### Post Oak Groundwater Summit Vista Ridge – What Happens Now?



August 14, 2019

### Management of Simsboro Aquifer & Vista Ridge Permit

- Aquifer Science
- District Planning, Policies, Rules & Regulations
- Monitoring of Groundwater Conditions & Compliance
- Modeling of Groundwater Conditions & Compliance
- Application of Management Strategies & Rules



### **Aquifer Science Background**

### How does POSGCD know what's going on underground?





### Aquifer Science: Geophysical Logs are used to Characterize Subsurface Deposits



#### **Geophysical Logs**





### Aquifer Science: Analysis of Geophysical Logs

Sand and Clays



### Aquifer Science: Groundwater System





### Aquifer Science: Groundwater System







#### Vista Ridge



#### Vista Ridge



























### What's an Acre-foot?





### What's an Acre-foot?







Milam County

Data from State databases & POSGCD records





**Burleson County** 

Data from State databases & POSGCD records







### **Historical Water Levels**



https://posgcd.halff.com/Map/Public

Data from:

- Texas Water Development Board state monitoring network
- POSGCD District monitoring network
- Other Districts BVGCD & LPGCD monitoring networks



### **Aquifer Science Summary**

- Geophysical Logs are used to Characterize Aquifers
  - aquifer boundaries
  - sands and clays
  - water quality
- Groundwater movement and drawdown impacts move more horizontal than vertical
- Shallow system above deep pumping is protected by clay deposits
- Large Pumping projects (like Vista Ridge) have occurred in Milam and are on-going in Brazos County
- We have decades of water level and pumping data from the Simsboro Aquifer



### Management

# What tools can POSGCD use to manage groundwater?





### **POSGCD Management Tools**

- Rules
  - Well Spacing Criteria for Permitted Wells
    - From Property Line
    - From Nearest Existing Well
  - Limit Maximum Production for Permitted Wells
    - Correlative Right (based on *contiguous* acreage)
    - 2 acre-ft/acre (500 acres → 1,000 acre-ft/year)
  - Curtail Existing Pumping if:
    - Drawdown exceeds Desired Future Conditions (deep aquifer)
    - Drawdown exceeds Protective Drawdown limits (shallow aquifer)



### Joint Planning Establishes Desired Future Conditions (DFCs)



- 5 Groundwater Conservation Districts
- Covers Central Carrizo-Wilcox Aquifer
- Update DFCs every 5 years
- Discuss pumping and management strategies
- Share available water and share impacts of pumping



# **Desired Future Conditions (DFC)**

What do you want your aquifers to look like in the future?



"Speed limit" for aquifer pumping:

- Measurable
- Enforceable
- Can be adjusted for special locations
- Can be adjusted based on new data
- Chosen as the best balance of safety vs. productivity



### Desired Future Conditions (DFCs) and Modeled Available Groundwater (MAG)

### What do you want your aquifers to look like in the future?

	Aquifers						
~	Yegua Jackson *	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
DFC: Average Drawdown (ft) from 2000 to 2070	100*	28	30	67	149	318	205
MAG: Modeled Available Groundwater (AFY)	12,923	6,734	502	7,059	1,038	48,501	4,422
*2010 to 2070							



Note: The MAG for an aquifer is based on the DFC for the aquifer.

Note: If the DFCs stay the same and the GAM changes, the MAGs will change



# Protective Drawdown Limits (PDLs)

### What do you want the <u>Shallow</u> portions of your aquifers to look like in the future?

	Aquifers						
`	Yegua Jackson *	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
PDL: Average drawdown (ft) from 2000 to 2070 in water table	20	20	20	20	20	20	20
						-	

- Protective Drawdown Limits are meant to protect water table levels in the aquifer outcrops (Shallow aquifer only).
- Protective Drawdown Limits are only used in POSGCD (not adopted by GMA 12)



### **POSGCD Management Tools Summary**

- Districts in GMA-12 are required by law to work jointly to manage aquifer resources
- Desired Future Conditions (DFCs) used as "speed limit" to manage aquifer use
  - Reviewed & updated every 5 years
  - Enforceable
- POSGCD has more restrictive well spacing and maximum production regulations than neighboring Districts
- POSGCD only district in GMA-12 that has regulations to protect wells in and near aquifer outcrops



### Groundwater Monitoring

### How can we check the aquifer health?





# Monitoring Network





### **POSGCD Guidance Document for Monitoring**

#### Post Oak Savannah Guidance Document for Evaluating Compliance with Desired Future Conditions and Protective Drawdown Limits

#### TABLE OF CONTENTS

1	INTRODUCTION			
	1.1	Desired Future Conditions	1	
	1.2	Protective Drawdown Limits	2	
2	MONI	TORING PERFORMANCE STANDARDS DEFINED IN POSGCD MANAGEMENT PLAN	3	
3	POSG	CD GROUNDWATER MONITORING WELL NETWORK	4	
	3.1	Locations	4	
	3.2	Aquifer Assignments	4	
	3.3	Monitoring Frequency	5	
	3.4	Data Transparency	5	
4	COLLE	CTING AND Managing MONITORING DATA	13	
	4.1	Collection procedures	13	
	4.2	Health and Safety Plan	13	
	4.3	Water Level Records	13	
	4.4	Data Availability	13	
5	METH	ODOLOGY FOR CALCULATING DRAWDOWN FROM MEASURED GROUNDWATER LEVELS.	14	
	5.1	Total Aquifer Management Zone	14	
	5.2	Shallow Aquifer Management Zone	14	
6	EVALU	JATING COMPLIANCE WITH DFCs and PDLs	20	
	6.1	DFC Compliance - Total Aquifer Management Zones	20	
	6.2	PDL Compliance - Shallow Aquifer Management Zones	21	

Appendix A: POSGCD Groundwater Monitoring Well Network

Appendix B: POSGCD Aquifer Assignment Methodology

Appendix C: POSGCD Monitoring Protocols

Appendix D: POSGCD Health and Safety Plan

Appendix E: POSGCD Water Level Measurement Form

Appendix F: Determining Average Drawdown in POSGCD Aquifer Management Zones for GMA 12 DFCs

Appendix G: Determining Average Drawdown in Shallow Aquifer Management Zones for POSGCD PDLs



### **Actions Based on Monitored Results**

Threshold Level	Trigger Value	Action
1	Drawdown Exceeds 50% of DFC or PDL	Studies will commerce that evaluate the nature and extent of curtailment in groundwater production needed to achieve PDL and DFC. Develop options for curtailment.
2	Drawdown Exceeds 60% of DFC or PDL	Review Management Plan, Rules, and Regulations. Notify well owners of possible curtailent in groundwater production.
3	Drawdown Exceeds 75% of DFC or PDL	Board will consider and adopt amendments to Management Plan, rules, and Regulations. District anticipates that one of adopted amendments will include strategy for curtailment of pumping



### **Actions Based on Monitored Results**

Calculated Drawdown Values Simsboro -10Expected Drawdown (linear interpolation) .10 Avg Drawdown (Surface) .30 ·50 from 2000 (feet) .70 .90 110 130 150 Threshold 1 (50 170 190 Drawdown 210 230 250 270 290 310 **Desired Future Condition** 330 350 2000 2010 2020 2030 2040 2050 2060 2070

Threshold 1 is set at 50% of the DFC

Expected Drawdown if DFC is achieved at a constant rate of drawdown



### DFC Compliance for Simsboro Aquifer



**Monitoring Wells** 



### PDL Compliance for Simsboro Aquifer



Wells< 400 ft deep used to Characterized Shallow Aquifer Zone



### **POSGCD Monitoring Summary**

- Monitoring Objectives
  - Impacts of current pumping
  - DFC and PDF compliance
  - Model evaluation/prediction assessment
  - Model improvement
- Use monitoring network to check Aquifer health
- POSGCD has Guidance Document for Monitoring & Analysis Protocols
- POSGCD and adjacent districts share data
- Keeps track of "real world" conditions
- Shows what DFC & PDL compliance looks like *NOW*
- Hydrographs are available for review on POSGCD web page



### How can we see into the future?





### Components that Comprise a Groundwater Availability (GAM) Model

- Conceptual Model
  - describes relationship and processes
- Data
  - aquifer properties, water level, flow rates
- Groundwater Numerical Code
  - equations that solves for flow and mass balances
- Model Construction and Calibration
  - size of aquifer blocks and methods used to fill data gaps

#### Schematic of Conceptual Model





# GAM: Updated GAM in 2018

- Includes area larger than GMA 12
- Calibrated to match water levels from 1930 to 2010
- Each aquifer is represented by a model layer
- Over 1000 geophysical logs used to remap the geologic faults
- Built a shallow flow zone into model







# Modeling

- Combine all data to create Groundwater Availability Model (GAM)
- Make sure model can reproduce observed historical behavior (calibration)
- Model shows POSGCD how much water is available <u>NOW</u>
- Model can predict how much water is available in <u>FUTURE</u>



### Groundwater Resource

### How Much Water is There?





### Groundwater in Aquifer and 50-Year of Pumping the MAG



Note: recharge is not included















# Planning for the Future

#### **POSGCD** does this now:



- Annual groundwater measurements
- Checks model against "real world"
- Communicates with neighbors
- Models "What if" future scenarios & plans accordingly



#### To prevent this in the future:



- Doesn't know if model matches "real world" conditions or not
- Unprepared for population growth or new development
- Surprised by effects from new projects & neighboring counties





# New Joint Planning Cycle



**Groundwater Management Area 12** 

- Adopt updated DFCs by January 5, 2022
  - science review
  - monitoring data
  - modeling results



### Pumping Scenario for Initial Round of Joint Planning

#### **Simsboro Total Pumping**





### **POSGCD Major Simsboro Well Fields**



Major Simsboro Future Pumpers in POSGCD:

ALCOA - 25,000 AFY

Manor I-130 – 20,000 AFY

Vista Ridge – 35,000 AFY (51,000 AFY total)



### **POSGCD** Pumping in GAM Simulation





### Simulated Average Drawdown in Simsboro



Year	POSGCD Contribution	Outside Contribution		
2030	58%	42%		
2040	57%	43%		
2050	49%	51%		
2060	41%	59%		
2070	38%	62%		

Estimated Percentage Contribution to Total Drawdown



### Simsboro Water Budget (acre-ft/year) Illustrates Importance of GMA 12 Cooperation



Simsboro 2040





### Simsboro Management



 Vista Ridge is far away from most registered Simsboro wells



# Monitoring Simsboro Wells Near Vista Ridge to Check GAM





### Planning for the Future

#### Can curtailment work using current POSGCD Rules?





### Management of Pumping Impacts: Aquifer Science

- Aquifer science provides a framework for understanding timing and magnitude of potential pumping impacts
  - Millions of acre-feet of fresh water available in Simsboro.
  - High Simsboro pumping the past (ALCOA in Milam and City of Bryan/College Station in Brazos County)
  - Drawdowns caused by Simsboro Pumping are limited by presence of aquitards- negligible in Sparta, Queen City, and Yegua Jackson
  - Impacts to Shallow wells in Carrizo-Wilcox Aquifer will require decades to occur



### Management of Pumping Impacts: Groundwater Monitoring

- Monitoring provides real-time assessment of drawdowns
  - Defensible data collected using technically sound protocols
  - Several Simsboro wells near Vista Ridge well field for early detection
  - Simsboro wells provide good areal coverage for existing users
  - Frequent measurements at selected wells will provide data useful for testing and/or improving the GAM



### Management of Pumping Impacts: Groundwater Modeling

- **Modeling** provides capability to assess current conditions and predict future conditions
  - GAM has been validated for predicting impacts from 1930 to 2010 but is still regional
  - Assessment of GAM predictive capability is possible by comparing measured versus model water level responses
  - POSGCD is and will collect data to improve GAM for local conditions near Vista Ridge, Manor, and ALCOA
    - Geophysical logs
    - Aquifer pumping tests
    - Water levels



### Management of Pumping Impacts: POSGCD Rules and Regulations

- **POSGCD Rules and Regulations** provide the tools to restrict future permit and to curtail pumping
  - Threshold limits
    - provide a clear path for curtailment of pumping
    - action levels provides appropriate work to understand what amount of curtailment is necessary by all pumpers in the Simsboro
  - DCF and PDLs
    - DFCs objective is regional sustainability of groundwater resource
    - PDLs protect the productivity and sustainability of wells in shallow portion of the aquifer



### Management of Pumping Impacts: POSGCD Rules and Regulations

- Correlative Rights
  - provides a roadblock for multiple large pumping projects in adjacent areas
  - provides a ceiling that limit maximum pumping amounts
  - provides a lever to cut back on existing pumping
- Set up for Adaptive Management
  - Decisions based monitoring data
  - Promotes science and updates
  - Rules for maximum production, well spacings, and drawdowns can be adjusted over time



### Take Aways

- Production from Simsboro (Wilcox ) Aquifer will have negligible effects on wells in Sparta, Queen City, and Yegua Jackson Aquifer
- DFC's in combination with PDLs are very protective of registered wells
- Sufficient water in storage to meet Simsboro pumping demands without violating DFCs
- Local impacts near Vista Ridge well field will be large but there are no nearby Simboro wells
- POSGCD is a Texas Leader in supporting Hydrogeologic Science
- POSGCD has been diligent in preparing for this project for the last 15 years



# **Questions**?









