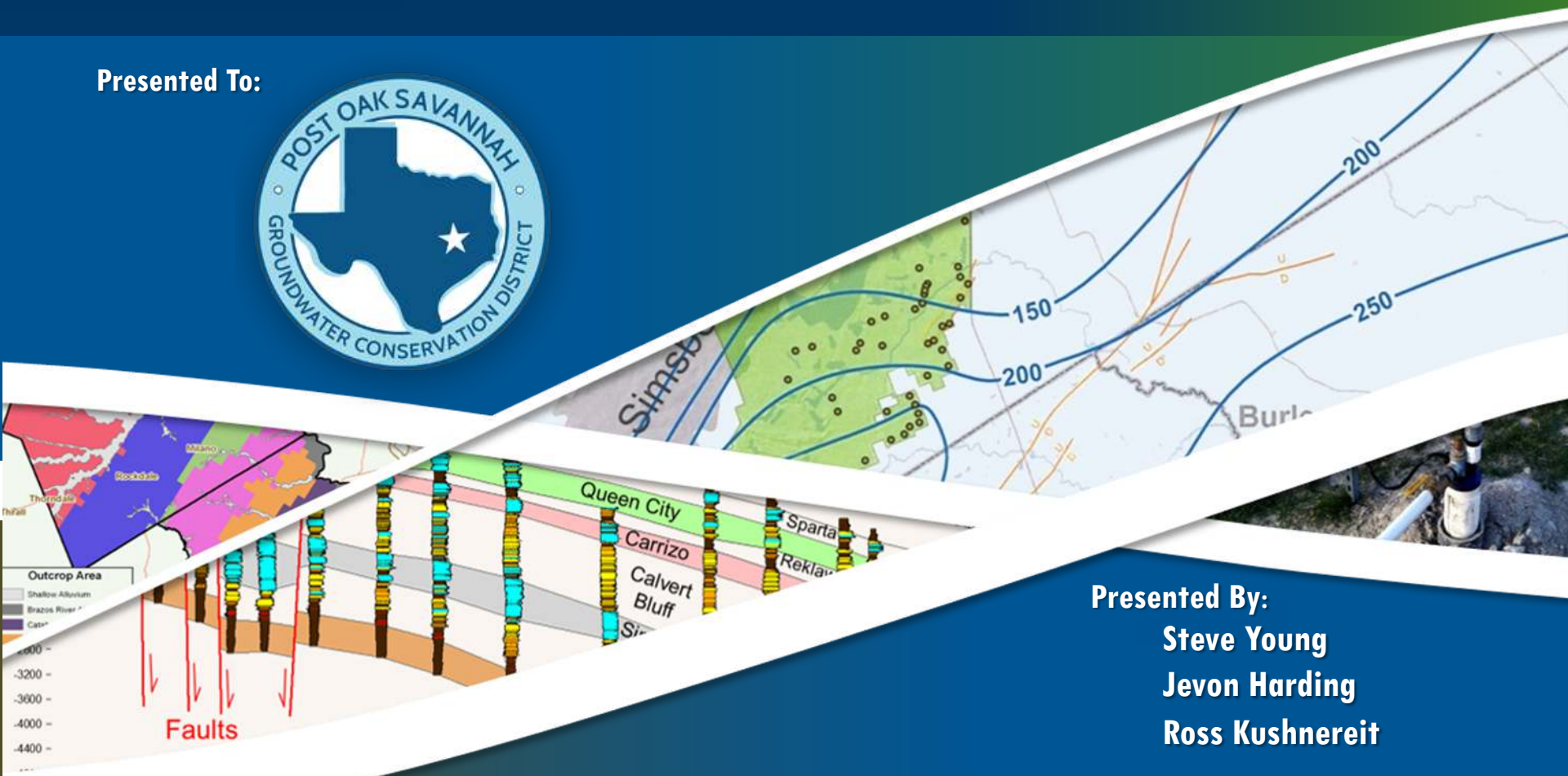
Status Report on Hydrogeological Investigation for the 22 Hills Area

Presented To:

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT



Presented By:

Steve Young

Jevon Harding

Ross Kushnereit

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May 7, 2019

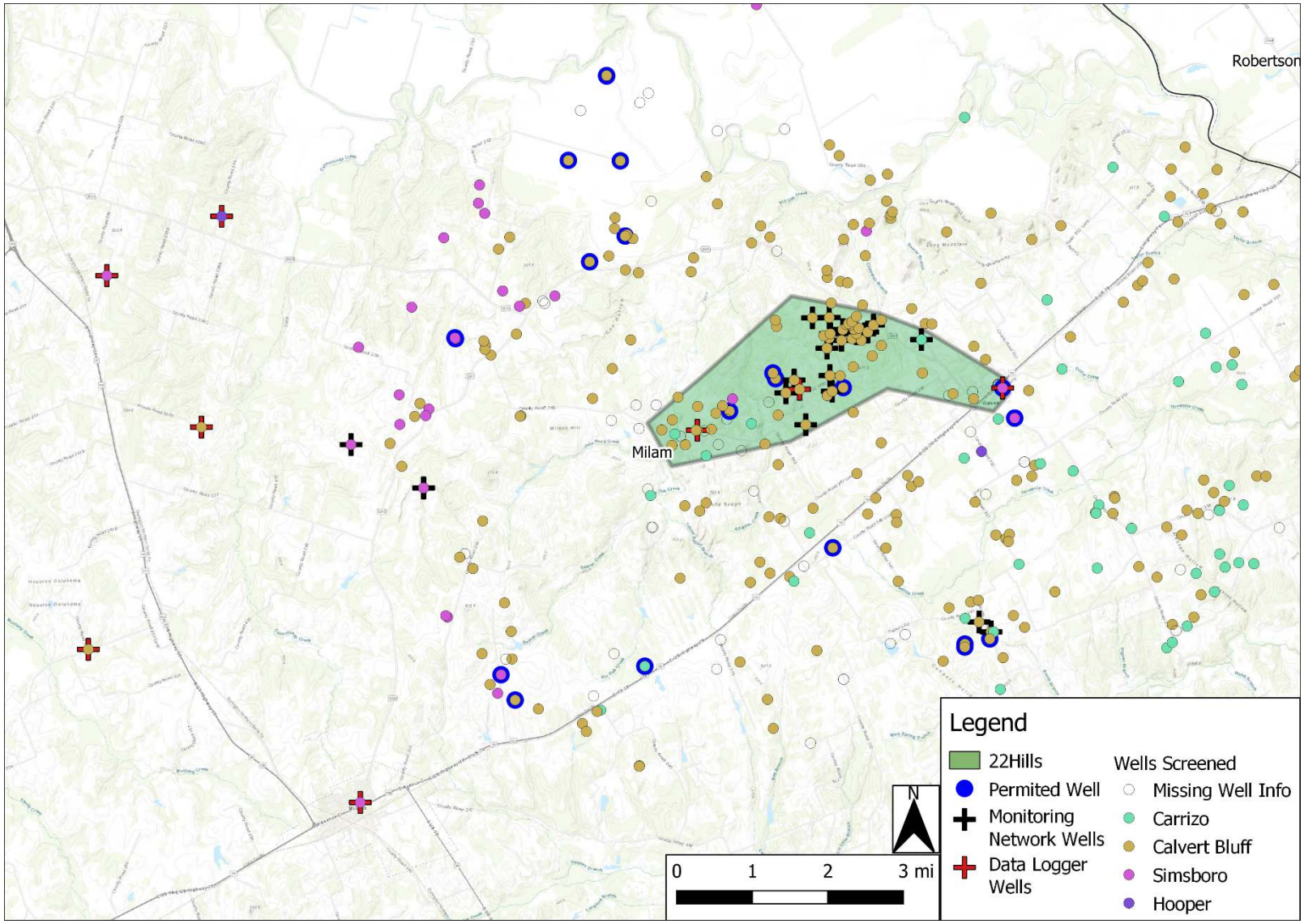
Agenda

- Review Tasks for On-going Work
- Aquifers and Well Assignments
- Measured Hydraulic Heads and Drawdowns from Monitoring Network
- Modeled Hydraulic Heads and Drawdowns from Sparta/Queen City/Carrizo-Wilcox GAM
- Interim Findings

Tasks for 22 Hill Area

- Assemble Well and Hydrogeologic Data
  - Well construction
  - Measured water level over time
  - Modeled water levels over time
  - Pumping information
  - Aquifer boundaries and sand & clay sequences
  - Geophysical Logs
  - Hydraulic properties
- Perform Data Analysis
  - Map location of permitted and exempt wells by aquifer
  - Compare measured and modeled hydrographs
  - Update aquifer boundaries and well assignments
  - Review evidence of pumping impacts on water levels
  - Simulate pumping impacts on water levels
- Prepare Report
  - Quantify measured and modeled drawdowns
  - Review compliance with DFCs and PDLs
  - Update boundaries and hydraulic properties for aquifers
  - Identify and evaluate possible factors causing drawdowns

Site Map



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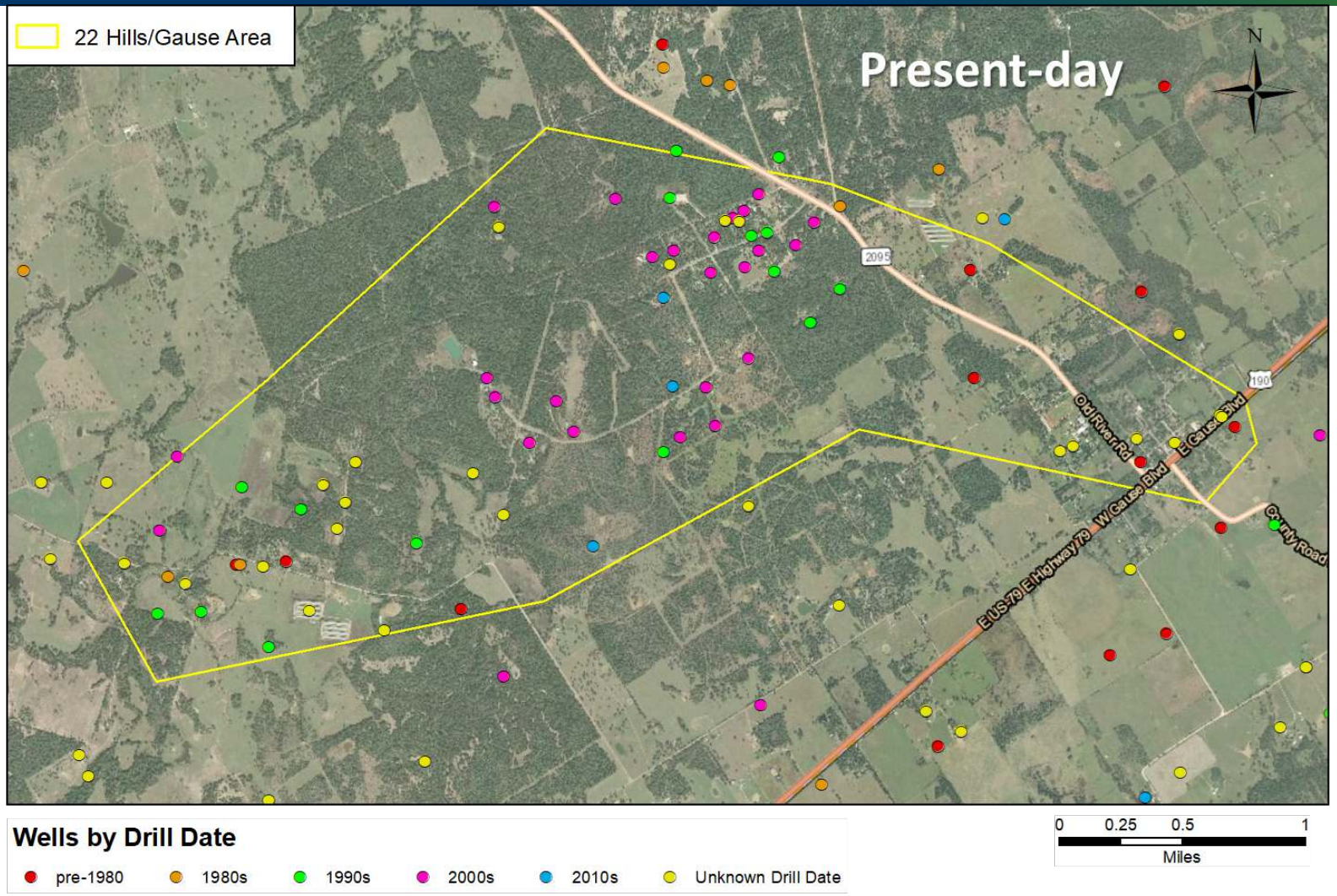
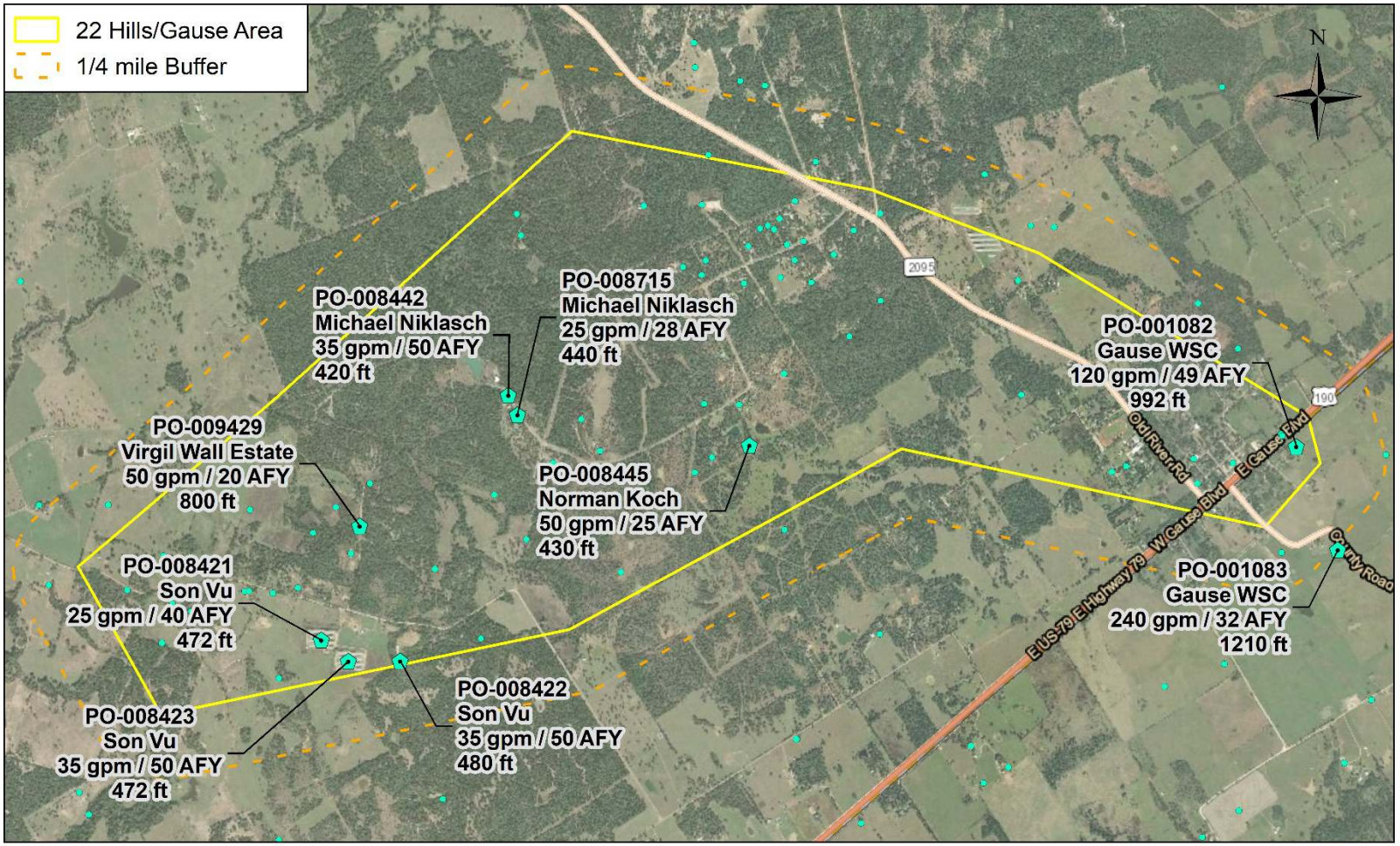
POSGCD Registered Wells



Most wells were drilled in 1990s & 2000s

Permitted Wells



Legend

- Permitted Well
- Exempt Well (<17.36 gpm)

0 0.25 0.5 1
Miles

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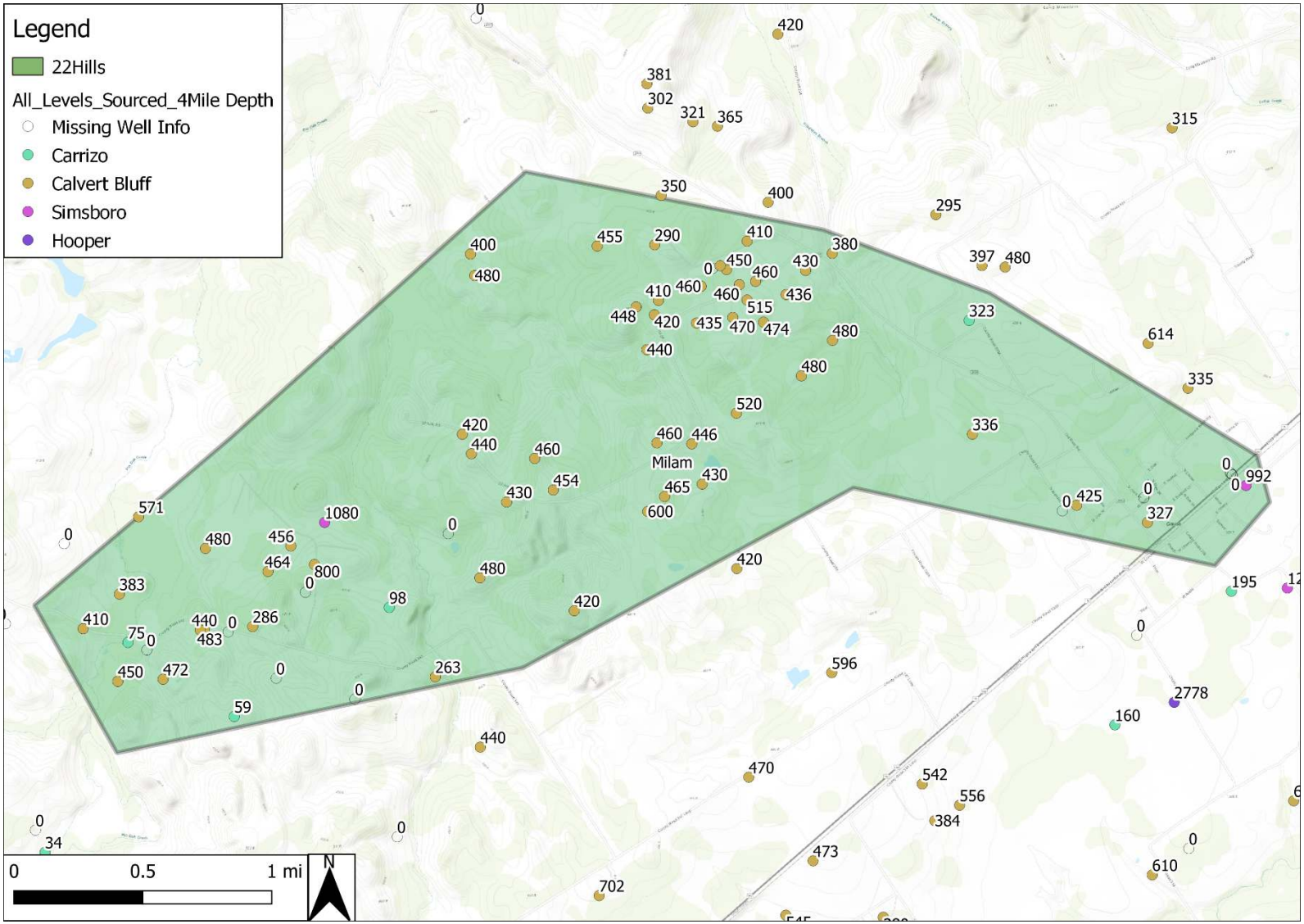
Depth of Well Installations



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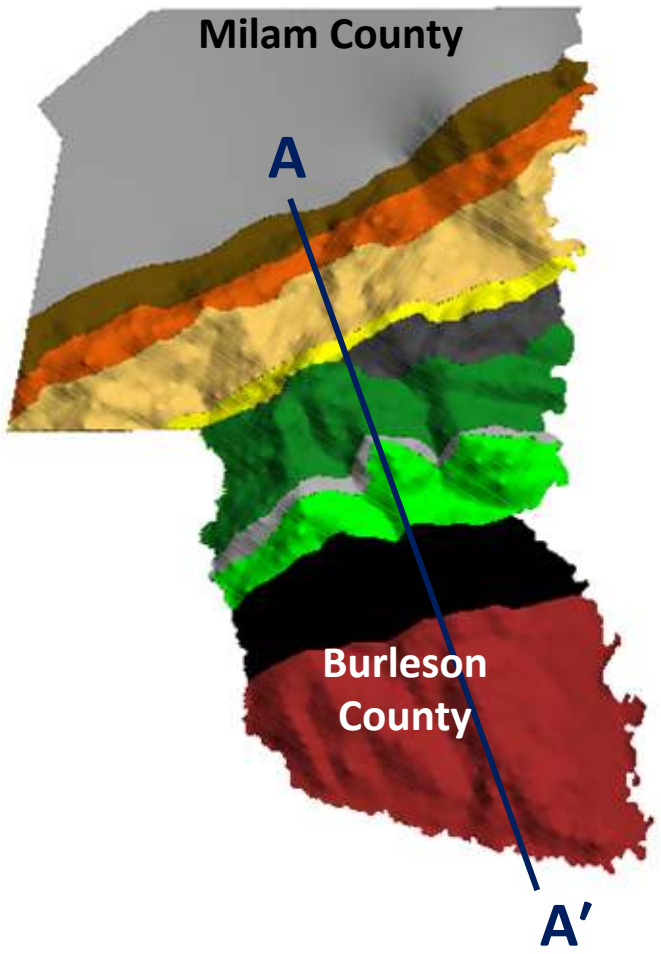
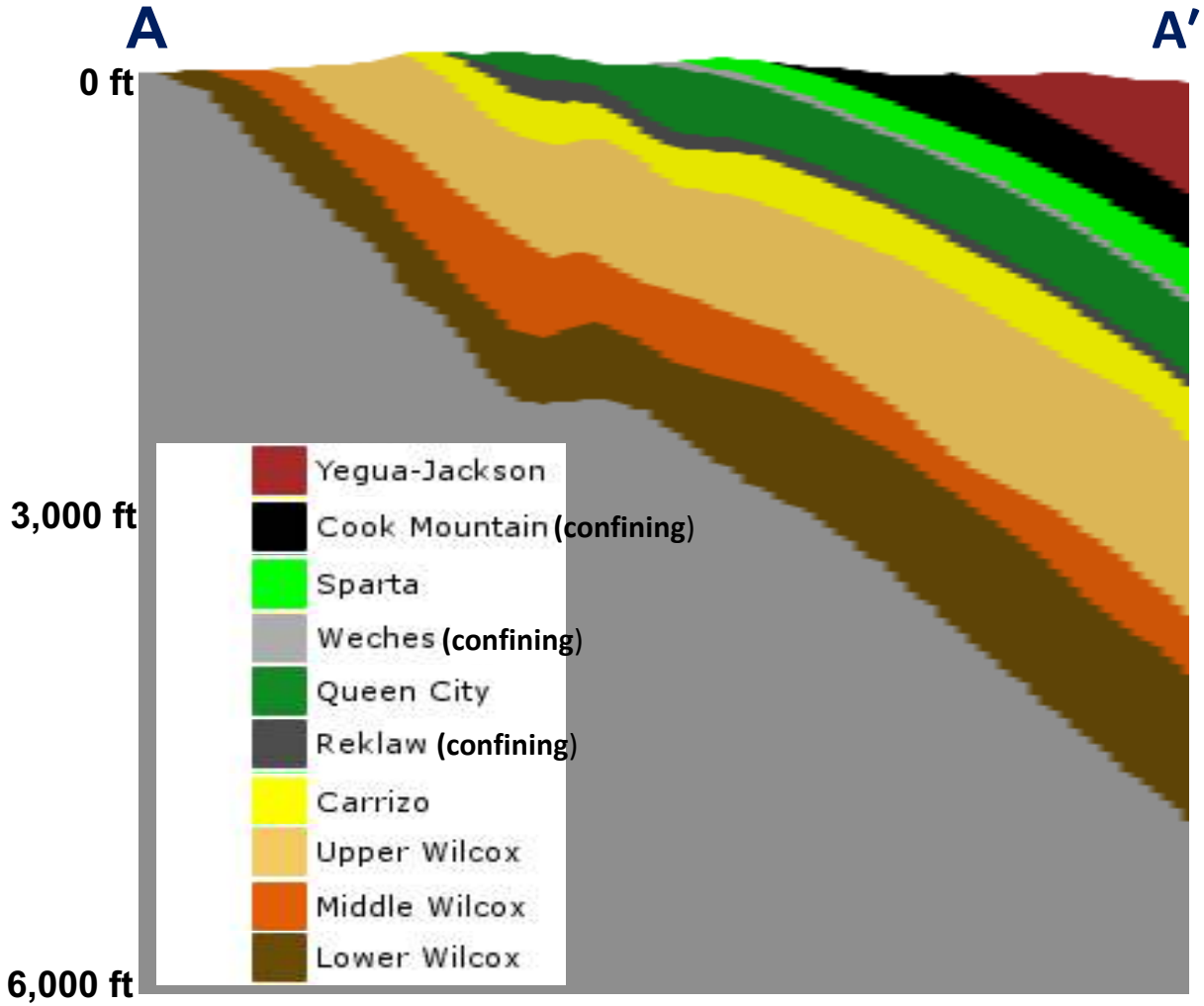
POSGCD Aquifers

Aerial View of Outcrops



Vertical Cross-Section View



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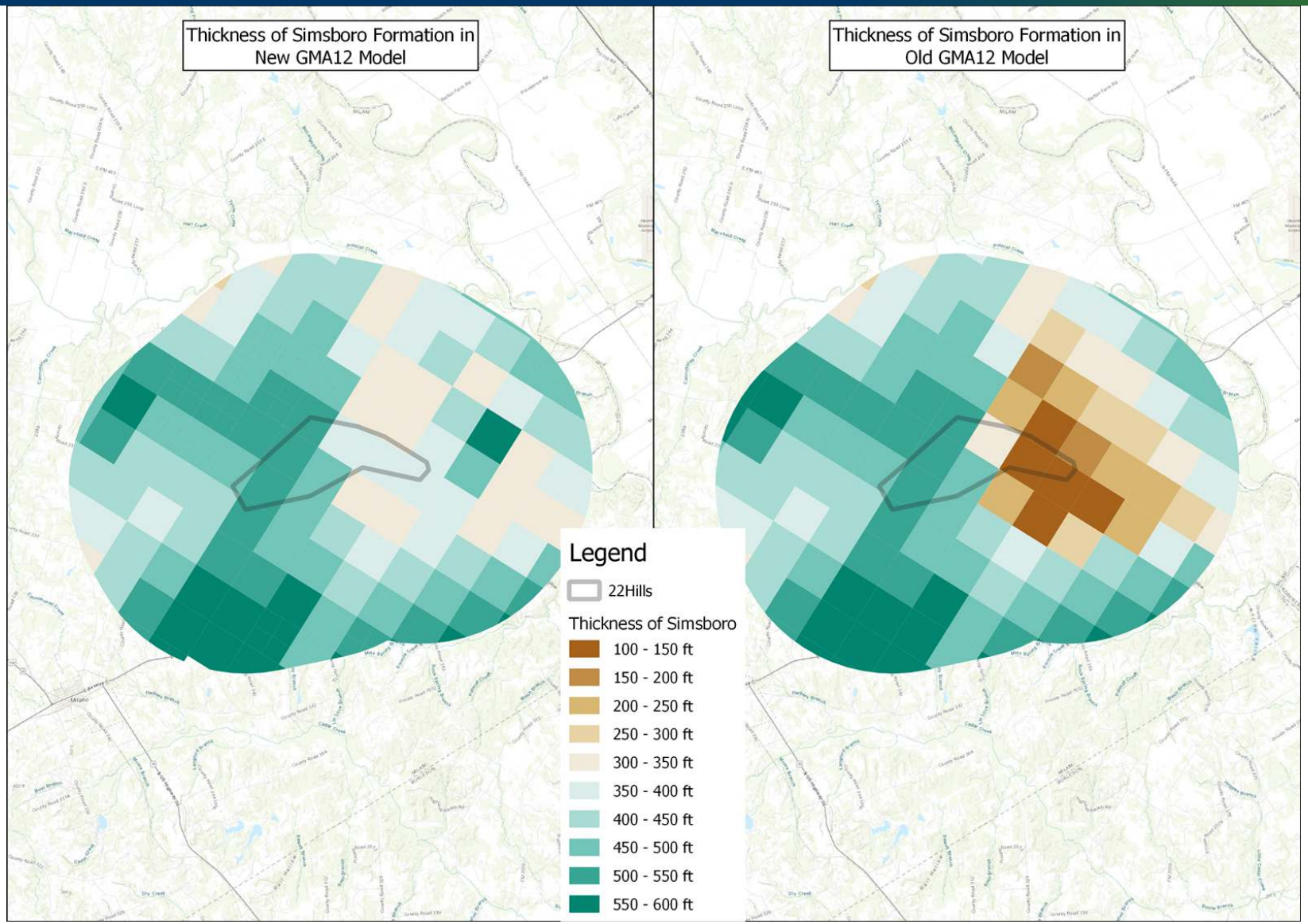
Thickness of Simsboro Aquifer



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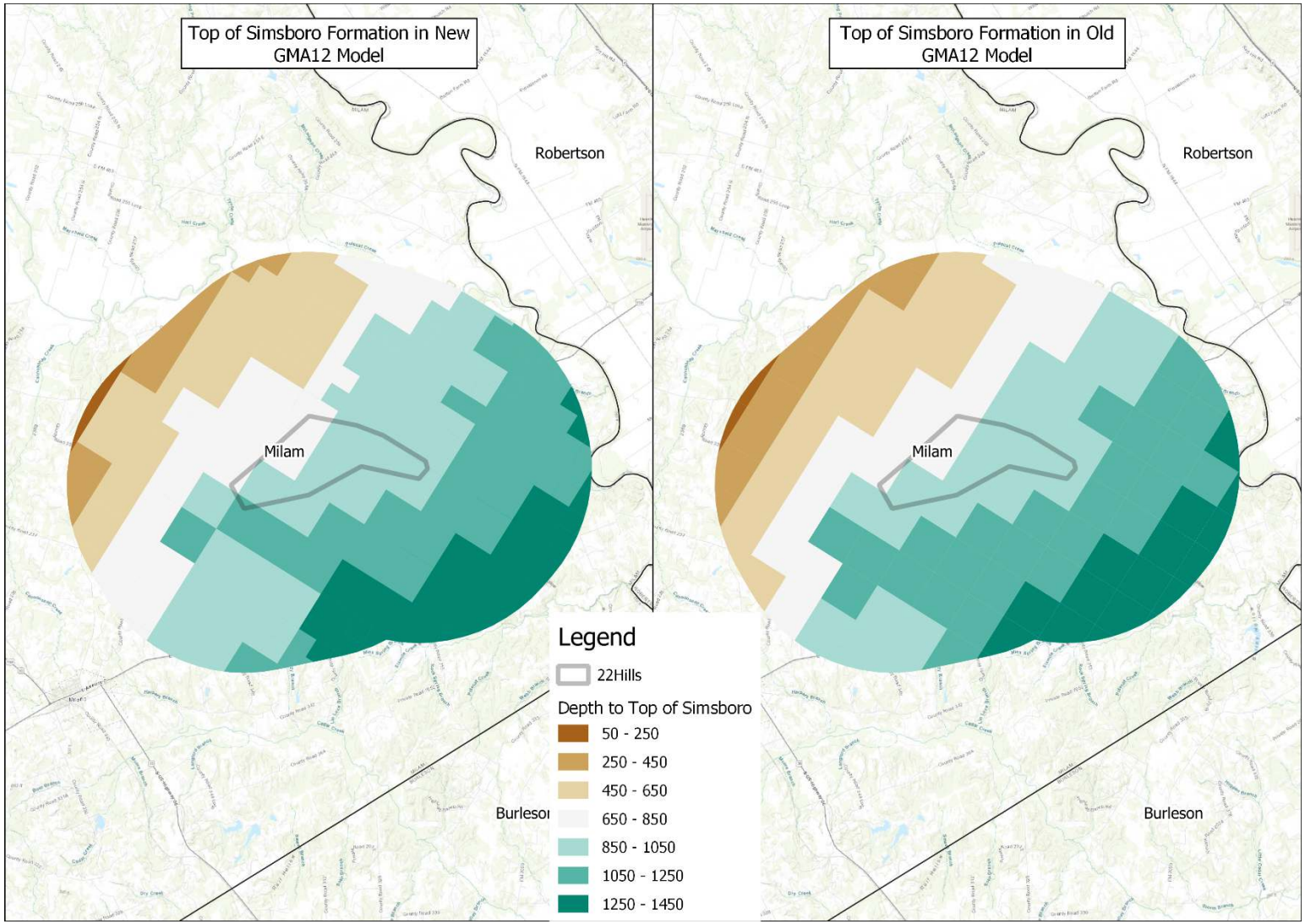
Depth (ft) to Top of Simsboro



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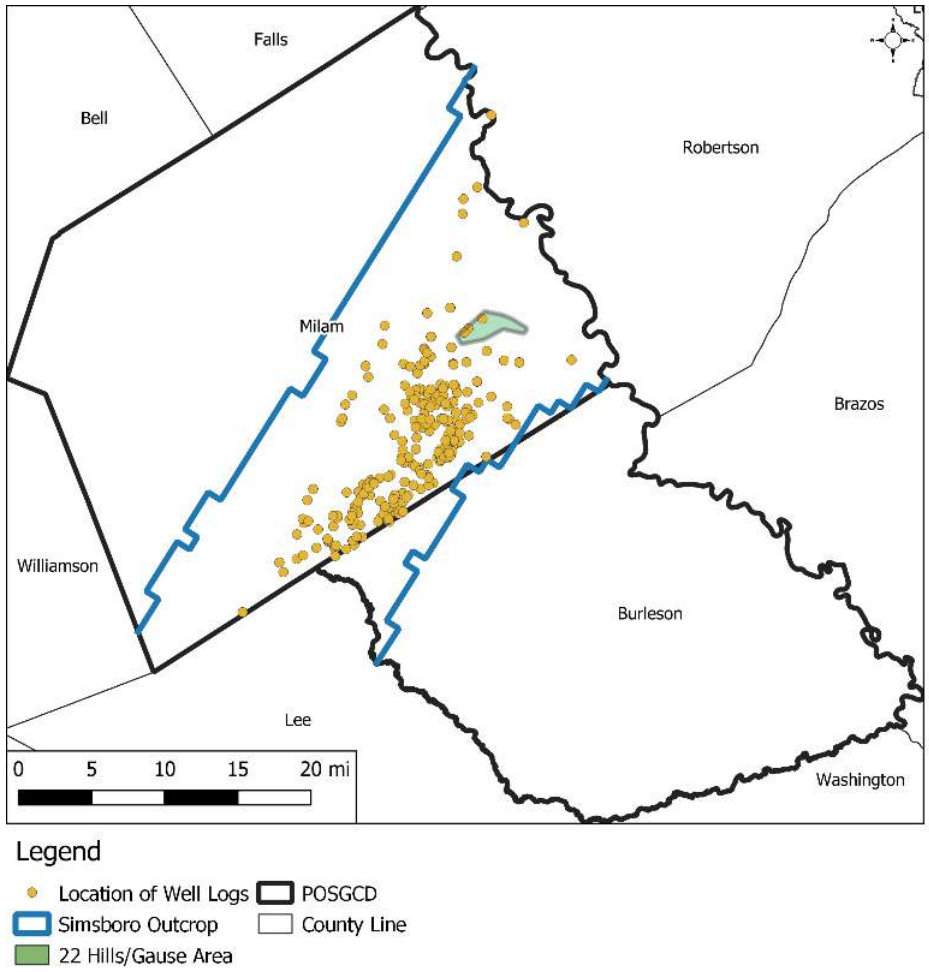
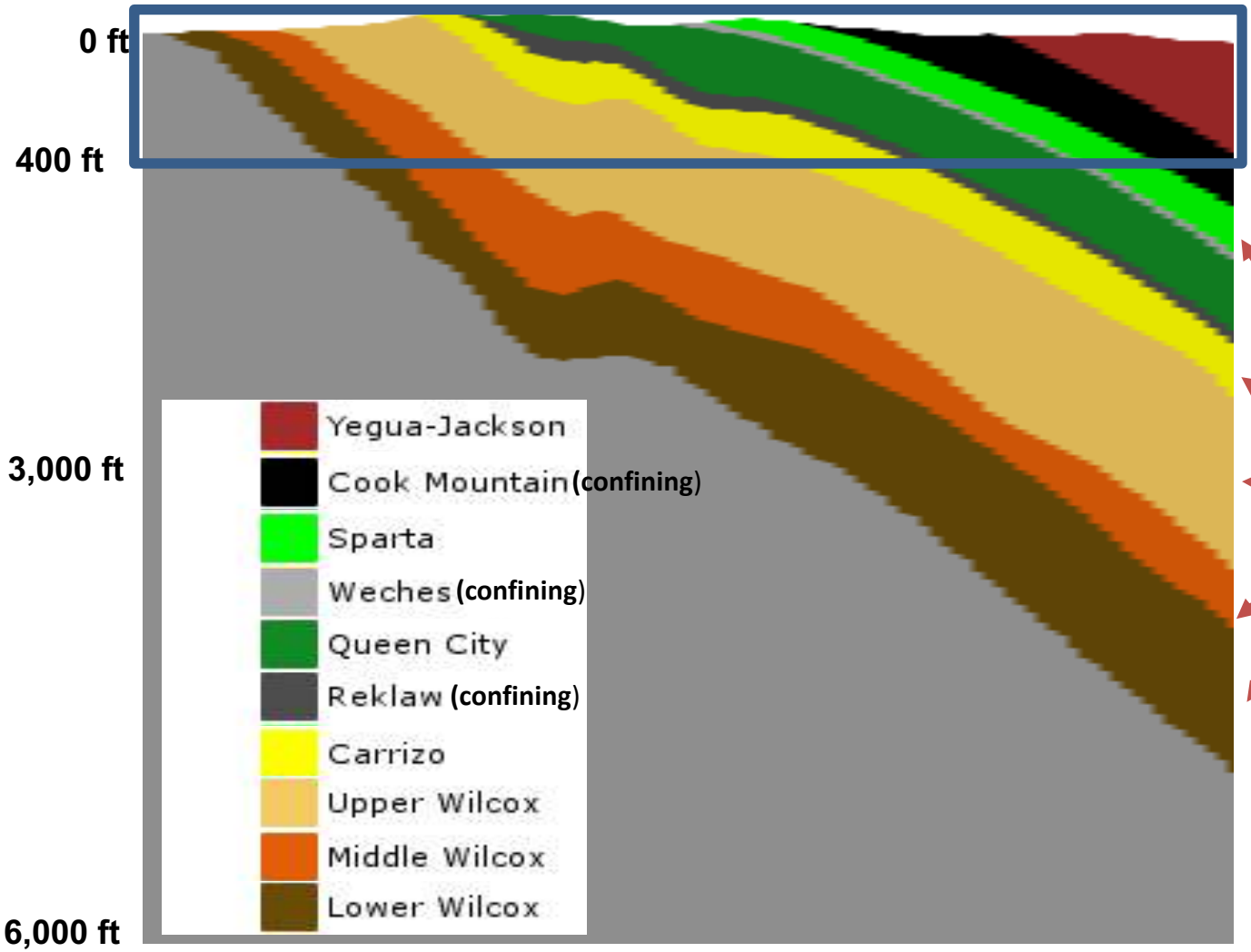
Location of Logs for On-going POSGCD Study



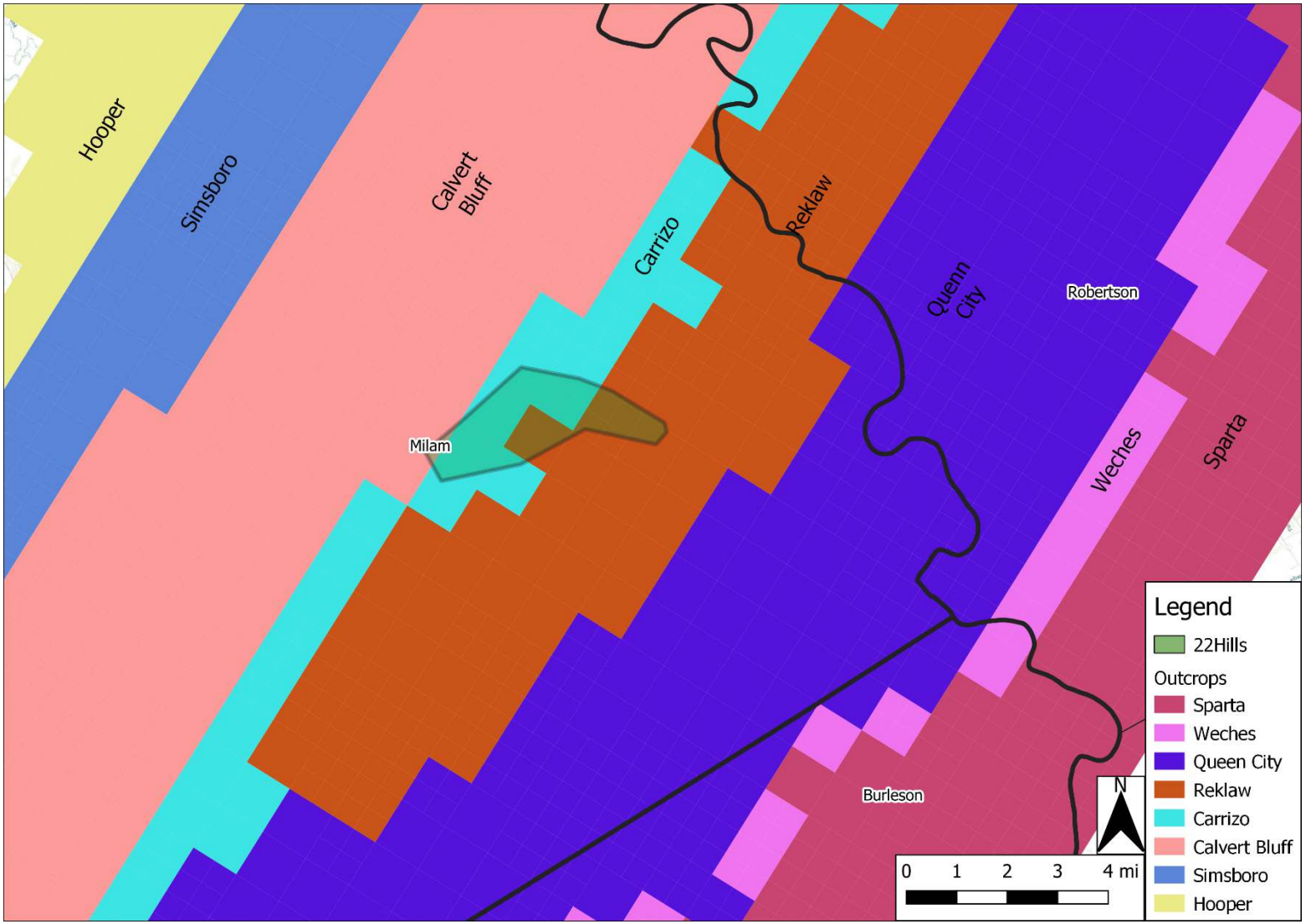
POSGCD Aquifers: Monitoring Progam



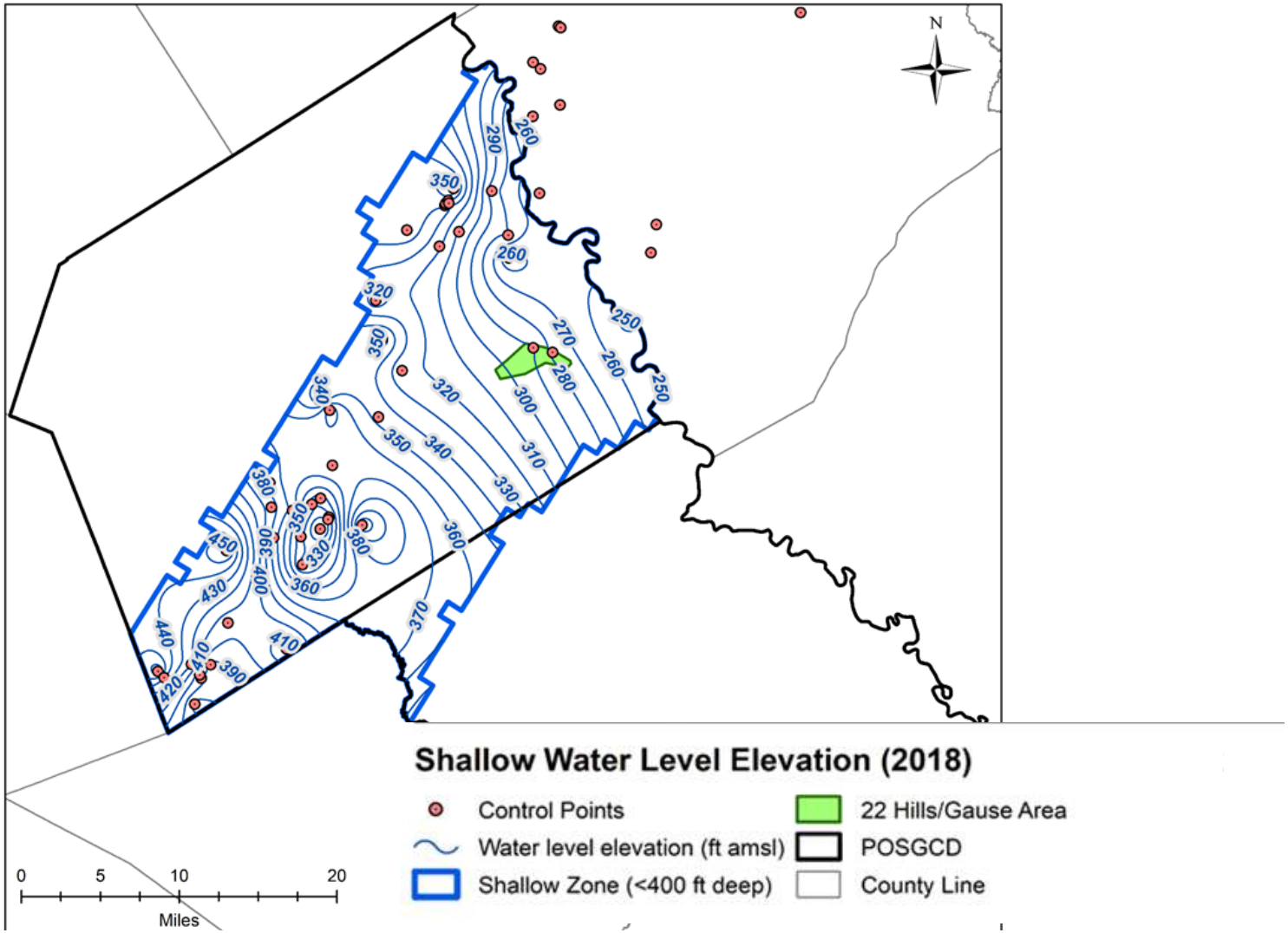
Shallow zone for PDL represents unconfined zone for all aquifers

Each aquifer (layer) also has a DFC

Aquifer Outcrops As Represented in GAM



2018 Hydraulic Heads in Shallow Zone



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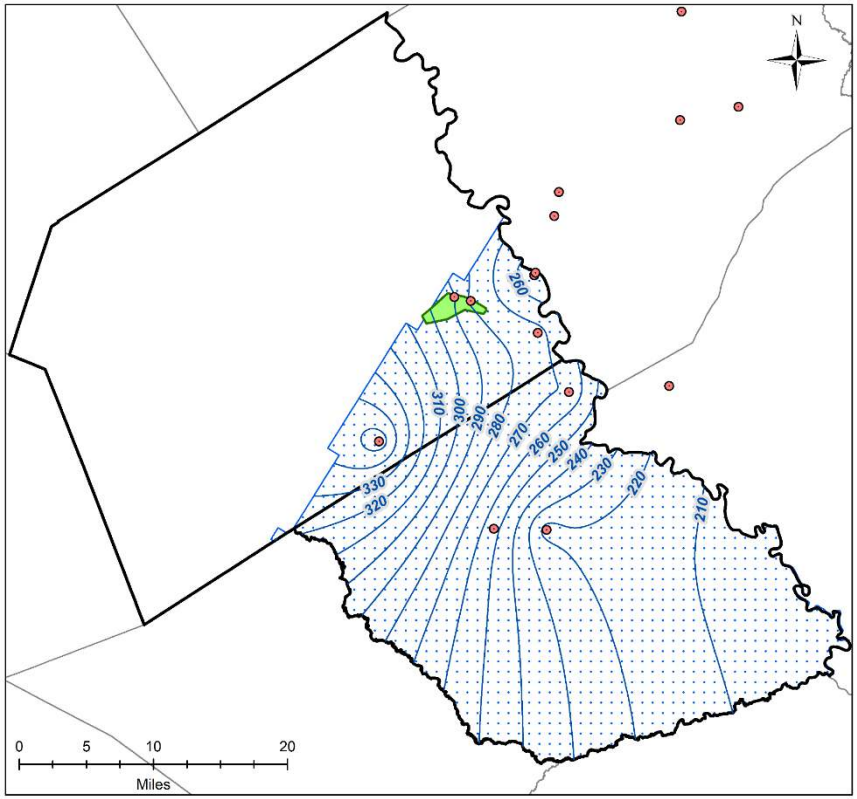
2018 Hydraulic Head in Carrizo

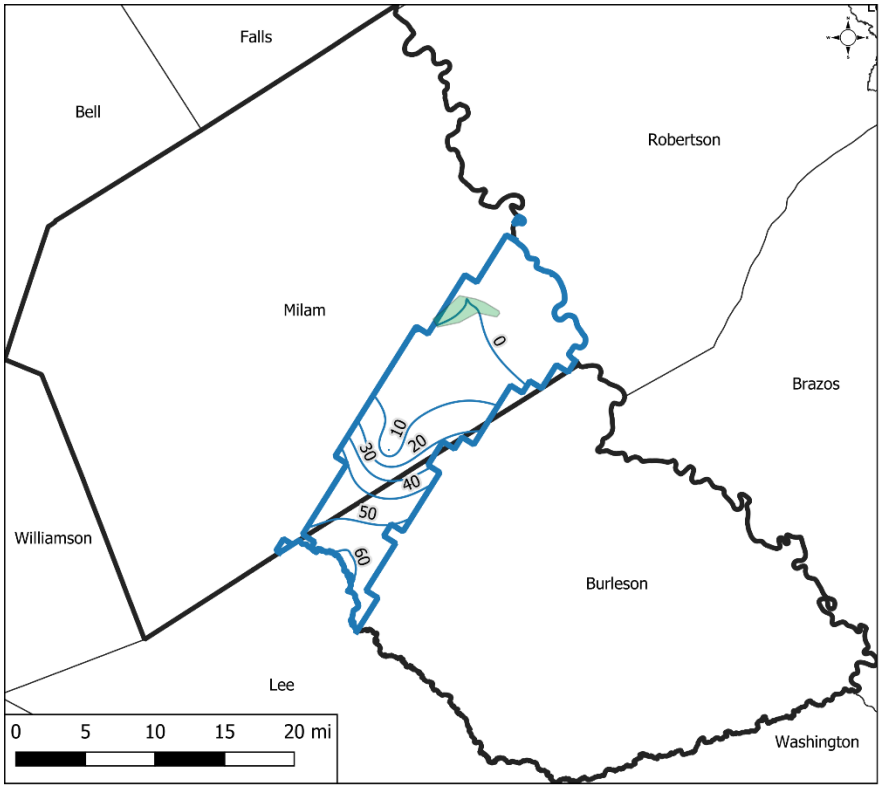
Carrizo Water Levels



Water Level in the Carrizo : 2018

- Control Points
- Water level elevation (ft amsl)
- Management Zone
- 22 Hills/Gause Area
- POSGCD
- County Line

Difference Between Shallow Zone and Carrizo Hydraulic Heads



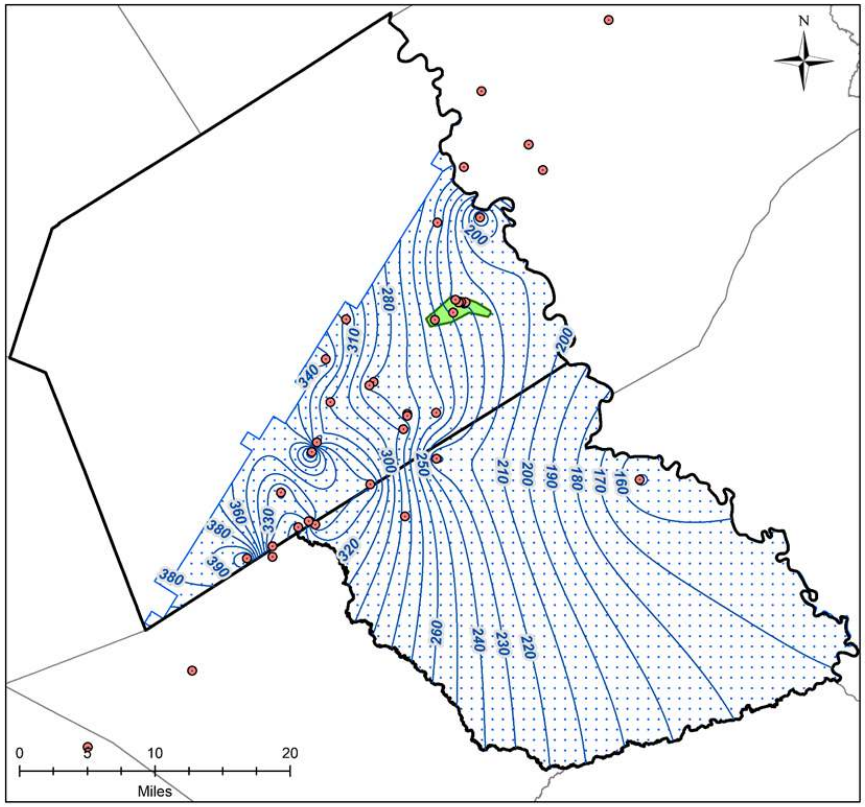
Difference From Shallow Water to Carrizo (2018)

- Difference From Shallow to CZ (ft)
- Shallow Zone (<400 ft deep)
- 22 Hills/Gause Area
- POSGCD
- County Line

Note: Two wells were moved from Calvert Bluff to Carrizo

2018 Hydraulic Head in Calvert Bluff

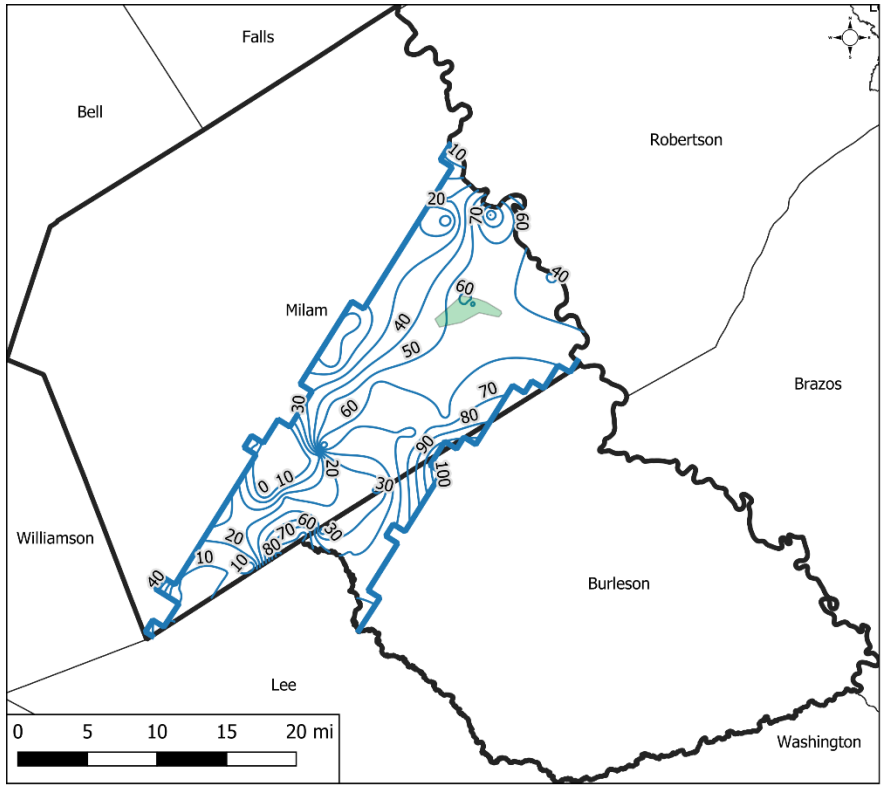
Calvert Bluff Water Levels



Water Level in the Calvert Bluff : 2018

- Control Points
- Water level elevation (ft amsl)
- Management Zone
- 22 Hills/Gause Area
- POSGCD
- County Line

Difference Between Shallow Zone and Calvert Bluff Hydraulic Heads



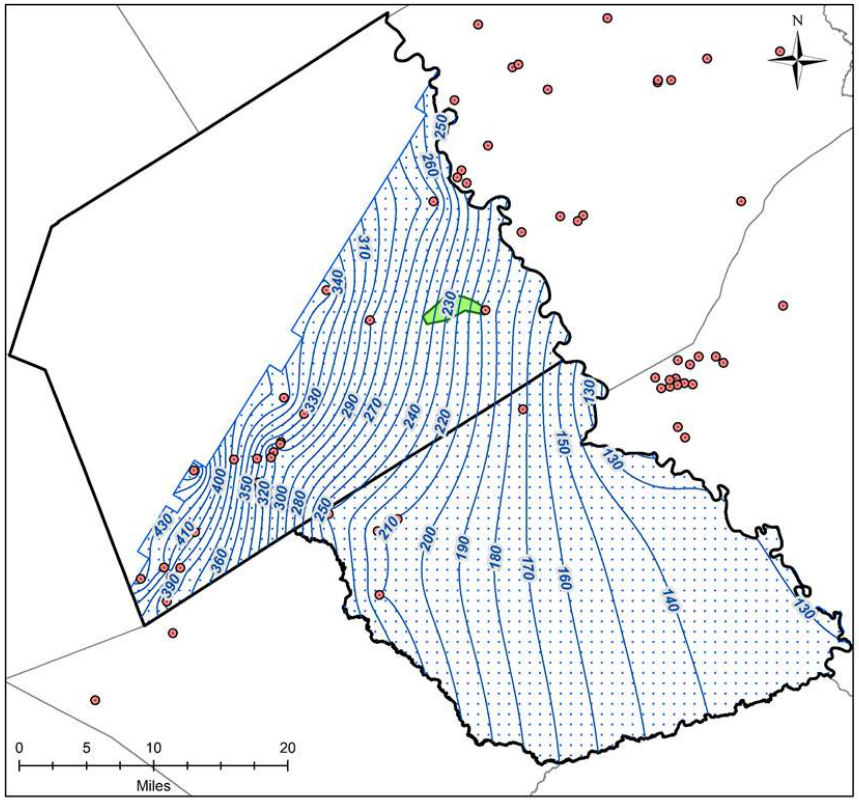
Difference From Shallow Water to Calvert Bluff (2018)

- Difference From Shallow to CB (ft)
- Shallow Zone (<400 ft deep)
- 22 Hills/Gause Area
- POSGCD
- County Line

Note: Two wells were moved from Calvert Bluff to Carrizo

2018 Hydraulic Head in Simsboro

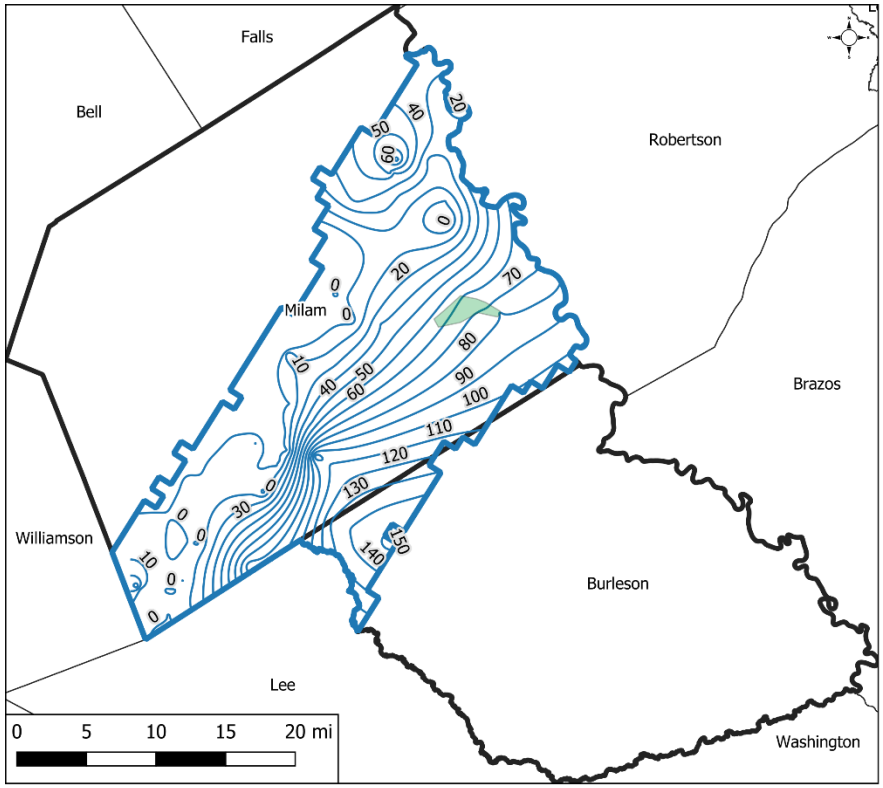
Simsboro Water Levels



Water Level in the Simsboro : 2018

- Control Points
- Water level elevation (ft amsl)
- Management Zone
- 22 Hills/Gause Area
- POSGCD
- County Line

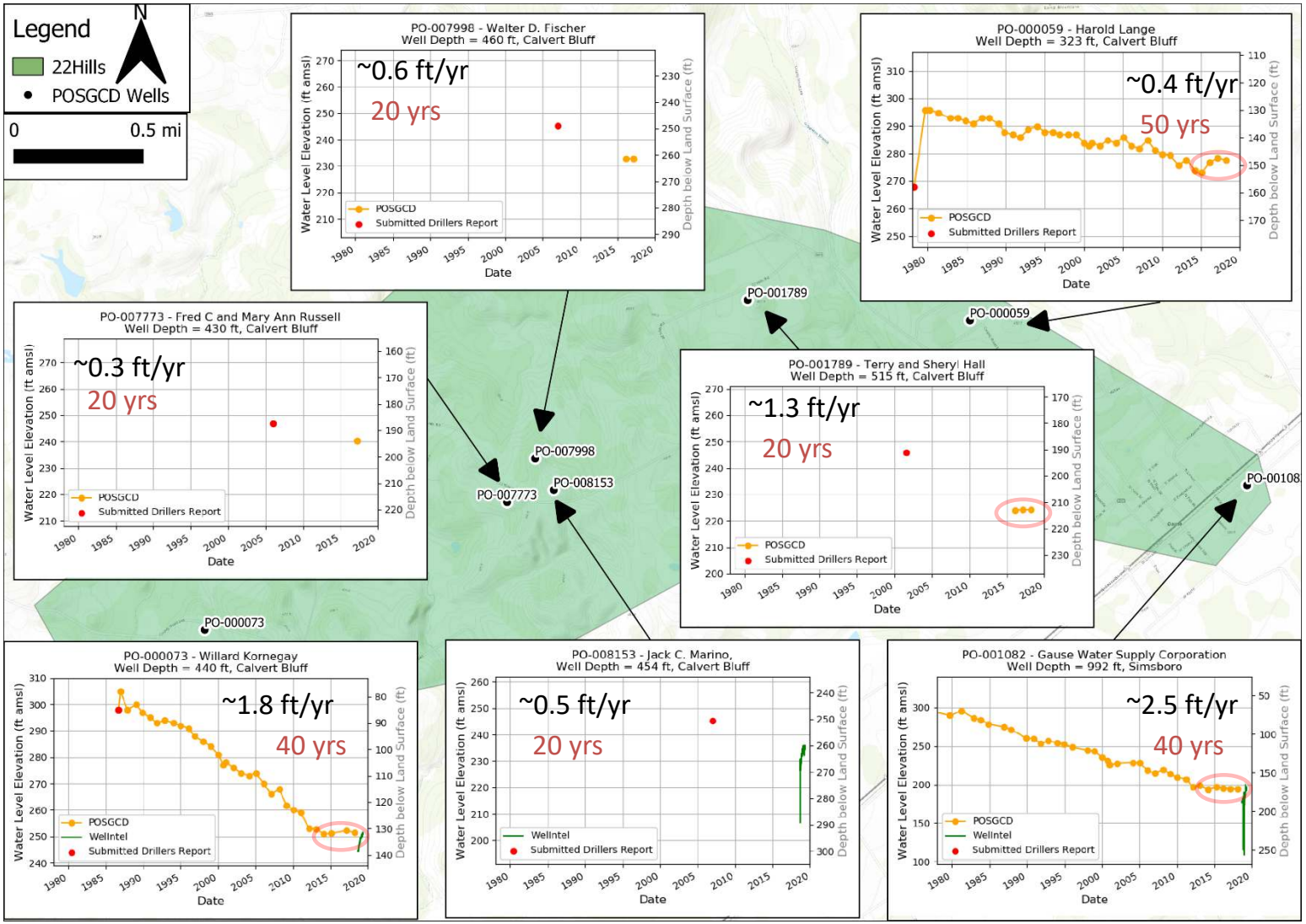
Difference Between Shallow Zone and Simsboro Hydraulic Heads



Difference From Shallow Water to Simsboro (2018)

- Difference From Shallow to SB (ft)
- Shallow Zone (<400 ft deep)
- 22 Hills/Gause Area
- POSGCD
- County Line

Estimated Drawdowns



Change in drawdown has been minimal since 2015

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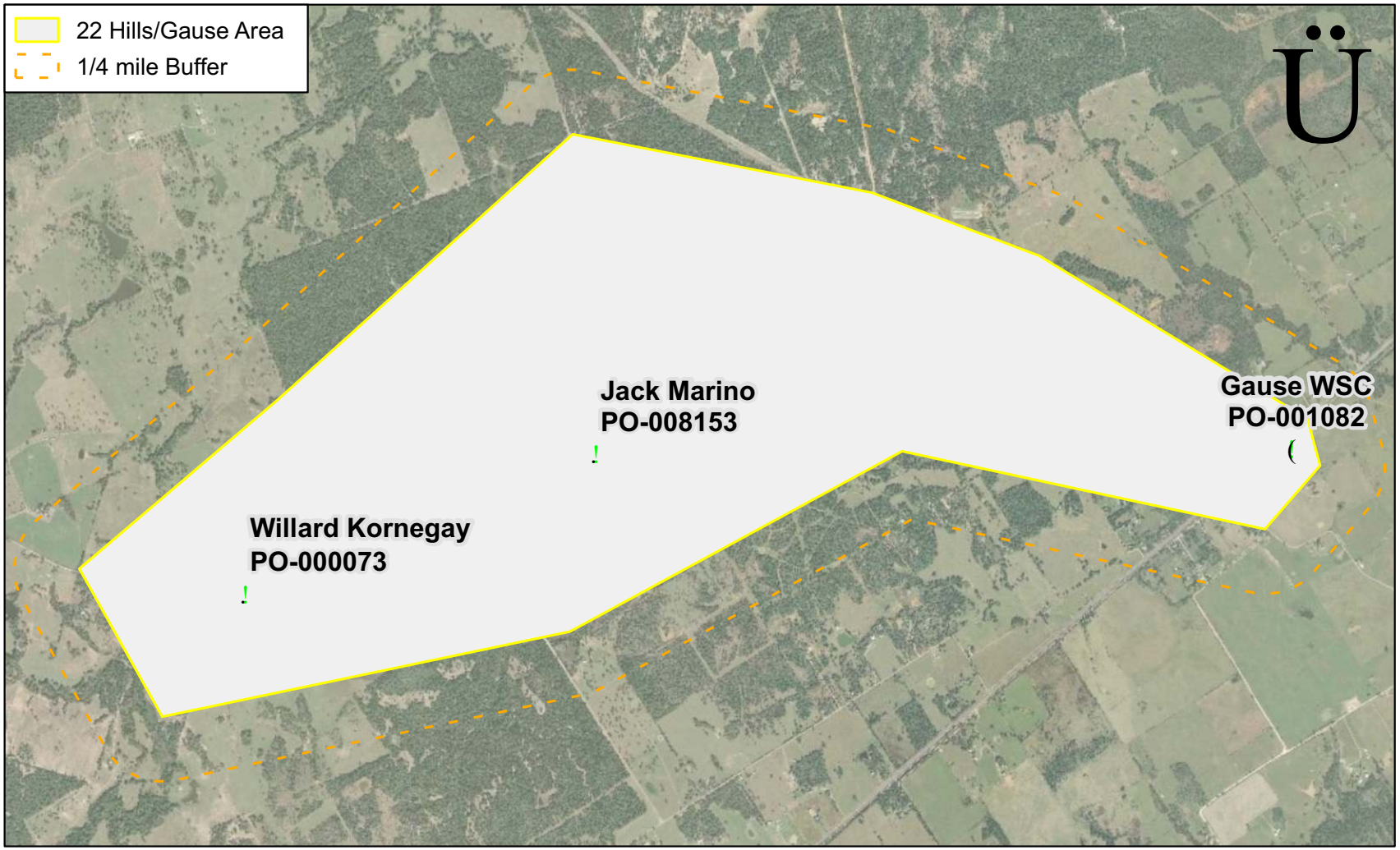
Monitoring Well with Well Intel in 22 Hills Area



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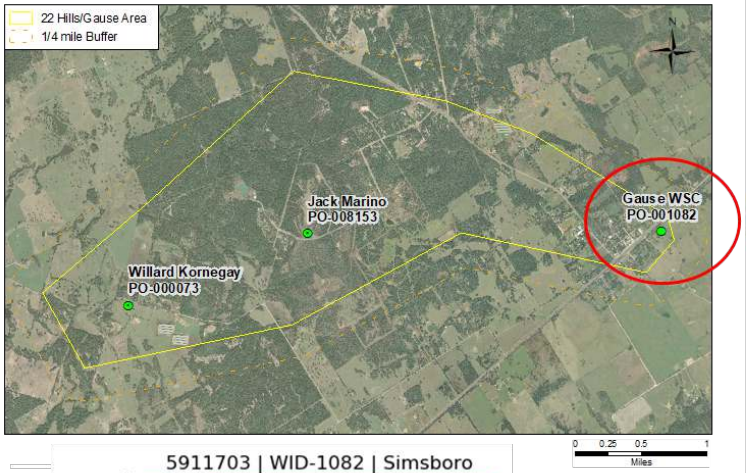
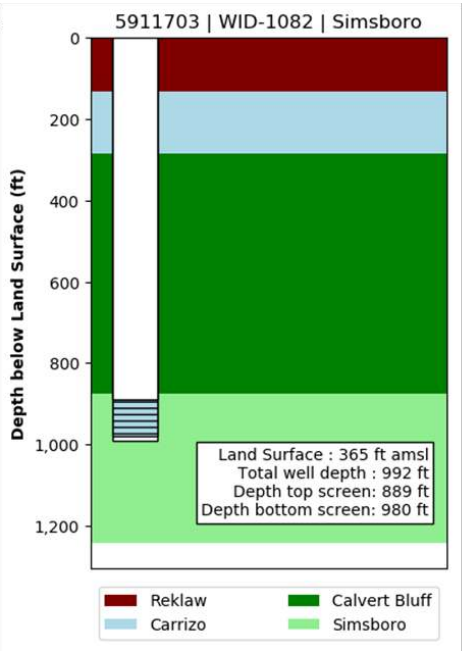
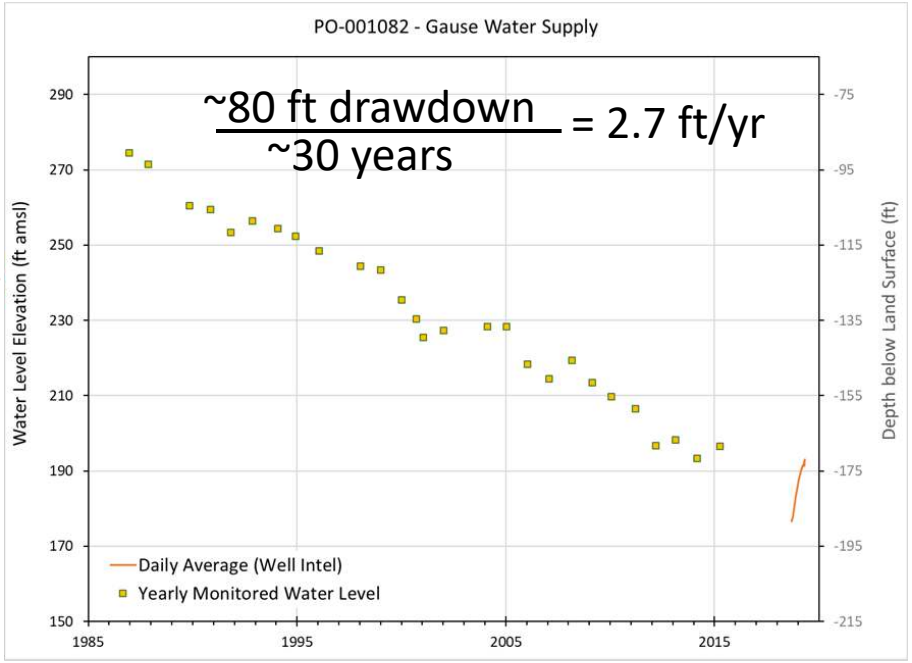
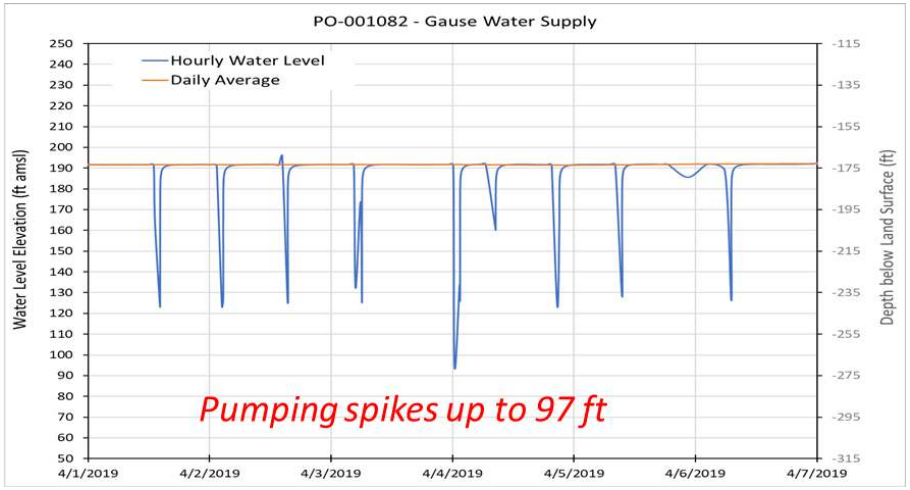
Monitoring Well with Well Intel: Gause Water Supply PO-001082









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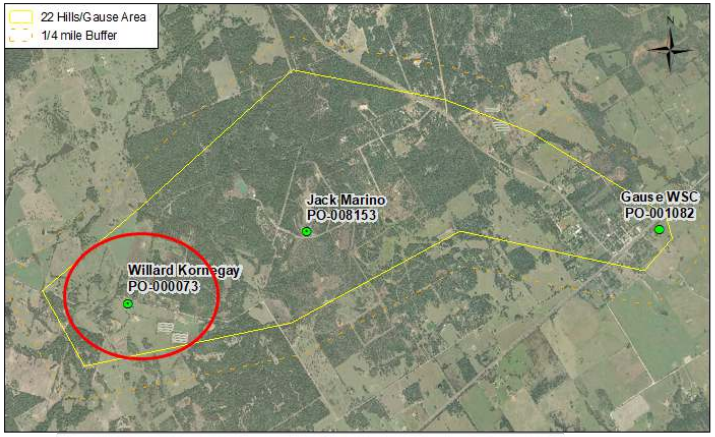
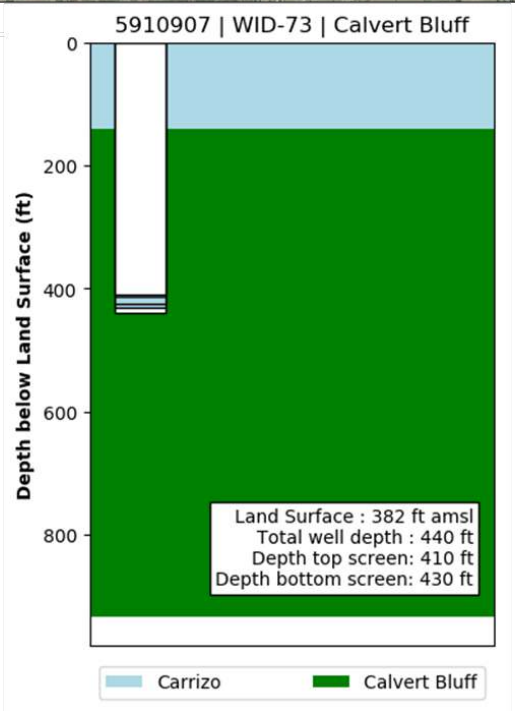
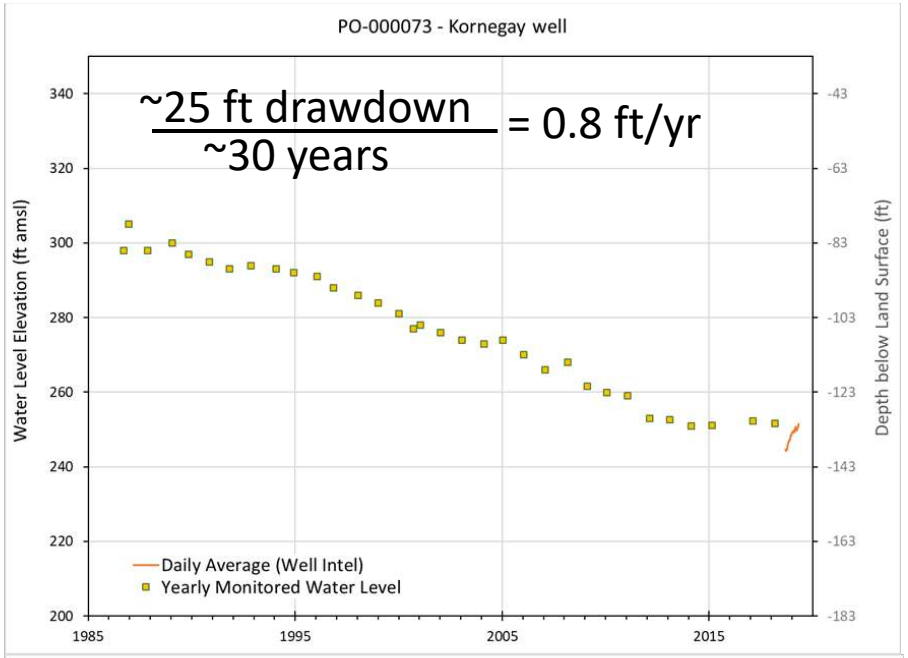
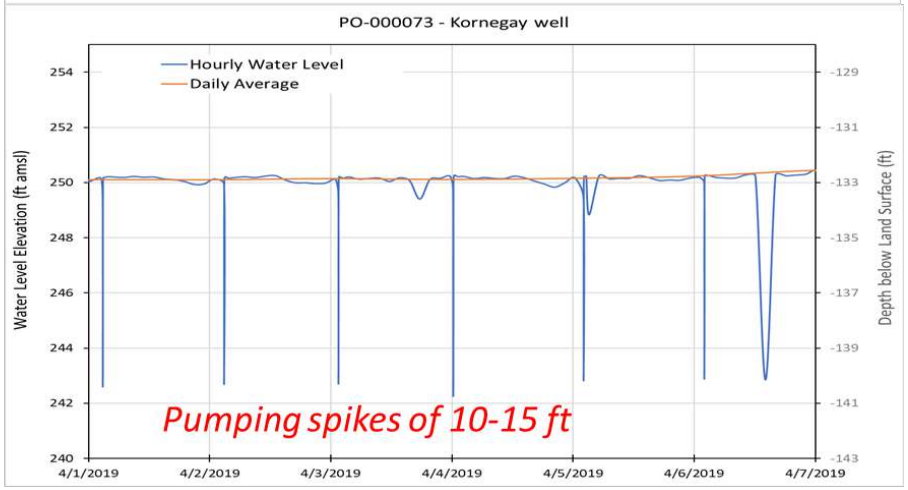
Monitoring Well with Well Intel: Kornegay Well









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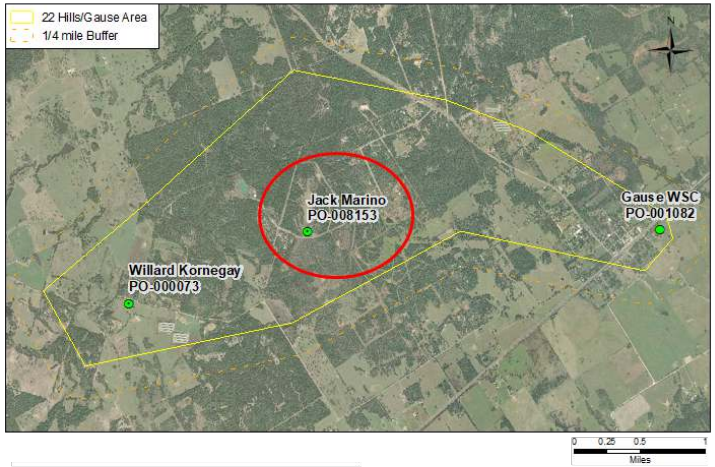
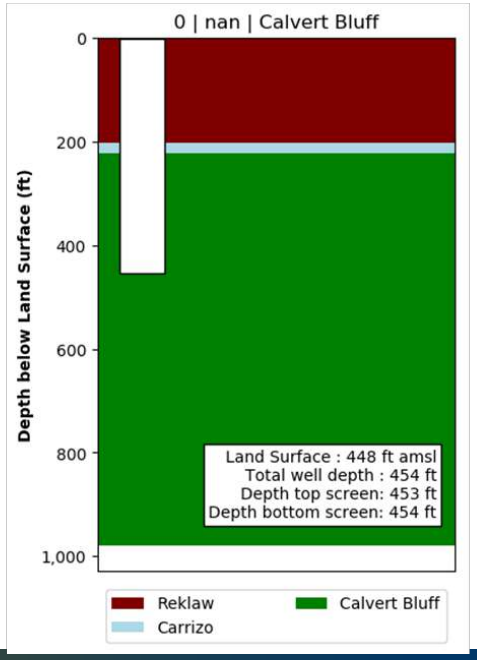
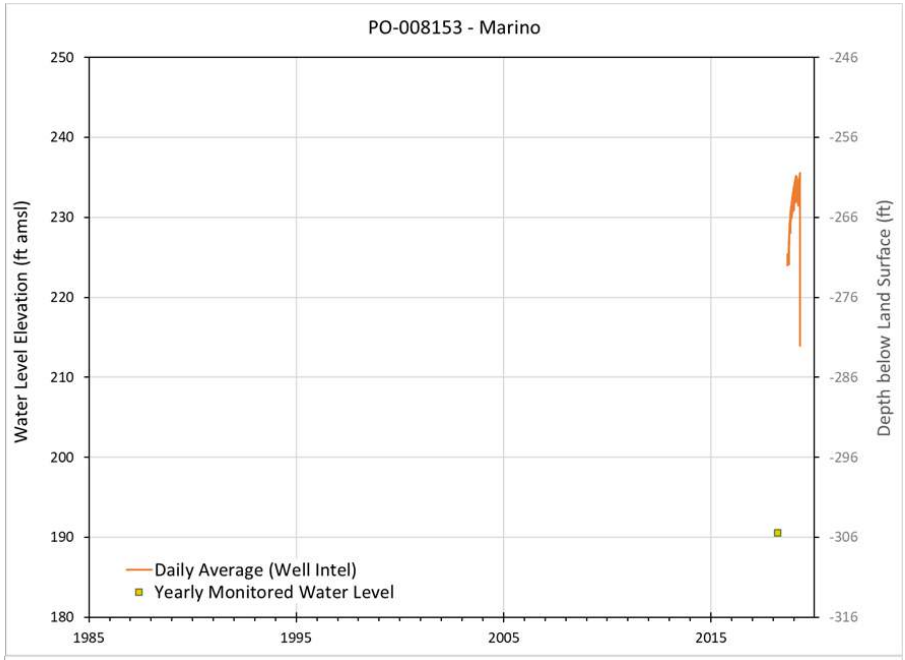
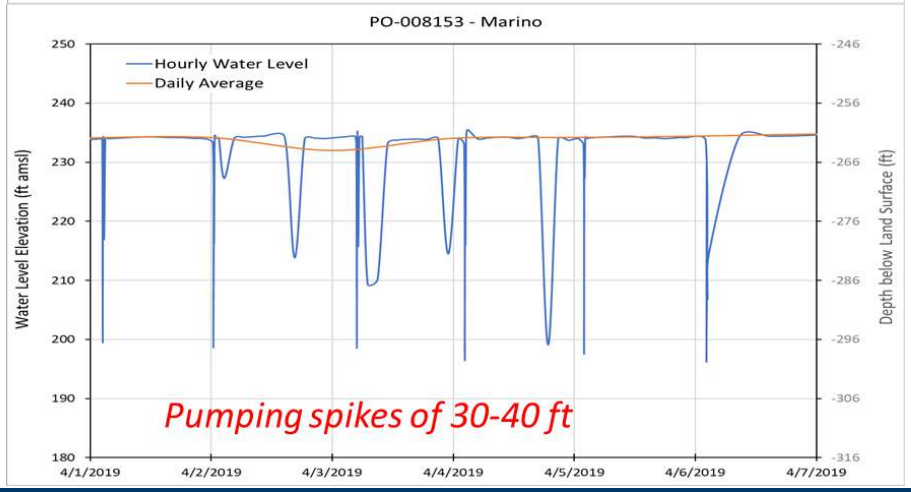
Monitoring Well with Well Intel: Marino Well









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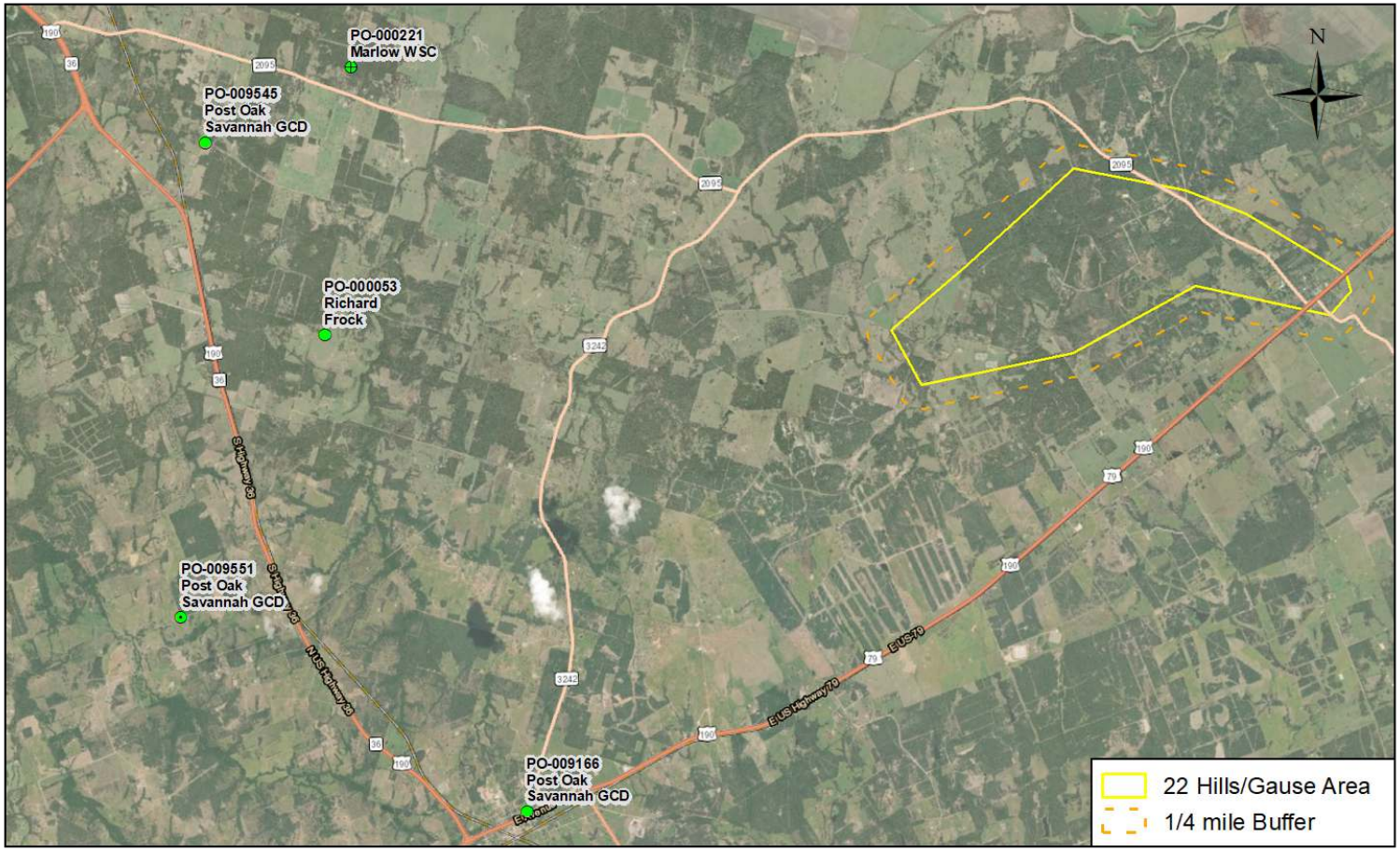
Monitoring Well with In-Situ Transducer: East of 22 Hills Area



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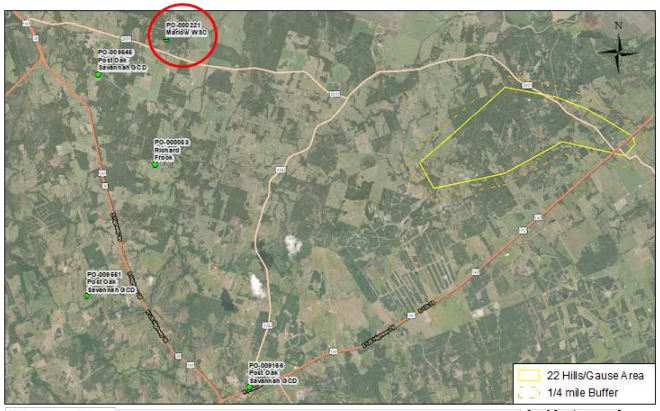
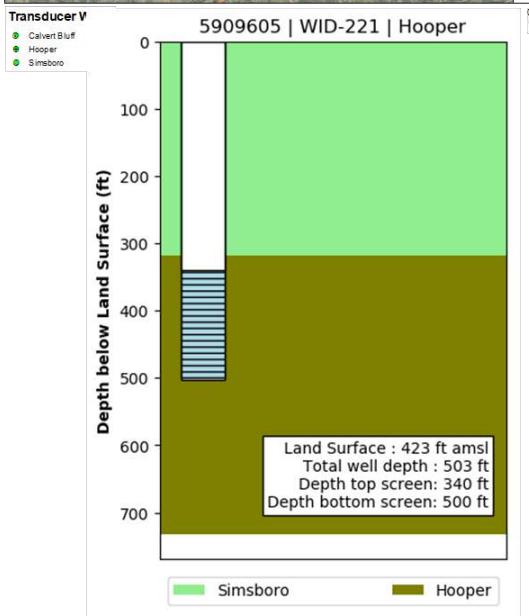
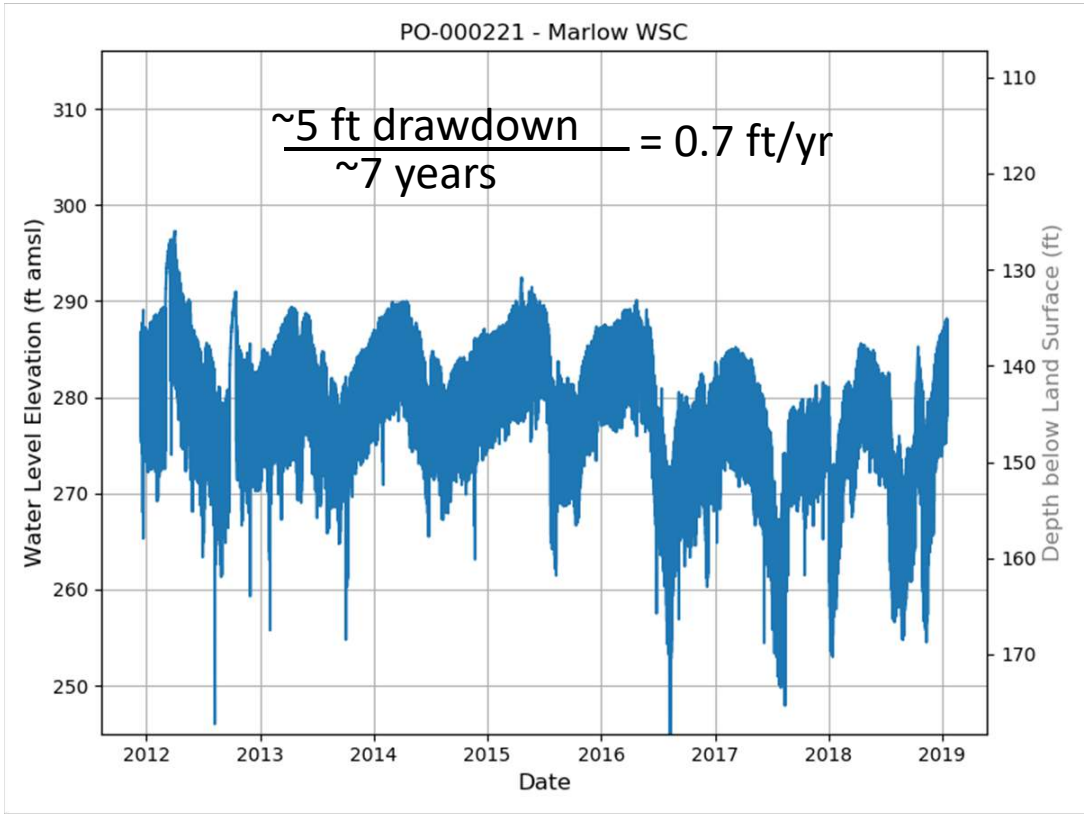
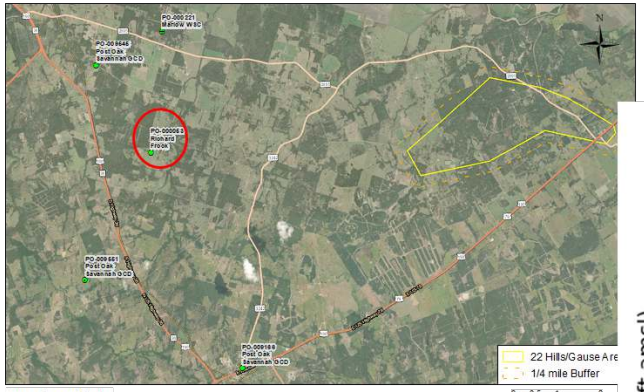
Monitoring Well with Transducer: PO-000221

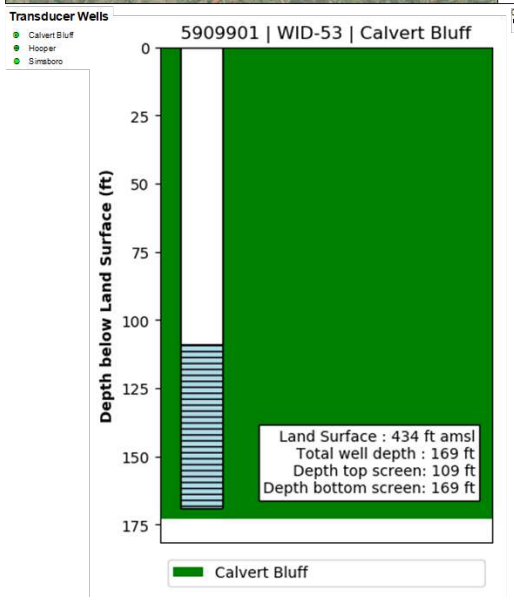


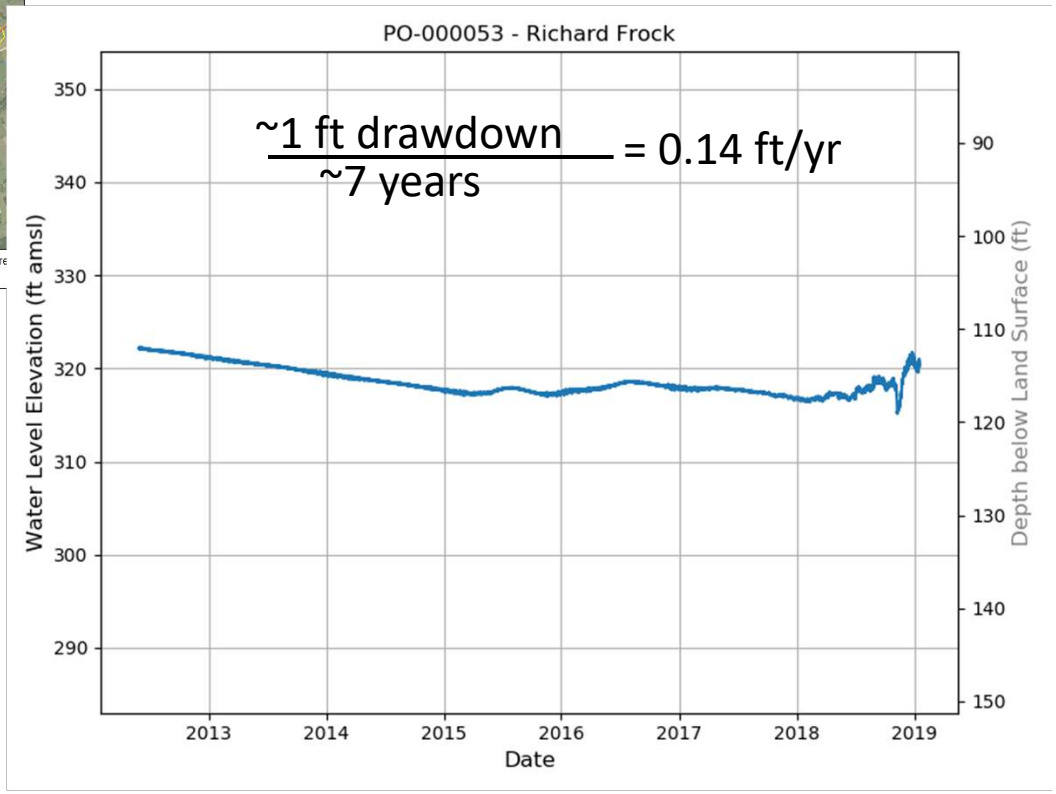




Monitoring Well with Transducer: Frock Well







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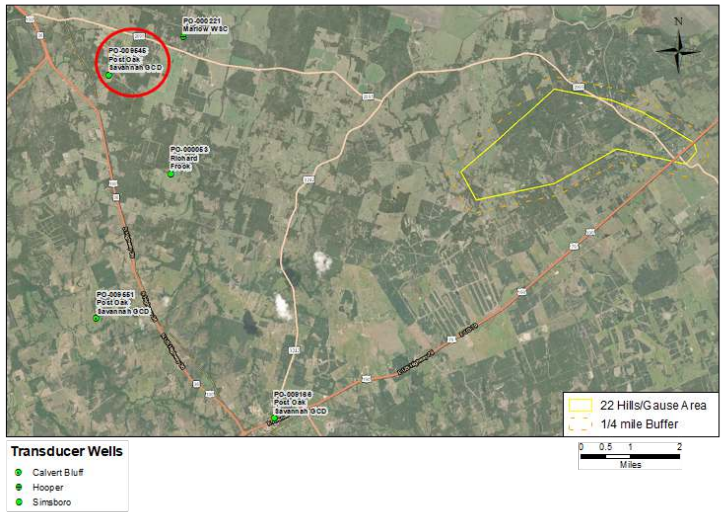
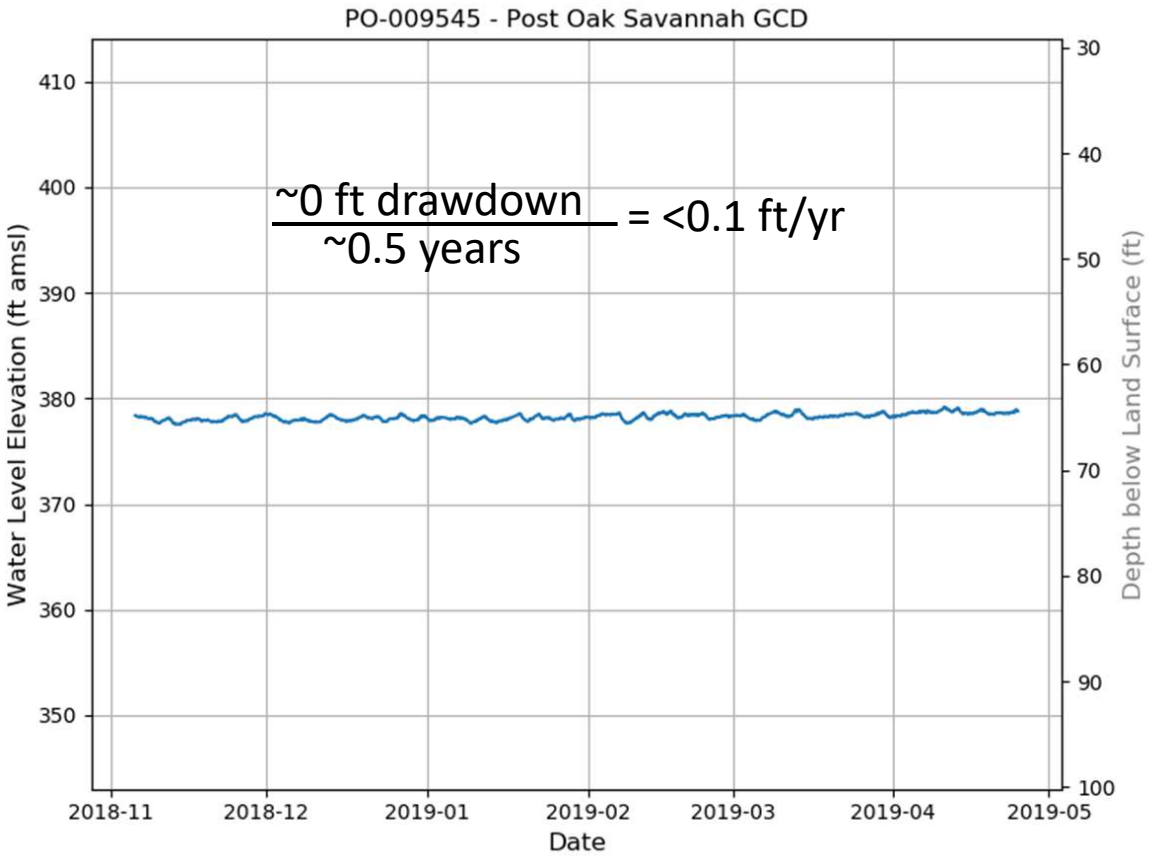
Monitoring Well with Transducer: PO-009454





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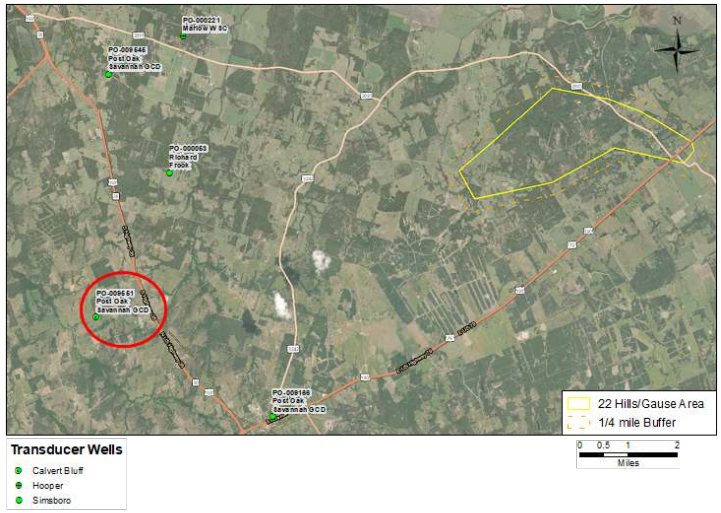
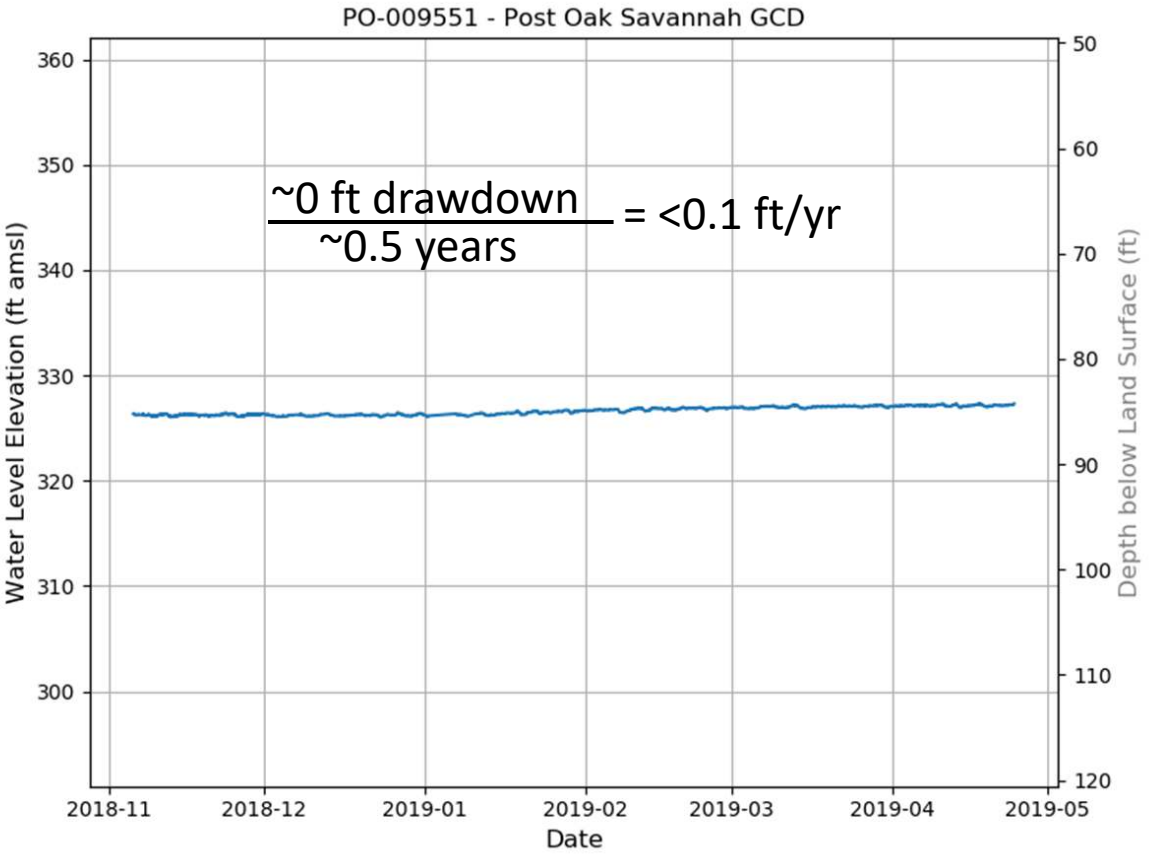
Monitoring Well with Transducer: PO-009551





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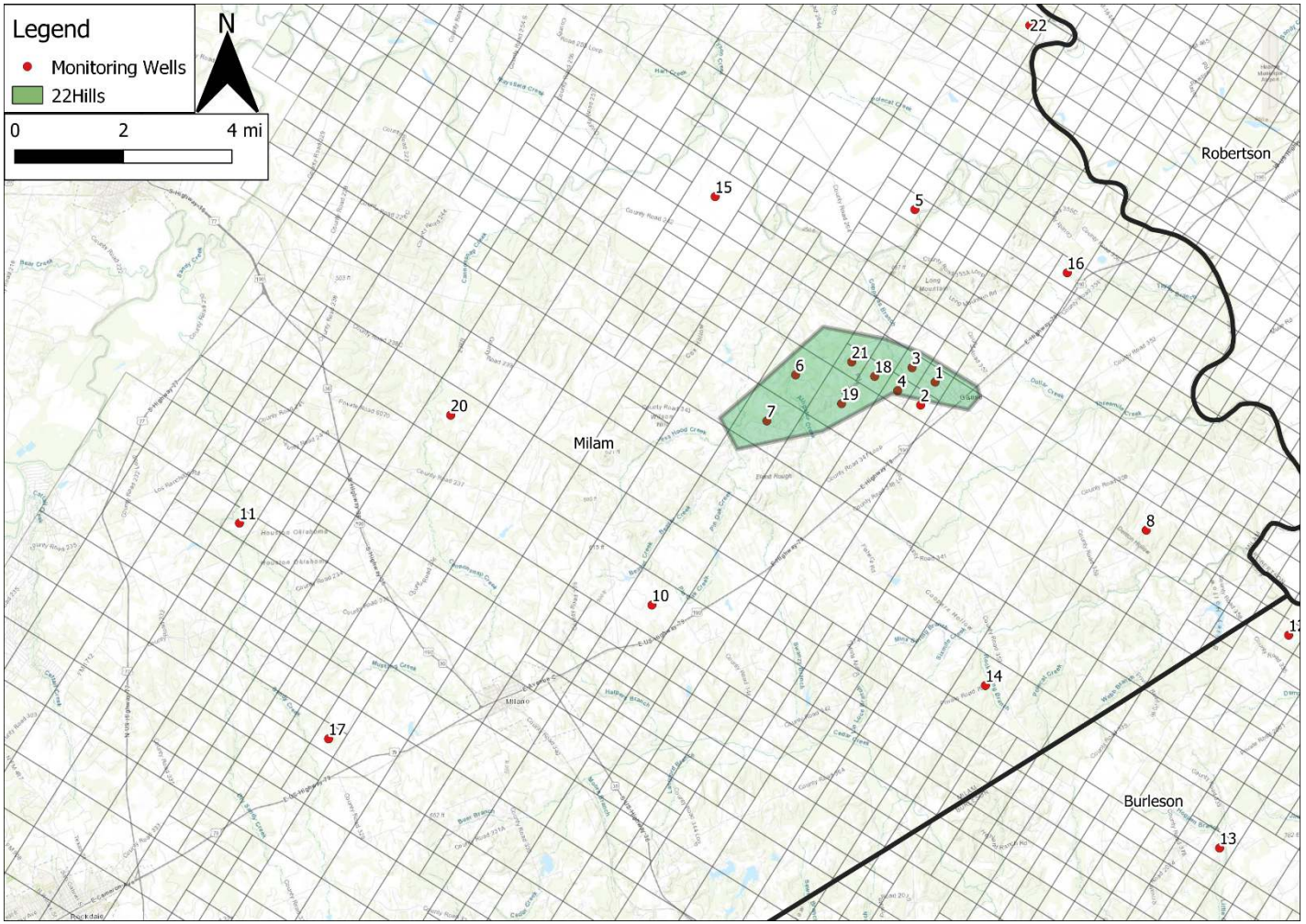
Locations for Modeled Hydrographs from 1930 to 2010 Using GAM



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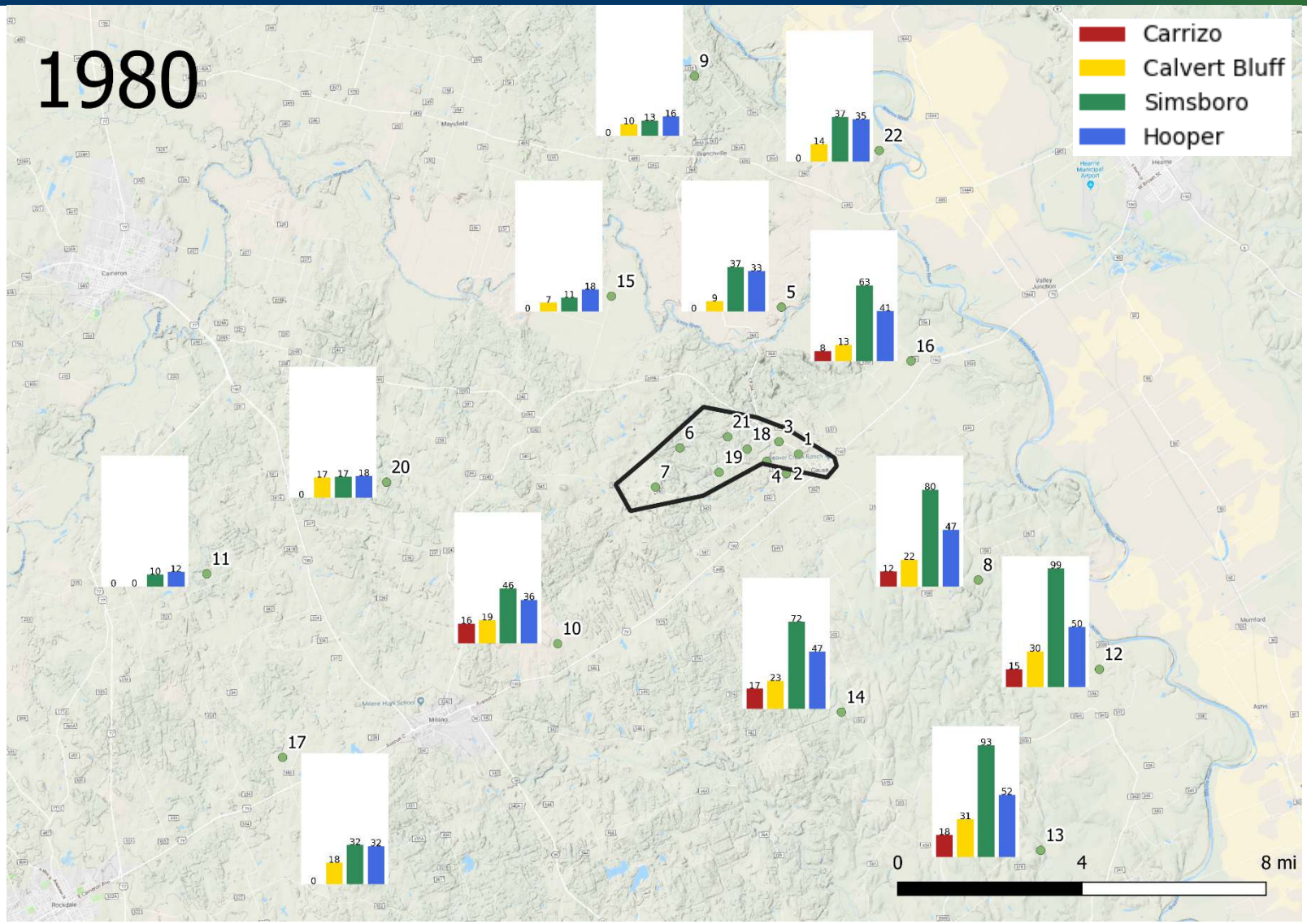
Drawdown Since 1980 Outside of 22 Hill Area



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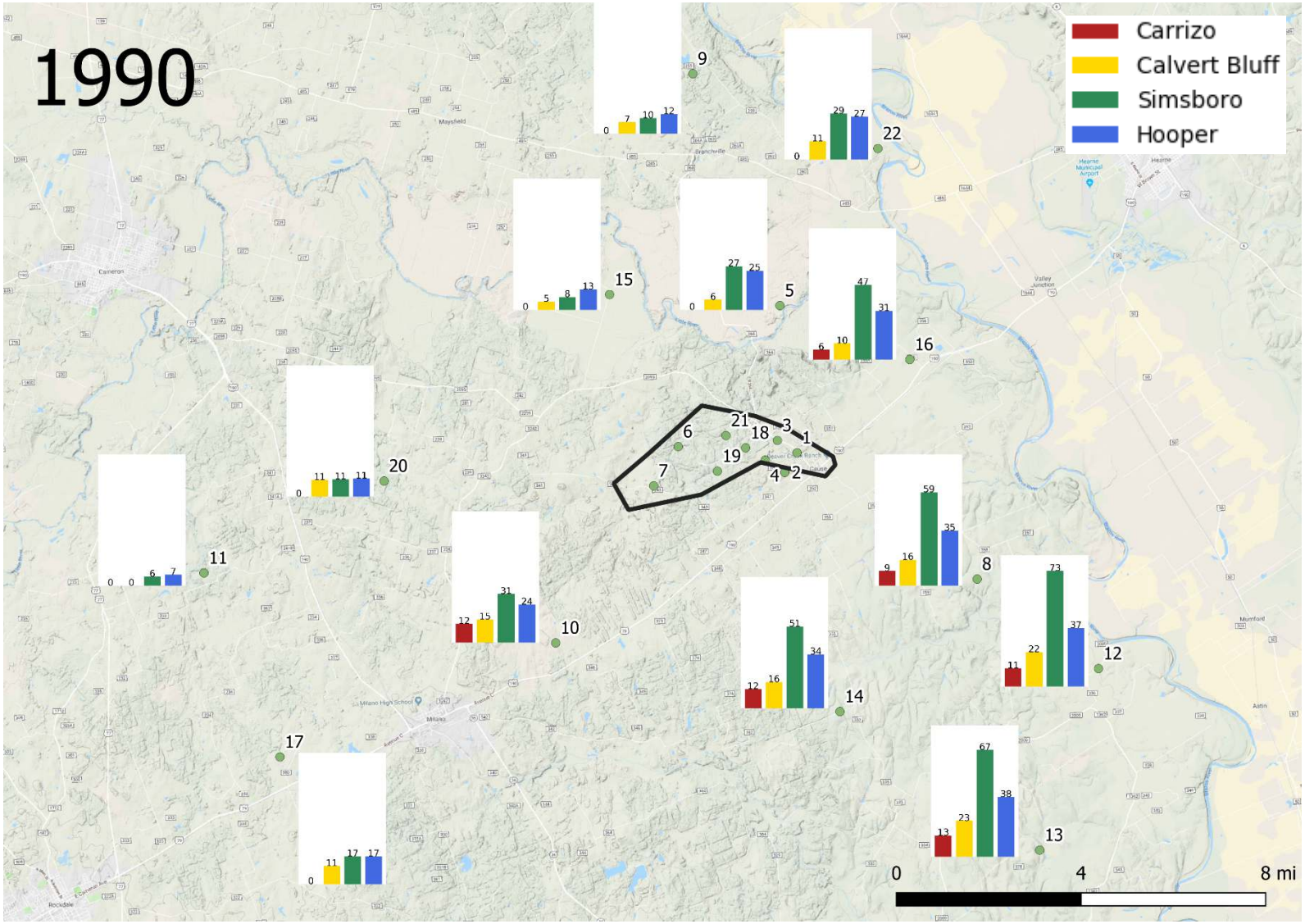
Drawdown Since 1990 Outside of 22 Hill Area



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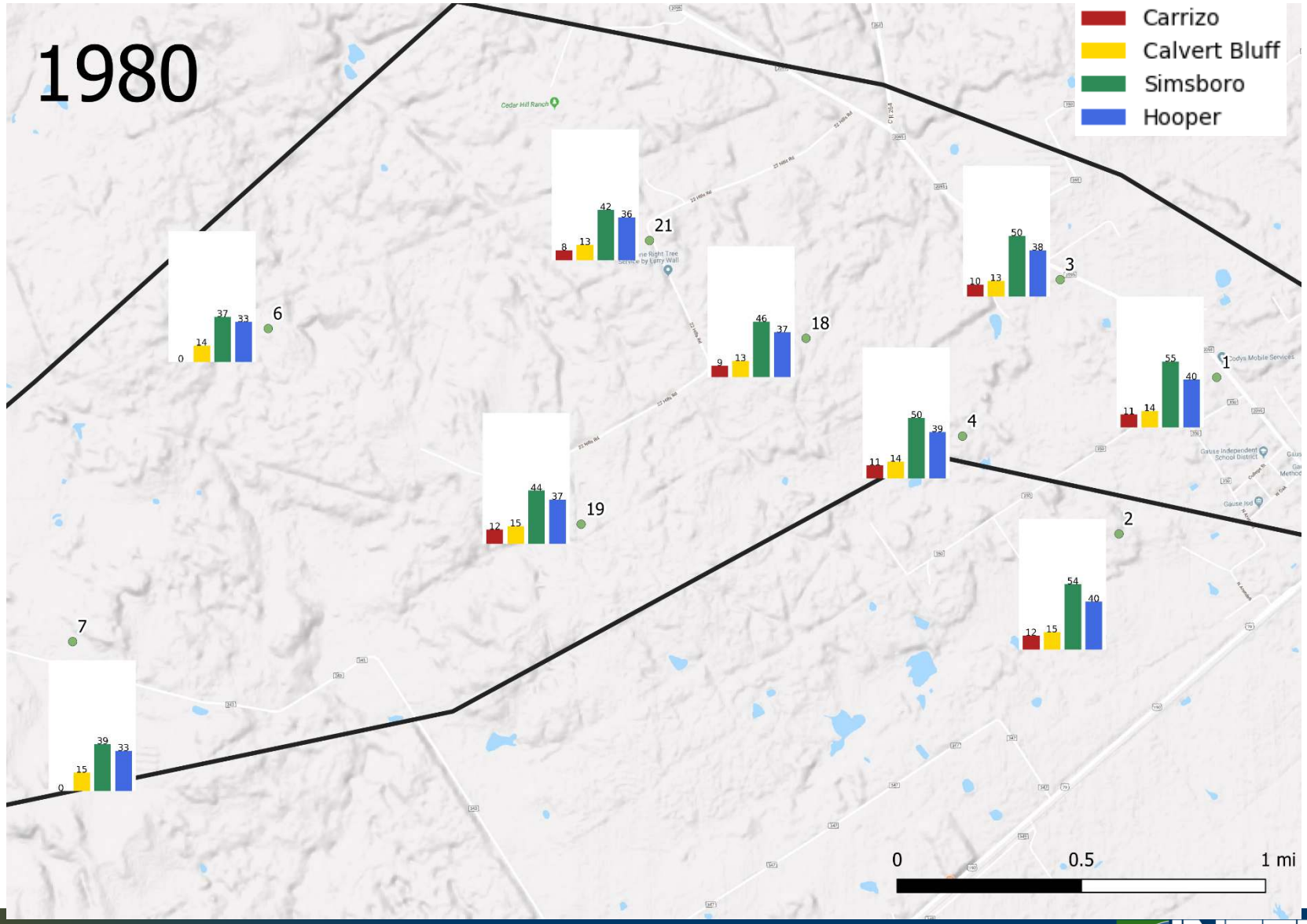
Drawdown Since 1980 Inside 22 Hill Area



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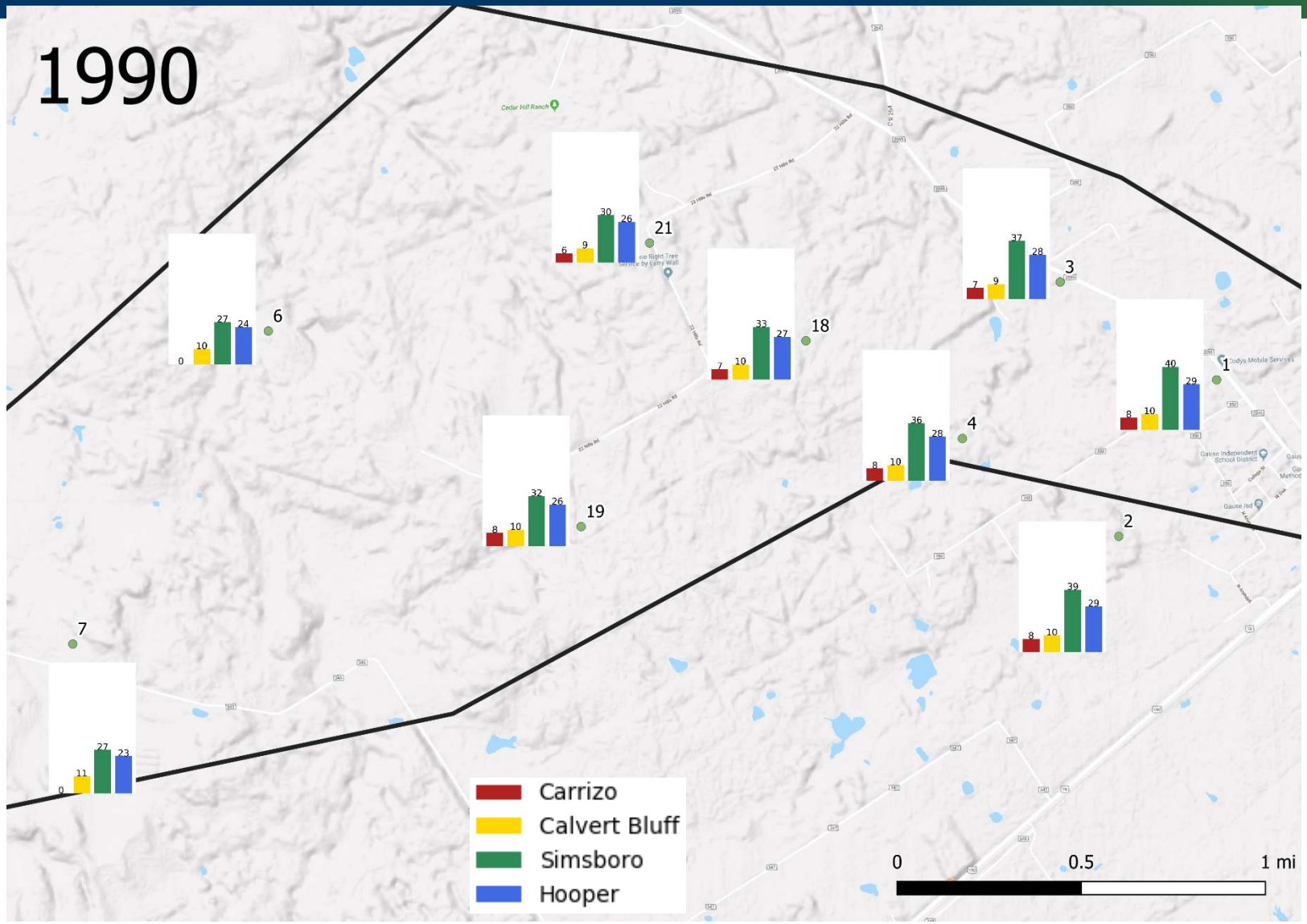
Drawdown Since 1990 Inside 22 Hill Area



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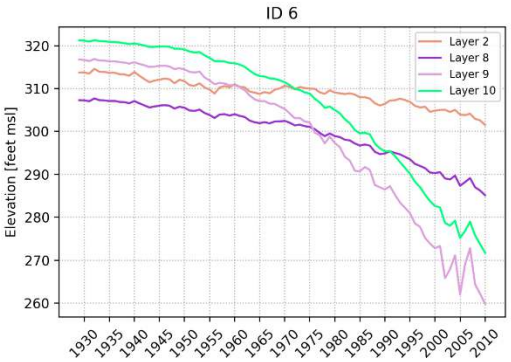
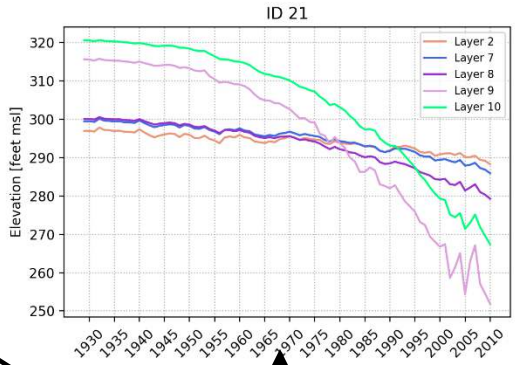
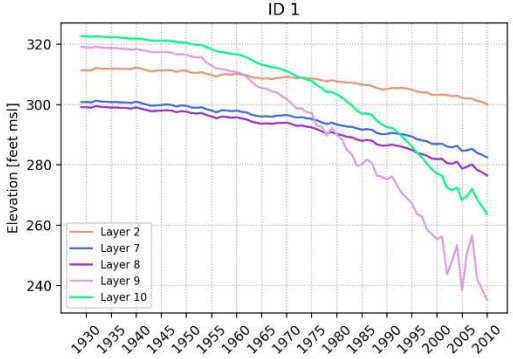
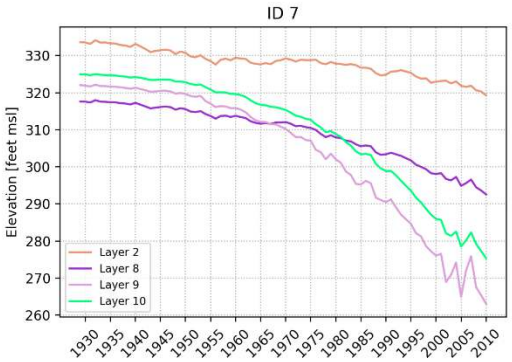
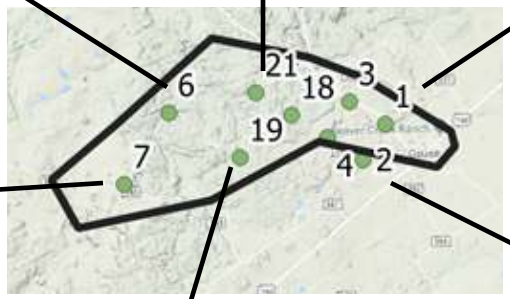
Comparison of Water Level Response in Different Aquifers

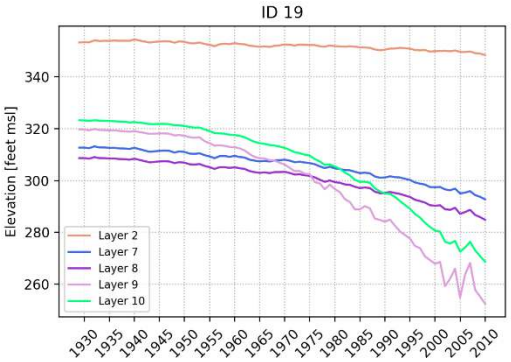


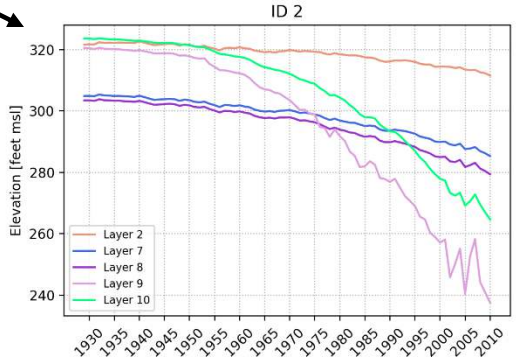












Average Drawdown

Shallow Zone -- 10 ft

Simsboro Aquifer -- 64 ft

Interim Findings for 22 Hills Area

- Well Locations
  - No screen information for majority of wells
  - Large majority of exempt wells terminate in Calvert Bluff
  - Permitted wells with largest pumping rate in Simsboro
  - Changes made in two well assignments so far. Two wells screened in upper-most Calvert Bluff were reassigned to Carrizo
  - Due to changes in updated GAM, Gause WSC Well was reassigned from Calvert Bluff to Simsboro
- Geology
  - Area located in outcrops for Carrizo and Reklaw
  - Aquifer thicknesses in GAM are not supported by picks on geophysical logs
  - POSGCD and Brazos Valley GCDs have studies that are reviewing geophysical logs to support updates to the aquifer thicknesses
  - In vicinity of Gause WSC wells, the distinctions between Carrizo-Wilcox Aquifer formations need to be reviewed as part of the 22 Hills Area investigation

Interim Findings for 22 Hills Area (con't)

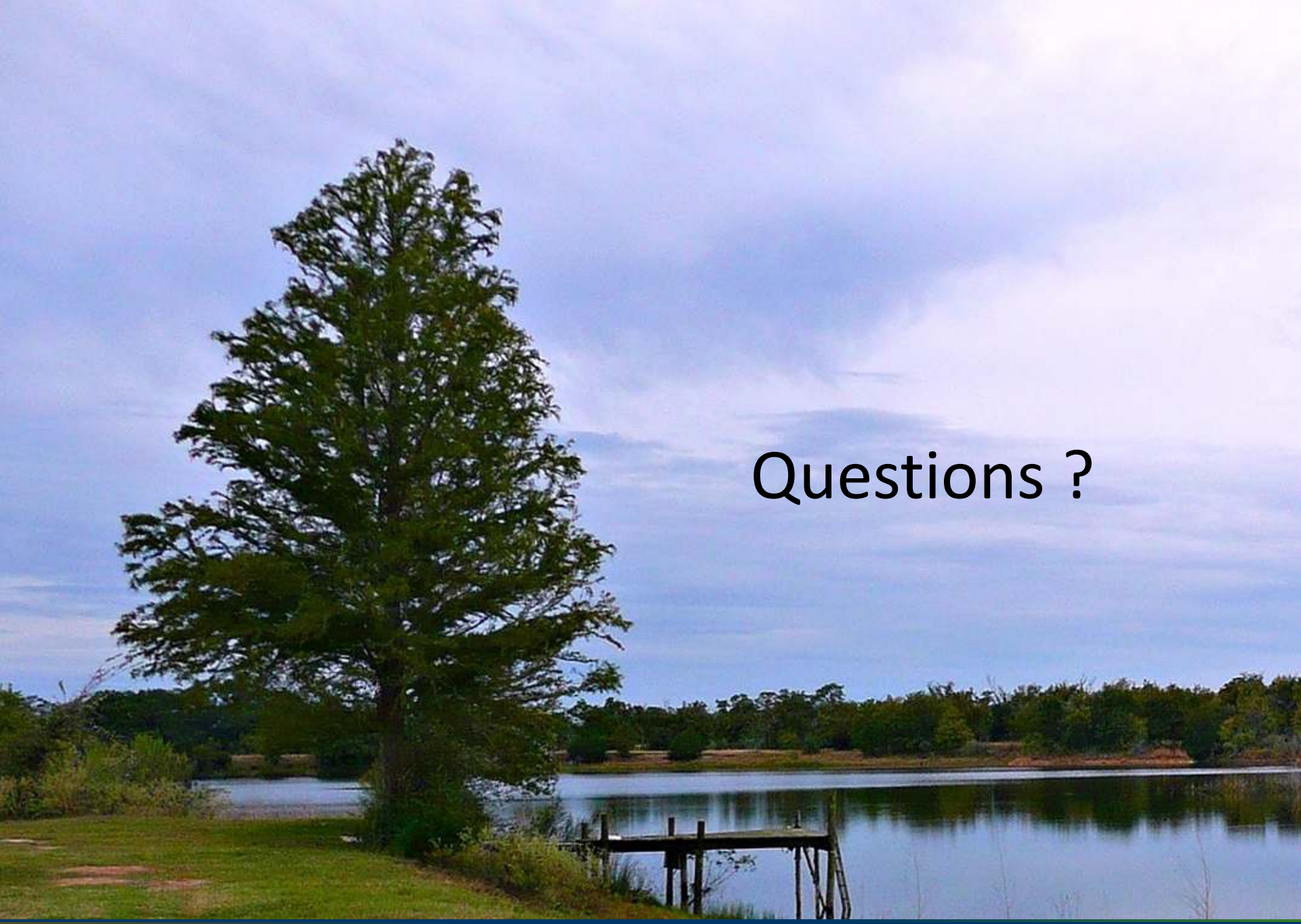
- 2018 Hydraulic Head from Monitoring Data
  - In East Milam, groundwater flow in Shallow Zone appears to be flowing toward the Brazos River
  - In East Milam, groundwater flow in Simsboro appears to be flowing toward City of Bryan & College Station
  - In East Milam, groundwater flow in Calvert Bluff appears to be a combination of the flow directions observed in Simsboro and Shallow Zone
  - Hydraulic head is about 70 feet lower in Simsboro than Shallow Zone
  - Hydraulic head is about 60 feet lower in Calvert Bluff than Shallow Zone

Interim Findings for 22 Hills Area (con't)

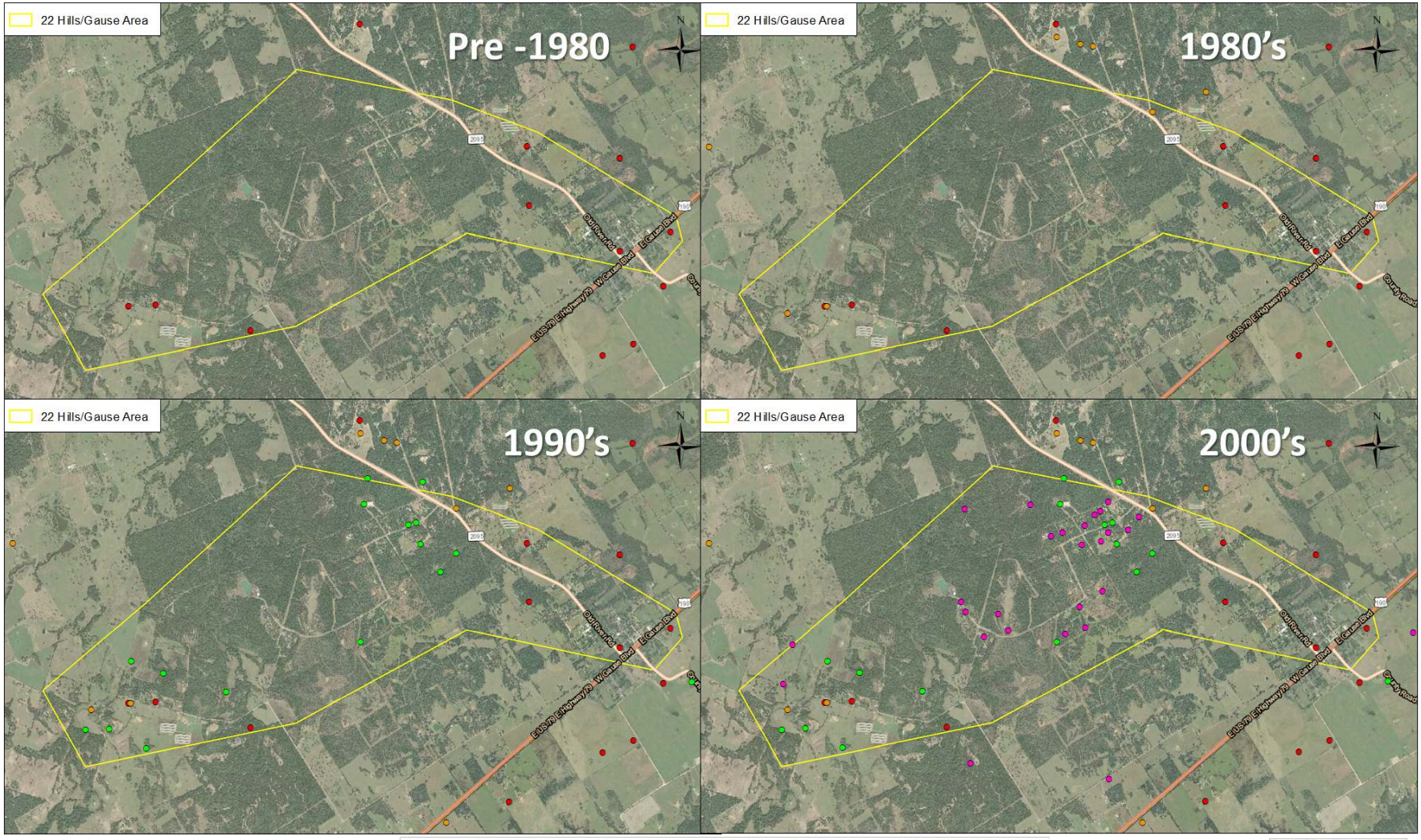
- Drawdowns observed in Monitoring Data
  - At Gause WSC well, Simsboro has an average drawdown rate of about 2.5 ft/yr for last 40 years
  - In Calvert Bluff, drawdown rates range from 0.4 ft/yr to 1.3 ft/year
  - Since 2015, water levels have remained nearly constant and drawdown rates are much lower than historical rates
  - Drawdown rates for shallow zone have not yet been estimated

Interim Findings for 22 Hills Area (con't)

- Modeled Water Levels and Drawdown from GAM
  - From 1930 to 2010, average drawdown in Shallow Zone is about 10 feet
  - From 1930 to 2010, average drawdown in Simsboro is about 64 feet
  - From 1930 to 2010, drawdown in Calvert Bluff closely mimics drawdown in Simsboro
  - Drawdown rate is greatest during period of 1990 to 2010
  - A major cause of drawdown in Simsboro is pumping from City of Bryan and College Station


Questions ?

Well Installations Over Time



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