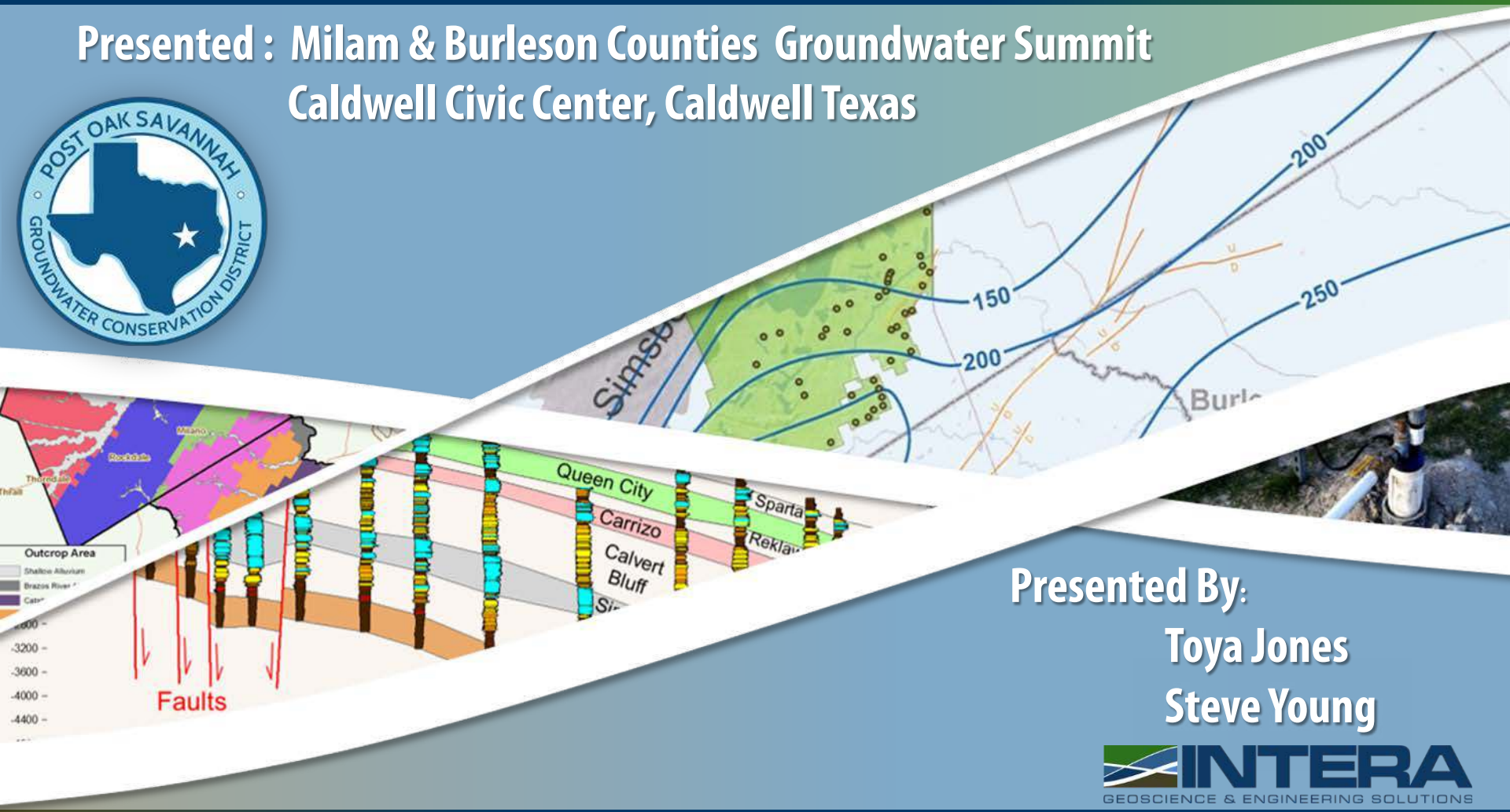
Monitoring and Modeling to Assess the Impacts of Pumping in Aquifers

Presented : Milam & Burleson Counties Groundwater Summit
Caldwell Civic Center, Caldwell Texas



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INTERA
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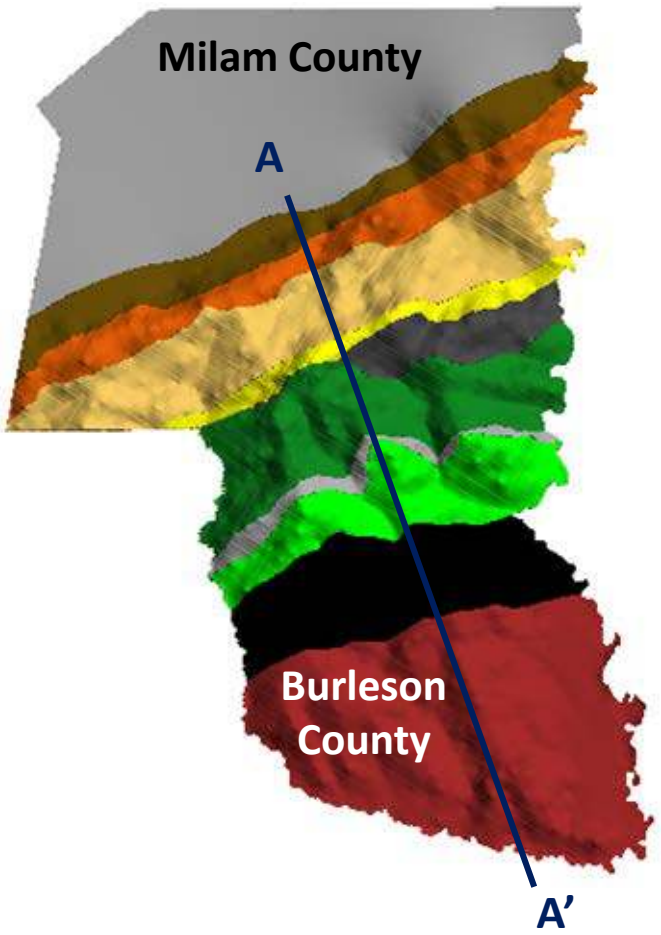
August 16, 2017

Outline

- Potential Impacts from Groundwater Pumping
- Approaches for Managing and Preventing Adverse Impacts
- Tools for Managing and Preventing from Adverse Impacts
  - Groundwater Monitoring
  - Groundwater Modeling

POSGCD Aquifers/Formations

Aerial View



Yegua-Jackson
Cook Mountain
Sparta
Weches
Queen City
Reklaw
Carrizo
Upper Wilcox
Middle Wilcox
Lower Wilcox

Vertical Cross-Section View

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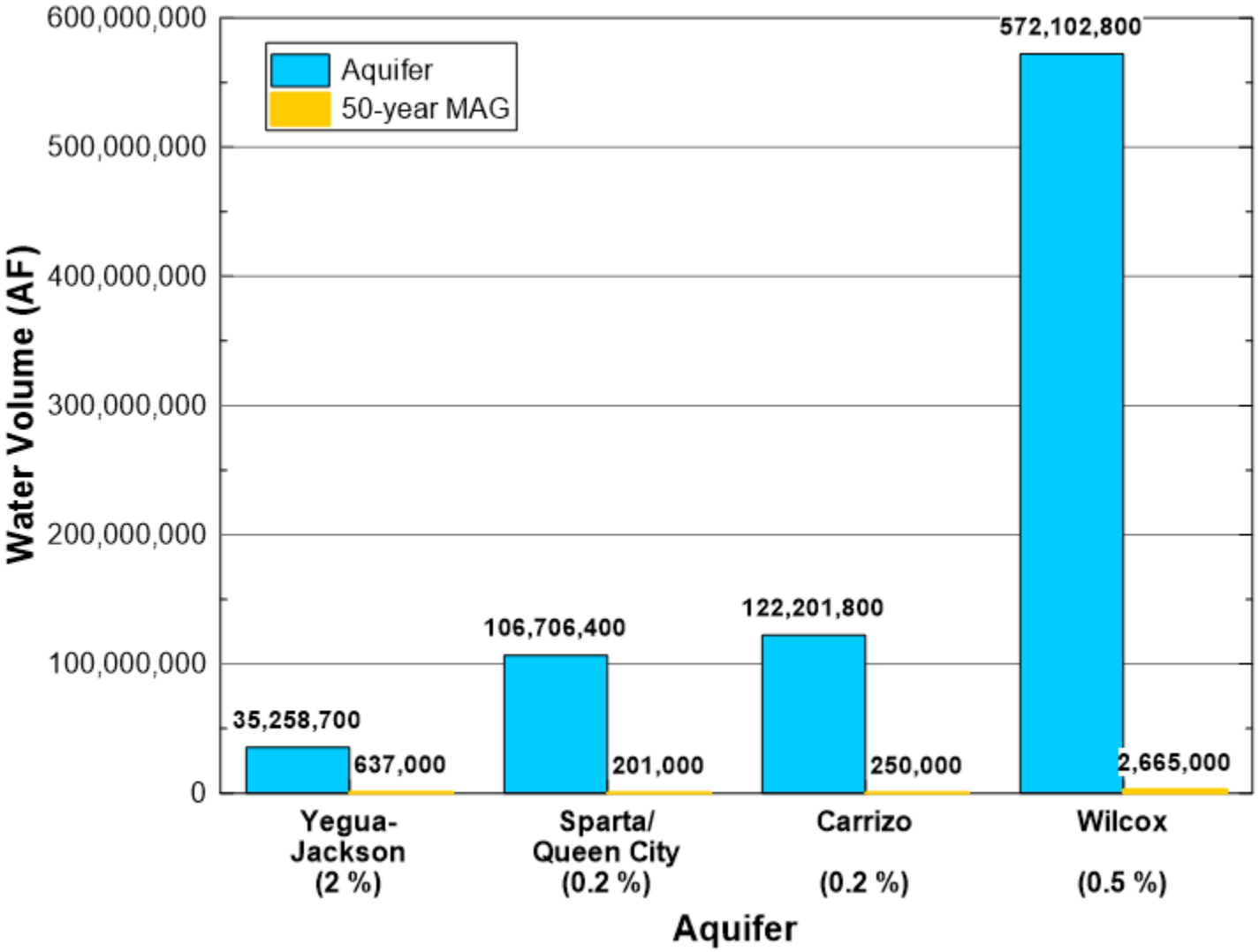
Groundwater Availability and 50-Year MAG



Approaches for Managing & Preventing Adverse Impacts

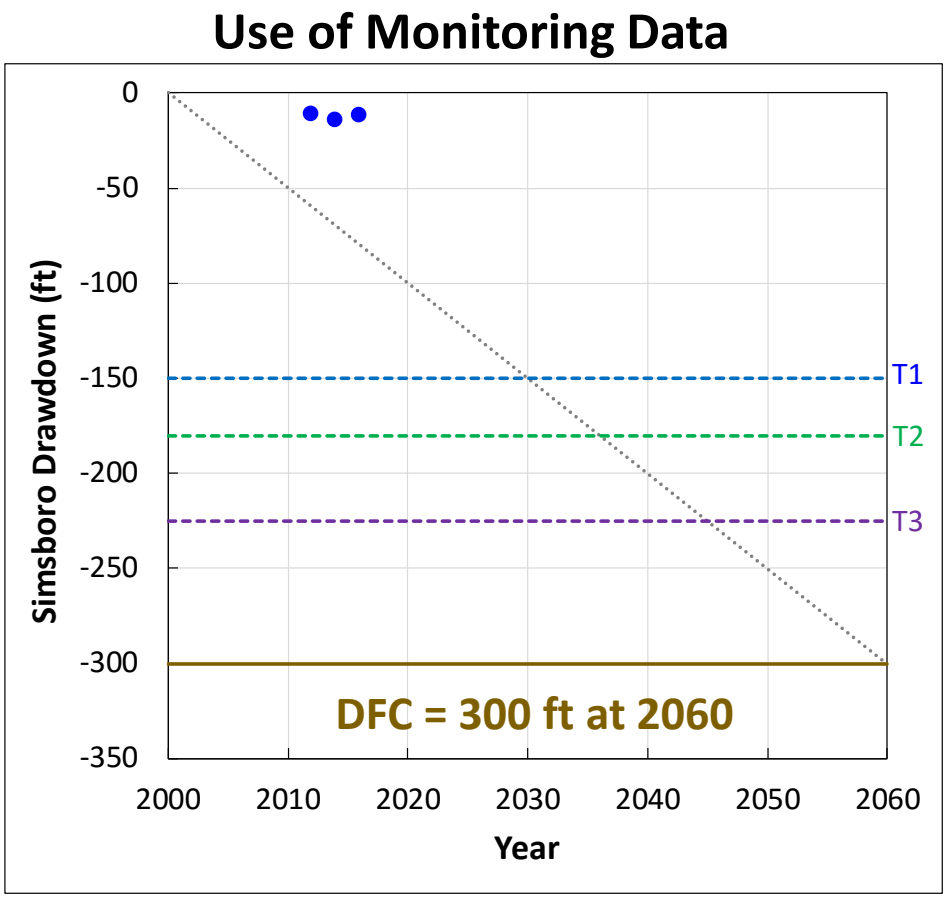
- **POSGCD Rules**
  - Maximum Pumping (2 acre-feet/year per acre)
  - Well Spacing Requirements
  - Desired Future Conditions (DFCs set by GMAs)
  - Protective Drawdown Limits (PDLs) for Shallow Zone (<400 ft) (Set by the District)
- **Scientific Investigations**
  - Monitoring
  - Modeling

Depths of Registered Wells

- 26 % < 200 ft deep
- 36 % between 200 and 400 ft deep
- 26 % between 400 and 600 ft deep
- 7 % between 600 and 800 ft deep
- 4 % > 800 ft deep

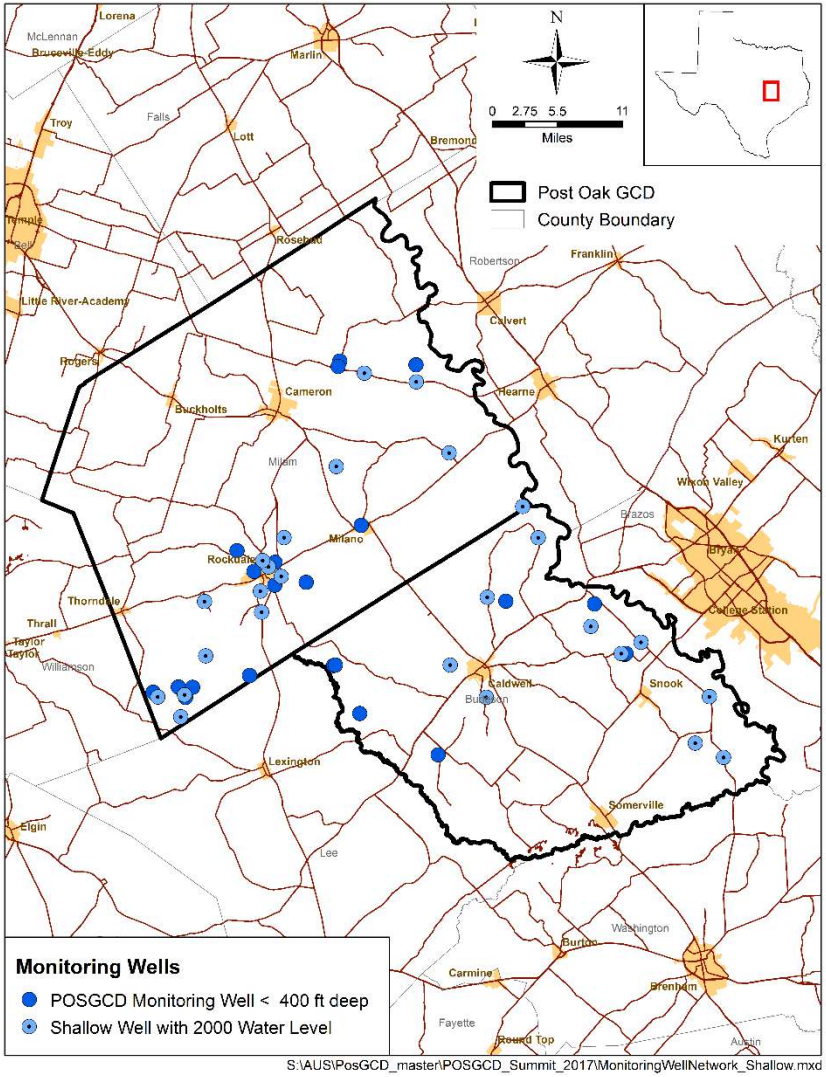
Aquifer Monitoring as a Management Tool

- 100 Monitoring Wells
- Monitoring Frequency
  - Continuous in some wells
  - Annually, but moving to quarterly, in remaining wells
- Collaborate with Neighboring GCDs
  - Aquifers do not stop at the District boundary
- Management Strategies Change if Threshold Levels Reach



Year	Drawdown Since 2000 (ft)
2012	11
2014	14
2016	12

Shallow Zone (< 400 ft) Monitoring as a Protection Tool



- **Protection**
  - District established shallow protection limits in 2005
  - Drawdown assessed annually
- **Observations Since 2000**
  - No net change in drawdown since 2012 in the shallow Calvert Bluff and Simsboro
  - Less drawdown in the shallow Hooper in 2016 than in 2012

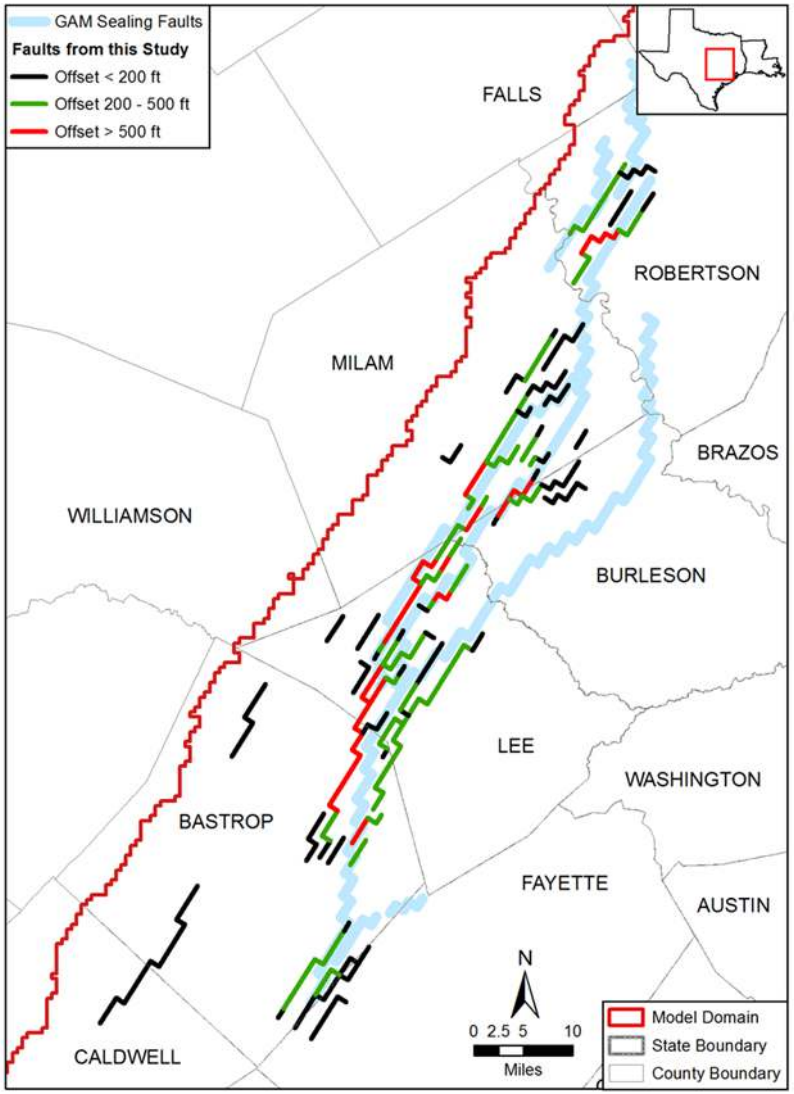
Aquifer	Drawdown Since 2000 (ft)				
	2012	2013	2014	2015	2016
Calvert Bluff	6	7	7	7	6
Simsboro	6	6	6	6	6
Hooper	6	7	7	8	5

Use of GAMs for Management & Protection

- **Carrizo-Wilcox, Queen City, and Sparta GAM**
  - Is a regional water planning tool
  - Developed from 1999 to 2004
  - Used to help set GMA 12 DFCs
  - Used to help evaluate large well operational permits
- **POSGCD is a Leader in Efforts to Improve the GAM**
  - District has worked since 2009 to update and improve the model
    - Fault representations
    - Aquifer characteristics
    - Surface water/groundwater interaction
    - Shallow zone predictions
  - Worked with other GMA 12 districts, LCRA, BRA, and TWDB to fund model improvements currently underway

Interim Progress on GAM – Fault Representations

- **Fault Analysis**
  - Reviewed 100s of geophysical logs for vertical offsets in aquifers
  - Modified fault representation and reran GAM
    - Compared modeled and measured water levels
  - Results presented to GAM 12 on April 27, 2017



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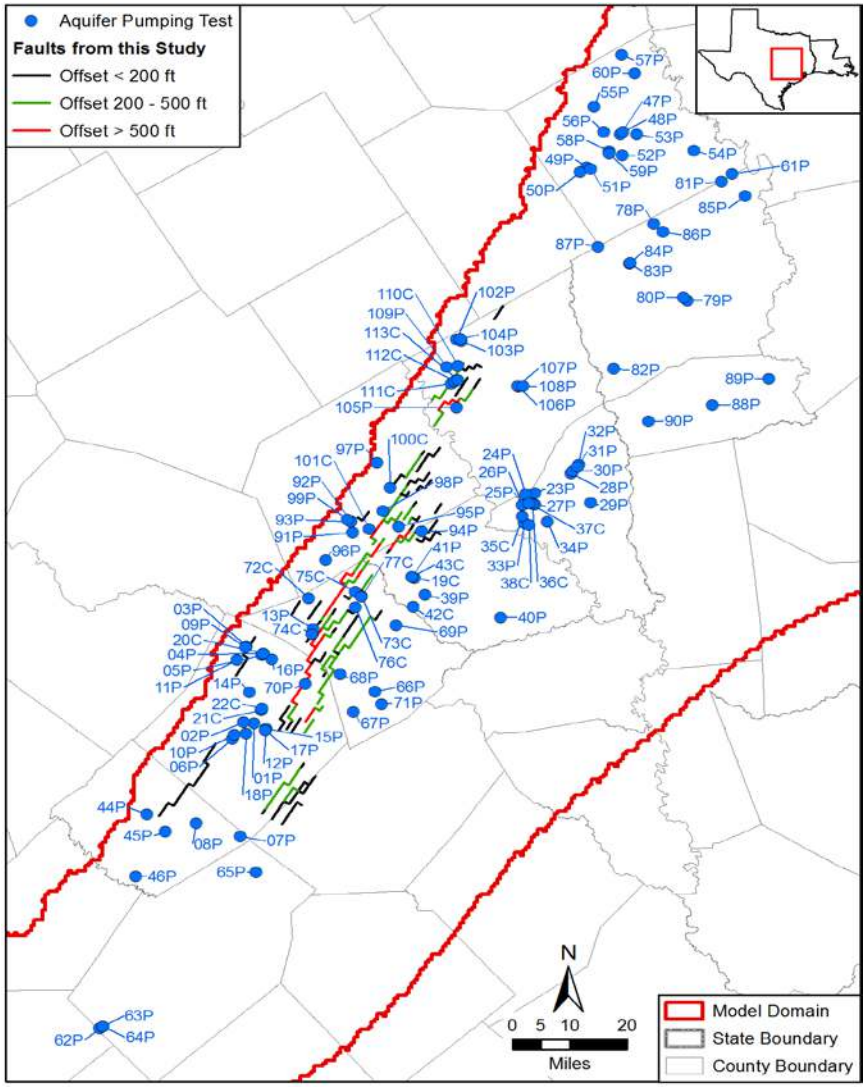
Interim Progress on GAM – Aquifer and Fault Characteristics

- **Aquifer Pumping Tests**
  - Assembled field data from 113 aquifer pumping tests
  - Analyzed data to
    - Estimate hydraulic properties
    - Assess sealing nature of faults
  - Modeled pumping tests near faults



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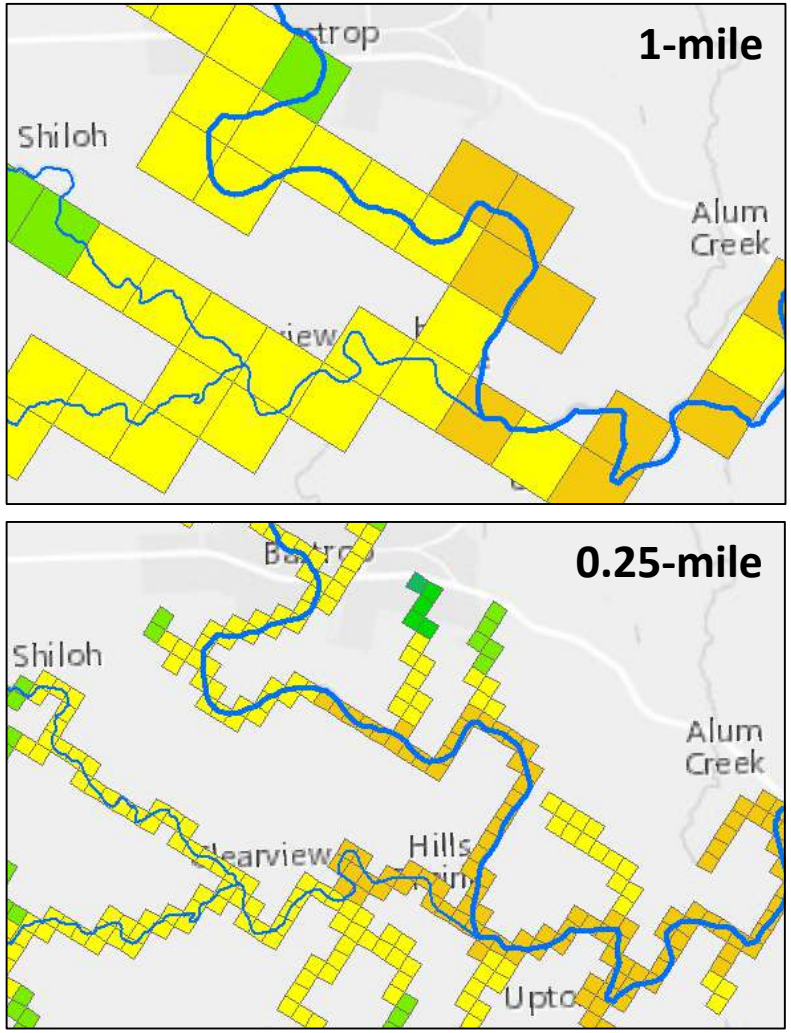
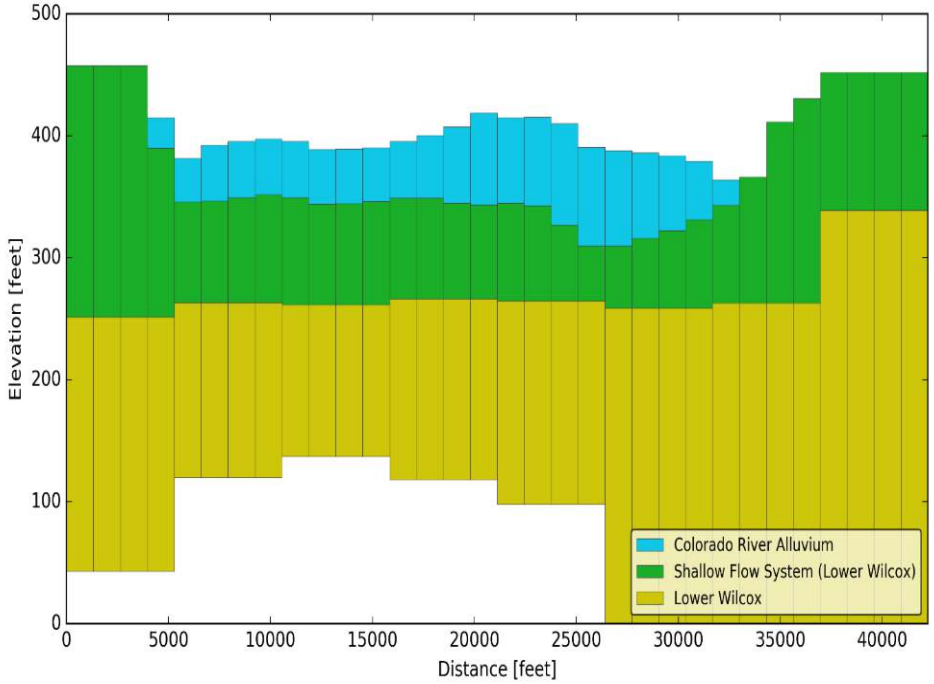
Interim Progress on GAM – Surface Water/Groundwater Interaction

Horizontal Grid Refinement



Vertical Grid Refinement from 1 to 3 Model Layers



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Concluding Points

- **Approaches to Assessing Impacts Caused by Pumping**
  - Use models to assist in planning and permitting
  - Use monitoring to evaluate compliance with DFCs and PDLs
- **POSGCD Monitoring Programs**
  - In process of expanding monitoring
    - Increasing number of wells, coverage of aquifers, frequency of monitoring, adding water quality monitoring
  - Deep monitoring - converting oil/gas wells
  - Shallow monitoring – plan to drill shallow wells
- **Groundwater Modeling Activities**
  - On-going support of GAM updates
  - On-going program to map water quality and formations based on geophysical log analysis


Questions ?