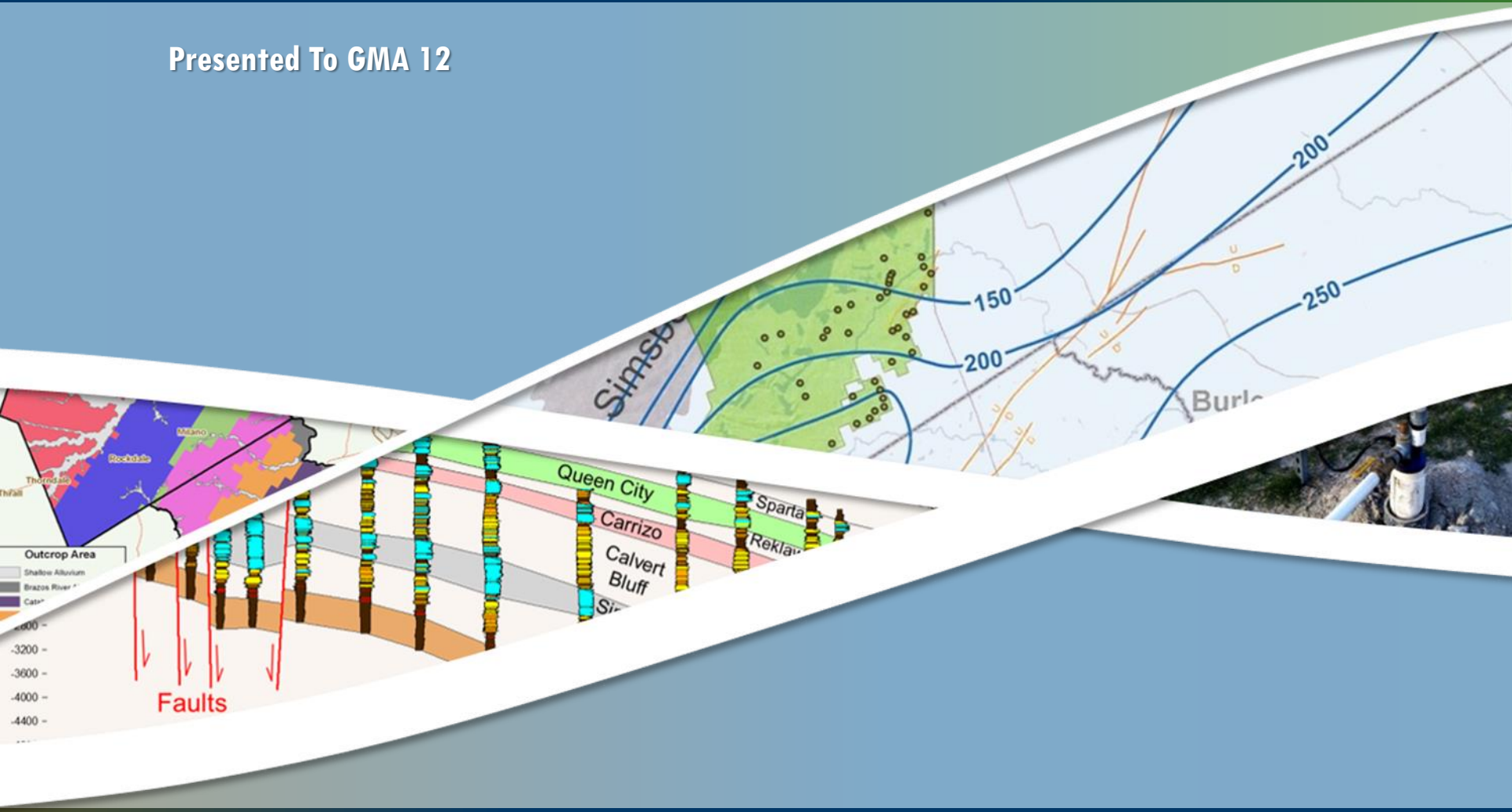
Review of POSGCD Approach for Developing DFCs

Presented To GMA 12



October 6, 2021

Outline

- Perspective on DFCs
- Development of DFC in the Joint Planning Process
- Questions for Future DFC Runs

Perspective on DFCs

- DFCs Should be Feasible
  - POSGCD rules should not prevent POSGCD DFCs from being achievable; therefore DFCs dictates what options are available to a district to limit and/or curtail pumping
  - All DFCs in a GMA need to be mutually compatible
  - Best Available Science should be used to evaluate whether or not POSGCD DFC are feasible

- DFCs Should Achieve a Balance
  - balance the conservation and development of groundwater to meet the needs of this state
  - balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater and control of subsidence in the management area.
  - balance among nine criteria in TWC 26.108

Note: Perspective is based on POSGCD Management Strategies Report

Perspective on DFCs

- DFC(s) Should be Capable of being Monitored
  - should be measurable quantity such as water level or a flow
  - area should be of a manageable extent and adequately instrumented
  - compliance method should be based on best available science
- DFCs Should be Defined at a Temporal and Spatial Scale that Allows Reasonable Monitoring, Meaningful Compliance Evaluations, and Timely Enforcement
  - Reasonable monitoring avoids excessive costs
  - Meaningful compliance evaluations acknowledges and accounts for uncertainty
  - Timely enforcement allows for checks for DFC exceedance for every year
- DFC(s) Are Integral to POSGCD Policy
  - DFCs and related drawdown metrics have been used by POSGCD since its first management plans and rules to manage production and permits
  - DFC are the trump cards for each aquifer; nothing in POSGCD rules should prevent a DFC from being achievable and feasible

Note: Perspective is based on POSGCD Management Strategies Report

Key Points: Pre-Joint Planning POSGCD Aquifer Management Trigger Points for Drawdown*

- Shallow Carrizo-Wilcox Management Zone
  - Maximum 50 ft drawdown in any well
  - Useable groundwater = 33,750 AFY
- Deep Carrizo-Wilcox (excludes Simsboro) Management Zone
  - Average drawdown of 190 ft
  - Useable groundwater = 30,750 AFY
- Deep Simsboro Management Zone
  - Average drawdown of 300 ft
  - Useable groundwater = 60,000 AFY

*POSGCD Management Plan – Adopted May 9, 2006, drawdown measured relative to 2005 water levels

Methodology Based on DFC Statement Presented to GMA-12 on June 24, 2009

POSGCD Preliminary Desired Future Conditions Statement

The POSGCD Board adopted preliminary DFCs for five aquifers in Table 1 during their Board meeting on February 10, 2009. These preliminary DFCs were recommended by the POSGCD DFC Committee, who had been working on the recommendations since September 2008.

Table 1: Preliminary POSGCDs DFCs for Five Aquifers

Aquifer	Average Drawdown (ft) Across the District from 2000 to 2060
Sparta	30
Queen City	40
Carrizo	120
Calvert Bluff	150
Simsboro	300
Hooper	180

Methodology does not require running a GAM simulation but GAM simulations are considered

The DFC committee developed the average drawdown in Table 1 using a methodology that URS has presented in several POSGCD meetings including a September 3rd POSGCD Stakeholder Meeting and September 9th POSGCD Board Meeting. This methodology calculates an average drawdown using the following parameters:

- Average drawdown in unconfined portion of the aquifer
- Allowable percent decline in the artesian pressure in the confined portion of the aquifer
- Maximum allowable drawdown in the confined portion of the aquifer
- Area of the unconfined portion of the aquifer
- Area of the confined portion of the aquifer

Approach Based on DFC Statement Given on GMA-12 Meeting on June 24, 2009

Methodology is principally based on water level changes in aquifer and in existing wells

POSGCD selected a DFC metric that is tied directly to a water levels because water levels can be used to address a wide-range of key management issues if the proper field measurements and analysis are performed. Among these key management issues are the following:

- Amount of protection for existing pumping wells (water level comparison to well screen intervals and pump locations)
- Volumetric change in aquifer storage (change in water level multiplied by aquifer storativity)
- Groundwater-surface water interaction (estimated flow exchange based on comparisons between groundwater levels and stream level and stream bottom)
- Groundwater flow directions and rates (application of Darcy's Law)
- Improvements to on-going evaluation of GAMs (additions of additional calibration targets)

Methodology allows consideration of other factors such as GAM simulations and stakeholder coners

Throughout the next several months, POSGCD will evaluate the preliminary DFCs with respect to stakeholder concerns, information and model results generated by the joint-planning process, databases and analysis being performed by POSGCD staff and consultants. On-going work by POSGCD includes the updates to its monitoring program, development of its well database, a review of historical and future pumping estimates, a review of existing data on surface-water groundwater interactions, analyses of GAM simulations, and analyses of geohydrologic data such as water levels, water quality parameters, and pumping test results.

Calculation & Considerations Used to Develop Proposed DFCs for 1st Joint Planning Cycle

- DFC committee selected 120 ft drawdown for the entire Carrizo Aquifer based on scenario outlined in orange
- Information used to guide the decision[1]
  - Permitted & exempt Wells
  - Future wells locations
  - GMA 12 Pumping
  - GAM Predictive Simulations
  - Sustainability (water balance)

Carrizo Aquifer

Conditions			Desired Future Conditions - Drawdown
			Aquifer
DD in Unconfined Area	% Decline in artesian pressure	Max DD in Confined Area	Carrizo
5	0.25	150	119
10	0.25	150	119
15	0.25	150	119
20	0.25	150	120
15	0.25	100	85
15	0.25	125	103
15	0.25	150	119
15	0.25	175	135
15	0.25	200	149
15	0.33	100	88
15	0.33	125	107
15	0.33	150	125
15	0.33	175	142
15	0.33	200	159

[1] URS presentation to POSGCD DFC committee on February 10, 2009

Methodology Used to Develop Final DFCs for 1st Joint Planning Cycle: GAM Simulations

- POSGCD Pumping File for DFC GAM Simulation
  - pumping rates and schedule adjusted to achieve average drawdowns associated with preliminary POSGCD DFCs
  - simulation of LPGCD (45 ft), BVGCD (47 ft), and POSGCD (120 ft) preliminary DFCs for Carrizo Aquifer was not achievable in a GAM simulations
- Adjustment to POSGCD Preliminary DFC
  - POSGCD and GMA 12 adopted all POSGCD preliminary except for the Carrizo Aquifer
  - POSGCD's DFC of 120 ft drawdown was lowered to 65 ft in order for a GAM simulation to show compatibility among all the GCD DFCs for the Carrizo
  - DFC of 65 ft for Carrizo produce a Carrizo MAG much lower than permitted Carrizo production

* Presented by Gary Westbrook (POSGCD General Manager) at GMA-12 meeting on May 26, 2010

Methodology Used to Develop Final DFCs for 1st Joint Planning Cycle: GAM Simulations (con't)

- Acknowledgment of Limitations Regarding GAM Predictions
  - Statement below was prepared by GMA 12 to state limitations should be acknowledged by

Based on the principle of using the GAM as a joint planning tool and the fact that the GAM predictions contain uncertainty, GMA 12 considered the DFCs to be compatible and physically possible if the difference between modeled drawdown results for model Run 12_7B and the DFC drawdown targets were within 5 feet or 5 percent of the DFC drawdown targets. Factors considered for determining tolerance criteria include:

- model calibration results and statistics,
- information used to calibrate the GAM,
- aquifer and recharge information collected since the GAM was developed,
- sensitivity of the GAM calibration and GAM predictions to changes in the model parameters, and
- range of uncertainty in the model parameters including historical and future pumping, and temporal variation in recharge distribution and magnitude.

*explanation of variance provided in GMA 12 Resolution to Adopt DFCs dated August 11, 2010. Resolution passed with 5 Ayes and 0 Nays.

Key Points: POSGCD Development of DFCs for 2nd DFC Planning Cycle

- Reiterated approach for developing DFCs based spreadsheet calculations (see table or right-hand side)[1]
- Expressed concerns of using a single drawdown for entire aquifer – asked GMA 12 to develop DFCs for shallow areas (outcrops) of aquifers[2]
- Expressed concerns that GAM over predicts drawdowns because of improper representation of faults

Hooper Aquifer

Example Calculation of a DFC Based on Drawdown(DD) Criteria for the Unconfined and Confined Regions

Conditions			Desired Future Conditions - Drawdown
			Aquifer
DD in Unconfined Area	% Decline in artesian pressure	Max DD in Confined Area	Hooper
10	0.25	200	164
15	0.25	200	164
20	0.25	200	165
25	0.25	200	165
20	0.25	100	88
20	0.25	150	127
20	0.25	200	165
20	0.25	250	201
20	0.25	300	236
20	0.33	100	89
20	0.33	150	129
20	0.33	200	169
20	0.33	250	207
20	0.33	300	243
Area (sq. miles) based on 2000 heads		Confined	1116
		Unconfined	124
Average head (ft) 2000		Confined	312.0
		Unconfined	369.9
Storage Volume (acre-ft) 2000		Confined	53,443,897
		Unconfined	1,401,128
Storage Volume (acre-ft) 2060		Confined	53,412,122
		Unconfined	1,156,350
Total Withdrawn (acre-ft)			276,552

[1] Table included in POSGCD presentation dated June 6, 2014 (similar data presented at other GMA 12 meetings)

[2] Included in POSGCD presentations dated June 27, 2014 and later meetings

Key Points: POSGCD Development of DFCs for 3rd Planning Cycle

- GMA 12 consultants updated GAM to better represent Simboro aquifer properties near Vista Ridge well field
- Allowable variance between average drawdown values and a proposed DFC generally increased from 5% to 10%
- POSGCD wanted to reduce Carrizo pumping in in Run S-7 to lower DFC to help prevent drawdown impacts at existing wells
- For Cycles 1 and 2, GCDs determined the pumping rates for their counties in the adopted DFC Run
- GMA 12 voted to retain all Carrizo pumping in DFC Run S-12 so POSGCD could not reduce POSGCD pumping
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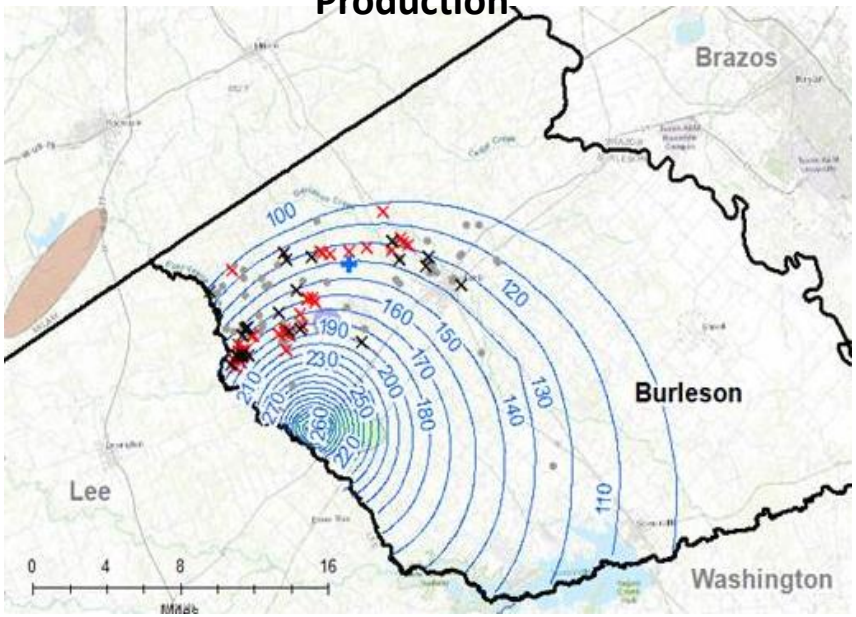
DFC Committee: Sensitivity of Number of Impacted Wells to POSGCD Carrizo Production



POSGCD Carrizo Production (AFY)	Impacted* Wells		
	2029	2039	2049
18,200	71	114	141
12,200	36	69	97

Comparison of Results for the Three Joint Planning Cycles

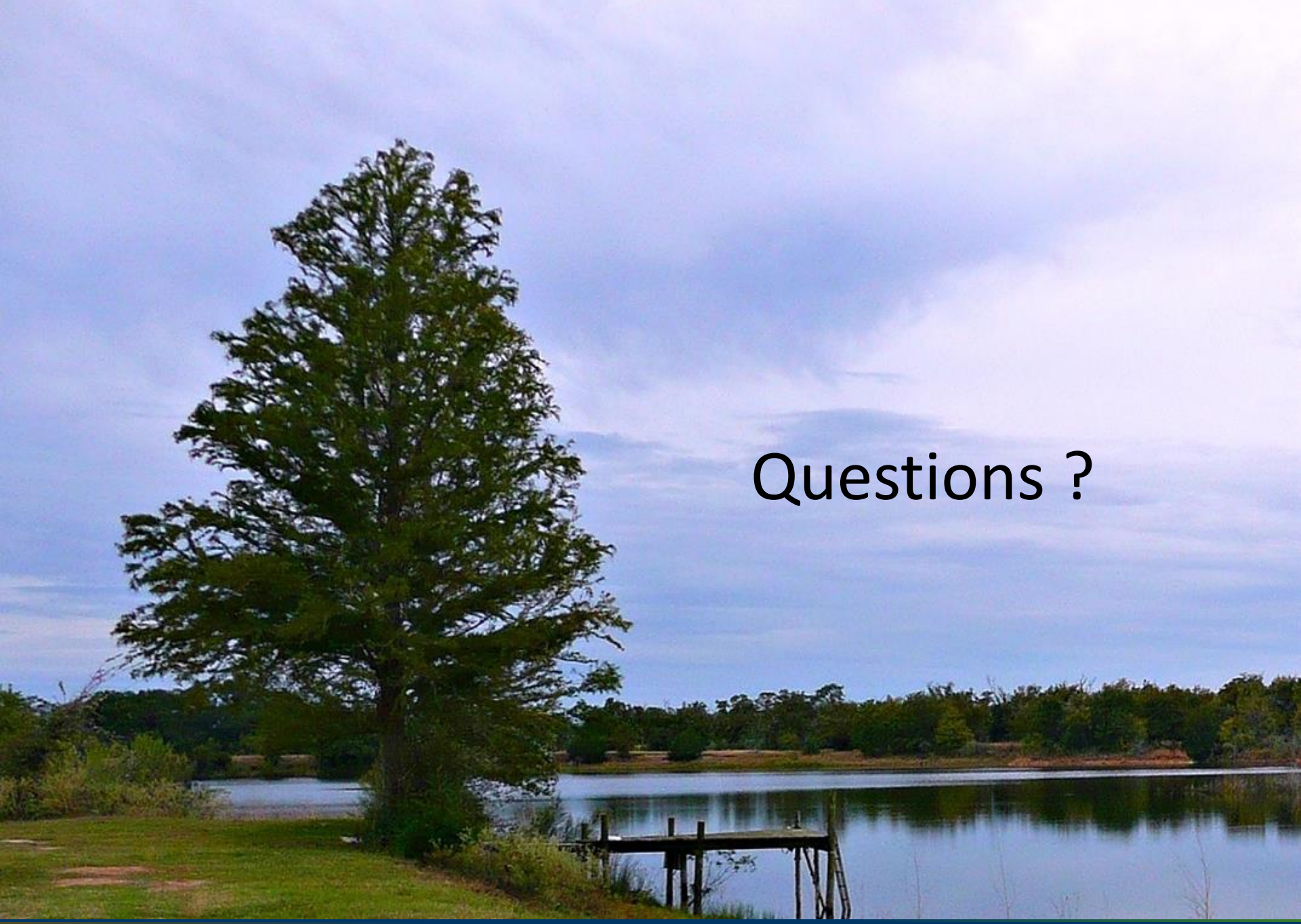
- Largest change in DFC and MAG values is for the Carrizo Aquifer between Cycle 2 and Cycle 3

Aquifer	Metric	Cycle 1 2000 - 2060	Cycle 2 2010 - 2070	Cycle 3*** 2011 - 2070
Sparta	DFC	30	28	32
	MAG	6,734	6,734	4,105
	Permitted	1,504	3,298	3,655
	%(MAG/Permitted)	448%	204%	112%
Queen City	DFC	30	30	31
	MAG	502	504	7,838
	Permitted	488	700	1,583
	%(MAG/Permitted)	103%	72%	495%
Carrizo	DFC	65*	67	172**
	MAG	7,059	7,058	18,206
	Permitted	17,298	18,323	19,862
	%(MAG/Permitted)	41%	39%	92%
Calvert Bluff	DFC	140	149	179
	MAG	1,038	1,036	4,761
	Permitted	869	1,189	1,753
	Percent(MG/PER)	119%	87%	272%
Simsboro	DFC	300	318	336
	MAG	48,501	48,503	79,433
	Permitted	75,389	103,061	107,944
	%(MAG/Permitted)	64%	47%	74%
Hooper	DFC	180	205	214
	MAG	4,422	4,422	3,126
	Permitted	2,610	2,938	3,260
	%(MAG/Permitted)	169%	151%	96%

*POSGCD adjusted from 120 ft to demonstrate DFCs were physically possible
**GMA 12 adjusted from 142 ft in order to include “known” pumping
*** proposed DFCs

Questions For Future DFC Runs

- What protocols will be used to determine how pumping files will be generated ? Will these protocols be different for the different GAMs?
- What criteria to be used to determine if DFCs have achieved the appropriate balance between production and conservation?
- Can a GCD adopt decadal DFCs if they are derived from the DFC GAM run?
- Will Management Plans need to clearly show that DFCs are feasible and achievable?
- Is curtailment of a permit an acceptable management tool for achieving a DFC?


Questions ?