

JOINT GROUNDWATER PLANNING CONCEPTS AND DESIRED FUTURE CONDITIONS

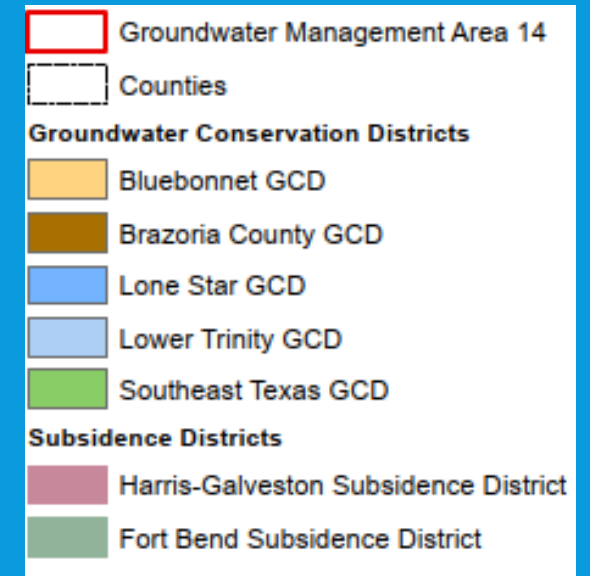
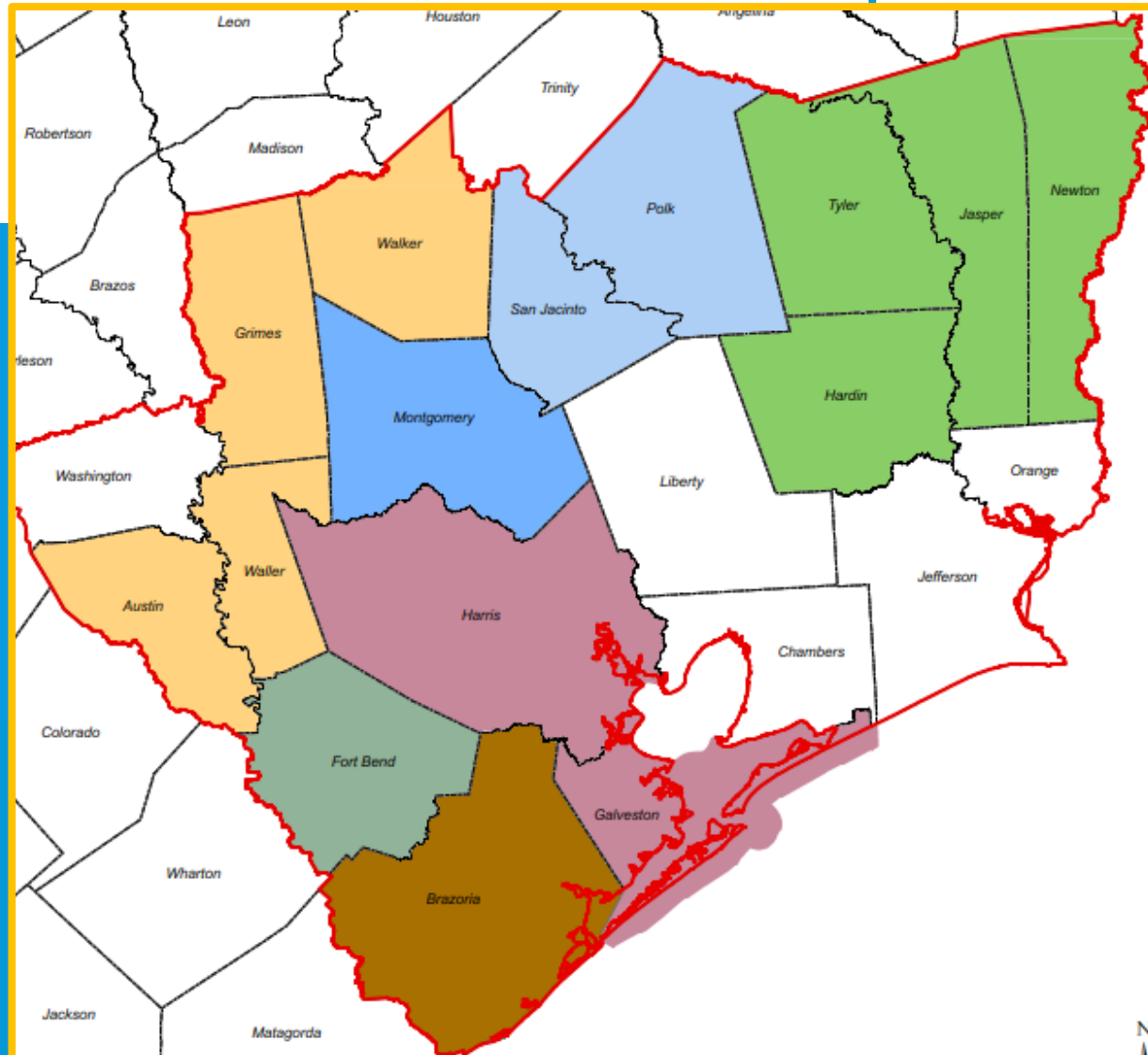
LONE STAR GCD

March 10, 2020

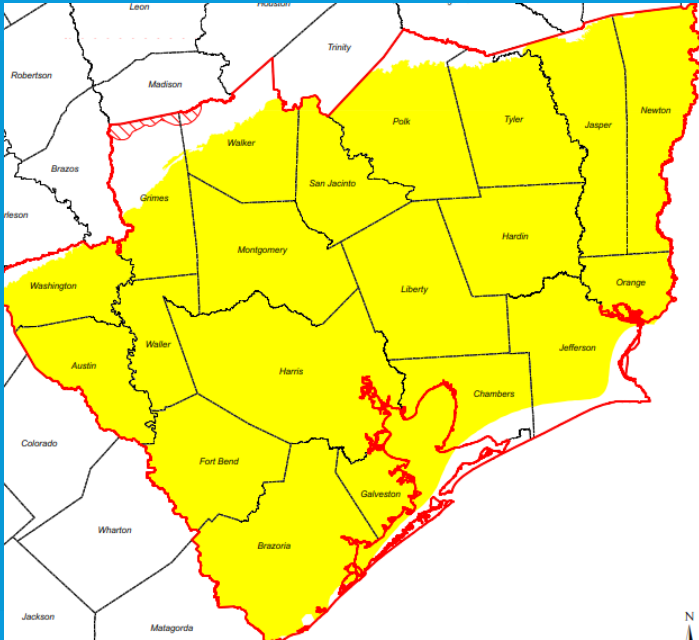
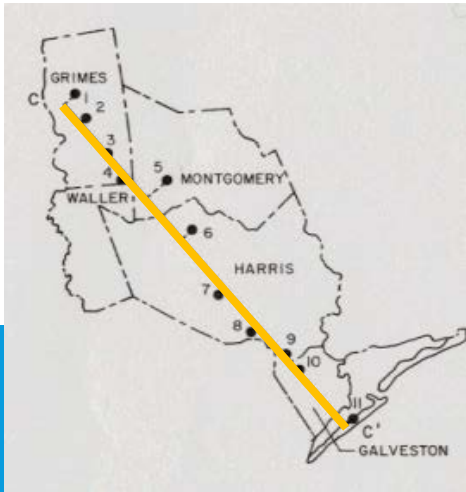
OUTLINE

- Joint Groundwater Planning
 - DFCs – GCD/GMA responsibility
 - MAGs – TWDB responsibility
 - Balance Test
 - 9 Factors
- Discussion

GMA 14

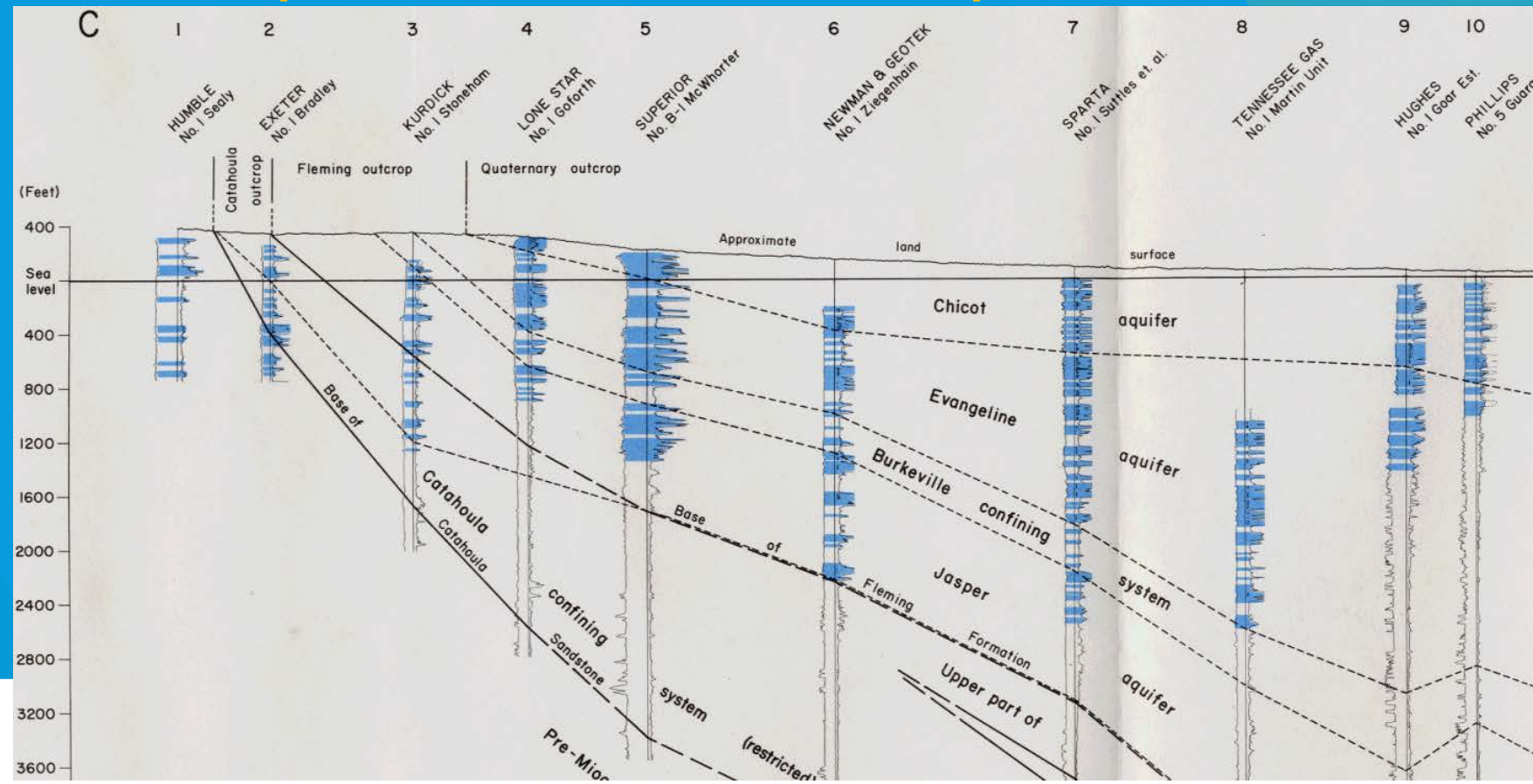


GULF COAST AQUIFER

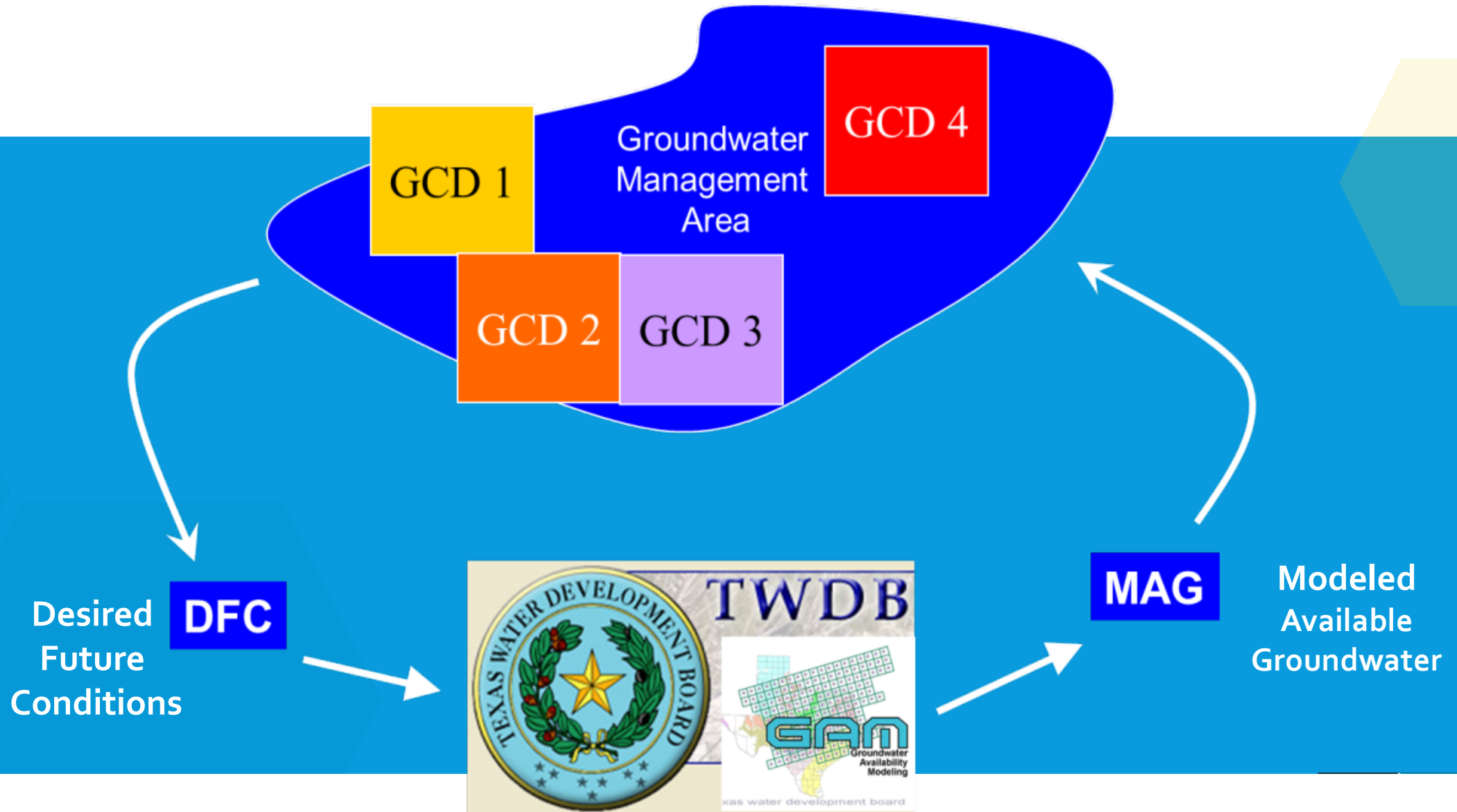


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Montgomery County



JOINT PLANNING



GMA 14 DESIRED FUTURE CONDITIONS (DFCS)

County	Aquifer	Desired Future Condition (DFC) Summary
All Counties	Chicot	From estimated year 2009 conditions, the average draw down of the Chicot Aquifer should not exceed approximately 28.3 feet after 61 years.
All Counties	Evangeline	From estimated year 2009 conditions, the average draw down of the Evangeline Aquifer should not exceed approximately 23.6 feet after 61 years.
All Counties	Burkeville	From estimated year 2009 conditions, the average draw down of the Burkeville confining unit should not exceed approximately 18.5 feet after 61 years
All Counties	Jasper	From estimated year 2009 conditions, the average draw down of the Jasper Aquifer should not exceed approximately 66.2 feet after 61 years.
Austin	Chicot	From estimated year 2009 conditions, the average draw down of the Chicot Aquifer should not exceed approximately 39 feet after 61 years.
Austin	Evangeline	From estimated year 2009 conditions, the average draw down of the Evangeline Aquifer should not exceed approximately 23 feet after 61 years.
Austin	Burkeville	From estimated year 2009 conditions, the average draw down of the Burkeville confining unit should not exceed approximately 23 feet after 61 years.
Austin	Jasper	From estimated year 2009 conditions, the average draw down of the Jasper Aquifer should not exceed approximately 76 feet after 61 years.
Austin	Gulf Coast System	From estimated year 1890 conditions, the maximum subsidence in Austin County should not exceed approximately 2.83 feet by the year 2070.
Brazoria	Chicot	From estimated year 2009 conditions, the average draw down of the Chicot Aquifer should not exceed approximately 23 feet after 61 years.
Brazoria	Evangeline	From estimated year 2009 conditions, the average draw down of the Evangeline Aquifer should not exceed approximately 27 feet after 61 years.

Drawdown averaged across **ALL** counties

Drawdown averaged across **ONE** county

LONE STAR GCD DESIRED FUTURE CONDITIONS

Montgomery	Chicot	From estimated year 2009 conditions, the average draw down of the Chicot Aquifer should not exceed approximately 26 feet after 61 years.
Montgomery	Evangeline	From estimated year 2009 conditions, the average draw down of the Evangeline Aquifer should not exceed approximately -4 feet after 61 years.
Montgomery	Burkeville	From estimated year 2009 conditions, the average draw down of the Burkeville confining unit should not exceed approximately -4 feet after 61 years.
Montgomery	Jasper	From estimated year 2009 conditions, the average draw down of the Jasper Aquifer should not exceed approximately 34 feet after 61 years.

STANDARD FOR DESIRED FUTURE CONDITIONS



Highest Practicable Level of
Groundwater Production



Conservation, Preservation,
Protection, Recharging, and
Prevention of Waste of
Groundwater, and Control of
Subsidence

9 FACTORS TO CONSIDER FOR DESIRED FUTURE CONDITIONS

Environmental
Impacts

Subsidence
Impacts

Hydrological
Conditions

Aquifer Uses or
Conditions

Supply Needs &
Management
Strategies

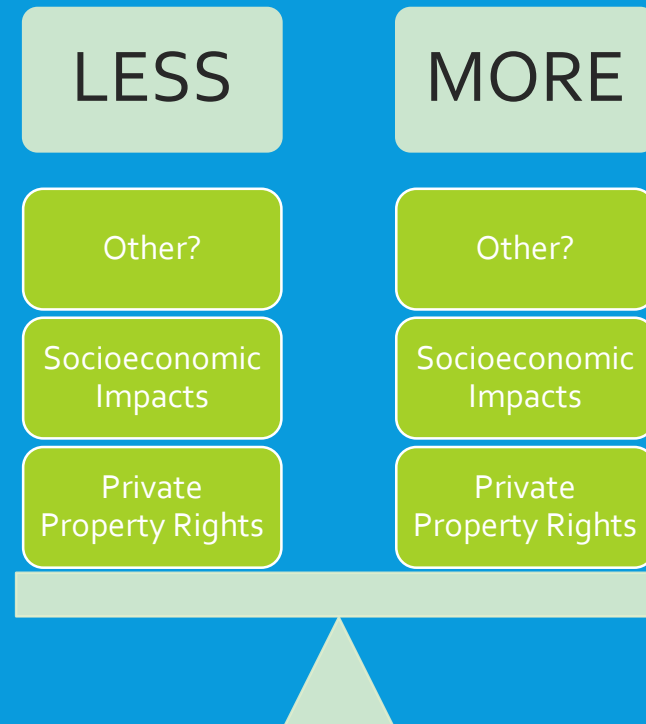
Private
Property Rights

Socioeconomic
Impacts

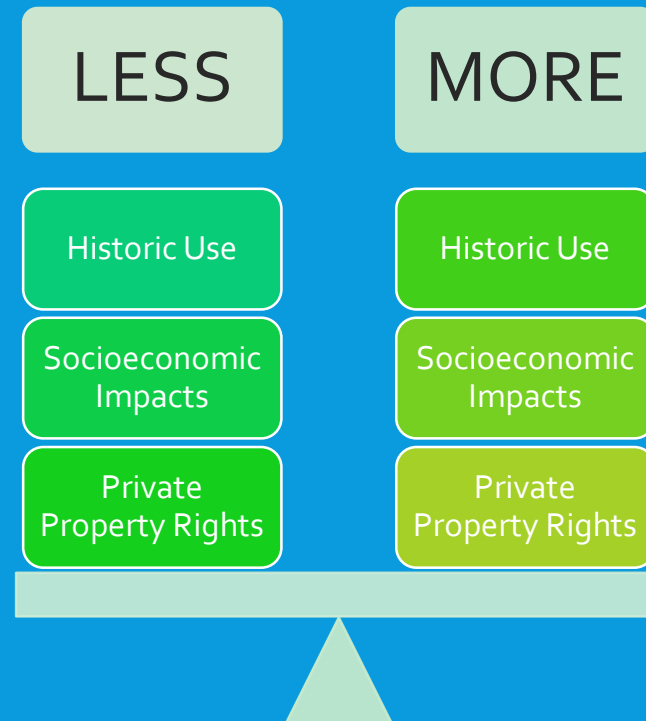
DFC Feasibility

Other Relevant
Information

BALANCING CHALLENGE



DIFFERENT AQUIFERS, DISTRICTS, HISTORY, ECONOMY, ETC.



DISCUSSION AND QUESTIONS



SUMMARY OF MODELING RELATED TO GMA 14 JOINT PLANNING

Presentation to Lone Star Groundwater Conservation District

Regular Meeting Agenda Item 13

March 10, 2020

LSGCD APPROACH

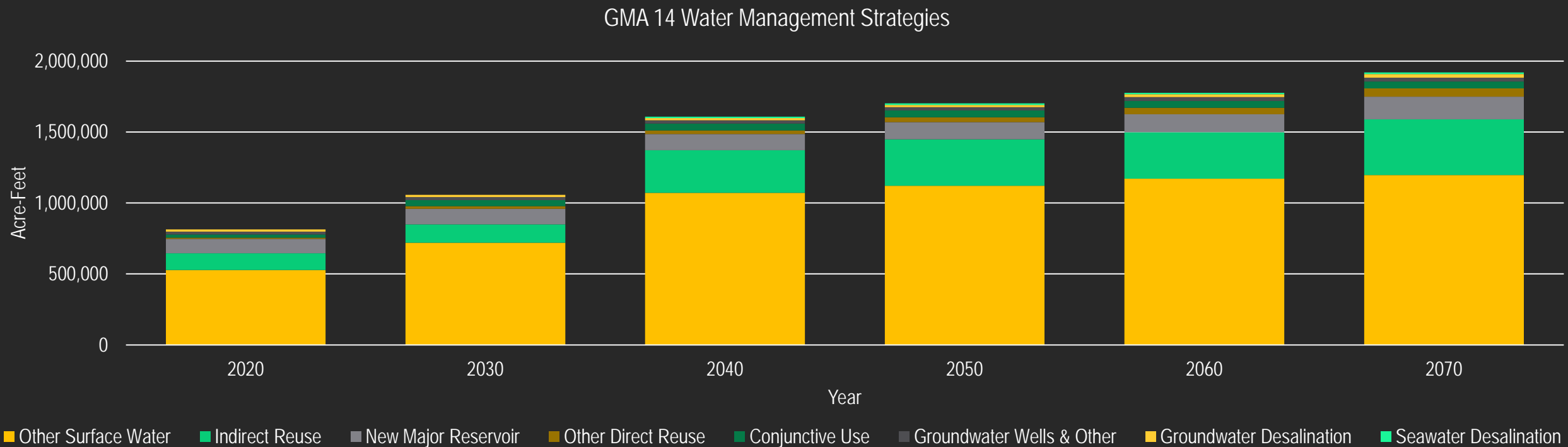
- Five steps (November 13, 2019 GMA 14 meeting)
 1. Delineate boundaries – common reservoir (gw reservoir or subdivision)
 2. Identify hydrogeologic characteristics
 3. Identify water management strategies
 4. Simulate pumping and evaluate results
 5. (Re)-Consider boundaries and desired future conditions
- Process resulted in multiple possible simulations

HYDROGEOLOGIC CHARACTERISTICS

- DFC considerations (TWC §36.108(d))
- Assessed pumping favorability on a cell-by-cell basis
 - Current predictive pumping
 - Available drawdown
 - Potential pumping rate
- Estimated total dissolved solids
- Favorability ranking from 1 (most favorable) to 4 (least favorable)

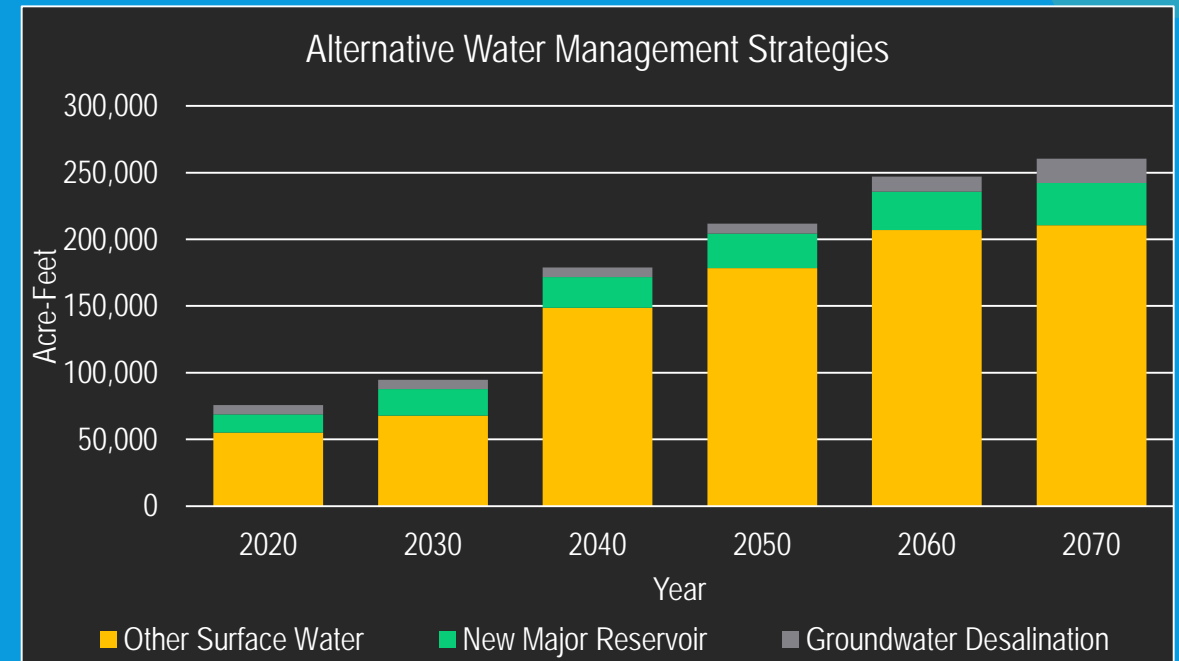
WATER MANAGEMENT STRATEGIES – GMA 14

- “A water management strategy is a plan to meet a water need (potential shortage) of a water user group.”
- 2070 strategies in GMA 14 = 1,919,912 acre-feet



WATER MANAGEMENT STRATEGIES – GMA 14

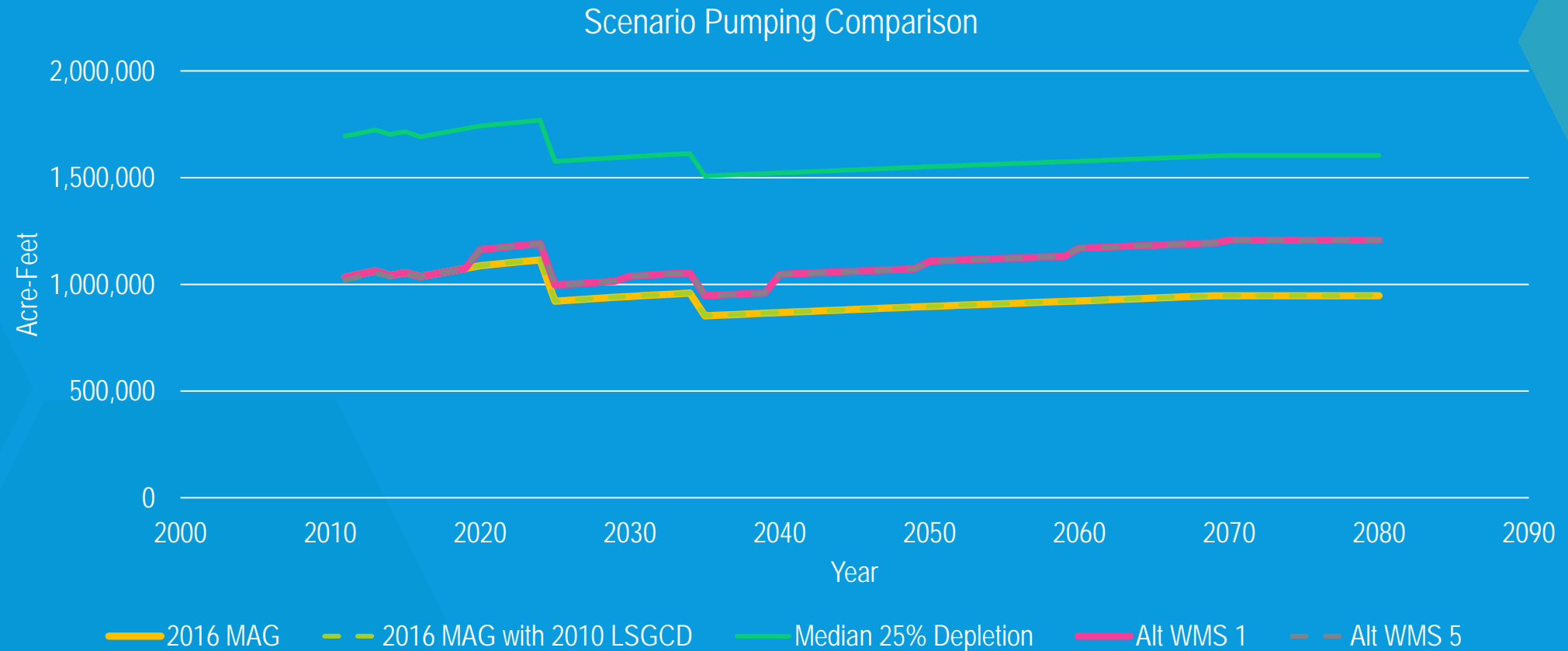
- Identified 43 strategies to simulate as groundwater (“alt WMS”)
- DFC consideration – Water supply needs (TWC §36.108(d)(2))
- WMS types
 - 4 groundwater desalination
 - 3 new major reservoir
 - 36 other surface water
- 75,771 acre-feet in 2020 to 260,579 acre-feet in 2070



SCENARIO DESCRIPTION

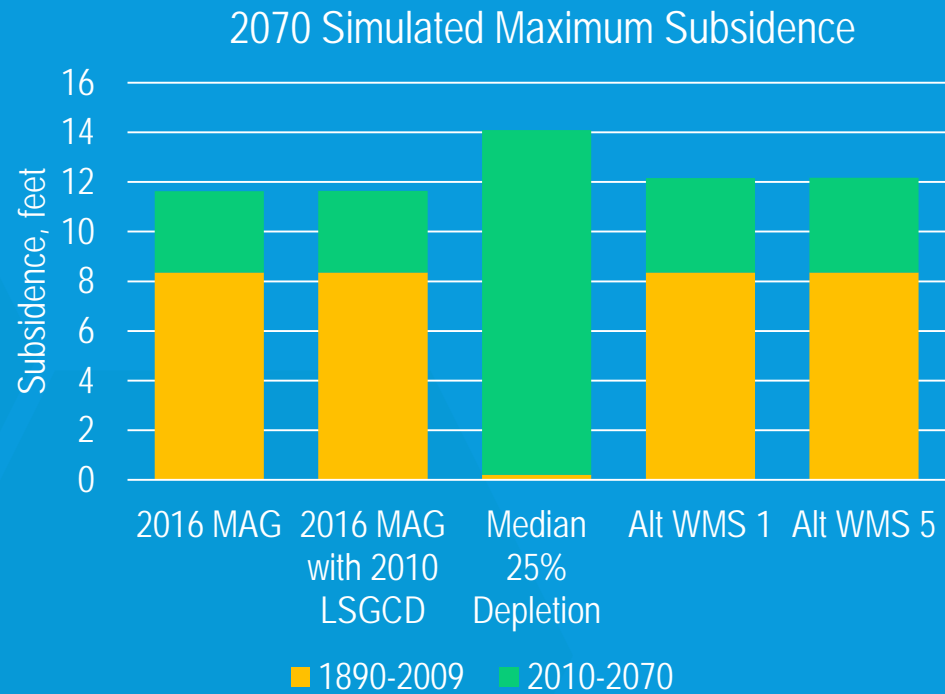
- Two primary simulations (of many evaluated)
 - “Alt WMS 1” – Used 2016 MAG as base pumping file
 - “Alt WMS 5” – Used 2016 MAG with 2010 MAG for Montgomery County as base pumping file
- No more than 2,500 acre-feet per year in a model cell
- Pumping added to aquifer where total dissolved solids is less than 1,000 milligrams per liter per BRACS study
- Pumping begins per strategy and remains constant for 10 years

SIMULATED PUMPING

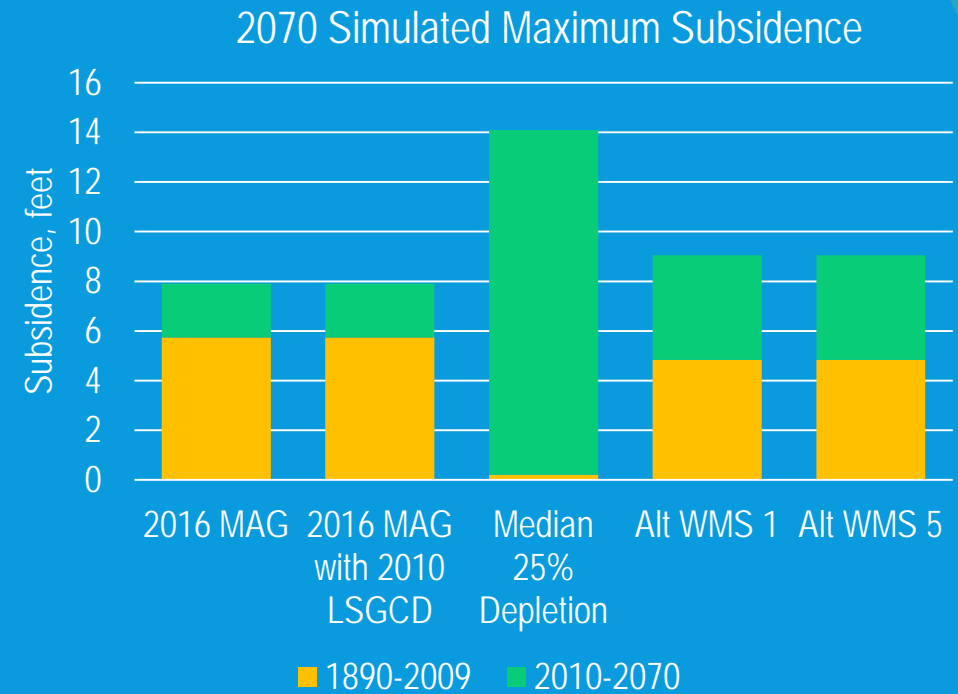


SUBSIDENCE

GMA 14

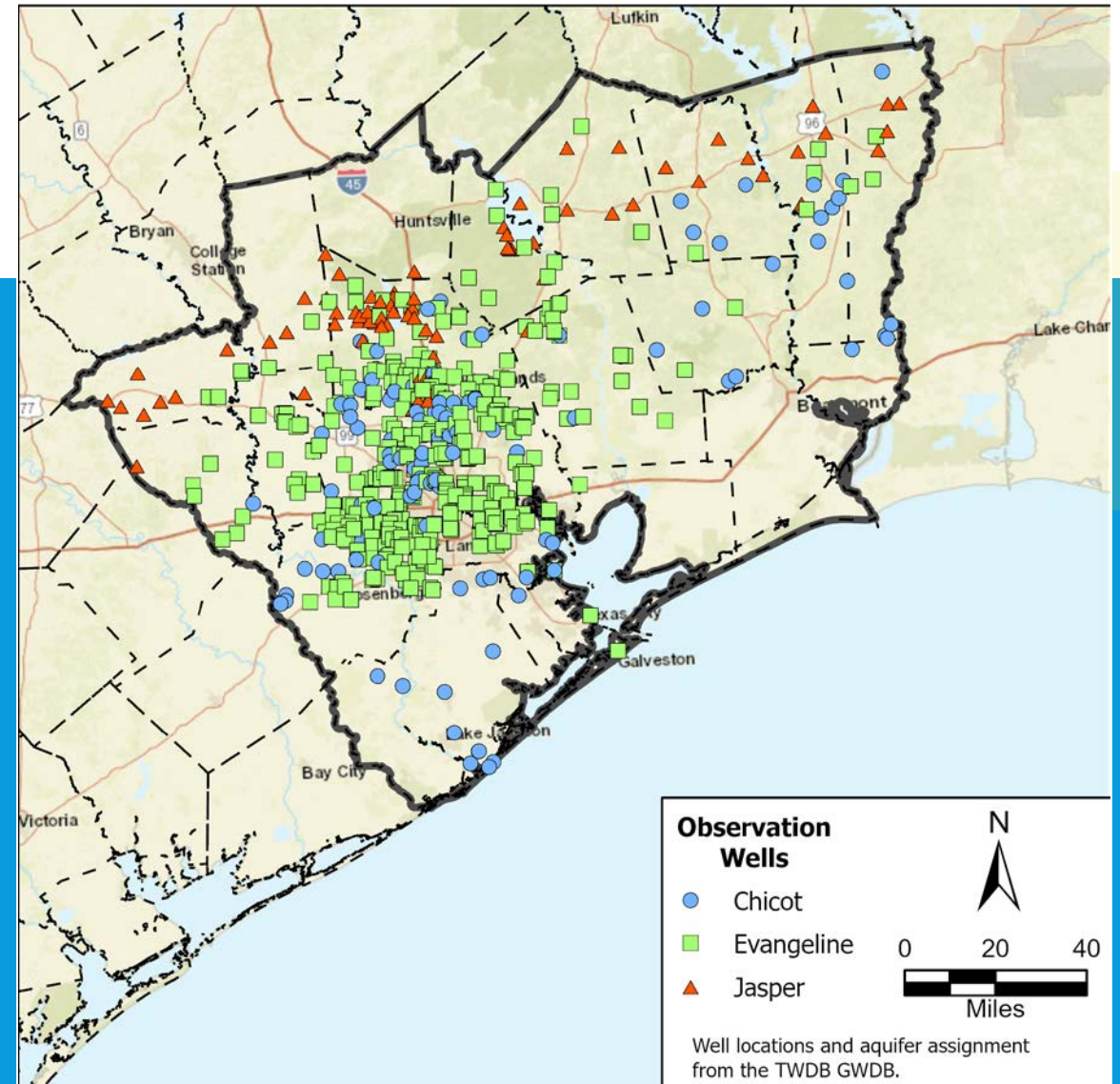


Not Including Subsidence Districts

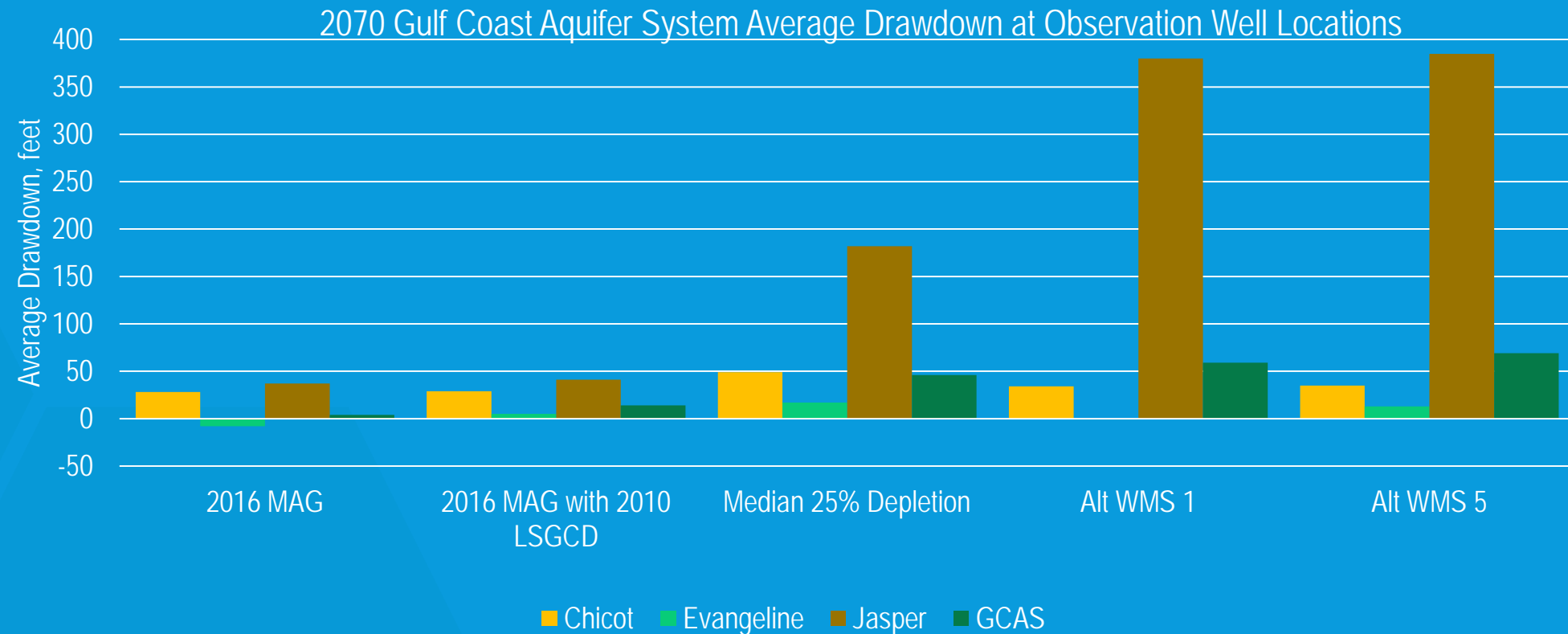


OBSERVATION WELLS

- <1,000 GCAS Observation Wells in TWDB GWDB
 - Current GCD, TWDB, USGS
 - TWDB Recorder Wells
- 57,056 Active Model Cells within Aquifer Footprint



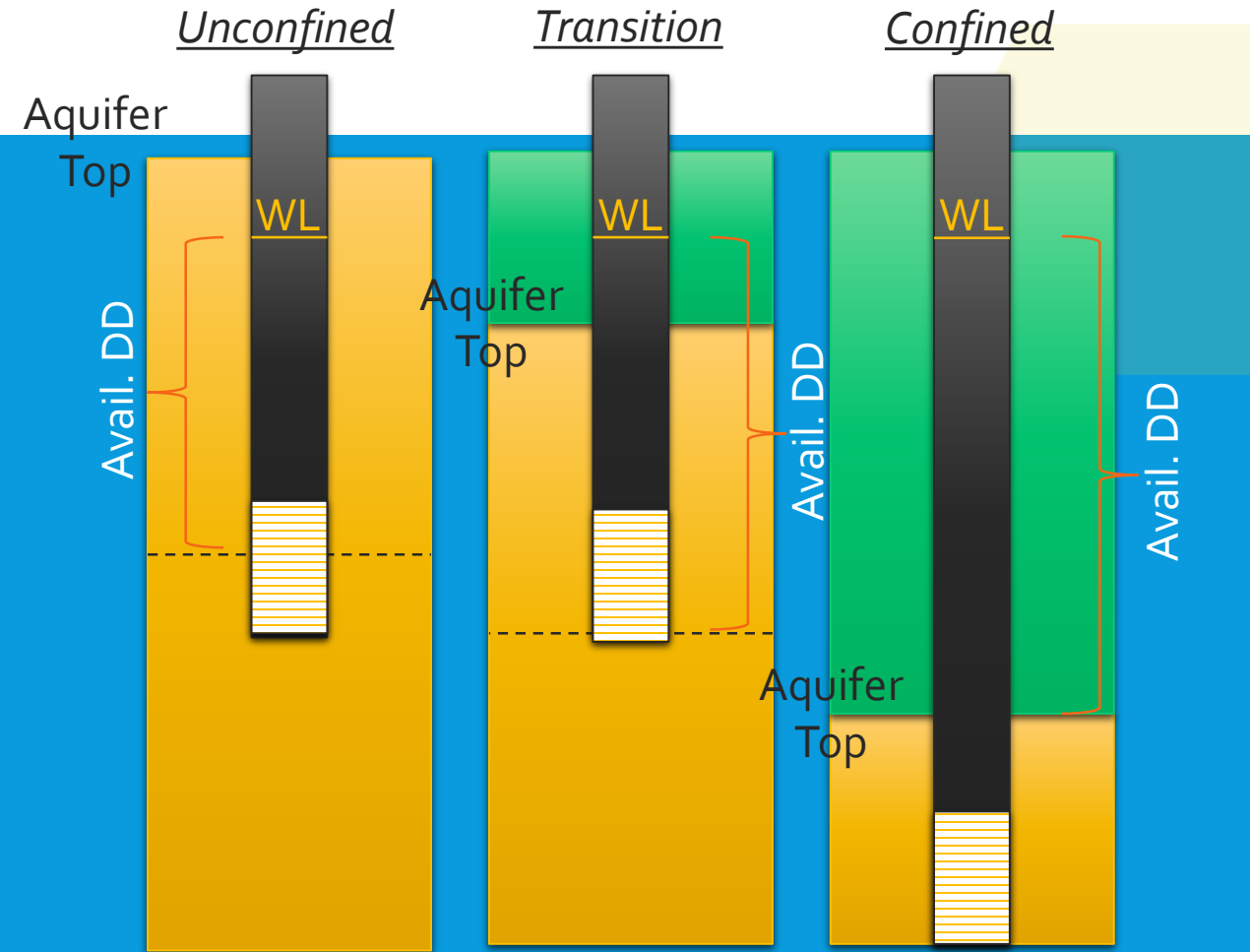
OBSERVATION WELL AVERAGE DRAWDOWN



Observation well average drawdown calculated using simulated water levels at wells in the TWDB GWDB with a water level type of: GCD Current Observation Well, TWDB Current Observation Well, USGS Current Observation Well, or TWDB Recorder Well. The HAGM layer was assigned based on aquifer code in the TWDB GWDB.

AVAILABLE DRAWDOWN

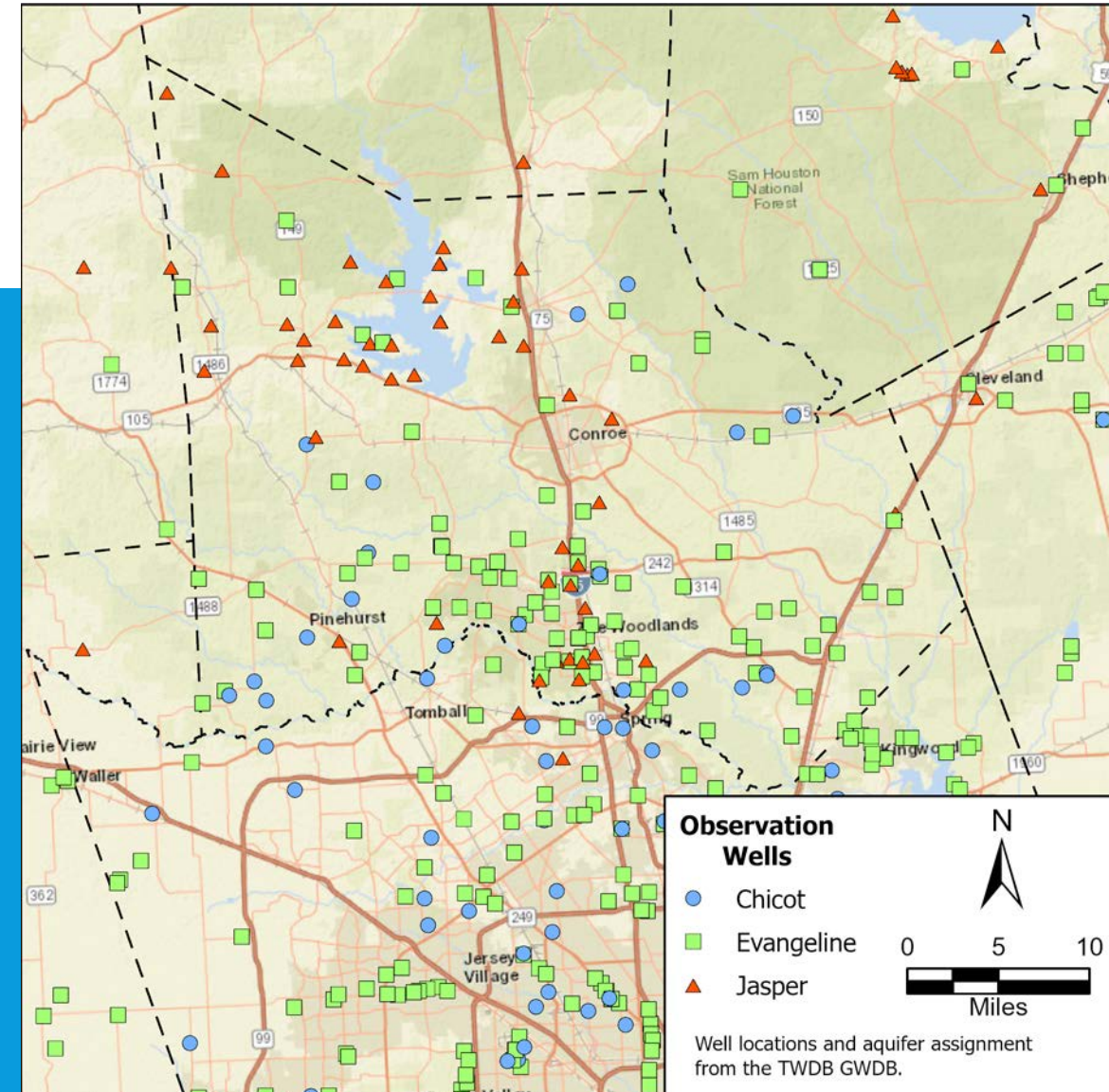
- Easily defined
- Measurable in observation wells
- Can state without a model



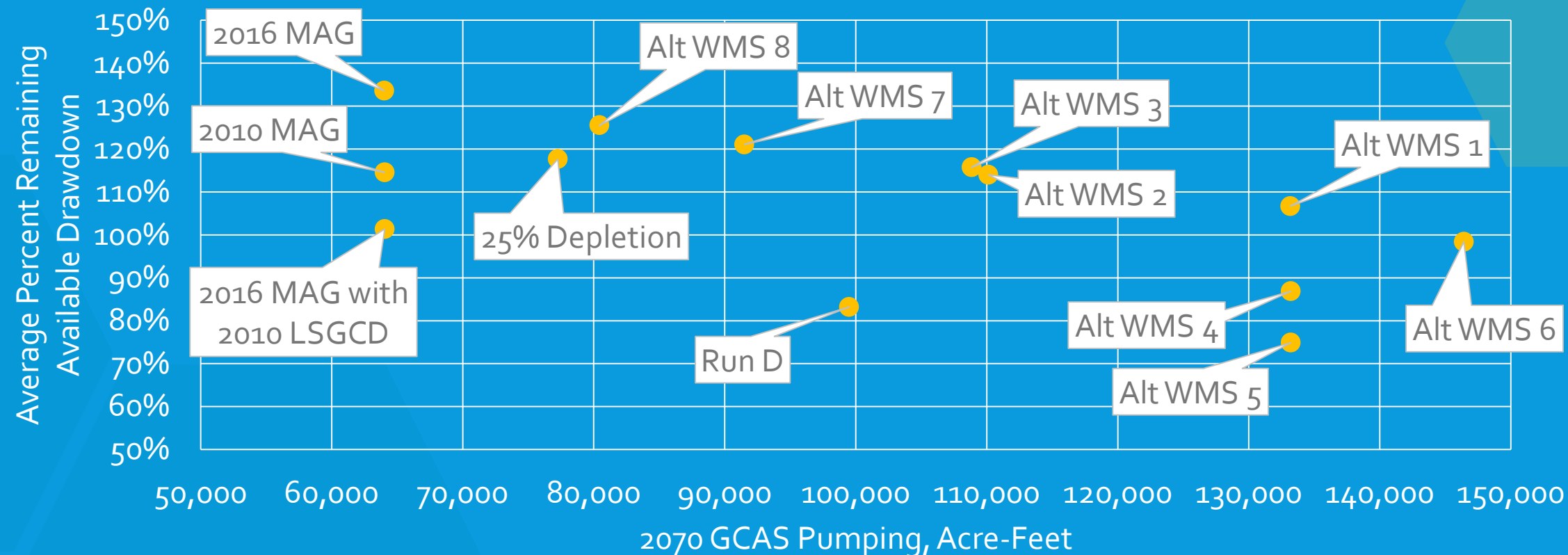
LSGCD OBSERVATION WELLS

County	LSGCD Observation Wells per Aquifer Zone			
	Unconfined	Transition	Confined	Total
Chicot	20	0	0	20
Evangeline	48	12	31	91
Jasper	2	2	44	48
Total	70	14	75	159

Areas for new observation wells identified in Task 1 of the LSGCD Strategic Water Plan

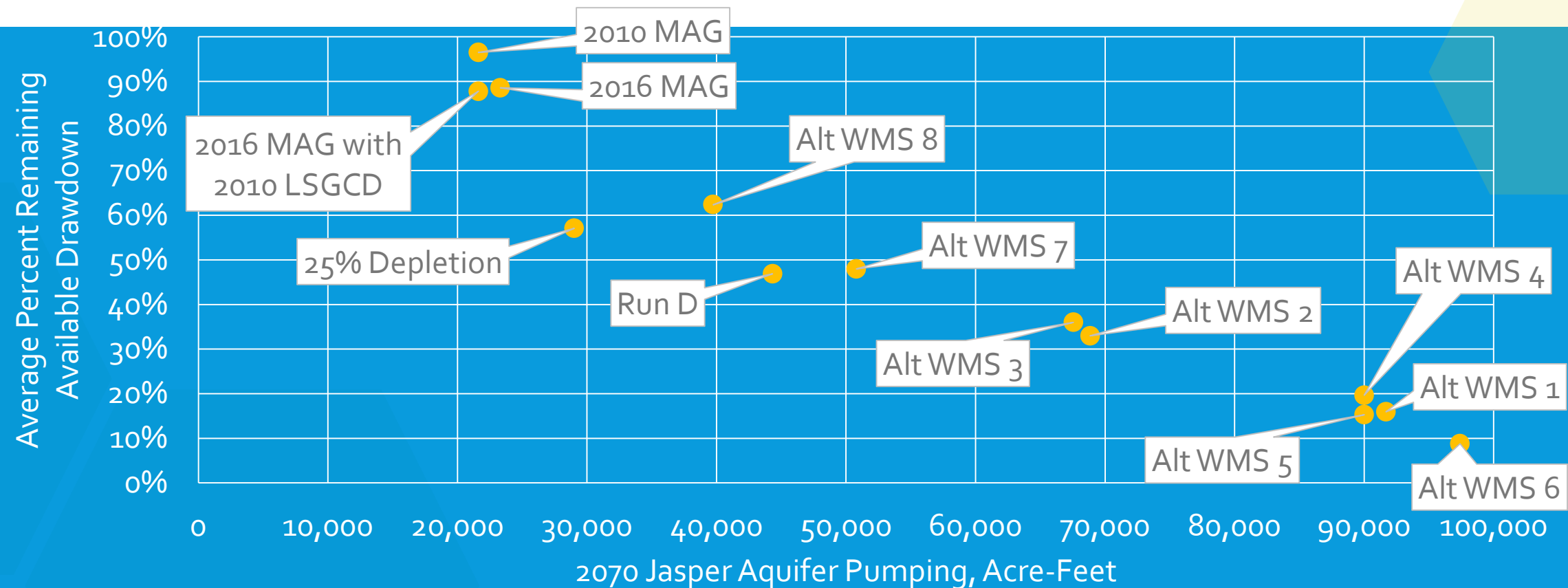


12/31/2070 PREDICTED AVAILABLE DRAWDOWN GCAS RESULTS



	LSGCD Observation Wells with Zero (0) feet of Available Drawdown (12/31/2070)													
	12/31/2009	2016 MAG	2010 MAG	2016 MAG with 2010 LSGCD	25% Depletion	Run D	Alt WMS 1	Alt WMS 2	Alt WMS 3	Alt WMS 4	Alt WMS 5	Alt WMS 6	Alt WMS 7	Alt WMS 8
County Chicot	2	7	4	6	7	7	7	7	7	4	6	8	7	7
Evangeline	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jasper	0	0	0	0	4	7	25	12	11	25	26	28	7	2
GCAS	2	7	4	6	11	14	32	19	18	29	32	36	14	9

12/31/2070 PREDICTED AVAILABLE DRAWDOWN JASPER AQUIFER RESULTS



County	LSGCD Observation Wells with Zero (0) feet of Available Drawdown (12/31/2070)													
	12/31/2009	2016 MAG	2010 MAG	2016 MAG with 2010 LSGCD	25% Depletion	Run D	Alt WMS 1	Alt WMS 2	Alt WMS 3	Alt WMS 4	Alt WMS 5	Alt WMS 6	Alt WMS 7	Alt WMS 8
Chicot	2	7	4	6	7	7	7	7	7	4	6	8	7	7
Evangeline	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jasper	0	0	0	0	4	7	25	12	11	25	26	28	7	2
GCAS	2	7	4	6	11	14	32	19	18	29	32	36	14	9

SUMMARY

- 13+ simulations considered and evaluated
- LSGCD simulations guided by:
 - Hydrogeologic conditions
 - Identified water demands and associated needs
- DFC metric is a key factor
 - Should be (relatively) easily measured
 - Should be (relatively) easily understood
 - Should allow GM to assess compliance

RECOMMENDATIONS

- Adopt a DFC metric
 - For example: "LSGCD will define our DFC(s) as the amount of available drawdown at the following observation well locations: ..."
 - "Available drawdown means ..."
- Consider possible desired future conditions
 - For example: "Jasper Aquifer water levels should remain above the top of the aquifer"
 - For example: "No more the __ observation wells should decline to zero (o) feet of available drawdown"

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