Welcome
to the

Gulf Coast Aquifer System Groundwater Availability Model

in Groundwater Management Areas 15 and 16

Stakeholder Advisory Forum

Thank you for signing in early.

The meeting will begin at 9:00 am, Central Daylight Time

Please stay muted during the meeting and use the chat box to submit questions

Texas Water Development Board

GAM Program

Texas Water Development Board

Aim:

Produce groundwater flow models for the major and minor aquifers of Texas.

Purpose:

Develop various tools that can be used to aid in groundwater resources management by stakeholders.

Public process: Stakeholder involvement during model development process and during associated aquifer related projects-as applicable.

Models: Freely available, standardized, thoroughly documented. Reports available over the internet.

Living tools: Periodically updated.

How we use groundwater models

Per statute:

- TWDB provides groundwater conservation districts with water budget data for their management plans.
- Groundwater management areas can use to assist in determining desired future conditions.
- TWDB uses when calculating estimated Modeled Available Groundwater.
- TWDB uses when calculating Total Estimated Recoverable Storage.

Why Stakeholder Advisory Forums?

- Keep you updated about model-related project progress
- Provide the opportunity to provide input and data to assist with model-related project development
- Discuss project limitations and applications

Groundwater Flow Conceptual Model for Gulf Coast Aquifer System in Groundwater Management Areas 15 and 16

An Online Update for Stakeholders
September 29, 2020

Jerry Shi, Ph.D., P.G.

Outline

- Project Team
- Acknowledgments
- Flow Chart of Project
- Highlights of Conceptual Model
- Schedule
- Inputs and Comments from Stakeholders

Project Team

- Jerry Shi, Ph.D., P.G.
  - Project Management
  - Modeling
- Radu Boghici, P.G.
  - Water Quality
  - Geology and Data Analysis
- Roberto Anaya, P.G.
  - Framework Analysis
  - GIS Support

Acknowledgment

We thank all stakeholders for your support, especially:

- Mr. Chris McFarlane and Mr. Landon Yosko of Evergreen Underground Water Conservation District

- Mr. Art Dohmann and Ms. Heather Sumpter of Goliad County Groundwater Conservation District

- Mr. Larijai Francis of Corpus Christi Aquifer Storage and Recovery Conservation District

Acknowledgment (continued)

- Mr. Andy Garza of Kenedy County Groundwater Conservation District

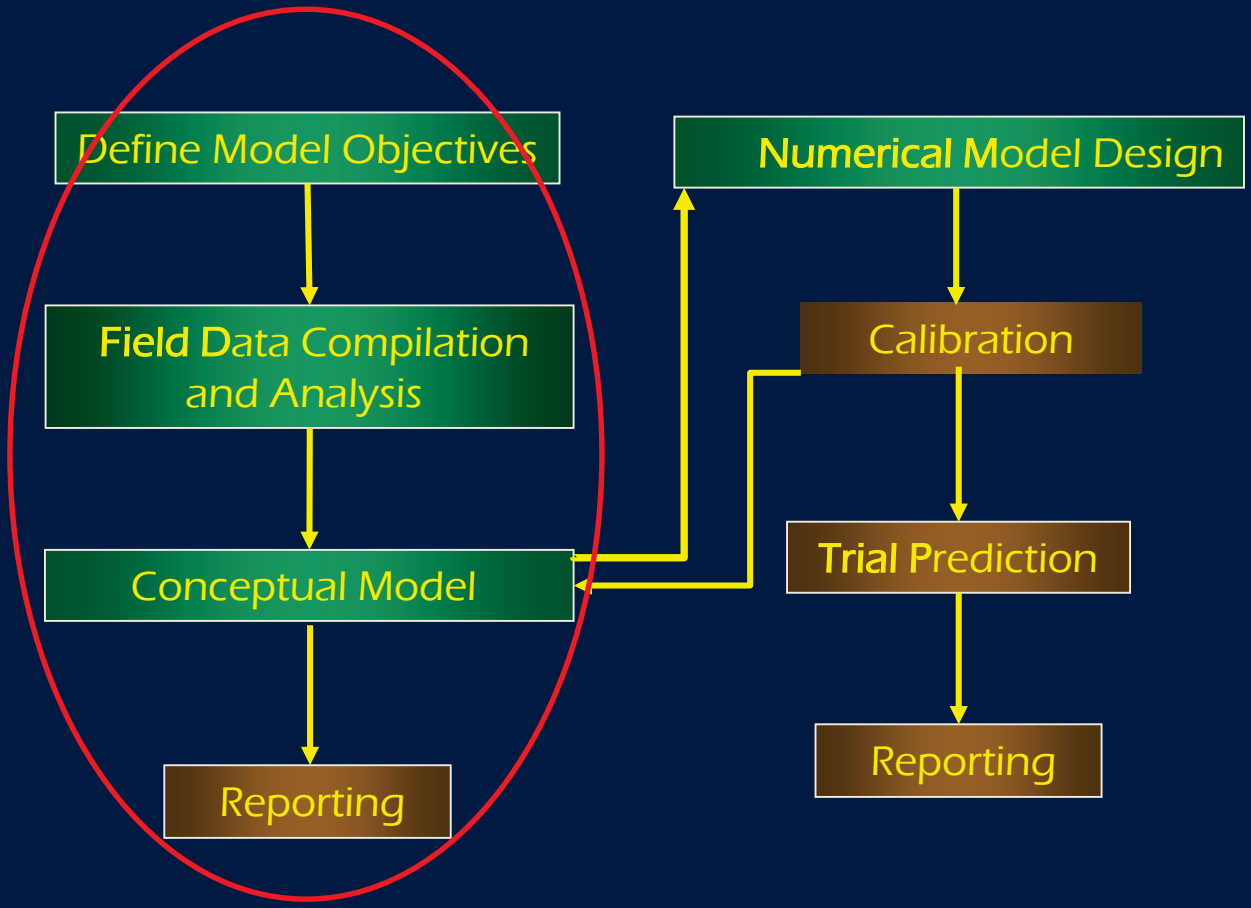
- Mr. James "Jim" Brasher of Colorado County Groundwater Conservation District

- Dr. Steve Young of INTERA, Inc.

- Mr. Kevin Spencer of R. W. Harden & Associates, Inc.

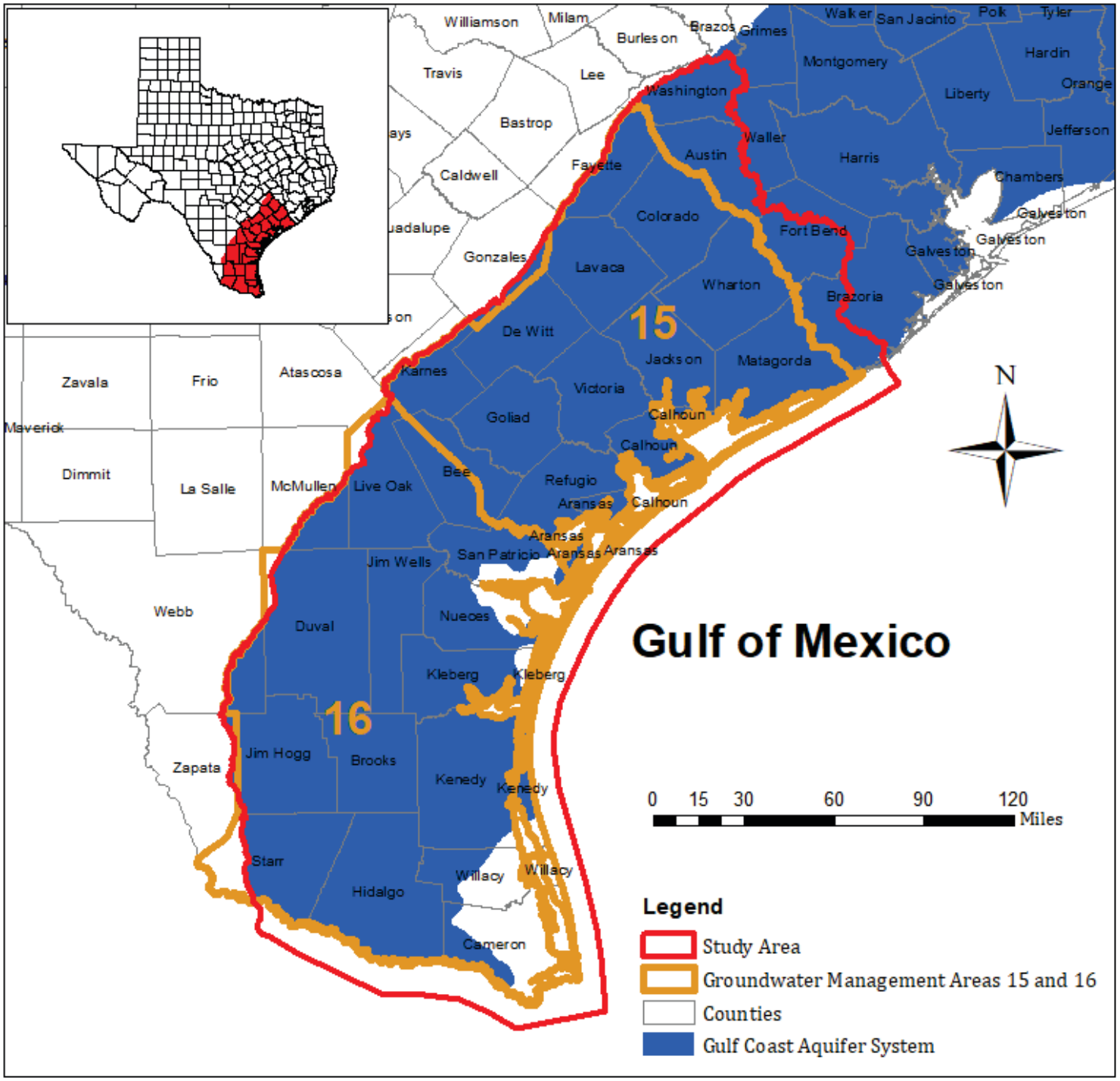
- Mr. David Morgan, Ms. Tina Shearman, and Mr. Terrel Graham of Neighborhood Against Destroying Aquifers

Flow Chart of Project

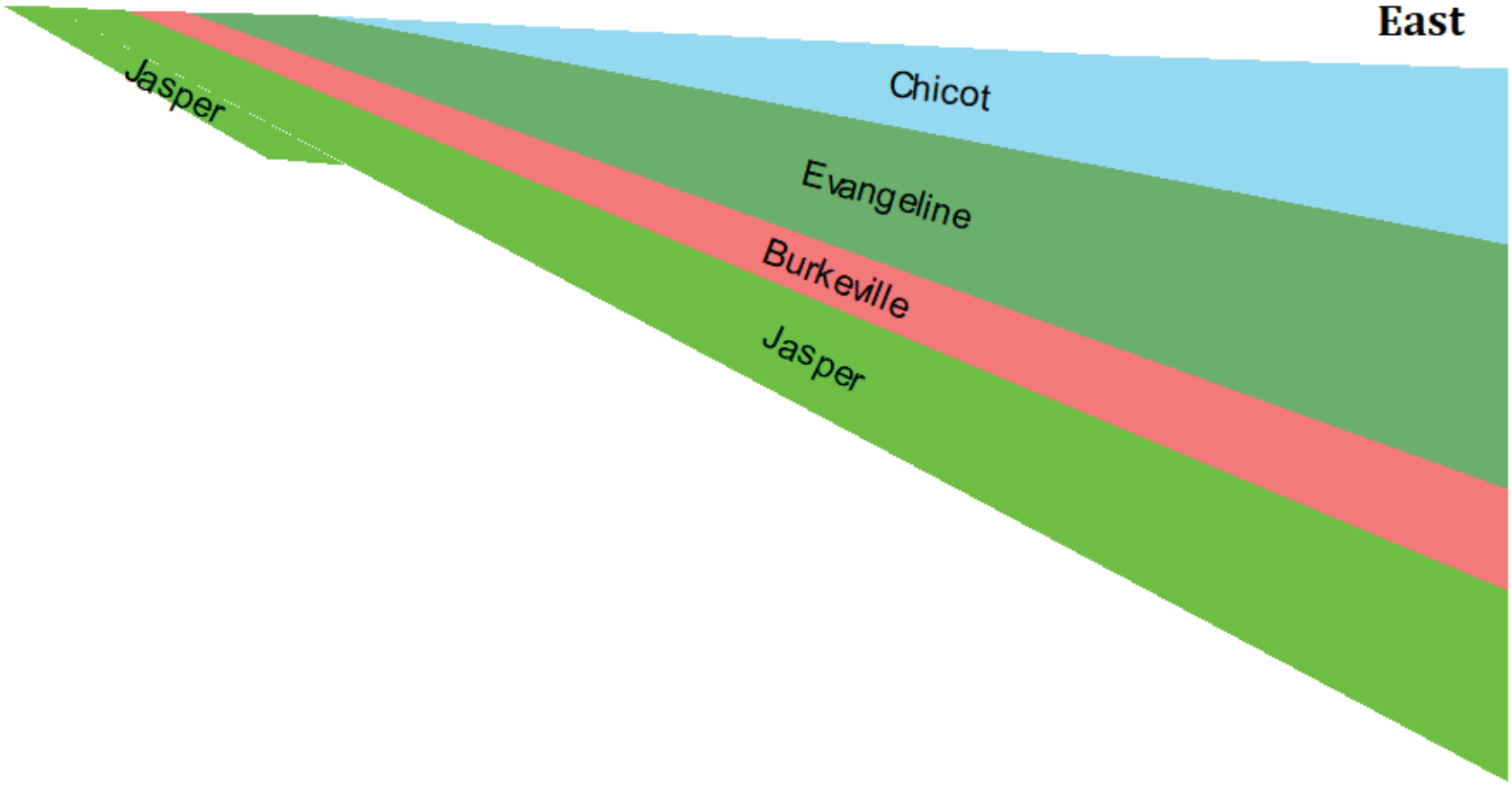


Highlights

Study Area Covering Gulf Coast Aquifer System from Brazos to South of Rio Grande



Gulf Coast Aquifer System

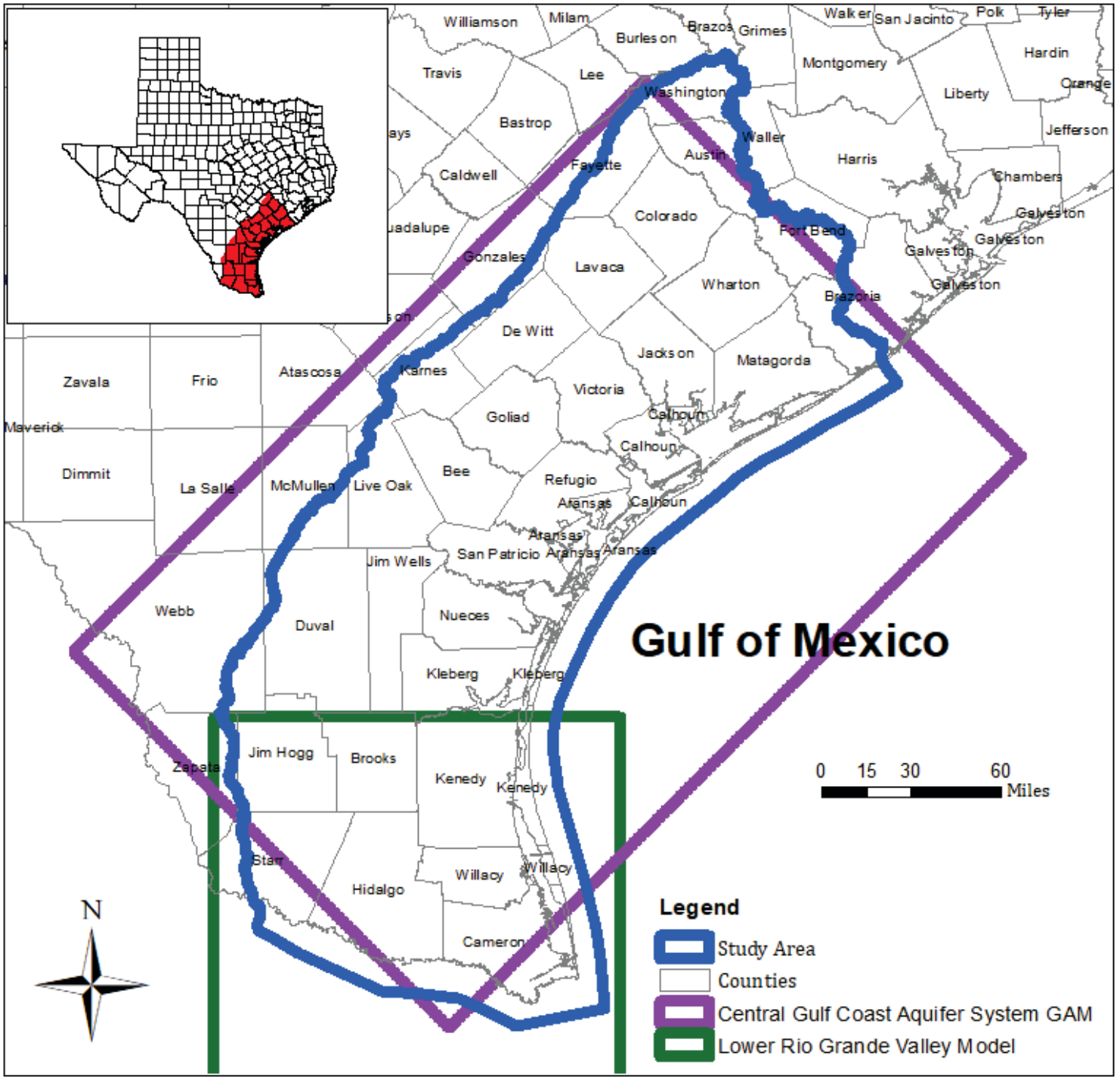


New Model Merging Two Existing Models:

- Central Gulf Coast Aquifer System
- Lower Rio Grande Valley

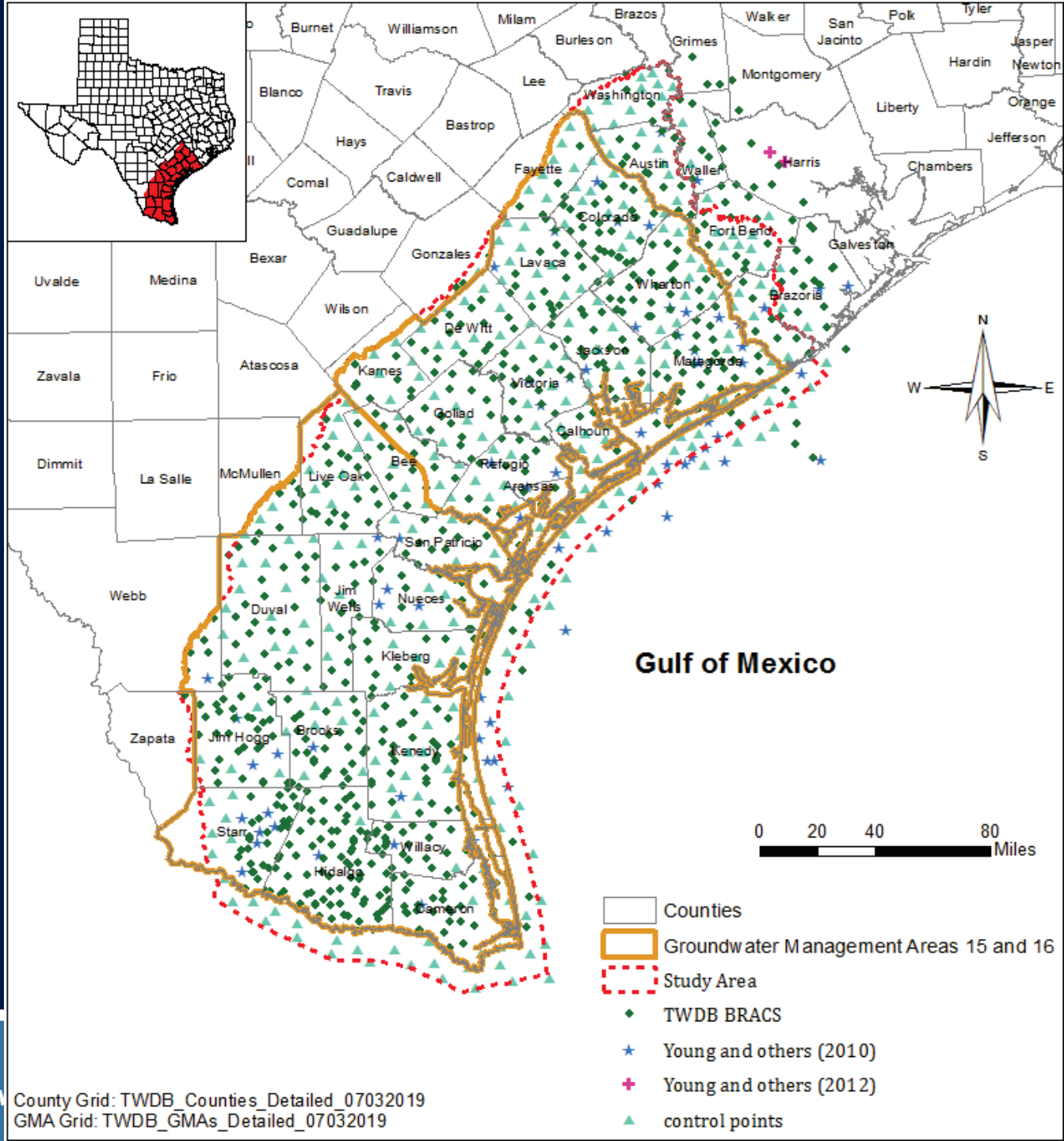
New Model Will Eliminate:

- Impacts from Boundaries
- Inconsistency between Existing Models



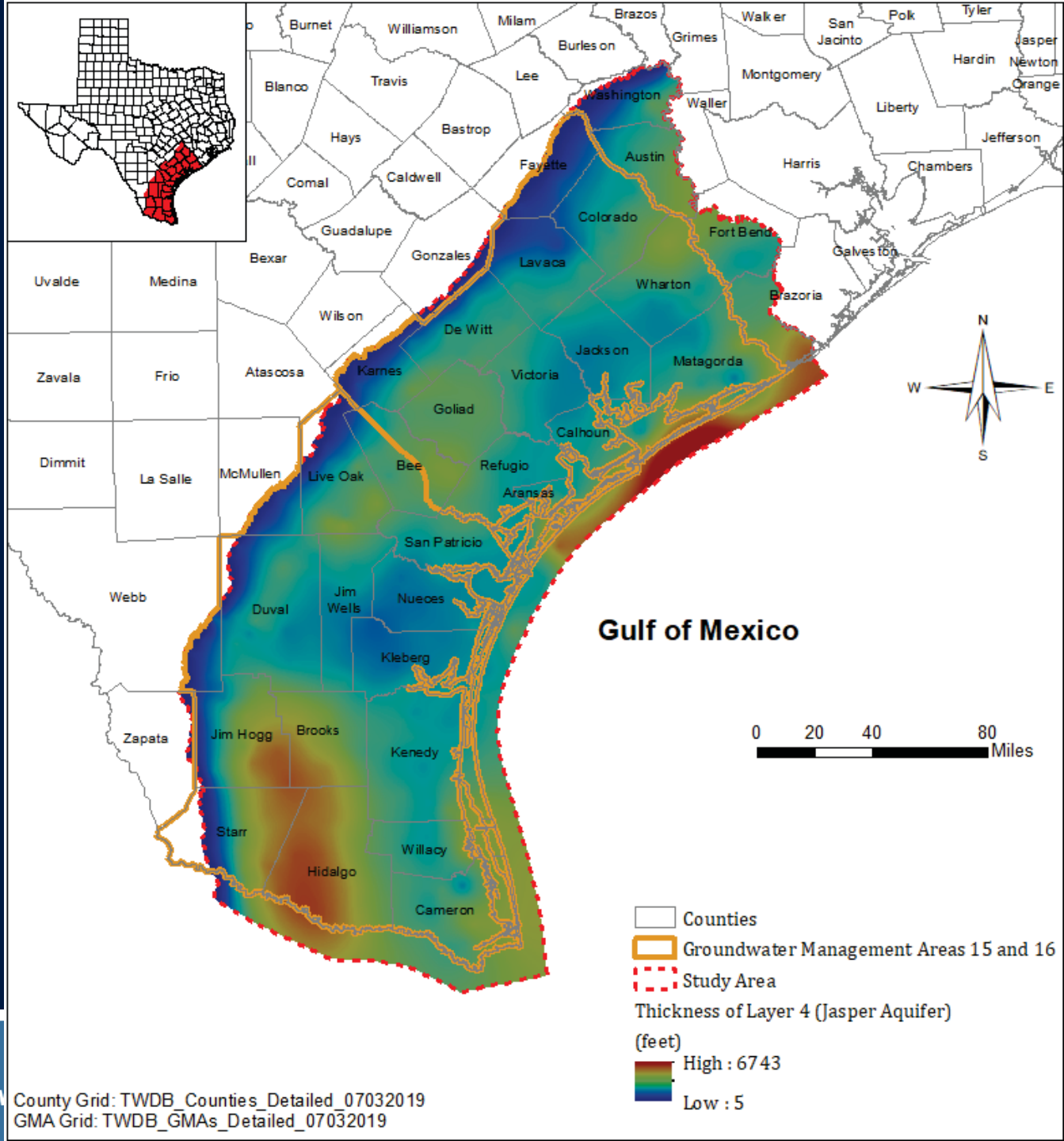
New Framework from:

- Geophysical Logs
- Water Well Logs
- Surface Geology (Geology Atlas of Texas)
- Control Points
- Create Thickness instead of Contact Surface
  - Minimize Faulting Impacts
  - No Worries about Unit Cropping out vs. Pinched out
  - Then Convert Thickness to Surface



New Framework Example:

Thickness of Jasper Unit



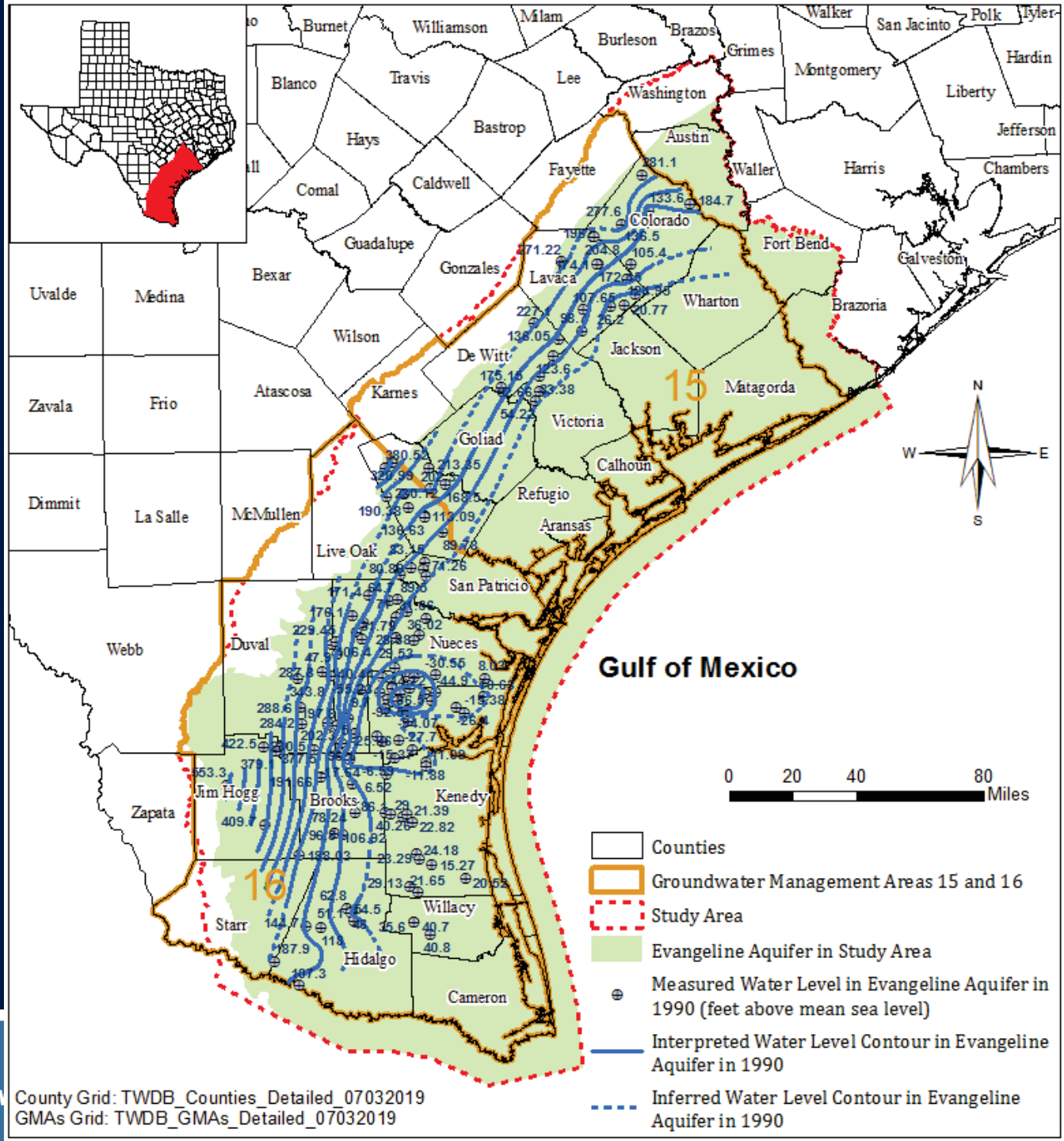
New Framework Example: A West-East Cross Section

Vertical Lines = Log Locations

Horizontal Lines = Hydrogeologic Contacts

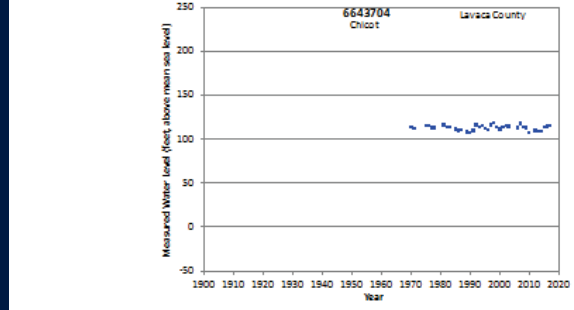
New Water Level Map Example (Evangeline in 1990):

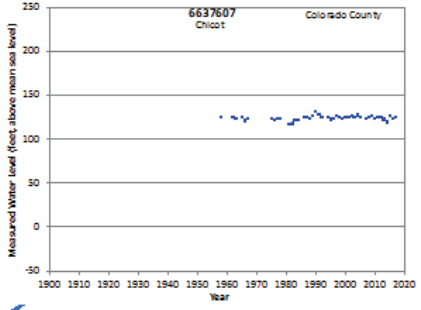
- Groundwater Flow toward Gulf
- However Locally Impacted by Pumping

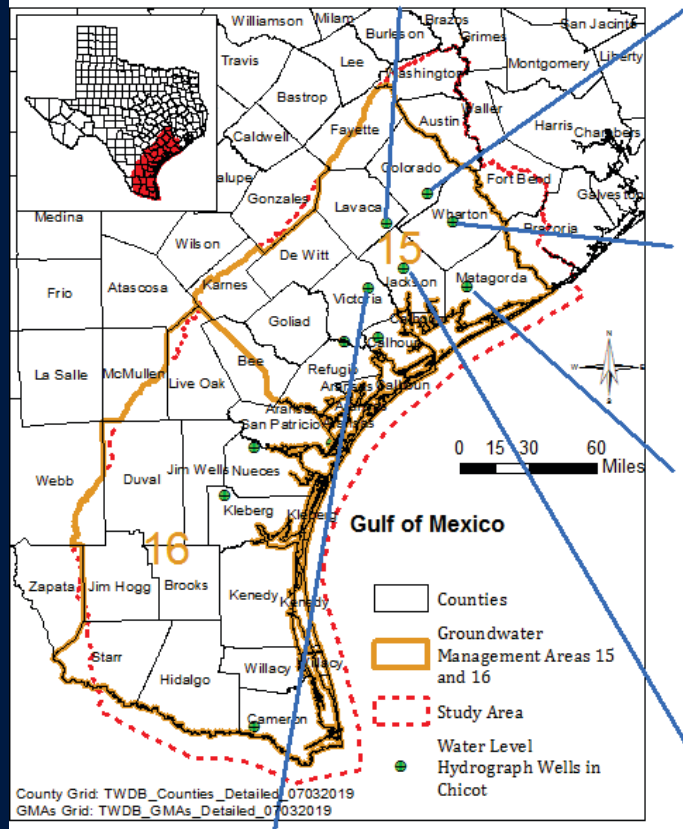


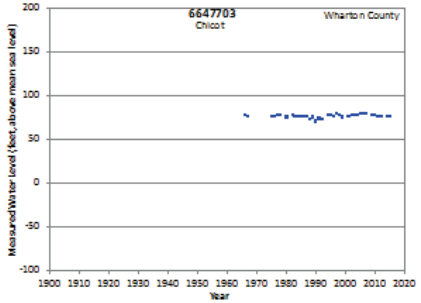
Water Level Change over Time (example):

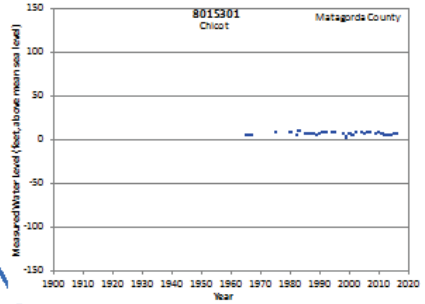
- Top Four Wells Show Little Water Level Change
- Bottom Two Wells Show Greater Water Level Change due to Pumping

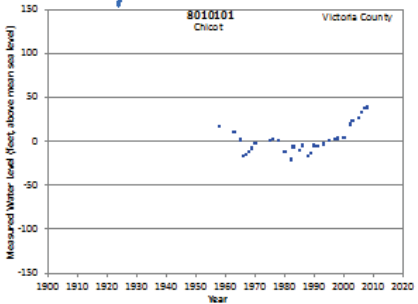


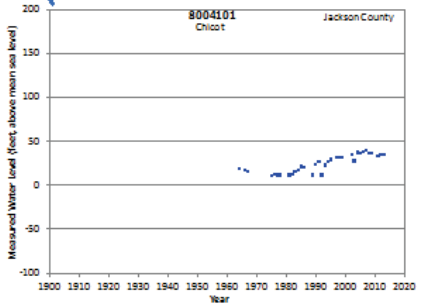






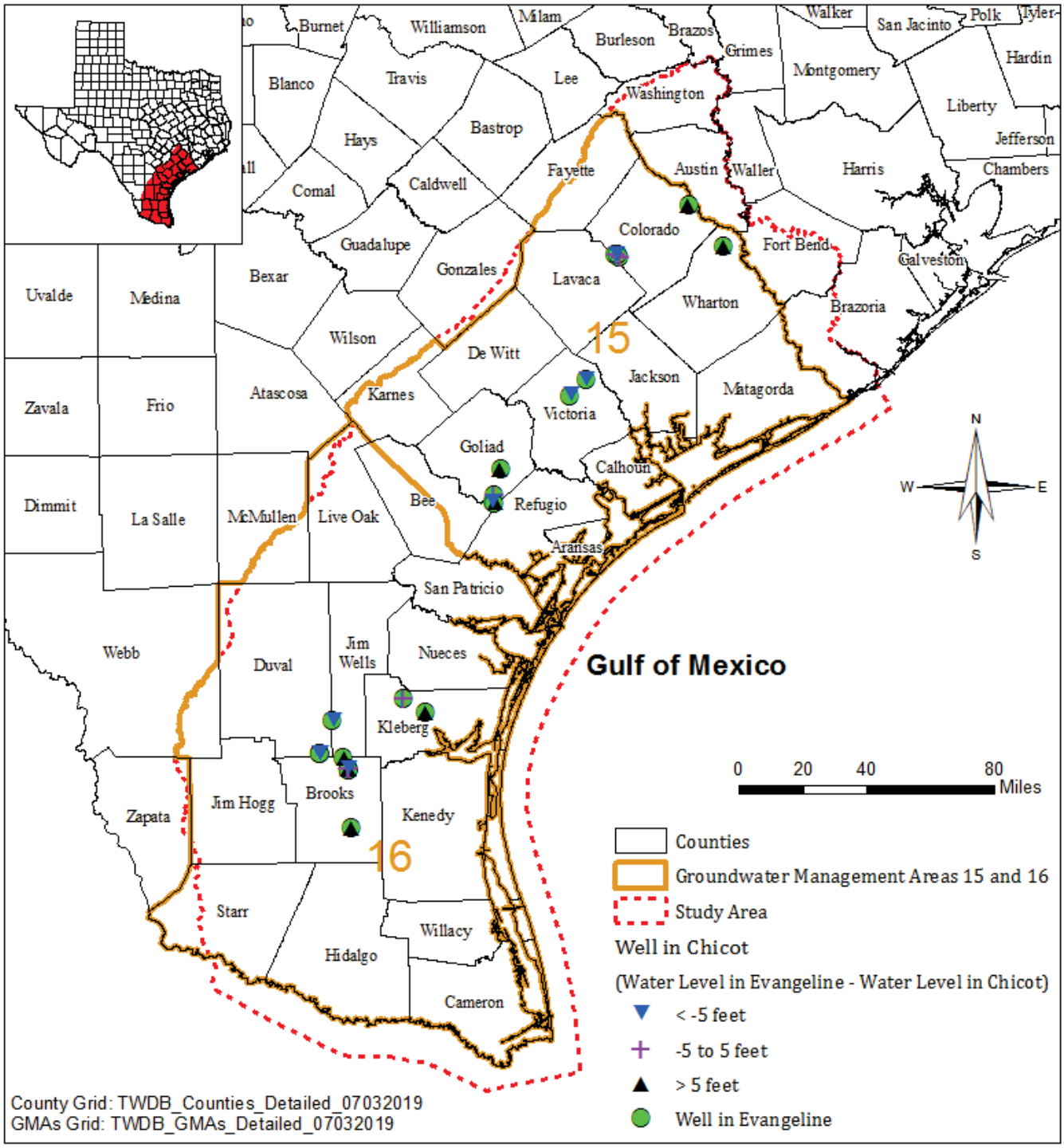






Vertical Groundwater Flow between Chicot and Evangeline (Example):

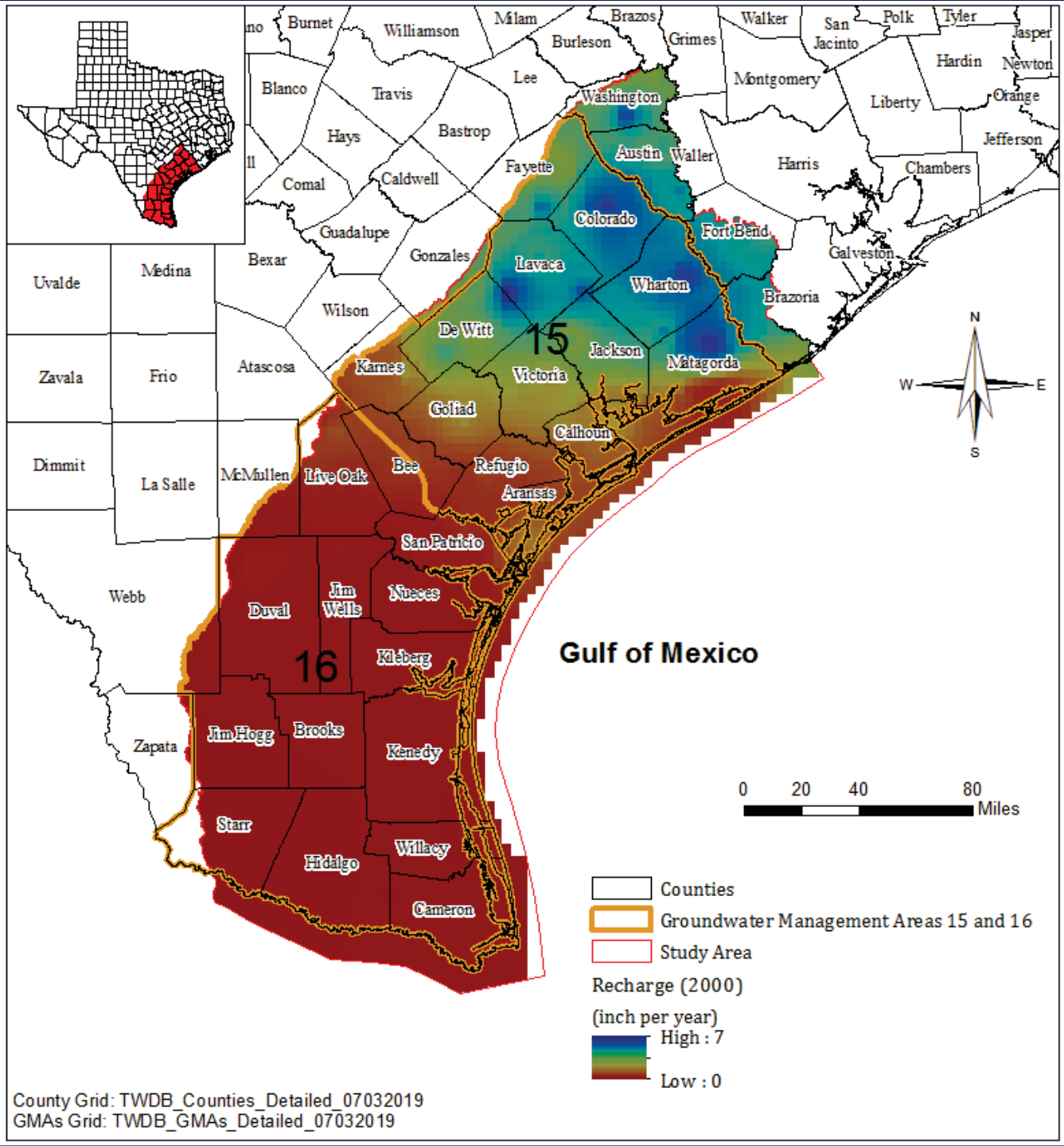
- Downward Flow at Outcrop/Recharge Area
- Upward Flow in Downdip Area and Near River



Continuous Groundwater Recharge Fields from Stream Baseflow and Precipitation between 1980 and 2015:

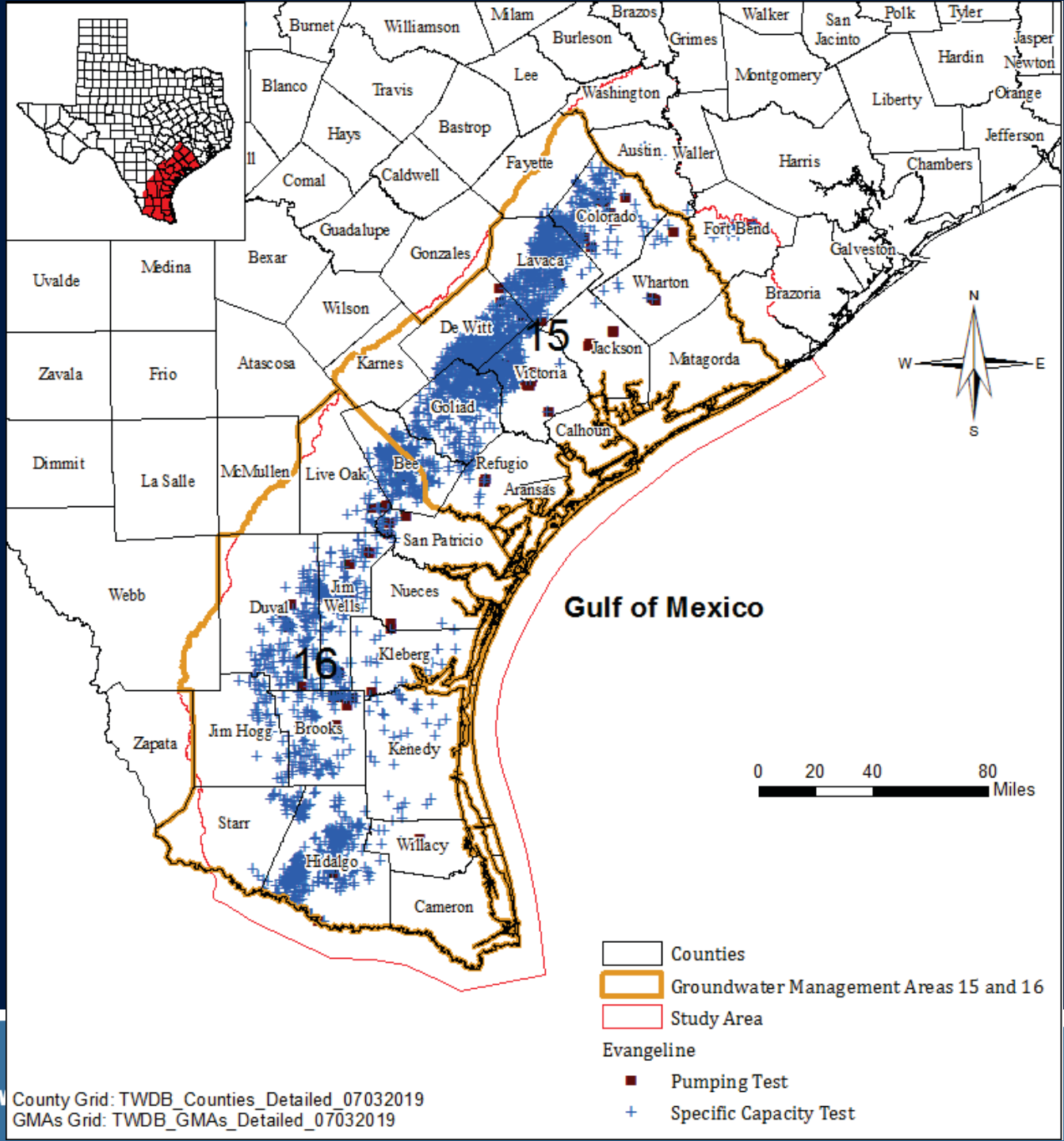
Example (2000)

- From North to South Groundwater Recharge Decreases from about 7 Inch/Year to almost Zero Inch/Year



Lots of Pumping Tests and Specific Capacity Tests Used to Estimate Hydraulic Conductivity and Storage Values:

- Pumping Test - Continuous Water Level Measurement during Pumping at Pumping Well and/or Observation Well(s)
- Specific Capacity Test – Pumping Rate over Water Level Decline (often by driller after well installation)



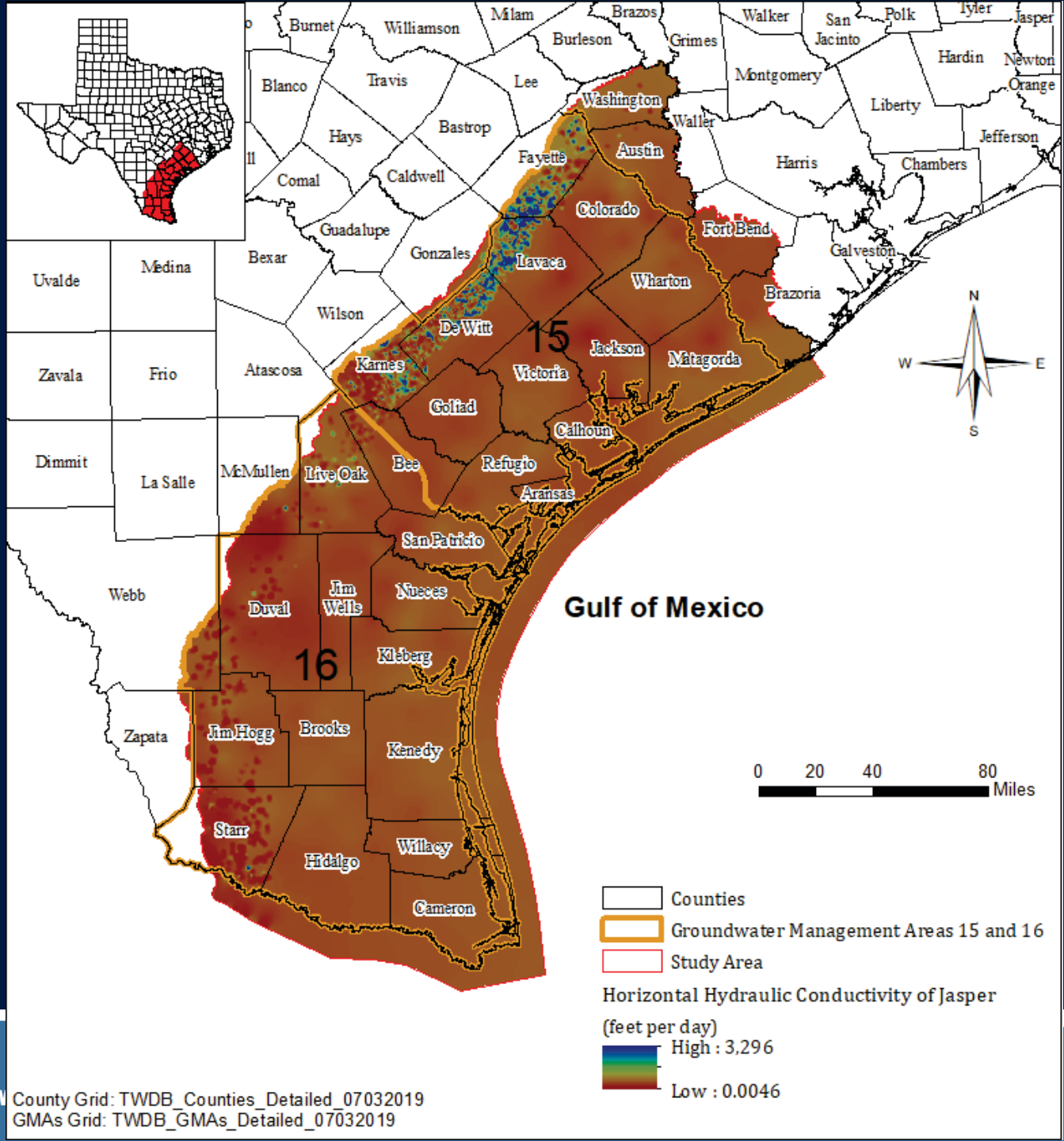
Lots of Pumping and Specific Capacity Tests

Unit	Count of Pumping Tests	Count of Specific Capacity Tests	Total Count
Chicot	157	4,388	4,545
Evangeline	91	3,398	3,489
Burkeville	5	595	600
Jasper	49	2,491	2,540
Total	**145**	**10,872**	**11,174**

Continuous Hydraulic Conductivity Field from Pumping Test, Specific Capacity Tests, and Sand Fraction

- Hydraulic Conductivity = A Measure of How Easy/Difficult Groundwater Flows through Rocks/Sediments; Coarser Materials Tend to Have Higher Values and Easier for Groundwater to Flow through
- Sand Fraction from Young and others (2010)
- Sand Fraction = Sand Thickness/Total Length of Interval

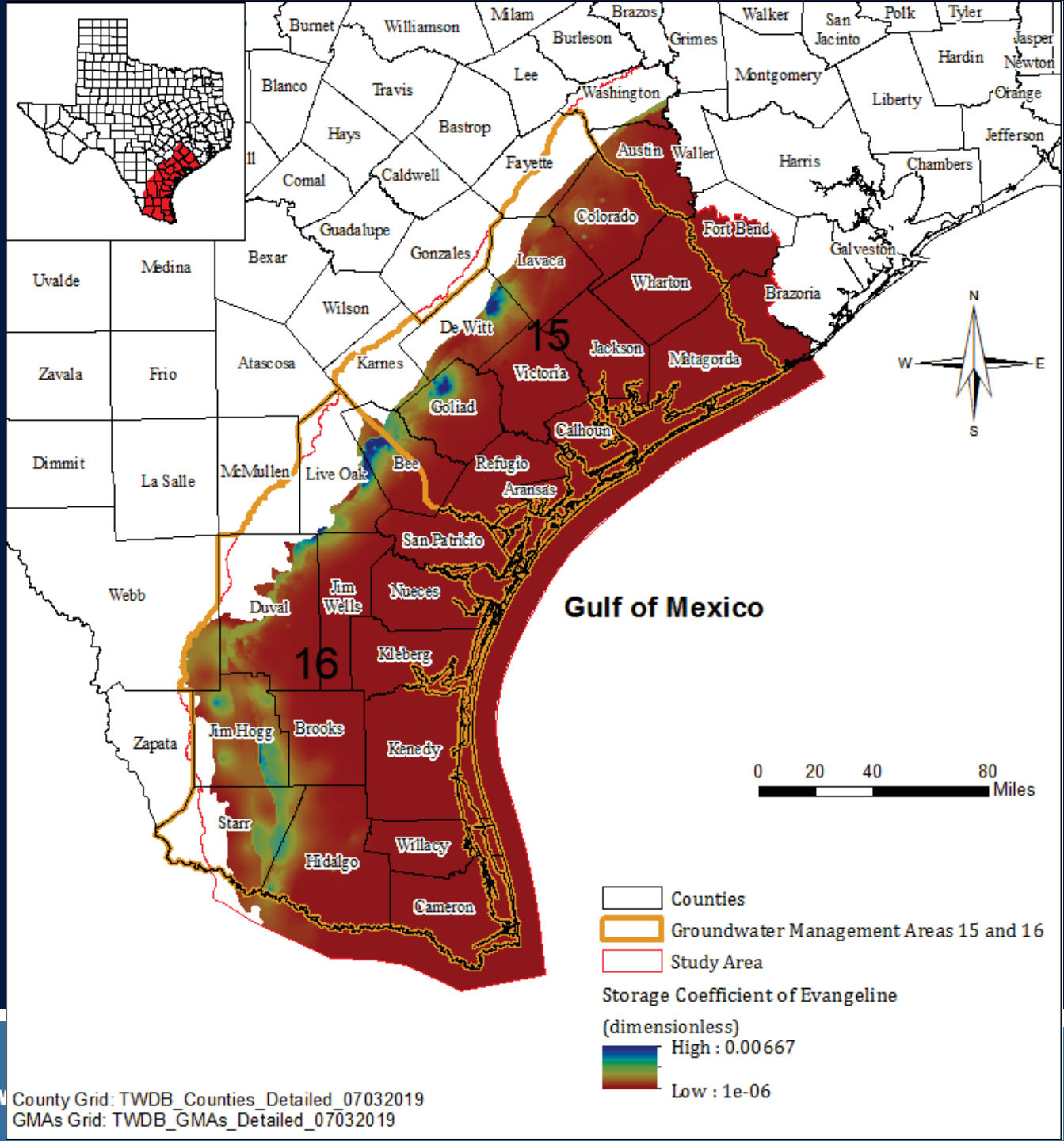
Example Jasper



Continuous Storage Field from Pumping Test and Sand Fraction

- Storage = Volume of Water Released When Water Level Declined by One
- Outcrop Area and Coarser Materials Tend to Have Higher Storage Values
- More Groundwater Available for Same Water Level Decline in Outcrop Area and Coarser Materials

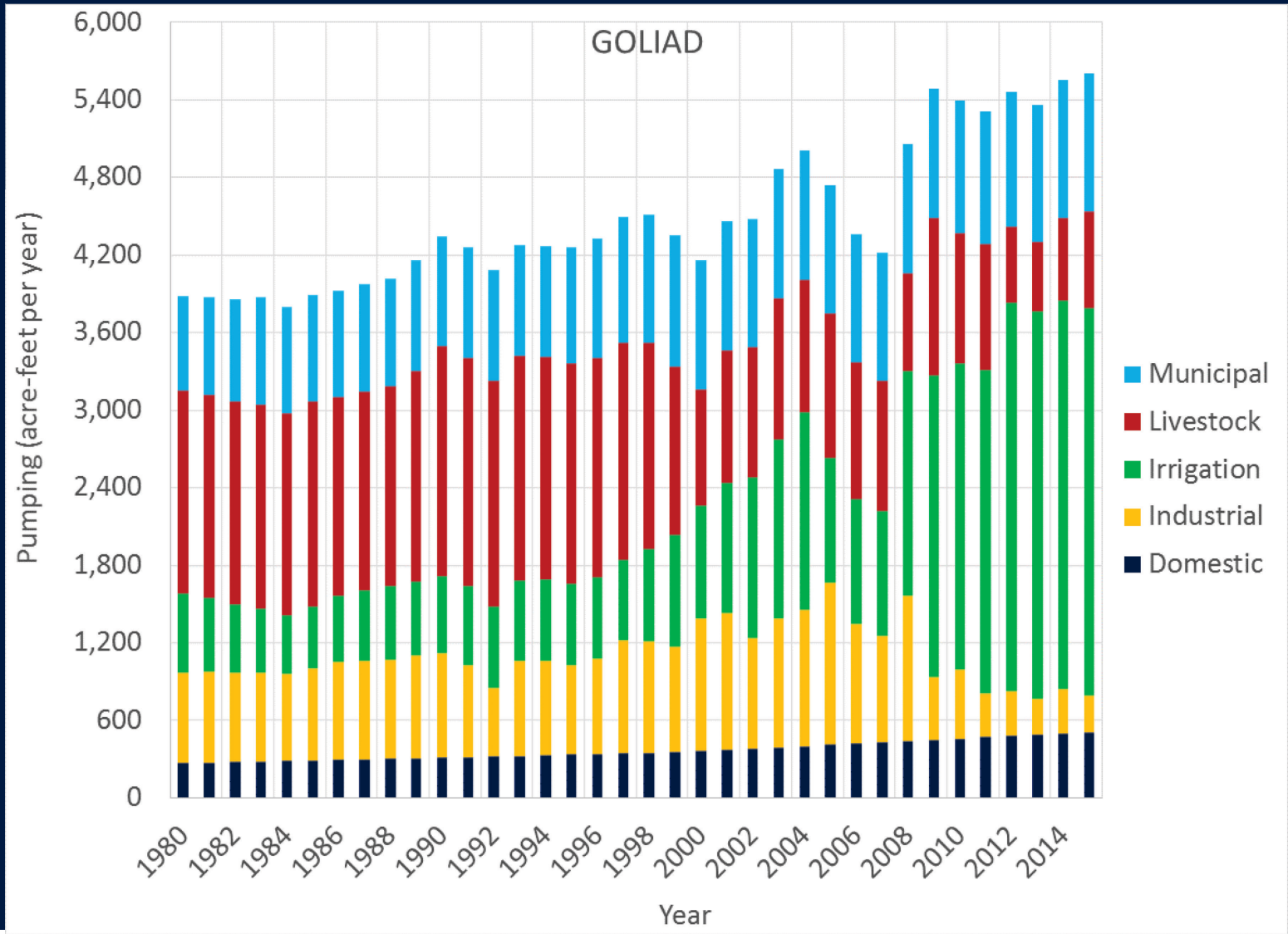
Example Evangeline



Example: Goliad County (1980 – 2015)

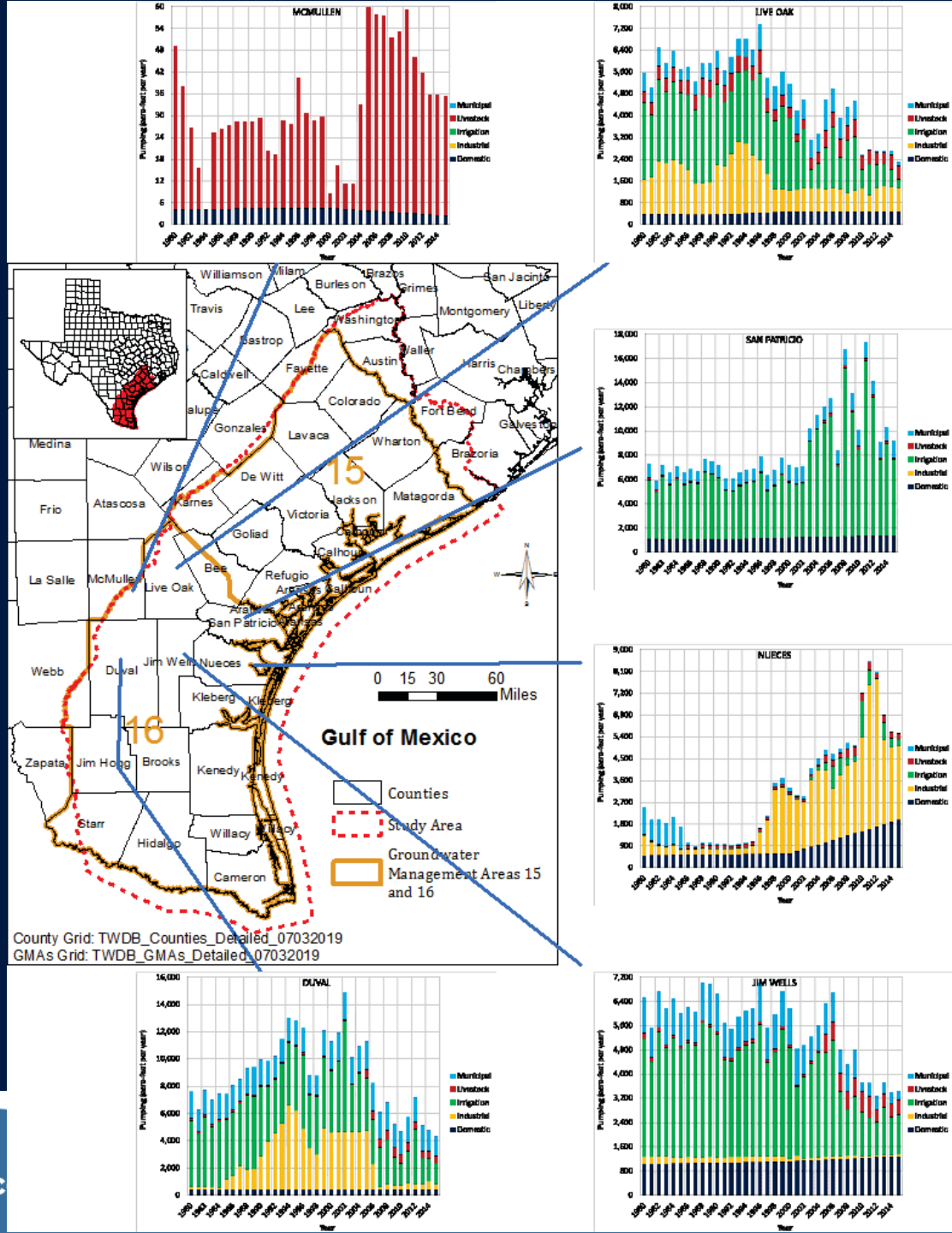
Pumping Data from Different Sources:

- Municipal
- Livestock
- Irrigation
- Industrial
- Domestic



Example Pumping Data by County

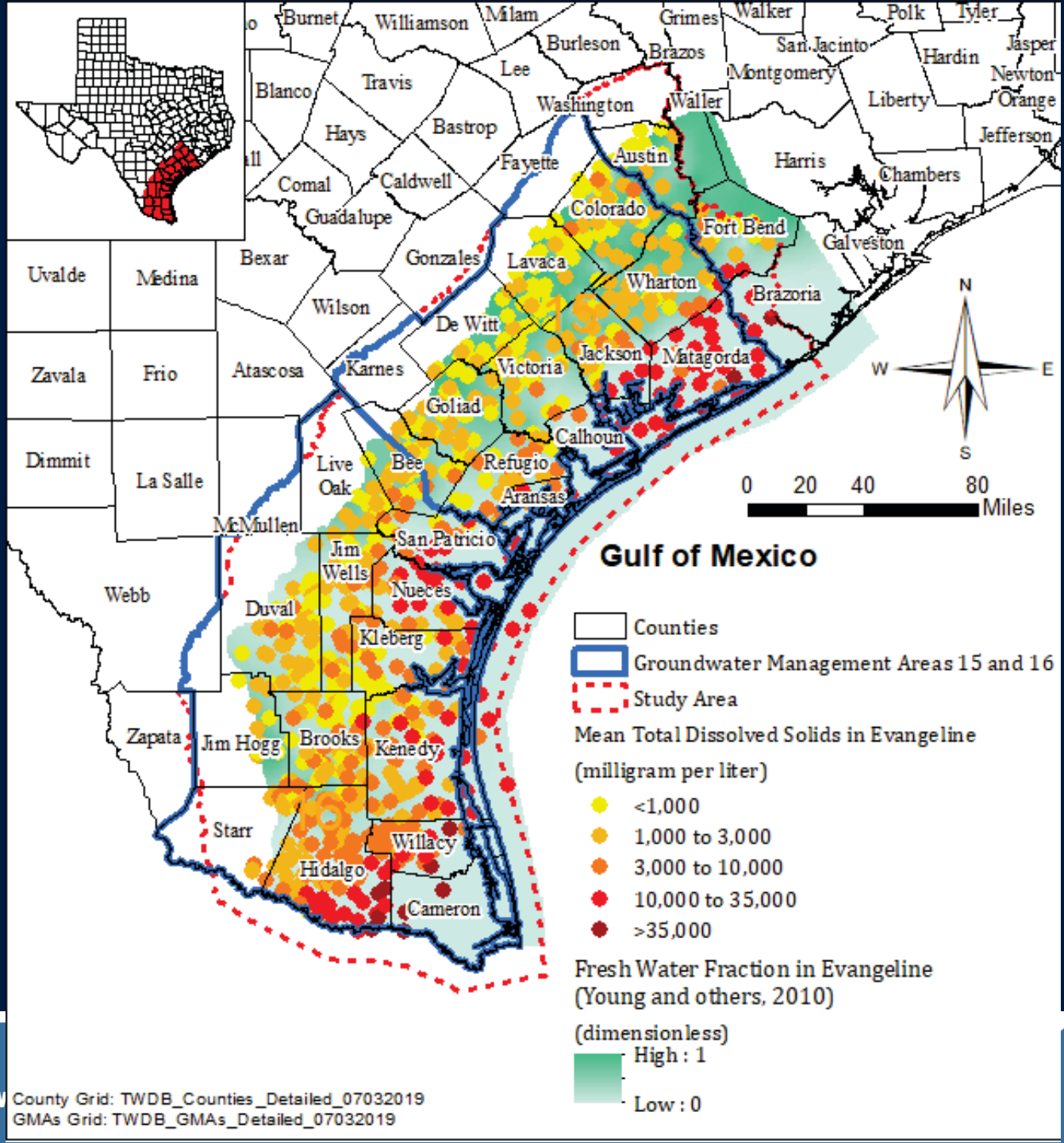
- All Counties in Study Area Available



Groundwater Quality Data for All Available Analytes

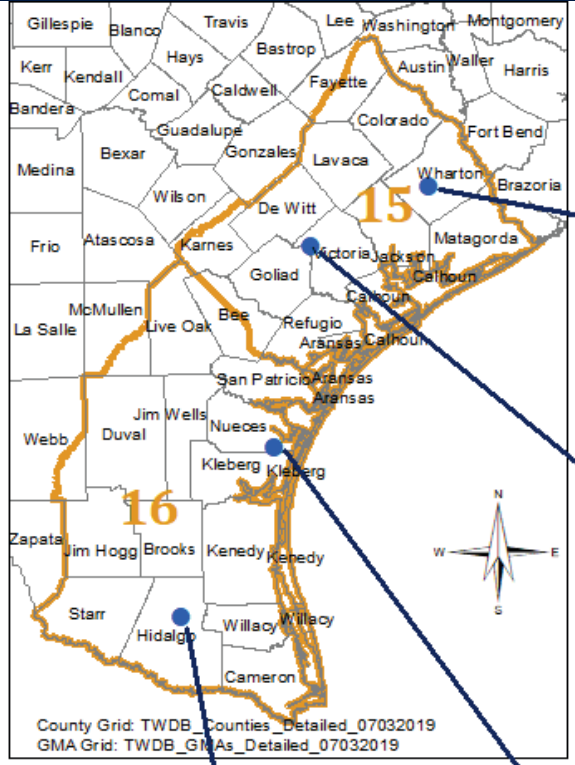
Example: Total Dissolved Solids in Evangeline vs. Fresh Water Fraction

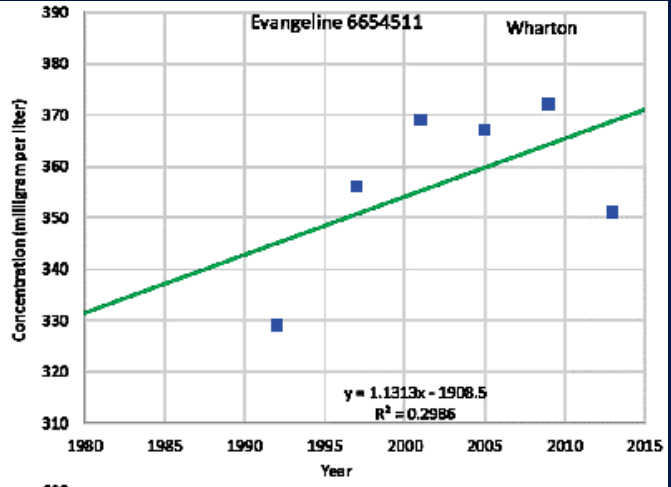
- Groundwater Fresher (lower total dissolved solids) in Outcrop Area and North
- Very Saline or Brine Groundwater along Gulf Coast and Lower Rio Grande Valley
- Similar Trend in Other Units

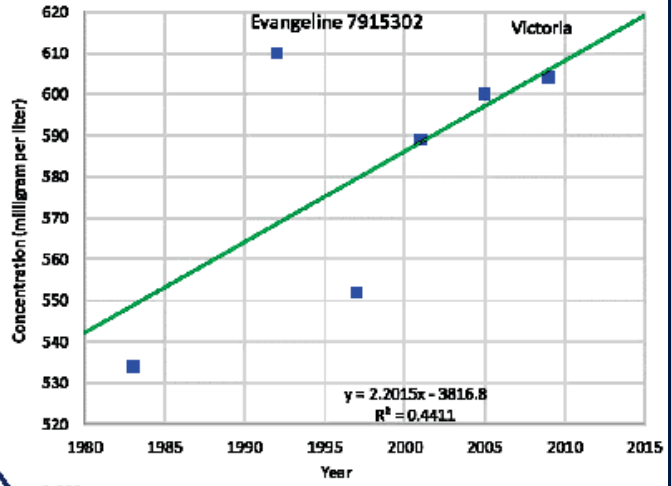


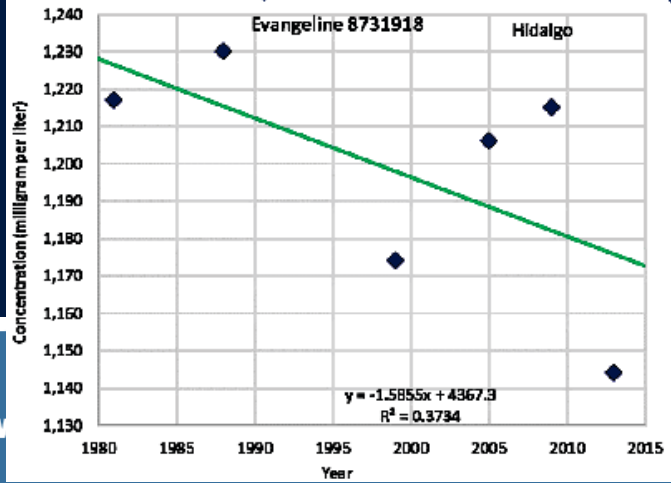
Change of Total Dissolved Solids over Time

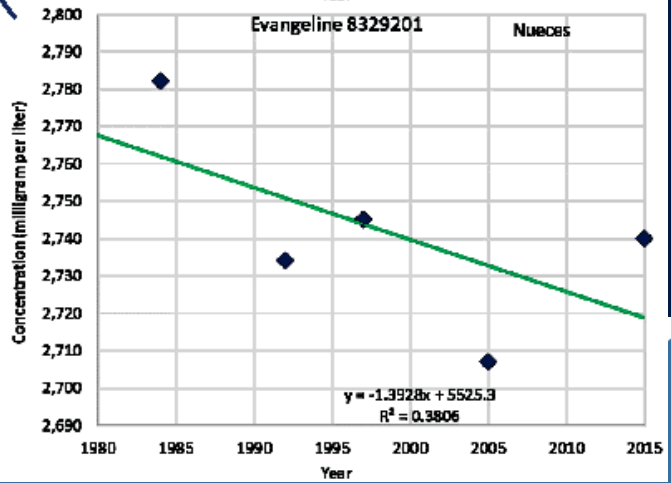
- Groundwater at Most Wells in Study Area Remains at Same Category





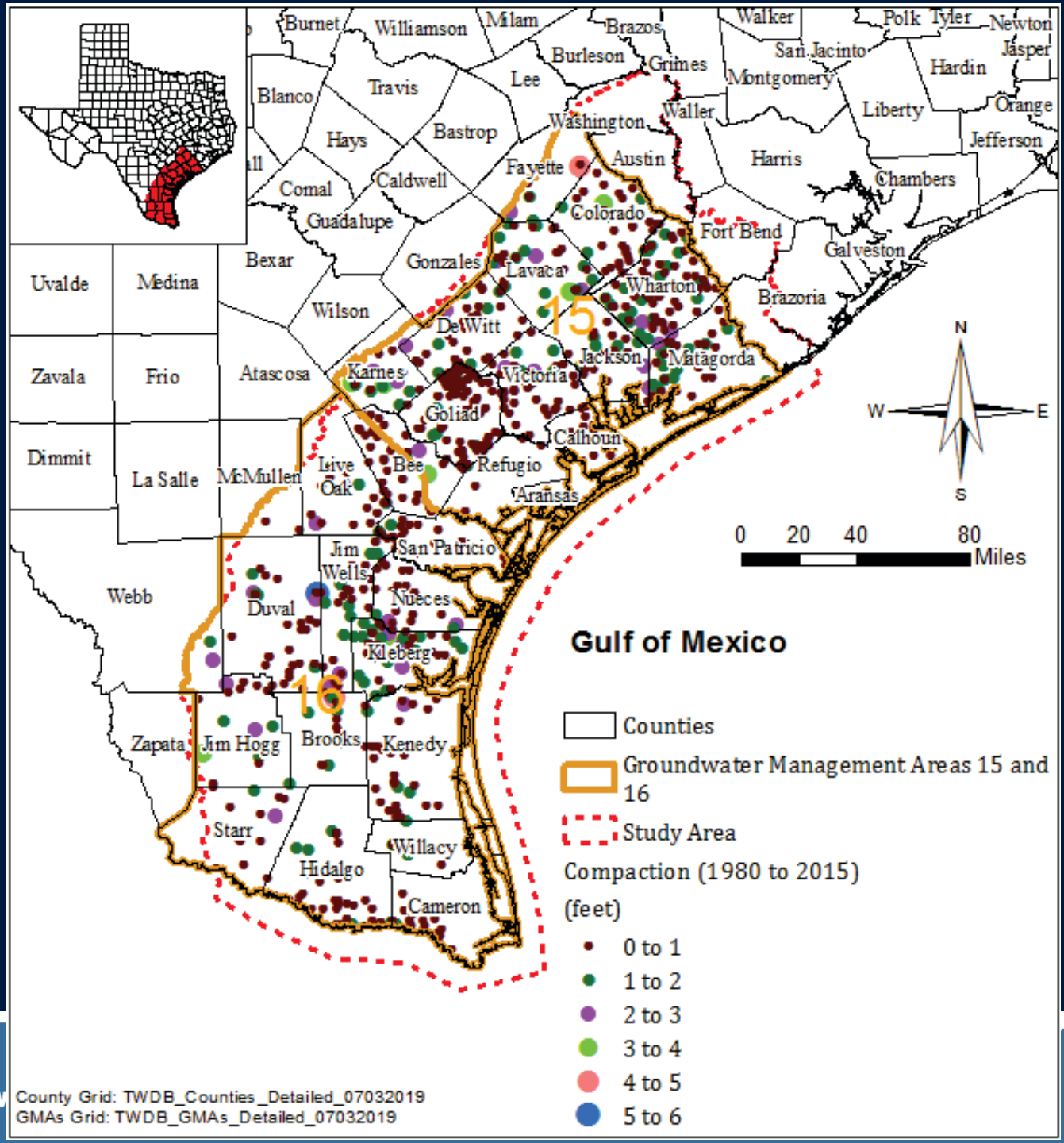




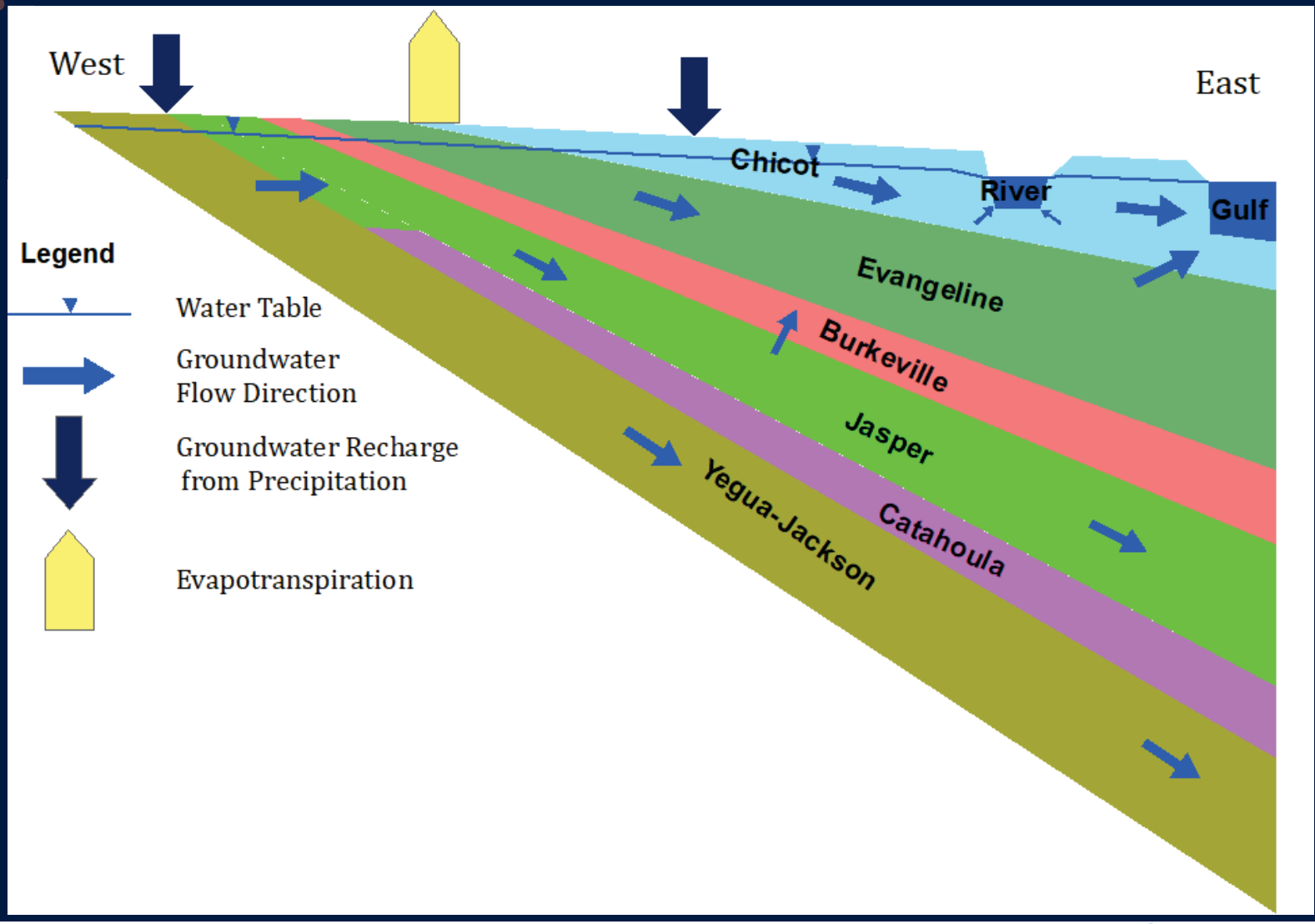


Ground Surface Subsidence (1980 – 2015)

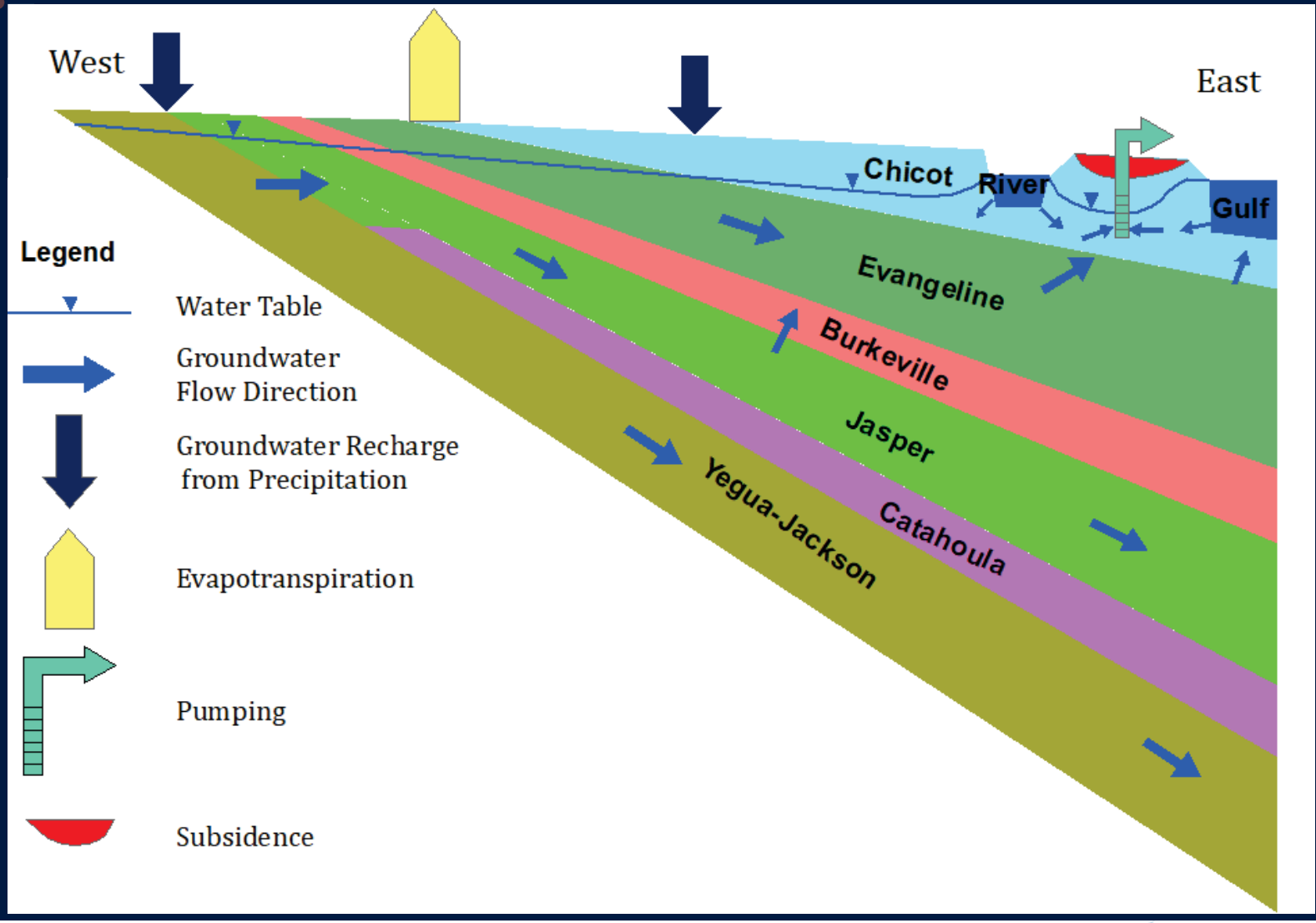
- Most of study area experienced less than one foot of subsidence
- Matagorda, Jackson, Wharton, Kleberg, and Nueces counties may have more than two feet of subsidence



Conceptual Model: Pre-development



Conceptual Model: Post-development



Summary

In comparison with existing groundwater availability models, new study has made following new discoveries and improvements:

- Combined two existing groundwater availability models to eliminate boundary impacts and inconsistency between two models
- New framework based on lots of water well logs, driller reports, geophysical logs, and surface geology
- Continuous, unprecedent hydraulic property fields from more than 11,000 pumping tests, specific capacity tests, and sand fraction
- Continuous, unprecedent groundwater recharge fields between 1980 and 2015 from stream baseflow and precipitation
- Water levels from different sources helped better understand how groundwater flows laterally and vertically
- Pumping information from different sources and new approaches improved data quality
- Water quality for all available chemicals
- Total dissolved solids from water wells and geophysical logs
- Ground surface subsidence across study area and during different time periods

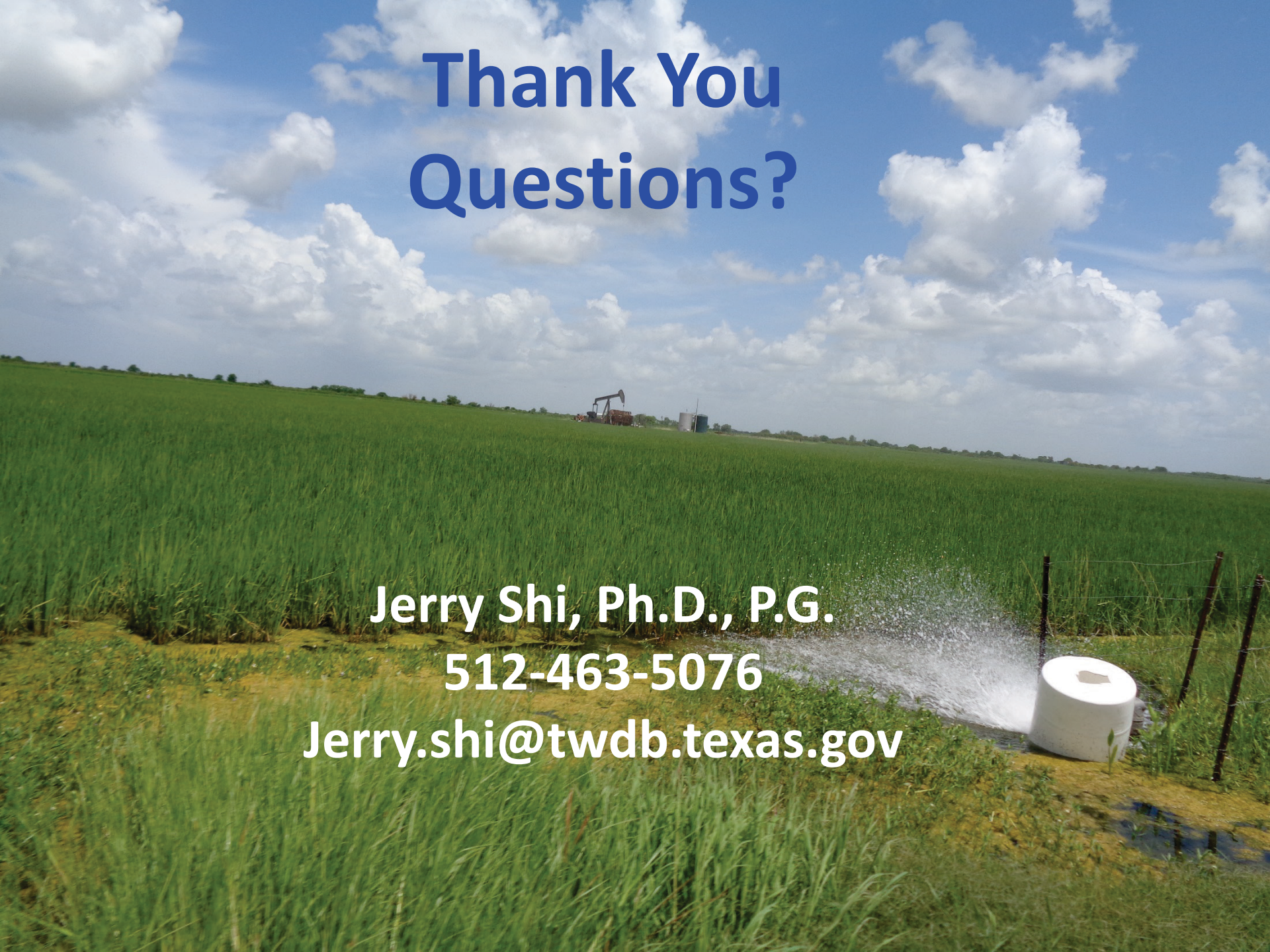
- To locate draft conceptual model report and this presentation, please go to

https://www.twdb.texas.gov/groundwater/models/gam/gma15_16/gma15_16.asp

- Please send your comments and suggestions
  - By October 16, 2020
  - To Jerry.Shi@TWDB.Texas.gov

Tentative Schedule

- Conceptual Model/ Draft Report Available for Public Review/Stakeholder Advisory Forum #2 – September 2020
- Numerical Model/Draft Report Available for Public Review/Stakeholder Advisory Forum #3 – Fall 2021
- Finalize Project – Winter 2021


Thank You
Questions?
Jerry Shi, Ph.D., P.G.
512-463-5076
Jerry.shi@twdb.texas.gov

David Van Dresar (to Everyone): 9:31 AM: Where did the subsidence data come from?
Answer: The subsidence data were from studies by the U. S. Geological Survey around Houston and RRatzlaff for our study area. We then correlated the subsidence to groundwater level decline to estimate subsidence across our study area. And we also compared with study by Dr. Young in part of Groundwater Management Area 15.
Tim Andruss, VCGCD (to Everyone): 9:38 AM: The boards of VCGCD, TGCD, CCGCD, and RGCD would like to have the conceptual report reviewed by their technical consultants. Will TWDB consider extending the comment period until April 2021?
Answer: Larry French, Division Director of Groundwater of TWDB, said in an email that it is ok to extend comment deadline to April 2021.
. **James Beach (to Organizer(s) Only)**: 9:40 AM: the conceptual model graphic seems to indicate that water always flows from rivers to aquifer. for a regional model, aren't there places where the rivers are gaining?
Answer: Yes most of the study area still experience gaining along rivers and streams. This conceptual diagram just shows what would happen if pumping is significant.
Bill Hutchison (to Everyone): 9:40 AM: Your conceptual flow diagram includes the Catahoula and the Yegua-Jackson. Will the numerical model include these formations, or only the four units of the Gulf Coast Aquifer?
Answer: We will not simulate the Yegua-Jackson. However, there is a connection between Jasper and Yegua-Jackson through top (sandy) portion of the Catahoula, so we showed the Yegua-Jackson in the conceptual flow diagram.
Venkatesh Uddameri (to Everyone): 9:40 AM: Do you all know which numerical code you will be using for modeling (Modflow 6) Are you plan on using Unstructured Grid Approach?
Answer: Probably we will try both MODFLOW-USG and MODFLOW 6 using unstructured grid.

Monica Jacobs (to Everyone): 9:41 AM: I represent certain landowners in GMA 16. Given the meeting schedules of our districts and GMAs, the upcoming holidays, and the importance of this model to our region, we would greatly appreciate an extension to the comment period until April 2021.
Answer: Answer: Larry French, Division Director of Groundwater of TWDB, said in an email that it is ok to extend comment deadline to April 2021.
Venkatesh Uddameri (to Everyone): 9:43 AM: As you have spent considerable time looking at water quality data, are there plans to include this in the regional modeling effort. Particularly, as this model will be used for studies supporting HB 722 Brackish Groundwater projects
Answer: This will be a flow model without transport. We provide the water quality here because water users, developers, and planners may need water quality data. If you know how, you still can use the flow model to do particle tracking to simulate brackish/seawater movement.
James Beach (to Everyone): 9:45 AM: this conceptual model seems to be less refined (no surficial aquifer) then the previous model for GMA-15 area. How will that affect the model's ability to simulate GW/SW interaction?
Answer: Based on my experience river/groundwater interaction may not be that sensitive to vertical refinement. We can do a sensitivity analysis by splitting a surface layer.
Cindy Ridgeway (to Organizer(s) Only): 9:51 AM: IF we do this then the model won't be done until 2022
Venkatesh Uddameri (to Everyone): 9:54 AM: Thank You

Stakeholder Advisory Forum: Gulf Coast Aquifer System GAM (Southern Portion) Attendees Summary

Meeting Date	Meeting Duration	Number of Attendees	Meeting ID
September 29, 2020 8:16 AM CD	98 minutes	54	699-349-933

Details

Name	Affiliation
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Connected by phone	
Andy Donnelly	GeoLogic
Andy Garza	
Bill Hutchison	Independent Groundwater Consultant
Bimal Gyawali	
Bryce McKee	Texas Railroad Commission
Chu-Lin Cheng	
Cindy Ridgeway	TWDB
Daryn Hardwick	TWDB
David Van Dresar	Fayette County GCD
Dorina Murgulet	Texas A&M Corpus Christi
Felix Saenz	Brush Country GCD
Grayson Dowlearn	TWDB
Heather Sumpter	Goliad County GCD
Ian Jones	TWDB
James Beach	WSP
James Dodson	
James Harcourt	
James Tolan	Texas Parks and Wildlife
Jerry Shi	TWDB
Jiabao Guan	TWDB
Jorge M Hernandez	
Jose Garcia	
Ki Cha	TWDB
Landon Yosko	Evergreen UWCD
Larry French	TWDB
Lonnie Stewart	Live Oak UWCD
Luis Pena	Brush Country GCD
Micaela Pedrazas	LRE Water
Mike Keester	LRE Water
Monica Jacobs	
Natalie Ballew (TWDB Moderator	TWDB
Radu B.	TWDB
Robert Bradley	TWDB
Roberto Anaya	TWDB
Royce Massey	
Russell Labus	
Shirley Wade	TWDB
Stephen Bond	TWDB
Tim Andruss, VCGCD	Victoria County GCD
Venkatesh Uddameri	Texas Tech University
Wilfred Korth	
van kelley	INTERA