-1,168	-3,000	-95	-1,653	-1,070	-1,597	-70	-1,446	-979
Storage Change	-6,178	-155	-1,875	-1,170	-3,002	-87	-1,653	-1,071	-1,595	-57	-1,445	-977
Model Error	5	-21	1	2	2	-8	0	1	-2	-13	-1	-2
Model Error (percent)	0.00%	0.03%	0.03%	0.15%	0.00%	0.01%	0.00%	0.08%	0.00%	0.02%	0.04%	0.17%

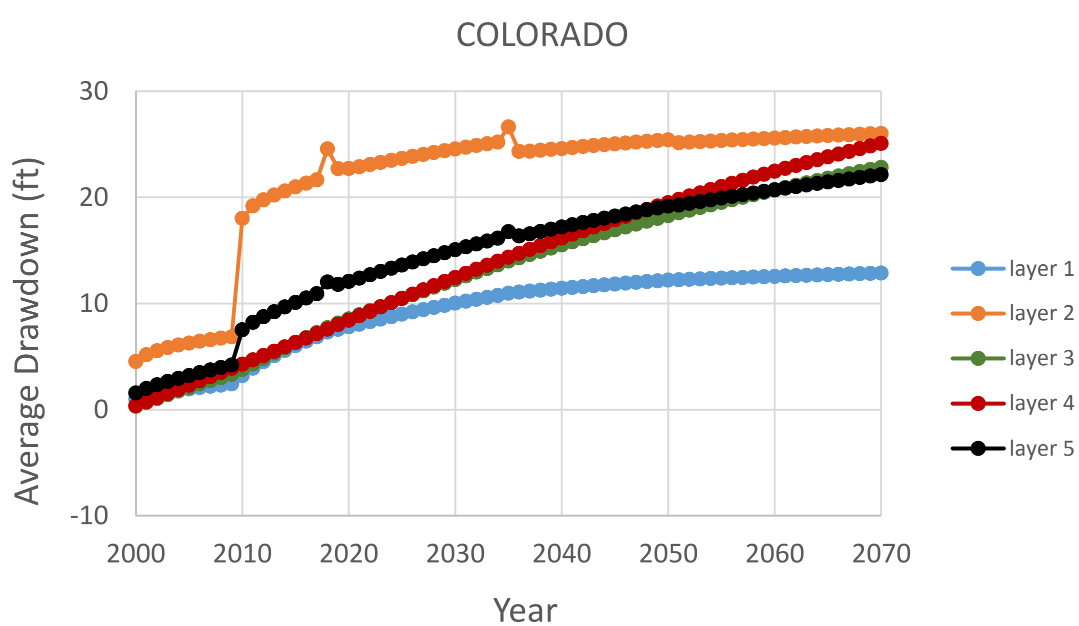
Exhibit D

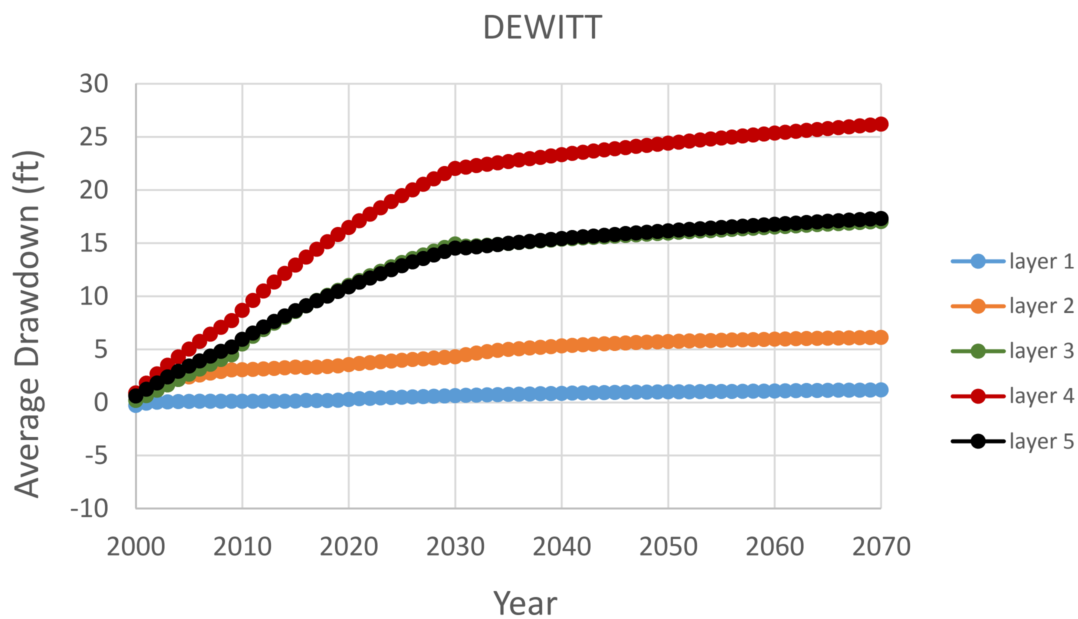
Baseline Option 1 Run Simulated Average Drawdown versus Time

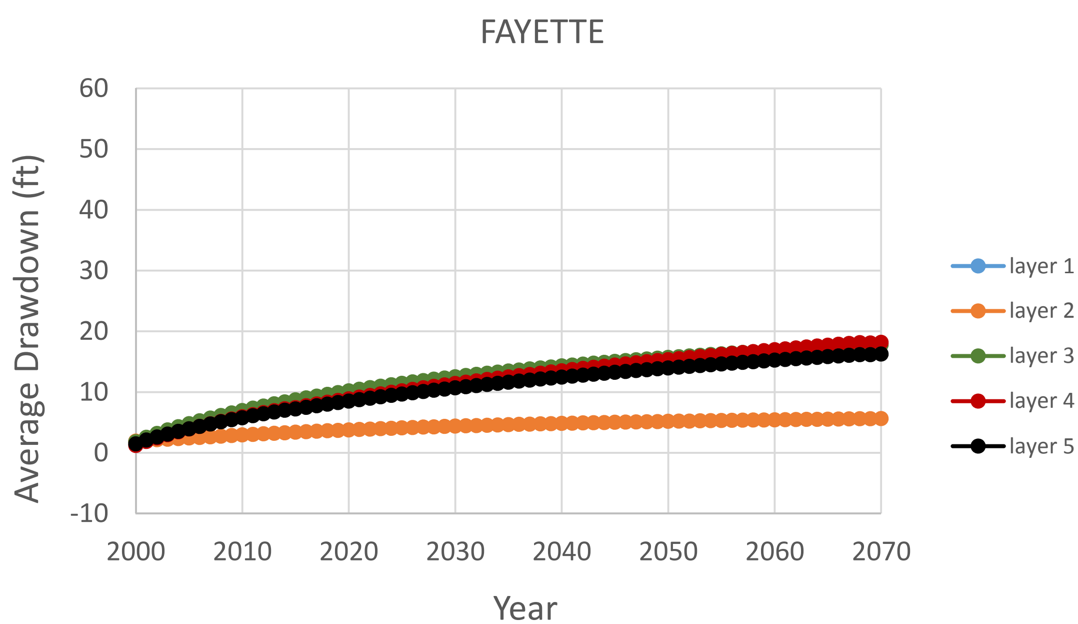

ARANSAS
8
6
4
2
0
-2
-4
-6
-8
-10
Average Drawdown (ft)
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 5

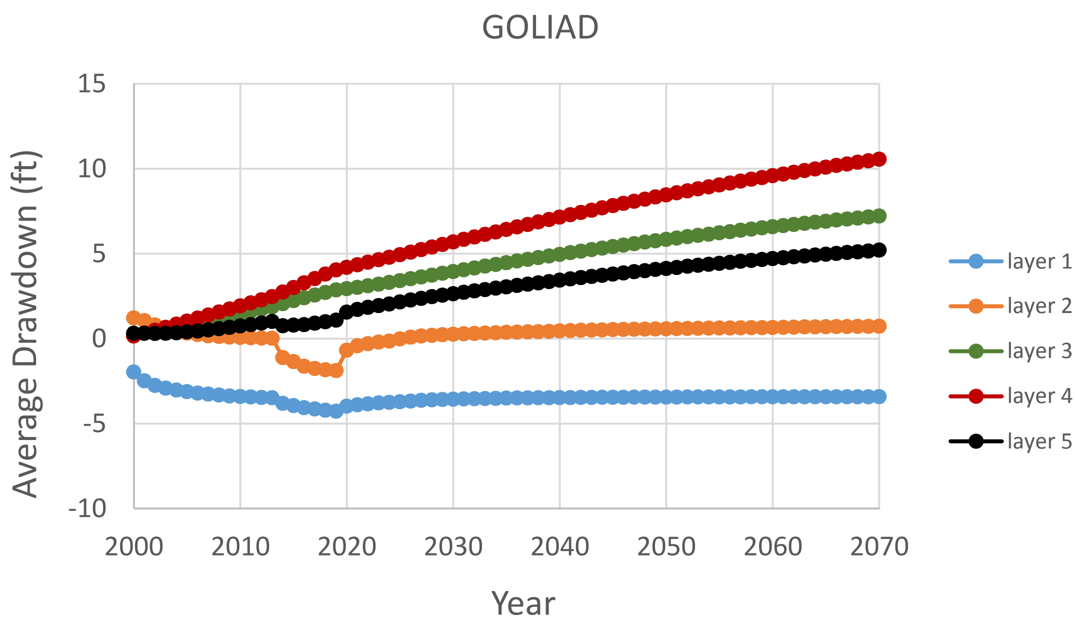

BEE
10
8
6
4
2
0
-2
-4
-6
-8
-10
Average Drawdown (ft)
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

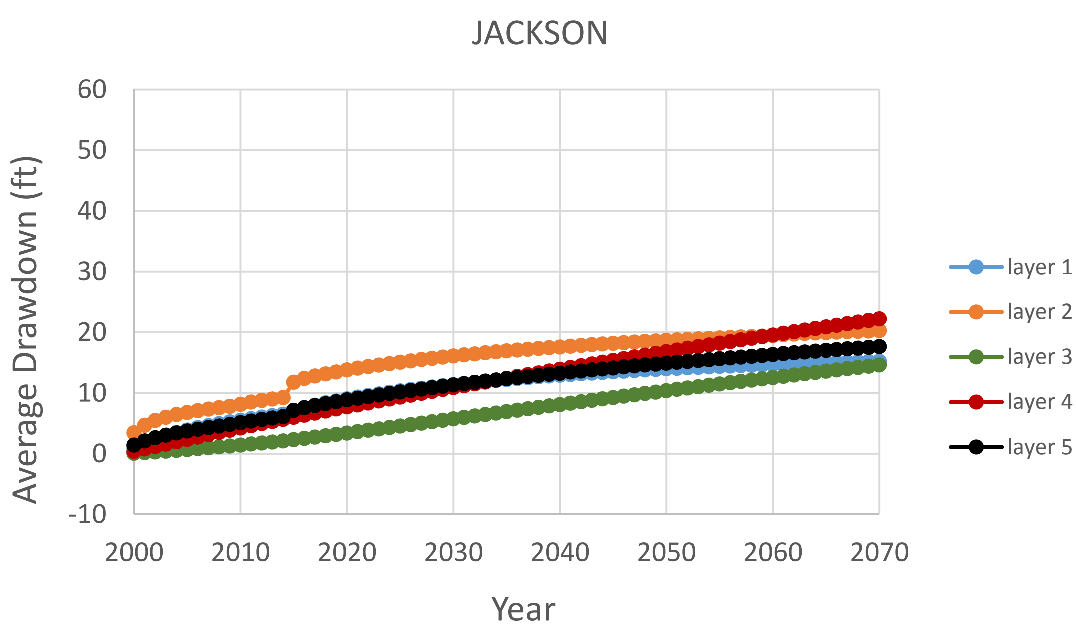

CALHOUN
15
10
5
0
-5
-10
Average Drawdown (ft)
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

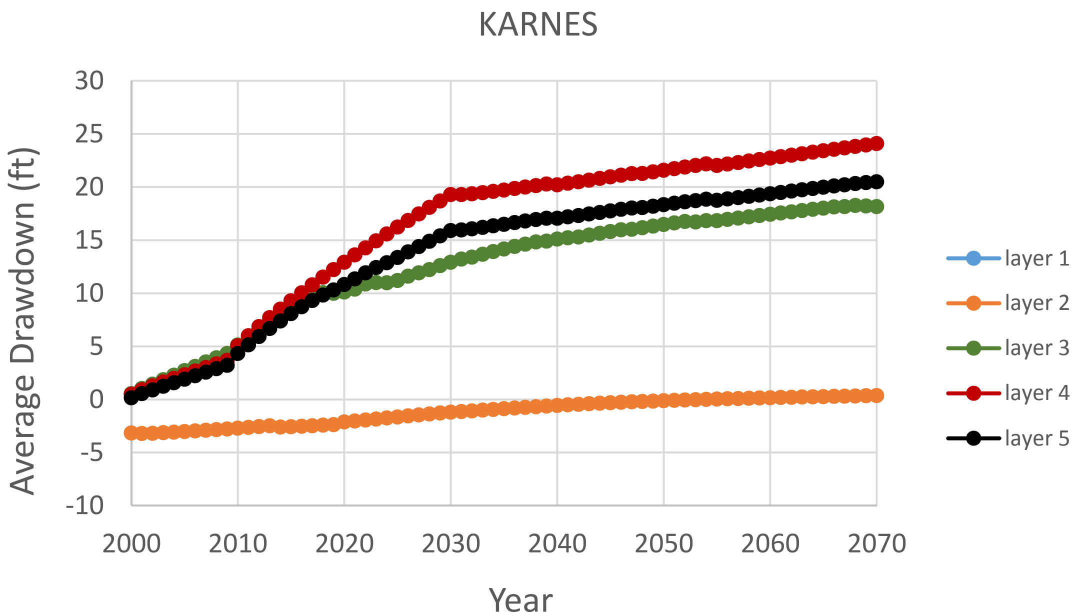

COLORADO
30
20
10
0
-10
Average Drawdown (ft)
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

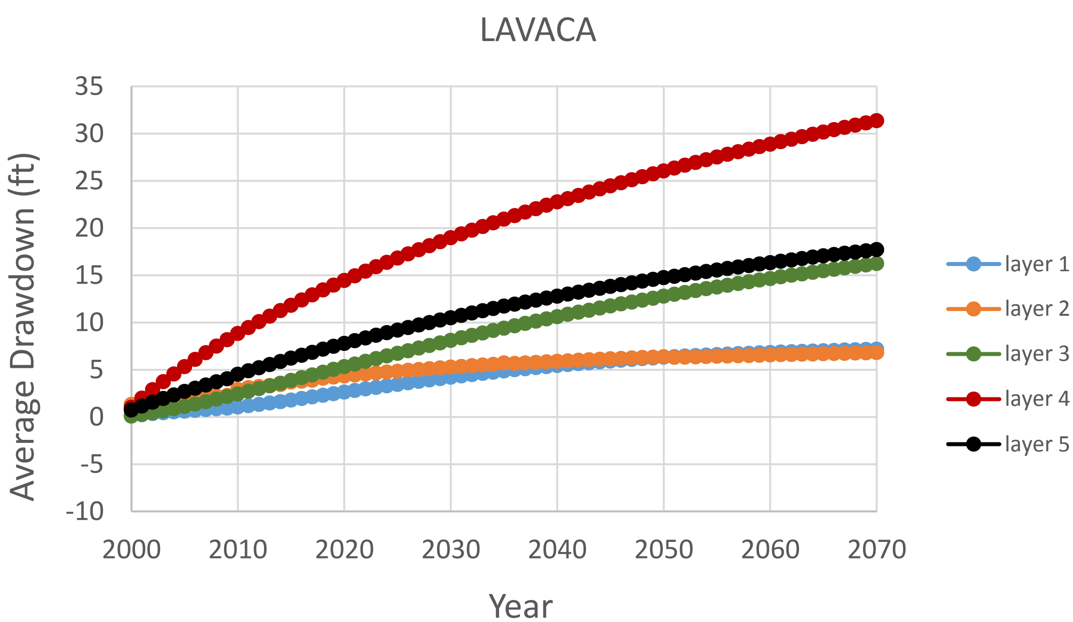

DEWITT
Average Drawdown (ft)
30
25
20
15
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

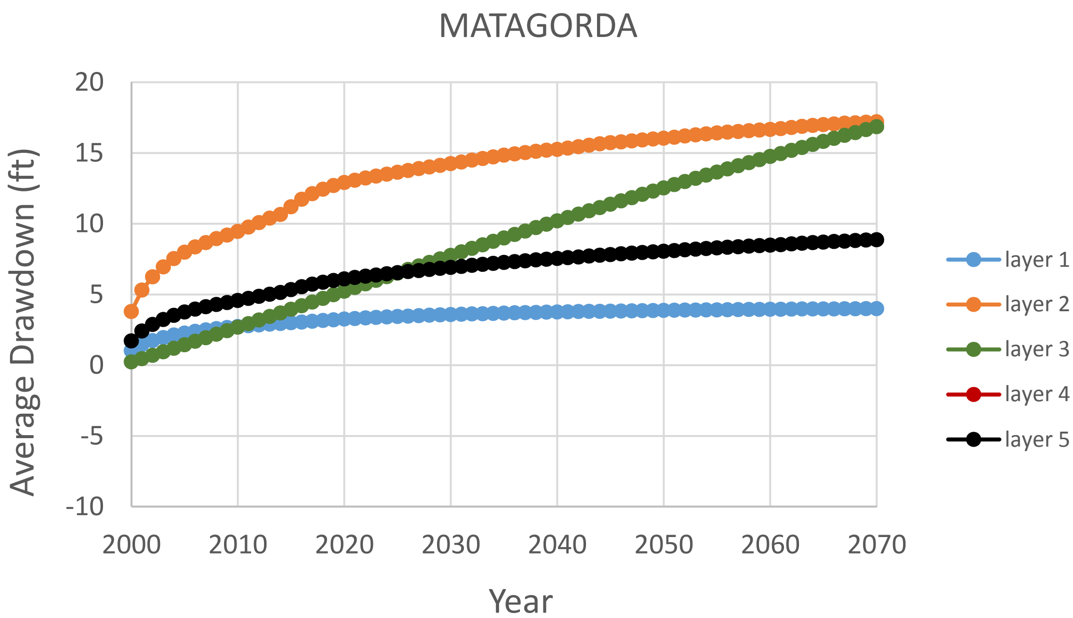

FAYETTE
Average Drawdown (ft)
60
50
40
30
20
10
0
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

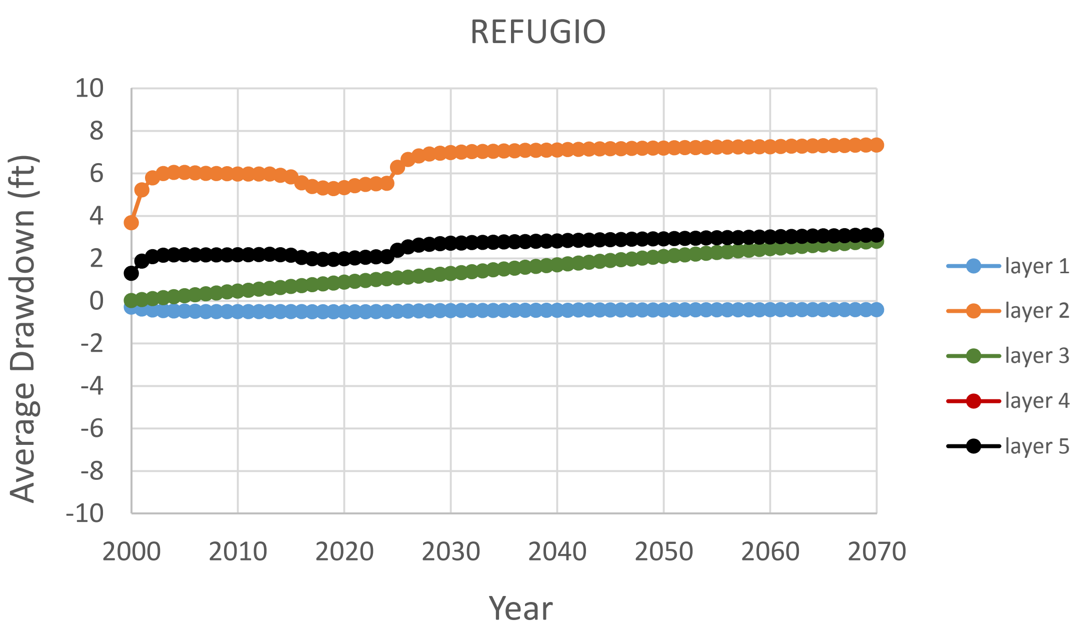

GOLIAD
Average Drawdown (ft)
15
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5


JACKSON
Average Drawdown (ft)
60
50
40
30
20
10
0
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5


KARNES
Average Drawdown (ft)
30
25
20
15
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5


LAVACA
Average Drawdown (ft)
35
30
25
20
15
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5





INTERA
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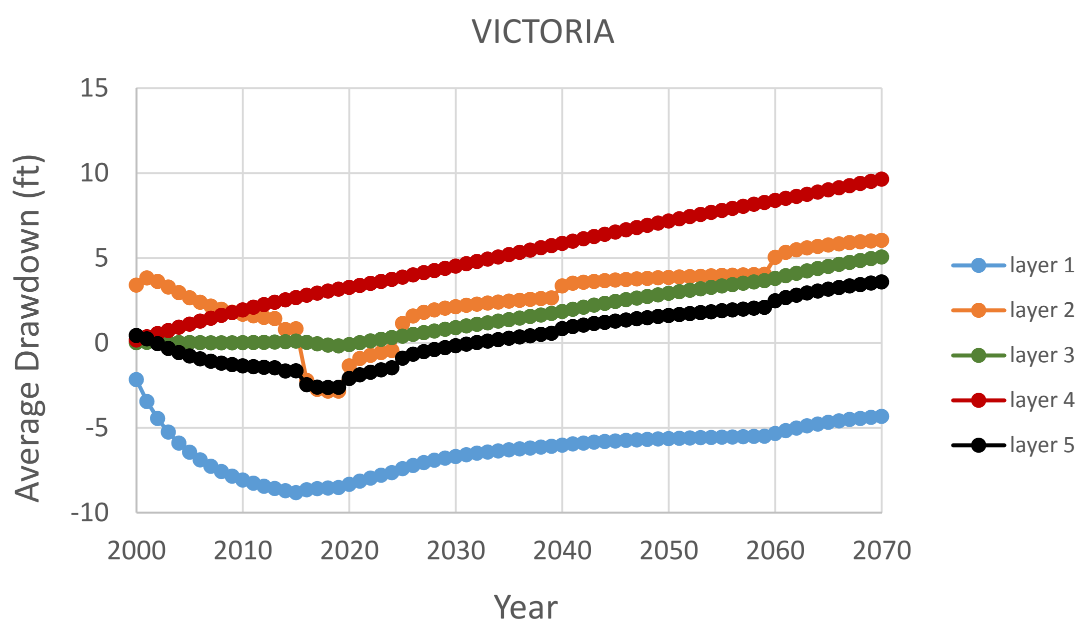

VICTORIA
Average Drawdown (ft)
15
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

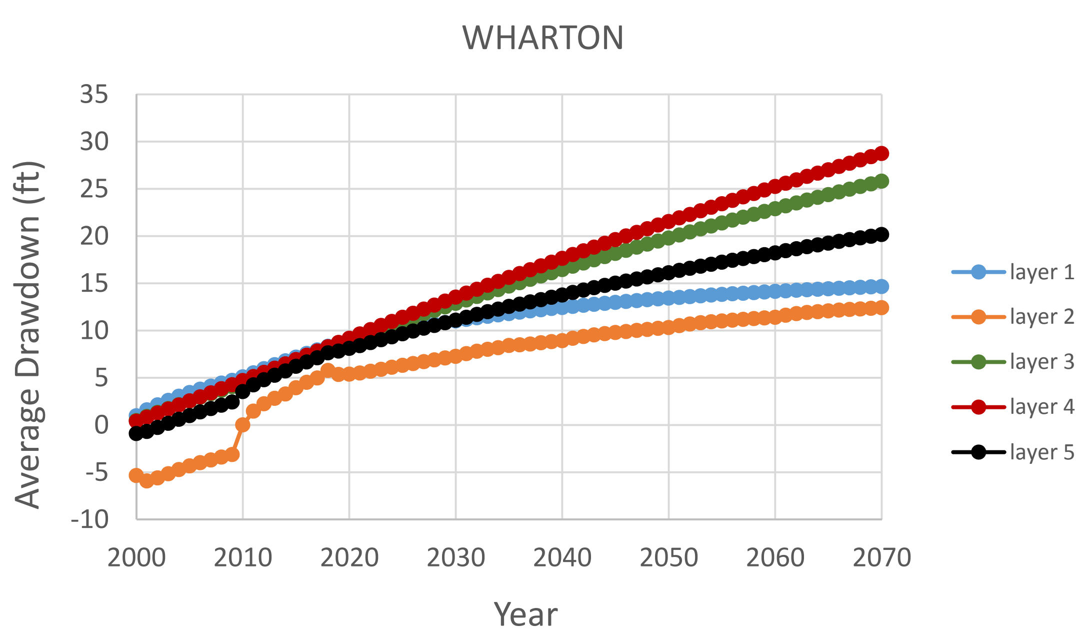
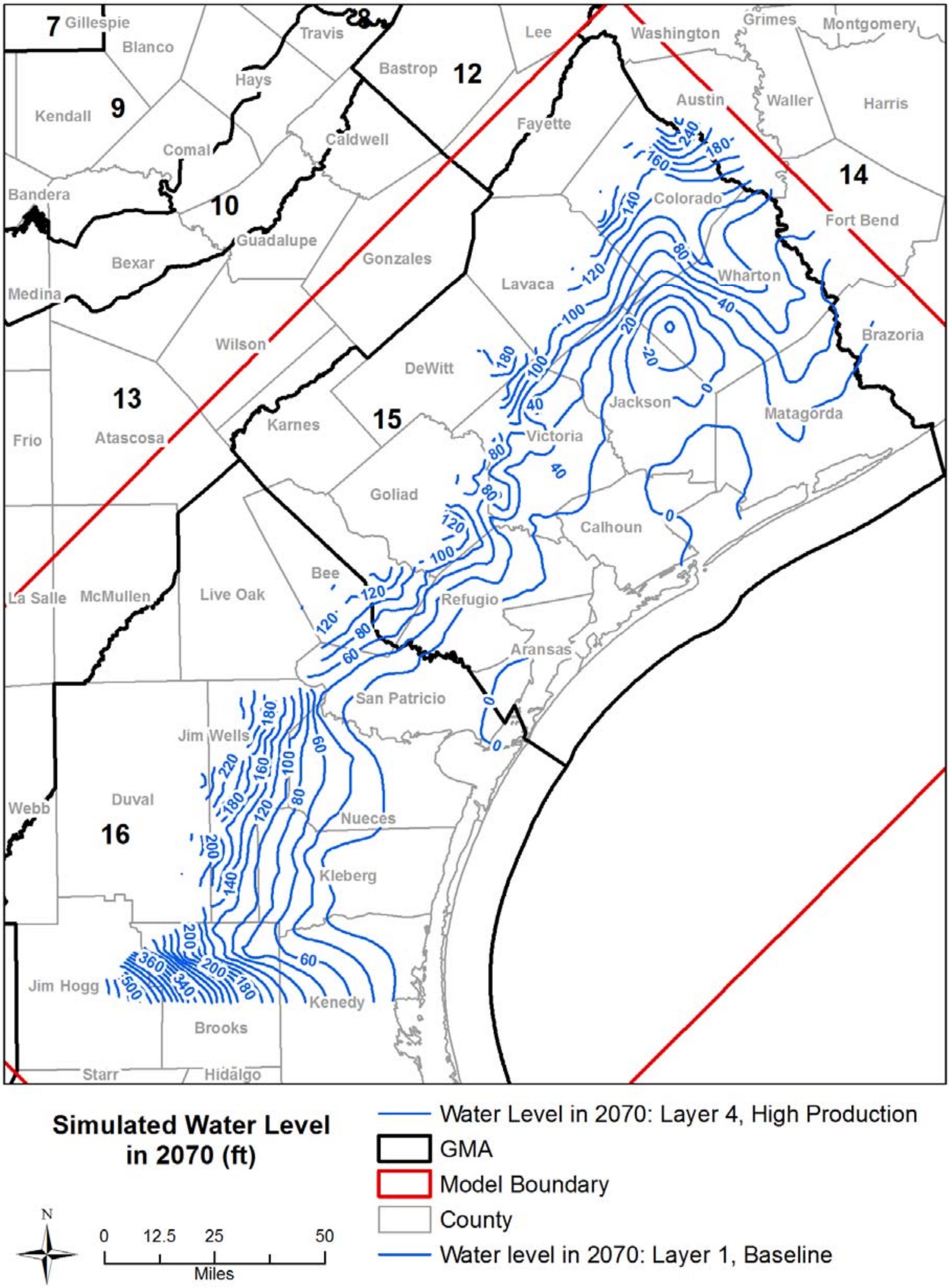
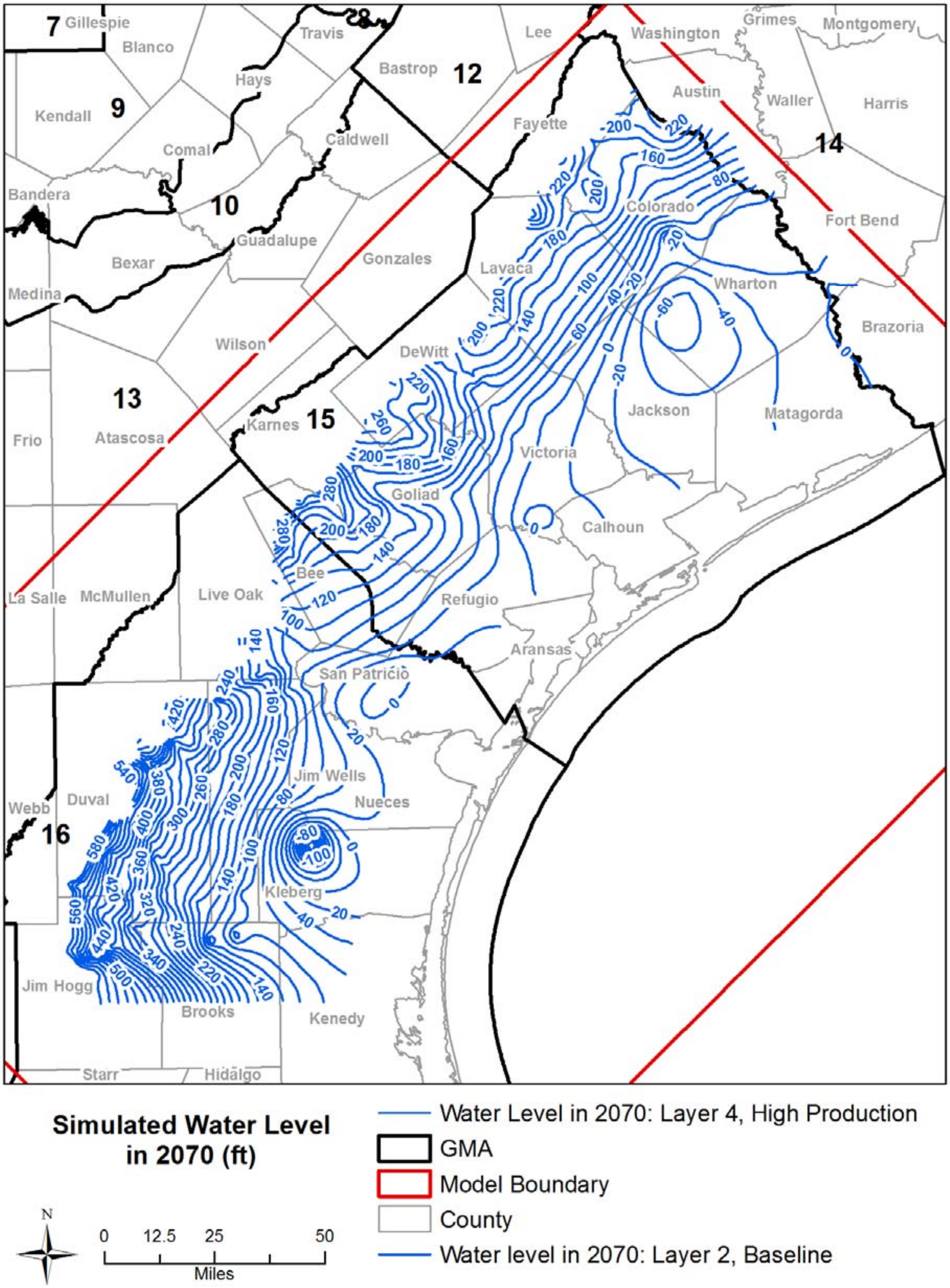

WHARTON
Average Drawdown (ft)
35
30
25
20
15
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

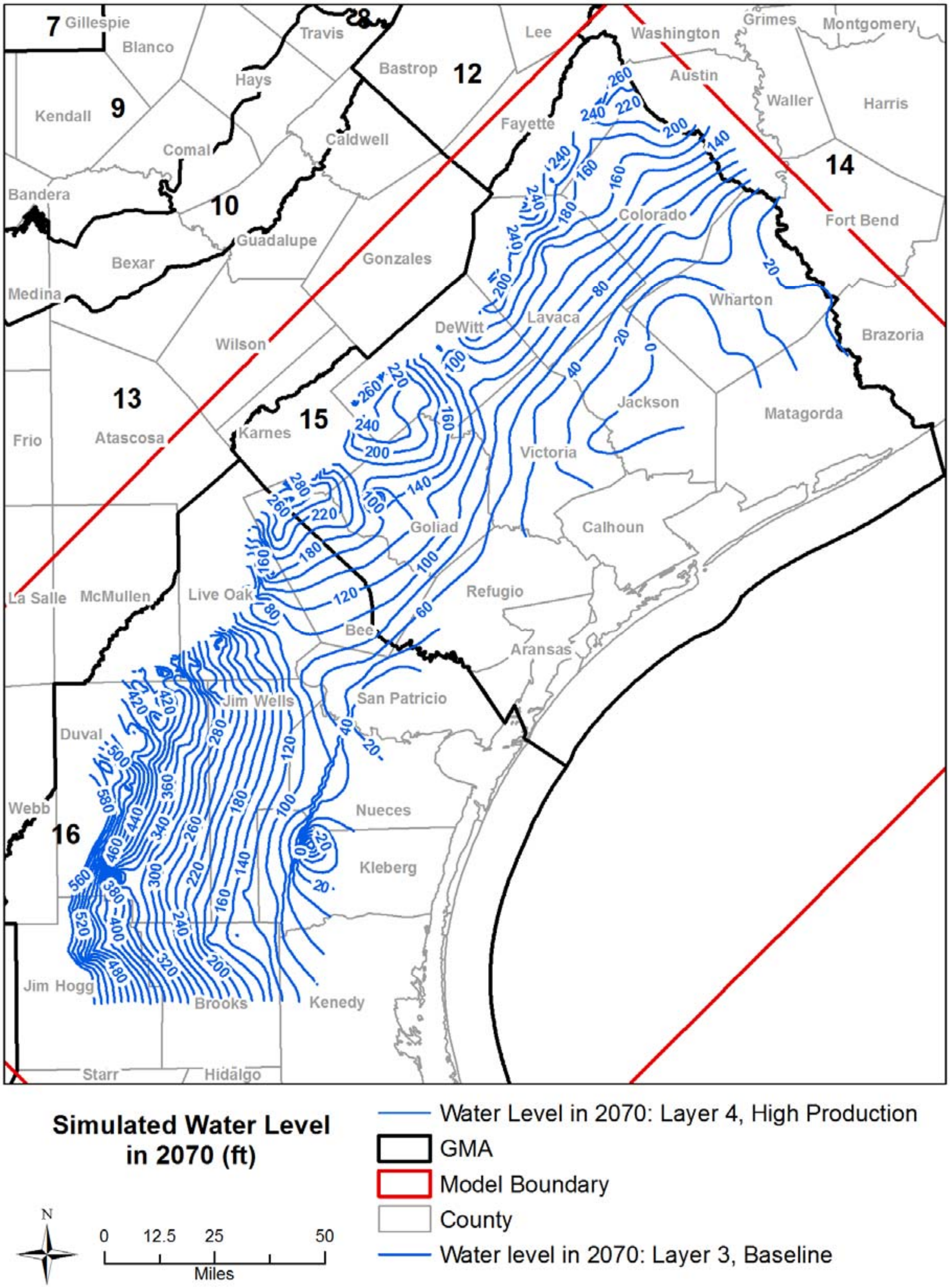
Exhibit E

Baseline Option 1 Run Simulated Contours of Hydraulic Head


Gillespie
Blanco
Travis
Lee
Washington
Grimes
Montgomery
Hays
Bastrop
Kendall
Austin
Waller
Harris
Comal
Caldwell
Fayette
Bandera
Colorado
Fort Bend
Guadalupe
Bexar
Gonzales
Wharton
Medina
Lavaca
Brazoria
Wilson
DeWitt
Jackson
Matagorda
Karnes
Frio
Atascosa
Victoria
Goliad
Calhoun
Bee
La Salle
McMullen
Live Oak
Refugio
Aransas
San Patricio
Jim Wells
Webb
Duval
Nueces
Kleberg
Jim Hogg
Kenedy
Brooks
Starr
Hidalgo
7
9
10
12
13
14
15
16
Simulated Water Level in 2070 (ft)
Water Level in 2070: Layer 4, High Production
GMA
Model Boundary
County
Water level in 2070: Layer 1, Baseline
N
0
12.5
25
50
Miles



INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS


Gillespie
Blanco
Travis
Lee
Washington
Grimes
Montgomery
Bastrop
Hays
Kendall
Austin
Waller
Harris
Fayette
Comal
Caldwell
Bandera
Guadalupe
Colorado
Fort Bend
Bexar
Gonzales
Medina
Wharton
DeWitt
Lavaca
Wilson
Brazoria
Jackson
Matagorda
Frio
Atascosa
Karnes
Victoria
Goliad
Calhoun
La Salle
McMullen
Live Oak
Refugio
Bee
Aransas
Jim Wells
San Patricio
Duval
Nueces
Webb
Kleberg
Jim Hogg
Brooks
Kenedy
Starr
Hidalgo
7
9
10
12
13
14
15
16
Simulated Water Level in 2070 (ft)
Water Level in 2070: Layer 4, High Production
GMA
Model Boundary
County
Water level in 2070: Layer 3, Baseline
N
0 12.5 25 50
Miles

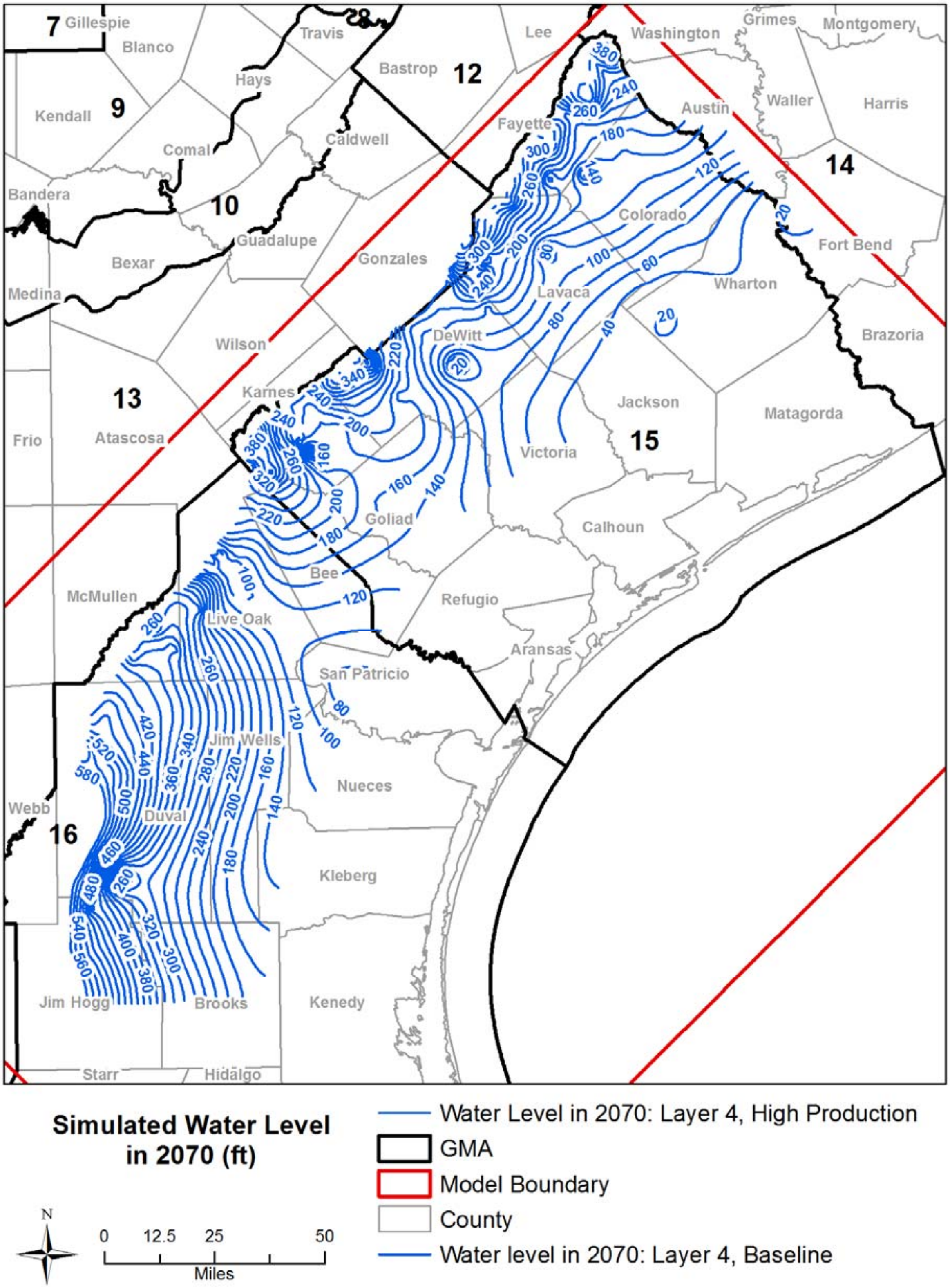

Simulated Water Level
in 2070 (ft)
Water Level in 2070: Layer 4, High Production
GMA
Model Boundary
County
Water level in 2070: Layer 4, Baseline
0 12.5 25 50
Miles
N

Exhibit F

HighProduction Option 1 Run Simulated Water Budgets

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Aransas	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	110	0	-	-	110	0	-	-	110	0	-	-
Net Stream Leakage	1,820	0	-	-	1,845	0	-	-	1,846	0	-	-
Vertical Leakage Upper	-	142	-	-	-	149	-	-	-	151	-	-
Net Lateral Flow From Refugio	1,971	-	-	-	1,942	-	-	-	1,938	-	-	-
Net Lateral Flow From San Patricio	200	-	-	-	182	-	-	-	173	-	-	-
Net Lateral Inflow From Other Areas	133	-	-	-	139	-	-	-	138	-	-	-
Total Inflow	*4,234*	*142*	-	-	*4,218*	*149*	-	-	*4,205*	*151*	-	-
Outflow												
Wells	1,642	0	-	-	1,642	0	-	-	1,642	0	-	-
Drains	8	0	-	-	8	0	-	-	8	0	-	-
Et	724	0	-	-	722	0	-	-	721	0	-	-
Net Head Dep Bounds	1,721	0	-	-	1,664	0	-	-	1,651	0	-	-
Vertical Leakage Lower	142	0	-	-	149	0	-	-	151	0	-	-
Net Lateral Flow To Calhoun	33	-	-	-	33	-	-	-	33	-	-	-
Net Lateral Flow To Refugio	-	146	-	-	-	149	-	-	-	151	-	-
Total Outflow	*4,270*	*146*	-	-	*4,218*	*149*	-	-	*4,206*	*151*	-	-
Inflow - Outflow	-36	-4	-	-	0	0	-	-	-1	0	-	-
Storage Change	-38	-4	-	-	-2	0	-	-	-1	0	-	-
Model Error	2	0	-	-	2	0	-	-	0	0	-	-
Model Error (percent)	0.05%	0.00%	-	-	0.05%	0.00%	-	-	0.00%	0.00%	-	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Bee	2030				2050				2070			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	18,826	5,053	26	23	18,826	5,019	60	23	18,826	5,007	72	23
Net Stream Leakage	3,805	4,967	91	10	4,042	5,121	95	41	4,119	5,193	97	65
Net Vertical Leakage Upper	-	7,673	9	458	-	7,725	51	431	-	7,766	114	442
Net Lateral Flow From Goliad	93	1,192	10	40	69	1,168	9	17	63	1,179	8	3
Net Lateral Flow From Karnes	-	120	-	201	-	119	-	194	-	119	-	184
Net Lateral Flow From Live Oak	185	-	-	-	194	-	-	-	199	-	-	-
Total Inflow	*22,909*	*19,005*	*136*	*732*	*23,131*	*19,152*	*215*	*706*	*23,207*	*19,264*	*291*	*717*
Outflow												
Wells	8,938	12,266	76	611	8,938	12,213	76	611	8,938	12,196	76	611
Et	96	0	0	0	83	0	0	0	76	0	0	0
Net Vertical Leakage Lower	7,673	9	458	-	7,725	51	431	-	7,766	114	442	-
Net Lateral Flow To Karnes	-	-	3	-	-	-	4	-	-	-	5	-
Net Lateral Flow To Live Oak	-	196	41	327	-	144	40	321	-	122	40	316
Net Lateral Flow To Refugio	5,177	5,502	19	-	5,000	5,483	19	-	4,845	5,463	20	-
Net Lateral Flow To San Patricio	2,444	1,508	13	97	2,316	1,535	14	107	2,234	1,544	14	111
Total Outflow	*24,328*	*19,481*	*610*	*1,035*	*24,062*	*19,426*	*584*	*1,039*	*23,859*	*19,439*	*597*	*1,038*
Inflow - Outflow	-1,419	-476	-474	-303	-931	-274	-369	-333	-652	-175	-306	-321
Storage Change	-1,420	-475	-473	-303	-930	-273	-372	-334	-653	-176	-307	-318
Model Error	1	-1	-1	0	-1	-1	3	1	1	1	1	-3
Model Error (percent)	0.00%	0.01%	0.16%	0.00%	0.00%	0.01%	0.50%	0.10%	0.00%	0.01%	0.16%	0.29%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Calhoun	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	3,110	0	0	-	3,571	0	0	-	3,766	0	0	-
Net Head Dep Bounds	1,465	0	0	-	10,443	0	0	-	14,108	0	0	-
Recharge	2,778	0	0	-	2,778	0	0	-	2,778	0	0	-
Net Stream Leakage	2,631	0	0	-	4,271	0	0	-	4,958	0	0	-
Net Vertical Leakage Upper	-	6,415	-	-	-	10,623	-	-	-	11,238	-	-
Net Vertical Leakage Lower	-	16	0	-	-	19	0	-	-	19	0	-
Net Lateral Flow From Aransas	33	-	-	-	33	-	-	-	33	-	-	-
Net Lateral Flow From Jackson	211	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Flow From Matagorda	58	-	-	-	67	-	-	-	62	-	-	-
Net Lateral Flow From Refugio	457	-	-	-	564	-	-	-	611	-	-	-
Net Lateral Flow From Victoria	1,062	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Inflow From Other Areas	2,942	-	-	-	6,272	3,305	-	-	7,408	3,232	-	-
Total Inflow	*14,747*	*6,431*	-	-	*27,999*	*13,947*	-	-	*33,724*	*14,489*	-	-
Outflow												
Wells	9,512	58	0	-	12,012	10,057	0	-	12,012	10,057	0	-
Drains	741	0	0	-	611	0	0	-	567	0	0	-
Et	1,100	0	0	-	1,003	0	0	-	968	0	0	-
Net Vertical Leakage Upper	-	-	16	-	-	-	19	-	-	-	19	-
Net Vertical Leakage Lower	6,415	-	-	-	10,623	-	-	-	11,238	-	-	-
Net Lateral Flow To Jackson	-	1,996	-	-	2,527	123	-	-	4,378	456	-	-
Net Lateral Flow To Refugio	-	411	-	-	-	112	-	-	-	31	-	-
Net Lateral Flow To Victoria	-	4,021	-	-	2,481	3,735	1	-	5,482	4,004	1	-
Net Lateral Outflow To Other Areas	-	129	-	-	-	-	-	-	-	-	-	-
Total Outflow	*17,768*	*6,615*	*16*	-	*29,257*	*14,027*	*20*	-	*34,645*	*14,548*	*20*	-
Inflow - Outflow	-3,021	-184	-16	-	-1,258	-80	-20	-	-921	-59	-20	-
Storage Change	-3,026	-179	-16	-	-1,256	-77	-19	-	-921	-62	-20	-
Model Error	5	-5	0	-	-2	-3	-1	-	0	3	0	-
Model Error (percent)	0.03%	0.08%	0.00%	-	0.01%	0.02%	5.13%	-	0.00%	0.02%	0.00%	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Colorado	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,408	0	0	0	1,408	0	0	0	1,408	0	0	0
Recharge	35,125	2,501	0	0	35,125	2,501	0	0	35,125	2,501	0	0
Net Stream Leakage	57,399	3,414	0	0	64,307	3,868	0	0	67,812	4,156	0	0
Net Vertical Leakage Upper	-	51,591	-	141	-	52,069	-	205	-	52,425	-	299
Net Vertical Leakage Lower	-	2,026	-	-	-	1,655	-	-	-	1,282	-	-
Net Lateral Flow From Austin	3,232	4,235	5	57	3,356	4,260	6	68	3,261	4,249	6	74
Net Lateral Flow From Fayette	-	517	7	-	-	499	7	-	-	499	7	-
Net Lateral Flow From Jackson	146	178	-	1	46	136	-	1	-	122	-	1
Net Lateral Flow From Lavaca	8,028	6,249	7	-	8,938	7,017	10	-	8,816	7,349	12	-
Total Inflow	*105,338*	*70,711*	*19*	*199*	*113,180*	*72,005*	*23*	*274*	*116,422*	*72,583*	*25*	*374*
Outflow												
Wells	48,041	62,418	0	919	48,417	62,872	0	919	48,417	62,872	0	919
Drains	4	0	0	0	3	0	0	0	3	0	0	0
Et	35	0	0	0	34	0	0	0	33	0	0	0
Net Vertical Leakage Upper	-	-	2,026	-	-	-	1,655	-	-	-	1,282	-
Net Vertical Leakage Lower	51,591	-	141	-	52,069	-	205	-	52,425	-	299	-
Net Lateral Flow To Fayette	-	-	-	58	-	-	-	49	-	-	-	43
Net Lateral Flow To Jackson	-	-	-	-	-	-	-	-	1	-	-	-
Net Lateral Flow To Lavaca	-	-	-	54	-	-	-	43	-	-	-	26
Net Lateral Flow To Wharton	19,295	8,612	40	158	20,202	9,363	37	153	20,667	9,881	35	150
Total Outflow	*118,966*	*71,030*	*2,207*	*1,189*	*120,725*	*72,235*	*1,897*	*1,164*	*121,546*	*72,753*	*1,616*	*1,138*
Inflow - Outflow	-13,628	-319	-2,188	-990	-7,545	-230	-1,874	-890	-5,124	-170	-1,591	-764
Storage Change	-13,628	-311	-2,187	-992	-7,547	-227	-1,874	-891	-5,121	-176	-1,590	-763
Model Error	0	-8	-1	2	2	-3	0	1	-3	6	-1	-1
Model Error (percent)	0.00%	0.01%	0.05%	0.17%	0.00%	0.00%	0.00%	0.09%	0.00%	0.01%	0.06%	0.09%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

De Witt	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	4,570	5,773	14	246	4,570	5,760	26	247	4,570	5,760	26	248
Net Stream Leakage	2,513	6,123	699	1,878	2,867	7,429	642	4,883	3,177	8,276	661	5,822
Net Vertical Leakage Upper	-	4,559	3,955	4,048	-	4,893	4,343	5,252	-	5,118	4,751	5,652
Net Lateral Flow From Goliad	-	170	-	106	-	159	-	183	-	149	-	200
Net Lateral Flow From Gonzales	-	-	-	203	-	-	-	320	-	-	-	351
Net Lateral Flow From Karnes	-	-	-	-	-	-	-	53	-	-	-	229
Net Lateral Flow From Lavaca	-	-	3	279	-	-	4	406	-	-	5	439
Total Inflow	*7,083*	*16,625*	*4,671*	*6,760*	*7,437*	*18,241*	*5,015*	*11,344*	*7,747*	*19,303*	*5,443*	*12,941*
Outflow												
Wells	1,019	6,680	1,176	11,183	1,019	7,071	64	19,205	1,019	7,071	50	19,205
Et	8	55	0	0	7	55	0	0	7	54	0	0
Net Vertical Leakage Lower	4,559	3,955	4,048	-	4,893	4,343	5,252	-	5,118	4,751	5,652	-
Net Lateral Flow To Goliad	-	-	2	-	-	-	1	-	-	-	1	-
Net Lateral Flow To Karnes	-	133	11	427	-	139	11	-	-	151	11	-
Net Lateral Flow To Lavaca	162	944	-	-	138	791	-	-	106	672	-	-
Net Lateral Flow To Victoria	1,341	5,166	15	117	1,414	6,041	17	189	1,570	6,739	24	481
Total Outflow	*7,089*	*16,933*	*5,252*	*11,727*	*7,471*	*18,440*	*5,345*	*19,394*	*7,820*	*19,438*	*5,738*	*19,686*
Inflow - Outflow	-6	-308	-581	-4,967	-34	-199	-330	-8,050	-73	-135	-295	-6,745
Storage Change	-8	-308	-582	-4,968	-33	-197	-330	-8,050	-73	-134	-296	-6,744
Model Error	2	0	1	1	-1	-2	0	0	0	-1	1	-1
Model Error (percent)	0.03%	0.00%	0.02%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.02%	0.01%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Fayette	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	-	0	306	168	-	0	320	197	-	0	328	217
Recharge	-	1,737	2	357	-	1,737	1	356	-	1,737	1	357
Net Stream Leakage	-	639	512	309	-	790	560	507	-	865	586	650
Net Vertical Leakage Upper	-	0	1,074	1,324	-	0	1,165	1,532	-	0	1,209	1,666
Net Lateral Flow From Austin	-	9	2	10	-	4	1	1	-	2	1	-
Net Lateral Flow From Colorado	-	-	-	58	-	-	-	49	-	-	-	43
Net Lateral Flow From Lavaca	-	-	3	85	-	-	3	105	-	-	3	125
Net Lateral Flow From Washington	-	-	-	12	-	-	-	13	-	-	-	13
Total Inflow	-	2,385	1,899	2,323	-	2,531	2,050	2,760	-	2,604	2,128	3,071
Outflow												
Wells	-	914	818	6,333	-	914	591	6,125	-	914	494	6,125
Et	-	0	19	6	-	0	19	5	-	0	19	5
Net Vertical Leakage Lower	-	1,074	1,324	-	-	1,165	1,532	-	-	1,209	1,666	-
Net Lateral Flow To Austin	-	-	-	-	-	-	-	-	-	-	-	3
Net Lateral Flow To Colorado	-	517	7	-	-	499	7	-	-	499	7	-
Net Lateral Flow To Lavaca	-	12	-	-	-	9	-	-	-	8	-	-
Total Outflow	-	*2,517*	*2,168*	*6,339*	-	*2,587*	*2,149*	*6,130*	-	*2,630*	*2,186*	*6,133*
Inflow - Outflow	-	-132	-269	-4,016	-	-56	-99	-3,370	-	-26	-58	-3,062
Storage Change	-	-132	-269	-4,016	-	-55	-99	-3,369	-	-25	-58	-3,063
Model Error	-	0	0	0	-	-1	0	-1	-	-1	0	1
Model Error (percent)	-	0.00%	0.00%	0.00%	-	0.04%	0.00%	0.02%	-	0.04%	0.00%	0.02%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Goliad	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,553	0	0	0	1,571	0	0	0	1,577	0	0	0
Recharge	10,511	7,991	13	0	10,511	7,991	13	0	10,511	7,991	13	0
Net Stream Leakage	-	10,189	0	0	-	11,056	0	0	-	11,464	0	0
Net Vertical Leakage Upper	-	8,234	-	31	-	8,326	-	210	-	8,381	116	475
Net Vertical Leakage Lower	-	375	-	-	-	162	-	-	-	-	-	-
Net Lateral Flow From De Witt	-	-	2	-	-	-	1	-	-	-	1	-
Net Lateral Flow From Karnes	-	530	12	89	-	499	9	69	-	486	8	63
Total Inflow	*12,064*	*27,319*	*27*	*120*	*12,082*	*28,034*	*23*	*279*	*12,088*	*28,322*	*138*	*538*
Outflow												
Wells	723	12,123	311	287	724	12,125	311	287	724	12,125	311	287
Drains	1	0	0	0	0	0	0	0	0	0	0	0
Et	149	27	0	0	140	26	0	0	138	25	0	0
Net Stream Leakage	1,726	-	-	-	862	-	-	-	714	-	-	-
Net Vertical Leakage Upper	-	-	375	-	-	-	162	-	-	-	-	-
Net Vertical Leakage Lower	8,234	-	31	-	8,326	-	210	-	8,381	116	475	-
Net Lateral Flow To Bee	93	1,192	10	40	69	1,168	9	17	63	1,179	8	3
Net Lateral Flow To De Witt	-	170	-	106	-	159	-	183	-	149	-	200
Net Lateral Flow To Refugio	2,123	9,690	13	-	1,629	9,589	14	-	1,550	9,569	15	-
Net Lateral Flow To Victoria	406	4,754	15	202	576	5,099	17	638	594	5,253	21	751
Total Outflow	*13,455*	*27,956*	*755*	*635*	*12,326*	*28,166*	*723*	*1,125*	*12,164*	*28,416*	*830*	*1,241*
Inflow - Outflow	-1,391	-637	-728	-515	-244	-132	-700	-846	-76	-94	-692	-703
Storage Change	-1,390	-629	-727	-515	-244	-133	-699	-847	-77	-94	-691	-701
Model Error	-1	-8	-1	0	0	1	-1	1	1	0	-1	-2
Model Error (percent)	0.01%	0.03%	0.13%	0.00%	0.00%	0.00%	0.14%	0.09%	0.01%	0.00%	0.12%	0.16%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Jackson	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	4,218	0	0	0	4,218	0	0	0	4,218	0	0	0
Head Dep Bounds	1,896	0	0	0	4,246	0	0	0	5,612	0	0	0
Recharge	11,758	0	0	0	11,758	0	0	0	11,758	0	0	0
Net Stream Leakage	65,607	0	0	0	55,156	0	0	0	50,074	0	0	0
Net Vertical Leakage Upper	-	36,216	-	-	-	50,798	-	-	-	49,803	-	-
Net Vertical Leakage Lower	-	3,208	613	-	-	4,304	778	-	-	4,402	785	-
Net Lateral Flow From Calhoun	-	1,996	-	-	2,527	123	-	-	4,378	456	-	-
Net Lateral Flow From Colorado	-	-	-	-	-	-	-	-	1	-	-	-
Net Lateral Flow From Lavaca	12,226	10,571	20	74	12,973	13,360	23	78	14,459	15,009	26	112
Net Lateral Flow From Matagorda	1,435	3,112	-	-	4,167	8,702	1	-	6,833	9,786	1	-
Net Lateral Flow From Victoria	3,307	4,018	1	19	2,425	2,312	-	-	3,349	2,009	-	-
Net Lateral Flow From Wharton	-	-	-	4	-	-	-	-	2,268	1,651	1	-
Net Lateral Inflow From Other Areas	*2,623*	*1,910*	-	-	*7,428*	*1,508*	-	-	*10,975*	*1,895*	-	-
Total Inflow	103,070	61,031	634	97	104,898	81,107	802	78	113,925	85,011	813	112
Outflow												
Wells	80,154	57,454	0	0	86,154	81,453	0	0	92,154	85,453	0	0
Drains	1	0	0	0	0	0	0	0	0	0	0	0
Et	255	0	0	0	67	0	0	0	41	0	0	0
Net Vertical Leakage Upper	-	-	3,208	613	-	-	4,304	778	-	-	4,402	785
Net Vertical Leakage Lower	36,216	-	-	-	50,798	-	-	-	49,803	-	-	-
Net Lateral Flow To Calhoun	211	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Flow To Colorado	146	178	-	1	46	136	-	1	-	122	-	1
Net Lateral Flow To Victoria	-	-	-	-	-	-	3	390	-	-	9	699
Net Lateral Flow To Wharton	4,075	3,888	2	-	1,119	202	1	1	-	-	-	1
Total Outflow	*121,058*	*61,520*	*3,210*	*614*	*138,184*	*81,791*	*4,308*	*1,170*	*141,998*	*85,575*	*4,411*	*1,486*
Inflow - Outflow	-17,988	-489	-2,576	-517	-33,286	-684	-3,506	-1,092	-28,073	-564	-3,598	-1,374
Storage Change	-17,964	-465	-2,575	-518	-33,281	-653	-3,507	-1,092	-28,057	-544	-3,599	-1,372
Model Error	-24	-24	-1	1	-5	-31	1	0	-16	-20	1	-2
Model Error (percent)	0.02%	0.04%	0.03%	0.16%	0.00%	0.04%	0.02%	0.00%	0.01%	0.02%	0.02%	0.13%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Karnes	2030				2050				2070			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	-	884	2	388	-	884	2	378	-	884	1	377
Net Stream Leakage	-	-	492	2,783	-	-	289	983	-	-	295	908
Net Vertical Leakage Upper	-	0	224	556	-	0	280	461	-	0	310	482
Net Lateral Flow From Bee	-	-	3	-	-	-	4	-	-	-	5	-
Net Lateral Flow From De Witt	-	133	11	427	-	139	11	-	-	151	11	-
Total Inflow	-	*1,017*	*732*	*4,154*	-	*1,023*	*586*	*1,822*	-	*1,035*	*622*	*1,767*
Outflow												
Wells	-	105	370	16,923	-	105	206	2,737	-	105	188	2,504
Et	-	0	1	49	-	0	1	33	-	0	1	26
Net Stream Leakage	-	48	-	-	-	31	-	-	-	22	-	-
Net Vertical Leakage Lower	-	224	556	-	-	280	461	-	-	310	482	-
Net Lateral Flow To Bee	-	120	-	201	-	119	-	194	-	119	-	184
Net Lateral Flow To De Witt	-	-	-	-	-	-	-	53	-	-	-	229
Net Lateral Flow To Goliad	-	530	12	89	-	499	9	69	-	486	8	63
Net Lateral Flow To Gonzales	-	-	-	12	-	-	-	10	-	-	-	8
Net Lateral Flow To Live Oak	-	-	-	141	-	-	-	139	-	-	-	138
Total Outflow	-	*1,027*	*939*	*17,415*	-	*1,034*	*677*	*3,235*	-	*1,042*	*679*	*3,152*
Inflow - Outflow	-	-10	-207	-13,261	-	-11	-91	-1,413	-	-7	-57	-1,385
Storage Change	-	-10	-206	-13,262	-	-10	-91	-1,415	-	-8	-58	-1,387
Model Error	-	0	-1	1	-	-1	0	2	-	1	1	2
Model Error (percent)	-	0.00%	0.11%	0.01%	-	0.10%	0.00%	0.05%	-	0.10%	0.15%	0.06%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Lavaca	**2030**				**2050**				**2070**			
	Chicot	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Inflow												
Recharge	18,332	6,107	2	171	18,332	6,107	2	171	18,332	6,107	2	170
Net Stream Leakage	11,306	11,436	243	622	13,238	14,243	275	721	15,243	16,471	294	799
Net Vertical Leakage Upper	-	10,845	385	1,331	-	12,044	594	1,589	-	12,175	808	1,781
Net Lateral Flow From Colorado	-	-	-	54	-	-	-	43	-	-	-	26
Net Lateral Flow From De Witt	162	944	-	-	138	791	-	-	106	672	-	-
Net Lateral Flow From Fayette	-	12	-	-	-	9	-	-	-	8	-	-
Net Lateral Flow From Gonzales	-	-	-	*192*	-	-	-	*191*	-	-	-	*191*
Net Lateral Flow From Victoria	394	378	1	12	191	278	1	6	277	249	-	-
Total Inflow	*30,194*	*29,722*	*631*	*2,382*	*31,899*	*33,472*	*872*	*2,721*	*33,958*	*35,682*	*1,104*	*2,967*
Outflow												
Wells	3,115	12,655	151	4,496	3,115	12,655	139	4,496	3,115	12,655	114	4,483
Et	2	3	0	9	1	2	0	3	0	2	0	1
Net Vertical Leakage Lower	10,845	385	1,331	-	12,044	594	1,589	-	12,175	808	1,781	-
Net Lateral Flow To Colorado	8,028	6,249	7	-	8,938	7,017	10	-	8,816	7,349	12	-
Net Lateral Flow To De Witt	-	-	3	279	-	-	4	406	-	-	5	439
Net Lateral Flow To Fayette	-	-	3	85	-	-	3	105	-	-	3	125
Net Lateral Flow To Jackson	12,226	10,571	20	74	12,973	13,360	23	78	14,459	15,009	26	112
Net Lateral Flow To Victoria	-	-	-	-	-	-	-	-	-	-	1	12
Total Outflow	*34,216*	*29,863*	*1,515*	*4,943*	*37,071*	*33,628*	*1,768*	*5,088*	*38,565*	*35,823*	*1,942*	*5,172*
Inflow - Outflow	-4,022	-141	-884	-2,561	-5,172	-156	-896	-2,367	-4,607	-141	-838	-2,205
Storage Change	-4,019	-139	-883	-2,561	-5,172	-155	-895	-2,367	-4,603	-146	-838	-2,202
Model Error	-3	-2	-1	0	0	-1	-1	0	-4	5	0	-3
Model Error (percent)	0.01%	0.01%	0.07%	0.00%	0.00%	0.00%	0.06%	0.00%	0.01%	0.01%	0.00%	0.06%

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Matagorda	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	797	0	0	-	798	0	0	-	798	0	0	-
Recharge	22,372	0	0	-	22,372	0	0	-	22,372	0	0	-
Net Stream Leakage	44,219	0	0	-	50,608	0	0	-	54,193	0	0	-
Net Vertical Leakage Upper	-	13,384	-	-	-	17,987	-	-	-	19,418	-	-
Net Vertical Leakage Lower	-	478	0	-	-	550	0	-	-	541	0	-
Net Lateral Flow From Brazoria	-	1,990	-	-	-	2,453	-	-	-	2,626	-	-
Net Lateral Flow From Wharton	377	-	2	-	-	-	-	-	-	-	-	-
Total Inflow	*67,765*	*15,852*	*2*	-	*73,778*	*20,990*	-	-	*77,363*	*22,585*	-	-
Outflow												
Wells	40,386	9,062	0	-	40,386	9,062	0	-	40,386	9,062	0	-
Drains	216	0	0	-	207	0	0	-	202	0	0	-
Et	2,934	0	0	-	2,892	0	0	-	2,864	0	0	-
Net Head Dep Bounds	4,287	0	0	-	2,982	0	0	-	2,083	0	0	-
Net Vertical Leakage Upper	-	-	478	-	-	-	550	-	-	-	541	-
Net Vertical Leakage Lower	13,384	-	-	-	17,987	-	-	-	19,418	-	-	-
Net Lateral Flow To Brazoria	2,660	-	7	-	2,706	-	7	-	2,729	-	7	-
Net Lateral Flow To Calhoun	58	-	-	-	67	-	-	-	62	-	-	-
Net Lateral Flow To Jackson	1,435	3,112	-	-	4,167	8,702	1	-	6,833	9,786	1	-
Net Lateral Flow To Wharton	-	3,945	-	-	1,101	3,451	-	-	2,611	3,936	2	-
Net Lateral Outflow To Other Areas	5,354	-	-	-	3,976	-	-	-	2,880	-	-	-
Total Outflow	*70,714*	*16,119*	*485*	-	*76,471*	*21,215*	*558*	-	*80,068*	*22,784*	*551*	-
Inflow - Outflow	-2,949	-267	-483	-	-2,693	-225	-558	-	-2,705	-199	-551	-
Storage Change	-2,952	-244	-482	-	-2,694	-202	-557	-	-2,710	-175	-550	-
Model Error	3	-23	-1	-	1	-23	-1	-	5	-24	-1	-
Model Error (percent)	0.00%	0.14%	0.21%	-	0.00%	0.11%	0.18%	-	0.01%	0.11%	0.18%	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

Refugio	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
Recharge	14,562	0	0	-	14,562	0	0	-	14,562	0	0	-
Net Stream Leakage	25,361	0	0	-	28,793	0	0	-	29,407	0	0	-
Net Vertical Leakage Upper	-	26,110	-	-	-	27,037	-	-	-	27,296	-	-
Net Vertical Leakage Lower	-	702	0	-	-	650	0	-	-	594	0	-
Net Lateral Flow From Aransas	-	146	-	-	-	149	-	-	-	151	-	-
Net Lateral Flow From Bee	5,177	5,502	19	-	5,000	5,483	19	-	4,845	5,463	20	-
Net Lateral Flow From Calhoun	-	411	-	-	-	112	-	-	-	31	-	-
Net Lateral Flow From Goliad	2,123	9,690	13	-	1,629	9,589	14	-	1,550	9,569	15	-
Net Lateral Flow From San Patricio	-	409	-	-	-	404	-	-	-	399	-	-
Net Lateral Flow From Victoria	-	-	1	-	-	-	-	-	-	-	-	-
Net Lateral Inflow From Other Areas	-	13	-	-	-	18	-	-	-	19	-	-
Total Inflow	*47,223*	*42,983*	*33*	-	*49,984*	*43,442*	*33*	-	*50,364*	*43,522*	*35*	-
Outflow												
Wells	6,177	37,920	0	-	6,177	37,920	0	-	6,177	37,920	0	-
Drains	68	0	0	-	64	0	0	-	63	0	0	-
Et	1,674	0	0	-	1,656	0	0	-	1,652	0	0	-
Head Dep Bounds	4,067	0	0	-	3,909	0	0	-	3,869	0	0	-
Net Vertical Leakage Upper	-	-	702	-	-	-	650	-	-	-	594	-
Net Vertical Leakage Lower	26,110	-	-	-	27,037	-	-	-	27,296	-	-	-
Net Lateral Flow To Aransas	1,971	-	-	-	1,942	-	-	-	1,938	-	-	-
Net Lateral Flow To Calhoun	457	-	-	-	564	-	-	-	611	-	-	-
Net Lateral Flow To San Patricio	2,628	-	1	-	2,646	-	1	-	2,658	-	1	-
Net Lateral Flow To Victoria	2,404	5,294	-	-	3,132	5,543	-	-	3,164	5,615	1	-
Net Lateral Outflow To Other Areas	2,933	-	-	-	2,974	-	-	-	2,995	-	-	-
Total Outflow	*48,489*	*43,214*	*703*	-	*50,101*	*43,463*	*651*	-	*50,423*	*43,535*	*596*	-
Inflow - Outflow	-1,266	-231	-670	-	-117	-21	-618	-	-59	-13	-561	-
Storage Change	-1,271	-227	-672	-	-118	-19	-618	-	-62	-14	-561	-
Model Error	5	-4	2	-	1	-2	0	-	3	1	0	-
Model Error (percent)	0.01%	0.01%	0.28%	-	0.00%	0.00%	0.00%	-	0.01%	0.00%	0.00%	-

Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

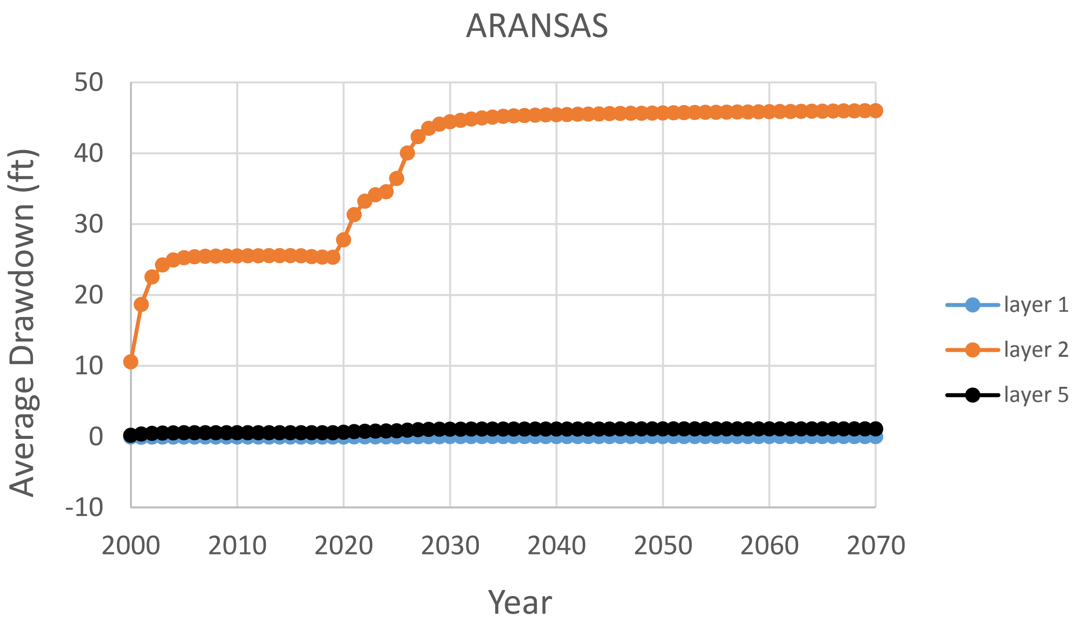
Victoria	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	1,056	0	0	0	1,056	0	0	0	1,056	0	0	0
Net Head Dep Bounds	-	-	-	-	637	0	0	0	1,025	0	0	0
Recharge	24,838	743	0	0	24,838	743	0	0	24,701	880	0	0
Net Stream Leakage	75,600	724	0	0	98,037	2,216	0	0	103,876	3,269	0	0
Net Vertical Leakage Upper	-	41,137	-	-	-	47,422	-	3,872	-	47,748	859	3,687
Net Vertical Leakage Lower	-	2,540	798	-	-	754	-	-	-	-	-	-
Net Lateral Flow From Calhoun	-	4,021	-	-	2,481	3,735	1	-	5,482	4,004	1	-
Net Lateral Flow From De Witt	1,341	5,166	15	117	1,414	6,041	17	189	1,570	6,739	24	481
Net Lateral Flow From Goliad	406	4,754	15	202	576	5,099	17	638	594	5,253	21	751
Net Lateral Flow From Jackson	-	-	-	-	-	-	3	390	-	-	9	699
Net Lateral Flow From Lavaca	-	-	-	-	-	-	-	-	-	-	1	12
Net Lateral Flow From Refugio	2,404	5,294	-	-	3,132	5,543	-	-	3,164	5,615	1	-
Net Lateral Inflow From Other Areas	-	5	-	-	791	-	-	-	1,473	-	-	-
Total Inflow	*105,645*	*64,384*	*828*	*319*	*132,962*	*71,553*	*38*	*5,089*	*142,941*	*73,508*	*916*	*5,630*
Outflow												
Wells	74,645	60,357	0	0	100,895	69,107	0	7,143	103,171	70,357	0	7,143
Drains	890	0	0	0	698	0	0	0	555	0	0	0
Et	696	26	0	0	614	25	0	0	587	25	0	0
Net Head Dep Bounds	5	0	0	0	-	-	-	-	-	-	-	-
Net Vertical Leakage Upper	-	-	2,540	798	-	-	754	-	-	-	-	-
Net Vertical Leakage Lower	41,137	-	-	-	47,422	-	3,872	-	47,748	859	3,687	-
Net Lateral Flow To Calhoun	1,062	-	-	-	-	-	-	-	-	-	-	-
Net Lateral Flow To Jackson	3,307	4,018	1	19	2,425	2,312	-	-	3,349	2,009	-	-
Net Lateral Flow To Lavaca	394	378	1	12	191	278	1	6	277	249	-	-
Net Lateral Flow To Refugio	-	-	1	-	-	-	-	-	-	-	-	-
Net Lateral Outflow To Other Areas	228	-	-	-	-	431	-	-	-	416	-	-
Total Outflow	*122,364*	*64,779*	*2,543*	*829*	*152,245*	*72,153*	*4,627*	*7,149*	*155,687*	*73,915*	*3,687*	*7,143*
Inflow - Outflow	-16,719	-395	-1,715	-510	-19,283	-600	-4,589	-2,060	-12,746	-407	-2,771	-1,513
Storage Change	-16,717	-375	-1,714	-509	-19,281	-584	-4,588	-2,060	-12,741	-413	-2,772	-1,509
Model Error	-2	-20	-1	-1	-2	-16	-1	0	-5	6	1	-4
Model Error (percent)	0.00%	0.03%	0.04%	0.12%	0.00%	0.02%	0.02%	0.00%	0.00%	0.01%	0.03%	0.05%

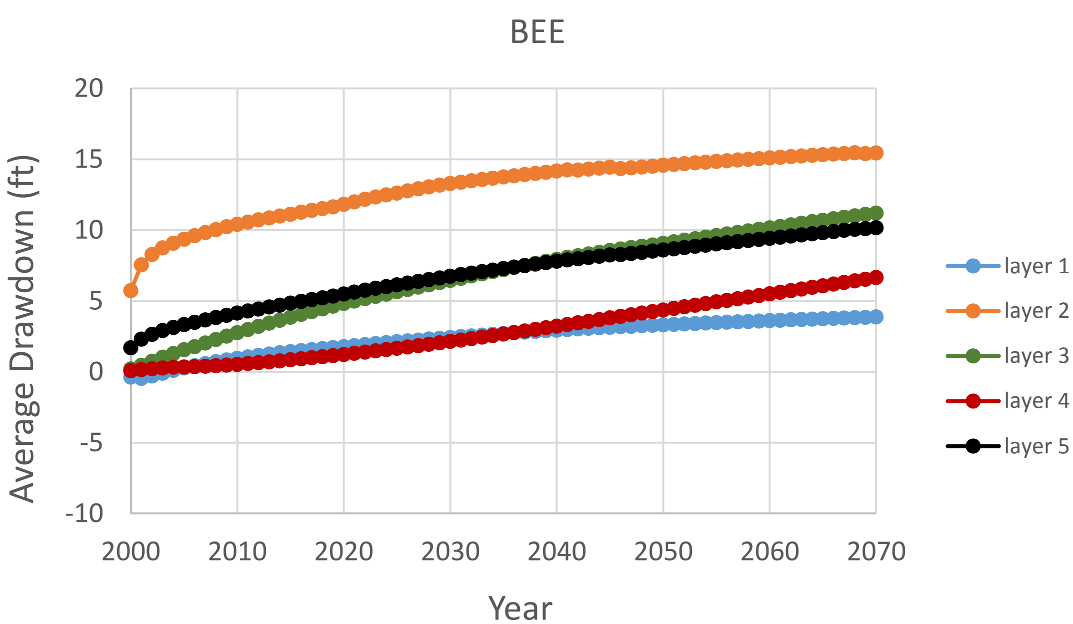
Water Budget for the Central Portion of the Gulf Coast Aquifer by County in the GAM (2030, 2050, 2070)

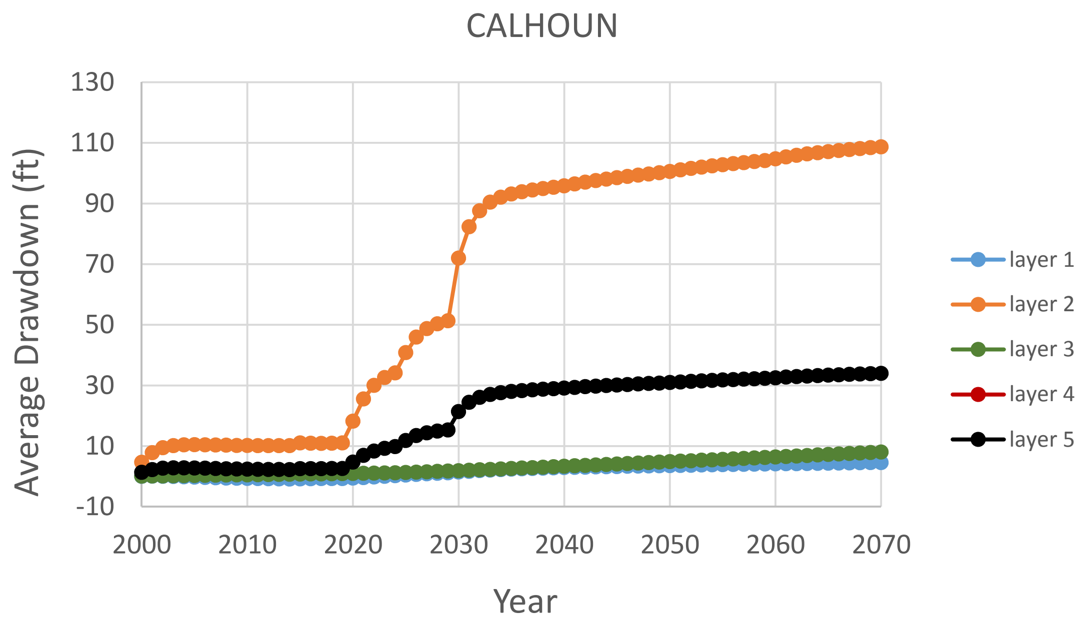
Wharton	2030				2050				2070			
	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper	Chicot	Evangeline	Burkeville	Jasper
Inflow												
River Leakage	537	0	0	0	537	0	0	0	537	0	0	0
Recharge	21,618	0	0	0	21,618	0	0	0	21,618	0	0	0
Net Stream Leakage	127,863	0	0	0	136,811	0	0	0	142,895	0	0	0
Net Vertical Leakage Upper	-	52,767	-	-	-	56,570	-	-	-	58,198	-	-
Net Vertical Leakage Lower	-	4,711	1,541	-	-	4,817	1,619	-	-	4,630	1,625	-
Net Lateral Flow From Austin	1,943	1,568	1	10	1,545	1,565	1	13	1,417	1,559	1	15
Net Lateral Flow From Brazoria	-	215	-	-	-	252	-	-	-	286	-	-
Net Lateral Flow From Colorado	19,295	8,612	40	158	20,202	9,363	37	153	20,667	9,881	35	150
Net Lateral Flow From Fort Bend	-	2,409	-	-	-	1,991	-	-	-	1,445	-	-
Net Lateral Flow From Jackson	4,075	3,888	2	-	1,119	202	1	1	-	-	-	1
Net Lateral Flow From Matagorda	-	3,945	-	-	1,101	3,451	-	-	2,611	3,936	2	-
Total Inflow	*175,331*	*78,115*	*1,584*	*168*	*182,933*	*78,211*	*1,658*	*167*	*189,745*	*79,935*	*1,663*	*166*
Outflow												
Wells	135,759	78,627	0	0	135,759	78,627	0	0	135,759	78,627	0	0
Drains	7	0	0	0	6	0	0	0	6	0	0	0
Et	171	0	0	0	158	0	0	0	152	0	0	0
Net Vertical Leakage Upper	-	-	4,711	1,541	-	-	4,817	1,619	-	-	4,630	1,625
Net Vertical Leakage Lower	52,767	-	-	-	56,570	-	-	-	58,198	-	-	-
Net Lateral Flow To Brazoria	605	-	2	8	590	-	2	6	579	-	2	5
Net Lateral Flow To Fort Bend	4,406	-	5	132	4,172	-	5	128	4,268	-	5	121
Net Lateral Flow To Jackson	-	-	-	4	-	-	-	-	2,268	1,651	1	-
Net Lateral Flow To Matagorda	377	-	2	-	-	-	-	-	-	-	-	-
Total Outflow	*194,092*	*78,627*	*4,720*	*1,685*	*197,255*	*78,627*	*4,824*	*1,753*	*201,230*	*80,278*	*4,638*	*1,751*
Inflow - Outflow	-18,761	-512	-3,136	-1,517	-14,322	-416	-3,166	-1,586	-11,485	-343	-2,975	-1,585
Storage Change	-18,761	-482	-3,136	-1,516	-14,321	-385	-3,166	-1,585	-11,480	-315	-2,974	-1,582
Model Error	0	-30	0	-1	-1	-31	0	-1	-5	-28	-1	-3
Model Error (percent)	0.00%	0.04%	0.00%	0.06%	0.00%	0.04%	0.00%	0.06%	0.00%	0.03%	0.02%	0.17%

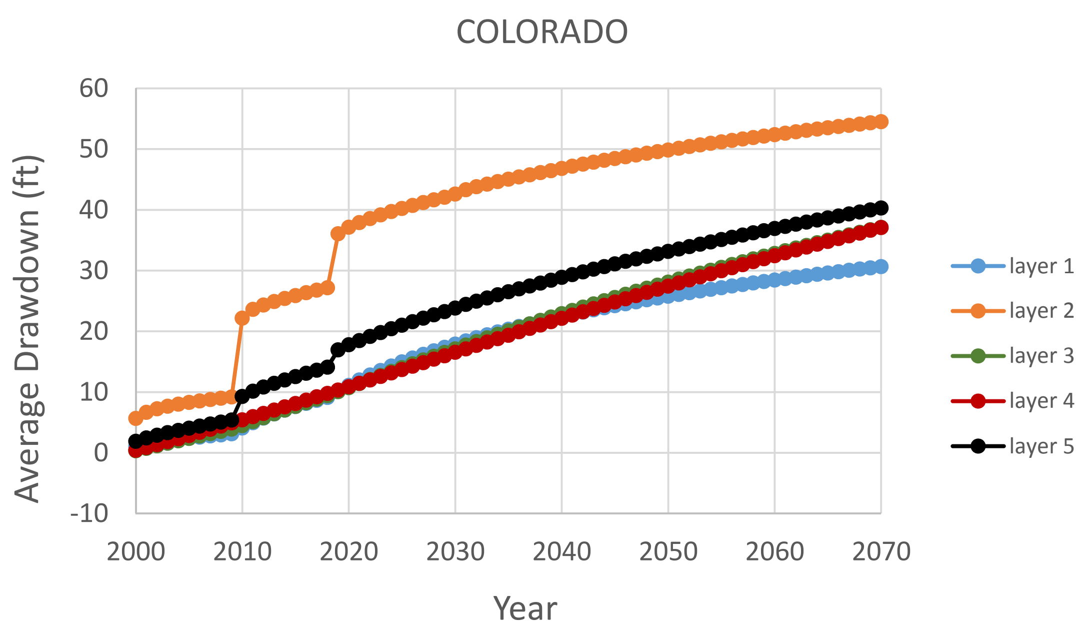
Exhibit G

HighProduction Option 1 Run Simulated Average Drawdown versus Time

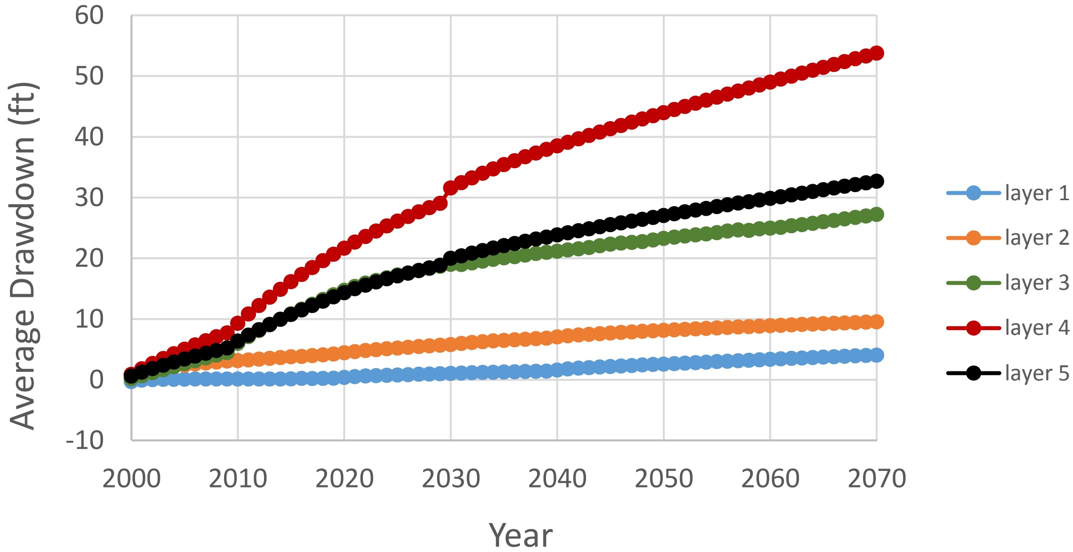

ARANSAS
Average Drawdown (ft)
50
40
30
20
10
0
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 5


BEE
Average Drawdown (ft)
20
15
10
5
0
-5
-10
2000
2010
2020
2030
2040
2050
2060
2070
Year
layer 1
layer 2
layer 3
layer 4
layer 5

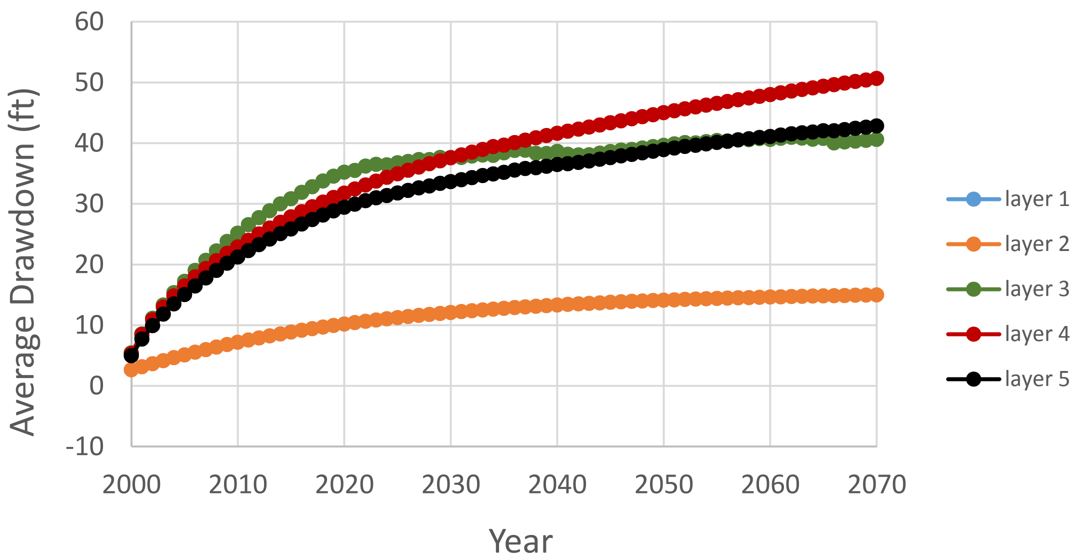

CALHOUN
130
110
90
70
50
30
10
-10
2000
2010
2020
2030
2040
2050
2060
2070
Average Drawdown (ft)
Year
layer 1
layer 2
layer 3
layer 4
layer 5


COLORADO
60
50
40
30
20
10
0
-10
2000
2010
2020
2030
2040
2050
2060
2070
Average Drawdown (ft)
Year
layer 1
layer 2
layer 3
layer 4
layer 5

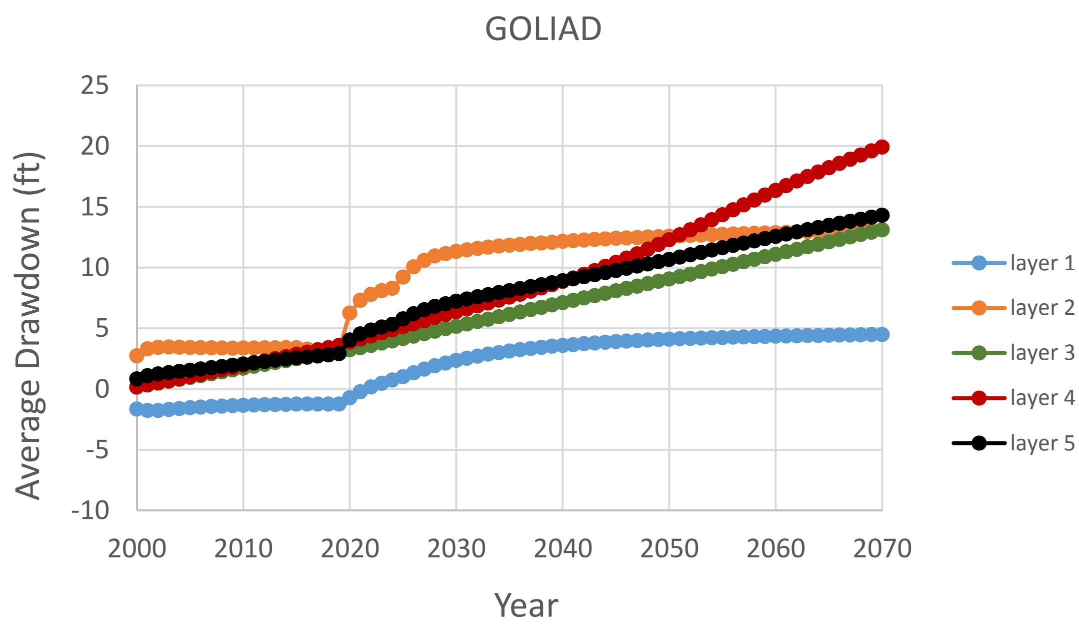
DEWITT

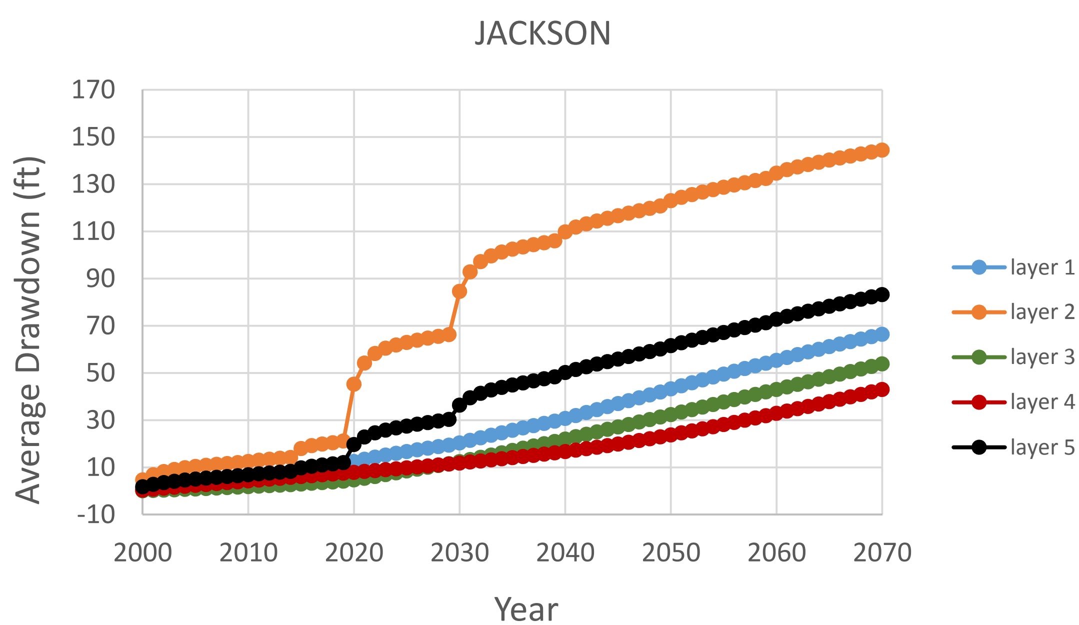


FAYETTE

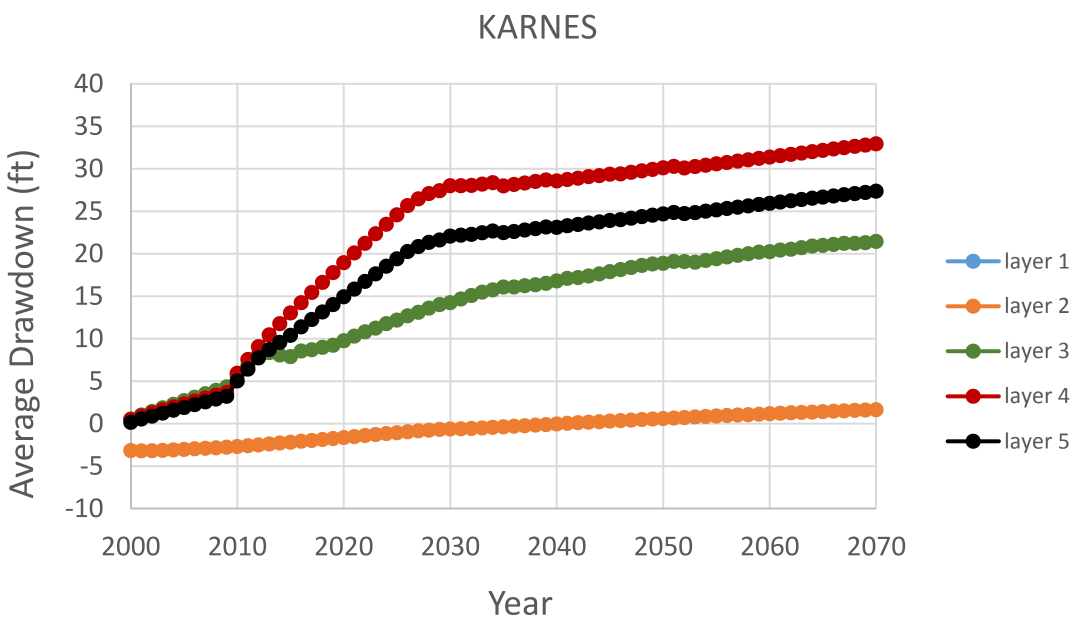


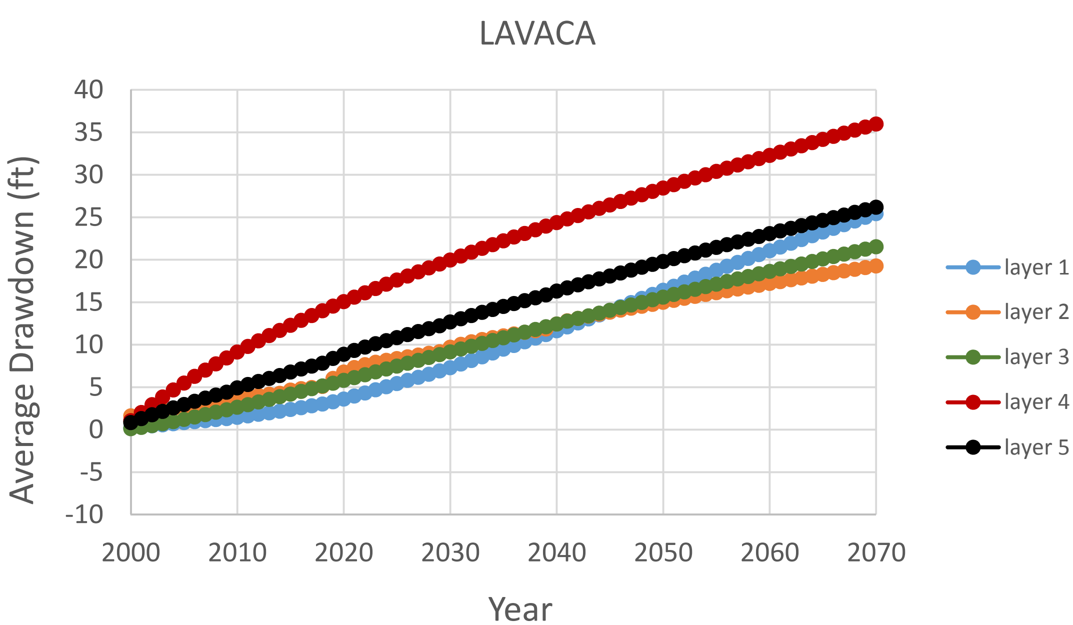
INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS



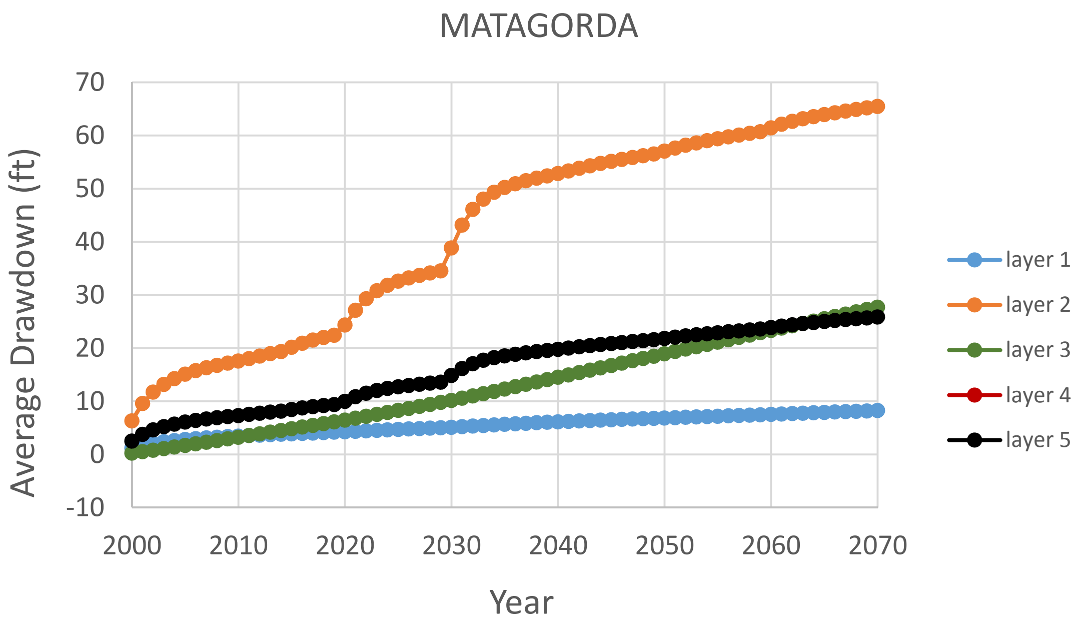


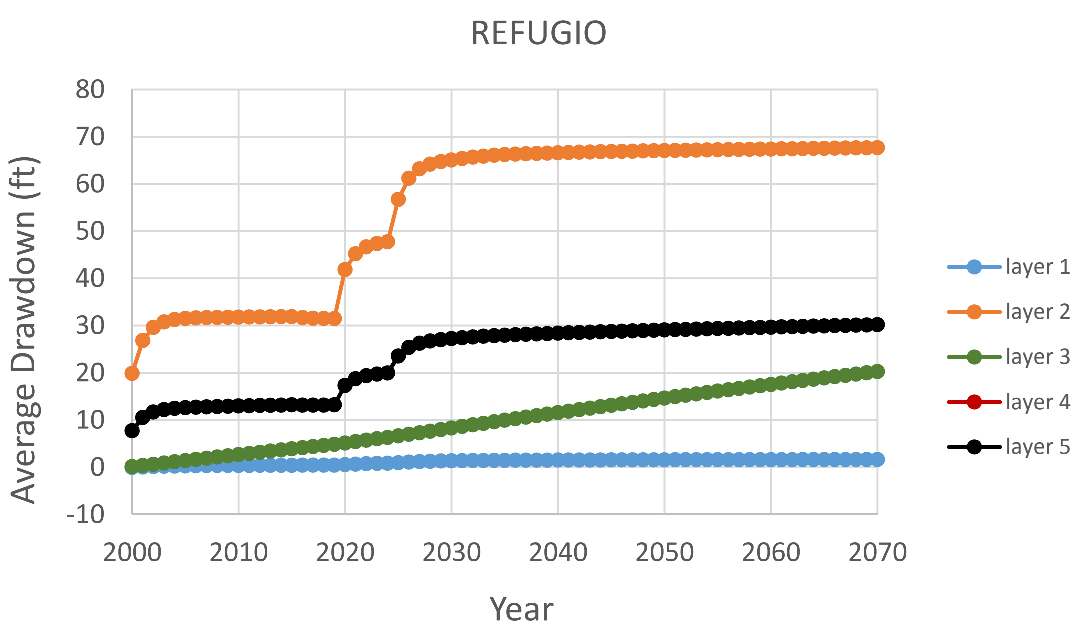
INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS





INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS





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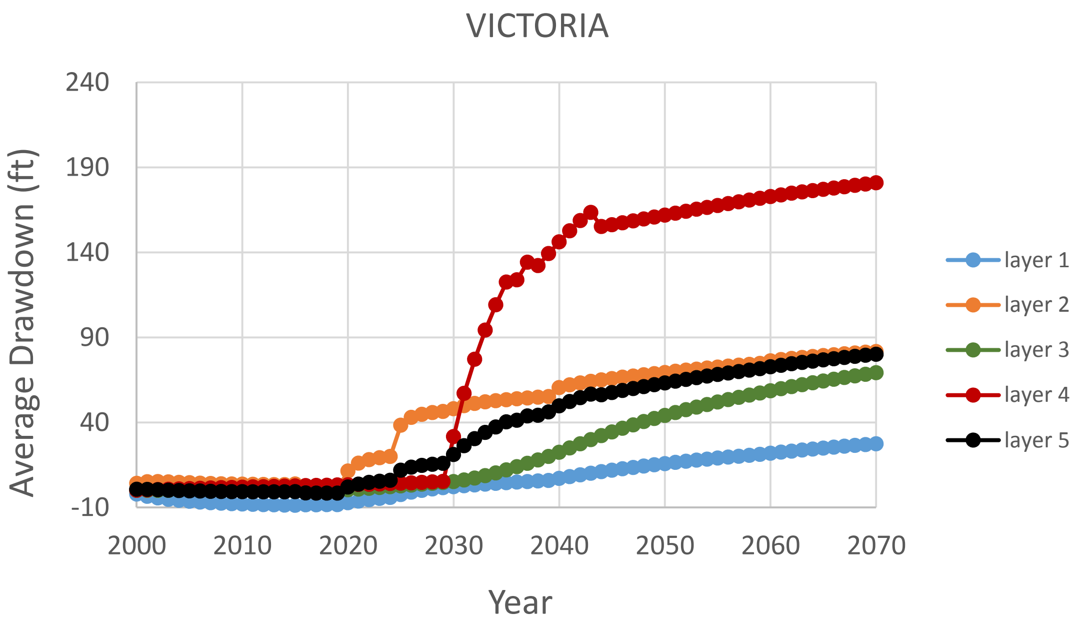

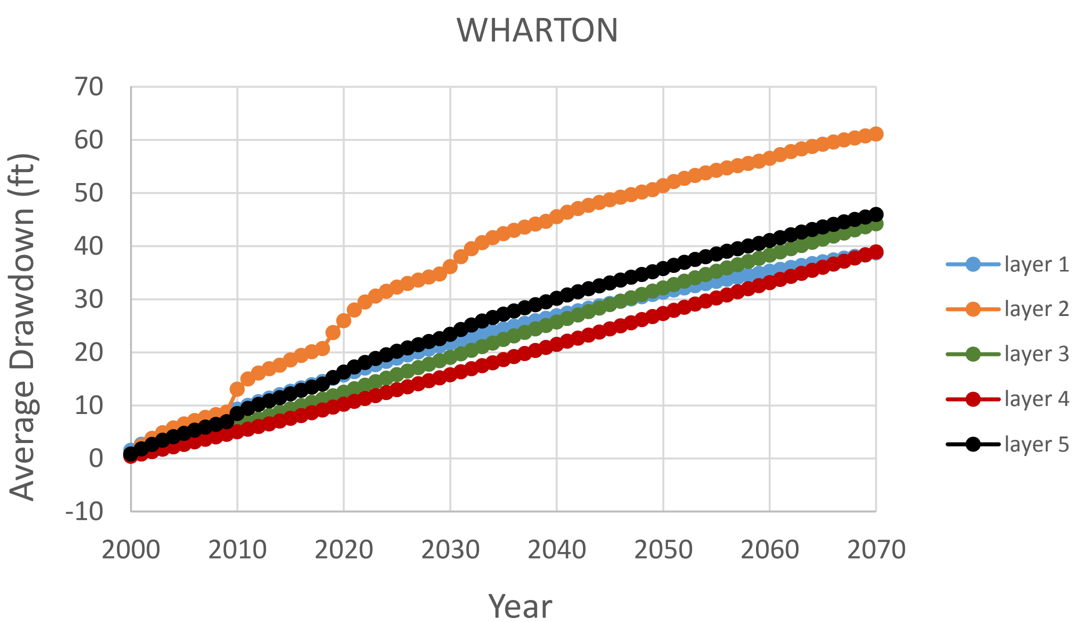

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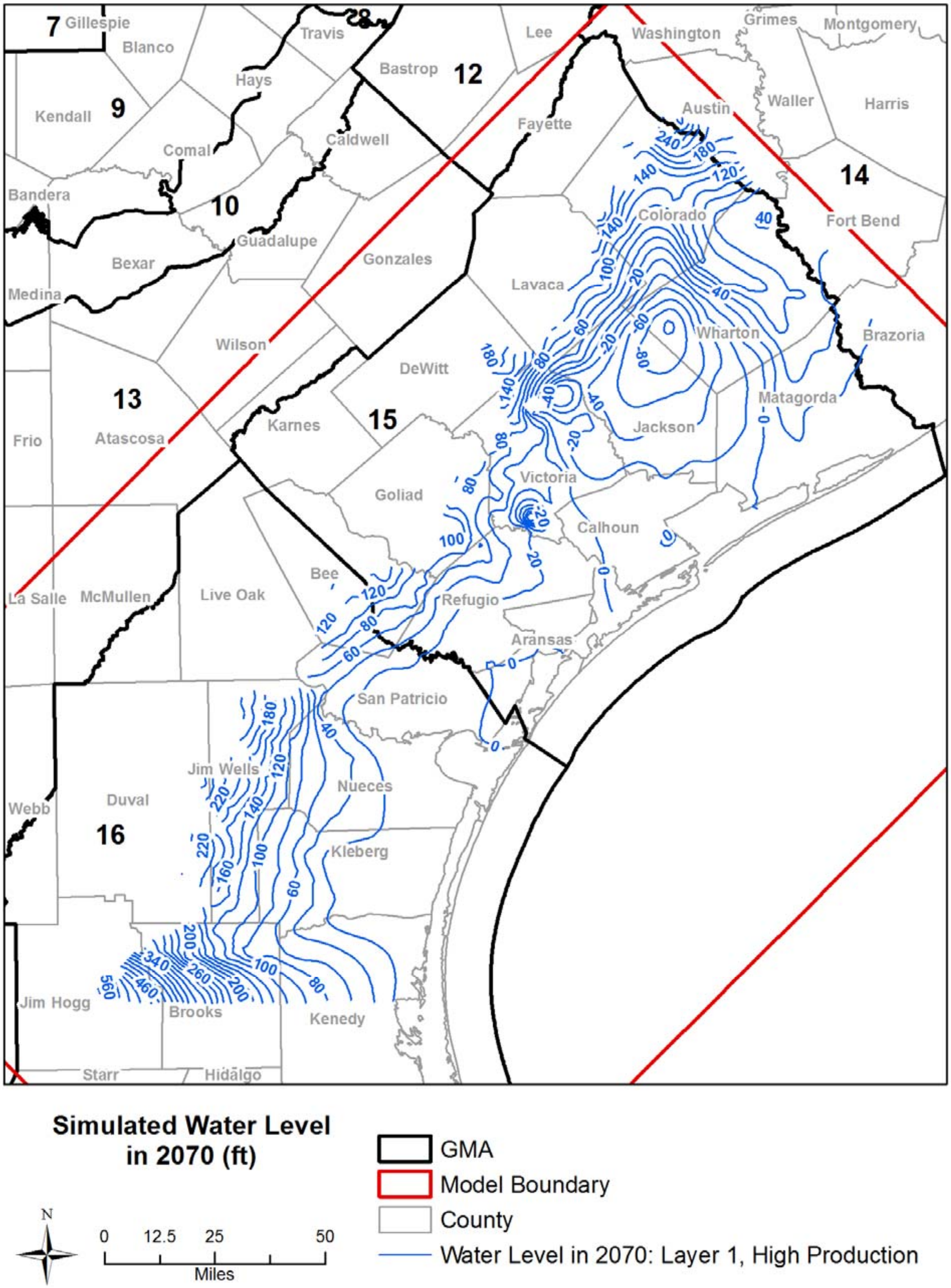
Exhibit H

HighProduction Option 1 Run Simulated Contours of Hydraulic Head



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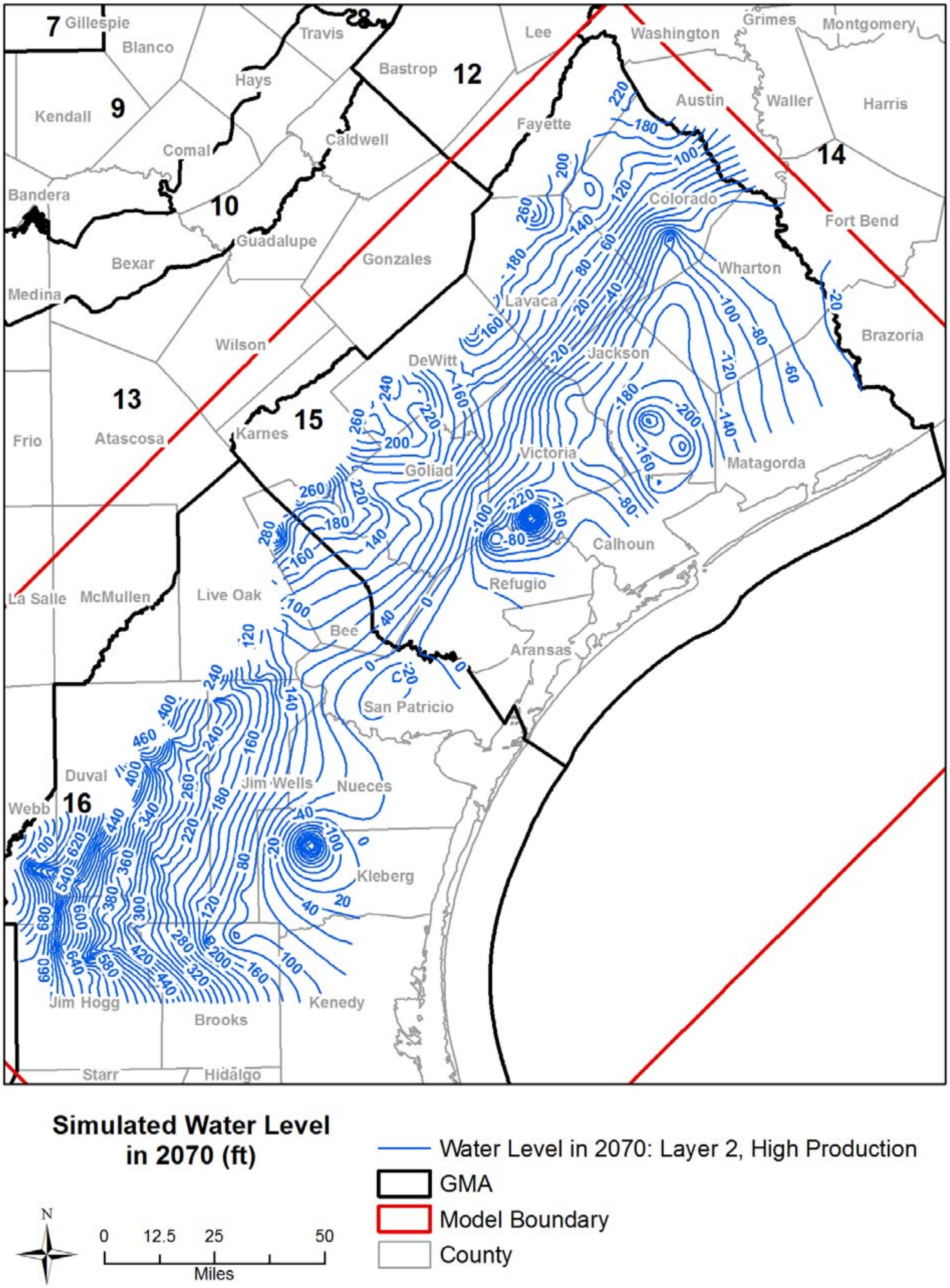
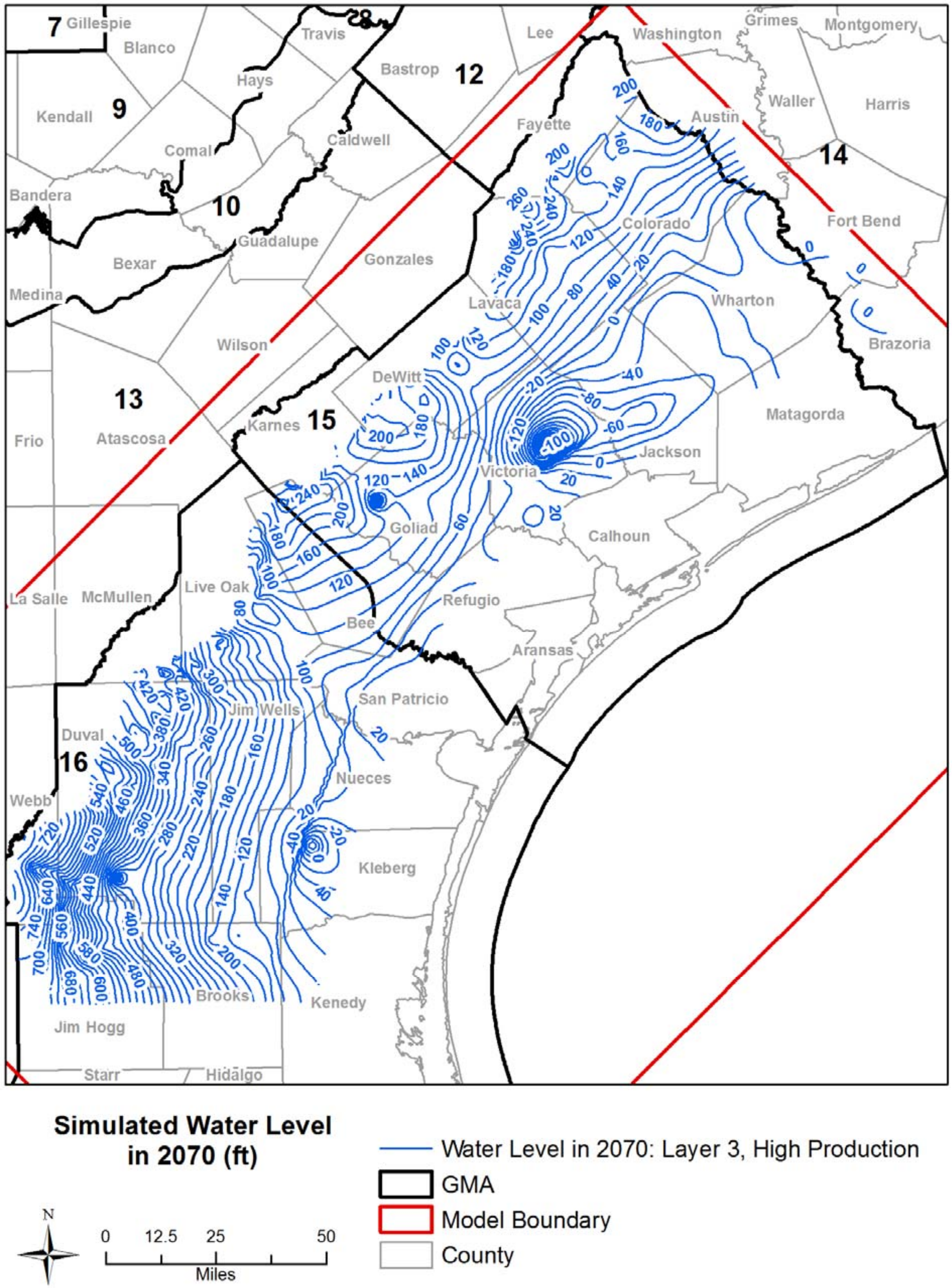

7 Gillespie
Blanco
Travis
Lee
Washington
Grimes
Montgomery
Hays
Bastrop 12
Kendall 9
Austin
Waller
Harris
Fayette
Comal
Caldwell
14
Bandera
10
Colorado
Fort Bend
Guadalupe
Bexar
Gonzales
Wharton
Medina
Lavaca
Brazoria
Wilson
DeWitt
Jackson
13
15
Frio
Atascosa
Karnes
Victoria
Goliad
Matagorda
Calhoun
Refugio
La Salle
McMullen
Live Oak
Bee
Aransas
San Patricio
Duval
Jim Wells
Nueces
Webb 16
Kleberg
Jim Hogg
Brooks
Kenedy
Starr
Hidalgo
Simulated Water Level in 2070 (ft)
Water Level in 2070: Layer 2, High Production
GMA
Model Boundary
County
N
0 12.5 25 50
Miles



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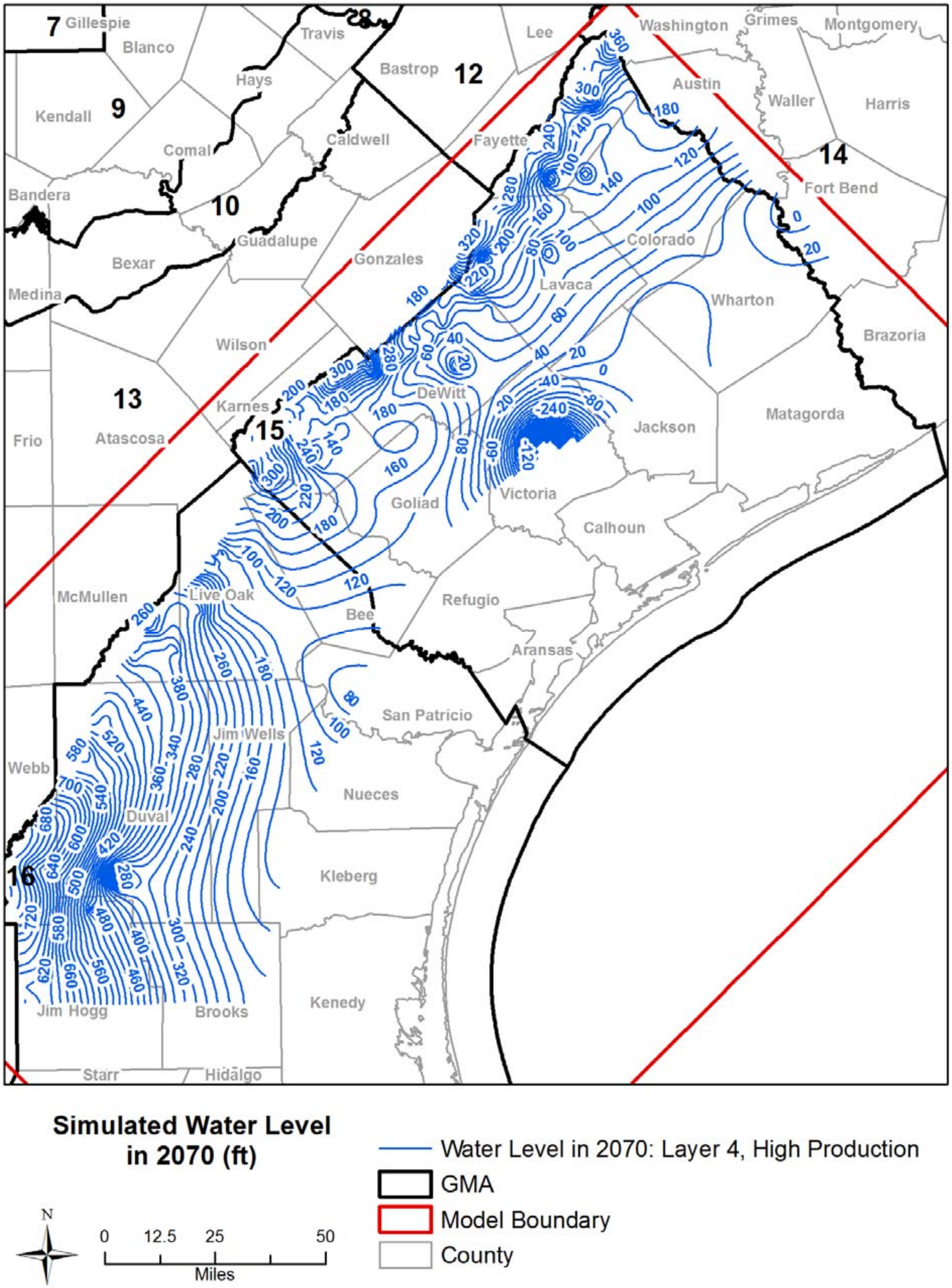

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Appendix L

Letter from Goliad County to Steve Young, INTERA, dated August 19, 2015

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
www.goliadcogcd.org

August 19, 2015

Steve Young
Intera Geosciences and Engineering Solutions
1812 Centre Creek Dr. #300
Austin, TX 78754
syoung@intera.com

Mr. Young;

Goliad County Groundwater Conservation District (GCGCD) proposes that a greater variance be allowed for the District in establishing a Desired Future Condition (DFC) based on the attached evidence to support a higher Groundwater Availability Model (GAM) predictive uncertainty.

During discussion at Groundwater Management Area (GMA) 15 meeting on Thursday, August 13, 2015 it was recommended that GCGCD send the supporting data to you with the request that you formulate a proposed DFC for GCGCD to consider. At the previous GMA 15 meeting on July 15, 2015 you commented that you could prepare a statement addressing the adverse situation for GCGCD where the model information is not supported by empirical data collected by GCGCD.

By giving GCGCD guidance, GCGCD can prepare a DFC that is compatible with your plans.

GMA 15 is scheduled to meet again on October 8, 2015. GCGCD asks for a reply no later than September 18, 2015 so that your proposed DFC statement can be presented to the Board at the GCGCD meeting of September 21, 2015.

Regards,
Art Dohmann
Goliad County Groundwater Conservation District Board of Directors

cc: Tim Andruss

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT

DESIRED FUTURE CONDITION

DATED AUGUST 17, 2015

The Goliad County Groundwater Conservation District (GCGCD) Mission Statement and Desired Future Condition (DFC) is to maintain groundwater availability from the Gulf Coast aquifer on a sustainable basis. A sustainable groundwater supply is critical for the continued viability of the agricultural economy of the county. Without a viable agricultural economy, the county would suffer major economic distress.

Historic water level data gathered by the Texas Water Development Board (TWDB) and by GCGCD since 2003 shows a steady water level decline since 1980. During the drought of the 1950's and periodic recordings to date, the upper aquifer sands are being depleted and some have completely dried up. GCGCD has prepared an economic impact statement that details the additional costs associated with continued declining water levels and is committed to minimize those additional costs by implementation of use, spacing, depth, and drawdown rules. GCGCD projects that some water level decline will continue and that there will be an associated economic impact.

GCGCD has compared empirical pumping and water level data with the Modeled Available Groundwater (MAG) run by Intera titled "2014 DFC Baseline Run-2070 Pumping". GCGCD finds that this modeled data using average recharge cannot be used to provide an accurate DFC. The MAG shows an annual overall pumping rate of 12,185 acre feet which far exceeds the 2014 groundwater pumping of 6,115 acre feet documented by GCGCD. Annual pumping continues to increase and the pumping recorded in 2014, which was a drought year, is considered to be the highest annual groundwater use to date. The associated modeled drawdown of 1.0 foot in the Evangeline aquifer and a rise of 3.3 feet in the Chicot Aquifer is contrary to the drawdown being recorded by GCGCD. GCGCD drawdown data will be presented in detail later.

GCGCD asserts that a primary reason that the TWDB Model data does not support the empirical drawdown data compiled by GCGCD is that the Model uses values for annual rainfall and recharge that are too high. Average annual rainfall for Goliad County continues to drop and there are long range projections that continued lower rainfall can be expected. Too much emphasis has been put on the drought of record with the implication that all of the other years are normal. Since the drought of the 1950's there have been several significant droughts and many mini droughts. In fact most years, even those with above average rainfall, have drought periods.

Annual recharge is affected by two components, rainfall and ground surface geology. In addition to the lower annual rainfall comments above, surface use has changed significantly in the last 60 years, especially in north Goliad County. Much of this area is classified as the recharge area for the Evangeline Aquifer. 60 years ago, 40-45 percent of north Goliad County was tilled for crops. This type of a surface that provided for greater rainfall capture and allowed rapid and significant percolation by rainfall into the subsurface. Today there is minimum tillage occurring in north Goliad County. The compacted and grass and brush covered soil fundamentally and substantially changed recharge rates.

Referring to the graph of the North Goliad County Wells, showing TWDB data note that there was a steady increase in water levels recorded after the drought of the 1950's until about 1980. These graphs were prepared by LBG Guyton for Region L using TWDB data from 1954-2000. During this time, farm land was being converted to range land. As previously noted, after 1980, water levels began a steady decline. That decline occurred without a notable change in rainfall. This data should support the thought that a change in land use has significantly reduced the amount of recharge occurring especially to the Evangeline aquifer in north Goliad County. Referring to the rainfall data attached, note that annual rainfall has declined significantly for the years 2008 through 2014 which along with reduced recharge has resulted in a recorded drop of water level of 8.6 feet in the Evangeline Aquifer in the last 12 years.

GCGCD is awaiting the release of the EDYS Brush Management Model for Goliad County. This Model may provide a more accurate recharge value for Goliad County. The EDYS Model data will not be available in time for use in developing the new DFC for GMA-15 in 2015.

Intera has recently completed the model run entitled "Baseline DFC Run with 50% Recharge" for GMA-15. The drawdown generated by this run is significantly more than with average recharge but still is much less than what is recorded by TWDB and GCGCD data.

After a thorough evaluation of all factors including model runs and empirical data compiled by TWDB and GCGCD, GCGCD proposes that a greater variance be allowed for the District based on evidence provided to support a higher GAM predictive uncertainty.

Included as attachments are graphs of water levels recorded by TWDB starting in 1955 and continuing with graphs of water levels recorded by GCGCD starting in 2003 through spring of 2015. Currently most of the groundwater supply comes from the Evangeline Aquifer in north Goliad County and the Chicot Aquifer in south Goliad County. Please note from the attached water level data that water levels have continued to decline in both of these aquifers since 1980. The GCGCD data covers a more dispersed area and includes a greater number of wells. In addition, all of the GCGCD wells are open cased not pumped and therefore are a true representation of static water levels.

The GCGCD data averages five depths of wells in the Evangeline Aquifer and three depths of wells in the Chicot Aquifer. The averages are from data generated since 2003 through spring of 2015.

For the Evangeline Aquifer:

7 wells above 100 feet depth, water level dropped 6.32 feet,

23 wells 101 to 199 feet depth, water level dropped 8.46 feet,

18 wells 201 to 300 feet depth, water level dropped 8.62 feet,

4 wells 301 to 400 feet depth, water level dropped 14 feet,

2 wells below 401 feet depth, water level dropped 7.44 feet.

The weighted average of sixty (60) wells in the Evangeline Aquifer is 8.59 feet drawdown.

For the Chicot Aquifer:

4 wells above 100 feet depth, water level dropped 5.24 feet,

_6__ wells 101 to 200 feet depth, water level dropped _2.61__ feet,

_5_ wells 201 to 400 feet depth, water level dropped _6.19_ feet.

The weighted average of fifteen (15) wells in the Chicot Aquifer is _4.50 feet drawdown.

GCGCD has expressed a great interest in working with TWDB in developing the updated model of the Gulf Coast Aquifer for the Central Gulf Coast. In addition to the question of recharge, GCGCD is concerned that the modeled water budget shows a significant inflow of streams to the Evangeline and Chicot Aquifers. The USGS gain-loss studies of the Lower San Antonio River Basin and the Coleto Creek Watershed shows in both studies a surface water gain from the Aquifer. This discrepancy needs extensive further evaluation.

Attachments:

Economic Impact Report

Groundwater Use Tables

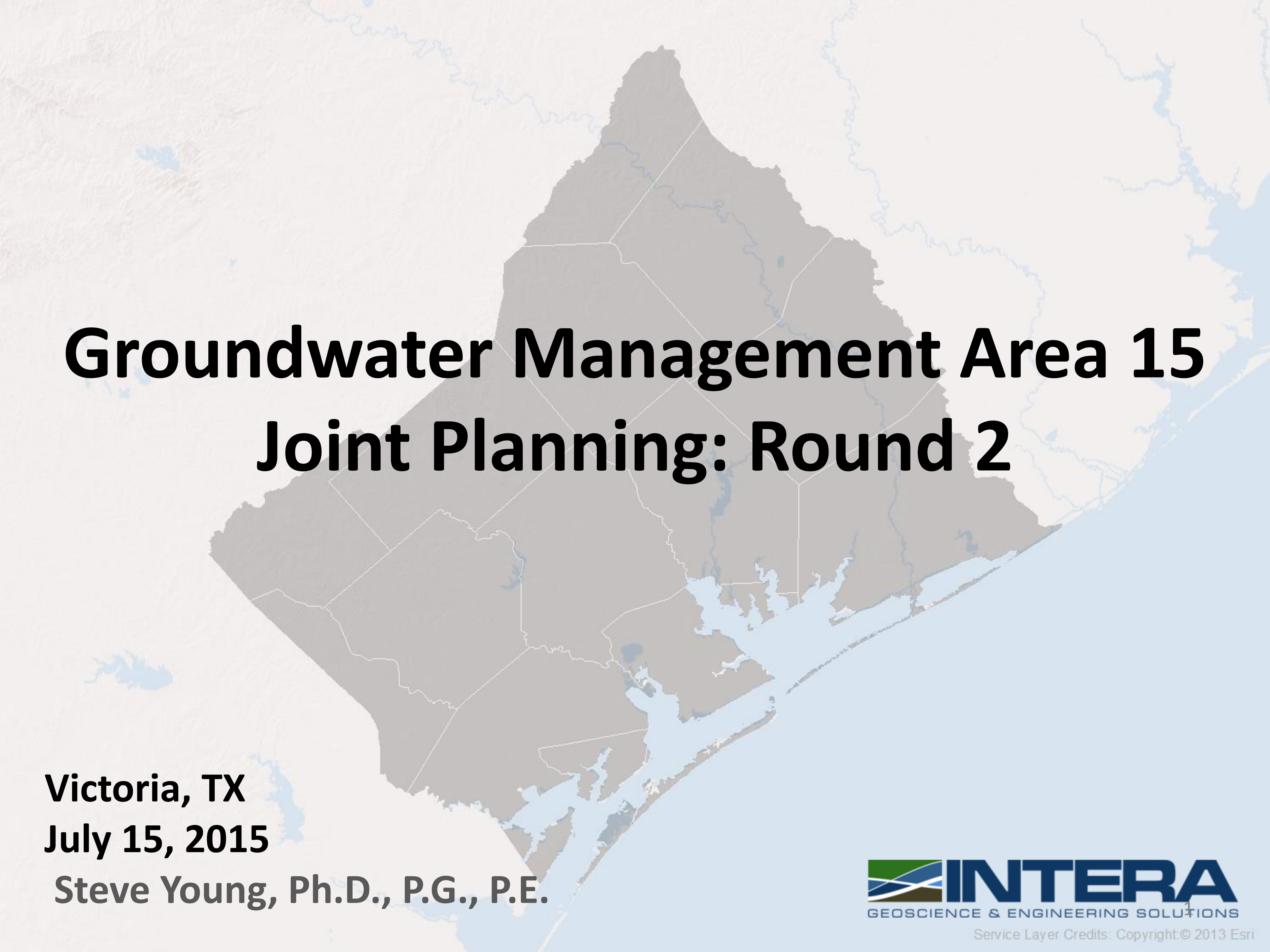
Groundwater Levels, Graphs and Tables

GCGCD Rainfall data

Appendix M

INTERA's Presentation to GMA 15 on July 15, 2015

Groundwater Management Area 15
Joint Planning: Round 2



Victoria, TX
July 15, 2015

Steve Young, Ph.D., P.G., P.E.

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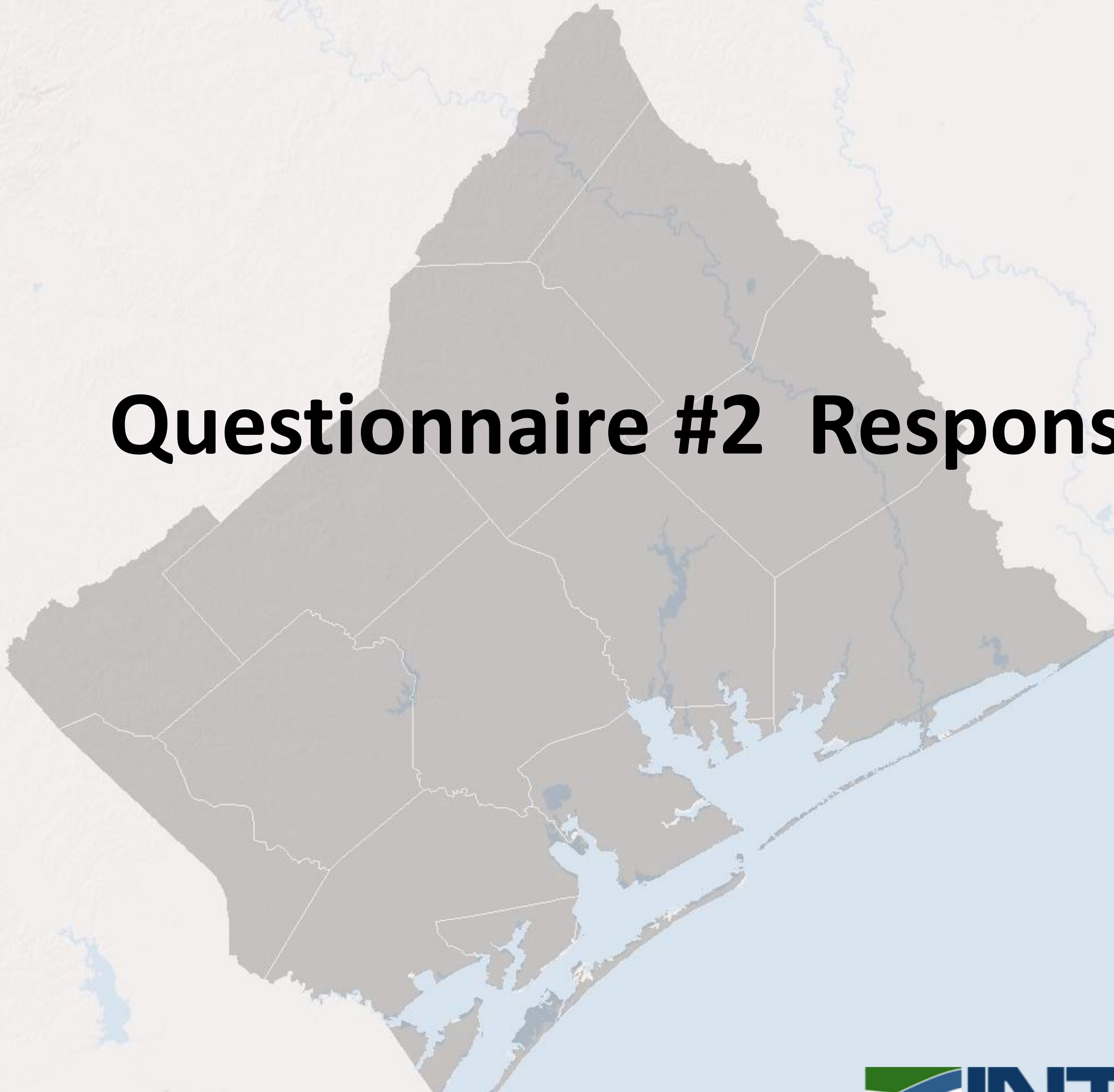
Discussion Topics

- Questionnaire #2 Responses
- Results from Three DFC GAM Runs
- Considerations for Allowing Differences between Adopted DFCs and DFCs Calculated from GAM Runs
- Suggested Approach for Establishing DFC for GMA 15

Questionnaire #2 Responses



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Questionnaire #2 Response

- Eight GCD Responded
- Strong support for DFCs based on changes in water levels in wells
- Other suggested DFCs included land subsidence & salt water intrusion
- General agreement that GAM is an acceptable tool for GMA planning
- Mixed comments on accuracy of GAM for predictions of future groundwater impacts
- 10% to 25% difference between adopted DFC and simulated DFC to demonstrate that DFCs are feasible
- Mixed comments on well state plan reflects anticipated GW use
- Some GCDs provided data besides GAM runs to be considered when setting DFCs

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Questionaire - Topic 1: Important Information other than Groundwater Availability Model Information

In addition to groundwater availability models, what, if any, other information for the management area would you like the GMA 15 member districts to consider for the purpose of proposing a desired future condition for adoption?

If you would like other information considered by GMA 15 member districts, provide a brief description of the information and submit the information to the GMA 15 Administrator with the survey response.

Responses - Topic 1: Important Information other than Groundwater Availability Model Information

GCD #1
Existing Groundwater Availability Models are sufficient tools in the process of adopting a DFC for this round of GMA planning.

GCD #2
Wishes that only water level changes, which is a common metric for measuring aquifer responses to pumpage be the only metric used for DFCs.

For the purposes of predictive scenarios, the use of GAMs is the main source of information that we see as necessary to include as part of the process. If, however, issues with the GAM can be shown for part of the GMA, and/or a better method can be shown to be applicable in the process, we are open to the use of alternate methods.

Responses - Topic 1: Important Information other than Groundwater Availability Model Information

GCD #3
The existing Groundwater Availability Model is acceptable

GCD #4
Actual data of pumping and extensive water level monitoring by GCGCD compared with the baseline and high capacity modeled drawdown and availability produces a major discrepancy. The model data shows double the available groundwater versus actual pumping at very little drawdown where actual drawdown measured is 6 times the modeled value.

Changed surface use from farming in the 1950's to ranching and brush for wildlife has changed recharge quantities. The question is if the recharge in the model is OK or not.

GCD #5, 6, 7, & 8
Historic Water Level Information; Subsidence information; Water Quality Information (high---quality water vs. Low--quality water); Historic Drought Information.

Questionaire - Topic 2: Current and Future Uses of the Aquifer

What are the current uses of the aquifer within the district/county?

What is the relative ranking of importance of each use?

Provide estimates of recent groundwater production amounts for each use within the district/county.

Do the uses of the aquifer in the district/county differ substantially geographically? If yes, explain.

Are there any current or future aquifer uses that you believe are not accurately represented in the state water plan? If yes, explain.

Response - Topic 2: Current and Future Uses of the Aquifer

GCD #1

Believes our current and future uses are represented in the state water plan.

GCD #2

Believes there are current or future uses that are not accurately represented in the state water plan.

GCD #3

State Water Plan covers the county adequately

GCD #4

As stated above 85% of water use comes from the Evangeline Aquifer and primarily in the north 60--70% of the county.

GCD #5, 6, 7, & 8

Future irrigation production is typically underestimated in state water plan

Questionaire - Topic 3: Aquifer Conditions

Are there specific aquifer conditions or hydrogeological impacts (such as subsidence and groundwater--surface water interactions, etc), other than changes to water levels within the district/county, that you would like the GMA 15 member districts to consider for the purpose of proposing a desired future condition for adoption? If yes, explain.

Response - Topic 3: Aquifer Conditions

GCD #1:

Water Level impacts should continue to be the main aquifer condition described in proposing a DFC. Controlling water level impacts should control detrimental effects such as subsidence.

Water Level impacts should continue to be the main aquifer condition described in proposing a DFC. Controlling water level impacts should control detrimental effects such as subsidence.

GCD #2:

There are no other aquifer conditions or impacts that we feel need to be incorporated into the DFC process. Subsidence is certainly an issue in some parts of the GMA, but based on the location of Fayette County, the ability of the aquifers to produce water, and the projected demands over the planning horizon, we do not feel that this is an issue for our district. Groundwater--surface water interactions may also be important in some parts of the GMA, but as with subsidence, based on the projected future demands we do not feel this is an issue for our district.

Response - Topic 3: Aquifer Conditions

GCD #3
Water Level changes should be the most important part of the DFC

GCD #4:
With the drop in Aquifer level in recent years, a reduction of gaining stream is anticipated. This would have an impact on WAM model data used in the Region L State Water Plan.There used to be heavy reliance on spring flow for livestock water supply. Most springs across the county have dried up except during heavy rain events.

GCD #5, 6, & 8
Other conditions besides drawdown to be considered for DFCs are subsidence & saltwater intrusion

GCD #7
Another conditions besides drawdown to be considered for DFCs is saltwater intrusion.

Questionaire - Topic 4: Socioeconomic and Property Right Impacts

Describe the major social consequences, especially negative impacts, you would anticipate if the adopted desired future condition not properly balanced (i.e., too lax or too restrictive).

Describe the major economic consequences, especially negative impacts, you would anticipate if the adopted desired future condition not properly balanced (i.e., too lax or too restrictive).

Describe the consequences related to private property rights, especially negative impacts, you would anticipate if the adopted desired future condition not properly balanced (i.e., too lax or too restrictive).

Response - Topic 4: Socioeconomic and Property Right Impacts

GCD #1:
Adopting a DFC too lax would more than likely allow for aquifer declines that would result in shallower wells eventually needing to be replaced. Energy cost would increase due to lower levels. Adopting a DFC too restrictive may trigger district action that could cripple our local economy that depends heavily of the agricultural industry.

Adopting a DFC too lax may cause landowners that needed to replace their wells, begin to question their rights or legal ramifications for damages caused by other permitted pumping. An adopted DFC too restrictive could lead to permit cutbacks and landowner takings claims against the Districts.

GCD #2:
we do not feel there will be any socio--economic or private property rights impacts if the DFCs are not properly balanced. Even if the MAGs that come out of the current round of joint groundwater planning are significantly higher than previous MAGs, the aquifers within Fayette County are not productive enough that this type of production will actually occur. And current MAGs cannot be lowered significantly, so that would not appear to be a valid concern for our district either at this time.

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Response - Topic 4: Socioeconomic and Property Right Impacts

GCD #3:
If too lax, wells could go dry causing landowners to drill deeper water wells. If restrictive, less pumping could impact irrigation use, mining and commercial use wells in the County

GCD #4:
The principle consideration by GCGCD in establishing a Desired Future Condition (DFC) for 2070 is water level drawdown. Water quality is also a principle consideration and could become a critical issue if residents were forced to drill deeper wells in order to have an adequate supply of drinking water.

When considering the economic impact of water level drawdown, two major costs are encountered: deeper well cost and pumping cost. When an existing water sand is no longer productive a replacement well is required or in the case of a new location, the well will need to be drilled deeper. Depth between sands varies from 50--100 feet in most areas. A budget price for a new well, drilled well only, is $6500. Adding 75 feet to the depth adds $1500 to the cost. As to pumping cost, for each drop of 10 feet of water level pumping 7000 acre feet per year, 2014 use estimate, the additional annual pumping cost is approximately $1,000,000.

Response - Topic 4: Socioeconomic and Property Right Impacts

GCD #5, 6, 7, & 8

Overly lax: Domestic/Livestock and small non--municipal business groundwater producers would likely face significant issues with existing water wells. Well drilling and operational costs would likely increase significantly due to need to produce groundwater from deeper formations; Subsidence and saltwater intrusion likely to occur or increase. *Potentially, groundwater production may negatively impact the availability and quality of groundwater resources of adjacent and near--by property owners.*

Overly restrictive:

Economic development, especially large--scale projects, Property values would likely significantly diminish; Existing business expansion would be curtailed. *Potentially, landowners may realize significant limitations regarding the development of groundwater resources associated with their property.*

Questionaire - Topic 5: Feasibility of Achieving the Desired Future Condition

Describe how your district would evaluate or assess the practicality of taking the necessary actions within your district to achieve or comply with a desired future condition?

What degree of variance between adopted desired future condition drawdown parameters and GAM-- simulated drawdown would your district consider acceptable for demonstrating a desired future condition is feasible? 0%, 10%, 25%, 50%, …?

Describe any policies or rules adopted by your district related to groundwater production limitations, well spacing requirements, or production reductions that are intended to support the achievement or compliance with the desired future condition of GMA 15.

Response - Topic 5: Feasibility of Achieving the Desired Future Condition

GCD #1

Have adopted Rules that address the achievement of DFC in defining stage cutbacks and different levels of percentage reductions.

Through the …..year 2000 has been used as the starting condition. Most, if not all districts, do not have data going back this far. It has been suggested by our CBGCD Attorney that the GMA adopt a more current start date in this round of GMA planning, but this may not be possible since we are unaware of other district monitoring efforts that may or may not be up and running.

GCD #2

The only method of assessing compliance with the current DFCs for GMA 15 is the use of a groundwater level monitoring network. Water levels, and more specifically water level changes, should be measured annually and then DFC compliance can be assessed.

+/- 10% would seem to be an appropriate variability for this process.

We do not have any alternative parameters other than drawdown to propose at this time for defining DFCs for GMA 15.

Response - Topic 5: Feasibility of Achieving the Desired Future Condition

GCD #3

Water level measurements and rules revisions for our county is how GCD #3 will measure DFC achievement

GCD #4

GCGCD will monitor water levels twice annually and will consider this data in decision making.

25% is the degree of variance between adopted desired future condition drawdown parameters and GAM--simulated drawdown that the GCD would consider acceptable for demonstrating the feasibly of desired future conditions.

Individual permits shall specify allowable pumping rates subject to curtailed rates in the event that monitored water levels drop below levels designated in the permit. The maximum allowable drawdown is 10 feet at the permit boundary.

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Response - Topic 5: Feasibility of Achieving the Desired Future Condition

GCD #5, 6, 7, & 8
A DFC that would require the direct measurement of hydrologic conditions via a reasonable subset of existing water wells for the purposes of extrapolating the over--all condition of an aquifer or a component of an aquifer would be considered practical.

A DFC that would require the District to rely primarily on the use of existing ground-water availability models to predict a hydrologic condition (other than water levels) of an aquifer or a component of an aquifer would be considered impractical.

With regard to evaluating occurrence and magnitude of subsidence, the District would consider the used of established remote--sensing methodologies as potentially practical.

GCD #5, 6, 7, & 8
Would consider a 25% variance between the drawdown computed from aquifer monitoring efforts and the drawdown parameter established in the adopted DFC to be acceptable.

GCD #5, 6, 7, & 8
Have adopted rules related to production limits for non--grandfathered uses and spacing limits for non--grandfathered uses that support the achievement of the DFC.

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Results from Three DFC Model Runs

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Baseline and High Production DFC* Runs

County	Avg drawdown in 2070 (ft) for Baseline DFC Run						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	-0.1	6.2	0.1	NA	NA	0.1	0.1
AUSTIN	-1.1	11.8	5.5	16.7	18.4	11.6	9.9
BEE	1.4	8.7	6.2	7.7	5.7	6.5	6.0
BRAZORIA	-0.3	10.7	3.8	13.1	19.1	5.9	4.4
CALHOUN	-0.2	23.0	6.4	3.5	NA	6.4	6.4
COLORADO	9.0	16.0	12.8	18.6	22.5	16.9	16.3
DEWITT	1.2	6.1	5.4	17.1	26.2	17.3	17.5
FAYETTE	NA	5.5	5.5	17.4	18.0	16.0	15.5
FORTBEND	2.4	16.6	9.5	19.2	22.0	15.0	13.7
GOLIAD	-3.3	1.0	0.1	7.2	10.5	5.3	4.4
JACKSON	16.3	34.2	25.2	18.2	23.0	23.1	24.8
KARNES	NA	0.4	0.4	18.1	24.1	20.5	21.1
LAVACA	5.8	6.0	5.9	15.9	31.1	17.2	17.7
MATAGORDA	4.3	24.1	10.3	18.3	NA	11.1	10.3
REFUGIO	-0.4	7.9	3.4	2.9	NA	3.3	3.4
VICTORIA	-3.8	10.9	3.8	6.7	10.4	5.7	5.3
WHARTON	14.2	11.6	12.9	25.3	28.0	19.5	17.5
Overall	4.8	13.0	9.0	15.2	21.7	13.3	12.8

County	Average Pumping (AFY) in 2070 (ft) for Baseline DFC Run						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	1,863	0	1,863	0	0	1,863	1,863
AUSTIN	3,180	4,006	7,187	5	22	7,214	7,209
BEE	3,707	5,505	9,212	17	289	9,518	9,501
BRAZORIA	8,901	289	9,189	0	0	9,189	9,189
CALHOUN	7,950	68	8,018	0	0	8,018	8,018
COLORADO	31,058	28,249	59,307	0	896	60,203	60,203
DEWITT	1,024	7,818	8,842	166	6,408	15,416	15,250
FAYETTE	0	264	264	378	1,878	62,500	2,142
FORTBEND	6,248	5,381	11,629	0	0	11,629	11,629
GOLIAD	821	10,946	11,767	311	107	12,185	11,874
JACKSON	66,147	36,546	102,694	0	0	102,694	102,694
KARNES	0	105	105	510	3,055	3,670	3,160
LAVACA	3,095	12,647	15,742	151	4,692	20,585	20,434
MATAGORDA	33,898	7,121	41,020	0	0	41,020	41,020
REFUGIO	3,383	3,099	6,481	0	0	6,481	6,481
VICTORIA	36,532	30,873	67,405	0	0	67,405	67,405
WHARTON	114,878	66,575	181,452	0	0	181,452	181,452
Overall	322,686	219,491	542,177	1,538	17,347	621,042	559,524

County	Avg drawdown in 2070 (ft) for High Production DFC Run						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	0.0	46.5	1.1	NA	NA	1.1	1.1
AUSTIN	12.2	34.7	23.7	35.8	34.6	29.5	27.4
BEE	3.9	15.5	11.6	11.3	6.8	10.3	9.8
BRAZORIA	0.0	26.9	10.1	21.6	23.9	12.5	10.6
CALHOUN	5.1	122.5	38.5	9.0	NA	38.2	38.5
COLORADO	22.2	38.6	31.3	30.7	33.3	31.6	32.0
DEWITT	4.1	8.7	8.0	23.7	45.9	28.2	30.0
FAYETTE	NA	14.9	14.9	40.0	50.5	42.6	43.3
FORTBEND	12.0	40.6	26.3	37.5	34.9	31.2	29.1
GOLIAD	4.8	14.4	12.4	14.3	21.1	15.4	16.0
JACKSON	67.6	157.3	112.4	57.0	43.4	88.3	98.6
KARNES	NA	3.4	3.4	22.3	32.6	27.5	28.7
LAVACA	19.5	16.1	17.1	20.3	35.2	24.0	25.5
MATAGORDA	8.6	72.0	27.9	29.0	NA	28.0	27.9
REFUGIO	1.7	68.7	32.4	20.4	NA	30.6	32.4
VICTORIA	29.1	89.3	60.3	71.7	181.9	83.6	88.2
WHARTON	36.8	57.0	46.9	42.6	37.6	43.7	44.0
Overall	20.0	56.9	38.8	34.6	45.5	39.3	40.8

County	Pumping (AFY) in 2070 (ft) for High Production DFC Run						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	1,863	0	1,863	0	0	1,863	1,863
AUSTIN	3,180	4,006	7,187	5	22	7,214	7,209
BEE	3,707	5,505	9,212	17	289	9,518	9,501
BRAZORIA	8,901	289	9,189	0	0	9,189	9,189
CALHOUN	12,456	10,070	22,526	0	0	22,526	22,526
COLORADO	44,810	45,669	90,479	0	899	91,378	91,378
DEWITT	1,019	7,813	8,832	165	6,408	15,405	15,240
FAYETTE	0	914	914	1,361	6,664	178,073	7,578
FORTBEND	6,286	5,381	11,667	0	0	11,667	11,667
GOLIAD	1,188	13,465	14,652	361	364	15,377	15,016
JACKSON	92,308	97,478	189,786	0	0	189,786	189,786
KARNES	0	105	105	510	3,055	3,670	3,160
LAVACA	3,095	12,647	15,742	151	4,692	20,585	20,434
MATAGORDA	42,732	9,063	51,795	0	0	51,795	51,795
REFUGIO	6,379	37,951	44,331	0	0	44,331	44,331
VICTORIA	111,032	75,374	186,405	0	50,000	236,405	236,405
WHARTON	135,864	78,713	214,577	0	0	214,577	214,577
Overall	474,821	404,442	879,262	2,570	72,394	1,123,361	951,656

*2070 DFC calculated from a base year of 2000

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Comparison of Average Drawdown from Three DFC* Runs

County	Avg drawdown in 2070 (ft) for Baseline DFC Run						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	-0.1	6.2	0.1	NA	NA	0.1	0.1
AUSTIN	-1.1	11.8	5.5	16.7	18.4	11.6	9.9
BEE	1.4	8.7	6.2	7.7	5.7	6.5	6.0
BRAZORIA	-0.3	10.7	3.8	13.1	19.1	5.9	4.4
CALHOUN	-0.2	23.0	6.4	3.5	NA	6.4	6.4
COLORADO	9.0	16.0	12.8	18.6	22.5	16.9	16.3
DEWITT	1.2	6.1	5.4	17.1	26.2	17.3	17.5
FAYETTE	NA	5.5	5.5	17.4	18.0	16.0	15.5
FORTBEND	2.4	16.6	9.5	19.2	22.0	15.0	13.7
GOLIAD	-3.3	1.0	0.1	7.2	10.5	5.3	4.4
JACKSON	16.3	34.2	25.2	18.2	23.0	23.1	24.8
KARNES	NA	0.4	0.4	18.1	24.1	20.5	21.1
LAVACA	5.8	6.0	5.9	15.9	31.1	17.2	17.7
MATAGORDA	4.3	24.1	10.3	18.3	NA	11.1	10.3
REFUGIO	-0.4	7.9	3.4	2.9	NA	3.3	3.4
VICTORIA	-3.8	10.9	3.8	6.7	10.4	5.7	5.3
WHARTON	14.2	11.6	12.9	25.3	28.0	19.5	17.5
Overall	4.8	13.0	9.0	15.2	21.7	13.3	12.8

County	Avg drawdown in 2070 (ft) for Baseline DFC Run with 50% Rech.						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	-0.1	7.3	0.1	NA	NA	0.1	0.1
AUSTIN	14.2	25.3	19.9	27.0	26.1	23.3	22.0
BEE	14.8	19.9	18.1	13.6	9.7	14.5	15.0
BRAZORIA	0.6	12.6	5.1	14.2	19.9	7.1	5.6
CALHOUN	0.0	24.6	7.0	3.6	NA	7.0	7.0
COLORADO	23.3	28.5	26.2	25.8	27.7	26.5	26.7
DEWITT	9.7	8.9	9.0	19.7	28.2	20.1	20.3
FAYETTE	NA	12.5	12.5	21.4	20.8	19.7	19.1
FORTBEND	8.1	22.7	15.4	23.9	25.4	20.0	18.7
GOLIAD	3.1	5.3	4.8	10.0	12.8	8.7	8.1
JACKSON	25.6	41.8	33.6	21.2	24.9	29.2	31.9
KARNES	NA	12.2	12.2	22.6	25.7	23.7	24.0
LAVACA	22.1	12.5	15.4	19.2	33.5	22.5	23.8
MATAGORDA	4.8	26.5	11.4	18.9	NA	12.1	11.4
REFUGIO	0.6	10.5	5.2	4.3	NA	5.0	5.2
VICTORIA	0.5	14.4	7.7	8.8	12.6	8.8	8.8
WHARTON	21.2	18.5	19.9	28.2	30.0	24.3	23.0
Overall	10.2	19.1	14.8	18.8	24.5	17.9	17.6

County	Avg drawdown in 2070 (ft) for Baseline DFC Run						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	-0.1	6.2	0.1	NA	NA	0.1	0.1
AUSTIN	-1.1	11.8	5.5	16.7	18.4	11.6	9.9
BEE	1.4	8.7	6.2	7.7	5.7	6.5	6.0
BRAZORIA	-0.3	10.7	3.8	13.1	19.1	5.9	4.4
CALHOUN	-0.2	23.0	6.4	3.5	NA	6.4	6.4
COLORADO	9.0	16.0	12.8	18.6	22.5	16.9	16.3
DEWITT	1.2	6.1	5.4	17.1	26.2	17.3	17.5
FAYETTE	NA	5.5	5.5	17.4	18.0	16.0	15.5
FORTBEND	2.4	16.6	9.5	19.2	22.0	15.0	13.7
GOLIAD	-3.3	1.0	0.1	7.2	10.5	5.3	4.4
JACKSON	16.3	34.2	25.2	18.2	23.0	23.1	24.8
KARNES	NA	0.4	0.4	18.1	24.1	20.5	21.1
LAVACA	5.8	6.0	5.9	15.9	31.1	17.2	17.7
MATAGORDA	4.3	24.1	10.3	18.3	NA	11.1	10.3
REFUGIO	-0.4	7.9	3.4	2.9	NA	3.3	3.4
VICTORIA	-3.8	10.9	3.8	6.7	10.4	5.7	5.3
WHARTON	14.2	11.6	12.9	25.3	28.0	19.5	17.5
Overall	4.8	13.0	9.0	15.2	21.7	13.3	12.8

County	Avg drawdown in 2070 (ft) for High Production DFC Run						
	Chicot	Evange-line	Chic. & Evan.	Burke-ville	Jasper	Overall	Overall (without Burkeville)
ARANSAS	0.0	46.5	1.1	NA	NA	1.1	1.1
AUSTIN	12.2	34.7	23.7	35.8	34.6	29.5	27.4
BEE	3.9	15.5	11.6	11.3	6.8	10.3	9.8
BRAZORIA	0.0	26.9	10.1	21.6	23.9	12.5	10.6
CALHOUN	5.1	122.5	38.5	9.0	NA	38.2	38.5
COLORADO	22.2	38.6	31.3	30.7	33.3	31.6	32.0
DEWITT	4.1	8.7	8.0	23.7	45.9	28.2	30.0
FAYETTE	NA	14.9	14.9	40.0	50.5	42.6	43.3
FORTBEND	12.0	40.6	26.3	37.5	34.9	31.2	29.1
GOLIAD	4.8	14.4	12.4	14.3	21.1	15.4	16.0
JACKSON	67.6	157.3	112.4	57.0	43.4	88.3	98.6
KARNES	NA	3.4	3.4	22.3	32.6	27.5	28.7
LAVACA	19.5	16.1	17.1	20.3	35.2	24.0	25.5
MATAGORDA	8.6	72.0	27.9	29.0	NA	28.0	27.9
REFUGIO	1.7	68.7	32.4	20.4	NA	30.6	32.4
VICTORIA	29.1	89.3	60.3	71.7	181.9	83.6	88.2
WHARTON	36.8	57.0	46.9	42.6	37.6	43.7	44.0
Overall	20.0	56.9	38.8	34.6	45.5	39.3	40.8

*2070 DFC calculated from a base year of 2000

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Considerations for Allowing Differences between Adopted DFCs and DFCs Calculated From GAM Runs

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Considerations for Allowing Differences Between Adopted DFCs and DFCs Calculated from GAM Runs

- GAM Predictive Uncertainty
- Unknown Errors in Starting 1999 Water Level Conditions
- Uncertainty in Future Environmental Conditions (Recharge and River levels)
- Uncertainty in Future Pumping Rates & Distribution
- Error/Uncertainty in Measurement of DFCs to Demonstrate Compliance
- Non-uniqueness of model calibration
- GAM will eventually be revised during text 50 years

Evidence & Sources of GAM Predictive Uncertainty

1. Central Gulf Coast GAM Report (2004)
   a. Calibration statistics between measured and model values
   b. Plots of residuals for different aquifers

2. LCRA-SAWS Water Project (LSWP) Reports (2005 to 2009)
   a. Spatial placement of pumping
   b. Vertical placement of pumping
   c. Temporal and Spatial distribution of recharge
   d. Numerical discretization around streams
   e. Aquifer boundaries
   f. Spatial variability in aquifers
   g. Addition of land subsidence (aquifer storage)

3. DFC Presentation to GMA 15 on Behalf of CCGCD, CBGCD, CPGCD (2010)
   a. Volume-weighted versus area-weighted drawdown averages
   b. Difference in pumping by aquifer between GMA model and reported by district
   c. Incomplete spatial coverage of aquifers by active model grid cells

4. PVGCD Report Regarding the Impacts of Large-scale Pumping (2012)
   a. Catahoula is an important Gulf Coast Geologic Unit
   b. Burkeville is not a low permeability unit for most of DeWitt County
   Jasper and Burkeville transmissivity is too low. Non-uniqueness of Central GAM calibration – can be recalibrated with much high recharge and transmissivity values

5. VCGCD Report discussing Science Development Program (2012)
   a. Aquifer boundaries and hydraulic properties – Burkeville K too low and K distribution for Chicot and Evangeline not consistent with field data
   b. Recharge and GW-SW exchange

6. VCGCD Report discussing Transmissivity values from Aquifer Tests (2014)/ TWDB Regional ASR & OCS Plan for Golden Crescent Region of Texas (2014)
   a. Evangeline modeled transmissivity values are too low in Victoria County
   b. Notable differenced between measured and modeled transmissivity in Jackson County

7. TWDB Report Evaluation of Hydrogeochemical Data regarding Implication to Developing Gulf Coast GAMs (2013)
   a. Implications to Conceptual Model
   b. Considerations for Implementing Recharge and GW-SW Interaction

8. On-going studies by CBGCD, CPGCD, VCGCD, TGCD, RGCD, EUWCD, and PVGCD to Support Development of GAM 15 & 16 (2015)
   a. Groundwater-surface water interaction
   b. Aquifer Hydraulic Properties are spatially variable
   c. Considerable uncertainty in recharge estimates
   d. Land-Subsidence has appear to occurred

Central Gulf Coast GAM Report (2004)

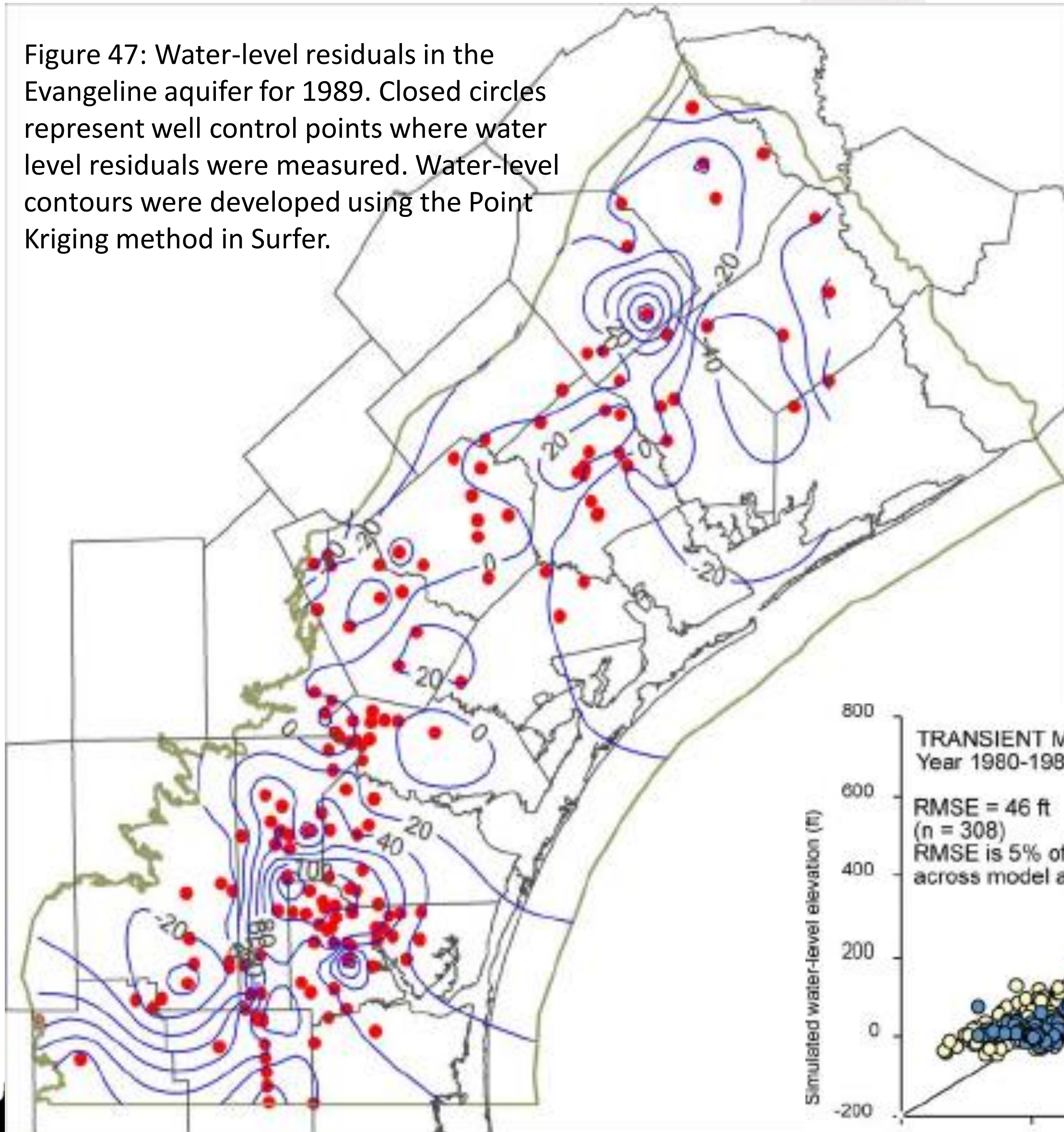


Figure 47: Water-level residuals in the Evangeline aquifer for 1989. Closed circles represent well control points where water level residuals were measured. Water-level contours were developed using the Point Kriging method in Surfer.

Hydraulic Head Residual

Residual = simulated – measured
neg = simulated head too low
pos = simulated head too high
(1989 & 1999 data sets)

Example

simulated = 10 ft
measured = 5 ft
residual = 5 ft

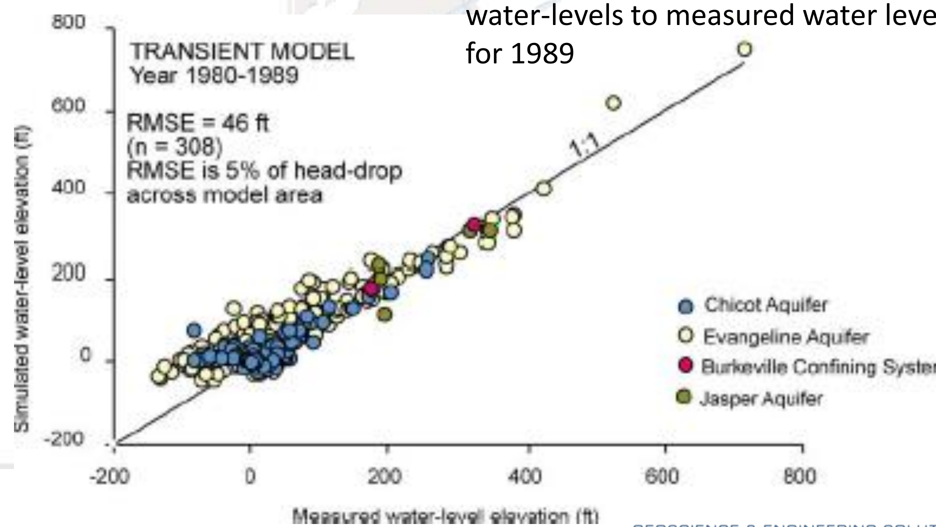
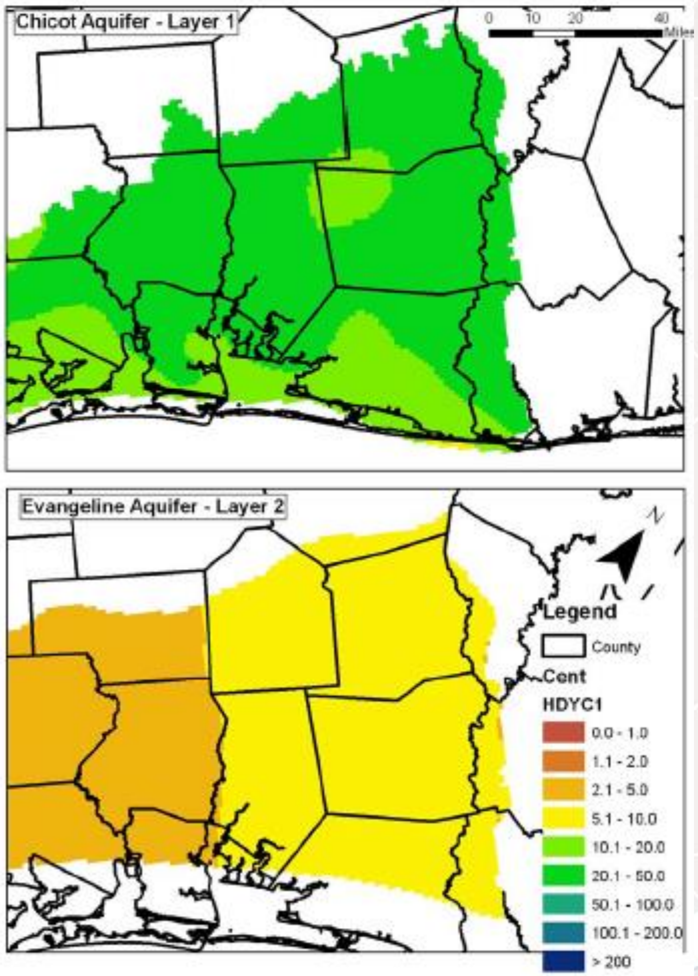


Figure 36: Comparison of simulated water-levels to measured water levels for 1989

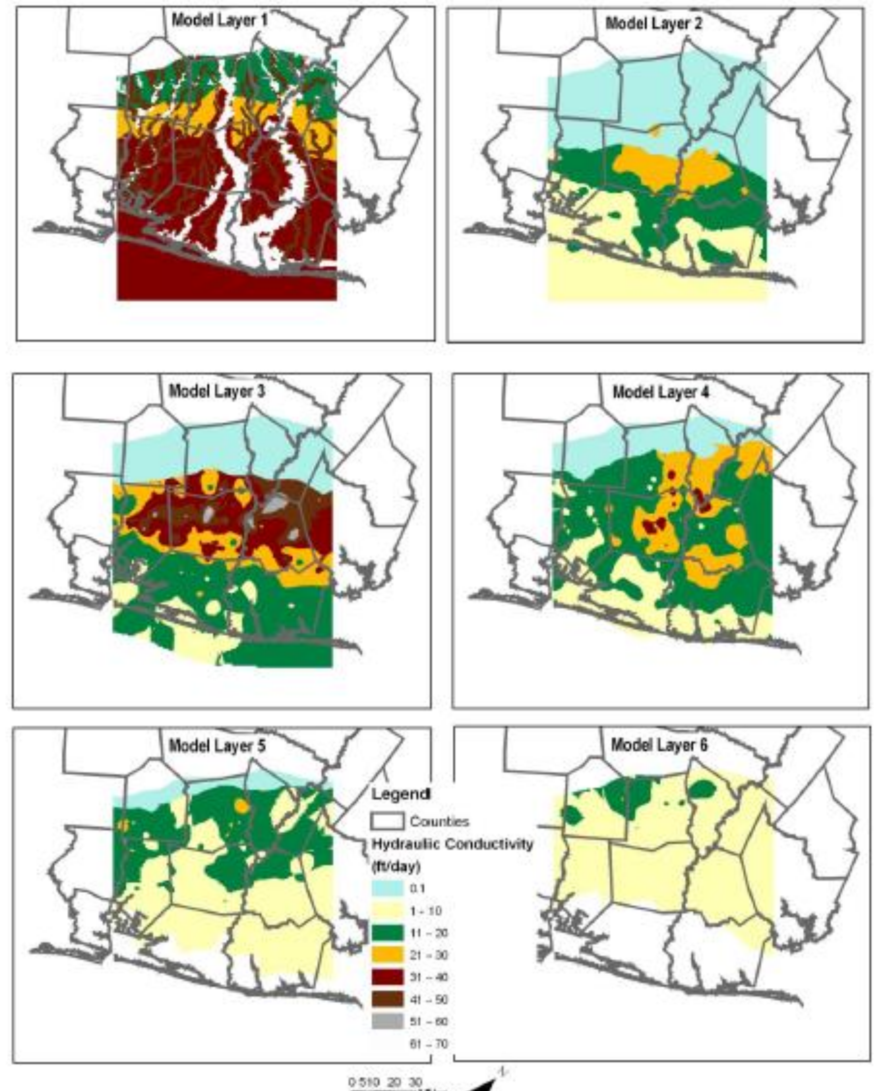
LCRA-SAWS Water Project Reports (2005 to 2009)

Two layers in Central G.C. GAM



GMA 15 Hydraulic Conductivity Distribution for Chicot & Evangeline aquifers

Six layers in LCRB Model



LCRB Hydraulic Conductivity Distribution for Chicot & Evangeline aquifers

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DFC Presentation to GMA 15 on Behalf of CCGCD, CBGCD, CPGCD (2010)

County	Chicot		Evangeline		Burkeville		Jasper	
	Area	Volume	Area	Volume	Area	Volume	Area	Volume
Aransas	-0.1	-0.1	24.7	24.6	[redacted]	[redacted]	[redacted]	[redacted]
Bee	2.9	4.8	13.8	14.7	8.8	8.5	4.1	4.3
Calhoun	-1.0	-0.8	8.7	8.7	2.5	2.5	[redacted]	[redacted]
Colorado	4.8	5.6	8.2	7.3	13.5	13.5	19.9	18.8
Dewitt	0.1	0.1	4.9	3.2	14.0	15.1	21.9	23.4
Fayette	[redacted]	[redacted]	13.2	12.5	38.6	39.4	44.6	49.6
Goliad	-1.4	-0.4	3.3	4.7	7.1	7.4	8.9	8.9
Jackson	11.8	11.9	14.4	14.6	10.9	11.4	18.8	18.0
Karnes	[redacted]	[redacted]	-0.6	0.4	10.4	14.7	15.0	18.4
Lavaca	4.4	6.3	4.8	5.4	13.8	14.6	27.8	27.1
Matagorda	3.1	2.9	16.8	17.0	14.1	14.0	[redacted]	[redacted]
Refugio	0.5	0.4	31.0	31.0	12.3	10.3	[redacted]	[redacted]
Victoria	-9.4	-10.6	3.0	3.2	2.9	4.3	7.2	6.9
Wharton	11.0	11.4	2.5	2.7	17.9	19.0	20.8	20.3
Total	3.1	3.7	9.3	10.7	12.5	11.9	19.9	18.5

Comparison of DFCs based on Weighting Grid Cells based on Area and

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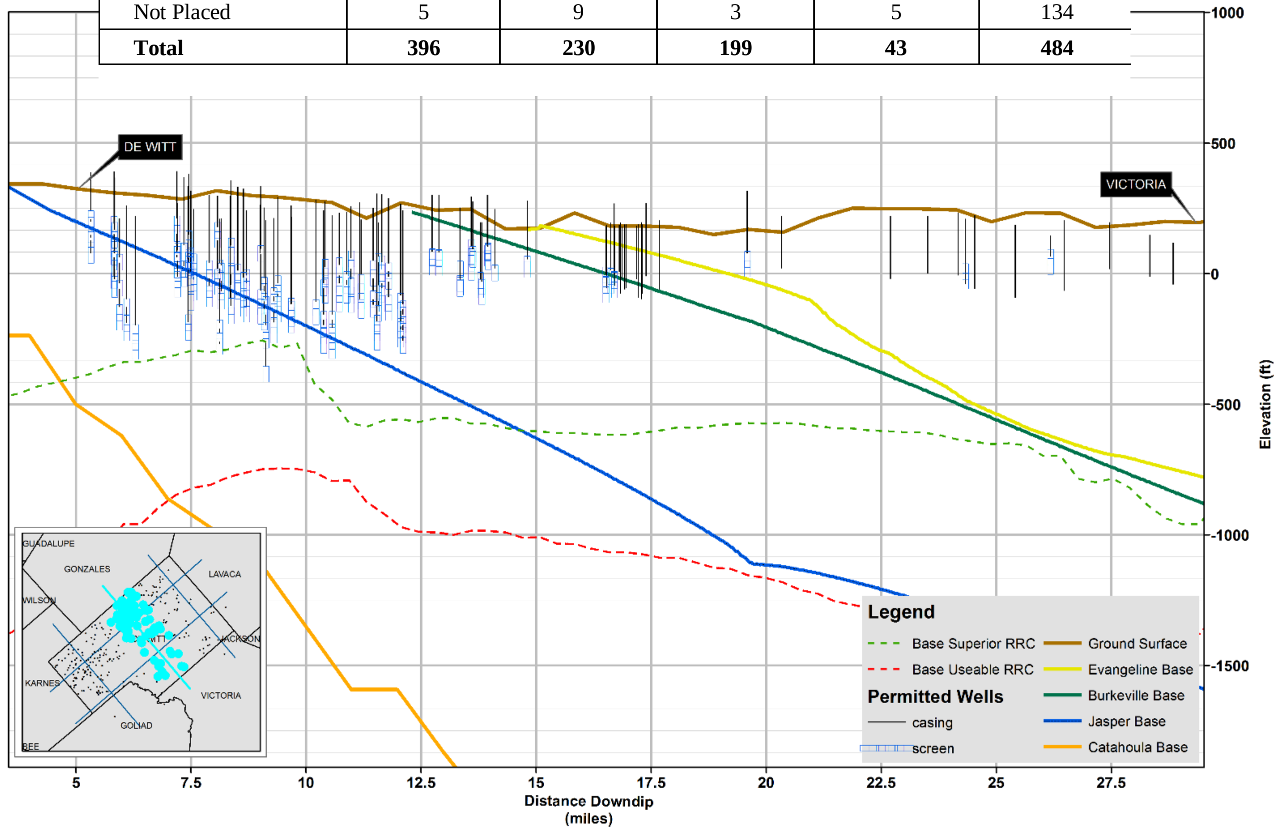
PVGCD Report Discussing the Effects of Large-scale Pumping (2012)

Hydrostratigraphic Unit	O & G Wells	Permitted Wells	Permitted and O & G Wells	Monitoring Wells	TWDB Wells
Chicot	1	0	0	2	16
Evangeline	62	12	1	13	162
Burkeville	25	2	3	6	38
Jasper	239	148	136	15	118
Catahoula	64	59	57	2	16
Not Placed	5	9	3	5	134
Total	**396**	**230**	**199**	**43**	**484**



Potential Importance of Pumping in Catahoula

PVGCD Report discussing the Effects of Large-scale Pumping (2012)

Table 2-7 Average Sand Percentages for the Evangeline Aquifer, the Burkeville Confining Unit, the Jasper Aquifer, and the Catahoula Formation.

Hydrostratigraphic Unit	Average Sand Percentage Calculated from Geophysical Logs
Evangeline Aquifer	53.2%
Burkeville Confining Unit	53.6%
Jasper Aquifer	45.0%
Catahoula Formation	36.4%

*based on sand percentages and transmissivity valı

Table 4-3 Comparison of Hydraulic Properties for DeWitt County in the GAM 15 GAM and the Modified GAM*

Hydrostratigraphic Unit	Average Recharge (inches/yr)		Average Hydraulic Conductivity (ft/day)		Specific Storage		Specific Yield	
	Original	Modified	Original	Modified	Original	Modified	Original	Modified
Aquifer	0.7	0.7	30.2	30.2	8.3E-06	8.3E-06	0.05	0.05
Evangeline Aquifer	0.20	0.24	3.6	4.3	1.0E-06	1.00E-05	0.01	0.015
Burkeville Unit	0.0003	0.03	0.09	2.7	1.0E-06	1.00E-06	0.005	0.005
Jasper Aquifer	0.02	0.5	0.54	2.2	8.3E-06	3.24E-06	0.05	0.075

The GAM and Modified GAM produce very similar matches to measured water level values. Root-mean square error or the Evangeline Aquifer, Burkeville Unit, and Jasper Aquifer are 18 ft, 4 ft, and 41 ft (this is an example of non-uniqueness in model calibration

PVGCD Report Regarding the Impacts of Large-scale Pumping (2012)

Table 4-5 Average Drawdowns Values for Four GAM Model Simulations that Evaluate the Impact of Different Pumping Assumptions on the DFC.

GAM Run	Simulated Year					
	2010	2020	2030	2040	2050	2060
DFC Run	5.25	8.65	11.05	12.82	14.17	15.23
DFC Run - No Pumping	-4.28	-6.30	-7.59	-8.43	-8.99	-9.38
DFC Run - Only DeWitt Pumping	4.12	6.88	8.74	10.05	11.01	11.74
DFC Run - With Fracking	5.24	9.45	12.40	14.00	15.00	15.90

Table 4-6 Average Drawdowns Values for Four Modified GAM Simulations that Evaluate the Impact of Different Pumping Assumptions on the DFC.

GAM Run	Simulated Year					
	2010	2020	2030	2040	2050	2060
DFC Run	3.56	4.91	5.8	6.46	6.97	7.39
DFC Run - No Pumping	-4.53	-5.75	-6.43	-6.89	-7.22	-7.46
DFC Run - Only DeWitt Pumping	2.47	3.24	3.71	4.00	4.19	4.32
DFC Run - With Fracking	3.56	5.5	6.6	6.97	7.32	7.64

VCGCD Report Regarding Science Development Program (2012)

Important Information Gaps in the Literature Search

-historical pumping rates and locations

-vertical hydraulic conductivity values

-specific storage coefficients

-groundwater-surface water interaction

-aquifer properties below well screens

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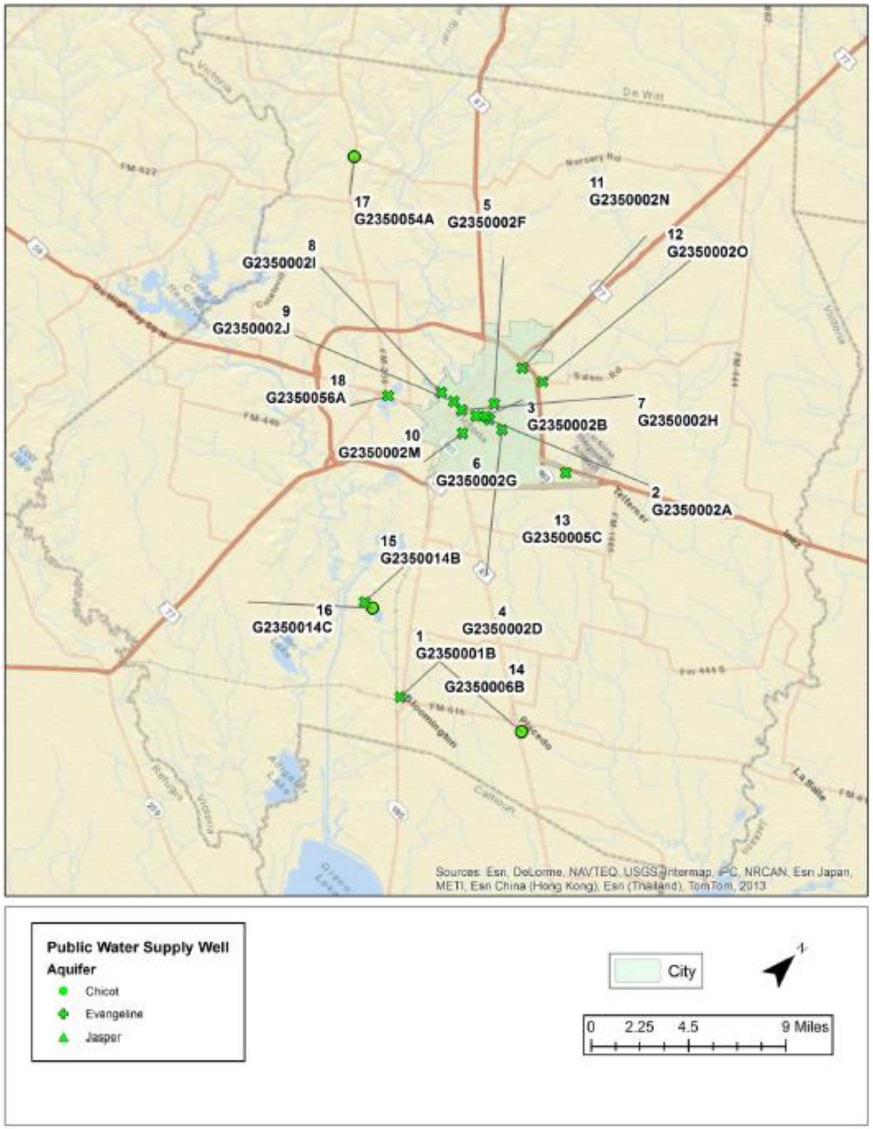
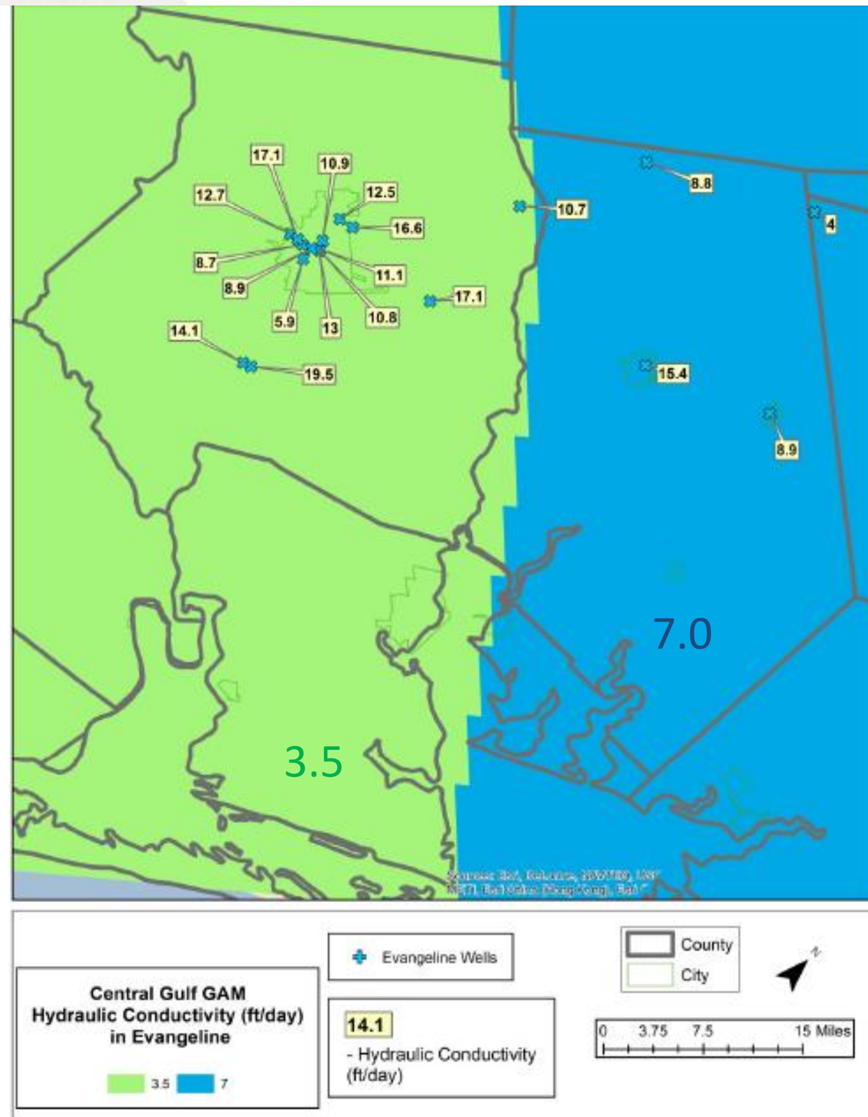
VCGCD Report & TWDB ASR/OCR Report Regarding Transmissivity Values from Aquifer Tests (2014)



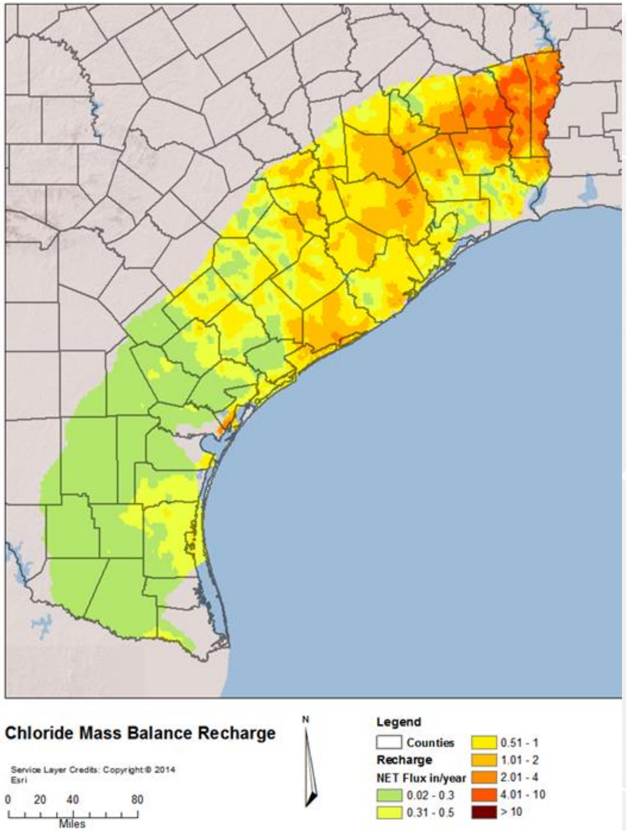


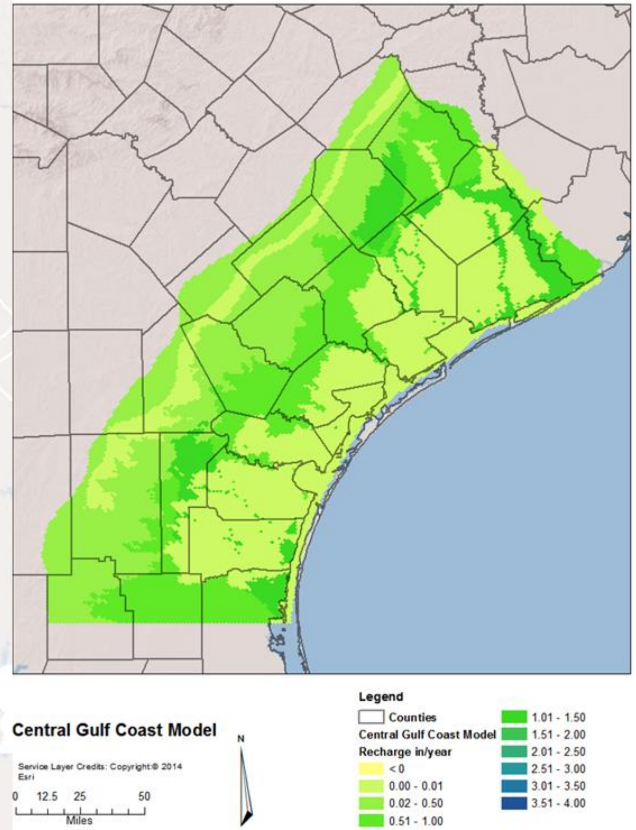
TWDB Gulf Coast Hydrogeochemical Evaluation Report (2013)

Implication to Conceptual Model

- The up-dip boundary for the regional Gulf Coast Aquifer System flow should be the Catahoula Formation outcrop;
- The downdip boundary for the regional Gulf Coast Aquifer System flow should allow groundwater to discharge across a large area of the ocean bottom;
- The bottom boundary of the regional Gulf Coast Aquifer System flow should be based on where the TDS concentrations are not less than 10,000 ppm
- The numerical representation of the regional groundwater flow system should be constrained by estimates of groundwater age estimated from ^{14}C measurements;
- A conceptual water budget should be developed and be guided by recharge estimates by Scanlon and others (2012) after appropriate uncertainty estimates have been developed;
- Proper conceptualization and representation of groundwater mixing and flow paths requires vertical layering smaller than the thicknesses of the major aquifers;
- A continuous, low permeability "Burkeville" Confining Unit does not exist up dip at the outcrop;

On-going studies by GCDs to Support Development of GAM 15 & 16 (2015)

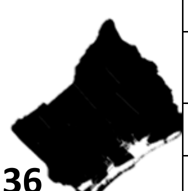




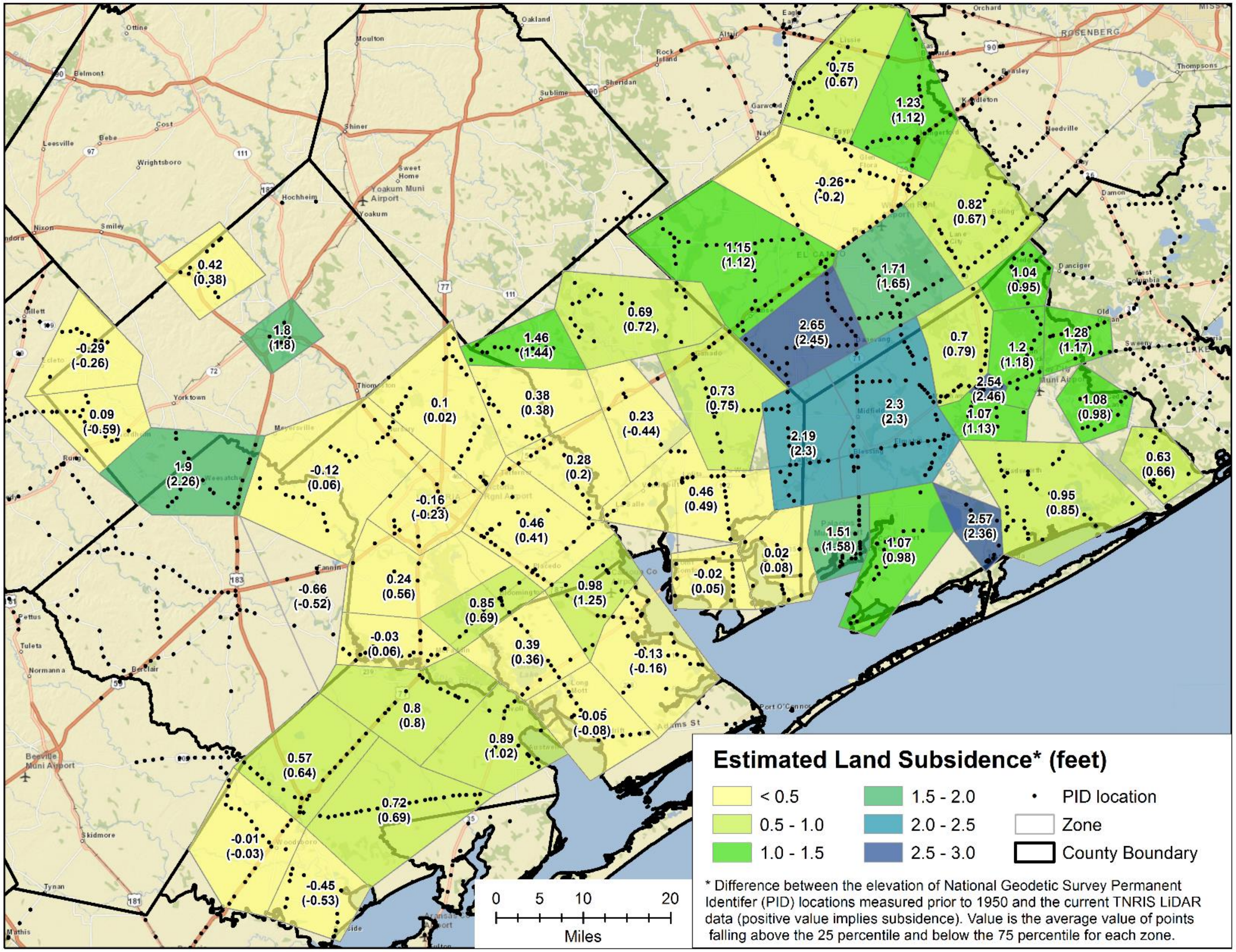
BEG Chloride Mass-Balance Study

County Name	County Area (acres)[A]	Recharge Area (acres)	Recharge (in/year)	Recharge (acre-ft/year)
Matagorda	753,951	718,582	1.08	65,464

	Recharge			Net Gain to Groundwater System			Net Loss to Groundwater System			Net Flux to Groundwater System		
Data Source	Area (acres)[A]	Rate (in/yr)	Flux (af/yr)	Area (acres)	Rate (in/yr)	Flux (af/yr)	Area (acres)	Rate (in/yr)	Flux (afy)	Area (acres)[A]	Rate (in/yr)	Flux (af/yr)
CGC-GAM	698,240	0.395	22,969	632,320	1.10	57,847	177,920	-3.97	-58,850	810,240	-0.01	-1,003
LCRB Model	656,238	2.9	160,415	566,919	2.9	136,131	122,109	-14.2	-144,345	689,028	-0.14	-8,214



On-going studies by GCDs to Support Development of GAM 15 & 16 (2015)



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Example of Allowable Difference Between Adopted DFCs and Calculated DFCs

- Per Aquifer (Maximum of two conditions)
  - Up to 2 feet
  - Up to 20% of calculated average drawdown for DFC
  - Greater variance allowed where a District provides evidence to support higher GAM predictive uncertainty
- Group of Aquifers (Maximum of two conditions)
  - Up to 3 feet
  - Up to 20% of calculated average drawdown for DFC
  - Greater variance allowed where a District provides evidence to support higher GAM predictive uncertainty

Example Calculation of Variance

County	Modeled 2070 Average Drawdown DFC						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	4.3	24.1	10.3	18.3	NA	11.1	10.3
GCD #2	-0.4	7.9	3.4	2.9	NA	3.3	3.4
GCD #3	-3.8	10.9	3.8	6.7	10.4	5.7	5.3
GCD #4	14.2	11.6	12.9	25.3	28.0	19.5	17.5

County	Proposed 2070 Average Drawdown DFC						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	6.3	21.0	10.8	18.3	NA	11.5	10.8
GCD #2	1.0	9.0	4.7	1.0	NA	4.1	4.7
GCD #3	-0.8	12.9	6.3	4.7	10.4	6.5	7.2
GCD #4	15.0	9.6	12.3	21.0	28.0	18.1	17.1

County	Proposed DFC - Modeled DFC						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	2.0	3.1	0.4	0.0	NA	0.4	0.4
GCD #2	1.4	1.1	1.3	1.9	NA	0.8	1.3
GCD #3	1.0	2.1	2.5	2.0	0.0	0.8	1.9
GCD #4	0.8	2.0	0.6	4.3	0.0	1.4	0.4

County	Allowed Difference Based on Example Rules						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	2.0	4.8	3.0	3.7	NA	3.0	3.0
GCD #2	2.0	2.0	3.0	2.0	NA	3.0	3.0
GCD #3	2.0	2.2	3.0	2.0	2.1	3.0	3.0
GCD #4	2.8	2.3	3.0	5.1	5.6	3.9	3.5

County	Is Proposed DFC Acceptable Based on Criteria						
	Chicot	Evangeline	Chic. & Evan.	Burkeville	Jasper	Overall	Overall (w/o Burke.)
GCD #1	Yes	Yes	Yes	Yes	NA	Yes	Yes
GCD #2	Yes	Yes	Yes	Yes	NA	Yes	Yes
GCD #3	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GCD #4	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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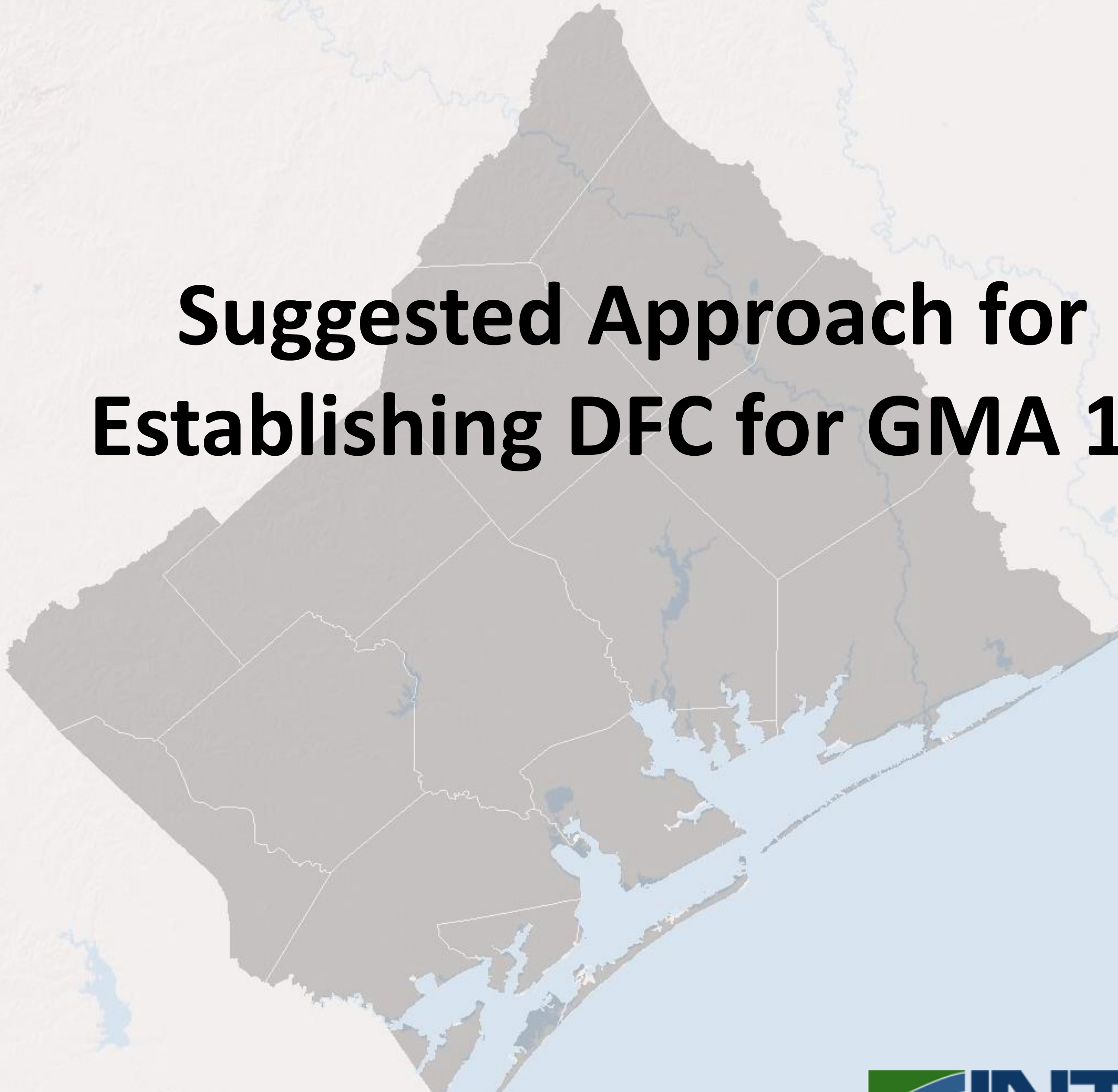
Suggested Approach for Establishing DFC for GMA 15



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Approach for DFCs

- GMA 15 selects Baseline DFC Run
- Districts agree to set drawdown-based DFCs for 2070
- Districts select which type of DFCs to use for Chicot, Evangeline, Burkeville, & Jasper
- GMA 15 set criteria for allowable difference between adopted DFC and estimated DFC from GAM runs (see previously suggested criteria)
- Districts consider other drawdown-based DFCs other than for 2070
- Districts consider other non-drawdown (land subsidence, salt water intrusion) DFCs based on Baseline DFC Run
- Districts discuss & adopt DFCs
- District conduct Public Hearings on DFCs
- GMA 15 prepares Explanatory Report

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Appendix N

INTERA Presenation to GMA 15 on Land Subsidence on April 29, 2016

Groundwater Management Area 15 Joint Planning: Round 2

Estimates of Land Subsidence in GMA 15 Based on Ground Surface Elevation Data and Model Results

Victoria, TX
April 29, 2015
Steve Young, Ph.D., P.G., P.E.

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Topics

- Executive Summary
- Aquifer Compressibility
- Simulated Land Subsidence in Gulf Coast
- Field Data
- Calculated Land Subsidence from Field Data
- Approach for Estimating Land Subsidence

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Executive Summary

The report presents ground surface elevation data from National Geodectic Survey (NGS) benchmarks called Permanent Identifiers (PIDs), old topographic maps, and LIght and raDAR (LIDAR) data from seven counties in GMA 15. The **PID data provide ground surface elevations at 1,700 point locations prior to 1950**. The **topographic maps cover approximately 2,150 square miles and were constructed between 1950 and 1960**. To extract point location data from the topographic maps, the maps were digitized and converted to Geographic Information System (GIS) files. **The LIDAR data cover approximately 2,500 square miles** and were collected after 2006. The joint analysis of these three data sets support the following conclusions:

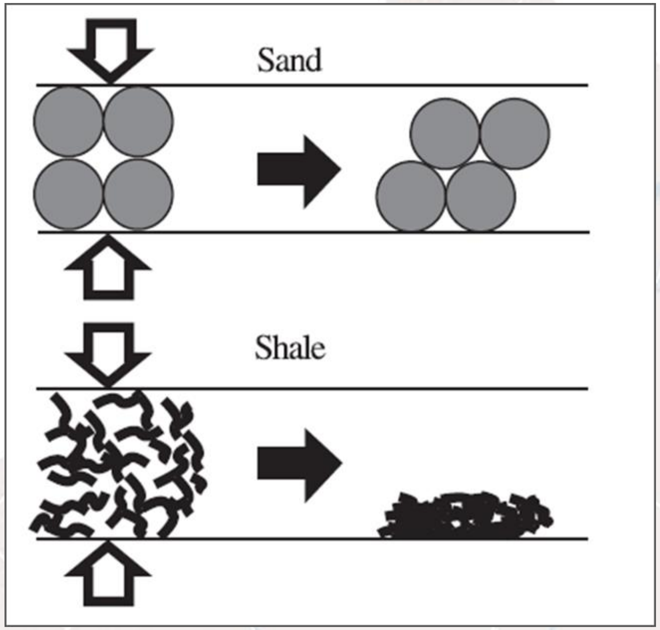
Executive Summary

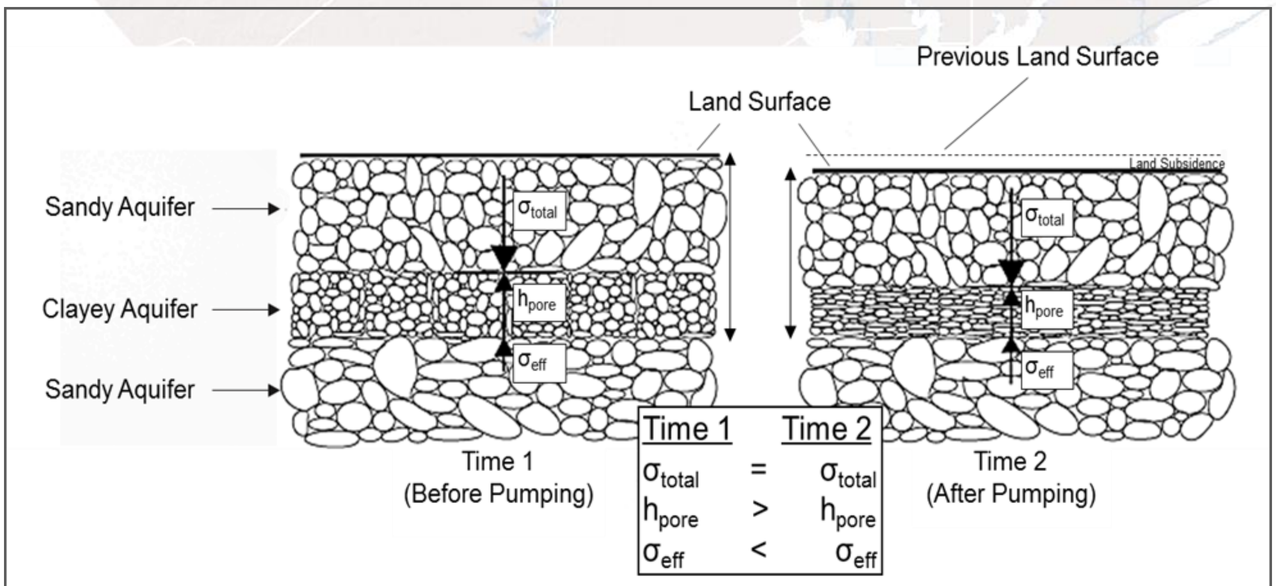
- The LIDAR and PID data indicate that DeWitt, Jackson, Matagorda, Refugio, Victoria, and Wharton counties have experienced at least 2 ft of land subsidence, and Calhoun County has experienced at least 1.5 ft of land subsidence.

- The LIDAR and topographic map data indicate that Calhoun, DeWitt, Jackson, Matagorda, Refugio, Victoria, and Wharton counties have experienced at least 2 ft of land subsidence since 1950.

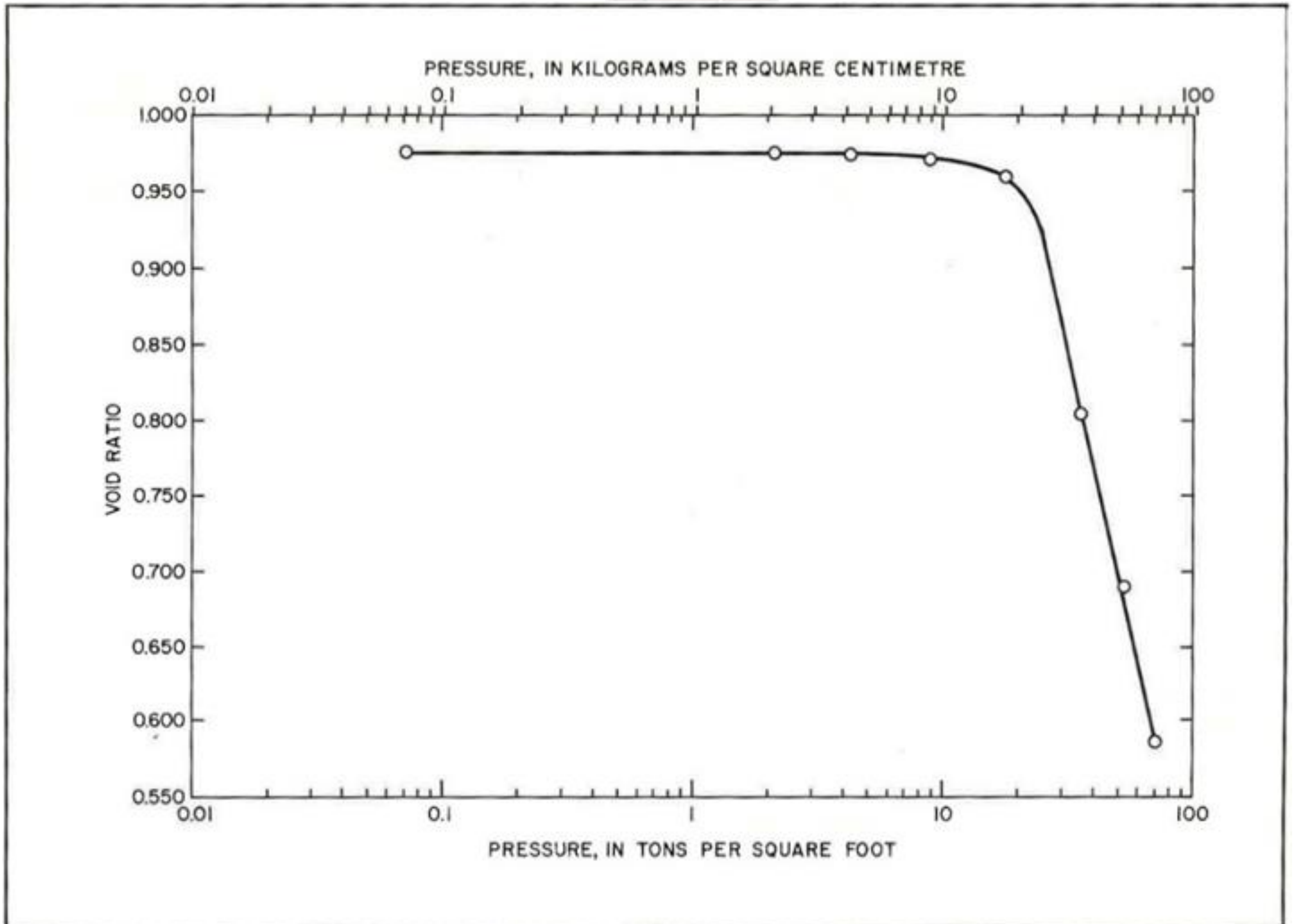
- An analysis of the PID data, topographic map data, and LIDAR data indicates that more than two feet of average subsidence has occurred across about 100 square miles covering southwest Wharton, southeast Jackson, and northwest Matagorda counties.

Compressibility

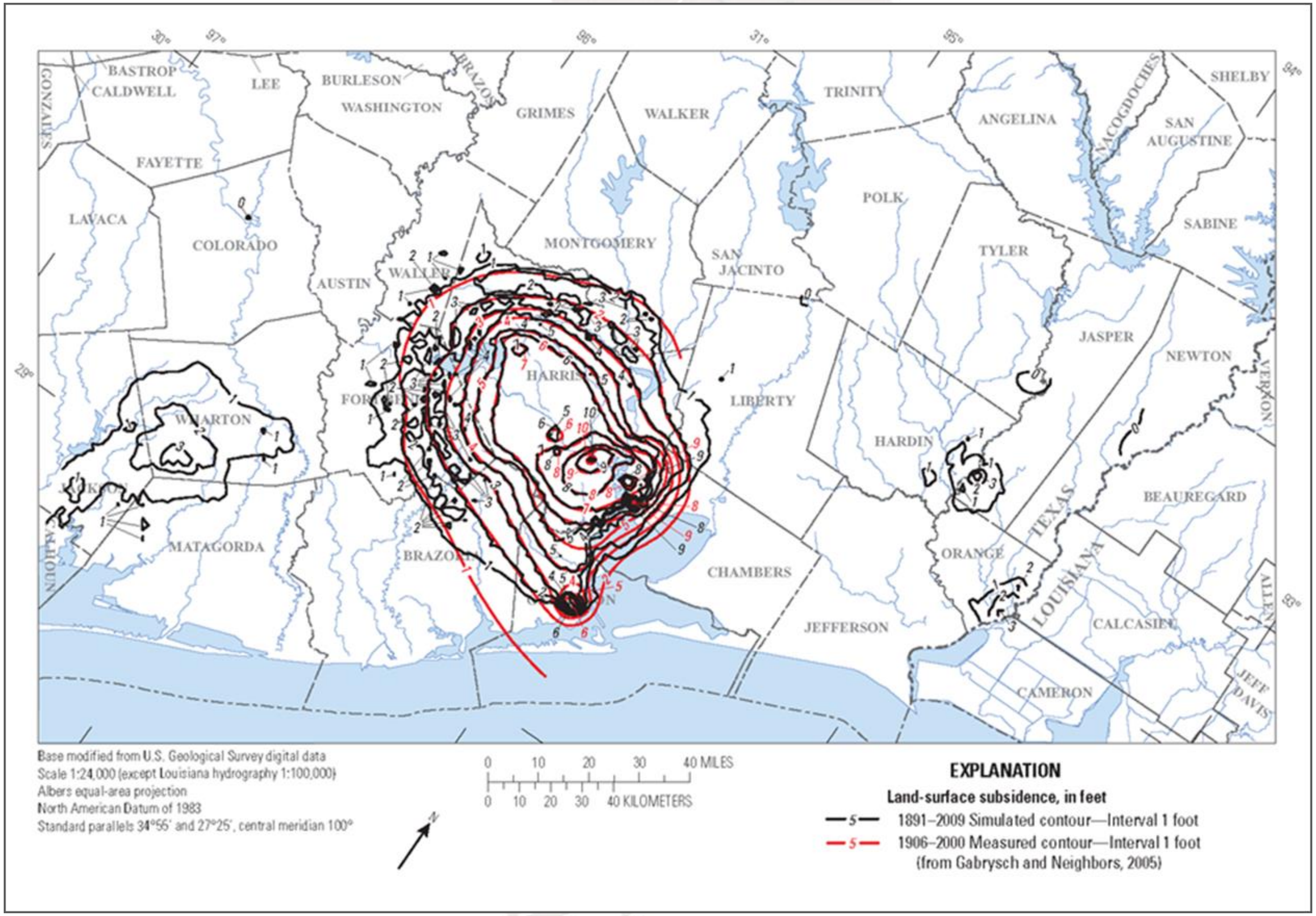




Compressibility (con't)



Simulated Land Subsidence by Houston Area Groundwater Model (HAGM)



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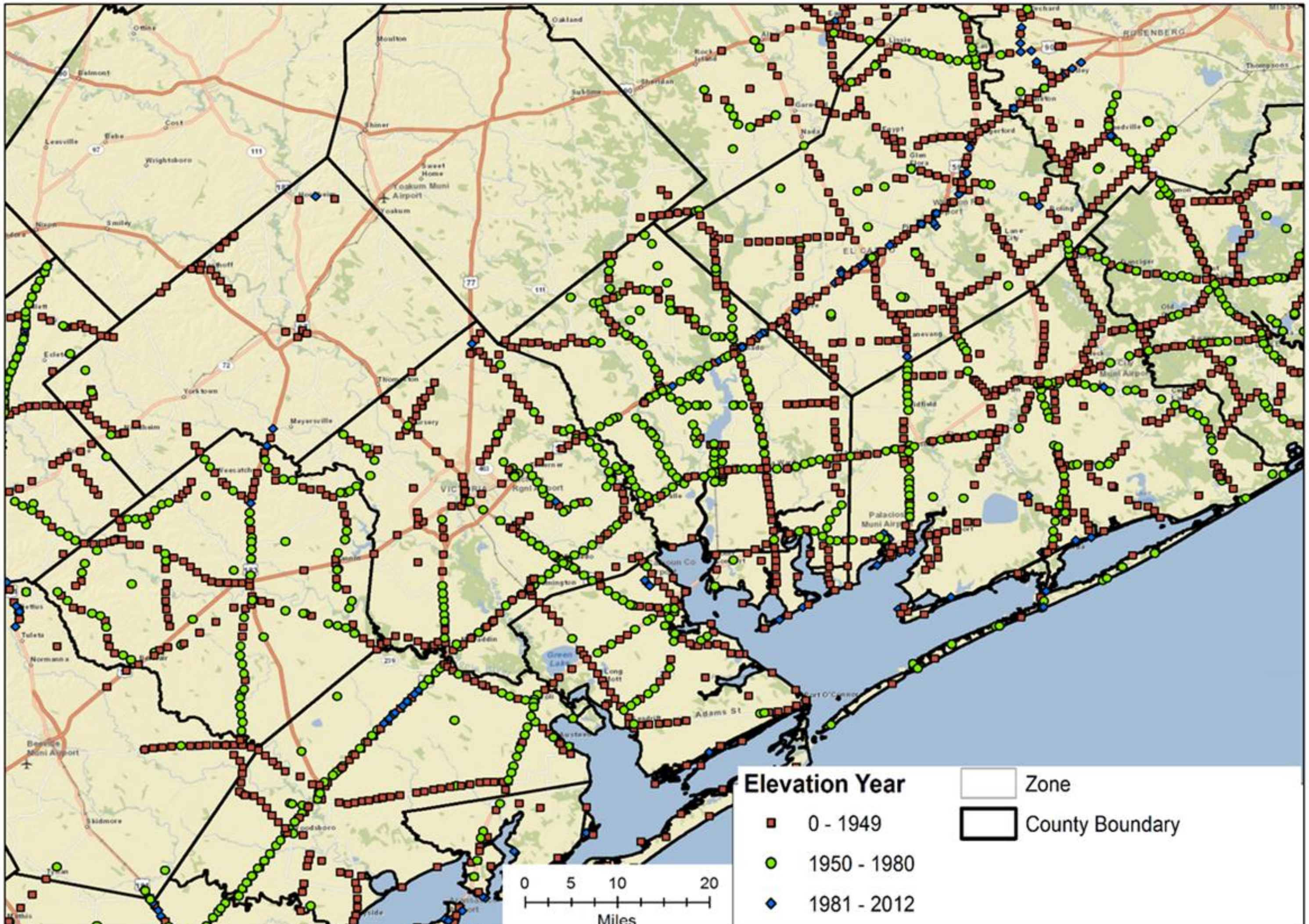
Field Data: Nation Geodetic Survey



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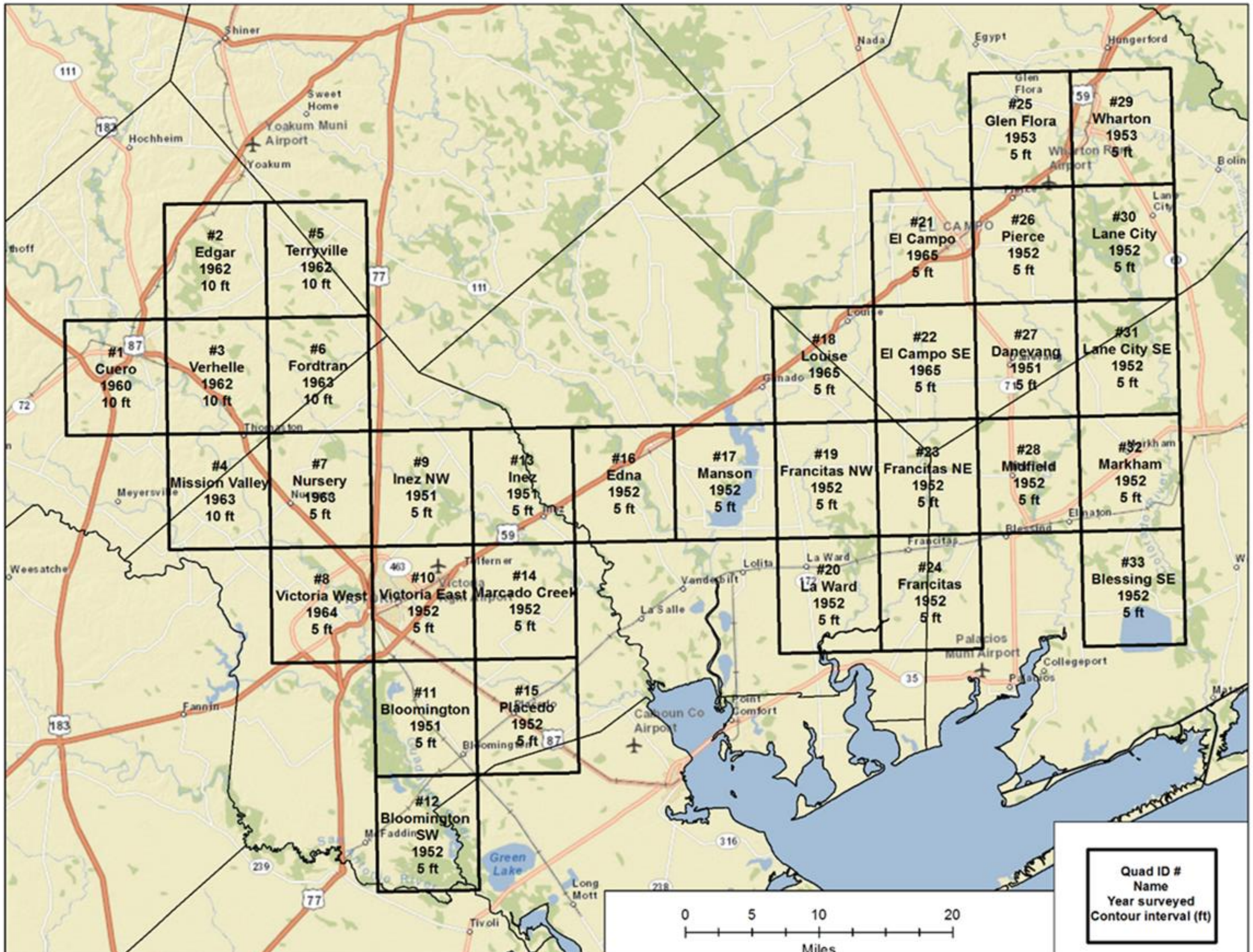
Field Data: Topographic Maps



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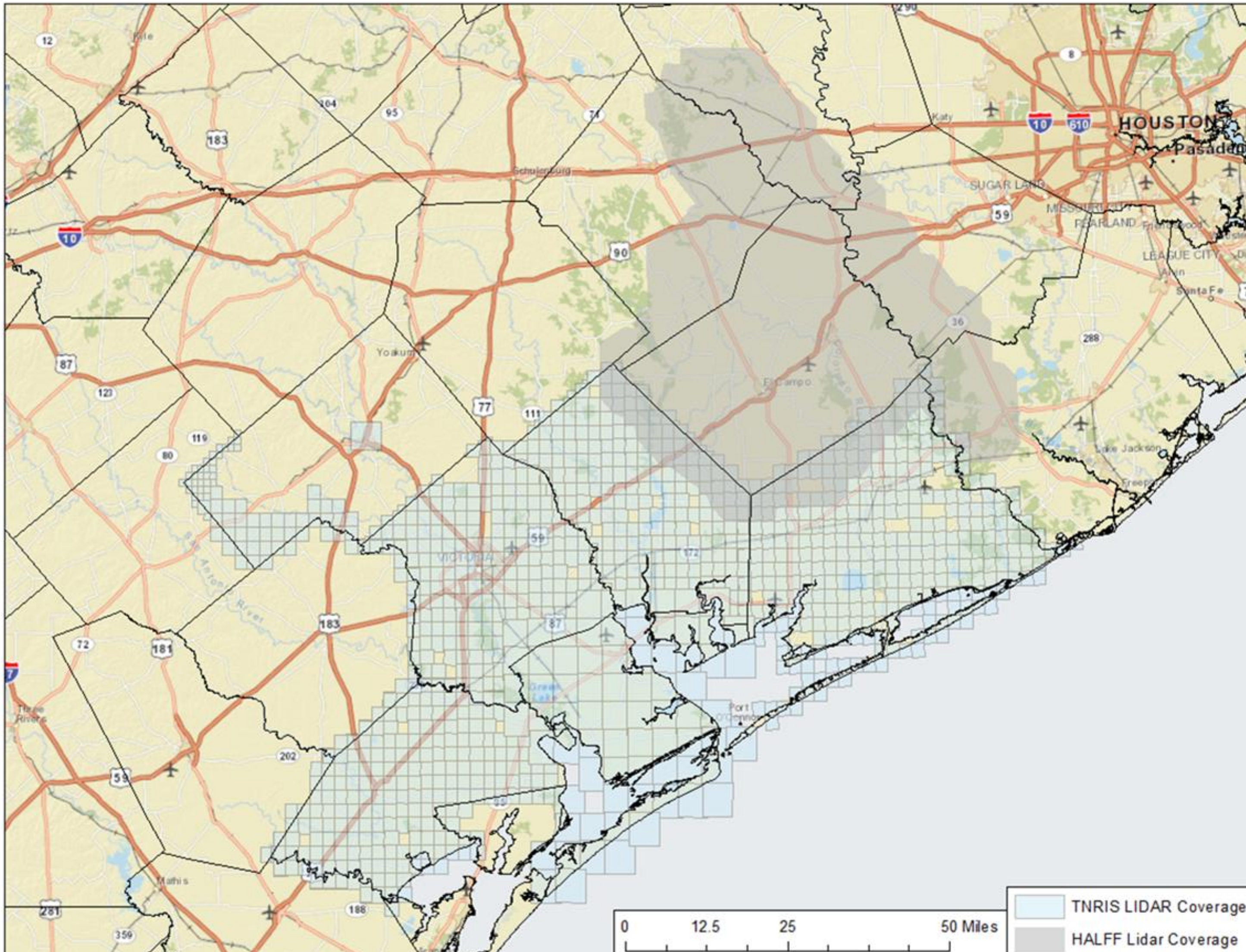
Field Data: LIDAR Survey



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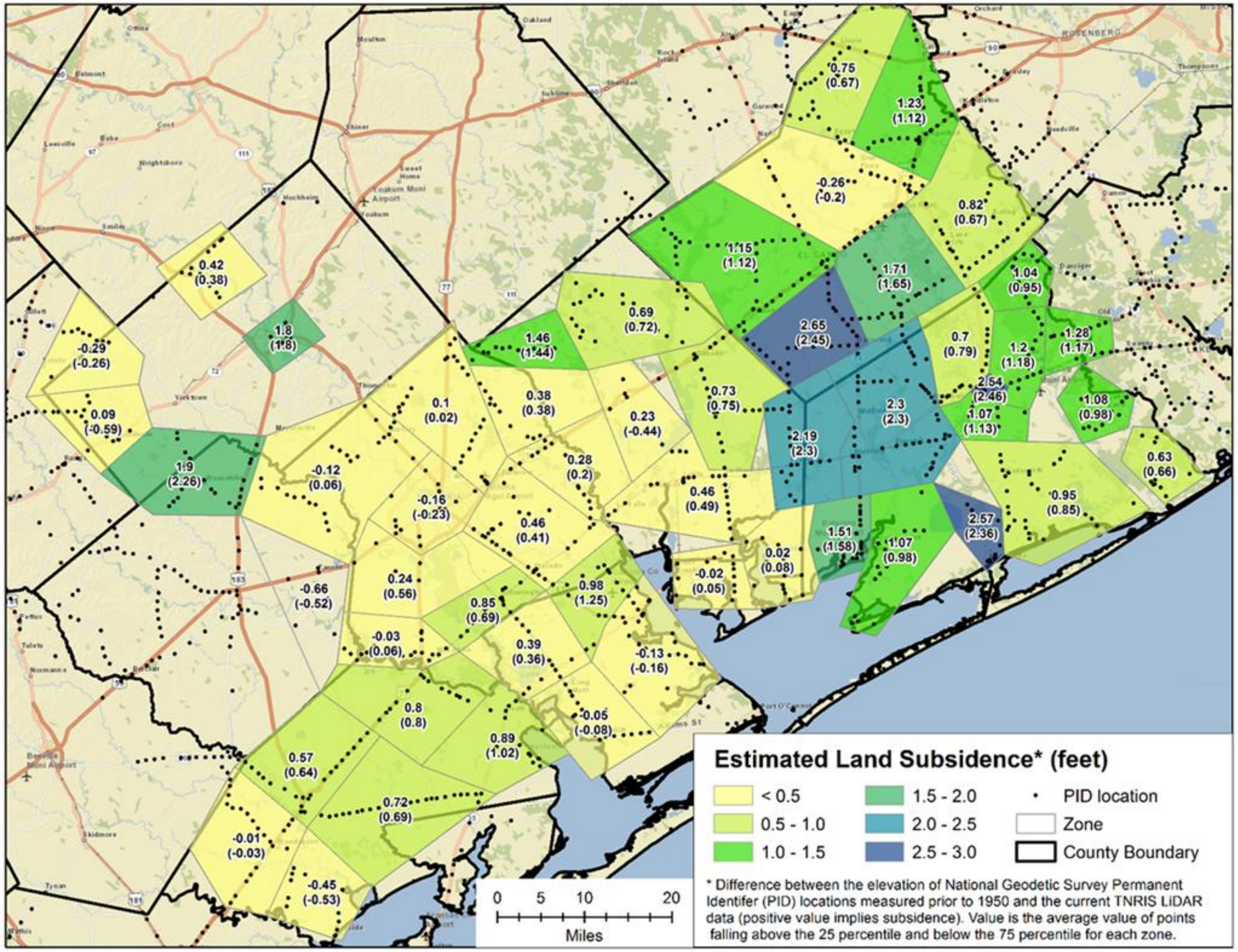
Calculated Land Subsidence: NGS Survey Data



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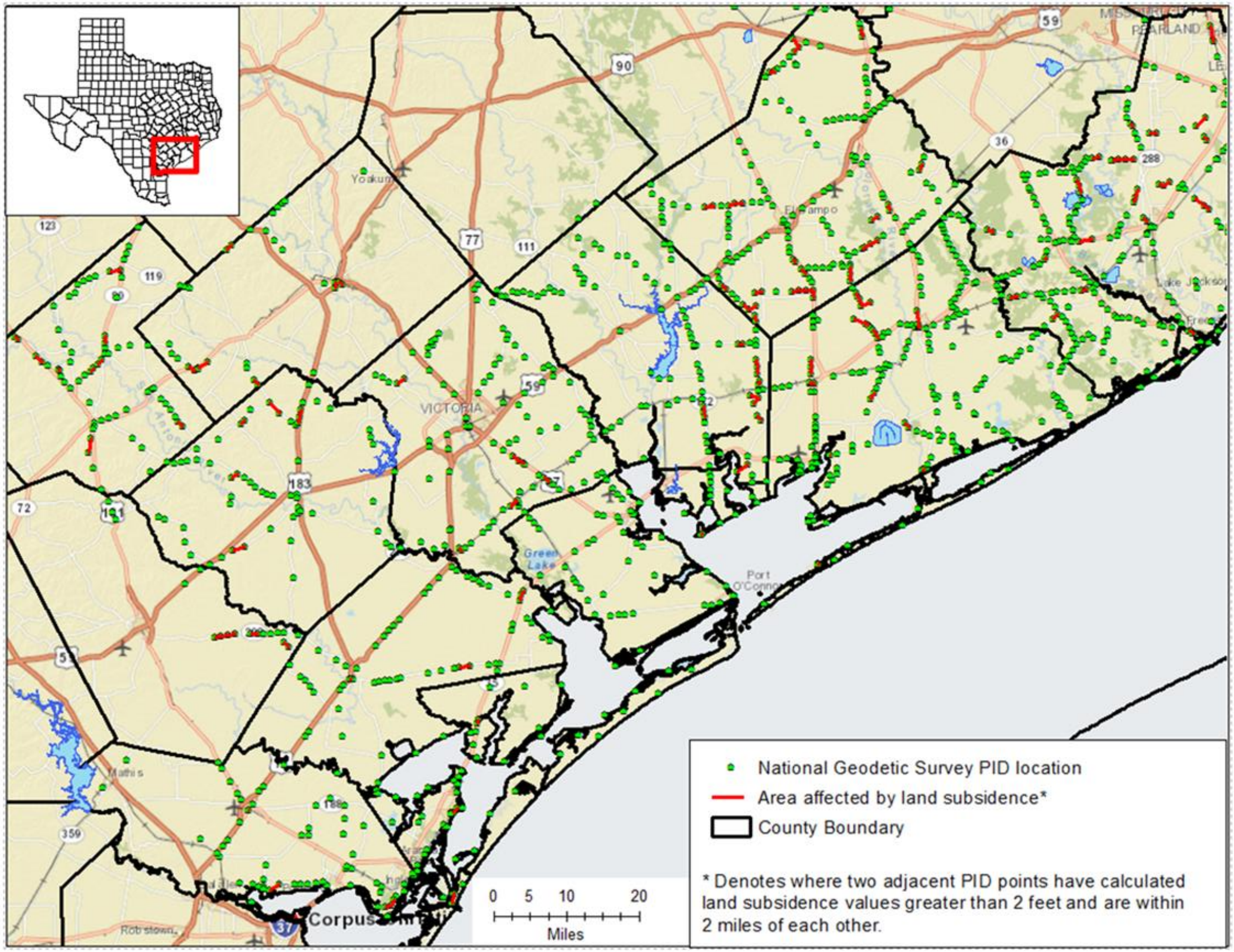
Calculated Land Subsidence: NGS Survey Data



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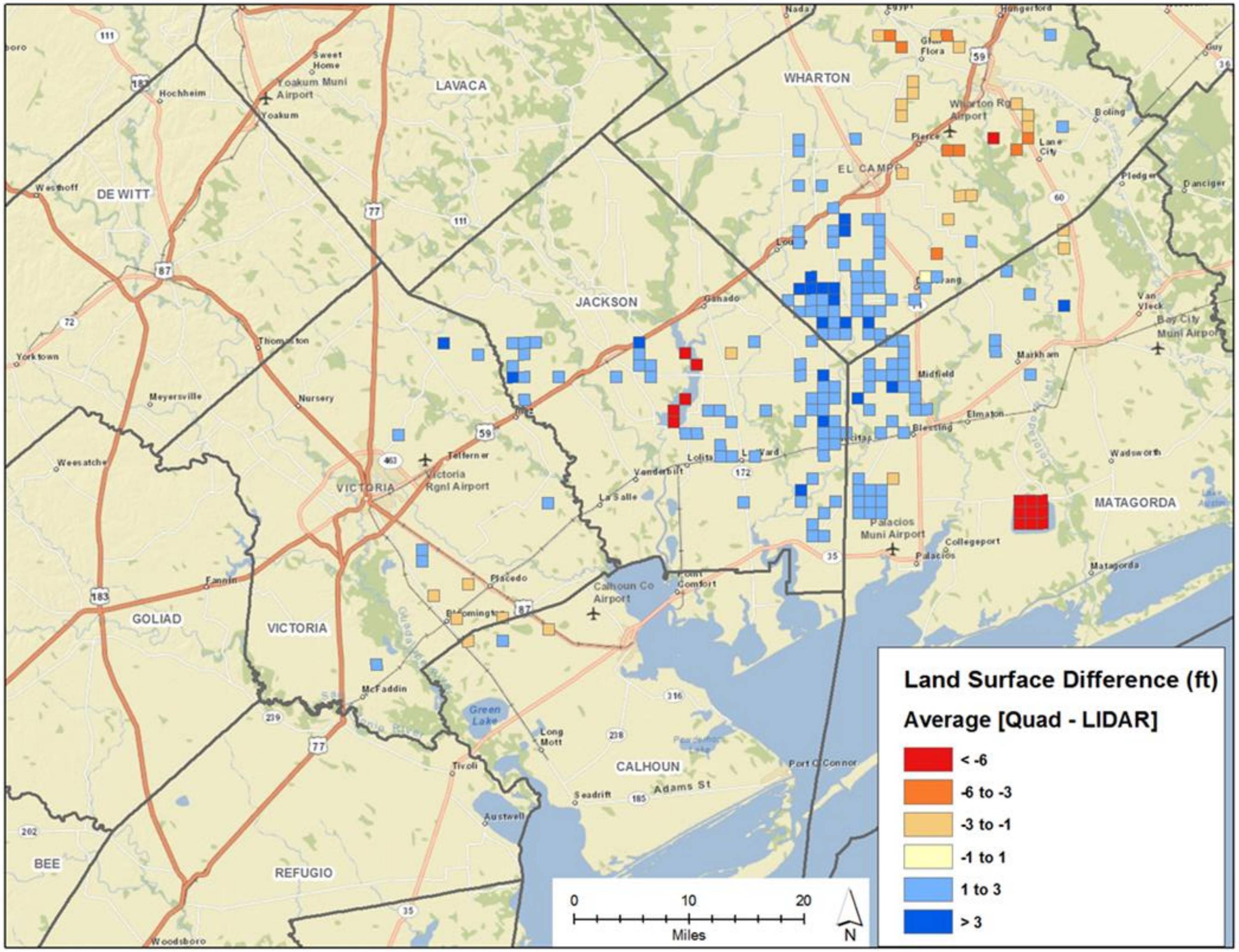
Calculated Land Subsidence: NGS Survey Data



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Approach to Estimate Land Subsidence

$$\Delta b = \Delta d * \alpha_{eff} * C_t$$

Where:

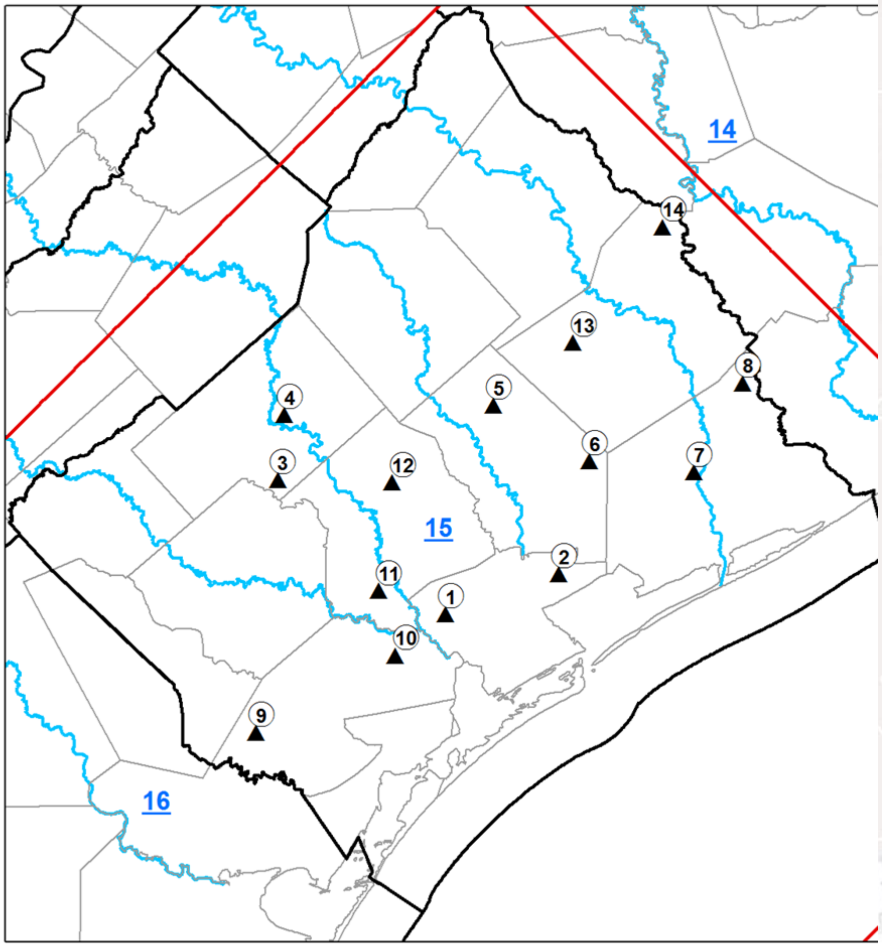
Δb = the thickness that the aquifer has compacted (L)

Δd = Amount of drawdown in the aquifer since predevelopment (L)

α_{eff} = Effective compressibility coefficient for clays in the aquifer (L^{-1})

C_t = Total thickness of the clay units in the aquifer (L)

Approach to Estimate Land Subsidence



ID	County	Drawdown (ft)								Land Subsidence (ft)	
		Chicot		Evangeline		Burkeville		Jasper			
		1940-2000	1940-2070	1940-2000	1940-2070	1940-2000	1940-2070	1940-2000	1940-2070	1940-2000	1940-2070
1	Calhoun	7.4	3.4	12.4	18.9	-	-	-	-	0.4	0.5
2	Calhoun	-0.8	2.2	22.9	40.6	-	-	-	-	0.7	1.2
3	Dewitt	-	-	0.8	1.0	3.4	9.8	7.9	24.1	0.1	0.3
4	Dewitt	-	-	9.5	15.6	51.7	73.0	142.3	185.2	1.9	2.5
5	Jackson	18.7	55.7	64.7	88.1	39.2	56.3	22.0	45.4	1.4	2.2
6	Jackson	12.1	32.4	55.9	78.4	33.0	52.6	-	-	1.5	2.3
7	Matagorda	-1.7	1.2	39.4	57.4	-	-	-	-	1.2	1.8
8	Matagorda	2.1	0.8	37.9	49.0	13.1	27.0	-	-	1.1	1.5
9	Refugio	5.2	1.8	3.4	10.1	-0.1	3.9	-	-	0.1	0.2
10	Refugio	0.3	1.2	4.1	15.5	-	-	-	-	0.1	0.4
11	Victoria	5.0	8.0	13.2	40.1	1.7	6.4	-	-	0.2	0.7
12	Victoria	27.0	34.9	45.3	52.5	38.0	43.9	26.2	33.0	1.2	1.4
13	Wharton	75.4	94.1	156.7	149.8	61.9	90.2	27.9	59.9	3.2	3.7
14	Wharton	8.7	27.5	57.4	91.0	44.5	80.9	38.2	72.2	1.6	2.8

Appendix O

TWDB Socioeconomic Impact Assessment for Region K Planning

Socioeconomic Impacts of Projected Water Shortages

for the Region K Regional Water Planning Area

Prepared in Support of the 2016 Region K Regional Water Plan

Dr. John R. Ellis
Water Use Projections & Planning Division
Texas Water Development Board

Yun Cho, Team Lead
Water Use Projections & Planning Division
Texas Water Development Board

Kevin Kluge, Manager
Water Use Projections & Planning Division
Texas Water Development Board

September, 2015

Table of Contents

Executive Summary

Evaluating the social and economic impacts of not meeting identified water needs is a required part of the regional water planning process. The Texas Water Development Board (TWDB) estimates those impacts for regional water planning groups, and summarizes the impacts in the state water plan. The analysis presented is for the Region K Regional Water Planning Group.

Based on projected water demands and existing water supplies, the Region K planning group identified water needs (potential shortages) that would occur within its region under a repeat of the drought of record for six water use categories. The TWDB then estimated the socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

The analysis was performed using an economic modeling software package, IMPLAN (Impact for Planning Analysis), as well as other economic analysis techniques, and represents a snapshot of socioeconomic impacts that may occur during a single year during a drought of record within each of the planning decades. For each water use category, the evaluation focused on estimating income losses and job losses. The income losses represent an approximation of gross domestic product (GDP) that would be foregone if water needs are not met.

The analysis also provides estimates of financial transfer impacts, which include tax losses (state, local, and utility tax collections); water trucking costs; and utility revenue losses. In addition, social impacts were estimated, encompassing lost consumer surplus (a welfare economics measure of consumer wellbeing); as well as population and school enrollment losses.

It is estimated that not meeting the identified water needs in Region K would result in an annually combined lost income impact of approximately \$1.6 billion in 2020, increasing to \$3.6 billion in 2070 (Table ES-1). In 2020, the region would lose approximately 9,900 jobs, and by 2070 job losses would increase to approximately 45,000.

All impact estimates are in year 2013 dollars and were calculated using a variety of data sources and tools including the use of a region-specific IMPLAN model, data from the TWDB annual water use estimates, the U.S. Census Bureau, Texas Agricultural Statistics Service, and Texas Municipal League.

Table ES-1: Region K Socioeconomic Impact Summary

Regional Economic Impacts	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$1,560	$1,557	$1,233	$1,093	$1,975	$3,568
Job losses	9,877	11,880	10,414	11,894	24,187	45,282
Financial Transfer Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Tax losses on production and imports ($ millions)*	$236	$217	$160	$113	$145	$248
Water trucking costs ($ millions)*	-	$3	$4	$4	$2	$6
Utility revenue losses ($ millions)*	$23	$84	$138	$205	$339	$592
Utility tax revenue losses ($ millions)*	$0	$1	$2	$3	$6	$10
Social Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Consumer surplus losses ($ millions)*	$1	$29	$51	$105	$194	$347
Population losses	1,813	2,181	1,912	2,184	4,441	8,314
School enrollment losses	335	403	354	404	822	1,538

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

1 Introduction

Water shortages during a repeat of the drought of record would likely curtail or eliminate certain economic activity in businesses and industries that rely heavily on water. Insufficient water supplies could not only have an immediate and real impact on existing businesses and industry, but they could also adversely and chronically affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages could disrupt activity in homes, schools and government and could adversely affect public health and safety. For these reasons, it is important to evaluate and understand how water supply shortages during drought could impact communities throughout the state.

Administrative rules (31 Texas Administrative Code §357.33 (c)) require that regional water planning groups evaluate the social and economic impacts of not meeting water needs as part of the regional water planning process, and rules direct the TWDB staff to provide technical assistance upon request. Staff of the TWDB's Water Use, Projections, & Planning Division designed and conducted this analysis in support of the Region K Regional Water Planning Group.

This document summarizes the results of the analysis and discusses the methodology used to generate the results. Section 1 summarizes the water needs calculation performed by the TWDB based on the regional water planning group's data. Section 2 describes the methodology for the impact assessment and discusses approaches and assumptions specific to each water use category (i.e., irrigation, livestock, mining, steam-electric, municipal and manufacturing). Section 3 presents the results for each water use category with results summarized for the region as a whole. Appendix A presents details on the socioeconomic impacts by county.

1.1 Identified Regional Water Needs (Potential Shortages)

As part of the regional water planning process, the TWDB adopted water demand projections for each water user group (WUG) with input from the planning groups. WUGs are composed of cities, utilities, combined rural areas (designated as county-other), and the county-wide water use of irrigation, livestock, manufacturing, mining and steam-electric power. The demands are then compared to the existing water supplies of each WUG to determine potential shortages, or needs, by decade. Existing water supplies are legally and physically accessible for immediate use in the event of drought. Projected water demands and existing supplies are compared to identify either a surplus or a need for each WUG.

Table 1-1 summarizes the region's identified water needs in the event of a repeat of drought of the record. Demand management, such as conservation, or the development of new infrastructure to increase supplies are water management strategies that may be recommended by the planning group to meet those needs. This analysis assumes that no strategies are implemented, and that the identified needs correspond to future water shortages. Note that projected water needs generally increase over time, primarily due to anticipated population and economic growth. To provide a general sense of proportion, total projected needs as an overall percentage of total demand by water use category are presented in aggregate in Table 1-1. Projected needs for individual water user groups within the aggregate vary greatly, and may reach 100% for a given WUG and water use category. Detailed water needs by WUG and county appear in Chapter 4 of the 2016 Region K Regional Water Plan.

Table 1-1 Regional Water Needs Summary by Water Use Category

Water Use Category		2020	2030	2040	2050	2060	2070
Irrigation	Water Needs (acre-feet per year)	335,489	319,584	304,106	289,044	274,387	260,124
	% of the category's total water demand	55%	54%	53%	52%	50%	49%
Livestock	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Manufacturing	Water Needs (acre-feet per year)	570	692	810	913	1,059	1,216
	% of the category's total water demand	1%	1%	1%	1%	1%	1%
Mining	Water Needs (acre-feet per year)	4,260	8,618	9,747	10,719	12,153	14,164
	% of the category's total water demand	20%	33%	35%	36%	38%	41%
Municipal	Water Needs (acre-feet per year)	7,389	27,362	45,011	66,372	118,804	180,979
	% of the category's total water demand	2%	8%	11%	14%	24%	32%
Steam-electric power	Water Needs (acre-feet per year)	25,363	26,751	26,775	31,974	42,212	54,627
	% of the category's total water demand	14%	14%	14%	16%	21%	26%
Total water needs (acre-feet per year)		**373,071**	**383,007**	**386,449**	**399,022**	**448,615**	**511,110**

2 Economic Impact Assessment Methodology Summary

This portion of the report provides a summary of the methodology used to estimate the potential economic impacts of future water shortages. The general approach employed in the analysis was to obtain estimates for income and job losses on the smallest geographic level that the available data would support, tie those values to their accompanying historic water use estimate (volume), and thereby determine a maximum impact per acre-foot of shortage for each of the socioeconomic measures. The calculations of economic impacts were based on the overall composition of the economy using many underlying economic "sectors." Sectors in this analysis refer to one or more of the 440 specific production sectors of the economy designated within IMPLAN (Impact for Planning Analysis), the economic impact modeling software used for this assessment. Economic impacts within this report are

estimated for approximately 310 of those sectors, with the focus on the more water intense production sectors. The economic impacts for a single water use category consist of an aggregation of impacts to multiple related economic sectors.

2.1 Impact Assessment Measures

A required component of the regional and state water plans is to estimate the potential economic impacts of shortages due to a drought of record. Consistent with previous water plans, several key variables were estimated and are described in Table 2-1.

Table 2-1 Socioeconomic Impact Analysis Measures

Regional Economic Impacts	Description
Income losses - value added	The value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry, sector, or group of sectors within a year. For a shortage, value added is a measure of the income losses to the region, county, or WUG and includes the direct, indirect and induced monetary impacts on the region.
Income losses - electrical power purchase costs	Proxy for income loss in the form of additional costs of power as a result of impacts of water shortages.
Job losses	Number of part-time and full-time jobs lost due to the shortage.
Financial Transfer Impacts	**Description**
Tax losses on production and imports	Sales and excise taxes (not collected due to the shortage), customs duties, property taxes, motor vehicle licenses, severance taxes, other taxes, and special assessments less subsidies.
Water trucking costs	Estimate for shipping potable water.
Utility revenue losses	Foregone utility income due to not selling as much water.
Utility tax revenue losses	Foregone miscellaneous gross receipts tax collections.
Social Impacts	**Description**
Consumer surplus losses	A welfare measure of the lost value to consumers accompanying less water use.
Population losses	Population losses accompanying job losses.
School enrollment losses	School enrollment losses (K-12) accompanying job losses.

2.1.1 Regional Economic Impacts

Two key measures were included within the regional economic impacts classification: income losses and job losses. Income losses presented consist of the sum of value added losses and additional purchase costs of electrical power. Job losses are also presented as a primary economic impact measure.

Income Losses - Value Added Losses

Value added is the value of total output less the value of the intermediate inputs also used in production of the final product. Value added is similar to Gross Domestic Product (GDP), a familiar measure of the productivity of an economy. The loss of value added due to water shortages was estimated by input-output analysis using the IMPLAN software package, and includes the direct, indirect, and induced monetary impacts on the region.

Income Losses - Electric Power Purchase Costs

The electrical power grid and market within the state is a complex interconnected system. The industry response to water shortages, and the resulting impact on the region, are not easily modeled using traditional input/output impact analysis and the IMPLAN model. Adverse impacts on the region will occur, and were represented in this analysis by the additional costs associated with power purchases from other generating plants within the region or state. Consequently, the analysis employed additional power purchase costs as a proxy for the value added impacts for that water use category, and these are included as a portion of the overall income impact for completeness.

For the purpose of this analysis, it was assumed that power companies with insufficient water will be forced to purchase power on the electrical market at a projected higher rate of 5.60 cents per kilowatt hour. This rate is based upon the average day-ahead market purchase price of electricity in Texas from the recent drought period in 2011.

Job Losses

The number of jobs lost due to the economic impact was estimated using IMPLAN output associated with the water use categories noted in Table 1-1. Because of the difficulty in predicting outcomes and a lack of relevant data, job loss estimates were not calculated for the steam-electric power production or for certain municipal water use categories.

2.1.2 Financial Transfer Impacts

Several of the impact measures estimated within the analysis are presented as supplemental information, providing additional detail concerning potential impacts on a sub-portion of the economy or government. Measures included in this category include lost tax collections (on production and imports), trucking costs for imported water, declines in utility revenues, and declines in utility tax revenue collected by the state. Many of these measures are not solely adverse, with some having both positive and negative impacts. For example, cities and residents would suffer if forced to pay large costs for trucking in potable water. Trucking firms, conversely, would benefit from the transaction. Additional detail for each of these measures follows.

Tax Losses on Production and Imports

Reduced production of goods and services accompanying water shortages adversely impacts the collection of taxes by state and local government. The regional IMPLAN model was used to estimate reduced tax collections associated with the reduced output in the economy.

Water Trucking Costs

In instances where water shortages for a municipal water user group were estimated to be 80 percent or more of water demands, it was assumed that water would be trucked in to support basic consumption and sanitation needs. For water shortages of 80 percent or greater, a fixed cost of $20,000 per acre-foot of water was calculated and presented as an economic cost. This water trucking cost was applied for both the residential and non-residential portions of municipal water needs and only impacted a small number of WUGs statewide.

Utility Revenue Losses

Lost utility income was calculated as the price of water service multiplied by the quantity of water not sold during a drought shortage. Such estimates resulted from city-specific pricing data for both water and wastewater. These water rates were applied to the potential water shortage to determine estimates of lost utility revenue as water providers sold less water during the drought due to restricted supplies.

Utility Tax Losses

Foregone utility tax losses included estimates of uncollected miscellaneous gross receipts taxes. Reduced water sales reduce the amount of utility tax that would be collected by the State of Texas for water and wastewater service sales.

2.1.3 Social Impacts

Consumer Surplus Losses of Municipal Water Users

Consumer surplus loss is a measure of impact to the wellbeing of municipal water users when their water use is restricted. Consumer surplus is the difference between how much a consumer is willing and able to pay for the commodity (i.e., water) and how much they actually have to pay. The difference is a benefit to the consumer's wellbeing since they do not have to pay as much for the commodity as they would be willing to pay. However, consumer's access to that water may be limited, and the associated consumer surplus loss is an estimate of the equivalent monetary value of the negative impact to the consumer's wellbeing, for example, associated with a diminished quality of their landscape (i.e., outdoor use). Lost consumer surplus estimates for reduced outdoor and indoor use, as well as residential and commercial/institutional demands, were included in this analysis. Consumer surplus is an attempt to measure effects on wellbeing by monetizing those effects; therefore, these values should not be added to the other monetary impacts estimated in the analysis.

Lost consumer surplus estimates varied widely by location and type. For a 50 percent shortage, the estimated statewide consumer surplus values ranged from $55 to $2,500 per household (residential use), and from $270 to $17,400 per firm (non-residential).

Population and School Enrollment Losses

Population losses due to water shortages, as well as the related loss of school enrollment, were based upon the job loss estimates and upon a recent study of job layoffs and the resulting adjustment of the labor market, including the change in population.[1] The study utilized Bureau of Labor Statistics data regarding layoffs between 1996 and 2013, as well as Internal Revenue Service data regarding migration, to model an estimate of the change in the population as the result of a job layoff event. Layoffs impact both out-migration, as well as in-migration into an area, both of which can negatively affect the population of an area. In addition, the study found that a majority of those who did move following a layoff moved to another labor market rather than an adjacent county. Based on this study, a simplified ratio of job and net population losses was calculated for the state as a whole: for every 100 jobs lost, 18 people were assumed to move out of the area. School enrollment losses were estimated as a proportion of the population lost.

2.2 Analysis Context

The context of the economic impact analysis involves situations where there are physical shortages of surface or groundwater due to drought of record conditions. Anticipated shortages may be nonexistent in earlier decades of the planning horizon, yet population growth or greater industrial, agricultural or other sector demands in later decades may result in greater overall demand, exceeding the existing supplies. Estimated socioeconomic impacts measure what would happen if water user groups experience water shortages for a period of one year. Actual socioeconomic impacts would likely become larger as drought of record conditions persist for periods greater than a single year.

2.2.1 IMPLAN Model and Data

Input-Output analysis using the IMPLAN (Impact for Planning Analysis) software package was the primary means of estimating value added, jobs, and taxes. This analysis employed county and regional level models to determine key impacts. IMPLAN is an economic impact model, originally developed by the U.S. Forestry Service in the 1970's to model economic activity at varying geographic levels. The model is currently maintained by the Minnesota IMPLAN Group (MIG Inc.) which collects and sells county and state specific data and software. The year 2011 version of IMPLAN, employing data for all 254 Texas counties, was used to provide estimates of value added, jobs, and taxes on production for the economic sectors associated with the water user groups examined in the study. IMPLAN uses 440 sector-specific Industry Codes, and those that rely on water as a primary input were assigned to their relevant planning water user categories (manufacturing, mining, irrigation, etc.). Estimates of value added for a water use category were obtained by summing value added estimates across the relevant IMPLAN sectors

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[1] Foote, Andrew, Grosz, Michel, Stevens, Ann. "Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response." University of California, Davis. April 2015. http://paa2015.princeton.edu/uploads/150194

associated with that water use category. Similar calculations were performed for the job and tax losses on production and import impact estimates.

Note that the value added estimates, as well as the job and tax estimates from IMPLAN, include three components:

- *Direct effects* representing the initial change in the industry analyzed;
- *Indirect effects* that are changes in inter-industry transactions as supplying industries respond to reduced demands from the directly affected industries; and,
- *Induced effects* that reflect changes in local spending that result from reduced household income among employees in the directly and indirectly affected industry sectors.

2.2.2 Elasticity of Economic Impacts

The economic impact of a water need is based on the relative size of the water need to the water demand for each water user group (Figure 2-1). Smaller water shortages, for example, less than 5 percent, were anticipated to result in no initial negative economic impact because water users are assumed to have a certain amount of flexibility in dealing with small shortages. As a water shortage deepens, however, such flexibility lessens and results in actual and increasing economic losses, eventually reaching a representative maximum impact estimate per unit volume of water. To account for such ability to adjust, an elasticity adjustment function was used in estimating impacts for several of the measures. Figure 2-1 illustrates the general relationship for the adjustment functions. Negative impacts are assumed to begin accruing when the shortage percentage reaches the lower bound b1 (10 percent in Figure 2-1), with impacts then increasing linearly up to the 100 percent impact level (per unit volume) once the upper bound for adjustment reaches the b2 level shortage (50 percent in Figure 2-1 example).

Initially, the combined total value of the three value added components (direct, indirect, and induced) was calculated and then converted into a per acre-foot economic value based on historical TWDB water use estimates within each particular water use category. As an example, if the total, annual value added for livestock in the region was $2 million and the reported annual volume of water used in that industry was 10,000 acre-feet, the estimated economic value per acre-foot of water shortage would be $200 per acre-foot. Negative economic impacts of shortages were then estimated using this value as the maximum impact estimate ($200 per acre-foot in the example) applied to the anticipated shortage volume in acre-feet and adjusted by the economic impact elasticity function. This adjustment varied with the severity as percentage of water demand of the anticipated shortage. If one employed the sample elasticity function shown in Figure 2-1, a 30% shortage in the water use category would imply an economic impact estimate of 50% of the original $200 per acre-foot impact value (i.e., $100 per acre-foot).

Such adjustments were not required in estimating consumer surplus, nor for the estimates of utility revenue losses or utility tax losses. Estimates of lost consumer surplus relied on city-specific demand curves with the specific lost consumer surplus estimate calculated based on the relative percentage of the city's water shortage. Estimated changes in population as well as changes in school enrollment were indirectly related to the elasticity of job losses.

Assumed values for the bounds b1 and b2 varied with water use category under examination and are presented in Table 2-2.

Figure 2-1 Example Economic Impact Elasticity Function (as applied to a single water user's shortage)

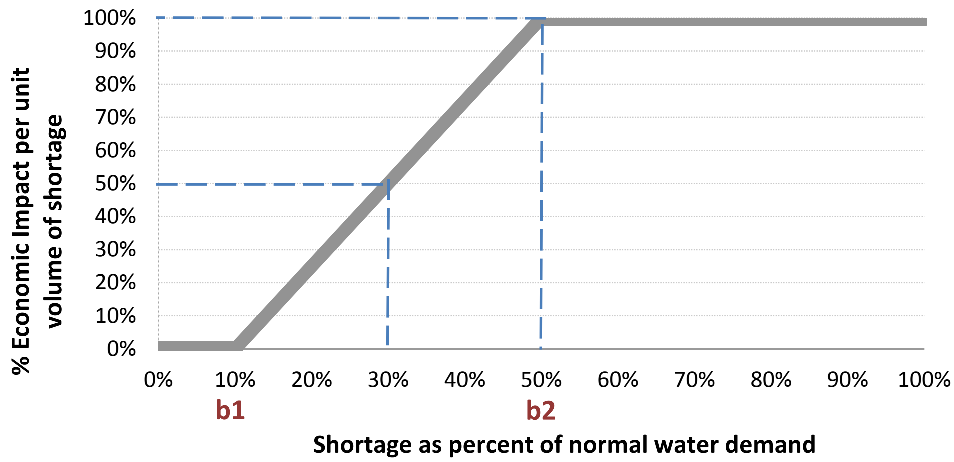

Table 2-2 Economic Impact Elasticity Function Lower and Upper Bounds

Water Use Category	Lower Bound (b1)	Upper Bound (b2)
Irrigation	**5%**	**50%**
Livestock	**5%**	**10%**
Manufacturing	**10%**	**50%**
Mining	**10%**	**50%**
Municipal (non-residential water intensive)	**50%**	**80%**
Steam-electric power	**20%**	**70%**

2.3 Analysis Assumptions and Limitations

Modeling of complex systems requires making assumptions and accepting limitations. This is particularly true when attempting to estimate a wide variety of economic impacts over a large geographic area and into future decades. Some of the key assumptions and limitations of the methodology include:

1. The foundation for estimating socioeconomic impacts of water shortages resulting from a drought are the water needs (potential shortages) that were identified as part of the regional water planning process. These needs have some uncertainty associated with them, but serve as a reasonable basis for evaluating potential economic impacts of a drought of record event.

2. All estimated socioeconomic impacts are snapshot estimates of impacts for years in which water needs were identified (i.e., 2020, 2030, 2040, 2050, 2060, and 2070). The estimates are independent and distinct "what if" scenarios for each particular year, and water shortages are assumed to be temporary events resulting from severe drought conditions. The evaluation assumed that no recommended water management strategies are implemented. In other words, growth occurs, future shocks are imposed on an economy at 10-year intervals, and the resulting impacts are estimated. Note that the estimates presented were not cumulative (i.e., summing up expected impacts from today up to the decade noted), but were simply an estimate of the magnitude of annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated supplies and demands for that same decade.

3. Input-output models such as IMPLAN rely on a static profile of the structure of the economy as it appears today. This presumes that the relative contributions of all sectors of the economy would remain the same, regardless of changes in technology, supplies of limited resources, and other structural changes to the economy that may occur into the future. This was a significant assumption and simplification considering the 50-year time period examined in this analysis. To presume an alternative future economic makeup, however, would entail positing many other major assumptions that would very likely generate as much or more error.

4. This analysis is not a cost-benefit analysis. That approach to evaluating the economic feasibility of a specific policy or project employs discounting future benefits and costs to their present value dollars using some assumed discount rate. The methodology employed in this effort to estimate the economic impacts of future water shortages did not use any discounting procedures to weigh future costs differently through time.

5. Monetary figures are reported in constant year 2013 dollars.

6. Impacts are annual estimates. The estimated economic model does not reflect the full extent of impacts that might occur as a result of persistent water shortages occurring over an extended duration. The drought of record in most regions of Texas lasted several years.

7. Value added estimates are the primary estimate of the economic impacts within this report. One may be tempted to add consumer surplus impacts to obtain an estimate of total adverse economic impacts to the region, but the consumer surplus measure represents the change to the wellbeing of households (and other water users), not an actual change in the flow of dollars through the economy. The two categories (value added and consumer surplus) are both valid impacts but should not be summed.

8. The value added, jobs, and taxes on production and import impacts include the direct, indirect and induced effects described in Section 2.2.1. Population and school enrollment losses also indirectly include such effects as they are based on the associated losses in employment. The remaining measures (consumer surplus, utility revenue, utility taxes, additional electrical power purchase costs, and potable water trucking costs), however, do not include any induced or indirect effects.

9. The majority of impacts estimated in this analysis may be considered smaller than those that might occur under drought of record conditions. Input-output models such as IMPLAN only capture "backward linkages" on suppliers (including households that supply labor to directly affected industries). While this is a common limitation in these types of economic impact modeling efforts, it is important to note that "forward linkages" on the industries that use the outputs of the directly affected industries can also be very important. A good example is impacts on livestock operators. Livestock producers tend to suffer substantially during droughts, not because there is not enough water for their stock, but because reductions in available pasture and higher prices for purchased hay have significant economic effects on their operations. Food processors could be in a similar situation if they cannot get the grains or other inputs that they need. These effects are not captured in IMPLAN, which is one reason why the impact estimates are likely conservative.

10. The methodology did not capture "spillover" effects between regions – or the secondary impacts that occur outside of the region where the water shortage is projected to occur.

11. The model did not reflect dynamic economic responses to water shortages as they might occur, nor does the model reflect economic impacts associated with a recovery from a drought of record including:
    a. The likely significant economic rebound to the landscaping industry immediately following a drought;
    b. The cost and years to rebuild liquidated livestock herds (a major capital item in that industry);
    c. Direct impacts on recreational sectors (i.e., stranded docks and reduced tourism); or,
    d. Impacts of negative publicity on Texas' ability to attract population and business in the event that it was not able to provide adequate water supplies for the existing economy.

12. Estimates for job losses and the associated population and school enrollment changes may exceed what would actually occur. In practice, firms may be hesitant to lay off employees, even in difficult economic times. Estimates of population and school enrollment changes are based on regional evaluations and therefore do not accurately reflect what might occur on a statewide basis.

13. The results must be interpreted carefully. It is the general and relative magnitudes of impacts as well as the changes of these impacts over time that should be the focus rather than the absolute numbers. Analyses of this type are much better at predicting relative percent differences brought about by a shock to a complex system (i.e., a water shortage) than the precise size of an impact. To illustrate, assuming that the estimated economic impacts of a drought of record on the manufacturing and mining water user categories are $2 and $1 million, respectively, one should be more confident that the economic impacts on manufacturing are twice as large as those on mining and that these impacts will likely be in the millions of dollars. But one should have less confidence that the actual total economic impact experienced would be $3 million.

3 Analysis Results

This section presents a breakdown of the results of the regional analysis for Region K. Projected economic impacts for six water use categories (irrigation, livestock. municipal, manufacturing, mining, and steam-electric power) are also reported by decade.

3.1 Overview of the Regional Economy

Table 3-1 presents the 2011 economic baseline as represented by the IMPLAN model and adjusted to 2013 dollars for Region K. In year 2011, Region K generated about $88 billion in gross state product associated with 975,000 jobs based on the 2011 IMPLAN data. These values represent an approximation of the current regional economy for a reference point.

Table 3-1 Region K Economy

Income ($ millions)*	Jobs	Taxes on production and imports ($ millions)*
$88,344	**975,269**	**$6,335**

[1] ***Year 2013 dollars based on 2011 IMPLAN model value added estimates for the region.***

The remainder of Section 3 presents estimates of potential economic impacts for each water use category that could reasonably be expected in the event of water shortages associated with a drought of record and if no recommended water management strategies were implemented.

3.2 Impacts for Irrigation Water Shortages

Four of the 14 counties in the region are projected to experience water shortages in the irrigated agriculture water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-2. Note that tax collection impacts were not estimated for this water use category. IMPLAN data indicates a negative tax impact (i.e., increased tax collections) for the associated production sectors, primarily due to past subsidies from the federal government. Two factors led to excluding any reported tax impacts: 1) Federal support (subsidies) has lessened greatly since the year 2011 IMPLAN data was collected, and 2) It was not considered realistic to report increasing tax revenue collections for a drought of record.

Table 3-2 Impacts of Water Shortages on Irrigation in Region

Impact Measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$56	$52	$49	$46	$43	$40
Job losses	1,338	1,258	1,181	1,108	1,039	974

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.3 Impacts for Livestock Water Shortages

None of the 14 counties in the region are projected to experience water shortages in the livestock water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-3. Note that tax impacts are not reported for this water use category for similar reasons that apply to the irrigation water use category described above.

Table 3-3 Impacts of Water Shortages on Livestock in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	-	-	-	-	-	-
Jobs losses	-	-	-	-	-	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

3.4 Impacts for Municipal Water Shortages

Eleven of the 14 counties in the region are projected to experience water shortages in the municipal water use category for one or more decades within the planning horizon. Impact estimates were made for the two subtypes of use within municipal use: residential, and non-residential. The latter includes commercial and institutional users. Consumer surplus measures were made for both residential and non-residential demands. In addition, available data for the non-residential, water-intensive portion of municipal demand allowed use of IMPLAN and TWDB Water Use Survey data to estimate income loss, jobs, and taxes. Trucking cost estimates, calculated for shortages exceeding 80 percent, assumed a fixed cost of $20,000 per acre-foot to transport water for municipal use. The estimated impacts to this water use category appear in Table 3-4.

Table 3-4 Impacts of Water Shortages on Municipal Water Users in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses[1] ($ millions)*	$1	$152	$175	$376	$1,135	$2,325
Job losses[1]	21	2,634	3,074	6,604	19,795	40,435
Tax losses on production and imports[1] ($ millions)*	$0	$12	$14	$30	$92	$187
Consumer surplus losses ($ millions)*	$1	$29	$51	$105	$194	$347
Trucking costs ($ millions)*	-	$3	$4	$4	$2	$6
Utility revenue losses ($ millions)*	$23	$84	$138	$205	$339	$592
Utility tax revenue losses ($ millions)*	$0	$1	$2	$3	$6	$10

[1] Estimates apply to the water-intensive portion of non-residential municipal water use.
**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.5 Impacts of Manufacturing Water Shortages

Manufacturing water shortages in the region are projected to occur in 3 of the 14 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-5.

Table 3-5 Impacts of Water Shortages on Manufacturing in Region

Impacts Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$35	$52	$70	$88	$106	$126
Job losses	390	575	788	985	1,165	1,365
Tax losses on production and Imports ($ millions)*	$4	$6	$8	$10	$13	$16

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.6 Impacts of Mining Water Shortages

Mining water shortages in the region are projected to occur in 4 of the 14 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use type appear in Table 3-6.

Table 3-6 Impacts of Water Shortages on Mining in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$1,403	$1,236	$872	$485	$299	$342
Job losses	8,128	7,414	5,371	3,196	2,187	2,508
Tax losses on production and Imports ($ millions)*	$230	$197	$136	$71	$39	$44

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.7 Impacts of Steam-Electric Water Shortages

Steam-electric water shortages in the region are projected to occur in 4 of the 14 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-7.

Note that estimated economic impacts to steam-electric water users:

- Are reflected as an income loss proxy in the form of the estimated additional purchasing costs for power from the electrical grid that could not be generated due to a shortage;
- Do not include estimates of impacts on jobs. Because of the unique conditions of power generators during drought conditions and lack of relevant data, it was assumed that the industry would retain, perhaps relocating or repurposing, their existing staff in order to manage their ongoing operations through a severe drought.
- Does not presume a decline in tax collections. Associated tax collections, in fact, would likely increase under drought conditions since, historically, the demand for electricity increases during times of drought, thereby increasing taxes collected on the additional sales of power.

Table 3-7 Impacts of Water Shortages on Steam-Electric Power in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income Losses ($ millions)*	$65	$66	$66	$98	$392	$736

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.8 Regional Social Impacts

Projected changes in population, based upon several factors (household size, population, and job loss estimates), as well as the accompanying change in school enrollment, were also estimated and are summarized in Table 3-8.

Table 3-8 Region-wide Social Impacts of Water Shortages in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Consumer surplus losses ($ millions)*	$1	$29	$51	$105	$194	$347
Population losses	1,813	2,181	1,912	2,184	4,441	8,314
School enrollment losses	335	403	354	404	822	1,538

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

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Appendix A - County Level Summary of Estimated Economic Impacts for Region K

County level summary of estimated economic impacts of not meeting identified water needs by water use category and decade (in 2013 dollars, rounded). Values presented only for counties with projected economic impacts for at least one decade.

***** Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

		Income losses (Million $)*						Job losses						Consumer Surplus (Million $)*					
County	**Water Use Category**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
BASTROP	MANUFACTURING	$6	$15	$26	$37	$42	$48	77	189	329	462	533	609	-	-	-	-	-	-
BASTROP	MINING	$11	$185	$213	$243	$276	$312	80	1,320	1,514	1,730	1,962	2,220	-	-	-	-	-	-
BASTROP	MUNICIPAL	-	-	-	$74	$448	$1,057	-	-	-	1,279	7,760	18,326	$0	$2	$5	$14	$44	$121
BASTROP Total		**$17**	**$200**	**$239**	**$353**	**$766**	**$1,417**	**157**	**1,508**	**1,842**	**3,471**	**10,255**	**21,156**	**$0**	**$2**	**$5**	**$14**	**$44**	**$121**
BLANCO	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0	$0	$0
BLANCO Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
BURNET	MINING	$1	$4	$7	$11	$15	$21	13	38	71	105	147	197	-	-	-	-	-	-
BURNET	MUNICIPAL	-	-	-	$0	$3	$5	-	-	-	7	51	93	$0	$0	$0	$1	$2	$3
BURNET Total		**$1**	**$4**	**$7**	**$11**	**$18**	**$26**	**13**	**38**	**71**	**112**	**197**	**290**	**$0**	**$0**	**$0**	**$1**	**$2**	**$3**
COLORADO	IRRIGATION	$7	$6	$5	$4	$4	$3	150	130	112	96	80	66	-	-	-	-	-	-
COLORADO	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0	$0	$0
COLORADO Total		**$7**	**$6**	**$5**	**$4**	**$4**	**$3**	**150**	**130**	**112**	**96**	**80**	**66**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
FAYETTE	MANUFACTURING	$17	$20	$23	$26	$29	$32	224	264	303	337	379	425	-	-	-	-	-	-
FAYETTE	MINING	$1,387	$1,042	$646	$225	$1	$1	8,006	6,014	3,729	1,299	5	4	-	-	-	-	-	-
FAYETTE	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0	$0	$0
FAYETTE Total		**$1,405**	**$1,062**	**$669**	**$251**	**$30**	**$33**	**8,230**	**6,279**	**4,032**	**1,636**	**384**	**430**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
GILLESPIE	MANUFACTURING	$12	$17	$21	$25	$35	$45	89	122	156	186	253	330	-	-	-	-	-	-
FAYETTE	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0
GILLESPIE Total		**$12**	**$17**	**$21**	**$25**	**$35**	**$45**	**89**	**122**	**156**	**186**	**253**	**330**	**-**	**-**	**-**	**-**	**-**	**$0**
HAYS	MINING	$3	$4	$6	$6	$7	$8	29	42	57	62	74	87	-	-	-	-	-	-
HAYS	MUNICIPAL	-	-	-	$44	$214	$557	-	-	-	771	3,705	9,655	-	$0	$1	$7	$22	$52
HAYS Total		**$3**	**$4**	**$6**	**$50**	**$221**	**$565**	**29**	**42**	**57**	**833**	**3,779**	**9,741**	**-**	**$0**	**$1**	**$7**	**$22**	**$52**
LLANO	MUNICIPAL	$1	$3	$2	$1	$2	$4	21	44	33	16	38	61	$0	$0	$0	$0	$0	$0
LLANO Total		**$1**	**$3**	**$2**	**$1**	**$2**	**$4**	**21**	**44**	**33**	**16**	**38**	**61**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
MATAGORDA	IRRIGATION	$29	$28	$27	$26	$25	$24	675	652	630	608	587	566	-	-	-	-	-	-

Appendix P

TWDB Socioeconomic Impact Assessment for Region L Planning

Socioeconomic Impacts of Projected Water Shortages

for the Region L Regional Water Planning Area

Prepared in Support of the 2016 Region L Regional Water Plan

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Executive Summary

Evaluating the social and economic impacts of not meeting identified water needs is a required part of the regional water planning process. The Texas Water Development Board (TWDB) estimates those impacts for regional water planning groups, and summarizes the impacts in the state water plan. The analysis presented is for the Region L Regional Water Planning Group.

Based on projected water demands and existing water supplies, the Region L planning group identified water needs (potential shortages) that would occur within its region under a repeat of the drought of record for six water use categories. The TWDB then estimated the socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

The analysis was performed using an economic modeling software package, IMPLAN (Impact for Planning Analysis), as well as other economic analysis techniques, and represents a snapshot of socioeconomic impacts that may occur during a single year during a drought of record within each of the planning decades. For each water use category, the evaluation focused on estimating income losses and job losses. The income losses represent an approximation of gross domestic product (GDP) that would be foregone if water needs are not met.

The analysis also provides estimates of financial transfer impacts, which include tax losses (state, local, and utility tax collections); water trucking costs; and utility revenue losses. In addition, social impacts were estimated, encompassing lost consumer surplus (a welfare economics measure of consumer wellbeing); as well as population and school enrollment losses.

It is estimated that not meeting the identified water needs in Region L would result in an annually combined lost income impact of approximately $2 billion in 2020, increasing to $6 billion in 2070 (Table ES-1). In 2020, the region would lose approximately 18,300 jobs, and by 2070 job losses would increase to approximately 50,100.

All impact estimates are in year 2013 dollars and were calculated using a variety of data sources and tools including the use of a region-specific IMPLAN model, data from the TWDB annual water use estimates, the U.S. Census Bureau, Texas Agricultural Statistics Service, and Texas Municipal League.

Table ES-1: Region L Socioeconomic Impact Summary

Regional Economic Impacts	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$1,990	$2,928	$3,320	$3,841	$4,633	$5,911
Job losses	18,277	20,809	23,550	25,559	30,450	50,102
Financial Transfer Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Tax losses on production and imports ($ millions)*	$175	$187	$193	$182	$192	$290
Water trucking costs ($ millions)*	$0	$0	$0	$1	$1	$3
Utility revenue losses ($ millions)*	$210	$304	$418	$537	$625	$809
Utility tax revenue losses ($ millions)*	$4	$6	$8	$10	$12	$15
Social Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Consumer surplus losses ($ millions)*	$29	$58	$108	$171	$264	$403
Population losses	3,356	3,821	4,324	4,693	5,591	9,199
School enrollment losses	621	707	800	868	1,034	1,702

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

1 Introduction

Water shortages during a repeat of the drought of record would likely curtail or eliminate certain economic activity in businesses and industries that rely heavily on water. Insufficient water supplies could not only have an immediate and real impact on existing businesses and industry, but they could also adversely and chronically affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages could disrupt activity in homes, schools and government and could adversely affect public health and safety. For these reasons, it is important to evaluate and understand how water supply shortages during drought could impact communities throughout the state.

Administrative rules (31 Texas Administrative Code §357.33 (c)) require that regional water planning groups evaluate the social and economic impacts of not meeting water needs as part of the regional water planning process, and rules direct the TWDB staff to provide technical assistance upon request. Staff of the TWDB's Water Use, Projections, & Planning Division designed and conducted this analysis in support of the Region L Regional Water Planning Group.

This document summarizes the results of the analysis and discusses the methodology used to generate the results. Section 1 summarizes the water needs calculation performed by the TWDB based on the regional water planning group's data. Section 2 describes the methodology for the impact assessment and discusses approaches and assumptions specific to each water use category (i.e., irrigation, livestock, mining, steam-electric, municipal and manufacturing). Section 3 presents the results for each water use category with results summarized for the region as a whole. Appendix A presents details on the socioeconomic impacts by county.

1.1 Identified Regional Water Needs (Potential Shortages)

As part of the regional water planning process, the TWDB adopted water demand projections for each water user group (WUG) with input from the planning groups. WUGs are composed of cities, utilities, combined rural areas (designated as county-other), and the county-wide water use of irrigation, livestock, manufacturing, mining and steam-electric power. The demands are then compared to the existing water supplies of each WUG to determine potential shortages, or needs, by decade. Existing water supplies are legally and physically accessible for immediate use in the event of drought. Projected water demands and existing supplies are compared to identify either a surplus or a need for each WUG.

Table 1-1 summarizes the region's identified water needs in the event of a repeat of drought of the record. Demand management, such as conservation, or the development of new infrastructure to increase supplies are water management strategies that may be recommended by the planning group to meet those needs. This analysis assumes that no strategies are implemented, and that the identified needs correspond to future water shortages. Note that projected water needs generally increase over time, primarily due to anticipated population and economic growth. To provide a general sense of proportion, total projected needs as an overall percentage of total demand by water use category are presented in aggregate in Table 1-1. Projected needs for individual water user groups within the aggregate vary greatly, and may reach 100% for a given WUG and water use category. Detailed water needs by WUG and county appear in Chapter 4 of the 2016 Region L Regional Water Plan.

Table 1-1 Regional Water Needs Summary by Water Use Category

Water Use Category		2020	2030	2040	2050	2060	2070
Irrigation	Water Needs (acre-feet per year)	105,799	97,325	89,057	81,302	73,968	67,383
	% of the category's total water demand	31%	29%	28%	27%	25%	24%
Livestock	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Manufacturing	Water Needs (acre-feet per year)	6,616	10,213	13,778	19,265	29,210	40,376
	% of the category's total water demand	5%	8%	9%	12%	17%	23%
Mining	Water Needs (acre-feet per year)	10,822	10,481	8,694	5,147	2,073	666
	% of the category's total water demand	22%	21%	18%	12%	5%	2%
Municipal	Water Needs (acre-feet per year)	86,856	124,059	168,754	215,946	268,513	322,831
	% of the category's total water demand	19%	24%	29%	34%	39%	43%
Steam-electric power	Water Needs (acre-feet per year)	4,506	29,778	37,178	53,599	70,696	70,696
	% of the category's total water demand	8%	33%	37%	44%	48%	46%
Total water needs (acre-feet per year)		**214,599**	**271,856**	**317,461**	**375,259**	**444,460**	**501,952**

2 Economic Impact Assessment Methodology Summary

This portion of the report provides a summary of the methodology used to estimate the potential economic impacts of future water shortages. The general approach employed in the analysis was to obtain estimates for income and job losses on the smallest geographic level that the available data would support, tie those values to their accompanying historic water use estimate (volume), and thereby determine a maximum impact per acre-foot of shortage for each of the socioeconomic measures. The calculations of economic impacts were based on the overall composition of the economy using many underlying economic "sectors." Sectors in this analysis refer to one or more of the 440 specific production sectors of the economy designated within IMPLAN (Impact for Planning Analysis), the economic impact modeling software used for this assessment. Economic impacts within this report are

estimated for approximately 310 of those sectors, with the focus on the more water intense production sectors. The economic impacts for a single water use category consist of an aggregation of impacts to multiple related economic sectors.

2.1 Impact Assessment Measures

A required component of the regional and state water plans is to estimate the potential economic impacts of shortages due to a drought of record. Consistent with previous water plans, several key variables were estimated and are described in Table 2-1.

Table 2-1 Socioeconomic Impact Analysis Measures

Regional Economic Impacts	Description
Income losses - value added	The value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry, sector, or group of sectors within a year. For a shortage, value added is a measure of the income losses to the region, county, or WUG and includes the direct, indirect and induced monetary impacts on the region.
Income losses - electrical power purchase costs	Proxy for income loss in the form of additional costs of power as a result of impacts of water shortages.
Job losses	Number of part-time and full-time jobs lost due to the shortage.
Financial Transfer Impacts	**Description**
Tax losses on production and imports	Sales and excise taxes (not collected due to the shortage), customs duties, property taxes, motor vehicle licenses, severance taxes, other taxes, and special assessments less subsidies.
Water trucking costs	Estimate for shipping potable water.
Utility revenue losses	Foregone utility income due to not selling as much water.
Utility tax revenue losses	Foregone miscellaneous gross receipts tax collections.
Social Impacts	**Description**
Consumer surplus losses	A welfare measure of the lost value to consumers accompanying less water use.
Population losses	Population losses accompanying job losses.
School enrollment losses	School enrollment losses (K-12) accompanying job losses.

2.1.1 Regional Economic Impacts

Two key measures were included within the regional economic impacts classification: income losses and job losses. Income losses presented consist of the sum of value added losses and additional purchase costs of electrical power. Job losses are also presented as a primary economic impact measure.

Income Losses - Value Added Losses

Value added is the value of total output less the value of the intermediate inputs also used in production of the final product. Value added is similar to Gross Domestic Product (GDP), a familiar measure of the productivity of an economy. The loss of value added due to water shortages was estimated by input-output analysis using the IMPLAN software package, and includes the direct, indirect, and induced monetary impacts on the region.

Income Losses - Electric Power Purchase Costs

The electrical power grid and market within the state is a complex interconnected system. The industry response to water shortages, and the resulting impact on the region, are not easily modeled using traditional input/output impact analysis and the IMPLAN model. Adverse impacts on the region will occur, and were represented in this analysis by the additional costs associated with power purchases from other generating plants within the region or state. Consequently, the analysis employed additional power purchase costs as a proxy for the value added impacts for that water use category, and these are included as a portion of the overall income impact for completeness.

For the purpose of this analysis, it was assumed that power companies with insufficient water will be forced to purchase power on the electrical market at a projected higher rate of 5.60 cents per kilowatt hour. This rate is based upon the average day-ahead market purchase price of electricity in Texas from the recent drought period in 2011.

Job Losses

The number of jobs lost due to the economic impact was estimated using IMPLAN output associated with the water use categories noted in Table 1-1. Because of the difficulty in predicting outcomes and a lack of relevant data, job loss estimates were not calculated for the steam-electric power production or for certain municipal water use categories.

2.1.2 Financial Transfer Impacts

Several of the impact measures estimated within the analysis are presented as supplemental information, providing additional detail concerning potential impacts on a sub-portion of the economy or government. Measures included in this category include lost tax collections (on production and imports), trucking costs for imported water, declines in utility revenues, and declines in utility tax revenue collected by the state. Many of these measures are not solely adverse, with some having both positive and negative impacts. For example, cities and residents would suffer if forced to pay large costs for trucking in potable water. Trucking firms, conversely, would benefit from the transaction. Additional detail for each of these measures follows.

Tax Losses on Production and Imports

Reduced production of goods and services accompanying water shortages adversely impacts the collection of taxes by state and local government. The regional IMPLAN model was used to estimate reduced tax collections associated with the reduced output in the economy.

Water Trucking Costs

In instances where water shortages for a municipal water user group were estimated to be 80 percent or more of water demands, it was assumed that water would be trucked in to support basic consumption and sanitation needs. For water shortages of 80 percent or greater, a fixed cost of $20,000 per acre-foot of water was calculated and presented as an economic cost. This water trucking cost was applied for both the residential and non-residential portions of municipal water needs and only impacted a small number of WUGs statewide.

Utility Revenue Losses

Lost utility income was calculated as the price of water service multiplied by the quantity of water not sold during a drought shortage. Such estimates resulted from city-specific pricing data for both water and wastewater. These water rates were applied to the potential water shortage to determine estimates of lost utility revenue as water providers sold less water during the drought due to restricted supplies.

Utility Tax Losses

Foregone utility tax losses included estimates of uncollected miscellaneous gross receipts taxes. Reduced water sales reduce the amount of utility tax that would be collected by the State of Texas for water and wastewater service sales.

2.1.3 Social Impacts

Consumer Surplus Losses of Municipal Water Users

Consumer surplus loss is a measure of impact to the wellbeing of municipal water users when their water use is restricted. Consumer surplus is the difference between how much a consumer is willing and able to pay for the commodity (i.e., water) and how much they actually have to pay. The difference is a benefit to the consumer’s wellbeing since they do not have to pay as much for the commodity as they would be willing to pay. However, consumer’s access to that water may be limited, and the associated consumer surplus loss is an estimate of the equivalent monetary value of the negative impact to the consumer’s wellbeing, for example, associated with a diminished quality of their landscape (i.e., outdoor use). Lost consumer surplus estimates for reduced outdoor and indoor use, as well as residential and commercial/institutional demands, were included in this analysis. Consumer surplus is an attempt to measure effects on wellbeing by monetizing those effects; therefore, these values should not be added to the other monetary impacts estimated in the analysis.

Lost consumer surplus estimates varied widely by location and type. For a 50 percent shortage, the estimated statewide consumer surplus values ranged from $55 to $2,500 per household (residential use), and from $270 to $17,400 per firm (non-residential).

Population and School Enrollment Losses

Population losses due to water shortages, as well as the related loss of school enrollment, were based upon the job loss estimates and upon a recent study of job layoffs and the resulting adjustment of the labor market, including the change in population.[1] The study utilized Bureau of Labor Statistics data regarding layoffs between 1996 and 2013, as well as Internal Revenue Service data regarding migration, to model an estimate of the change in the population as the result of a job layoff event. Layoffs impact both out-migration, as well as in-migration into an area, both of which can negatively affect the population of an area. In addition, the study found that a majority of those who did move following a layoff moved to another labor market rather than an adjacent county. Based on this study, a simplified ratio of job and net population losses was calculated for the state as a whole: for every 100 jobs lost, 18 people were assumed to move out of the area. School enrollment losses were estimated as a proportion of the population lost.

2.2 Analysis Context

The context of the economic impact analysis involves situations where there are physical shortages of surface or groundwater due to drought of record conditions. Anticipated shortages may be nonexistent in earlier decades of the planning horizon, yet population growth or greater industrial, agricultural or other sector demands in later decades may result in greater overall demand, exceeding the existing supplies. Estimated socioeconomic impacts measure what would happen if water user groups experience water shortages for a period of one year. Actual socioeconomic impacts would likely become larger as drought of record conditions persist for periods greater than a single year.

2.2.1 IMPLAN Model and Data

Input-Output analysis using the IMPLAN (Impact for Planning Analysis) software package was the primary means of estimating value added, jobs, and taxes. This analysis employed county and regional level models to determine key impacts. IMPLAN is an economic impact model, originally developed by the U.S. Forestry Service in the 1970's to model economic activity at varying geographic levels. The model is currently maintained by the Minnesota IMPLAN Group (MIG Inc.) which collects and sells county and state specific data and software. The year 2011 version of IMPLAN, employing data for all 254 Texas counties, was used to provide estimates of value added, jobs, and taxes on production for the economic sectors associated with the water user groups examined in the study. IMPLAN uses 440 sector-specific Industry Codes, and those that rely on water as a primary input were assigned to their relevant planning water user categories (manufacturing, mining, irrigation, etc.). Estimates of value added for a water use category were obtained by summing value added estimates across the relevant IMPLAN sectors

[1] Foote, Andrew, Grosz, Michel, Stevens, Ann. "Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response." University of California, Davis. April 2015. http://paa2015.princeton.edu/uploads/150194

associated with that water use category. Similar calculations were performed for the job and tax losses on production and import impact estimates.

Note that the value added estimates, as well as the job and tax estimates from IMPLAN, include three components:

- *Direct effects* representing the initial change in the industry analyzed;
- *Indirect effects* that are changes in inter-industry transactions as supplying industries respond to reduced demands from the directly affected industries; and,
- *Induced effects* that reflect changes in local spending that result from reduced household income among employees in the directly and indirectly affected industry sectors.

2.2.2 Elasticity of Economic Impacts

The economic impact of a water need is based on the relative size of the water need to the water demand for each water user group (Figure 2-1). Smaller water shortages, for example, less than 5 percent, were anticipated to result in no initial negative economic impact because water users are assumed to have a certain amount of flexibility in dealing with small shortages. As a water shortage deepens, however, such flexibility lessens and results in actual and increasing economic losses, eventually reaching a representative maximum impact estimate per unit volume of water. To account for such ability to adjust, an elasticity adjustment function was used in estimating impacts for several of the measures. Figure 2-1 illustrates the general relationship for the adjustment functions. Negative impacts are assumed to begin accruing when the shortage percentage reaches the lower bound b1 (10 percent in Figure 2-1), with impacts then increasing linearly up to the 100 percent impact level (per unit volume) once the upper bound for adjustment reaches the b2 level shortage (50 percent in Figure 2-1 example).

Initially, the combined total value of the three value added components (direct, indirect, and induced) was calculated and then converted into a per acre-foot economic value based on historical TWDB water use estimates within each particular water use category. As an example, if the total, annual value added for livestock in the region was $2 million and the reported annual volume of water used in that industry was 10,000 acre-feet, the estimated economic value per acre-foot of water shortage would be $200 per acre-foot. Negative economic impacts of shortages were then estimated using this value as the maximum impact estimate ($200 per acre-foot in the example) applied to the anticipated shortage volume in acre-feet and adjusted by the economic impact elasticity function. This adjustment varied with the severity as percentage of water demand of the anticipated shortage. If one employed the sample elasticity function shown in Figure 2-1, a 30% shortage in the water use category would imply an economic impact estimate of 50% of the original $200 per acre-foot impact value (i.e., $100 per acre-foot).

Such adjustments were not required in estimating consumer surplus, nor for the estimates of utility revenue losses or utility tax losses. Estimates of lost consumer surplus relied on city-specific demand curves with the specific lost consumer surplus estimate calculated based on the relative percentage of the city's water shortage. Estimated changes in population as well as changes in school enrollment were indirectly related to the elasticity of job losses.

Assumed values for the bounds b1 and b2 varied with water use category under examination and are presented in Table 2-2.

Figure 2-1 Example Economic Impact Elasticity Function (as applied to a single water user's shortage)

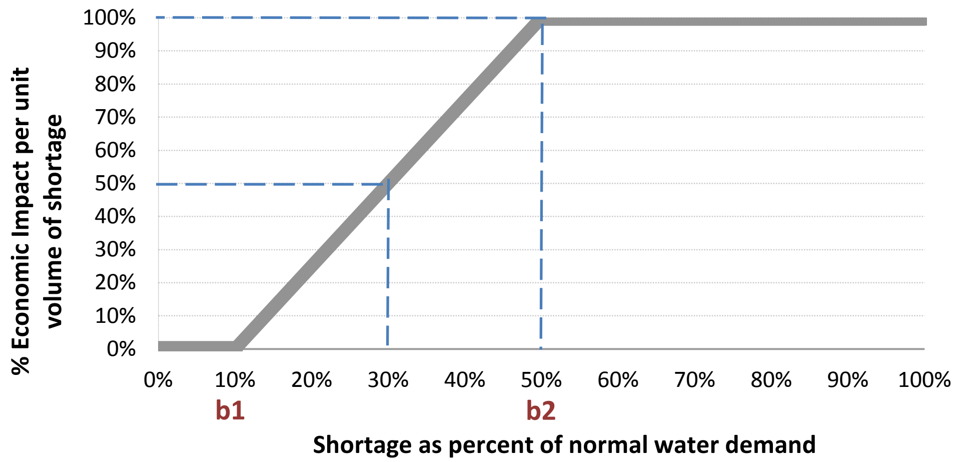

Table 2-2 Economic Impact Elasticity Function Lower and Upper Bounds

Water Use Category	Lower Bound (b1)	Upper Bound (b2)
Irrigation	5%	50%
Livestock	5%	10%
Manufacturing	10%	50%
Mining	10%	50%
Municipal (non-residential water intensive)	50%	80%
Steam-electric power	20%	70%

2.3 Analysis Assumptions and Limitations

Modeling of complex systems requires making assumptions and accepting limitations. This is particularly true when attempting to estimate a wide variety of economic impacts over a large geographic area and into future decades. Some of the key assumptions and limitations of the methodology include:

1. The foundation for estimating socioeconomic impacts of water shortages resulting from a drought are the water needs (potential shortages) that were identified as part of the regional water planning process. These needs have some uncertainty associated with them, but serve as a reasonable basis for evaluating potential economic impacts of a drought of record event.

2. All estimated socioeconomic impacts are snapshot estimates of impacts for years in which water needs were identified (i.e., 2020, 2030, 2040, 2050, 2060, and 2070). The estimates are independent and distinct "what if" scenarios for each particular year, and water shortages are assumed to be temporary events resulting from severe drought conditions. The evaluation assumed that no recommended water management strategies are implemented. In other words, growth occurs, future shocks are imposed on an economy at 10-year intervals, and the resulting impacts are estimated. Note that the estimates presented were not cumulative (i.e., summing up expected impacts from today up to the decade noted), but were simply an estimate of the magnitude of annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated supplies and demands for that same decade.

3. Input-output models such as IMPLAN rely on a static profile of the structure of the economy as it appears today. This presumes that the relative contributions of all sectors of the economy would remain the same, regardless of changes in technology, supplies of limited resources, and other structural changes to the economy that may occur into the future. This was a significant assumption and simplification considering the 50-year time period examined in this analysis. To presume an alternative future economic makeup, however, would entail positing many other major assumptions that would very likely generate as much or more error.

4. This analysis is not a cost-benefit analysis. That approach to evaluating the economic feasibility of a specific policy or project employs discounting future benefits and costs to their present value dollars using some assumed discount rate. The methodology employed in this effort to estimate the economic impacts of future water shortages did not use any discounting procedures to weigh future costs differently through time.

5. Monetary figures are reported in constant year 2013 dollars.

6. Impacts are annual estimates. The estimated economic model does not reflect the full extent of impacts that might occur as a result of persistent water shortages occurring over an extended duration. The drought of record in most regions of Texas lasted several years.

7. Value added estimates are the primary estimate of the economic impacts within this report. One may be tempted to add consumer surplus impacts to obtain an estimate of total adverse economic impacts to the region, but the consumer surplus measure represents the change to the wellbeing of households (and other water users), not an actual change in the flow of dollars through the economy. The two categories (value added and consumer surplus) are both valid impacts but should not be summed.

8. The value added, jobs, and taxes on production and import impacts include the direct, indirect and induced effects described in Section 2.2.1. Population and school enrollment losses also indirectly include such effects as they are based on the associated losses in employment. The remaining measures (consumer surplus, utility revenue, utility taxes, additional electrical power purchase costs, and potable water trucking costs), however, do not include any induced or indirect effects.

9. The majority of impacts estimated in this analysis may be considered smaller than those that might occur under drought of record conditions. Input-output models such as IMPLAN only capture "backward linkages" on suppliers (including households that supply labor to directly affected industries). While this is a common limitation in these types of economic impact modeling efforts, it is important to note that "forward linkages" on the industries that use the outputs of the directly affected industries can also be very important. A good example is impacts on livestock operators. Livestock producers tend to suffer substantially during droughts, not because there is not enough water for their stock, but because reductions in available pasture and higher prices for purchased hay have significant economic effects on their operations. Food processors could be in a similar situation if they cannot get the grains or other inputs that they need. These effects are not captured in IMPLAN, which is one reason why the impact estimates are likely conservative.

10. The methodology did not capture "spillover" effects between regions – or the secondary impacts that occur outside of the region where the water shortage is projected to occur.

11. The model did not reflect dynamic economic responses to water shortages as they might occur, nor does the model reflect economic impacts associated with a recovery from a drought of record including:
    a. The likely significant economic rebound to the landscaping industry immediately following a drought;
    b. The cost and years to rebuild liquidated livestock herds (a major capital item in that industry);
    c. Direct impacts on recreational sectors (i.e., stranded docks and reduced tourism); or,
    d. Impacts of negative publicity on Texas' ability to attract population and business in the event that it was not able to provide adequate water supplies for the existing economy.

12. Estimates for job losses and the associated population and school enrollment changes may exceed what would actually occur. In practice, firms may be hesitant to lay off employees, even in difficult economic times. Estimates of population and school enrollment changes are based on regional evaluations and therefore do not accurately reflect what might occur on a statewide basis.

13. The results must be interpreted carefully. It is the general and relative magnitudes of impacts as well as the changes of these impacts over time that should be the focus rather than the absolute numbers. Analyses of this type are much better at predicting relative percent differences brought about by a shock to a complex system (i.e., a water shortage) than the precise size of an impact. To illustrate, assuming that the estimated economic impacts of a drought of record on the manufacturing and mining water user categories are $2 and $1 million, respectively, one should be more confident that the economic impacts on manufacturing are twice as large as those on mining and that these impacts will likely be in the millions of dollars. But one should have less confidence that the actual total economic impact experienced would be $3 million.

3 Analysis Results

This section presents a breakdown of the results of the regional analysis for Region L. Projected economic impacts for six water use categories (irrigation, livestock. municipal, manufacturing, mining, and steam-electric power) are also reported by decade.

3.1 Overview of the Regional Economy

Table 3-1 presents the 2011 economic baseline as represented by the IMPLAN model and adjusted to 2013 dollars for Region L. In year 2011, Region L generated about $119 billion in gross state product associated with 1.4 million jobs based on the 2011 IMPLAN data. These values represent an approximation of the current regional economy for a reference point.

Table 3-1 Region L Economy

Income ($ millions)*	Jobs	Taxes on production and imports ($ millions)*
$118,558	**1,421,846**	**$8,686**

[1]*Year 2013 dollars based on 2011 IMPLAN model value added estimates for the region.*

The remainder of Section 3 presents estimates of potential economic impacts for each water use category that could reasonably be expected in the event of water shortages associated with a drought of record and if no recommended water management strategies were implemented.

3.2 Impacts for Irrigation Water Shortages

Eight of the 21 counties in the region are projected to experience water shortages in the irrigated agriculture water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-2. Note that tax collection impacts were not estimated for this water use category. IMPLAN data indicates a negative tax impact (i.e., increased tax collections) for the associated production sectors, primarily due to past subsidies from the federal government. Two factors led to excluding any reported tax impacts: 1) Federal support (subsidies) has lessened greatly since the year 2011 IMPLAN data was collected, and 2) It was not considered realistic to report increasing tax revenue collections for a drought of record.

Table 3-2 Impacts of Water Shortages on Irrigation in Region

Impact Measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$32	$28	$25	$22	$19	$16
Job losses	1,377	1,233	1,091	950	814	701

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.3 Impacts for Livestock Water Shortages

None of the 21 counties in the region are projected to experience water shortages in the livestock water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-3. Note that tax impacts are not reported for this water use category for similar reasons that apply to the irrigation water use category described above.

Table 3-3 Impacts of Water Shortages on Livestock in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	-	-	-	-	-	-
Jobs losses	-	-	-	-	-	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

3.4 Impacts for Municipal Water Shortages

Seventeen of the 21 counties in the region are projected to experience water shortages in the municipal water use category for one or more decades within the planning horizon. Impact estimates were made for the two subtypes of use within municipal use: residential, and non-residential. The latter includes commercial and institutional users. Consumer surplus measures were made for both residential and non-residential demands. In addition, available data for the non-residential, water-intensive portion of municipal demand allowed use of IMPLAN and TWDB Water Use Survey data to estimate income loss, jobs, and taxes. Trucking cost estimates, calculated for shortages exceeding 80 percent, assumed a fixed cost of $20,000 per acre-foot to transport water for municipal use. The estimated impacts to this water use category appear in Table 3-4.

Table 3-4 Impacts of Water Shortages on Municipal Water Users in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses[1] ($ millions)*	$178	$243	$340	$450	$658	$1,600
Job losses[1]	3,225	4,407	6,169	8,163	11,931	28,863
Tax losses on production and imports[1] ($ millions)*	$15	$21	$29	$38	$56	$136
Consumer surplus losses ($ millions)*	$29	$58	$108	$171	$264	$403
Trucking costs ($ millions)*	$0	$0	$0	$1	$1	$3
Utility revenue losses ($ millions)*	$210	$304	$418	$537	$625	$809
Utility tax revenue losses ($ millions)*	$4	$6	$8	$10	$12	$15

[1] Estimates apply to the water-intensive portion of non-residential municipal water use.
**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.5 Impacts of Manufacturing Water Shortages

Manufacturing water shortages in the region are projected to occur in 6 of the 21 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-5.

Table 3-5 Impacts of Water Shortages on Manufacturing in Region

Impacts Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$724	$889	$1,123	$1,367	$1,709	$2,176
Job losses	8,455	10,113	12,091	14,005	16,702	20,267
Tax losses on production and Imports ($ millions)*	$44	$55	$71	$89	$113	$148

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.6 Impacts of Mining Water Shortages

Mining water shortages in the region are projected to occur in 4 of the 21 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use type appear in Table 3-6.

Table 3-6 Impacts of Water Shortages on Mining in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$925	$895	$743	$432	$177	$48
Job losses	5,220	5,055	4,199	2,441	1,002	272
Tax losses on production and Imports ($ millions)*	$114	$110	$92	$53	$22	$6

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.7 Impacts of Steam-Electric Water Shortages

Steam-electric water shortages in the region are projected to occur in 1 of the 21 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-7.

Note that estimated economic impacts to steam-electric water users:

- Are reflected as an income loss proxy in the form of the estimated additional purchasing costs for power from the electrical grid that could not be generated due to a shortage;
- Do not include estimates of impacts on jobs. Because of the unique conditions of power generators during drought conditions and lack of relevant data, it was assumed that the industry would retain, perhaps relocating or repurposing, their existing staff in order to manage their ongoing operations through a severe drought.
- Does not presume a decline in tax collections. Associated tax collections, in fact, would likely increase under drought conditions since, historically, the demand for electricity increases during times of drought, thereby increasing taxes collected on the additional sales of power.

Table 3-7 Impacts of Water Shortages on Steam-Electric Power in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income Losses ($ millions)*	$132	$872	$1,089	$1,570	$2,070	$2,070

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.8 Regional Social Impacts

Projected changes in population, based upon several factors (household size, population, and job loss estimates), as well as the accompanying change in school enrollment, were also estimated and are summarized in Table 3-8.

Table 3-8 Region-wide Social Impacts of Water Shortages in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Consumer surplus losses ($ millions)*	$29	$58	$108	$171	$264	$403
Population losses	3,356	3,821	4,324	4,693	5,591	9,199
School enrollment losses	621	707	800	868	1,034	1,702

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

Appendix A - County Level Summary of Estimated Economic Impacts for Region L

County level summary of estimated economic impacts of not meeting identified water needs by water use category and decade (in 2013 dollars, rounded). Values presented only for counties with projected economic impacts for at least one decade.

**** Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

		Income losses (Million $)*						Job losses						Consumer Surplus losses (Million $)*					
County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
ATASCOSA	MUNICIPAL	-	-	-	$0	$3	$7	-	-	-	2	61	124	$0	$0	$0	$0	$0	$0
ATASCOSA Total		**-**	**-**	**-**	**$0**	**$3**	**$7**	**-**	**-**	**-**	**2**	**61**	**124**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
BEXAR	IRRIGATION	$2	$1	$1	$1	$1	$1	72	61	51	42	34	27	-	-	-	-	-	-
BEXAR	MANUFACTURING	-	-	-	-	-	$6	-	-	-	-	-	60	-	-	-	-	-	-
BEXAR	MUNICIPAL	$23	$34	$44	$56	$68	$476	422	613	799	1,015	1,231	8,631	$15	$34	$68	$107	$158	$216
BEXAR Total		**$25**	**$35**	**$45**	**$57**	**$69**	**$483**	**493**	**674**	**849**	**1,057**	**1,265**	**8,718**	**$15**	**$34**	**$68**	**$107**	**$158**	**$216**
CALDWELL	MUNICIPAL	$0	$0	$0	$1	$4	$36	5	7	8	9	70	658	$0	$0	$0	$1	$2	$5
CALDWELL Total		**$0**	**$0**	**$0**	**$1**	**$4**	**$36**	**5**	**7**	**8**	**9**	**70**	**658**	**$0**	**$0**	**$0**	**$1**	**$2**	**$5**
CALHOUN	IRRIGATION	$4	$3	$3	$3	$3	$2	96	84	76	70	64	59	-	-	-	-	-	-
CALHOUN	MANUFACTURING	-	-	-	-	-	$47	-	-	-	-	-	259	-	-	-	-	-	-
CALHOUN Total		**$4**	**$3**	**$3**	**$3**	**$3**	**$50**	**96**	**84**	**76**	**70**	**64**	**317**	**-**	**-**	**-**	**-**	**-**	**-**
COMAL	MANUFACTURING	$710	$832	$950	$1,052	$1,195	$1,350	8,327	9,757	11,149	12,341	14,017	15,834	-	-	-	-	-	-
COMAL	MUNICIPAL	-	-	-	-	$61	$161	-	-	-	-	1,110	2,914	$1	$4	$10	$20	$32	$49
COMAL Total		**$710**	**$832**	**$950**	**$1,052**	**$1,256**	**$1,510**	**8,327**	**9,757**	**11,149**	**12,341**	**15,127**	**18,748**	**$1**	**$4**	**$10**	**$20**	**$32**	**$49**
DEWITT	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0	-	$0
DEWITT Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**-**	**$0**
DIMMIT	IRRIGATION	$1	$1	$1	$1	$1	$1	33	32	30	28	26	24	-	-	-	-	-	-
DIMMIT	MINING	$413	$420	$363	$234	$105	$44	2,333	2,373	2,052	1,320	591	251	-	-	-	-	-	-
DIMMIT	MUNICIPAL	-	$0	$1	$2	-	-	-	9	19	36	-	-	$0	$0	$0	$0	$0	$0
DIMMIT Total		**$414**	**$421**	**$365**	**$236**	**$105**	**$45**	**2,366**	**2,414**	**2,101**	**1,384**	**616**	**275**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
FRIO	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0
FRIO Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**
GONZALES	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0
GONZALES Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**$0**	**$0**
GUADALUPE	MANUFACTURING	-	-	-	-	$2	$16	-	-	-	-	28	219	-	-	-	-	-	-
GUADALUPE	MUNICIPAL	-	-	$42	$92	$148	$243	-	-	761	1,666	2,687	4,415	$0	$4	$10	$17	$30	$49
GUADALUPE Total		**-**	**-**	**$42**	**$92**	**$150**	**$260**	**-**	**-**	**761**	**1,666**	**2,715**	**4,634**	**$0**	**$4**	**$10**	**$17**	**$30**	**$49**
HAYS	MANUFACTURING	$14	$16	$18	$20	$21	$23	129	146	165	182	198	214	-	-	-	-	-	-

		Income losses (Million $)*						Job losses						Consumer Surplus losses (Million $)*					
County		**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
HAYS	MUNICIPAL	$1	$1	$2	$3	$30	$292	20	27	35	46	542	5,148	$0	$1	$2	$4	$18	$57
HAYS Total		**$15**	**$17**	**$20**	**$22**	**$51**	**$316**	**149**	**173**	**201**	**228**	**740**	**5,363**	**$0**	**$1**	**$2**	**$4**	**$18**	**$57**
KARNES	MINING	$162	$113	$61	$2	-	-	910	631	342	13	-	-	-	-	-	-	-	-
KARNES	MUNICIPAL	$2	$1	-	-	-	-	36	12	-	-	-	-	$0	$0	$0	$0	$0	$0
KARNES Total		**$164**	**$113**	**$61**	**$2**	**-**	**-**	**947**	**643**	**342**	**13**	**-**	**-**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
KENDALL	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$1
KENDALL Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**$0**	**$1**
LA SALLE	MINING	$350	$363	$319	$196	$73	$4	1,977	2,051	1,805	1,107	411	21	-	-	-	-	-	-
LA SALLE	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0	-	-
LA SALLE Total		**$350**	**$363**	**$319**	**$196**	**$73**	**$4**	**1,977**	**2,051**	**1,805**	**1,107**	**411**	**21**	**$0**	**$0**	**$0**	**$0**	**-**	**-**
MEDINA	IRRIGATION	$11	$10	$10	$9	$7	$6	524	485	447	399	346	301	-	-	-	-	-	-
MEDINA	MUNICIPAL	-	-	-	$0	$2	$3	-	-	-	1	29	60	$0	$0	$0	$0	$0	$1
MEDINA Total		**$11**	**$10**	**$10**	**$9**	**$9**	**$10**	**524**	**485**	**447**	**399**	**375**	**361**	**$0**	**$0**	**$0**	**$0**	**$0**	**$1**
UVALDE	IRRIGATION	$9	$8	$7	$6	$5	$4	453	399	344	297	255	221	-	-	-	-	-	-
UVALDE	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0	$0	$0
UVALDE Total		**$9**	**$8**	**$7**	**$6**	**$5**	**$4**	**453**	**399**	**344**	**297**	**255**	**221**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
VICTORIA	IRRIGATION	$1	$1	$1	$1	$1	$1	16	16	16	16	16	16	-	-	-	-	-	-
VICTORIA	MANUFACTURING	-	$42	$155	$296	$491	$734	-	211	776	1,482	2,459	3,680	-	-	-	-	-	-
VICTORIA	MUNICIPAL	$151	$206	$251	$297	$342	$381	2,741	3,741	4,548	5,388	6,201	6,913	$11	$14	$17	$19	$22	$25
VICTORIA	STEAM ELECTRIC POWER	$132	$872	$1,089	$1,570	$2,070	$2,070	-	-	-	-	-	-	-	-	-	-	-	-
VICTORIA Total		**$284**	**$1,121**	**$1,495**	**$2,163**	**$2,903**	**$3,186**	**2,757**	**3,968**	**5,340**	**6,887**	**8,676**	**10,609**	**$11**	**$14**	**$17**	**$19**	**$22**	**$25**
WILSON	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0
WILSON Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**$0**	**$0**	**$0**
ZAVALA	IRRIGATION	$4	$4	$3	$2	$2	$1	182	156	127	99	74	53	-	-	-	-	-	-
ZAVALA Total		**$4**	**$4**	**$3**	**$2**	**$2**	**$1**	**182**	**156**	**127**	**99**	**74**	**53**	**-**	**-**	**-**	**-**	**-**	**-**
Regional Total		**$1,990**	**$2,928**	**$3,320**	**$3,841**	**$4,633**	**$5,911**	**18,277**	**20,809**	**23,550**	**25,559**	**30,450**	**50,102**	**$29**	**$58**	**$108**	**$171**	**$264**	**$403**

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Appendix Q

TWDB Socioeconomic Impact Assessment for Region N Planning

Socioeconomic Impacts of Projected Water Shortages

for the Region N Regional Water Planning Area

Prepared in Support of the 2016 Region N Regional Water Plan

Texas Water
Development Board

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Executive Summary

Evaluating the social and economic impacts of not meeting identified water needs is a required part of the regional water planning process. The Texas Water Development Board (TWDB) estimates those impacts for regional water planning groups, and summarizes the impacts in the state water plan. The analysis presented is for the Region N Regional Water Planning Group.

Based on projected water demands and existing water supplies, the Region N planning group identified water needs (potential shortages) that would occur within its region under a repeat of the drought of record for six water use categories. The TWDB then estimated the socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

The analysis was performed using an economic modeling software package, IMPLAN (Impact for Planning Analysis), as well as other economic analysis techniques, and represents a snapshot of socioeconomic impacts that may occur during a single year during a drought of record within each of the planning decades. For each water use category, the evaluation focused on estimating income losses and job losses. The income losses represent an approximation of gross domestic product (GDP) that would be foregone if water needs are not met.

The analysis also provides estimates of financial transfer impacts, which include tax losses (state, local, and utility tax collections); water trucking costs; and utility revenue losses. In addition, social impacts were estimated, encompassing lost consumer surplus (a welfare economics measure of consumer wellbeing); as well as population and school enrollment losses.

It is estimated that not meeting the identified water needs in Region N would result in an annually combined lost income impact of approximately $4.5 billion in 2020, decreasing to $1.7 billion in 2070 (Table ES-1). In 2020, the region would lose approximately 24,000 jobs, and by 2070 job losses would decrease to approximately 8,400.

All impact estimates are in year 2013 dollars and were calculated using a variety of data sources and tools including the use of a region-specific IMPLAN model, data from the TWDB annual water use estimates, the U.S. Census Bureau, Texas Agricultural Statistics Service, and Texas Municipal League.

Table ES-1: Region N Socioeconomic Impact Summary

Regional Economic Impacts	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$4,492	$5,451	$5,487	$1,790	$872	$1,715
Job losses	24,228	29,394	29,595	9,758	4,635	8,412
Financial Transfer Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Tax losses on production and imports ($ millions)*	$649	$782	$779	$233	$71	$117
Water trucking costs ($ millions)*	-	-	-	-	-	-
Utility revenue losses ($ millions)*	$4	$4	$4	$4	$4	$4
Utility tax revenue losses ($ millions)*	$0	$0	$0	$0	$0	$0
Social Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Consumer surplus losses ($ millions)*	$1	$1	$1	$1	$1	$1
Population losses	4,448	5,397	5,433	1,791	851	1,544
School enrollment losses	823	998	1,005	331	157	286

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

1 Introduction

Water shortages during a repeat of the drought of record would likely curtail or eliminate certain economic activity in businesses and industries that rely heavily on water. Insufficient water supplies could not only have an immediate and real impact on existing businesses and industry, but they could also adversely and chronically affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages could disrupt activity in homes, schools and government and could adversely affect public health and safety. For these reasons, it is important to evaluate and understand how water supply shortages during drought could impact communities throughout the state.

Administrative rules (31 Texas Administrative Code §357.33 (c)) require that regional water planning groups evaluate the social and economic impacts of not meeting water needs as part of the regional water planning process, and rules direct the TWDB staff to provide technical assistance upon request. Staff of the TWDB's Water Use, Projections, & Planning Division designed and conducted this analysis in support of the Region N Regional Water Planning Group.

This document summarizes the results of the analysis and discusses the methodology used to generate the results. Section 1 summarizes the water needs calculation performed by the TWDB based on the regional water planning group's data. Section 2 describes the methodology for the impact assessment and discusses approaches and assumptions specific to each water use category (i.e., irrigation, livestock, mining, steam-electric, municipal and manufacturing). Section 3 presents the results for each water use category with results summarized for the region as a whole. Appendix A presents details on the socioeconomic impacts by county.

1.1 Identified Regional Water Needs (Potential Shortages)

As part of the regional water planning process, the TWDB adopted water demand projections for each water user group (WUG) with input from the planning groups. WUGs are composed of cities, utilities, combined rural areas (designated as county-other), and the county-wide water use of irrigation, livestock, manufacturing, mining and steam-electric power. The demands are then compared to the existing water supplies of each WUG to determine potential shortages, or needs, by decade. Existing water supplies are legally and physically accessible for immediate use in the event of drought. Projected water demands and existing supplies are compared to identify either a surplus or a need for each WUG.

Table 1-1 summarizes the region's identified water needs in the event of a repeat of drought of the record. Demand management, such as conservation, or the development of new infrastructure to increase supplies are water management strategies that may be recommended by the planning group to meet those needs. This analysis assumes that no strategies are implemented, and that the identified needs correspond to future water shortages. Note that projected water needs generally increase over time, primarily due to anticipated population and economic growth. To provide a general sense of proportion, total projected needs as an overall percentage of total demand by water use category are presented in aggregate in Table 1-1. Projected needs for individual water user groups within the aggregate vary greatly, and may reach 100% for a given WUG and water use category. Detailed water needs by WUG and county appear in Chapter 4 of the 2016 Region N Regional Water Plan.

Table 1-1 Regional Water Needs Summary by Water Use Category

Water Use Category		2020	2030	2040	2050	2060	2070
Irrigation	Water Needs (acre-feet per year)	40	42	44	545	2,112	4,242
	% of the category's total water demand	<0.5%	<0.5%	<0.5%	2%	6%	11%
Livestock	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Manufacturing	Water Needs (acre-feet per year)	6,451	8,804	11,126	15,077	26,735	38,132
	% of the category's total water demand	7%	9%	11%	14%	23%	30%
Mining	Water Needs (acre-feet per year)	2,733	3,269	3,219	1,087	315	-
	% of the category's total water demand	31%	33%	33%	15%	5%	0%
Municipal	Water Needs (acre-feet per year)	1,583	1,575	1,567	1,607	1,646	1,683
	% of the category's total water demand	1%	1%	1%	1%	1%	1%
Steam-electric power	Water Needs (acre-feet per year)	-	-	-	-	2,846	6,893
	% of the category's total water demand	-	-	-	-	10%	20%
Total water needs (acre-feet per year)		**10,807**	**13,690**	**15,956**	**18,316**	**33,654**	**50,950**

2 Economic Impact Assessment Methodology Summary

This portion of the report provides a summary of the methodology used to estimate the potential economic impacts of future water shortages. The general approach employed in the analysis was to obtain estimates for income and job losses on the smallest geographic level that the available data would support, tie those values to their accompanying historic water use estimate (volume), and thereby determine a maximum impact per acre-foot of shortage for each of the socioeconomic measures. The calculations of economic impacts were based on the overall composition of the economy using many underlying economic "sectors." Sectors in this analysis refer to one or more of the 440 specific production sectors of the economy designated within IMPLAN (Impact for Planning Analysis), the economic impact modeling software used for this assessment. Economic impacts within this report are

estimated for approximately 310 of those sectors, with the focus on the more water intense production sectors. The economic impacts for a single water use category consist of an aggregation of impacts to multiple related economic sectors.

2.1 Impact Assessment Measures

A required component of the regional and state water plans is to estimate the potential economic impacts of shortages due to a drought of record. Consistent with previous water plans, several key variables were estimated and are described in Table 2-1.

Table 2-1 Socioeconomic Impact Analysis Measures

Regional Economic Impacts	Description
Income losses - value added	The value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry, sector, or group of sectors within a year. For a shortage, value added is a measure of the income losses to the region, county, or WUG and includes the direct, indirect and induced monetary impacts on the region.
Income losses - electrical power purchase costs	Proxy for income loss in the form of additional costs of power as a result of impacts of water shortages.
Job losses	Number of part-time and full-time jobs lost due to the shortage.
Financial Transfer Impacts	**Description**
Tax losses on production and imports	Sales and excise taxes (not collected due to the shortage), customs duties, property taxes, motor vehicle licenses, severance taxes, other taxes, and special assessments less subsidies.
Water trucking costs	Estimate for shipping potable water.
Utility revenue losses	Foregone utility income due to not selling as much water.
Utility tax revenue losses	Foregone miscellaneous gross receipts tax collections.
Social Impacts	**Description**
Consumer surplus losses	A welfare measure of the lost value to consumers accompanying less water use.
Population losses	Population losses accompanying job losses.
School enrollment losses	School enrollment losses (K-12) accompanying job losses.

2.1.1 Regional Economic Impacts

Two key measures were included within the regional economic impacts classification: income losses and job losses. Income losses presented consist of the sum of value added losses and additional purchase costs of electrical power. Job losses are also presented as a primary economic impact measure.

Income Losses - Value Added Losses

Value added is the value of total output less the value of the intermediate inputs also used in production of the final product. Value added is similar to Gross Domestic Product (GDP), a familiar measure of the productivity of an economy. The loss of value added due to water shortages was estimated by input-output analysis using the IMPLAN software package, and includes the direct, indirect, and induced monetary impacts on the region.

Income Losses - Electric Power Purchase Costs

The electrical power grid and market within the state is a complex interconnected system. The industry response to water shortages, and the resulting impact on the region, are not easily modeled using traditional input/output impact analysis and the IMPLAN model. Adverse impacts on the region will occur, and were represented in this analysis by the additional costs associated with power purchases from other generating plants within the region or state. Consequently, the analysis employed additional power purchase costs as a proxy for the value added impacts for that water use category, and these are included as a portion of the overall income impact for completeness.

For the purpose of this analysis, it was assumed that power companies with insufficient water will be forced to purchase power on the electrical market at a projected higher rate of 5.60 cents per kilowatt hour. This rate is based upon the average day-ahead market purchase price of electricity in Texas from the recent drought period in 2011.

Job Losses

The number of jobs lost due to the economic impact was estimated using IMPLAN output associated with the water use categories noted in Table 1-1. Because of the difficulty in predicting outcomes and a lack of relevant data, job loss estimates were not calculated for the steam-electric power production or for certain municipal water use categories.

2.1.2 Financial Transfer Impacts

Several of the impact measures estimated within the analysis are presented as supplemental information, providing additional detail concerning potential impacts on a sub-portion of the economy or government. Measures included in this category include lost tax collections (on production and imports), trucking costs for imported water, declines in utility revenues, and declines in utility tax revenue collected by the state. Many of these measures are not solely adverse, with some having both positive and negative impacts. For example, cities and residents would suffer if forced to pay large costs for trucking in potable water. Trucking firms, conversely, would benefit from the transaction. Additional detail for each of these measures follows.

Tax Losses on Production and Imports

Reduced production of goods and services accompanying water shortages adversely impacts the collection of taxes by state and local government. The regional IMPLAN model was used to estimate reduced tax collections associated with the reduced output in the economy.

Water Trucking Costs

In instances where water shortages for a municipal water user group were estimated to be 80 percent or more of water demands, it was assumed that water would be trucked in to support basic consumption and sanitation needs. For water shortages of 80 percent or greater, a fixed cost of $20,000 per acre-foot of water was calculated and presented as an economic cost. This water trucking cost was applied for both the residential and non-residential portions of municipal water needs and only impacted a small number of WUGs statewide.

Utility Revenue Losses

Lost utility income was calculated as the price of water service multiplied by the quantity of water not sold during a drought shortage. Such estimates resulted from city-specific pricing data for both water and wastewater. These water rates were applied to the potential water shortage to determine estimates of lost utility revenue as water providers sold less water during the drought due to restricted supplies.

Utility Tax Losses

Foregone utility tax losses included estimates of uncollected miscellaneous gross receipts taxes. Reduced water sales reduce the amount of utility tax that would be collected by the State of Texas for water and wastewater service sales.

2.1.3 Social Impacts

Consumer Surplus Losses of Municipal Water Users

Consumer surplus loss is a measure of impact to the wellbeing of municipal water users when their water use is restricted. Consumer surplus is the difference between how much a consumer is willing and able to pay for the commodity (i.e., water) and how much they actually have to pay. The difference is a benefit to the consumer’s wellbeing since they do not have to pay as much for the commodity as they would be willing to pay. However, consumer’s access to that water may be limited, and the associated consumer surplus loss is an estimate of the equivalent monetary value of the negative impact to the consumer’s wellbeing, for example, associated with a diminished quality of their landscape (i.e., outdoor use). Lost consumer surplus estimates for reduced outdoor and indoor use, as well as residential and commercial/institutional demands, were included in this analysis. Consumer surplus is an attempt to measure effects on wellbeing by monetizing those effects; therefore, these values should not be added to the other monetary impacts estimated in the analysis.

Lost consumer surplus estimates varied widely by location and type. For a 50 percent shortage, the estimated statewide consumer surplus values ranged from $55 to $2,500 per household (residential use), and from $270 to $17,400 per firm (non-residential).

Population and School Enrollment Losses

Population losses due to water shortages, as well as the related loss of school enrollment, were based upon the job loss estimates and upon a recent study of job layoffs and the resulting adjustment of the labor market, including the change in population.[1] The study utilized Bureau of Labor Statistics data regarding layoffs between 1996 and 2013, as well as Internal Revenue Service data regarding migration, to model an estimate of the change in the population as the result of a job layoff event. Layoffs impact both out-migration, as well as in-migration into an area, both of which can negatively affect the population of an area. In addition, the study found that a majority of those who did move following a layoff moved to another labor market rather than an adjacent county. Based on this study, a simplified ratio of job and net population losses was calculated for the state as a whole: for every 100 jobs lost, 18 people were assumed to move out of the area. School enrollment losses were estimated as a proportion of the population lost.

2.2 Analysis Context

The context of the economic impact analysis involves situations where there are physical shortages of surface or groundwater due to drought of record conditions. Anticipated shortages may be nonexistent in earlier decades of the planning horizon, yet population growth or greater industrial, agricultural or other sector demands in later decades may result in greater overall demand, exceeding the existing supplies. Estimated socioeconomic impacts measure what would happen if water user groups experience water shortages for a period of one year. Actual socioeconomic impacts would likely become larger as drought of record conditions persist for periods greater than a single year.

2.2.1 IMPLAN Model and Data

Input-Output analysis using the IMPLAN (Impact for Planning Analysis) software package was the primary means of estimating value added, jobs, and taxes. This analysis employed county and regional level models to determine key impacts. IMPLAN is an economic impact model, originally developed by the U.S. Forestry Service in the 1970's to model economic activity at varying geographic levels. The model is currently maintained by the Minnesota IMPLAN Group (MIG Inc.) which collects and sells county and state specific data and software. The year 2011 version of IMPLAN, employing data for all 254 Texas counties, was used to provide estimates of value added, jobs, and taxes on production for the economic sectors associated with the water user groups examined in the study. IMPLAN uses 440 sector-specific Industry Codes, and those that rely on water as a primary input were assigned to their relevant planning water user categories (manufacturing, mining, irrigation, etc.). Estimates of value added for a water use category were obtained by summing value added estimates across the relevant IMPLAN sectors

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[1] Foote, Andrew, Grosz, Michel, Stevens, Ann. "Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response." University of California, Davis. April 2015. http://paa2015.princeton.edu/uploads/150194

associated with that water use category. Similar calculations were performed for the job and tax losses on production and import impact estimates.

Note that the value added estimates, as well as the job and tax estimates from IMPLAN, include three components:

- *Direct effects* representing the initial change in the industry analyzed;
- *Indirect effects* that are changes in inter-industry transactions as supplying industries respond to reduced demands from the directly affected industries; and,
- *Induced effects* that reflect changes in local spending that result from reduced household income among employees in the directly and indirectly affected industry sectors.

2.2.2 Elasticity of Economic Impacts

The economic impact of a water need is based on the relative size of the water need to the water demand for each water user group (Figure 2-1). Smaller water shortages, for example, less than 5 percent, were anticipated to result in no initial negative economic impact because water users are assumed to have a certain amount of flexibility in dealing with small shortages. As a water shortage deepens, however, such flexibility lessens and results in actual and increasing economic losses, eventually reaching a representative maximum impact estimate per unit volume of water. To account for such ability to adjust, an elasticity adjustment function was used in estimating impacts for several of the measures. Figure 2-1 illustrates the general relationship for the adjustment functions. Negative impacts are assumed to begin accruing when the shortage percentage reaches the lower bound b1 (10 percent in Figure 2-1), with impacts then increasing linearly up to the 100 percent impact level (per unit volume) once the upper bound for adjustment reaches the b2 level shortage (50 percent in Figure 2-1 example).

Initially, the combined total value of the three value added components (direct, indirect, and induced) was calculated and then converted into a per acre-foot economic value based on historical TWDB water use estimates within each particular water use category. As an example, if the total, annual value added for livestock in the region was $2 million and the reported annual volume of water used in that industry was 10,000 acre-feet, the estimated economic value per acre-foot of water shortage would be $200 per acre-foot. Negative economic impacts of shortages were then estimated using this value as the maximum impact estimate ($200 per acre-foot in the example) applied to the anticipated shortage volume in acre-feet and adjusted by the economic impact elasticity function. This adjustment varied with the severity as percentage of water demand of the anticipated shortage. If one employed the sample elasticity function shown in Figure 2-1, a 30% shortage in the water use category would imply an economic impact estimate of 50% of the original $200 per acre-foot impact value (i.e., $100 per acre-foot).

Such adjustments were not required in estimating consumer surplus, nor for the estimates of utility revenue losses or utility tax losses. Estimates of lost consumer surplus relied on city-specific demand curves with the specific lost consumer surplus estimate calculated based on the relative percentage of the city's water shortage. Estimated changes in population as well as changes in school enrollment were indirectly related to the elasticity of job losses.

Assumed values for the bounds b1 and b2 varied with water use category under examination and are presented in Table 2-2.

Figure 2-1 Example Economic Impact Elasticity Function (as applied to a single water user's shortage)

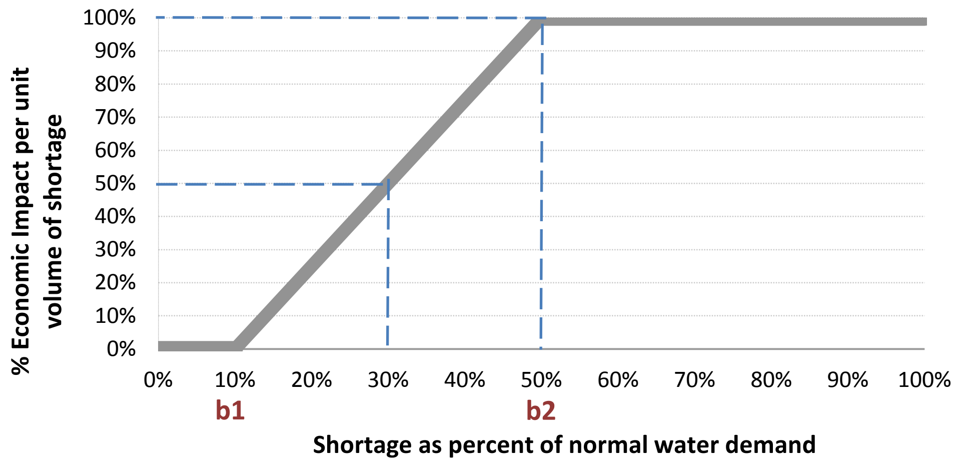

Table 2-2 Economic Impact Elasticity Function Lower and Upper Bounds

Water Use Category	Lower Bound (b1)	Upper Bound (b2)
Irrigation	**5%**	**50%**
Livestock	**5%**	**10%**
Manufacturing	**10%**	**50%**
Mining	**10%**	**50%**
Municipal (non-residential water intensive)	**50%**	**80%**
Steam-electric power	**20%**	**70%**

2.3 Analysis Assumptions and Limitations

Modeling of complex systems requires making assumptions and accepting limitations. This is particularly true when attempting to estimate a wide variety of economic impacts over a large geographic area and into future decades. Some of the key assumptions and limitations of the methodology include:

1. The foundation for estimating socioeconomic impacts of water shortages resulting from a drought are the water needs (potential shortages) that were identified as part of the regional water planning process. These needs have some uncertainty associated with them, but serve as a reasonable basis for evaluating potential economic impacts of a drought of record event.

2. All estimated socioeconomic impacts are snapshot estimates of impacts for years in which water needs were identified (i.e., 2020, 2030, 2040, 2050, 2060, and 2070). The estimates are independent and distinct "what if" scenarios for each particular year, and water shortages are assumed to be temporary events resulting from severe drought conditions. The evaluation assumed that no recommended water management strategies are implemented. In other words, growth occurs, future shocks are imposed on an economy at 10-year intervals, and the resulting impacts are estimated. Note that the estimates presented were not cumulative (i.e., summing up expected impacts from today up to the decade noted), but were simply an estimate of the magnitude of annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated supplies and demands for that same decade.

3. Input-output models such as IMPLAN rely on a static profile of the structure of the economy as it appears today. This presumes that the relative contributions of all sectors of the economy would remain the same, regardless of changes in technology, supplies of limited resources, and other structural changes to the economy that may occur into the future. This was a significant assumption and simplification considering the 50-year time period examined in this analysis. To presume an alternative future economic makeup, however, would entail positing many other major assumptions that would very likely generate as much or more error.

4. This analysis is not a cost-benefit analysis. That approach to evaluating the economic feasibility of a specific policy or project employs discounting future benefits and costs to their present value dollars using some assumed discount rate. The methodology employed in this effort to estimate the economic impacts of future water shortages did not use any discounting procedures to weigh future costs differently through time.

5. Monetary figures are reported in constant year 2013 dollars.

6. Impacts are annual estimates. The estimated economic model does not reflect the full extent of impacts that might occur as a result of persistent water shortages occurring over an extended duration. The drought of record in most regions of Texas lasted several years.

7. Value added estimates are the primary estimate of the economic impacts within this report. One may be tempted to add consumer surplus impacts to obtain an estimate of total adverse economic impacts to the region, but the consumer surplus measure represents the change to the wellbeing of households (and other water users), not an actual change in the flow of dollars through the economy. The two categories (value added and consumer surplus) are both valid impacts but should not be summed.

8. The value added, jobs, and taxes on production and import impacts include the direct, indirect and induced effects described in Section 2.2.1. Population and school enrollment losses also indirectly include such effects as they are based on the associated losses in employment. The remaining measures (consumer surplus, utility revenue, utility taxes, additional electrical power purchase costs, and potable water trucking costs), however, do not include any induced or indirect effects.

9. The majority of impacts estimated in this analysis may be considered smaller than those that might occur under drought of record conditions. Input-output models such as IMPLAN only capture "backward linkages" on suppliers (including households that supply labor to directly affected industries). While this is a common limitation in these types of economic impact modeling efforts, it is important to note that "forward linkages" on the industries that use the outputs of the directly affected industries can also be very important. A good example is impacts on livestock operators. Livestock producers tend to suffer substantially during droughts, not because there is not enough water for their stock, but because reductions in available pasture and higher prices for purchased hay have significant economic effects on their operations. Food processors could be in a similar situation if they cannot get the grains or other inputs that they need. These effects are not captured in IMPLAN, which is one reason why the impact estimates are likely conservative.

10. The methodology did not capture "spillover" effects between regions – or the secondary impacts that occur outside of the region where the water shortage is projected to occur.

11. The model did not reflect dynamic economic responses to water shortages as they might occur, nor does the model reflect economic impacts associated with a recovery from a drought of record including:
    a. The likely significant economic rebound to the landscaping industry immediately following a drought;
    b. The cost and years to rebuild liquidated livestock herds (a major capital item in that industry);
    c. Direct impacts on recreational sectors (i.e., stranded docks and reduced tourism); or,
    d. Impacts of negative publicity on Texas' ability to attract population and business in the event that it was not able to provide adequate water supplies for the existing economy.

12. Estimates for job losses and the associated population and school enrollment changes may exceed what would actually occur. In practice, firms may be hesitant to lay off employees, even in difficult economic times. Estimates of population and school enrollment changes are based on regional evaluations and therefore do not accurately reflect what might occur on a statewide basis.

13. The results must be interpreted carefully. It is the general and relative magnitudes of impacts as well as the changes of these impacts over time that should be the focus rather than the absolute numbers. Analyses of this type are much better at predicting relative percent differences brought about by a shock to a complex system (i.e., a water shortage) than the precise size of an impact. To illustrate, assuming that the estimated economic impacts of a drought of record on the manufacturing and mining water user categories are \$2 and \$1 million, respectively, one should be more confident that the economic impacts on manufacturing are twice as large as those on mining and that these impacts will likely be in the millions of dollars. But one should have less confidence that the actual total economic impact experienced would be \$3 million.

3 Analysis Results

This section presents a breakdown of the results of the regional analysis for Region N. Projected economic impacts for six water use categories (irrigation, livestock. municipal, manufacturing, mining, and steam-electric power) are also reported by decade.

3.1 Overview of the Regional Economy

Table 3-1 presents the 2011 economic baseline as represented by the IMPLAN model and adjusted to 2013 dollars for Region N. In year 2011, Region N generated about $31.7 billion in gross state product associated with 302,400 jobs based on the 2011 IMPLAN data. These values represent an approximation of the current regional economy for a reference point.

Table 3-1 Region N Economy

Income ($ millions)*	Jobs	Taxes on production and imports ($ millions)*
$31,703	**302,438**	**$2,429**

[1]*Year 2013 dollars based on 2011 IMPLAN model value added estimates for the region.*

The remainder of Section 3 presents estimates of potential economic impacts for each water use category that could reasonably be expected in the event of water shortages associated with a drought of record and if no recommended water management strategies were implemented.

3.2 Impacts for Irrigation Water Shortages

Two of the 11 counties in the region are projected to experience water shortages in the irrigated agriculture water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-2. Note that tax collection impacts were not estimated for this water use category. IMPLAN data indicates a negative tax impact (i.e., increased tax collections) for the associated production sectors, primarily due to past subsidies from the federal government. Two factors led to excluding any reported tax impacts: 1) Federal support (subsidies) has lessened greatly since the year 2011 IMPLAN data was collected, and 2) It was not considered realistic to report increasing tax revenue collections for a drought of record.

Table 3-2 Impacts of Water Shortages on Irrigation in Region

Impact Measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$0	$0	$0	$0	$0	$1
Job losses	1	1	1	1	8	36

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.3 Impacts for Livestock Water Shortages

None of the 11 counties in the region are projected to experience water shortages in the livestock water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-3. Note that tax impacts are not reported for this water use category for similar reasons that apply to the irrigation water use category described above.

Table 3-3 Impacts of Water Shortages on Livestock in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	-	-	-	-	-	-
Jobs losses	-	-	-	-	-	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

3.4 Impacts for Municipal Water Shortages

Three of the 11 counties in the region are projected to experience water shortages in the municipal water use category for one or more decades within the planning horizon. Impact estimates were made for the two subtypes of use within municipal use: residential, and non-residential. The latter includes commercial and institutional users. Consumer surplus measures were made for both residential and non-residential demands. In addition, available data for the non-residential, water-intensive portion of municipal demand allowed use of IMPLAN and TWDB Water Use Survey data to estimate income loss, jobs, and taxes. Trucking cost estimates, calculated for shortages exceeding 80 percent, assumed a fixed cost of $20,000 per acre-foot to transport water for municipal use. The estimated impacts to this water use category appear in Table 3-4.

Table 3-4 Impacts of Water Shortages on Municipal Water Users in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses[1] ($ millions)*	$6	$6	$5	$5	$6	$6
Job losses[1]	120	112	99	104	113	121
Tax losses on production and imports[1] ($ millions)*	$1	$1	$0	$0	$1	$1
Consumer surplus losses ($ millions)*	$1	$1	$1	$1	$1	$1
Trucking costs ($ millions)*	-	-	-	-	-	-
Utility revenue losses ($ millions)*	$4	$4	$4	$4	$4	$4
Utility tax revenue losses ($ millions)*	$0	$0	$0	$0	$0	$0

[1] Estimates apply to the water-intensive portion of non-residential municipal water use.
**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.5 Impacts of Manufacturing Water Shortages

Manufacturing water shortages in the region are projected to occur in 2 of the 11 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-5.

Table 3-5 Impacts of Water Shortages on Manufacturing in Region

Impacts Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$74	$169	$286	$405	$776	$1,708
Job losses	410	935	1,583	2,241	4,034	8,256
Tax losses on production and Imports ($ millions)*	$6	$13	$23	$32	$57	$117

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.6 Impacts of Mining Water Shortages

Mining water shortages in the region are projected to occur in 1 of the 11 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use type appear in Table 3-6.

Table 3-6 Impacts of Water Shortages on Mining in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$4,411	$5,276	$5,196	$1,380	$89	-
Job losses	23,698	28,345	27,912	7,412	480	-
Tax losses on production and Imports ($ millions)*	$642	$768	$756	$201	$13	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.7 Impacts of Steam-Electric Water Shortages

Steam-electric water shortages in the region are projected to occur in 1 of the 11 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-7.

Note that estimated economic impacts to steam-electric water users:

- Are reflected as an income loss proxy in the form of the estimated additional purchasing costs for power from the electrical grid that could not be generated due to a shortage;
- Do not include estimates of impacts on jobs. Because of the unique conditions of power generators during drought conditions and lack of relevant data, it was assumed that the industry would retain, perhaps relocating or repurposing, their existing staff in order to manage their ongoing operations through a severe drought.
- Does not presume a decline in tax collections. Associated tax collections, in fact, would likely increase under drought conditions since, historically, the demand for electricity increases during times of drought, thereby increasing taxes collected on the additional sales of power.

Table 3-7 Impacts of Water Shortages on Steam-Electric Power in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income Losses ($ millions)*	-	-	-	-	-	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.8 Regional Social Impacts

Projected changes in population, based upon several factors (household size, population, and job loss estimates), as well as the accompanying change in school enrollment, were also estimated and are summarized in Table 3-8.

Table 3-8 Region-wide Social Impacts of Water Shortages in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Consumer surplus losses ($ millions)*	$1	$1	$1	$1	$1	$1
Population losses	4,448	5,397	5,433	1,791	851	1,544
School enrollment losses	823	998	1,005	331	157	286

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

Appendix A - County Level Summary of Estimated Economic Impacts for Region N

County level summary of estimated economic impacts of not meeting identified water needs by water use category and decade (in 2013 dollars, rounded). Values presented only for counties with projected economic impacts for at least one decade.

**** Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

		Income losses (Million $)*						Job losses						Consumer Surplus (Million $)*					
County	Water Use Category	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
DUVAL	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0	$0
DUVAL Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**$0**	**$0**	**$0**	**$0**
JIM WELLS	MUNICIPAL	-	-	-	-	-	-	-	-	-	-	-	-	-	$0	$0	$0	$0	$0
JIM WELLS Total		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**$0**	**$0**	**$0**	**$0**	**$0**
MCMULLEN	IRRIGATION	$0	$0	$0	$0	$0	$0	-	-	-	-	-	-	-	-	-	-	-	-
MCMULLEN	MINING	$4,411	$5,276	$5,196	$1,380	$89	-	23,698	28,345	27,912	7,412	480	-	-	-	-	-	-	-
MCMULLEN Total		**$4,411**	**$5,276**	**$5,196**	**$1,380**	**$89**	**-**	**23,699**	**28,346**	**27,913**	**7,413**	**481**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
NUECES	MANUFACTURING	-	-	-	-	$204	$940	-	-	-	-	871	4,006	-	-	-	-	-	-
NUECES	MUNICIPAL	$6	$6	$5	$5	$6	$6	120	112	99	104	113	121	$1	$1	$1	$1	$1	$1
NUECES Total		**$6**	**$6**	**$5**	**$5**	**$210**	**$946**	**120**	**112**	**99**	**104**	**983**	**4,127**	**$1**	**$1**	**$1**	**$1**	**$1**	**$1**
SAN PATRICIO	IRRIGATION	-	-	-	-	$0	$1	-	-	-	-	7	35	-	-	-	-	-	-
SAN PATRICIO	MANUFACTURING	$74	$169	$286	$405	$572	$768	410	935	1,583	2,241	3,163	4,249	-	-	-	-	-	-
SAN PATRICIO Total		**$74**	**$169**	**$286**	**$405**	**$572**	**$770**	**410**	**935**	**1,583**	**2,241**	**3,171**	**4,284**	**-**	**-**	**-**	**-**	**-**	**-**
Regional Total		**$4,492**	**$5,451**	**$5,487**	**$1,790**	**$872**	**$1,715**	**24,228**	**29,394**	**29,595**	**9,758**	**4,635**	**8,412**	**$1**	**$1**	**$1**	**$1**	**$1**	**$1**

Appendix R

TWDB Socioeconomic Impact Assessment for Region P Planning

Socioeconomic Impacts of Projected Water Shortages

for the Region P Regional Water Planning Area

Prepared in Support of the 2016 Region P Regional Water Plan

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Executive Summary

Evaluating the social and economic impacts of not meeting identified water needs is a required part of the regional water planning process. The Texas Water Development Board (TWDB) estimates those impacts for regional water planning groups, and summarizes the impacts in the state water plan. The analysis presented is for the Region P Regional Water Planning Group.

Based on projected water demands and existing water supplies, the Region P planning group identified water needs (potential shortages) that would occur within its region under a repeat of the drought of record for six water use categories. The TWDB then estimated the socioeconomic impacts of those needs—if they are not met—for each water use category and as an aggregate for the region.

The analysis was performed using an economic modeling software package, IMPLAN (Impact for Planning Analysis), as well as other economic analysis techniques, and represents a snapshot of socioeconomic impacts that may occur during a single year during a drought of record within each of the planning decades. For each water use category, the evaluation focused on estimating income losses and job losses. The income losses represent an approximation of gross domestic product (GDP) that would be foregone if water needs are not met.

The analysis also provides estimates of financial transfer impacts, which include tax losses (state, local, and utility tax collections); water trucking costs; and utility revenue losses. In addition, social impacts were estimated, encompassing lost consumer surplus (a welfare economics measure of consumer wellbeing); as well as population and school enrollment losses.

It is estimated that not meeting the identified water needs in Region P would result in an annually combined lost income impact of approximately $9 million (Table ES-1). In 2020, the region would lose approximately 240 jobs.

All impact estimates are in year 2013 dollars and were calculated using a variety of data sources and tools including the use of a region-specific IMPLAN model, data from the TWDB annual water use estimates, the U.S. Census Bureau, Texas Agricultural Statistics Service, and Texas Municipal League.

Table ES-1: Region P Socioeconomic Impact Summary

Regional Economic Impacts	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$9	$9	$9	$9	$9	$9
Job losses	236	236	236	236	236	236
Financial Transfer Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Tax losses on production and imports ($ millions)*	-	-	-	-	-	-
Water trucking costs ($ millions)*	-	-	-	-	-	-
Utility revenue losses ($ millions)*	-	-	-	-	-	-
Utility tax revenue losses ($ millions)*	-	-	-	-	-	-
Social Impacts	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Consumer surplus losses ($ millions)*	-	-	-	-	-	-
Population losses	43	43	43	43	43	43
School enrollment losses	8	8	8	8	8	8

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

1 Introduction

Water shortages during a repeat of the drought of record would likely curtail or eliminate certain economic activity in businesses and industries that rely heavily on water. Insufficient water supplies could not only have an immediate and real impact on existing businesses and industry, but they could also adversely and chronically affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages could disrupt activity in homes, schools and government and could adversely affect public health and safety. For these reasons, it is important to evaluate and understand how water supply shortages during drought could impact communities throughout the state.

Administrative rules (31 Texas Administrative Code §357.33 (c)) require that regional water planning groups evaluate the social and economic impacts of not meeting water needs as part of the regional water planning process, and rules direct the TWDB staff to provide technical assistance upon request. Staff of the TWDB's Water Use, Projections, & Planning Division designed and conducted this analysis in support of the Region P Regional Water Planning Group.

This document summarizes the results of the analysis and discusses the methodology used to generate the results. Section 1 summarizes the water needs calculation performed by the TWDB based on the regional water planning group's data. Section 2 describes the methodology for the impact assessment and discusses approaches and assumptions specific to each water use category (i.e., irrigation, livestock, mining, steam-electric, municipal and manufacturing). Section 3 presents the results for each water use category with results summarized for the region as a whole. Appendix A presents details on the socioeconomic impacts by county.

1.1 Identified Regional Water Needs (Potential Shortages)

As part of the regional water planning process, the TWDB adopted water demand projections for each water user group (WUG) with input from the planning groups. WUGs are composed of cities, utilities, combined rural areas (designated as county-other), and the county-wide water use of irrigation, livestock, manufacturing, mining and steam-electric power. The demands are then compared to the existing water supplies of each WUG to determine potential shortages, or needs, by decade. Existing water supplies are legally and physically accessible for immediate use in the event of drought. Projected water demands and existing supplies are compared to identify either a surplus or a need for each WUG.

Table 1-1 summarizes the region's identified water needs in the event of a repeat of the drought of record. Demand management, such as conservation, or the development of new infrastructure to increase supplies are water management strategies that may be recommended by the planning group to meet those needs. This analysis assumes that no strategies are implemented, and that the identified needs correspond to future water shortages. Note that projected water needs generally increase over time, primarily due to anticipated population and economic growth. To provide a general sense of proportion, total projected needs as an overall percentage of total demand by water use category are presented in aggregate in Table 1-1. Projected needs for individual water user groups within the aggregate vary greatly, and may reach 100% for a given WUG and water use category. Detailed water needs by WUG and county appear in Chapter 4 of the 2016 Region P Regional Water Plan.

Table 1-1 Regional Water Needs Summary by Water Use Category

Water Use Category		2020	2030	2040	2050	2060	2070
Irrigation	Water Needs (acre-feet per year)	50,285	50,285	50,285	50,285	50,285	50,285
	% of the category's total water demand	23%	23%	23%	23%	23%	23%
Livestock	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Manufacturing	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Mining	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Municipal	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Steam-electric power	Water Needs (acre-feet per year)	-	-	-	-	-	-
	% of the category's total water demand	-	-	-	-	-	-
Total water needs		**50,285**	**50,285**	**50,285**	**50,285**	**50,285**	**50,285**

2 Economic Impact Assessment Methodology Summary

This portion of the report provides a summary of the methodology used to estimate the potential economic impacts of future water shortages. The general approach employed in the analysis was to obtain estimates for income and job losses on the smallest geographic level that the available data would support, tie those values to their accompanying historic water use estimate (volume), and thereby determine a maximum impact per acre-foot of shortage for each of the socioeconomic measures. The calculations of economic impacts were based on the overall composition of the economy using many underlying economic "sectors." Sectors in this analysis refer to one or more of the 440 specific production sectors of the economy designated within IMPLAN (Impact for Planning Analysis), the economic impact modeling software used for this assessment. Economic impacts within this report are

estimated for approximately 310 of those sectors, with the focus on the more water intense production sectors. The economic impacts for a single water use category consist of an aggregation of impacts to multiple related economic sectors.

2.1 Impact Assessment Measures

A required component of the regional and state water plans is to estimate the potential economic impacts of shortages due to a drought of record. Consistent with previous water plans, several key variables were estimated and are described in Table 2-1.

Table 2-1 Socioeconomic Impact Analysis Measures

Regional Economic Impacts	Description
Income losses - value added	The value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry, sector, or group of sectors within a year. For a shortage, value added is a measure of the income losses to the region, county, or WUG and includes the direct, indirect and induced monetary impacts on the region.
Income losses - electrical power purchase costs	Proxy for income loss in the form of additional costs of power as a result of impacts of water shortages.
Job losses	Number of part-time and full-time jobs lost due to the shortage.
Financial Transfer Impacts	**Description**
Tax losses on production and imports	Sales and excise taxes (not collected due to the shortage), customs duties, property taxes, motor vehicle licenses, severance taxes, other taxes, and special assessments less subsidies.
Water trucking costs	Estimate for shipping potable water.
Utility revenue losses	Foregone utility income due to not selling as much water.
Utility tax revenue losses	Foregone miscellaneous gross receipts tax collections.
Social Impacts	**Description**
Consumer surplus losses	A welfare measure of the lost value to consumers accompanying less water use.
Population losses	Population losses accompanying job losses.
School enrollment losses	School enrollment losses (K-12) accompanying job losses.

2.1.1 Regional Economic Impacts

Two key measures were included within the regional economic impacts classification: income losses and job losses. Income losses presented consist of the sum of value added losses and additional purchase costs of electrical power. Job losses are also presented as a primary economic impact measure.

Income Losses - Value Added Losses

Value added is the value of total output less the value of the intermediate inputs also used in production of the final product. Value added is similar to Gross Domestic Product (GDP), a familiar measure of the productivity of an economy. The loss of value added due to water shortages was estimated by input-output analysis using the IMPLAN software package, and includes the direct, indirect, and induced monetary impacts on the region.

Income Losses - Electric Power Purchase Costs

The electrical power grid and market within the state is a complex interconnected system. The industry response to water shortages, and the resulting impact on the region, are not easily modeled using traditional input/output impact analysis and the IMPLAN model. Adverse impacts on the region will occur, and were represented in this analysis by the additional costs associated with power purchases from other generating plants within the region or state. Consequently, the analysis employed additional power purchase costs as a proxy for the value added impacts for that water use category, and these are included as a portion of the overall income impact for completeness.

For the purpose of this analysis, it was assumed that power companies with insufficient water will be forced to purchase power on the electrical market at a projected higher rate of 5.60 cents per kilowatt hour. This rate is based upon the average day-ahead market purchase price of electricity in Texas from the recent drought period in 2011.

Job Losses

The number of jobs lost due to the economic impact was estimated using IMPLAN output associated with the water use categories noted in Table 1-1. Because of the difficulty in predicting outcomes and a lack of relevant data, job loss estimates were not calculated for the steam-electric power production or for certain municipal water use categories.

2.1.2 Financial Transfer Impacts

Several of the impact measures estimated within the analysis are presented as supplemental information, providing additional detail concerning potential impacts on a sub-portion of the economy or government. Measures included in this category include lost tax collections (on production and imports), trucking costs for imported water, declines in utility revenues, and declines in utility tax revenue collected by the state. Many of these measures are not solely adverse, with some having both positive and negative impacts. For example, cities and residents would suffer if forced to pay large costs for trucking in potable water. Trucking firms, conversely, would benefit from the transaction. Additional detail for each of these measures follows.

Tax Losses on Production and Imports

Reduced production of goods and services accompanying water shortages adversely impacts the collection of taxes by state and local government. The regional IMPLAN model was used to estimate reduced tax collections associated with the reduced output in the economy.

Water Trucking Costs

In instances where water shortages for a municipal water user group were estimated to be 80 percent or more of water demands, it was assumed that water would be trucked in to support basic consumption and sanitation needs. For water shortages of 80 percent or greater, a fixed cost of $20,000 per acre-foot of water was calculated and presented as an economic cost. This water trucking cost was applied for both the residential and non-residential portions of municipal water needs and only impacted a small number of WUGs statewide.

Utility Revenue Losses

Lost utility income was calculated as the price of water service multiplied by the quantity of water not sold during a drought shortage. Such estimates resulted from city-specific pricing data for both water and wastewater. These water rates were applied to the potential water shortage to determine estimates of lost utility revenue as water providers sold less water during the drought due to restricted supplies.

Utility Tax Losses

Foregone utility tax losses included estimates of uncollected miscellaneous gross receipts taxes. Reduced water sales reduce the amount of utility tax that would be collected by the State of Texas for water and wastewater service sales.

2.1.3 Social Impacts

Consumer Surplus Losses of Municipal Water Users

Consumer surplus loss is a measure of impact to the wellbeing of municipal water users when their water use is restricted. Consumer surplus is the difference between how much a consumer is willing and able to pay for the commodity (i.e., water) and how much they actually have to pay. The difference is a benefit to the consumer’s wellbeing since they do not have to pay as much for the commodity as they would be willing to pay. However, consumer’s access to that water may be limited, and the associated consumer surplus loss is an estimate of the equivalent monetary value of the negative impact to the consumer’s wellbeing, for example, associated with a diminished quality of their landscape (i.e., outdoor use). Lost consumer surplus estimates for reduced outdoor and indoor use, as well as residential and commercial/institutional demands, were included in this analysis. Consumer surplus is an attempt to measure effects on wellbeing by monetizing those effects; therefore, these values should not be added to the other monetary impacts estimated in the analysis.

Lost consumer surplus estimates varied widely by location and type. For a 50 percent shortage, the estimated statewide consumer surplus values ranged from $55 to $2,500 per household (residential use), and from $270 to $17,400 per firm (non-residential).

Population and School Enrollment Losses

Population losses due to water shortages, as well as the related loss of school enrollment, were based upon the job loss estimates and upon a recent study of job layoffs and the resulting adjustment of the labor market, including the change in population.[1] The study utilized Bureau of Labor Statistics data regarding layoffs between 1996 and 2013, as well as Internal Revenue Service data regarding migration, to model an estimate of the change in the population as the result of a job layoff event. Layoffs impact both out-migration, as well as in-migration into an area, both of which can negatively affect the population of an area. In addition, the study found that a majority of those who did move following a layoff moved to another labor market rather than an adjacent county. Based on this study, a simplified ratio of job and net population losses was calculated for the state as a whole: for every 100 jobs lost, 18 people were assumed to move out of the area. School enrollment losses were estimated as a proportion of the population lost.

2.2 Analysis Context

The context of the economic impact analysis involves situations where there are physical shortages of surface or groundwater due to drought of record conditions. Anticipated shortages may be nonexistent in earlier decades of the planning horizon, yet population growth or greater industrial, agricultural or other sector demands in later decades may result in greater overall demand, exceeding the existing supplies. Estimated socioeconomic impacts measure what would happen if water user groups experience water shortages for a period of one year. Actual socioeconomic impacts would likely become larger as drought of record conditions persist for periods greater than a single year.

2.2.1 IMPLAN Model and Data

Input-Output analysis using the IMPLAN (Impact for Planning Analysis) software package was the primary means of estimating value added, jobs, and taxes. This analysis employed county and regional level models to determine key impacts. IMPLAN is an economic impact model, originally developed by the U.S. Forestry Service in the 1970's to model economic activity at varying geographic levels. The model is currently maintained by the Minnesota IMPLAN Group (MIG Inc.) which collects and sells county and state specific data and software. The year 2011 version of IMPLAN, employing data for all 254 Texas counties, was used to provide estimates of value added, jobs, and taxes on production for the economic sectors associated with the water user groups examined in the study. IMPLAN uses 440 sector-specific Industry Codes, and those that rely on water as a primary input were assigned to their relevant planning water user categories (manufacturing, mining, irrigation, etc.). Estimates of value added for a water use category were obtained by summing value added estimates across the relevant IMPLAN sectors

[1] Foote, Andrew, Grosz, Michel, Stevens, Ann. "Locate Your Nearest Exit: Mass Layoffs and Local Labor Market Response." University of California, Davis. April 2015. http://paa2015.princeton.edu/uploads/150194

associated with that water use category. Similar calculations were performed for the job and tax losses on production and import impact estimates.

Note that the value added estimates, as well as the job and tax estimates from IMPLAN, include three components:

- *Direct effects* representing the initial change in the industry analyzed;
- *Indirect effects* that are changes in inter-industry transactions as supplying industries respond to reduced demands from the directly affected industries; and,
- *Induced effects* that reflect changes in local spending that result from reduced household income among employees in the directly and indirectly affected industry sectors.

2.2.2 Elasticity of Economic Impacts

The economic impact of a water need is based on the relative size of the water need to the water demand for each water user group (Figure 2-1). Smaller water shortages, for example, less than 5 percent, were anticipated to result in no initial negative economic impact because water users are assumed to have a certain amount of flexibility in dealing with small shortages. As a water shortage deepens, however, such flexibility lessens and results in actual and increasing economic losses, eventually reaching a representative maximum impact estimate per unit volume of water. To account for such ability to adjust, an elasticity adjustment function was used in estimating impacts for several of the measures. Figure 2-1 illustrates the general relationship for the adjustment functions. Negative impacts are assumed to begin accruing when the shortage percentage reaches the lower bound b1 (10 percent in Figure 2-1), with impacts then increasing linearly up to the 100 percent impact level (per unit volume) once the upper bound for adjustment reaches the b2 level shortage (50 percent in Figure 2-1 example).

Initially, the combined total value of the three value added components (direct, indirect, and induced) was calculated and then converted into a per acre-foot economic value based on historical TWDB water use estimates within each particular water use category. As an example, if the total, annual value added for livestock in the region was $2 million and the reported annual volume of water used in that industry was 10,000 acre-feet, the estimated economic value per acre-foot of water shortage would be $200 per acre-foot. Negative economic impacts of shortages were then estimated using this value as the maximum impact estimate ($200 per acre-foot in the example) applied to the anticipated shortage volume in acre-feet and adjusted by the economic impact elasticity function. This adjustment varied with the severity as percentage of water demand of the anticipated shortage. If one employed the sample elasticity function shown in Figure 2-1, a 30% shortage in the water use category would imply an economic impact estimate of 50% of the original $200 per acre-foot impact value (i.e., $100 per acre-foot).

Such adjustments were not required in estimating consumer surplus, nor for the estimates of utility revenue losses or utility tax losses. Estimates of lost consumer surplus relied on city-specific demand curves with the specific lost consumer surplus estimate calculated based on the relative percentage of the city's water shortage. Estimated changes in population as well as changes in school enrollment were indirectly related to the elasticity of job losses.

Assumed values for the bounds b1 and b2 varied with water use category under examination and are presented in Table 2-2.

Figure 2-1 Example Economic Impact Elasticity Function (as applied to a single water user's shortage)

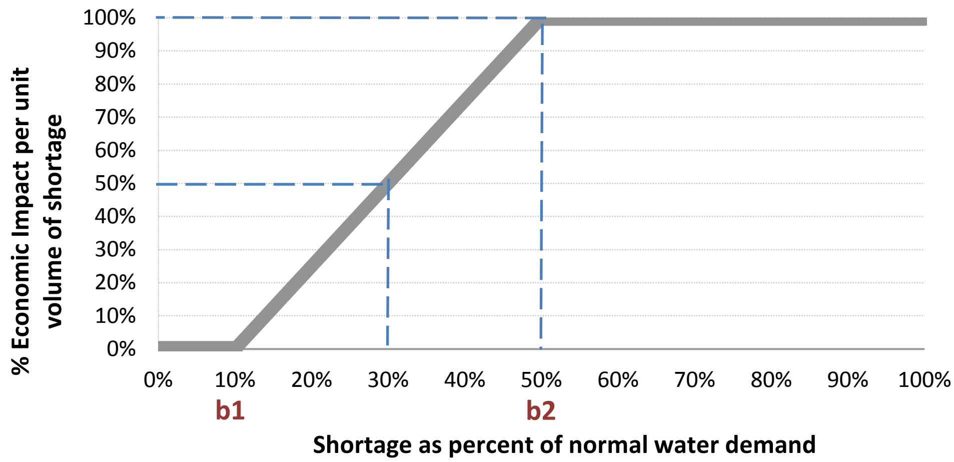

Table 2-2 Economic Impact Elasticity Function Lower and Upper Bounds

Water Use Category	Lower Bound (b1)	Upper Bound (b2)
Irrigation	**5%**	**50%**
Livestock	**5%**	**10%**
Manufacturing	**10%**	**50%**
Mining	**10%**	**50%**
Municipal (non-residential water intensive)	**50%**	**80%**
Steam-electric power	**20%**	**70%**

2.3 Analysis Assumptions and Limitations

Modeling of complex systems requires making assumptions and accepting limitations. This is particularly true when attempting to estimate a wide variety of economic impacts over a large geographic area and into future decades. Some of the key assumptions and limitations of the methodology include:

1. The foundation for estimating socioeconomic impacts of water shortages resulting from a drought are the water needs (potential shortages) that were identified as part of the regional water planning process. These needs have some uncertainty associated with them, but serve as a reasonable basis for evaluating potential economic impacts of a drought of record event.

2. All estimated socioeconomic impacts are snapshot estimates of impacts for years in which water needs were identified (i.e., 2020, 2030, 2040, 2050, 2060, and 2070). The estimates are independent and distinct "what if" scenarios for each particular year, and water shortages are assumed to be temporary events resulting from severe drought conditions. The evaluation assumed that no recommended water management strategies are implemented. In other words, growth occurs, future shocks are imposed on an economy at 10-year intervals, and the resulting impacts are estimated. Note that the estimates presented were not cumulative (i.e., summing up expected impacts from today up to the decade noted), but were simply an estimate of the magnitude of annual socioeconomic impacts should a drought of record occur in each particular decade based on anticipated supplies and demands for that same decade.

3. Input-output models such as IMPLAN rely on a static profile of the structure of the economy as it appears today. This presumes that the relative contributions of all sectors of the economy would remain the same, regardless of changes in technology, supplies of limited resources, and other structural changes to the economy that may occur into the future. This was a significant assumption and simplification considering the 50-year time period examined in this analysis. To presume an alternative future economic makeup, however, would entail positing many other major assumptions that would very likely generate as much or more error.

4. This analysis is not a cost-benefit analysis. That approach to evaluating the economic feasibility of a specific policy or project employs discounting future benefits and costs to their present value dollars using some assumed discount rate. The methodology employed in this effort to estimate the economic impacts of future water shortages did not use any discounting procedures to weigh future costs differently through time.

5. Monetary figures are reported in constant year 2013 dollars.

6. Impacts are annual estimates. The estimated economic model does not reflect the full extent of impacts that might occur as a result of persistent water shortages occurring over an extended duration. The drought of record in most regions of Texas lasted several years.

7. Value added estimates are the primary estimate of the economic impacts within this report. One may be tempted to add consumer surplus impacts to obtain an estimate of total adverse economic impacts to the region, but the consumer surplus measure represents the change to the wellbeing of households (and other water users), not an actual change in the flow of dollars through the economy. The two categories (value added and consumer surplus) are both valid impacts but should not be summed.

8. The value added, jobs, and taxes on production and import impacts include the direct, indirect and induced effects described in Section 2.2.1. Population and school enrollment losses also indirectly include such effects as they are based on the associated losses in employment. The remaining measures (consumer surplus, utility revenue, utility taxes, additional electrical power purchase costs, and potable water trucking costs), however, do not include any induced or indirect effects.

9. The majority of impacts estimated in this analysis may be considered smaller than those that might occur under drought of record conditions. Input-output models such as IMPLAN only capture "backward linkages" on suppliers (including households that supply labor to directly affected industries). While this is a common limitation in these types of economic impact modeling efforts, it is important to note that "forward linkages" on the industries that use the outputs of the directly affected industries can also be very important. A good example is impacts on livestock operators. Livestock producers tend to suffer substantially during droughts, not because there is not enough water for their stock, but because reductions in available pasture and higher prices for purchased hay have significant economic effects on their operations. Food processors could be in a similar situation if they cannot get the grains or other inputs that they need. These effects are not captured in IMPLAN, which is one reason why the impact estimates are likely conservative.

10. The methodology did not capture "spillover" effects between regions – or the secondary impacts that occur outside of the region where the water shortage is projected to occur.

11. The model did not reflect dynamic economic responses to water shortages as they might occur, nor does the model reflect economic impacts associated with a recovery from a drought of record including:
    a. The likely significant economic rebound to the landscaping industry immediately following a drought;
    b. The cost and years to rebuild liquidated livestock herds (a major capital item in that industry);
    c. Direct impacts on recreational sectors (i.e., stranded docks and reduced tourism); or,
    d. Impacts of negative publicity on Texas' ability to attract population and business in the event that it was not able to provide adequate water supplies for the existing economy.

12. Estimates for job losses and the associated population and school enrollment changes may exceed what would actually occur. In practice, firms may be hesitant to lay off employees, even in difficult economic times. Estimates of population and school enrollment changes are based on regional evaluations and therefore do not accurately reflect what might occur on a statewide basis.

13. The results must be interpreted carefully. It is the general and relative magnitudes of impacts as well as the changes of these impacts over time that should be the focus rather than the absolute numbers. Analyses of this type are much better at predicting relative percent differences brought about by a shock to a complex system (i.e., a water shortage) than the precise size of an impact. To illustrate, assuming that the estimated economic impacts of a drought of record on the manufacturing and mining water user categories are $2 and $1 million, respectively, one should be more confident that the economic impacts on manufacturing are twice as large as those on mining and that these impacts will likely be in the millions of dollars. But one should have less confidence that the actual total economic impact experienced would be $3 million.

3 Analysis Results

This section presents a breakdown of the results of the regional analysis for Region P. Projected economic impacts for six water use categories (irrigation, livestock. municipal, manufacturing, mining, and steam-electric power) are also reported by decade.

3.1 Overview of the Regional Economy

Table 3-1 presents the 2011 economic baseline as represented by the IMPLAN model and adjusted to 2013 dollars for Region P. In year 2011, Region P generated about $1.2 billion in gross state product associated with 19,000 jobs based on the 2011 IMPLAN data. These values represent an approximation of the current regional economy for a reference point.

Table 3-1 Region P Economy

Income ($ millions)*	Jobs	Taxes on production and imports ($ millions)*
$1,215	**18,991**	**$123**

[1]*Year 2013 dollars based on 2011 IMPLAN model value added estimates for the region.*

The remainder of Section 3 presents estimates of potential economic impacts for each water use category that could reasonably be expected in the event of water shortages associated with a drought of record and if no recommended water management strategies were implemented.

3.2 Impacts for Irrigation Water Shortages

One of the 3 counties in the region is projected to experience water shortages in the irrigated agriculture water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-2. Note that tax collection impacts were not estimated for this water use category. IMPLAN data indicates a negative tax impact (i.e., increased tax collections) for the associated production sectors, primarily due to past subsidies from the federal government. Two factors led to excluding any reported tax impacts: 1) Federal support (subsidies) has lessened greatly since the year 2011 IMPLAN data was collected, and 2) It was not considered realistic to report increasing tax revenue collections for a drought of record.

Table 3-2 Impacts of Water Shortages on Irrigation in Region

Impact Measure	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	$9	$9	$9	$9	$9	$9
Job losses	236	236	236	236	236	236

***** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.3 Impacts for Livestock Water Shortages

None of the 3 counties in the region are projected to experience water shortages in the livestock water use category for one or more decades within the planning horizon. Estimated impacts to this water use category appear in Table 3-3. Note that tax impacts are not reported for this water use category for similar reasons that apply to the irrigation water use category described above.

Table 3-3 Impacts of Water Shortages on Livestock in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	-	-	-	-	-	-
Job losses	-	-	-	-	-	-

***** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

3.4 Impacts for Municipal Water Shortages

None of the 3 counties in the region are projected to experience water shortages in the municipal water use category for one or more decades within the planning horizon. Impact estimates were made for the two subtypes of use within municipal use: residential, and non-residential. The latter includes commercial and institutional users. Consumer surplus measures were made for both residential and non-residential demands. In addition, available data for the non-residential, water-intensive portion of municipal demand allowed use of IMPLAN and TWDB Water Use Survey data to estimate income loss, jobs, and taxes. Trucking cost estimates, calculated for shortages exceeding 80 percent, assumed a fixed cost of $20,000 per acre-foot to transport water for municipal use. The estimated impacts to this water use category appear in Table 3-4.

Table 3-4 Impacts of Water Shortages on Municipal Water Users in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses[1] ($ millions)*	-	-	-	-	-	-
Job losses[1]	-	-	-	-	-	-
Tax losses on production and imports[1] ($ millions)*	-	-	-	-	-	-
Consumer surplus losses ($ millions)*	-	-	-	-	-	-
Trucking costs ($ millions)*	-	-	-	-	-	-
Utility revenue losses ($ millions)*	-	-	-	-	-	-
Utility tax revenue losses ($ millions)*	-	-	-	-	-	-

[1] Estimates apply to the water-intensive portion of non-residential municipal water use.
**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.5 Impacts of Manufacturing Water Shortages

Manufacturing water shortages in the region are projected to occur in none of the 3 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-5.

Table 3-5 Impacts of Water Shortages on Manufacturing in Region

Impacts Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	-	-	-	-	-	-
Job losses	-	-	-	-	-	-
Tax losses on production and Imports ($ millions)*	-	-	-	-	-	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.6 Impacts of Mining Water Shortages

Mining water shortages in the region are projected to occur in none of the 3 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use type appear in Table 3-6.

Table 3-6 Impacts of Water Shortages on Mining in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income losses ($ millions)*	-	-	-	-	-	-
Job losses	-	-	-	-	-	-
Tax losses on production and Imports ($ millions)*	-	-	-	-	-	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.7 Impacts of Steam-Electric Water Shortages

Steam-electric water shortages in the region are projected to occur in none of the 3 counties in the region for at least one decade of the planning horizon. Estimated impacts to this water use category appear in Table 3-7.

Note that estimated economic impacts to steam-electric water users:

- Are reflected as an income loss proxy in the form of the estimated additional purchasing costs for power from the electrical grid that could not be generated due to a shortage;
- Do not include estimates of impacts on jobs. Because of the unique conditions of power generators during drought conditions and lack of relevant data, it was assumed that the industry would retain, perhaps relocating or repurposing, their existing staff in order to manage their ongoing operations through a severe drought.
- Does not presume a decline in tax collections. Associated tax collections, in fact, would likely increase under drought conditions since, historically, the demand for electricity increases during times of drought, thereby increasing taxes collected on the additional sales of power.

Table 3-7 Impacts of Water Shortages on Steam-Electric Power in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Income Losses ($ millions)*	-	-	-	-	-	-

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

3.8 Regional Social Impacts

Projected changes in population, based upon several factors (household size, population, and job loss estimates), as well as the accompanying change in school enrollment, were also estimated and are summarized in Table 3-8.

Table 3-8 Region-wide Social Impacts of Water Shortages in Region

Impact Measures	2020	2030	2040	2050	2060	2070
Consumer surplus losses ($ millions)*	-	-	-	-	-	-
Population losses	43	43	43	43	43	43
School enrollment losses	8	8	8	8	8	8

**** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.***

Appendix A - County Level Summary of Estimated Economic Impacts for Region P

County level summary of estimated economic impacts of not meeting identified water needs by water use category and decade (in 2013 dollars, rounded). Values presented only for counties with projected economic impacts for at least one decade.

**** Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000***

		Income losses (Million $)*						Job losses						Consumer Surplus (Million $)*					
County	Water Use Category	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070	2020	2030	2040	2050	2060	2070
WHARTON	IRRIGATION	$9	$9	$9	$9	$9	$9	236	236	236	236	236	236	-	-	-	-	-	-
WHARTON TOTAL	**IRRIGATION**	**$9**	**$9**	**$9**	**$9**	**$9**	**$9**	**236**	**236**	**236**	**236**	**236**	**236**	**-**	**-**	**-**	**-**	**-**	**-**
REGION Total		**$9**	**$9**	**$9**	**$9**	**$9**	**$9**	**236**	**236**	**236**	**236**	**236**	**236**	**-**	**-**	**-**	**-**	**-**	**-**

Appendix S

INTERA Presentation to GMA 15 on Socioecomonics on April 29, 2016

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

Groundwater Management Area 15 Joint Planning: Round 2

Socioeconomics

Victoria, TX
April 29, 2015

Steve Young, Ph.D., P.G., P.E.

Socioeconomic Impact Topics

- Background
  - Regulatory
  - Methods of analysis
- Socioeconomic Impacts of Projected Water Shortages
  - 2011 Round of Planning
  - 2016 Round of Planning
- Qualitative Review of GMA District GCDs
  - Responses to Questionnaire Topic 4

GMA Requirement - Socioeconomic Impact

- Texas Water Code (TWC) Chapter 36.108 (d) Before voting on the proposed desired future conditions of the aquifer under Subsection (d-2) the districts shall consider:
  - TWC 36.108 (6)(6) **socioeconomic impacts reasonably expected to occur**
- There is a lack of information available to GCDs regarding socioeconomic impacts that would be considered relevant to the joint-planning process
- As a result, most GMAs rely heavily on the TWDB analyses for quantification of socioeconomic impacts of unmet water needs performed as part of Regional Water Planning (RWP)

Socioeconomic Impacts and Water Planning in Texas

- Texas Water Code Chapter 16.051 (a) the board shall prepare, develop, formulate and adopt a comprehensive state water plan that incorporates the regional water plans (RWPs) adopted under Section 16.053.
  - The state water plan shall provide for….**further economic development**;
- Texas Administrative Code (TAC), Title 31, Chapter 357.7(4)(A) states that ..
  - ”***The executive administrator shall provide available technical assistance to the regional 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***.”
- TAC, Title 31, Chapter 357.40 (a)
  - “**RWPs shall include a quantitative description of the socioeconomic impacts of not meeting the identified water needs**……”

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TWDB Socioeconomic Impact Analysis

- Executed by TWDB at request of RWPGs
- Uses water supply needs from RWP
- 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. Water supply has been needed and will continue to be needed for various uses.
- Multiple impacts examined
  - Sales, income and tax revenue
  - Jobs
  - Population
  - School enrollment
- Results of analysis are incorporated into RWP

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

TWDB Socioeconomic Impact Analysis

- Generate Input-Output Models combined with Social Accounting Models (IO/SAM) and develop economic baselines. Utilizes IMPLAN (Impact for Planning Analysis) software.
  - Develop an economic baseline based on 440 economic sector codes which are assigned to each of the plans Water User Groups (WUGs)
- 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. Anticipates growth in Texas economy.

TWDB Socioeconomic Impact Analysis

- At the beginning of this round of Joint Planning the GMA only had available the 2011 RWP Socioeconomic Analyses:
  - The results from these have been summarized in past GMA Meetings and circulated to GMA-15 GCD representatives and will be included in the Explanatory Report
- Since our last meeting the 2016 RWP Socioeconomic Analyses have been released
  - The important conclusions will be summarized here and the reports will be included in the Explanatory Report

TWDB Socioeconomic Impact Analysis

- A consistent method of evaluating losses across regions is to review social impacts
  - The table below provides a summary of the Region L consumer surplus losses, population losses and school enrollment losses from not meeting supply needs
  - Region L is presented because impacts are most significant for this region in the GMA. Similar analyses for Regions K,N & O are provided in the Explanatory Report Appendices N, P, & Q, respectively.

Impact Measures	2020	2030	2040	2050	2060	2070
Consumer surplus losses ($ millions)*	$29	$58	$108	$171	$264	$403
Population losses	3,356	3,821	4,324	4,693	5,591	9,199
School enrollment losses	621	707	800	868	1,034	1,702

** Year 2013 dollars, rounded. Entries denoted by a dash (-) indicate no economic impact. Entries denoted by a zero ($0) indicate income losses less than $500,000.*

Income and Job Loss – 2020
TWDB 2016 RWPs

- The estimates are based upon the assumption that no water management strategies recommended are employed.
- The evaluation presented in for the year 2020
- Losses increase with time

Region	Lost Income ($ Million)	Job Losses
Region L	1,990	18,300
Region K	1,560	9,877
Region P	9	279
Region N	4,490	24,000

TWDB Socioeconomic Impact Analysis

- Unlike regional planning, there is no standardized local or regional socioeconomic analytical tool that has been developed to support GMAs
- Instead, GMA-15, through public meetings and through a questionnaire have qualitatively discussed socioeconomic impacts
- A summary of the GMA-15 discussion and the results from the questionnaire were presented at the July 15th GMA Meeting and can be found in the appendices of the Explanatory Report.
  - Responses are provided below and reflect the positive and negative potential impacts of adopting the proposed DFC.

Questionaire - Topic 4: Socioeconomic and Property Right Impacts

Questions Posed:

Describe the major social consequences, especially negative impacts, you would anticipate if the adopted desired future condition not properly balanced (i.e., too lax or too restrictive).

Describe the major economic consequences, especially negative impacts, you would anticipate if the adopted desired future condition not properly balanced (i.e., too lax or too restrictive).

Describe the consequences related to private property rights, especially negative impacts, you would anticipate if the adopted desired future condition not properly balanced (i.e., too lax or too restrictive).

GEOSCIENCE & ENGINEERING SOLUTIONS

Response - Topic 4: Socioeconomic and Property Right Impacts

GCD #1:

Adopting a DFC too lax would more than likely allow for aquifer declines that would result in shallower wells eventually needing to be replaced. Energy cost would increase due to lower levels. Adopting a DFC too restrictive may trigger district action that could cripple our local economy that depends heavily of the agricultural industry.

Adopting a DFC too lax may cause landowners that needed to replace their wells, begin to question their rights or legal ramifications for damages caused by other permitted pumping. An adopted DFC too restrictive could lead to permit cutbacks and landowner takings claims against the Districts.

GCD #2:

we do not feel there will be any socio--economic or private property rights impacts if the DFCs are not properly balanced. Even if the MAGs that come out of the current round of joint groundwater planning are significantly higher than previous MAGs, the aquifers within Fayette County are not productive enough that this type of production will actually occur. And current MAGs cannot be lowered significantly, so that would not appear to be a valid concern for our district either at this time.

Response - Topic 4: Socioeconomic and Property Right Impacts

GCD #3:
If too lax, wells could go dry causing landowners to drill deeper water wells. If restrictive, less pumping could impact irrigation use, mining and commercial use wells in the County

GCD #4:
The principle consideration by GCGCD in establishing a Desired Future Condition (DFC) for 2070 is water level drawdown. Water quality is also a principle consideration and could become a critical issue if residents were forced to drill deeper wells in order to have an adequate supply of drinking water.

When considering the economic impact of water level drawdown, two major costs are encountered: deeper well cost and pumping cost. When an existing water sand is no longer productive a replacement well is required or in the case of a new location, the well will need to be drilled deeper. Depth between sands varies from 50--100 feet in most areas. A budget price for a new well, drilled well only, is $6500. Adding 75 feet to the depth adds $1500 to the cost. As to pumping cost, for each drop of 10 feet of water level pumping 7000 acre feet per year, 2014 use estimate, the additional annual pumping cost is approximately $1,000,000.

Response - Topic 4: Socioeconomic and Property Right Impacts

GCD #5, 6, 7, & 8
Overly lax: Domestic/Livestock and small non--municipal business groundwater producers would likely face significant issues with existing water wells. Well drilling and operational costs would likely increase significantly due to need to produce groundwater from deeper formations; Subsidence and saltwater intrusion likely to occur or increase. *Potentially, groundwater production may negatively impact the availability and quality of groundwater resources of adjacent and near--by property owners.*

Overly restrictive:
Economic development, especially large--scale projects, Property values would likely significantly diminish; Existing business expansion would be curtailed. *Potentially, landowners may realize significant limitations regarding the development of groundwater resources associated with their property.*

INTERA GEOSCIENCE & ENGINEERING SOLUTIONS

Appendix T

Goliad County Economic Impact Assessment on Lower Water Levels

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
www.goliadcogcd.org

November 13, 2014
GMA 15
Tim Andruss
Via email: tim.andruss@vcgcd.org

Re: Economic Impact of DFC in Goliad County

The Mission of Goliad County Groundwater Conservation District is to develop rules to provide for the protection, preservation, and conservation of groundwater, and to prevent waste of groundwater from the Gulf Coast Aquifer to the extent of which the District has jurisdiction. The District is committed to manage and protect the groundwater resources within its jurisdiction and to work with others to ensure a sustainable, adequate, high quality and cost effective supply of water, now and in the future. The District will strive to develop, promote, and implement water conservation and management strategies to protect water resources for the benefit of the citizens, economy, and environment of the District. The preservation of this most valuable resource can be achieved in a prudent and cost effective manner through conservation, education, management, and cooperation.

The principle consideration by GCGCD in establishing a Desired Future Condition (DFC) for 2070 is water level drawdown. Water quality is also a principle consideration and could become a critical issue if residents were forced to drill deeper wells in order to have an adequate supply of drinking water.

The District which covers Goliad County has approximately 550,000 acres of agricultural land as its primary industry. Using an average of 80 acres per well, approximately 6900 wells are required to service the 550,000 agricultural acres. Add to this number wells for domestic households only, and miscellaneous use, there are over 7000 water wells providing a drinking water supply in the District. At the current water well cost, drilled well only, this constitutes a $34 million investment.

GCGCD has registered 1100 new water wells since its beginning in 2003. This is an average of 100 new water wells per year. As rural development continues the acreage per well decreases. In addition GCGCD has registered 122 replacement wells since 2003.

When considering the economic impact of water level drawdown, two major costs are encountered: deeper well cost and pumping cost. When an existing water sand is no longer productive a replacement well is required or in the case of a new location, the well will need to be drilled deeper. Depth between sands varies from 50-100 feet in most areas. A budget price for a new well, drilled well only, is $6500. Adding 75 feet to the depth adds $1500 to the cost. As to pumping cost, for each drop of 10 feet of water level pumping 7000 acre feet per year, 2014 use estimate, the additional annual pumping cost is approximately $1,000,000.

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The above discussion primarily addresses water management of the Evangeline Aquifer in the north sector of the District and the Chicot Aquifer in the south sector of the District. These two aquifers are the upper aquifers where most of the groundwater is currently supplied with very few wells in the Jasper and Burkeville Aquifers. The Jasper and Burkeville Aquifers are much deeper. Therefore the DFC focus is on the Evangeline and Chicot Aquifers.
GCGCD has reviewed the latest data generated by Intera for GMA-15. Included in that data is the: 2010 DFC GAM Run, 2014 Baseline Run, 2014 High Production Run.

When comparing the data that GCGCD has compiled monitoring water levels across the District since 2003 with the GAM Run data, it is clear that the GAM Run data does not reflect the real conditions that exist. This is especially the case in the Evangeline Aquifer in the north sector of the District. A separate data packet is being prepared that will be attached to this communication which will show a drastic drop in water level in the last ten years in the north sector and a moderate water level drop in the south sector. These drops far exceed the drops predicted by the model and at a lower pumping rate than what the model predicts.

The Desired Future Condition (DFC) for the District is clearly defined in its Management Plan Mission statement. This is "to ensure a sustainable, adequate, high quality and cost effective supply of water, now and in the future. GCGCD has an extensive water level monitoring program, an accurate pumping data base, and rainfall records for use in continued application of management strategies to minimize the cost increase of the groundwater supply. GCGCD cannot use the current GAM Run pumping and drawdown data as a management strategy as there is no correlation between the GAM Run data and the empirical data compiled by GCGCD. GCGCD management strategies will include individual evaluation of the Evangeline and Chicot Aquifers data. Groundwater use in the District is point source. There is no transport of water across the District so averaging of water levels for the Evangeline and Chicot Aquifers is not applicable. It is envisioned that future permitted groundwater needs will precipitate greater use of the Jasper and Burkeville Aquifers in order to protect the shallower water supplies to maintain economic domestic and livestock supplies. Periodic review and update of District rules is ongoing to address achievement of the DFC.

Goliad County Groundwater Conservation District

11/13/2014

X Barbara Smith

Barbara Smith
General Manager

Appendix U

INTERA Presentation to GMA 15 on Property Rights on April 29, 2016

Groundwater Management Area 15
Joint Planning: Round 2
Consideration of the Private Property Rights

Victoria, TX
April 29, 2016

Prepared* by
INTERA
Austin, TX

*Much of the material is from a similar presentation made to GMA 12 by Monique Norman

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 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, but does not 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; 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, ncluding a landowner's lessees, heirs, or assigns, of the groundwater ownership and rights escribed by this section.

Sec 36.002 Ownership of Groundwater (con't)

(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.

(e)This section does not affect the ability to regulate groundwater in any manner authorized under:

1) Chapter 626, Acts of the 73rd Legislature, Regular Session, 1993, for the Edwards Aquifer Authority;
2) Chapter 8801, Special District Local Laws Code, for the Harris-Galveston Subsidence District; and
3) Chapter 8834, Special District Local Laws Code, for the Fort Bend Subsidence District."

The Edwards Aquifer Authority v. Burrell Day and Joel McDaniel (2012)

- 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.

Current Groundwater Ownership

- 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

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.

Appendix V

Goliad County Supporting Information to Appendix M

GCGCD Groundwater Water Use
2014

Owner	Permit Number	ScreenWell Depths	GPS	Acreage Considered	Permitted Usage (ac/ft per year)	HUAC Allocation	Usage Reported ac/ft (2014)	Permitted Livestock	HUAC Livestock	Permitted Irrigation	HUAC Irrigation	PermittedManufacturing	HUAC Manufacturing	HUAC Steam/ Electric	HUAC Mining	HUAC Municipal	Permitted County Other	HUAC County Other
Berclair Water Supply		240-300	28.532833 -97.594633				12.79										12.68	
CASH FORTENBERRY TRUST Jeremy Fortenberry Trustee	79-20-P-0001	700-855	28.7284 -97.524217	3300	70.3		0			70.3								
David Johnson	79-20-P-0002	189-239	28.621833 -97.432933	2260	96.78		15.4	92.78									4	
C Yandell	79-13-P-0003		2846.754N 9728.115W	65	32.5		7.26					27.5					5	
D Crow	79-23-P-0004		2841.084N 9713.133W	4000	14		3.86	14										
Bissett Ranch	79-29-P-0005	140-160 300-340	28.525167 -97.434683	5000	144		5.2	144										
D Bar J Ranch Management Co. (David Johnson)	79-29-P-0006	95-115, 155-175, 215-235, 335-355	28.475417 -97.46945	538	177.5		13.75			177.5								
Dewey R. Young - Allscape	79-38-P-0007		2843.479N 9718.522W	144	36		0.07	31									5	
Sabrena Fisher	79-14-P-0008		2847.127N 9715.247W	15.32	2.5		0.15	1									1.5	
Lavern Meyer	79-13-P-0009		2850.35N 9727.726W	185	5.5		1.04	2.5									3	
N-Way LLP/8 Shooter Ranch LP	79-20-P-0010		2841.887N 9734.880W	403	16.5		8.37			16.5								
Goliad Water Supply Corp.-Fannin	79-23-P-0016	475-510	28.6905 -97.235333	90	17.1		13.57										17.1	
James Kersey	79-23-P-0017		2843.655N 9718.716W	93	20		1.3	20										
Michael & Shelagh Cope	79-14-P-0019		2847.199N 9715.183W	20.98	8.2		7	4.8									3.4	
Placke, LTD	79-20-P-0027	400-440	28.58485 -97.5915	568	120		38.42			120								
Placke, LTD	79-20-P-0028	260-280, 320-370, 460-490	28.57575 -97.592717	1420	320		10.22			320								
Brent Dornburg	79-14-P-0030		2845.306N 9718.895W	36	9		0.29	1									8	
Goliad Water Supply Corp - La Bahia	79-21-P-0037	428-520	28.638333 -97.384167		49.72		12.08										49.72	
Albrecht Ranch - Albrecht Cattle Co	79-13-P-0039	260-320	28.849883 -97.378017	2500	51		19.4	6		40							5	
Texas Meek Ranches	79-20-P-0040	200-280	28.620017 -97.57865	2150	181		181			181								
W. Dale Morris	79-22-P-0041	260-320 360-400	28.657367 -97.352583	607	293		8			293								
Stacy Family	79-22-P-0042		2843.607N 9721.155W	30	15		0.06	10									5	
Shady Oaks Speedway	79-22-P-0043		2843.893N 9721.222W	27	2.4		2.34										2.4	
Albrecht Cattle Company	79-13-P-0048	291-331	28.8414 -97.370567	3000	25		25.2	25										
Holt Ranch Properties, Ltd.	79-20-P-0050	380-840	28.64055 -97.59305	2585	600		200.41			600								
Fair Oaks Properties, Ltd.	79-29-P-0051		2832.457N 9730.991W	1000	10		0.01	10										
Etoco	79-13-P-0052		28 46.524N 9723.503W	300	10		6.81	5									5	
Wes Warren	79-05-P-0053	280-320	28.877 -97.482633	130	55		41.43	10		40							5	
Eula Pfennninger - Country RV Park	79-22-P-0055		28 40.552N 97 20.620W	4	2		0.066										2	
Roland Preiss	79-15-P-0057		28 51.617N 97 13.817W	160	1.4		1.4	1									0.4	

GCGCD Groundwater Water Use
2014

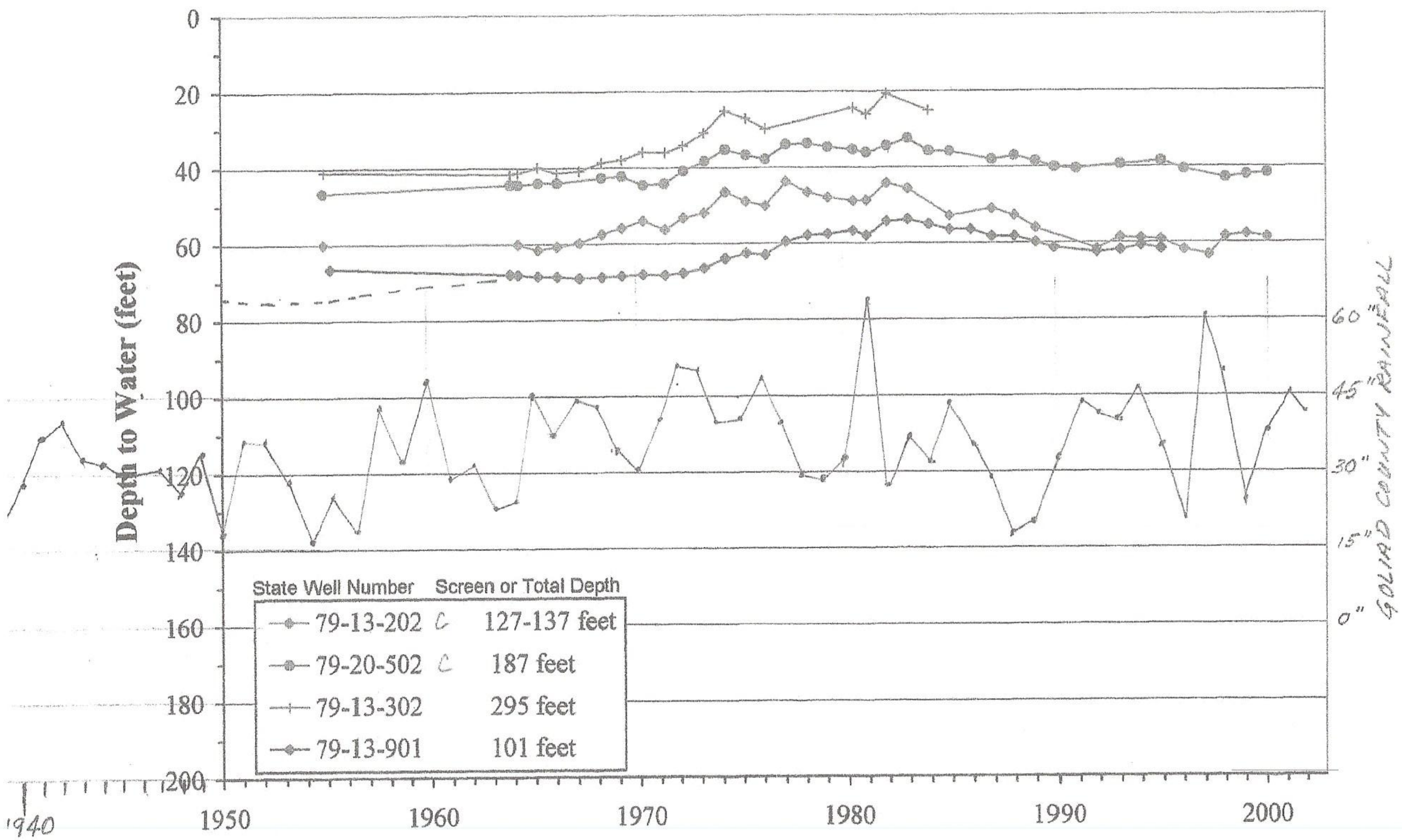
Owner	Permit Number	ScreenWell Depths	GPS	Acreage Considered	Permitted Usage (ac/ft per year)	HUAC Allocation	Usage Reported ac/ft (2014)	Permitted Livestock	HUAC Livestock	Permitted Irrigation	HUAC Irrigation	PermittedManufacturing	HUAC Manufacturing	HUAC Steam/ Electric	HUAC Mining	HUAC Municipal	Permitted County Other	HUAC County Other
Bobby Tislow III - Shady Acres RV Park	79-23-P-0058		28 42.614N 28 42.614N	50	2		0.53	1									1	
Jason Mikeska/Cecelia Edwards - RV Park	79-06-P-0059		28 52.643N 97 21.847W	36	1		0.392										1	
Texas Meek Ranches	79-20-P-0060	180-220 260-300	28.631917 -97.5659	2050	119		119.69			119								
Craig Duderstadt	79-13-P-0061		28 54.976N 97 23.368W	488	15		0.05	9									6	
John Ware - Countryside RV's	79-21-P-0062		28 44.493N 97 24.526W	42.7	1.01		0.77										1.01	
Matt Mahone (ORYX OILFIELD SVCS)	79-20-P-0063		28 45.099N 97 37.063W	24	4		0.04	1									3	
Jim Fly - RV park	79-21-P-0064		28 42.504N 97 25.770W	6	3		0.024										3	
Wexford Cattle Co.	79-22-P-0065		28 39.631N 97 16.966W	3500	15		5.45	15										
DCP Midstream, LP	79-27-P-0066	300-340 420-460	28.61889 -97.63778	682	25		0.66					25						
Los Dos Robles	79-14-P-0068		28.756717 -97.33122	160	10		0.004										10	
Art Dohmann	79-13-P-0069		28.80196 -97.42744	128	15		14.325	2		13								
Fred Boas	79-13-P-0070		28.86172 -97.433506	105.91	0.56		4.36	5										
DCP Midstream, LP - INDUSTRIAL	79-28-P-0071	300-380	28.61576 -97.63992	381.21	25.8		3.22					25.8						
DCP Midstream, LP - POTABLE	79-28-P-0072	300-360	28.616389 -97.6425	381.21	2.8		0.29										2.8	
Daniel Gustafson - Encina Ranch	79-28-P-0073		28 33.59N 97 38.89W	4272	2.46		1.22			2.46								
Albrecht, William E & Franke	79-13-P-0074		28.84222 -97.38352	95	5		0.12										5	
Alberto V. Puga	79-22-P-0075		2108 E. Fannin, Goliad, TX	7.5	0.13		0.18										0.13	
Jerry & Darlynn Horn	79-21-P-0076		1729 Fannin, Goliad, TX	7.2	0.6		0.01										0.6	
Joe K & Melissa Sterling	79-22-P-0077		28.728531 -97.371442	15	10		0			10								
Gregory C Chapman	79-13-P-0078		28.87524 -97.37837	116	6		3.65	3									3	
Goliad Brewery	79-21-P-0080	210-230	28.69125 -97.40027	46.6	23.3		1.883					19.3					4	
Leroy Landgrebe	1		FM 1961	283 acres		25	25		25									
Roy Ward	2		58 Hossier Creek Road	50 acres		3	3		2									1
Roy Ward	3		Dobskyville Road	80 acres		20	20		2		18							
Connie Arnold	4		FM 884	110 acres		3	3		1		1							1
Ward S, Conover	5		Chicken Creek Ranch Road	266 acres		8	8		8									
Leroy Landgrebe	6		Diebel Road	185 acres		8	8		8									
BDL Family Ltd.	7		Enke Road	125 acres		60	60		58		2							
Art Dohmann	8		Halleman Road	273 acres		10	10		3.4		6.6							
George R. Kallick	10		Hwy 119	12 acres		9	9		6		3							
Don Hooper	11		3748 Old Goliad Road	244 acres		4	3.4		3									1
Maurice Reitz	12		28.847222 -97.455556	43 acres		55	56				55							
Mike Abrameit	13		FM 1961	93 acres		2	2		1									1
Raymond L. Bednorz	14		Coletoville Road South	60 acres		19	19		1		12							6

GCGCD Groundwater Water Use
2014

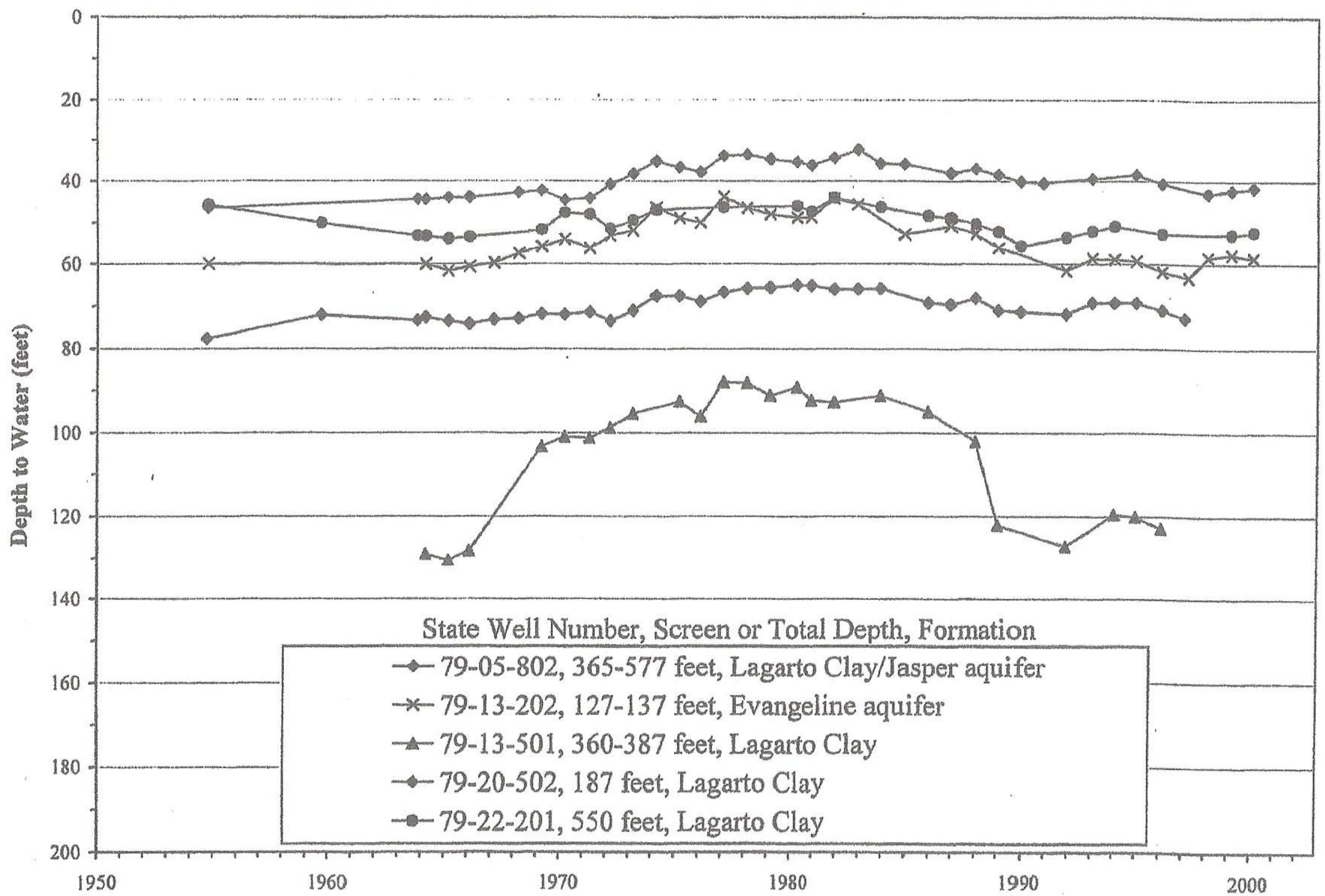
Owner	Permit Number	ScreenWell Depths	GPS	Acreage Considered	Permitted Usage (ac/ft per year)	HUAC Allocation	Usage Reported ac/ft (2014)	Permitted Livestock	HUAC Livestock	Permitted Irrigation	HUAC Irrigation	PermittedManufacturing	HUAC Manufacturing	HUAC Steam/ Electric	HUAC Mining	HUAC Municipal	Permitted County Other	HUAC County Other
David Post	15		Berger Rd.	61 acres		7	6.4		2		3							2
Michael Reagan	16		28.751667 -97.629444	200 acres		200	200				200							
Jim Bower	17		28.7106667 -97.6	416 acres		83	83.125				83							
James W. Cosper	18		FM 1726	175 acres		10	10		10									
Rogers Road Investors LP	20		28.725 -97.592778	1000+		160	250				160							
Michael Reagan - Replacement well	21	300-342 560-660 720-760	28.75457 -97.629910	100 acres		187	187				187							
Goliad County Recreation Assoc., Inc.	22		28.664733 -97.406333	100 acres - Golf Course		24	13				24							
Eddie and Linda Gerland	23		712 Alcalde La Bahia	18.75 acres		6	4.24		6									
Mildred Johnson Estate - Nancy Lubbock Executor	24		2304 Horseshoe Bend	15 acres		7	7								7			
Lamar Riggs	25		570 Midway Road	94 acres		4	2		4									
David Bruns and Carol Rains - Texas Energy	26	360-400	28.72333 -97.372167	50 acres		13	13								13			
Robin Pesek	27		691 Pesek Lane	12 acres		3	1		3									
Robin Pesek	28		553 Pesek Road	43.94 acres		10	2				10							
Janice Ohrt	29		Frank Road @ Hall Rd.	221 acres		2	2		2									
Randy Riggs	30		Hwy 183 N./77A	75acres		4	2		4									
Wanda Pounds	31		474 Hennig Rd.	75 acres		2	1		2									
James A. Young	32		448 Hall Road			3	3		3									
Carl W. Barrett - Dos Ombres Ranch	33		Dos Ombres Ranch FM 2987	215 acres		13	12.28		10		2							1
Clifford W. Carter	34		234 Lakeview Dr.	1.75 acres		3	3											3
GBRA Coleto Creek Park	35		365 Coleto Park Rd	190 acres		5	3.6											5
Coleto Creek Power Station	36&37		28.713333 -97.215833	8300 acres		311	311							311				
Robert J. Gardner	38		Coleto Park Road @ Hwy 59 North	24 acres		5.4	5.4		4									1.4
Barnhart Family Partnership, Ltd.	39		28.621083 -97.67185	706 acres		128	128		25		100							3
Jennifer Hale	41		Fm 883	14.9 acres		6.5	3.53				6.5							
Dale and Patsy Rasco	42		519 Oak Creek Ranch Rd.	60 acres		17	17		13		4							
Morgan Dunn O'Connor Trust	43		5420 St. Hwy 239 East	6648 acres		35	35		35									
Cravens, LLC	44		28.399722 -97.390556	500 acres		200	194		200									
Tierra Padre Partners, Etal	45		28.515833 -97.348889	10,000+ acres		50	30.7		50									
City of Goliad - Chilton well	46		28.67255 -97.394217	N/A		202	202									202		
City of Goliad - San Patricio well	47		28.666117 -97.3985	N/A		215	215									215		
Larry Lange	48		7483 US Hwy 183 N	880 acres		14	14		14									
Sidney Arnold	49		FM 1726 Bethke Rd. #846	24.82acres		25	25		2.5		20							2.5
Darwyn Duderstadt	50		11086 W.Church Rd. Weesatche	85 acres		1.5	1.5								1			0.5

GCGCD Groundwater Water Use
2014

Owner	Permit Number	ScreenWell Depths	GPS	Acreage Considered	Permitted Usage (ac/ft per year)	HUAC Allocation	Usage Reported ac/ft (2014)	Permitted Livestock	HUAC Livestock	Permitted Irrigation	HUAC Irrigation	PermittedManufacturing	HUAC Manufacturing	HUAC Steam/ Electric	HUAC Mining	HUAC Municipal	Permitted County Other	HUAC County Other
William D. Stewart, Jr.	51		6.5 miles N. on 183/77	544 acres		40	30		10		30							
Darwyn Duderstadt	52		28.86611 -97.437778	212 acres		60	60		7		51							2
Werger Dohmann	53		1481 Dohmann Rd. Weesatche, TX	273 acres		4	4		4									
Coleto Creek Power Station/Park well	54		45 FM 2987 Fannin, TX	8300 acres		1	1											1
Coleto Creek Power Station/ Park well	55		45 FM 2987 Fannin, TX	8300 acres		1	0.4											1
				76951.58 acres														
TOTALS					2672.06	2288.4	3103.339	414.08	528.9	2002.76	978.1	97.6	0	311	21	417	174.74	32.4
								Livestock-GW90%/ SW-10%		**Irrigation**		**Manufactur-ing**		**Steam Electric**	**Mining**	**County Municipal**	**County Other**	
								1015\ 113						**150/ 16930**				
EVANGELINE TOTALS								**660**		**3200**		**34**		**150**	**70**	**611**	**932**	
CHICOT TOTALS								**355**									**103**	
TOTAL GROUNDWATER USE - 2014								**1015**		**3200**		**34**		**150**	**70**	**611**	**1035**	**TOTAL -6115**
Rainfall totals for 2014 - County Average	**24.36**																	
2017 State Water Plan #'s								1128		3200		34		17080	70	611	1035	



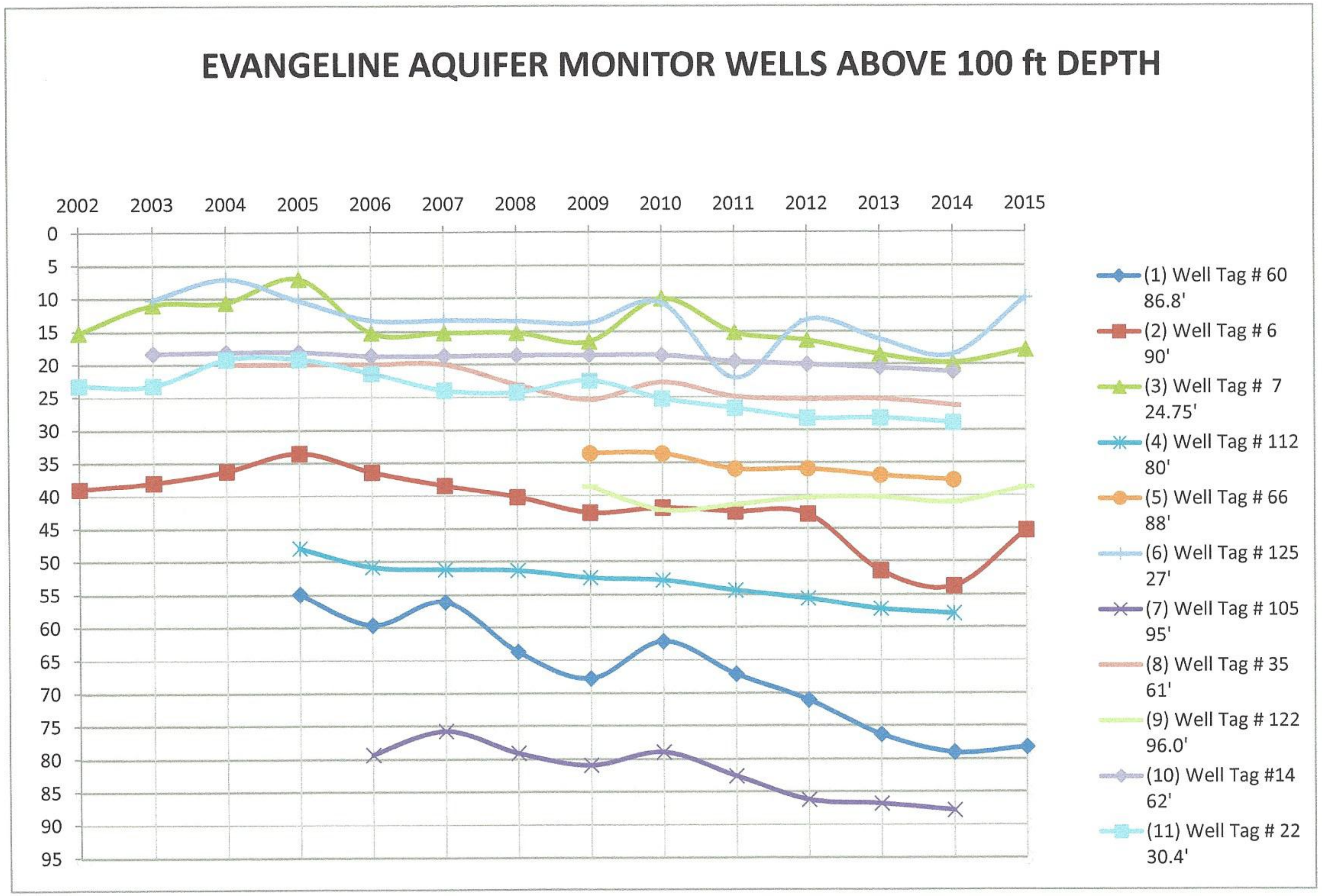
North Goliad County
Static Water Level in Selected Wells



North Goliad County
Static Water Levels in Wells

EVANGELINE AQUIFER MONITOR WELLS ABOVE 100 ft DEPTH

Year	(1) Well Tag # 60 86.8'	(2) Well Tag # 6 90'	(3) Well Tag # 7 24.75'	(4) Well Tag # 112 80'	(5) Well Tag # 66 88'	(6) Well Tag # 125 27'	(7) Well Tag # 105 95'	(8) Well Tag # 35 61'	(9) Well Tag # 122 96.0'	(10) Well Tag #14 62'	(11) Well Tag # 22 30.4'
2002		39	15.25								
2003		38.05	11			10.275				18.4	23.3
2004		36.27	10.65			7.125		20.1		18.2	23.3
2005	55	33.57	7.1			10.425		20.1		18.2	19.28
2006	59.7	36.45	15.3	48		13.4	79.4	20.1		18.8	19.28
2007	56.2	38.5	15.3	50.875		13.4	75.83	20.1		18.8	21.45
2008	63.8	40.25	15.3	51.213		13.5	79.2	23.2		18.7	24.05
2009	67.85	42.65	16.63	51.4	33.625	13.793	81.05	25.5	38.65	18.7	24.35
2010	62.23	41.925	10.1	52.525	33.68	10.77	79.06	22.875	42.25	18.7	22.6
2011	67.18	42.5	15.265	52.8975	36	22.17	82.705	25.05	41.46	19.65	25.335
2012	71.125	42.9	16.465	54.45	36	13.35	86.3	25.45	40.42	20.125	26.775
2013	76.4	51.49	18.6	55.7	36.995	16.3	86.9	25.415	40.355	20.62	28.3
2014	79.125	53.825	19.825	57.3	37.7	18.575	87.9	26.375	41.05	21.25	28.3
2015	78.3	45.35	17.9	58		10			38.75		29


EVANGELINE AQUIFER MONITOR WELLS ABOVE 100 ft DEPTH
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
(1) Well Tag # 60 86.8'
(2) Well Tag # 6 90'
(3) Well Tag # 7 24.75'
(4) Well Tag # 112 80'
(5) Well Tag # 66 88'
(6) Well Tag # 125 27'
(7) Well Tag # 105 95'
(8) Well Tag # 35 61'
(9) Well Tag # 122 96.0'
(10) Well Tag #14 62'
(11) Well Tag # 22 30.4'

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS LESS THAN 100' DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.816667 -97.468833	86.8'	2005	55		
			2006	59.7		
			2009	67.85		
			2012	71.13		
			2015	78.3	(23.3')	
2	28.84172 -97.42451	90'	2002	39		
			2003	38.05		
			2006	36.45		
			2009	42.65		
			2012	42.9		
			2015	45.35	(6.35')	
3	28.84390 -97.431690	24.75'	2002	15.25		
			2003	11		
			2006	15.3		
			2009	16.63		
			2012	16.47		
			2015	17.9	(-2.65)	
4	28.87547 -97.35225	80	2006	48		
			2009	51.4		
			2012	54.45		
			2015	58	(10')	
5	28.858133 -97.33175	88	2009	33.63		
			2012	36		
			2014	37.7	(-4.07)	
6	28.84349 -97.42737	27'	2003	10.28		
			2006	13.4		
			2009	13.8		
			2012	13.35		
			2015	10	0.28	
7	28.59323 -97.5108	95'	2006	79.4		
			2009	81.05		
			2012	86.3		
			2014	87.9	(-8.5)	
8	28.40202 -97.38967	61'	2004	20.1		
			2006	20.1		
			2009	25.5		
			2012	25.45		
			2014	26.38	(-6.28)	
9	28.40632 -97.37969	96'	2009	38.65		
			2012	40.42		
			2015	38.75	(-.10)	
10	28.47385 -97.273667	62'	2003	18.4		
			2006	18.8		
			2009	18.7		
			2012	20.13		
			2014	21.25	(-2.85)	

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS LESS THAN 100' DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
11	28.851867 -97.449067	30.4'	2003	23.3		
			2006	19.28		
			2009	24.35		
			2012	26.78		
			2015	29	(-5.7)	
	AVERAGE WATER DECLINE					6.32

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 101-200 DEPTH

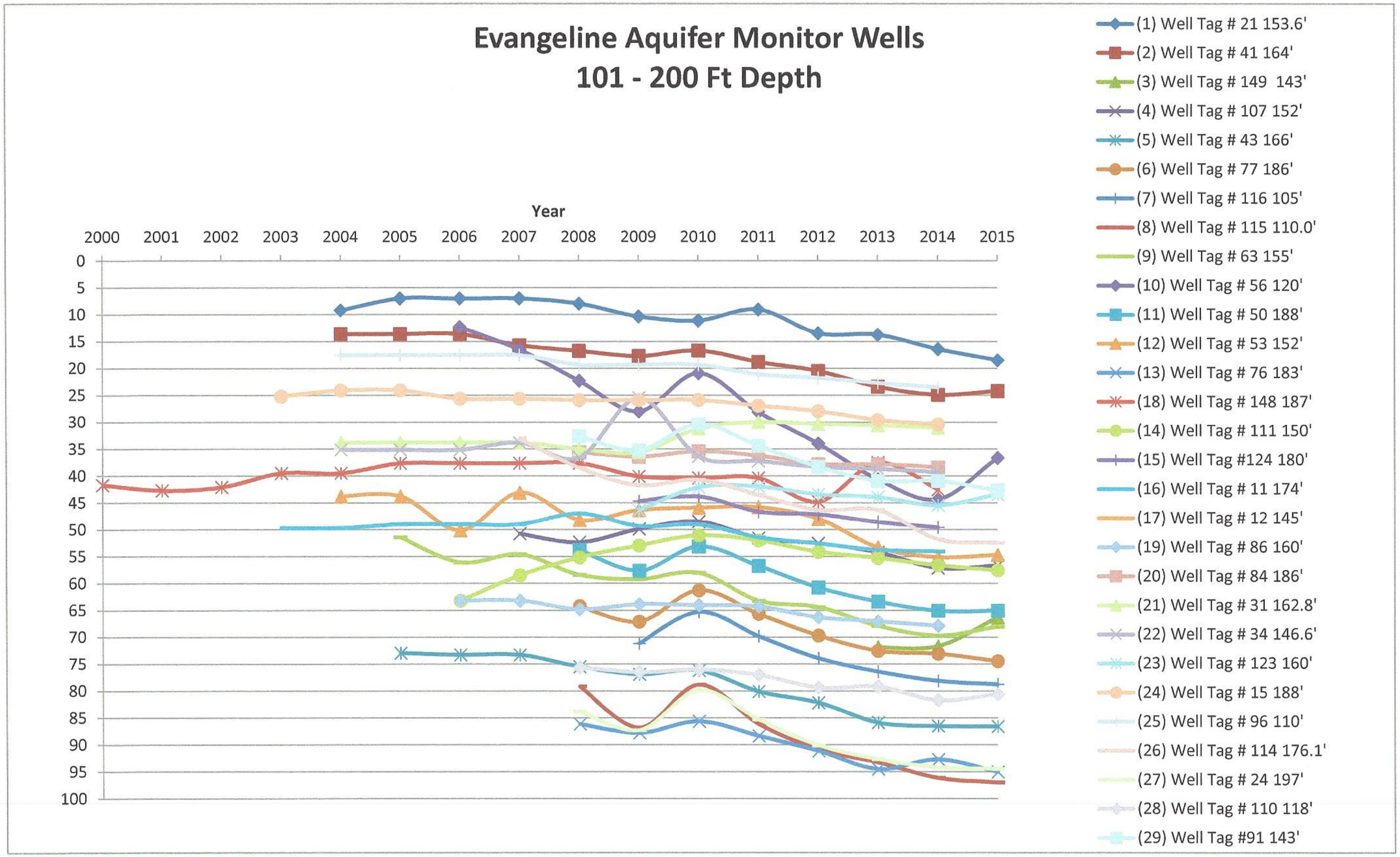
	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.92248 -97.40919	153.6	2003	9.2		
			2006	7		
			2009	11.1		
			2012	13.75		
			2015	16.42	(-7.22)	
2	28.89565 -97.37772	164'	2004	13.62		
			2006	13.62		
			2009	17.73		
			2012	20.49		
			2015	24.2	(-10.58)	
3	28.88756 -97.38267	143'	2013	71.87		
			2015	72.6	-0.73	
4	28.88629 -97.36115	152	2007	50.78		
			2009	49.88		
			2012	52.55		
			2015	56.7	(-5.92)	
5	28.85005 -97.51231	166	2005	72.95		
			2006	73.3		
			2009	76.9		
			2012	82.18		
			2015	86.6	(-13.65)	
6	28 76936 -97.43199	186	2008	64.2		
			2009	67.1		
			2012	69.7		
			2015	74.45	(-10.25)	
7	28.76982 -97.43112	105	2009	71.15		
			2012	73		
			2015	78.75	(-7.6	
8	28.7908166 -97.4195833	110	2008	79.12		
			2009	86.8		
			2012	90.85		
			2015	97	(-17.88)	
9	28.86225 -97.475633	155	2005	51.4		
			2006	56.1		
			2009	59.2		
			2012	64.41		
			2015	68.05	(-16.65)	
10	28.82779 -97.41455	120	2006	12.3		
			2009	28		
			2012	34		
			2014	44.65		
			2015	36.65	(-24.35)	

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 101-200 DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
11	28.76558 -97.43933	188	2008	53.75		
			2009	57.65		
			2012	60.75		
			2015	65.05	(-11.3)	
12	28.848166 -97.44116	152	2004	43.8		
			2006	50.13		
			2009	46.37		
			2012	48		
			2015	54.7	(-10.90)	
13	28.76748 -97.43389	183	2008	86.15		
			2009	87.8		
			2012	91.15		
			2015	95.05	(-8.9)	
14	28.875467 -97.35189	150	2006	63.2		
			2009	51.08		
			2012	53.65		
			2015	57.55	5.65	
15	28.84025 -97.30061	180	2009	44.703		
			2012	47.165		
			2014	49.575	(-4.87)	
16	28.77465 -97.21466	174	2003	49.7		
			2006	49		
			2009	49.34		
			2012	52.6		
			2014	54.02	(-4.37)	
17	28.81313 -97.23324	145	2003	79.8		
			2006	76.9		
			2009	76.13		
			2012	77.75		
			2014	79.2	0.6	
18	28.69066 -97.54343	187'	2000	41.68		
			2003	39.5		
			2006	37.64		
			2009	40.1		
			2012	44.8		
			2014	42.55	0.87	
19	28.736166 -97.30633	160	2006	63.2		
			2009	63.86		
			2012	66.3		
			2014	67.87	(-4.67)	
20	28.39955 -97.39585	186'	2008	35.6		
			2009	36.45		
			2012	37.8		
			2014	38.4	(-2.8)	

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 101-200 DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
21	28.39404 -97.37833	162.8'	2004	33.8		
			2006	33.8		
			2009	35.6		
			2012	30.35		
			2014	31.05	2.75	
22	28.40253 -97.39197	146.6	2004	35.15		
			2006	35.15		
			2009	25.5		
			2012	38.3		
			2014	39.3	(-4.15)	
23	28.40564 -97.38155	160'	2009	46.4		
			2012	43.44		
			2016	43.45	2.95	
24	28.469933 -97.3120833	188'	2003	25.2		
			2006	25.65		
			2009	25.9		
			2012	27.95		
			2014	30.4	(-5.2)	
25	28.49533 -97.24523	110'	2004	17.55		
			2006	17.55		
			2009	19.31		
			2012	21.78		
			2014	23.53	(-5.98)	
26	28.81929 -97.48663	176.1	2007	33.1		
			2010	40.72		
			2014	51.1		
			2015	52.45	(-19.35)	
27	28.7703 -97.41897	197	2008	83.8		
			2011	87.75		
			2014	94.75		
			2015	94.45	(-11)	
28	28.88572 -97.38656	118	2008	75.6		
			2011	77.6		
			2014	81.95		
			2015	80.6	(-5)	
29	28.76734 -97.43934	143	2008	32.6		
			2011	36.93		
			2015	42.7	(-10)	
	AVERAGE WATER DECLINE					7.26



Evangeline Aquifer Monitor Wells
101 - 200 Ft Depth
Year
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
(1) Well Tag # 21 153.6'
(2) Well Tag # 41 164'
(3) Well Tag # 149 143'
(4) Well Tag # 107 152'
(5) Well Tag # 43 166'
(6) Well Tag # 77 186'
(7) Well Tag # 116 105'
(8) Well Tag # 115 110.0'
(9) Well Tag # 63 155'
(10) Well Tag # 56 120'
(11) Well Tag # 50 188'
(12) Well Tag # 53 152'
(13) Well Tag # 76 183'
(18) Well Tag # 148 187'
(14) Well Tag # 111 150'
(15) Well Tag #124 180'
(16) Well Tag # 11 174'
(17) Well Tag # 12 145'
(19) Well Tag # 86 160'
(20) Well Tag # 84 186'
(21) Well Tag # 31 162.8'
(22) Well Tag # 34 146.6'
(23) Well Tag # 123 160'
(24) Well Tag # 15 188'
(25) Well Tag # 96 110'
(26) Well Tag # 114 176.1'
(27) Well Tag # 24 197'
(28) Well Tag # 110 118'
(29) Well Tag #91 143'

EVANGELINE AQUIFER MONITOR WELLS 101 - 200 ft DEPTH

Year	(1) Well Tag # 21 153.6'	(2) Well Tag # 41 164'	(3) Well Tag # 149 143'	(4) Well Tag # 107 152'	(5) Well Tag # 43 166'	(6) Well Tag # 77 186'	(7) Well Tag # 116 105'	(8) Well Tag # 115 110.0'	(9) Well Tag # 63 155'	(10) Well Tag # 56 120'	(11) Well Tag # 50 188'	(12) Well Tag # 53 152'	(13) Well Tag # 76 183'	(14) Well Tag # 111 150'	(15) Well Tag #124 180'	(16) Well Tag # 11 174'	(17) Well Tag # 12 145'
2000																	
2001																	
2002																	
2003	9.2															49.7	79.8
2004	7	13.62										43.8				49.7	79.8
2005	7	13.62			72.95				51.4			43.8				49	76.9
2006	7	13.62			73.3				56.1	12.3		50.125		63.2		49	76.9
2007	7.96	15.725		50.775	73.3				54.6	16.51		43.1		58.5		49	76.9
2008	10.35	16.75		52.35	75.5	64.2		79.12	58.4	22.3	53.75	48.2	86.15	55.16		47	74.7
2009	11.1	17.73		49.875	76.9	67.1	71.15	86.8	59.2	28	57.65	46.37	87.8	52.95	44.70333	49.3433	76.133
2010	9.05	16.685		48.5	76.2	61.265	65.275	78.805	58.045	20.9	53.125	45.92	85.65	51.08	43.85	49.05	75.6
2011	13.475	18.8		51.575	80.09	65.665	69.82	86.15	63.225	28.11	56.74	45.82	88.36	52.01	46.66	51.45	76.6
2012	13.75	20.485		52.565	82.175	69.7	73.915	90.85	64.405	34	60.75	47.995	91.15	54.125	47.165	52.6	77.75
2013	16.425	23.4	71.87	54.2	85.89	72.54	76.4	93.275	67.9	40.65	63.37	53.31	94.51	55.26	48.575	53.8	79
2014	18.5	24.9	71.675	57.15	86.525	73.075	78.1	96.15	69.725	44.325	65.05	55.125	92.725	56.625	49.575	54.025	79.2
2015	16.42	24.2	66.35	56.7	86.6	74.45	78.75	97	68.05	36.65	65.05	54.7	95.05	57.55			

EVANGELINE AQUIFER MONITOR WELLS 101 - 200 ft DEPTH

Year	(18) Well Tag # 148 187'	(19) Well Tag # 86 160'	(20) Well Tag # 84 186'	(21) Well Tag # 31 162.8'	(22) Well Tag # 34 146.6'	(23) Well Tag # 123 160'	(24) Well Tag # 15 188'	(25) Well Tag # 96 110'	(26) Well Tag # 114 176.1'	(27) Well Tag # 24 197'	(28) Well Tag # 110 118'	(29) Well Tag #91 143'
2000	41.68											
2001	42.7											
2002	42.1											
2003	39.5						25.2					
2004	39.5			33.8	35.15		24.1	17.55				
2005	37.64			33.8	35.15		24.1	17.55				
2006	37.64	63.2		33.8	35.15		25.65	17.55				
2007	37.64	63.2		33.8	33.85		25.65	17.55	33.1			
2008	37.64	64.8	35.6	35	36.6		25.9	19.31	38.5	83.8	75.6	32.6
2009	40.1	63.8667	36.45	35.6	25.5	46.4	25.9	19.31	41.75	87.3	76.5	35.25
2010	40.39	64.05	35.45	31.2	36.38	42.125	25.9	19.31	40.72	79.865	76.01	30.4
2011	40.39	64.3	36.275	29.985	37.24	41.98	26.925	21.125	43.525	85.325	77.025	34.415
2012	44.8	66.3	37.8	30.35	38.3	43.435	27.95	21.775	46.35	90.125	79.34	38.3
2013	37.54	67.05	37.85	30.59	38.705	43.96	29.6	22.72	46.35	92.685	79.2	40.925
2014	42.55	67.875	38.4	31.05	39.3	45.45	30.4	23.53	51.8	94.185	81.725	40.925
2015						43.45			52.45	94.45	80.6	42.7

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 201-300 DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.694067 -97.32505	262.8	2003	52.58		
			2006	54.5		
			2009	51.88		
			2012	54.55		
			2014	56.75	(-4.17)	
2	28.72113 -97.31355	226	2002	59		
			2003	52.98		
			2006	53.23		
			2009	53.39		
			2012	56.25		
			2014	58.15	0.85	
3	28.818933 -97.27850	250	2003	78.5		
			2006	77.3		
			2009	78.8		
			2012	81.4		
			2014	83.65	(-5.15)	
4	28.82917 -97.41266	275	2005	83.72		
			2006	83.72		
			2009	89.1		
			2012	92		
			2015	94	(-10.25)	
5	28.76425 -97.43395	222	2008	72.75		
			2009	73.45		
			2012	76.8		
			2015	80.5	(-7.75)	
6	28.76361 -97.43091	222	2008	67.45		
			2009	70.3		
			2012	73.68		
			2015	77.9	(-10.45)	
7	28.76806 -97.43671	291	2008	84.33		
			2009	84.55		
			2012	86.87		
			2015	91.7	(-7.37)	
8	28.86947 -97.45477	210'	2003	105.78		
			2006	104.2		
			2009	107.35		
			2012	111.63		
			2015	115.3	(-9.52)	
9	28.85705 -97.45466	282'	2003	63.6		
			2006	63.6		
			2009	67.53		
			2012	71.76		
			2015	75.45	(-11.86)	

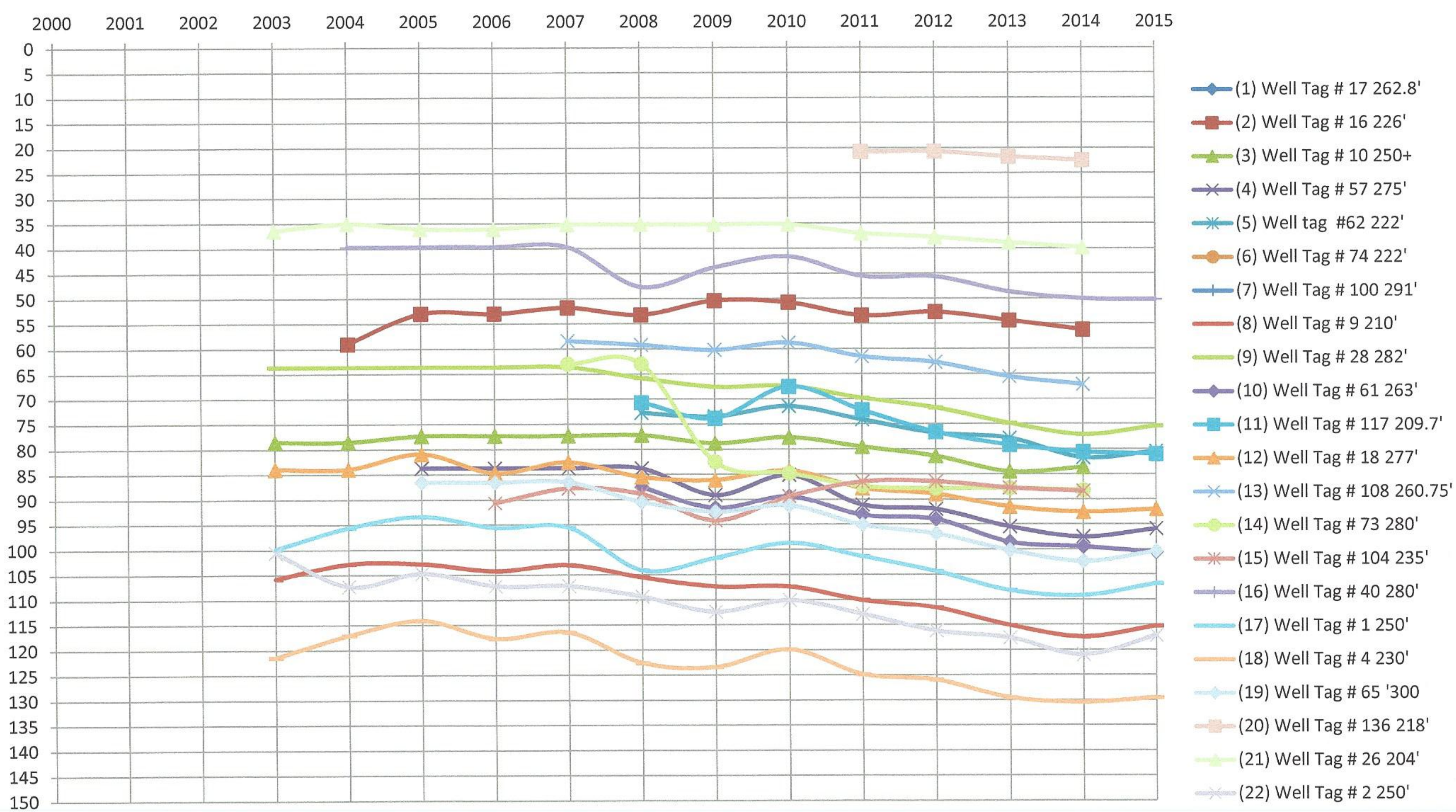
GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 201-300 DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
10	28.827833 -97.43015	263	2008	87.55		
			2009	91.7		
			2012	93.5		
			2015	100.69	(-13.19)	
11	28.77197 -97.42549	209.7	2008	70.7		
			2009	73.85		
			2012	76.5		
			2015	81.05	(-10.35)	
12	28.88218 -97.39616	277	2003	83.9		
			2006	84.7		
			2009	86.4		
			2012	90.3		
			2015	92.05	(-8.15)	
13	28.89046 -97.37759	260.8	2007	58.4		
			2009	60.21		
			2012	62.7		
			2015	66.35	(-7.95)	
14	28.59194 -97.62675	280'	2007	63		
			2009	82.5		
			2012	87.83		
			2014	88.23	(-25.23)	
15	28.59306 -97.50164	235'	2006	90.65		
			2009	94.2		
			2012	86.45		
			2014	88.4	2.25	
16	28.89363 -97.37844	280	2004	39.66		
			2006	39.7		
			2009	43.8		
			2012	45.65		
			2015	50.25	(-10.59)	
17	28.828583 -97.441017	250	2003	99.84		
			2006	95.6		
			2009	101.65		
			2012	104.34		
			2015	106.8	(-6.96)	
18	28.79782 -97.42313	230	2003	121.43		
			2006	117.7		
			2009	123.43		
			2012	126		
			2015	129.55	(-8.08)	
19	28.84853 -9747564	300	2005	86.55		
			2006	86.55		
			2009	92.5		
			2012	96.87		
			2015	100.4	(-13.85)	

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 201-300 DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
20	228.52155 -97.24815	218	2011	21.8		
			2012	20.73		
			2014	22.5	(-1.72)	
21	28.5618 -97.204583	204	2003	36.4		
			2006	36.1		
			2009	35.25		
			2012	37.8		
			2014	39.88	(-3.48)	
22	28.831717 -97.4413	250	2003	100.58		
			2006	107.2		
			2009	112.38		
			2012	116.25		
			2015	117.17	(-16.59)	
	AVERAGE WATER DECLINE					8.62

EVANGELINE AQUIFER MONITOR WELLS 201' - 300' DEPTH



EVANGELINE AQUIFER MONITOR WELLS 201 ft - 300 ft DEPTH

Year	(1) Well Tag # 17 262.8'	(2) Well Tag # 16 226'	(3) Well Tag # 10 250+	(4) Well Tag # 57 275'	(5) Well tag #62 222'	(6) Well Tag # 74 222'	(7) Well Tag # 100 291'	(8) Well Tag # 9 210'	(9) Well Tag # 28 282'	(10) Well Tag # 61 263'	(11) Well Tag # 117 209.7'	(12) Well Tag # 18 277'	(13) Well Tag # 108 260.75'	(14) Well Tag # 73 280'	(15) Well Tag # 104 235'	(16) Well Tag # 40 280'	(17) Well Tag # 1 250'
2000																	
2001																	
2002		59															
2003	52.58	52.98	78.5					105.775	63.6			83.9					99.835
2004	52.58	52.98	78.5					102.81	63.6			83.9				39.66	95.6
2005	54.5	51.8	77.3	83.72				102.81	63.6			80.9				39.66	93.4
2006	54.5	53.23	77.3	83.72				104.2	63.6			84.7			90.65	39.66	95.6
2007	49.32	50.4	77.3	83.72				103.05	63.6			82.53	58.4	63	87.74	39.7	95.6
2008	50.63	50.78	77.2	83.8	72.75	67.45	84.33	105.53	65.8	87.55	70.7	85.53	59.21	63	88.9	47.65	104.1
2009	51.87667	53.3933	78.8	89.1	73.45	70.3	84.55	107.35	67.53	91.7	73.85	86.125	60.21	82.5	94.2	43.8	101.65
2010	52.35	52.7	77.65	85.175	71.465	66.6	81.9	107.4	67.39	89.425	67.515	84.285	58.8	84.8	89.4	41.62	98.7
2011	53.2	54.4	79.55	91.1	74.125	69.85	85.015	110.1	69.8	93.125	72.24	87.775	61.525	87.4	86.5	45.51	101.395
2012	54.55	56.25	81.4	92	76.8	73.675	86.865	111.625	71.76	94	76.6	88.965	62.7	87.825	86.45	45.65	104.34
2013	56.7	55.35	84.5	95.5	77.85	76.075	91.21	115.175	74.85	98.55	79.2	91.525	65.565	87.825	87.745	48.64	108.15
2014	56.75	58.15	83.65	97.525	81.75	77.475	92.55	117.475	77.125	99.49	80.6	92.6	67.15	88.225	88.4	50.075	109.15
2015				95.9	80.5	77.9	91.7	115.3	75.45	100.6	81.05	92.05				50.25	106.8

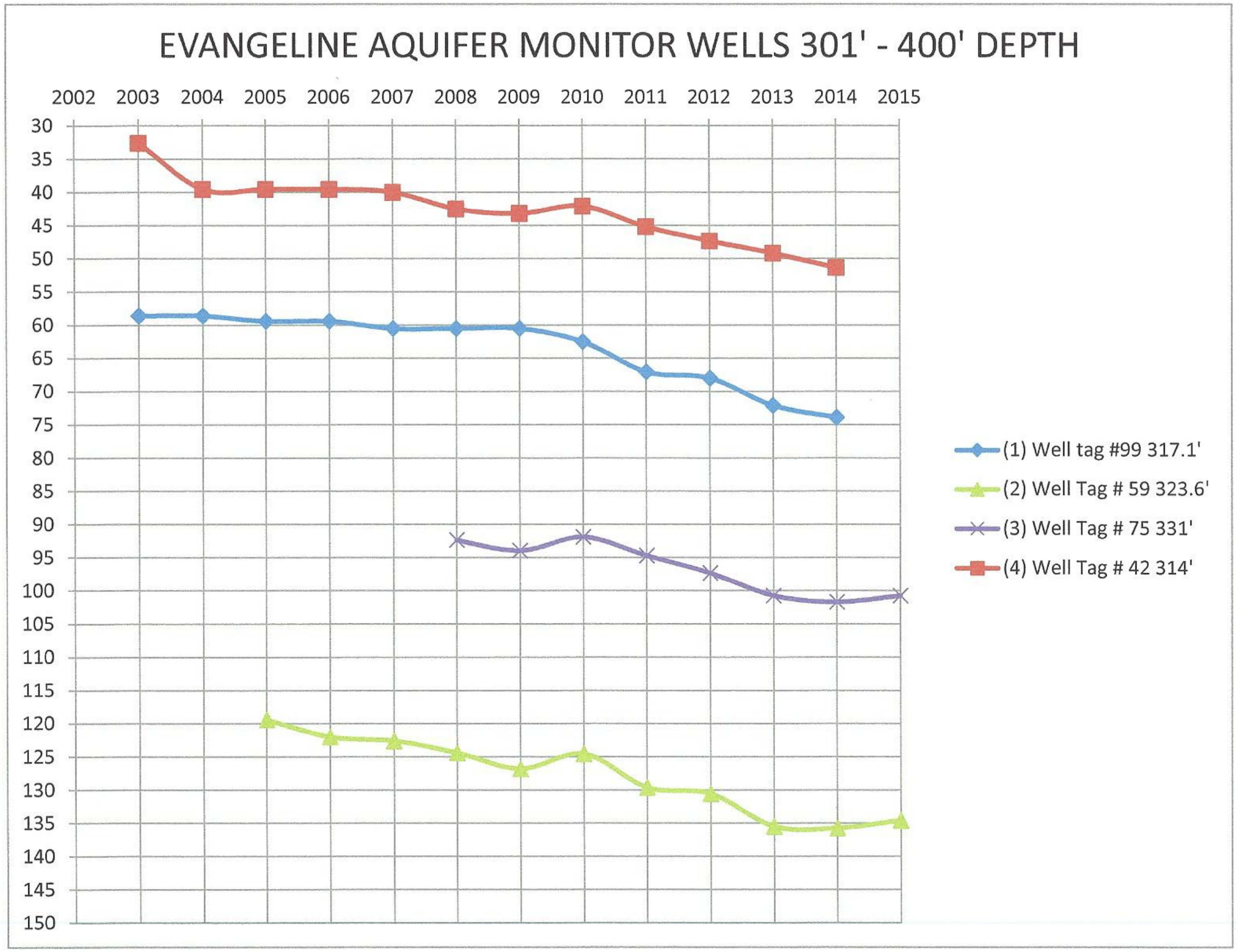
EVANGELINE AQUIFER MONITOR WELLS 201 ft - 300 ft DEPTH

Year	(18) Well Tag # 4 230'	(19) Well Tag # 65 '300	(20) Well Tag # 136 218'	(21) Well Tag # 26 204'	(22) Well Tag # 2 250'
2000					
2001					
2002					
2003	121.425			36.4	100.575
2004	117.05			35.05	107.275
2005	114.125	86.55		36.1	104.7
2006	117.7	86.55		36.1	107.2
2007	116.5	86.55		35.25	107.2
2008	122.6	90.52		35.25	109.35
2009	123.425	92.5		35.25	112.375
2010	119.94	91.27		35.25	110.1
2011	124.9	95.1	20.775	37	112.89
2012	126	96.875	20.725	37.8	116.225
2013	129.55	100.2	21.75	38.9	117.635
2014	130.45	102.4	22.5	39.88	121
2015	129.55	100.4			117.17

EVANGELINE AQUIFER MONITOR WELLS 301 ft - 400 ft

Depth

Year	(1) Well tag #99 317.1'	(2) Well Tag # 59 323.6'	(3) Well Tag # 75 331'	(4) Well Tag # 42 314'
2002				
2003	58.6			32.6
2004	58.6			39.54
2005	59.4	119.4		39.54
2006	59.4	122		39.54
2007	60.5	122.6		40
2008	60.5	124.4	92.35	42.5
2009	60.5	126.8	93.95	43.175
2010	62.5	124.575	91.91	42.105
2011	67.05	129.625	94.7	45.175
2012	68	130.55	97.325	47.325
2013	72.1	135.5	100.735	49.175
2014	73.9	135.75	101.7	51.35
2015		134.6	100.75	


EVANGELINE AQUIFER MONITOR WELLS 301' - 400' DEPTH
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
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115
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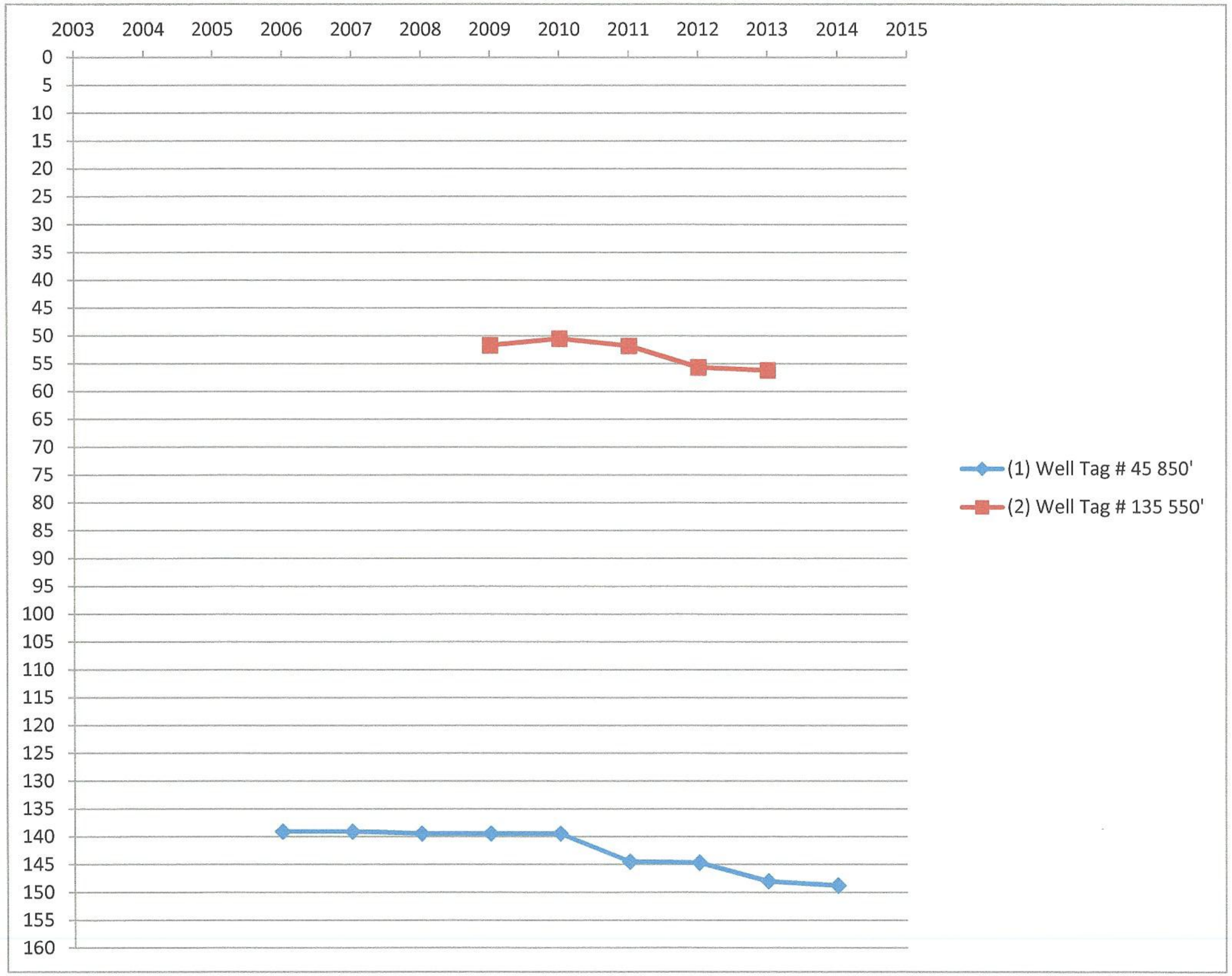
125
130
135
140
145
150
(1) Well tag #99 317.1'
(2) Well Tag # 59 323.6'
(3) Well Tag # 75 331'
(4) Well Tag # 42 314'

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 301-400 DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.894383 -97.3815	314	2003	32.6		
			2006	39.54		
			2009	43.18		
			2012	47.33		
			2015	49.73	(-17.13)	
2	28.8142 -97.471933	323.6	2005	119.4		
			2006	122		
			2009	126.8		
			2012	130.55		
			2015	134.6	(-15.2)	
3	28.765483 -97.4298067	331	2008	92.35		
			2009	93.95		
			2012	97.5		
			2015	100.75	(-8.4)	
4	28.8694 -97.42175	317.1	2003	58.6		
			2006	59.4		
			2009	60.5		
			2012	68		
			2014	73.9	(-15.3)	
	AVERAGE WATER DECLINE					**14'**

EVANGELINE AQUIFER MONITOR WELLS 401 ft AND BELOW DEPTH

Year	(1) Well Tag # 45 850'	(2) Well Tag # 135 550'
2003		
2004		
2005		
2006	139.05	
2007	139.05	
2008	139.45	
2009	139.45	51.7
2010	139.45	50.5
2011	144.5	51.8
2012	144.65	55.65
2013	148	56.2
2014	148.75	


2003
2004
2005
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2015
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75
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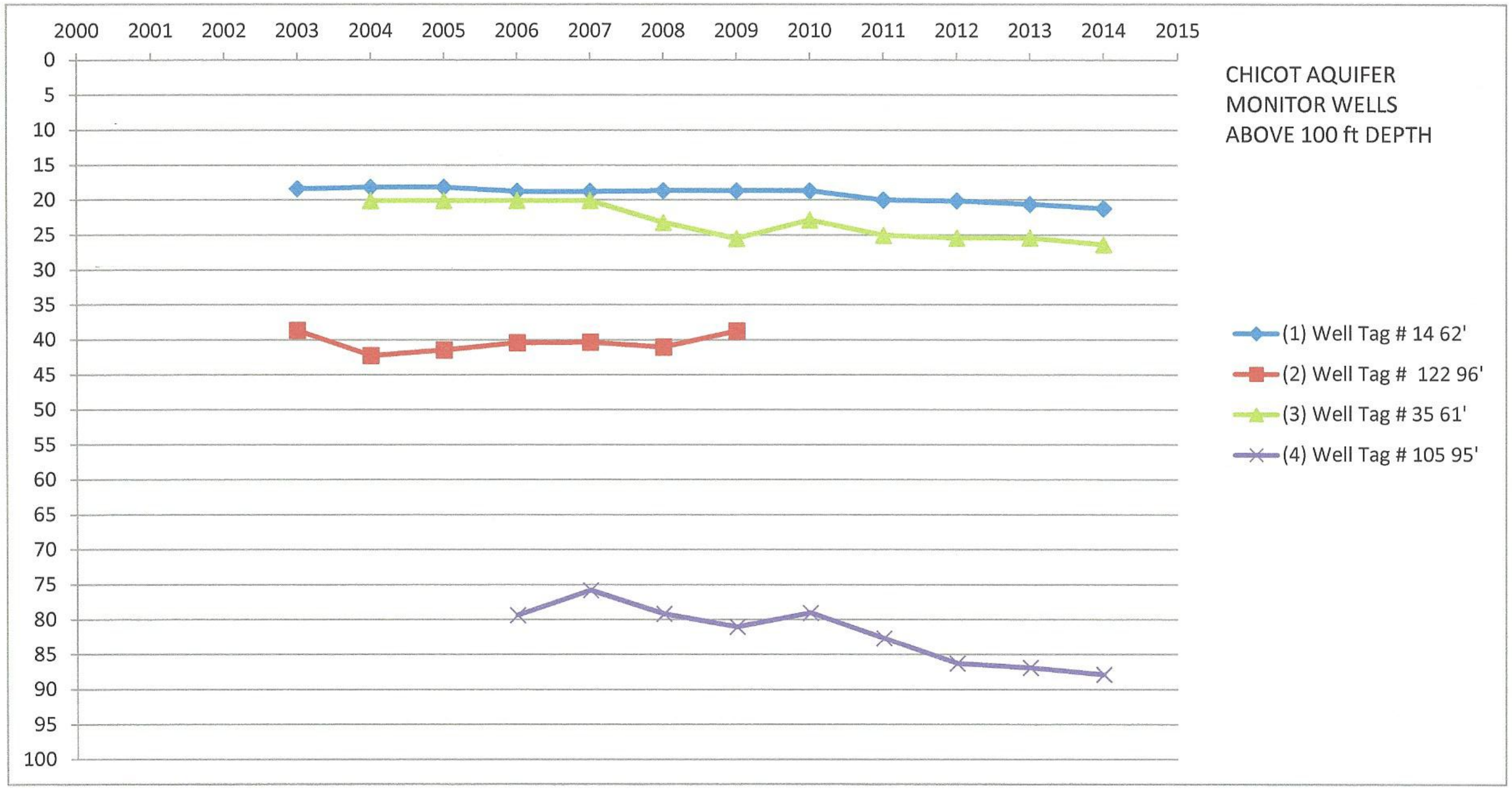
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
(1) Well Tag # 45 850'
(2) Well Tag # 135 550'

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
EVANGELINE AQUIFER MONITOR WELLS 401' AND BELOW DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.752717 -97.530467	850	2006	137.8		
			2009	139.45		
			2012	144.65		
			2014	148.75	(-10.95)	
2	28.71934 -97.32055	550	2000	52.28		
			2003	53.25		
			2006	48.41		
			2009	51.7		
			2012	56.8		
			2013	56.2	(-3.92)	
	AVERAGE WATER DECLINE					7.44

CHICOT AQUIFER MONITOR WELLS ABOVE 100 ft DEPTH

Year	(1) Well Tag # 14 62'	(2) Well Tag # 122 96'	(3) Well Tag # 35 61'	(4) Well Tag # 105 95'
2002				
2003	18.4			
2004	18.2		20.1	
2005	18.2		20.1	
2006	18.8		20.1	79.4
2007	18.8		20.1	75.83
2008	18.7		23.2	79.2
2009	18.7	38.65	25.5	81.05
2010	18.7	42.25	22.875	79.06
2011	20.03	41.465	25.05	82.705
2012	20.125	40.42	25.45	86.3
2013	20.62	40.355	25.415	86.9
2014	21.25	41.05	26.375	87.9
2015		38.75		



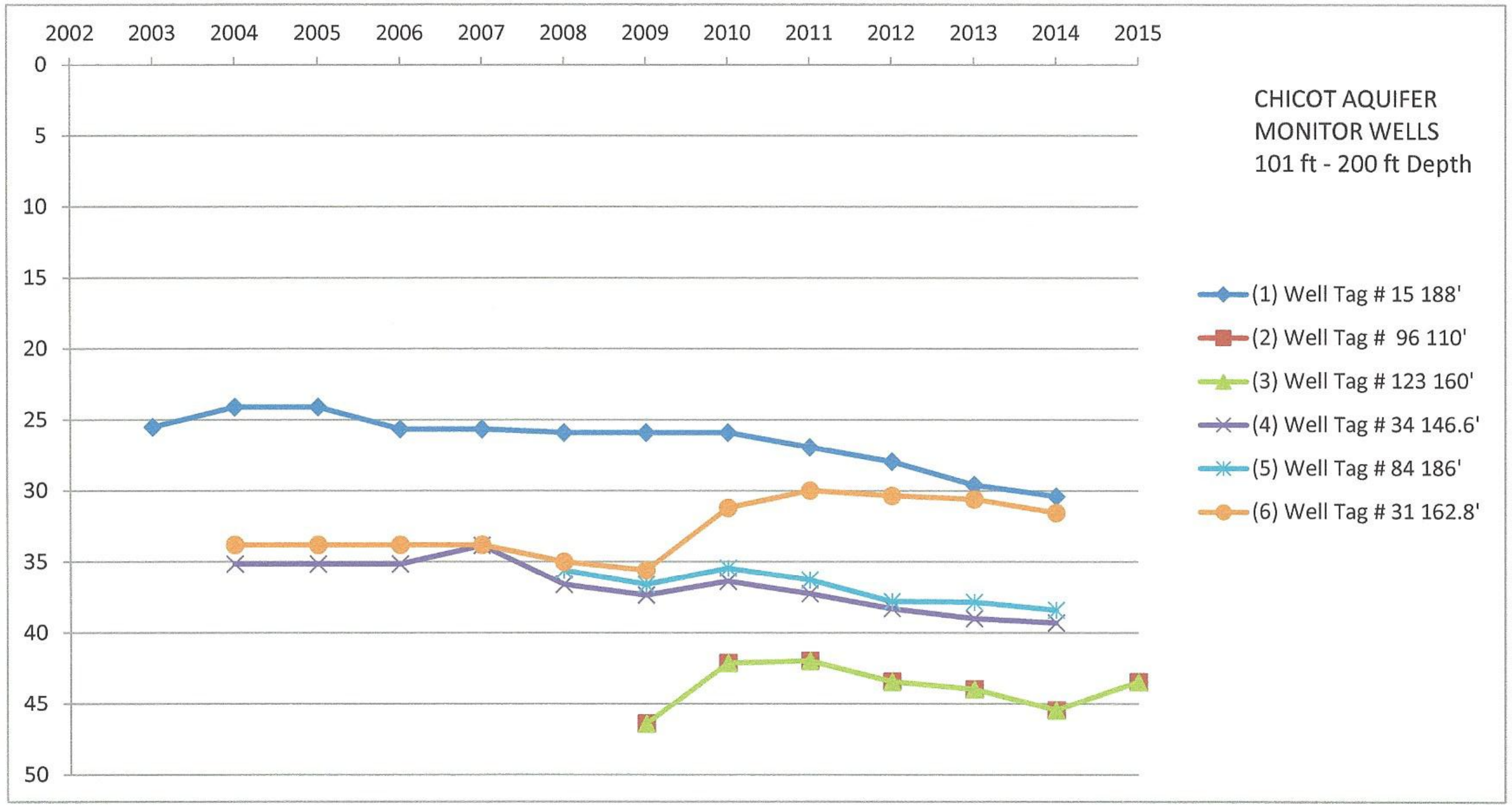
CHICOT AQUIFER
MONITOR WELLS
ABOVE 100 ft DEPTH
(1) Well Tag # 14 62'
(2) Well Tag # 122 96'
(3) Well Tag # 35 61'
(4) Well Tag # 105 95'
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
CHICOT AQUIFER MONITOR WELLS ABOVE 100 FT. DEPTH

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.47385 -97.273667	62'	2003	18.4		
			2006	18.8		
			2009	18.7		
			2012	20.125		
			2014	21.25	(-2.85)	
2	28.40632 -97.37969	96'	2009	38.65		
			2012	40.42		
			2014	41.35	(-2.7)	
3	28.40202 -97.38966	61'	2004	20.1		
			2006	20.1		
			2009	25.5		
			2012	25.45		
			2014	27	(-6.9)	
4	28.59323 -97.5108	95'	2006	79.4		
			2009	81.05		
			2012	86.3		
			2014	87.9	(-8.5)	
	AVERAGE WATER DECLINE					5.24'

CHICOT AQUIFER MONITOR WELLS 101 ft - 200 ft DEPTH

Year	(1) Well Tag # 15 188'	(2) Well Tag # 96 110'	(3) Well Tag # 123 160'	(4) Well Tag # 34 146.6'	(5) Well Tag # 84 186'	(6) Well Tag # 31 162.8'
2002						
2003	25.5					
2004	24.1	17.55		35.15		33.8
2005	24.1	17.55		35.15		33.8
2006	25.65	17.55		35.15		33.8
2007	25.65	17.55		33.85		33.8
2008	25.9	19.31		36.6	35.6	35
2009	25.9	19.31	46.4	37.35	36.6	35.6
2010	25.9	19.31	42.125	36.38	35.45	31.2
2011	26.925	21.125	41.98	37.24	36.275	29.985
2012	27.95	21.775	43.435	38.3	37.8	30.35
2013	29.6	22.72	43.96	39	37.85	30.59
2014	30.4	23.53	45.45	39.3	38.4	31.55
2015			43.45			


CHICOT AQUIFER
MONITOR WELLS
101 ft - 200 ft Depth
(1) Well Tag # 15 188'
(2) Well Tag # 96 110'
(3) Well Tag # 123 160'
(4) Well Tag # 34 146.6'
(5) Well Tag # 84 186'
(6) Well Tag # 31 162.8'
2002
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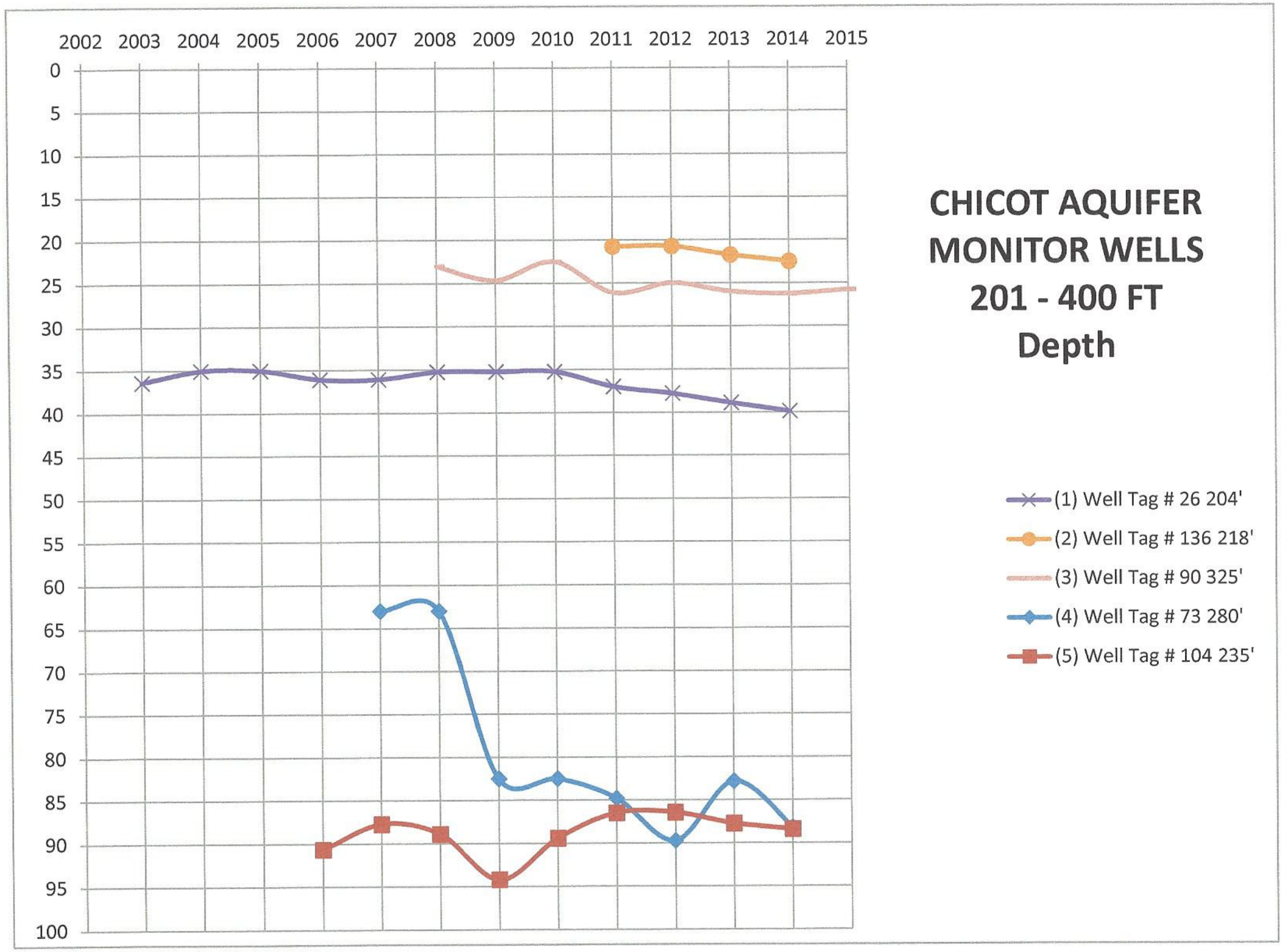
45
50

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
CHICOT AQUIFER MONITOR WELLS 101-200 FT.DEEP

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.469933 -97.3120833	188	2003	25.2		
			2006	25.65		
			2009	25.9		
			2012	27.95		
			2014	30.4	(-5.2)	
2	28.49533 -97.245233	110	2004	17.55		
			2006	17.55		
			2009	19.31		
			2012	21.775		
			2014	23.53	(-5.98)	
3	28.40564 -97.38155	160	2009	46.4		
			2012	43.77		
			2014	46.65	(-.25)	
4	28.40253 -97.39179	146.6	2004	35.15		
			2006	35.15		
			2009	25.5		
			2012	38.3		
			2014	39.3	(-4.15)	
5	28.39955 -97.39575	186	2008	35.6		
			2009	36.45		
			2012	37.8		
			2014	38.4	(-2.8)	
6	28.39404 -97.37833	162.8	2004	33.8		
			2006	33.8		
			2009	35.6		
			2012	30.35		
			2014	31.05	2.75	
	AVERAGE WATER DECLINE					**2.61**

CHICOT AQUIFER MONITOR WELLS 201 ft - 400 ft Depth

Year	(1) Well Tag # 26 204'	(2) Well Tag # 136 218'	(3) Well Tag # 90 325'	(4) Well Tag # 73 280'	(5) Well Tag # 104 235'
2002					
2003	36.4				
2004	35.05				
2005	35.05				
2006	36.1				90.65
2007	36.1			63	87.74
2008	35.25		23	63	88.9
2009	35.25		24.65	82.5	94.2
2010	35.25		22.5	82.5	89.4
2011	37	20.775	26.1	84.8	86.5
2012	37.8	20.725	24.99	89.7	86.45
2013	38.9	21.75	25.985	82.825	87.745
2014	39.88	22.5	26.25	88.225	88.4
2015			25.8		



CHICOT AQUIFER
MONITOR WELLS
201 - 400 FT
Depth
2002
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2008
2009
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2011
2012
2013
2014
2015
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55
60
65
70
75
80
85
90
95
100
(1) Well Tag # 26 204'
(2) Well Tag # 136 218'
(3) Well Tag # 90 325'
(4) Well Tag # 73 280'
(5) Well Tag # 104 235'

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
CHICOT AQUIFER MONITOR WELLS 201-400 FT.DEEP

	GPS LOCATION	DEPTH OF WELL	YEAR MEASURED	STATIC WATER LEVEL (FT.)	WELL LOSS OR GAIN (- OR +) LEVEL (FT.)	
1	28.39864 -97.37049	325	2008	23		
			2009	24.65		
			2012	25.2		
			2015	25.8	(-2.8)	
2	28.59194 -97.63675	280	2007	63		
			2009	82.5		
			2012	87.825		
			2014	88.22	(-25.2)	
3	28.59306 -97.50164	235	2006	90.65		
			2009	94.2		
			2012	86.45		
			2014	88.4	2.25	
4	28.5618 -97.2045833	204	2003	36.4		
			2006	36.1		
			2009	35.25		
			2012	37.8		
			2014	39.88	(-3.48)	
5	28.52155 -97.24815	218	2011	20.78		
			2012	20.73		
			2014	22.5	(-1.72)	
	AVERAGE WATER DECLINE					**6.19**

Goliad County Texas
Rainfall Averages

Yearly Totals average (inches)	Year	Total	Year	Total	Year	Total	Year	Total	Year	Total
	1913	34.21	1920	24.30	1930	44.62	1940	28.30	1950	18.69
	1914	42.19	1921	31.23	1931	25.94	1941	38.05	1951	37.52
	1915	21.47	1922	26.34	1932	40.06	1942	41.08	1952	37.22
	1916	19.99	1923	45.35	1933	35.17	1943	33.49	1953	28.50
	1917	9.73	1924	45.35	1934	31.67	1944	32.05	1954	16.14
	1918	32.34	1925	22.38	1935	28.32	1945	29.43	1955	25.27
	1919	47.25	1926	28.78	1936	36.55	1946	45.98	1956	19.63
			1927	32.86	1937	26.78	1947	30.91	1957	51.52
			1928	22.47	1938	27.30	1948	26.74	1958	41.85
			1929	29.59	1939	21.66	1949	35.44	1959	32.05
	Year	Total	Year	Total	Year	Total	Year	Total	Year	Total
	1960	48.21	1970	30.17	1980	32.96	1990	32.95	2000	38.22
	1961	29.11	1971	39.61	1981	66.40	1991	44.65	2001	45.86
	1962	31.77	1972	52.87	1982	27.40	1992	41.15	2002	42.38
	1963	23.59	1973	51.12	1983	38.50	1993	40.00	2003	33.75
	1964	25.21	1974	38.25	1984	31.70	1994	46.90	2004	48.00
	1965	45.18	1975	39.36	1985	43.80	1995	35.20	2005	29.01
	1966	37.63	1976	48.30	1986	35.70	1996	21.15	2006	30.95
	1967	44.78	1977	35.56	1987	29.50	1997	60.55	2007	49.58
	1968	42.25	1978	29.48	1988	17.40	1998	51.35	2008	21.28
	1969	35.49	1979	27.85	1989	19.15	1999	25.15	2009	38.00
	Year	Total								
	2010	38.75								
	2011	20.07								
	2012	24.54								
	2013	27.68								
	2014	25.08								