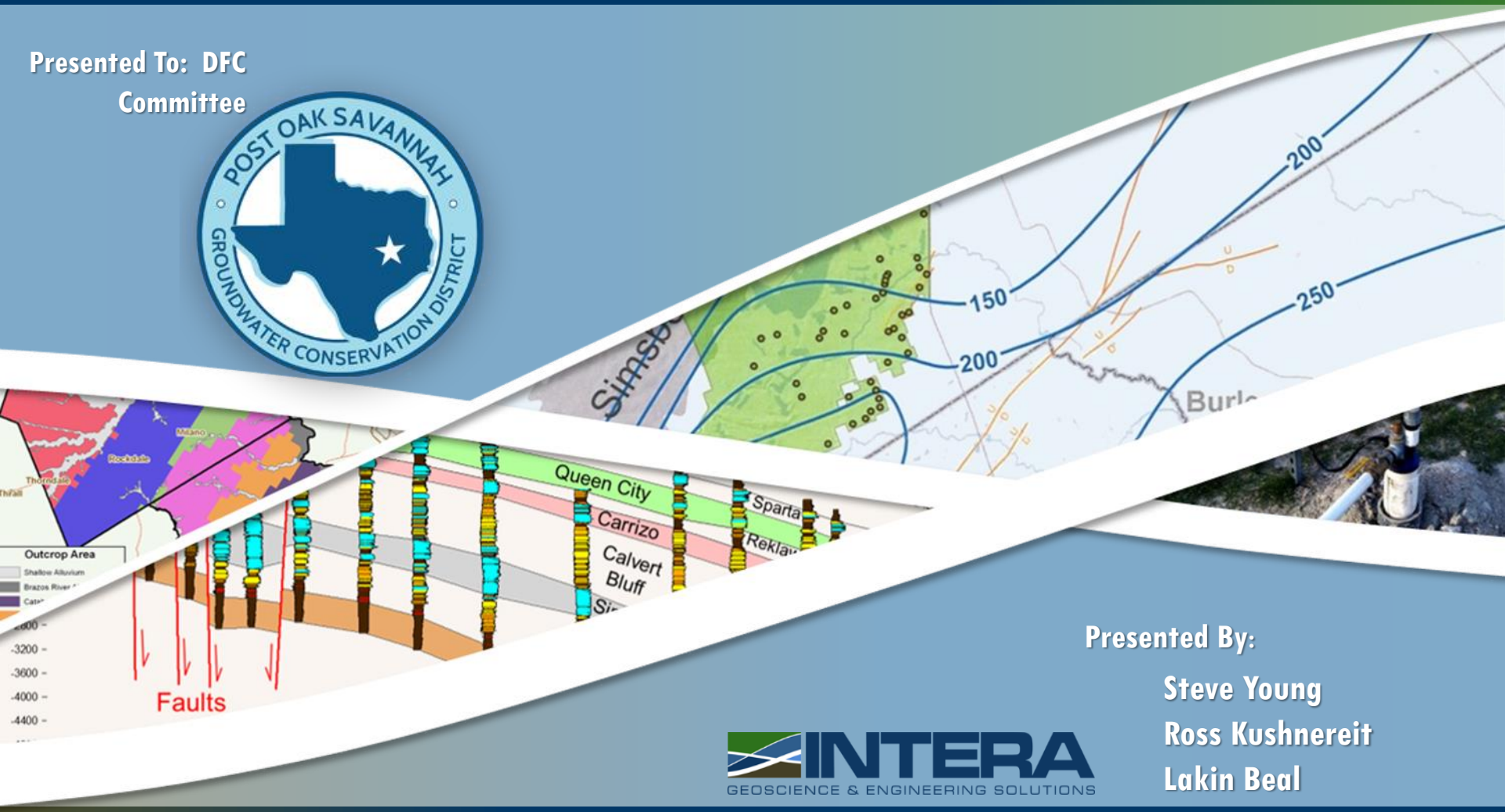
Desired Future Conditions Committee Update

Presented To: DFC Committee

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT



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GEOSCIENCE & ENGINEERING SOLUTIONS

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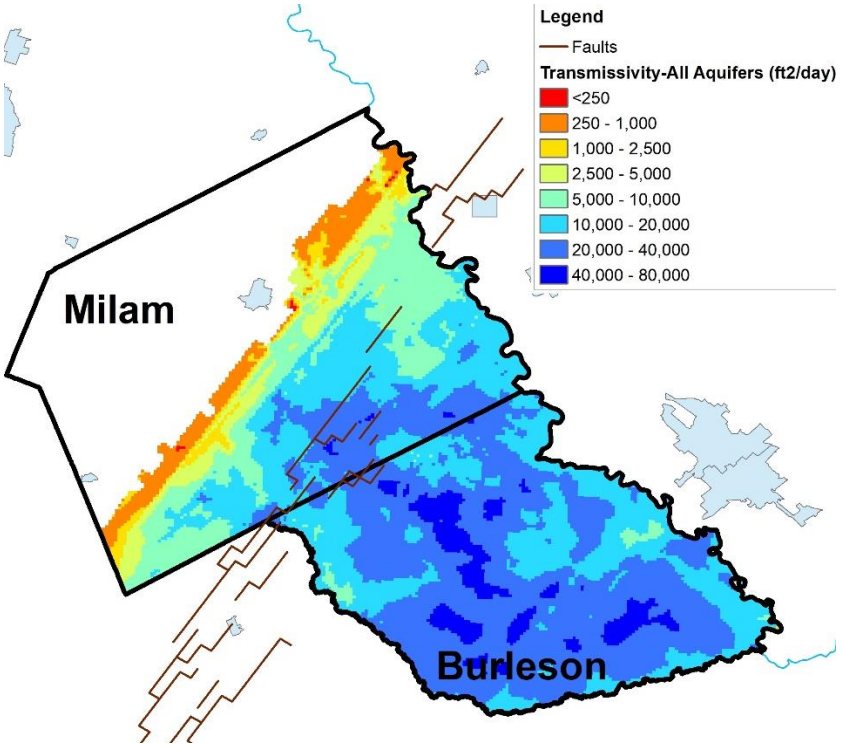
Fair Share

Production Capacity in POSGCD

Aquifers	Production Capacity		Aquifer Property	
	Amount*	Percent	Area (mi^2)	Average Transmissivity (ft^2/day)
Upper Trinity	17	1	807	211
Lower Trinity	14	1	807	591
Sparta	62	3	577	1,066
Queen City	97	4	753	1,286
Carrizo	181	8	832	2,178
Calvert Bluff	179	8	1,025	1,747
Simsboro	1,583	68	1,128	14,035
Hooper	109	5	1,234	885
Yegua Jackson	90	4	368	2,440

* area x average transmissivity



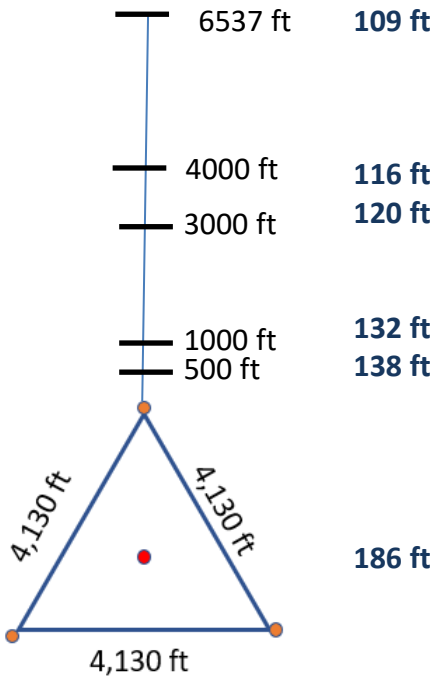
Key Observations

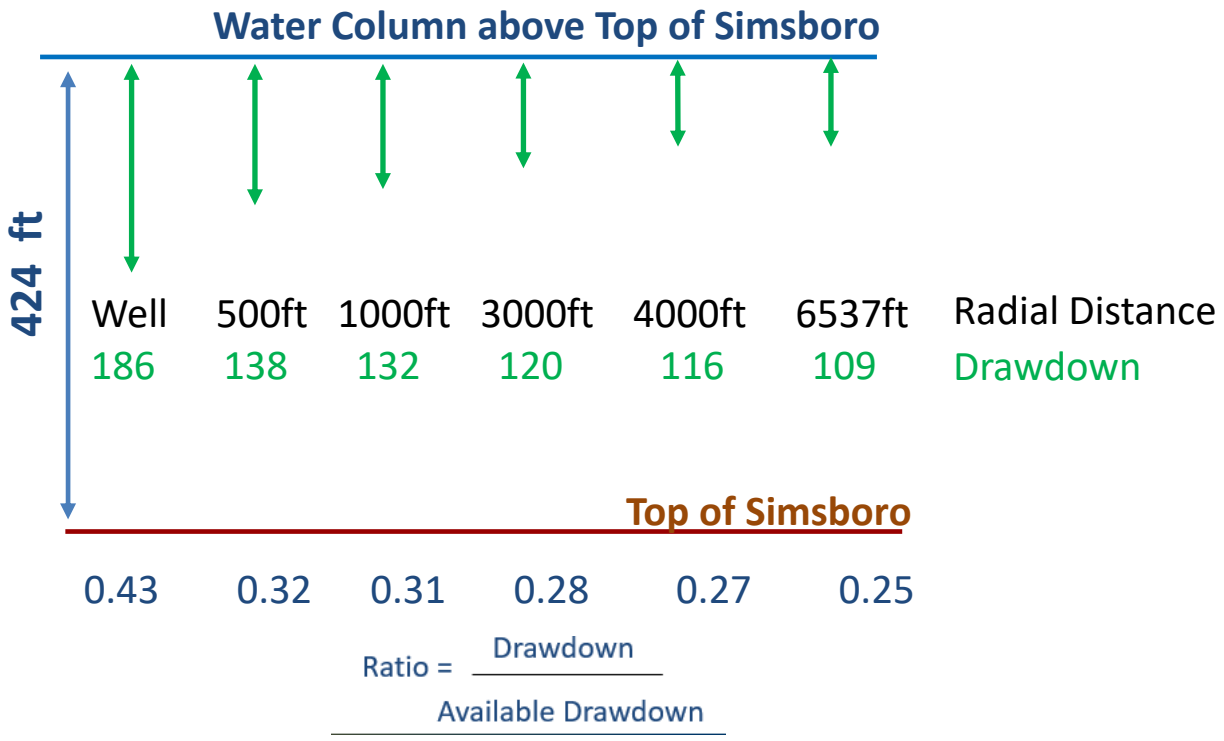
- Average production capacity among aquifers varies by a factor of 10
- Within each aquifer the production capacity can vary by a factor of 5
- A 2 acre-ft/ac production allotment is not physical possible for aquifers
- Prudent aquifer management includes adjusting the production allotment to the aquifer different hydrogeologic conditions

Simulate Drawdown After 5-years of Pumping: Simsboro Example @ 2 Acre-ft/Acre

Aquifer	Depth of Aquifer	Available Drawdown (ft)	Simulated Drawdown					
			Pumping Well	Radial Distance from Well				
				500 ft	1000 ft	3000 ft	4000 ft	6537 ft
Simsboro	0 to 250	-61	223	145	135	116	110	99
	250 to 500	67	154	111	105	95	91	85
	500 to 1000	424	186	138	132	120	116	109
	1000 to 2000	1089	125	95	91	84	82	78
	2000 to 3000	2026	105	81	78	72	71	67

Simulated Drawdown for Simsboro (depth= 500 to 1000 ft)





Impact Matrix for 5-years of Pumping based on Different Maximum Production Allocations

Aquifer	Depth (ft)	2 af/ac			1 af/ac			0.5 af/ac			0.25 af/ac			0.125 af/ac		
		Well	3000 ft	6537 ft	Well	3000 ft	6537 ft	Well	3000 ft	6537 ft	Well	3000 ft	6537 ft	Well	3000 ft	6537 ft
Sparta	0 to 250	8.1	3.9	***3.2***	4.1	1.9	***1.6***	2.0	1.0	0.8	1.0	0.5	0.4	0.5	0.2	0.2
	250 to 500	25.1	13.6	***11.7***	12.6	6.8	***5.9***	6.3	3.4	***2.9***	3.1	1.7	***1.5***	1.6	0.9	0.7
	500 to 1000	6.4	3.7	***3.3***	3.2	1.9	***1.6***	1.6	0.9	***0.8***	0.8	0.5	***0.4***	0.4	0.2	0.2
	1000 to 2000	2.2	1.3	***1.2***	1.1	0.7	***0.6***	0.5	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1
	2000 to 3000	2.3	1.4	***1.3***	1.2	0.7	***0.6***	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1
Queen City	0 to 250	8.4	4.0	***3.3***	4.2	2.0	***1.7***	2.1	1.0	0.8	1.1	0.5	0.4	0.5	0.3	0.2
	250 to 500	12.8	7.1	***6.2***	6.4	3.6	***3.1***	3.2	1.8	***1.6***	1.6	0.9	0.8	0.8	0.4	0.4
	500 to 1000	2.9	1.8	***1.6***	1.5	0.9	***0.8***	0.7	0.4	0.4	0.4	0.2	0.2	0.2	0.1	0.1
	1000 to 2000	1.7	1.1	***0.9***	0.9	0.5	***0.5***	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	2000 to 3000	1.5	0.9	***0.9***	0.8	0.5	***0.4***	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Carrizo	0 to 250	8.9	4.2	***3.4***	4.4	2.1	***1.7***	2.2	1.1	0.9	1.1	0.5	0.4	0.6	0.3	0.2
	250 to 500	4.5	2.6	***2.2***	2.2	1.3	***1.1***	1.1	0.6	0.6	0.6	0.3	0.3	0.3	0.2	0.1
	500 to 1000	1.7	1.1	***0.9***	0.9	0.5	***0.5***	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	1000 to 2000	0.6	0.4	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
	2000 to 3000	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Calvert Bluff	0 to 250	7.9	3.8	***3.1***	3.9	1.9	***1.6***	2.0	0.9	0.8	1.0	0.5	0.4	0.5	0.2	0.2
	250 to 500	8.1	4.7	***4.1***	4.1	2.3	***2.1***	2.0	1.2	1.0	1.0	0.6	0.5	0.5	0.3	0.3
	500 to 1000	2.3	1.4	***1.3***	1.2	0.7	***0.7***	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1
	1000 to 2000	1.1	0.7	***0.6***	0.6	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0
	2000 to 3000	1.5	0.9	***0.8***	0.7	0.5	***0.4***	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Simsboro	0 to 250	3.0	1.5	1.3	1.5	0.8	***0.7***	0.7	0.4	0.3	0.4	0.2	0.2	0.2	0.1	0.1
	250 to 500	2.1	1.3	1.1	1.0	0.6	***0.6***	0.5	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1
	500 to 1000	0.4	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
	1000 to 2000	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2000 to 3000	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hooper	0 to 250	12.3	5.7	***4.6***	6.2	2.8	***2.3***	3.1	1.4	1.1	1.5	0.7	0.6	0.8	0.4	0.3
	250 to 500	17.3	9.5	***8.2***	8.6	4.8	***4.1***	4.3	2.4	***2.1***	2.2	1.2	1.0	1.1	0.6	0.5
	500 to 1000	4.0	2.4	***2.1***	2.0	1.2	***1.1***	1.0	0.6	***0.5***	0.5	0.3	0.3	0.2	0.1	0.1
	1000 to 2000	1.6	1.0	***0.9***	0.8	0.5	***0.4***	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	2000 to 3000	1.0	0.6	***0.6***	0.5	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0

$$\text{Ratio} = \frac{\text{Drawdown}}{\text{Available Drawdown}}$$

Color								
Ratio	0 - 0.25	0.25 - 0.5	0.5 - 0.75	0.75 - 1	1.0 - 2.0	2.0 - 4.0	4.0 - 8.0	8.0 - 16.0	16.0 - 32.0

Possible Implementation Approach: Technical

Maximum Production Allocation for any parcel is 2.5 acre-ft/acre

Maximum production allocation can vary among aquifers and can vary spatially within an Aquifer

- Production Allocations for Carrizo-Wilcox Aquifers
  - Outcrop and less than 250 feet thickness: minimum rate
  - Increase allocations based on aquifer depth and aquifer thickness
  - Include a threshold production rate
  - Perform additional evaluations with different productions other than 10,000 AFY

Aquifer	Production Allocation (ac-ft/acre)	
	Minimum	Maximum
Yegua Jackson	0.25	0.25
Sparta	0.25	0.25
Queen City	0.25	0.25
Carrizo	0.25	0.75
Calvert Bluff	0.25	0.5
Simsboro	0.5	2
Hooper	0.25	0.5

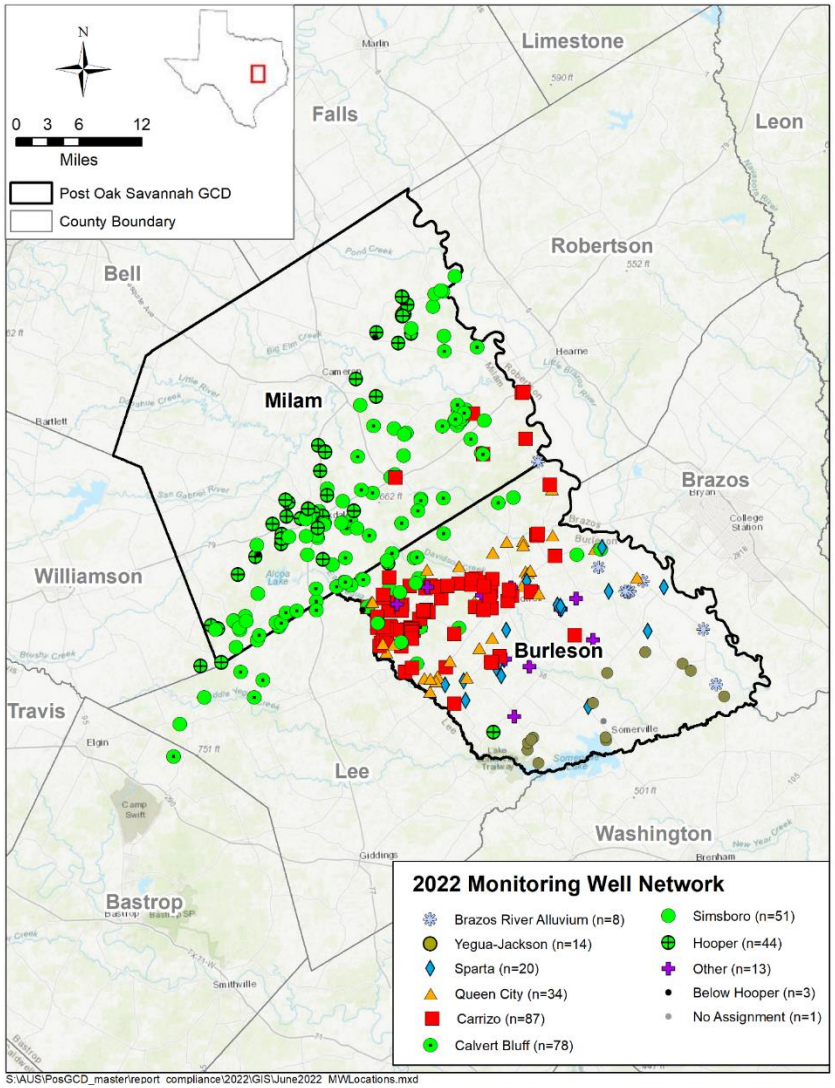
Possible Implementation Approach: Legal

- Incorporate modifications as part of the curtailment actions in response to Threshold exceedances for DFC
- Incorporate modifications as part readjustments during 5-year review process
- Establish a future time when modifications will go into effect based on termination of most recent 40-year permit

Preliminary 2022 DFC & PDL Compliance Evaluations

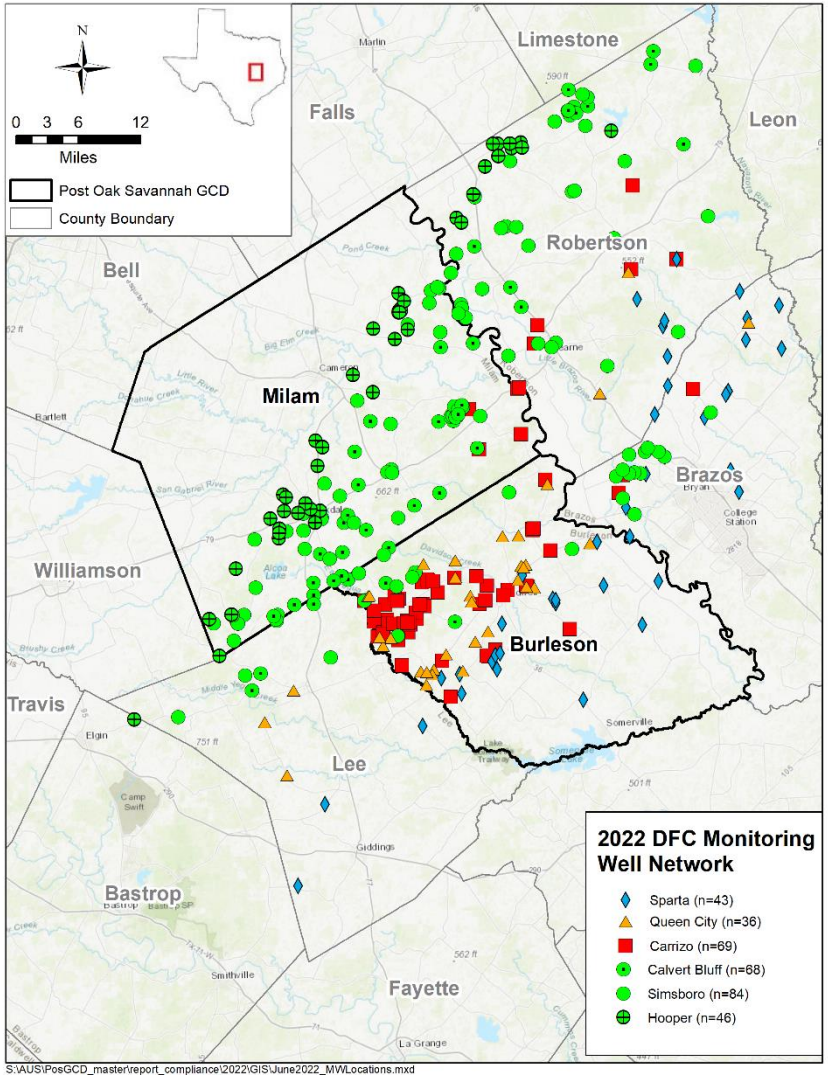
2022 Monitoring Network

2022 POSGCD (353 Count)*



* Active monitoring well

2022 POSGCD, LPGCD, BVGCD (349 Count*)



* POSGCD wells >70% coverage , well used for DFC/PDF calculations

Preliminary DFC Compliance 2022 Evaluation

Management Zone	DFC	Drawdown Calculations	Threshold Criteria	Compliant With DFC
		Avg. Drawdown (ft) / % of DFC	Avg Drawdown	
		# Methods > Threshold 1	# Methods	
Sparta	32	12.0 (37.6%)	No Threshold Reach	Yes
		1	No Threshold Reach	
Queen City	30	11.3 (37.8%)	No Threshold Reach	Yes
		1	No Threshold Reach	
Carrizo	146	41.2(28.2%)	No Threshold Reach	Yes
		0	No Threshold Reach	
Calvert Bluff (Upper Wilcox)	156	44.3 (28.4%)	No Threshold Reach	Yes
		0	No Threshold Reach	
Simsboro (Middle Wilcox)	278	32.2 (11.6%)	No Threshold Reach	Yes
		0	No Threshold Reach	
Hooper (Lower Wilcox)	178	20.7 (11.6%)	No Threshold Reach	Yes
		0	No Threshold Reach	

Threshold 1 = 50% DFC Threshold 2 = 60% DFC Threshold 3 = 75% DFC

Preliminary PDL Compliance 2022 Evaluation

Management Area		PDL	Drawdown Calculations	Threshold Criteria	Compliant with PDL
			Avg. Drawdown (ft) / % of DFC	Avg. Drawdown	
			# Methods > Threshold 1	# Methods	
Sparta	Area 1	28	2.9 (10.2%)	No Threshold Reached	Yes
			0	No Threshold Reached	
Queen City	Area 1	75	0.1 (0%)	No Threshold Reached	Yes
			0	No Threshold Reached	
Carrizo	Area 1	75	29.7 (40%)	No Threshold Reached	Yes
			0	No Threshold Reached	
	Area 2	175	54.5 (31%)	No Threshold Reached	Yes
			0	No Threshold Reached	
Calvert Bluff (Upper Wilcox)	Area 1	88	43.6 (<50%)	No Threshold Reached	Yes
			1	No Threshold Reached	
	Area 2	223	38.0 (17%)	No Threshold Reached	Yes
			0	No Threshold Reached	
Simsboro (Middle Wilcox)	Area 1	91	17.5 (19%)	No Threshold Reached	Yes
			0	No Threshold Reached	
	Area 2	335	40.7 (12%)	No Threshold Reached	Yes
			0	No Threshold Reached	
Hooper (Lower Wilcox)	Area 1	210	11.9 (6%)	No Threshold Reached	Yes
			0	No Threshold Reached	

Threshold 1 = 50% PDL Threshold 2 = 60% PDL Threshold 3 = 75% DFC

Updates to Tops and Bottoms for the Carrizo Wilcox Aquifer

Reason for Update

- Existing GAM
  - No documentation on construction of aquifer surfaces from geophysical logs
  - About 300 ft increase in Simsboro thickness in Vista Ridge well field, Gauze Well , and other areas to account for bias is GAM layers
  - Alcoa 0148 permit indicated that numerous Simsboro wells are classified as Calvert Bluff wells based on GAM layering

Guidance for Drilling Water Wells in the Carrizo Wilcox Aquifer

Driller's Guidance Document

- Purpose
  - Prevent newly drilled wells from having water levels drop below elevation of pump in the next 50 years
- Proposed Approach
  - Simulate future water levels based of best available science, and then calculate depth

Depth of Pump (ft, bgs) = Ground Surface (ft, msl) - Simulated 2070 Water Level (ft, msl) - 100 feet

  - Develop a Driller Guidance Document & Map
  - POSGCD will provide depth to driller/well owner as part of registration process
  - Complete process by December 31, 2022

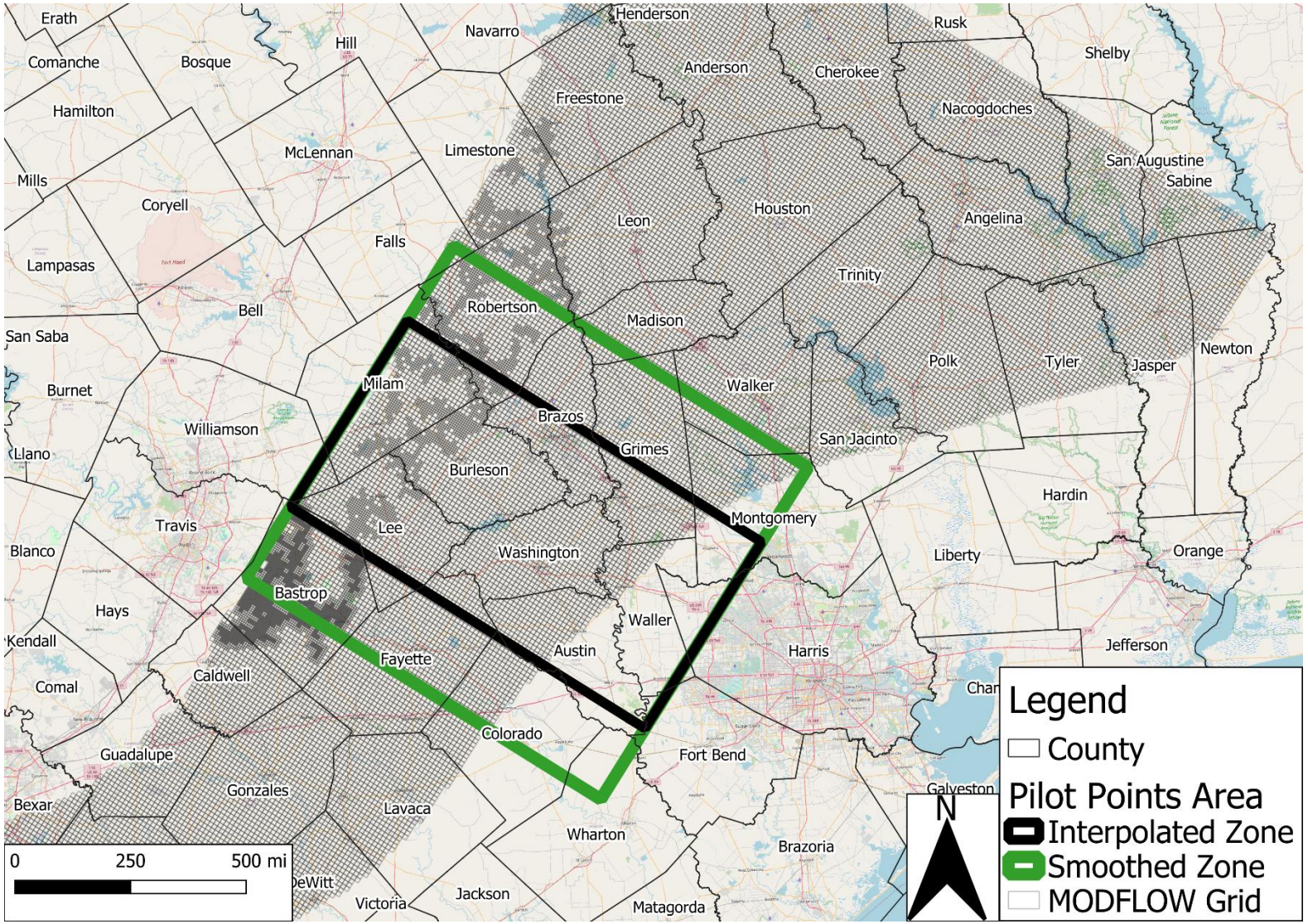
POSGCD Operational Model

POSGCD Operational Model

Generate a Technical Defensible GW Model to Support District Decisions Related to:

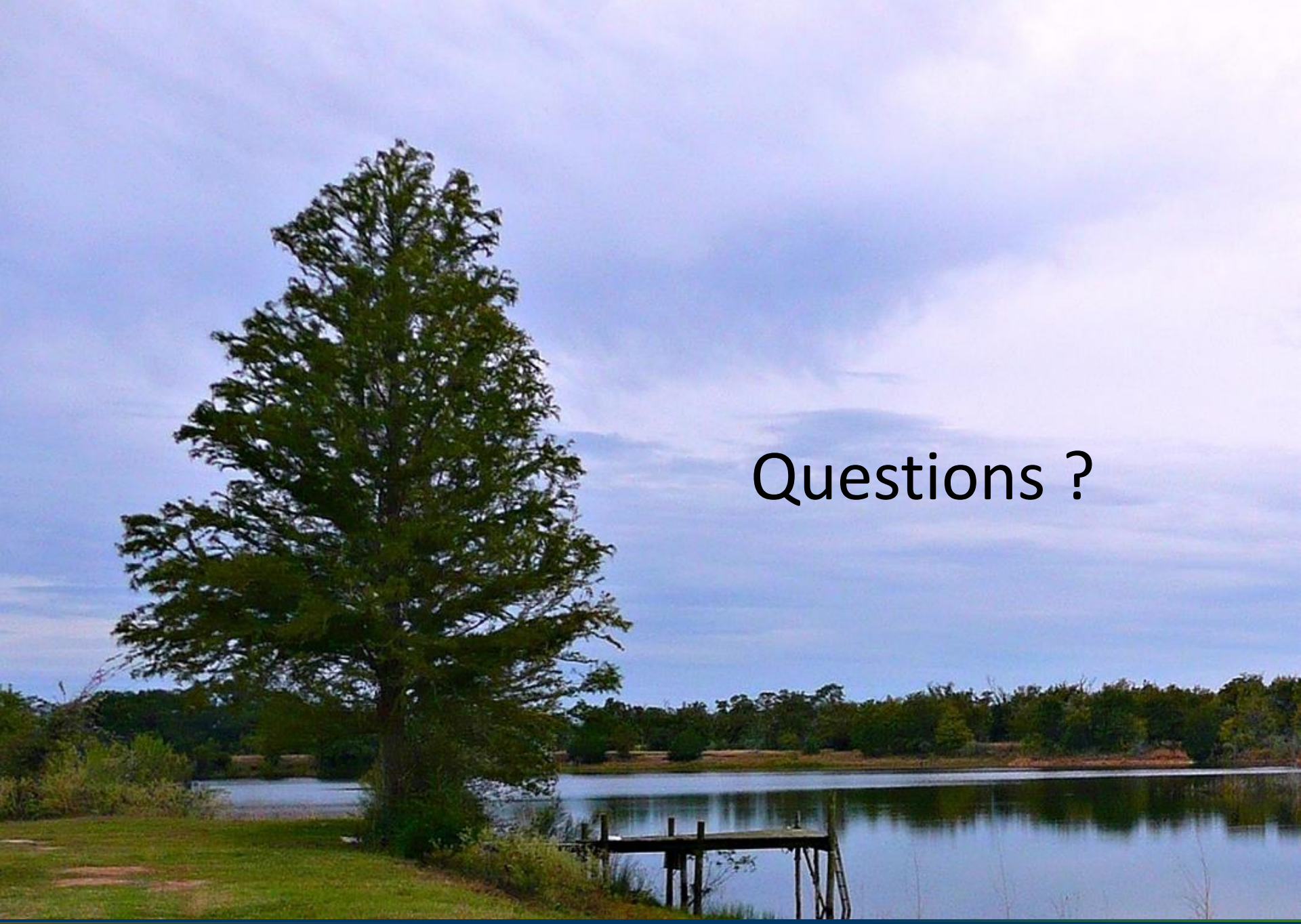
- Permit Renewals
- Long-term aquifer sustainability
- Improved climate resiliency
- Desired Future Conditions
- Curtailment of production
- Fair share allocations
- Drought management

GAM Recalibration Area for Aquifer Hydraulic Properties



Modeling Approach

- Refined Grid in POSGCD to Better Define Location of Pumping wells and Surface Water Bodies
- Update model layering to better reflect the site geology
- Extend GAM calibration from 2010 to 2022 (present)
- Improved simulation of surface water /groundwater interactions
- Incorporate results of large-scale pumping tests
- Quantify uncertainty in model predictions


Questions ?