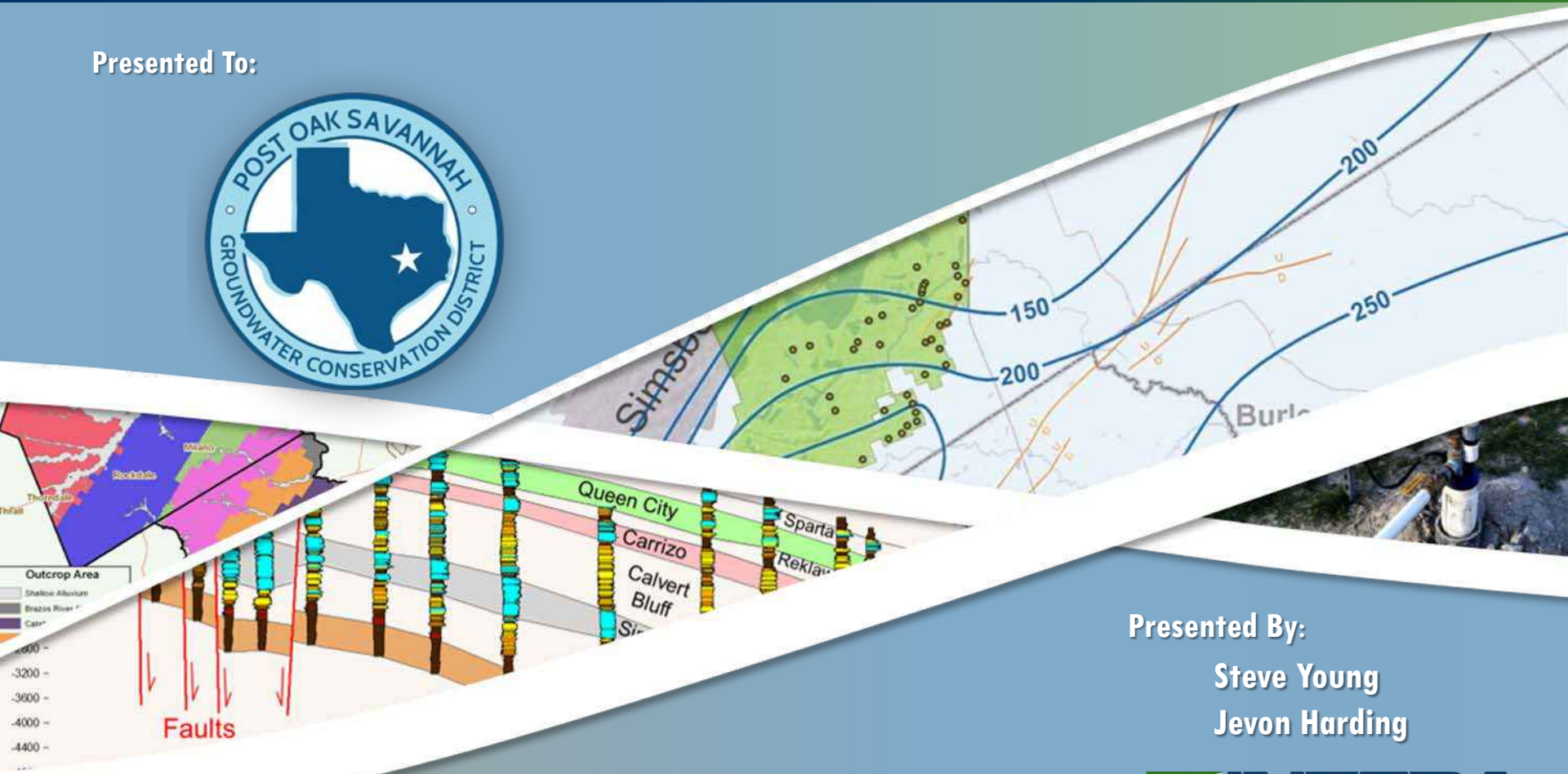
Methodology for Calculating Average Drawdown for the Upper 400-foot of Subsurface in POSGCD

Presented To:

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT



Presented By:

Steve Young

Jevon Harding

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January 9, 2018

Outline

- Footprint of Total Aquifer and at 400-ft Depth
- 3-D Configuration of Aquifer Portion at Depth of 400-ft
- Well Coverage across 400-ft Shallow Zone
- Approach for Calculating Average Drawdown Across 400-ft Zone
- Approach for Calculating Average Drawdown for Each Aquifer
- Comparison of Calculated Average Drawdowns

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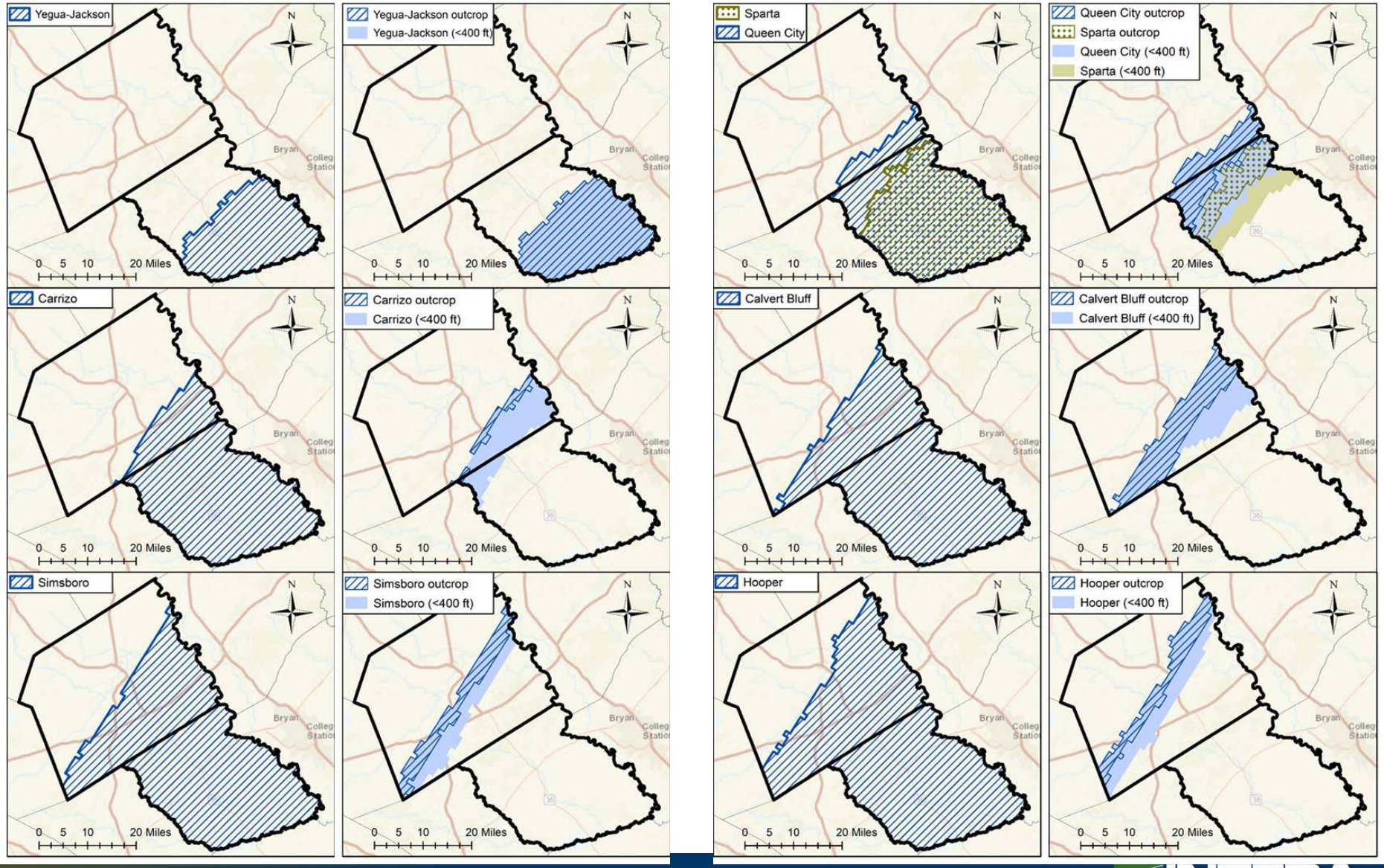
Footprint Comparisons of Aquifer and 400-ft Zone



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Subsurface Geology for 400-ft Depth

- Data Source
  - Map of Geology at Ground Surface
  - Tops and Bottoms of Aquifer Layer in GAMs

- Interpolation Approach
  - 3-D Program called Leapfrog
  - 500 ft x 500 ft x 50 ft grid blocks

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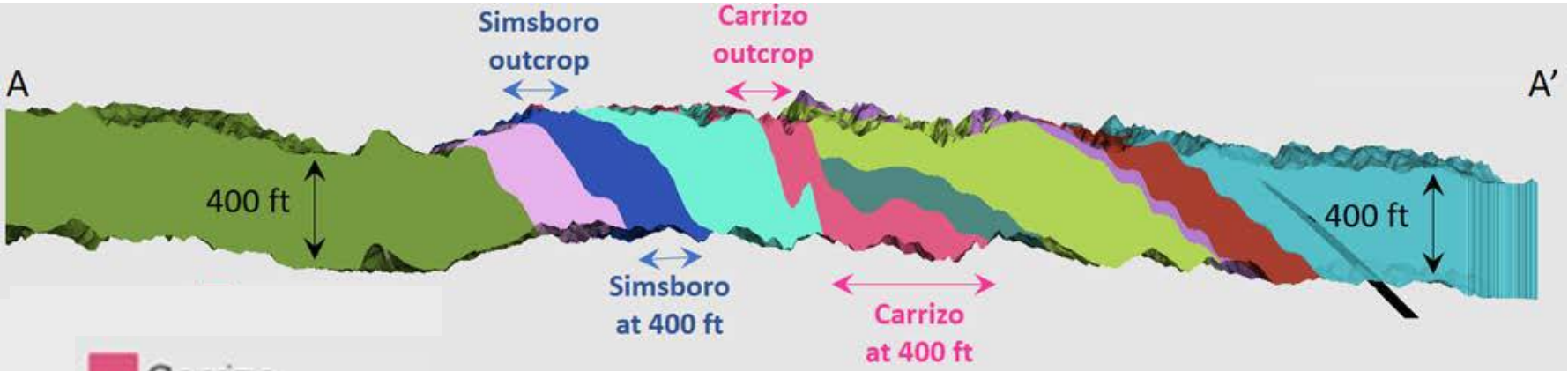
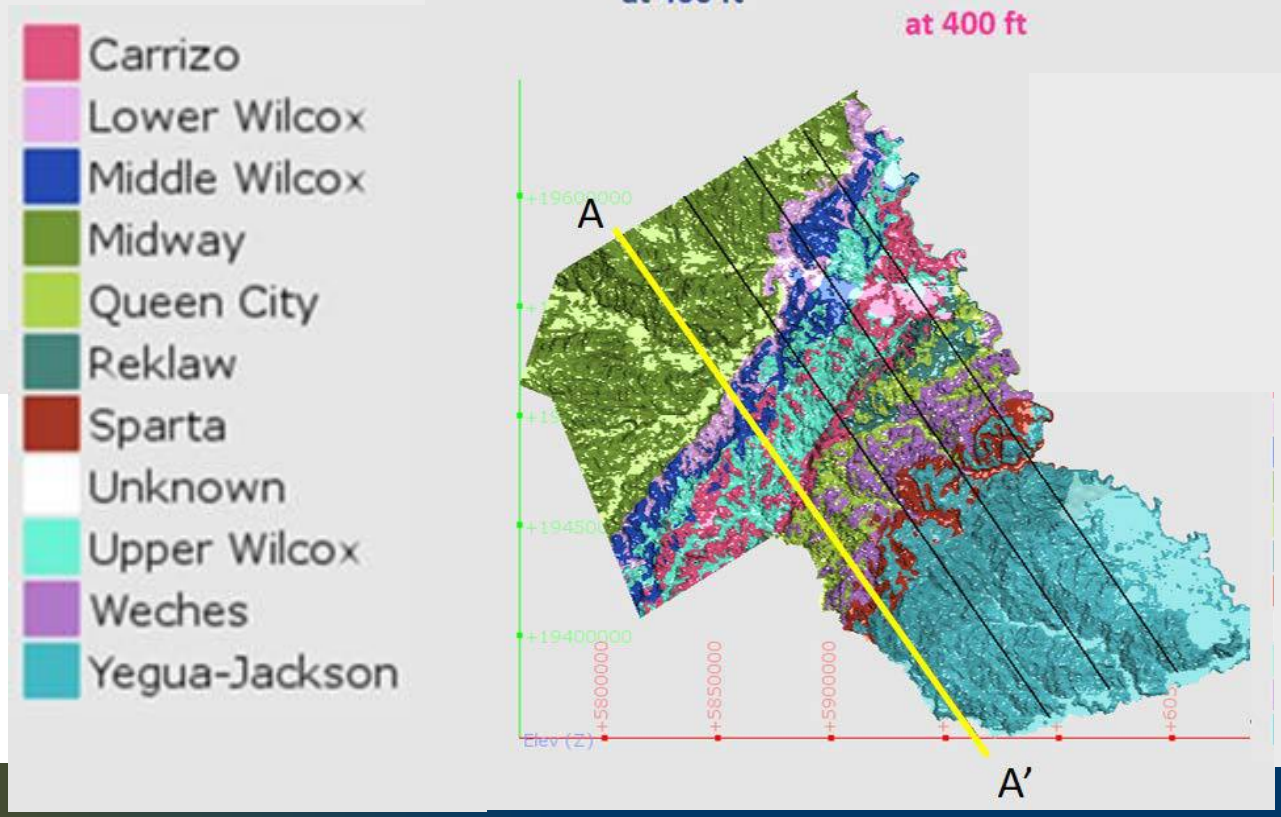
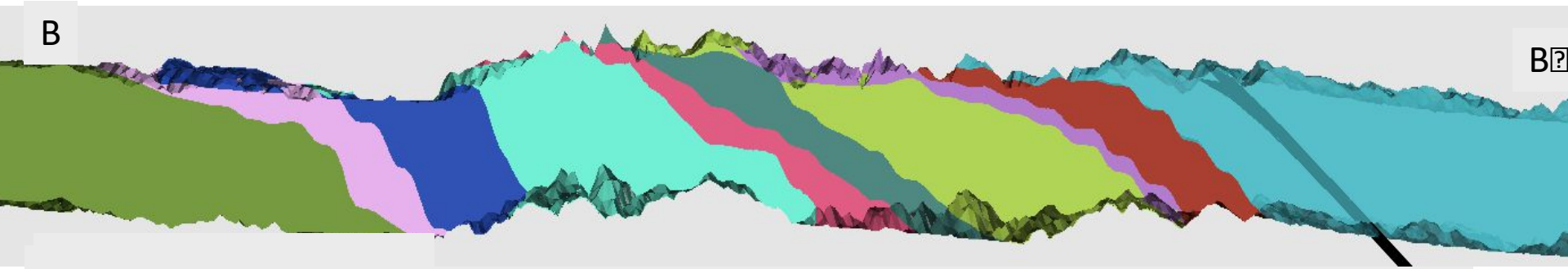
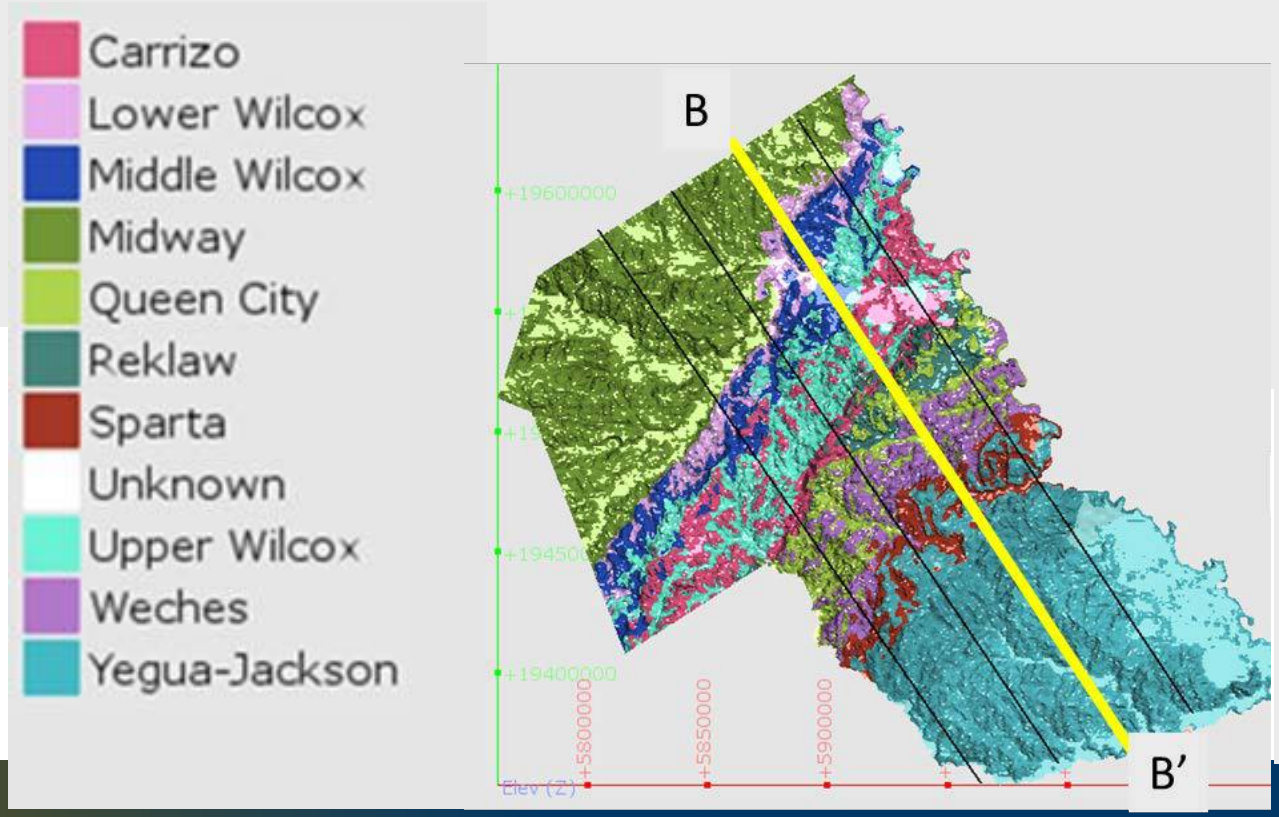
Vertical Cross Section A-A





Vertical Cross Section B-B





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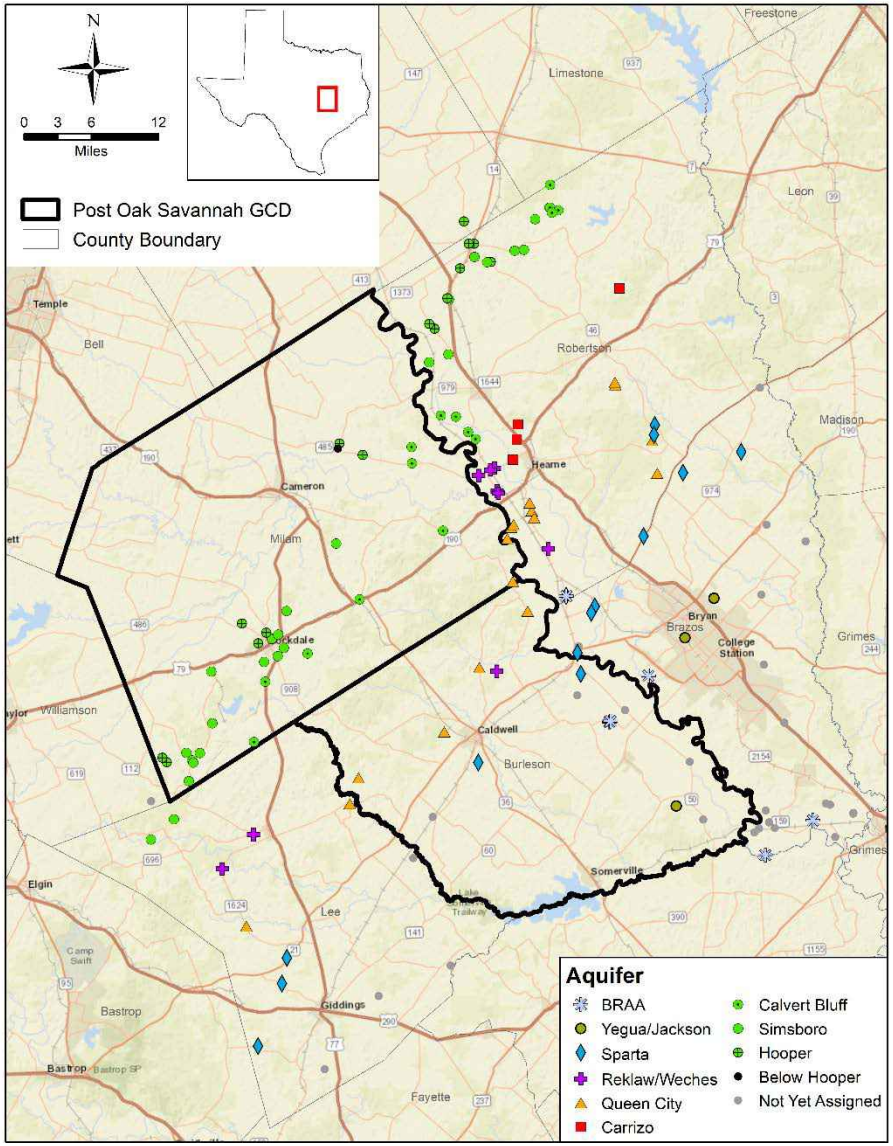
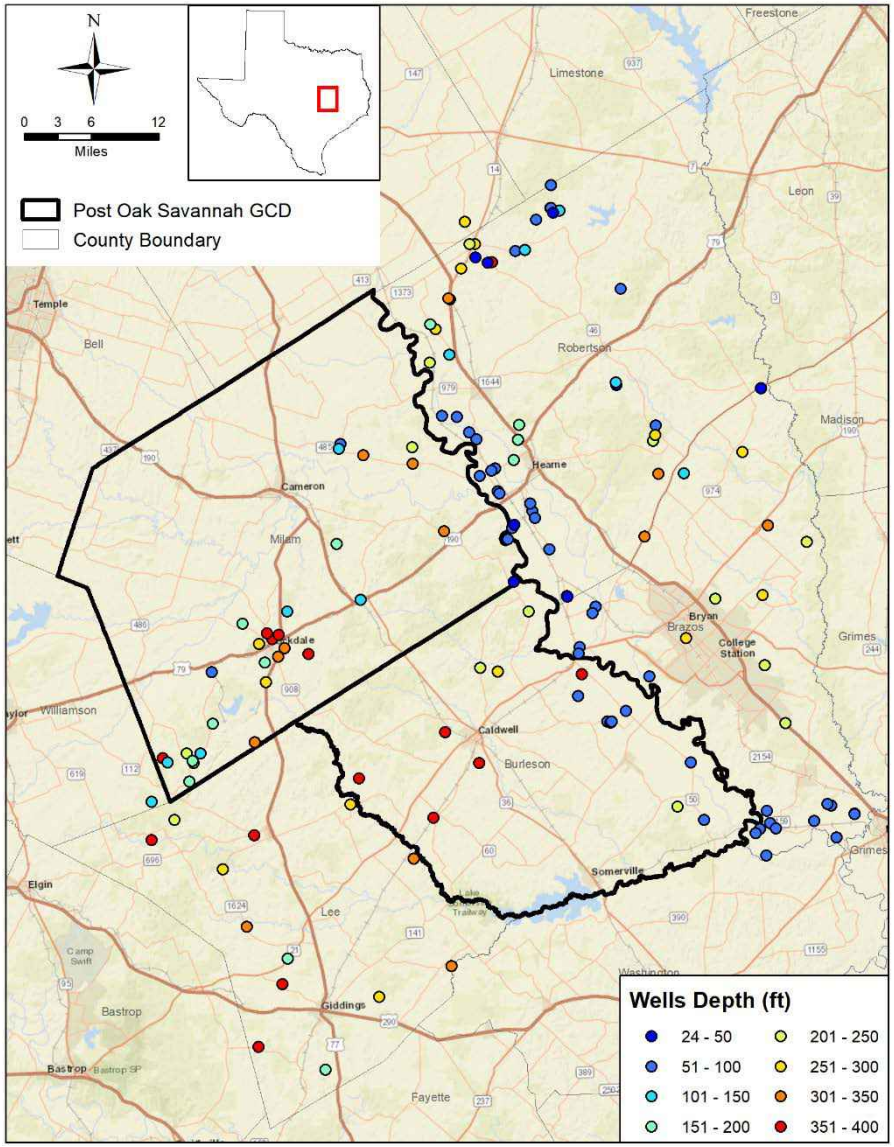
Location of Wells for 400-ft Zone





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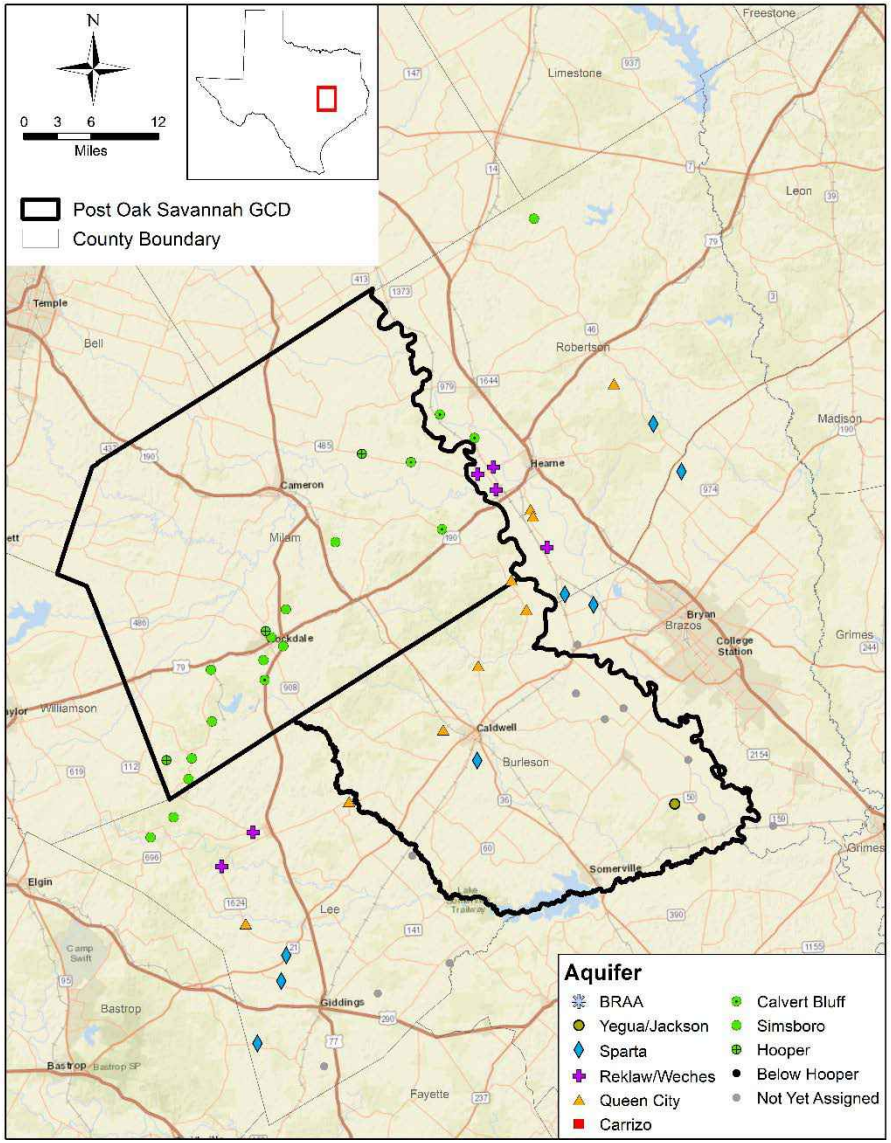
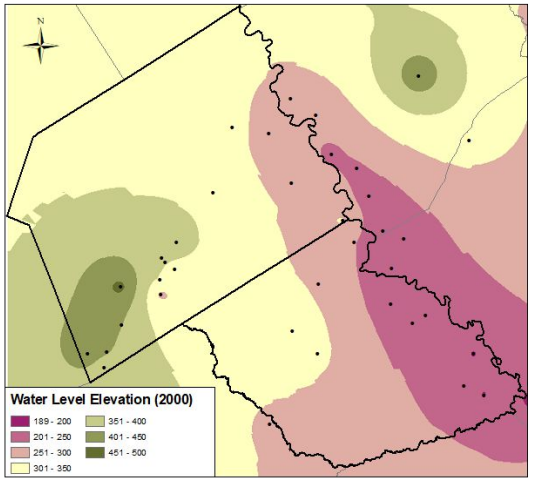
Locations of 2000-2014 Well Pairs for 400-ft Shallow Zone



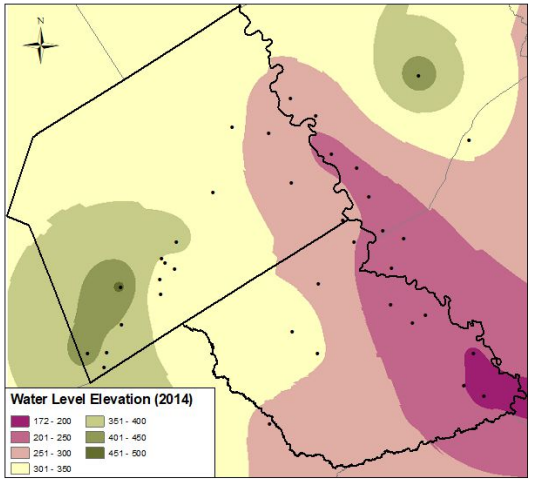
Aquifer	POSGCD wells	with outside Wells
Hooper	3	3
Simsboro	9	10
Calvert Bluff	3	5
Carrizo	0	0
Queen City	4	7
Sparta	1	5
Yegua-Jackson	1	1

Calculated Drawdown For 2000-2014

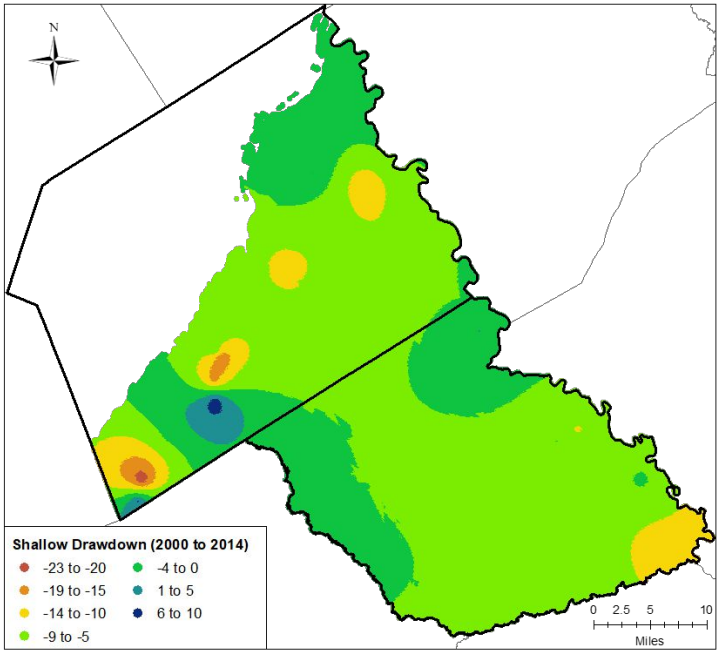
Interpolate Baseline (2000)
Shallow Water Level Surface



Interpolate Evaluation Year (2014)
Shallow Water Level Surface



Calculate Shallow Drawdown Surface
(Evaluation Year – Baseline)



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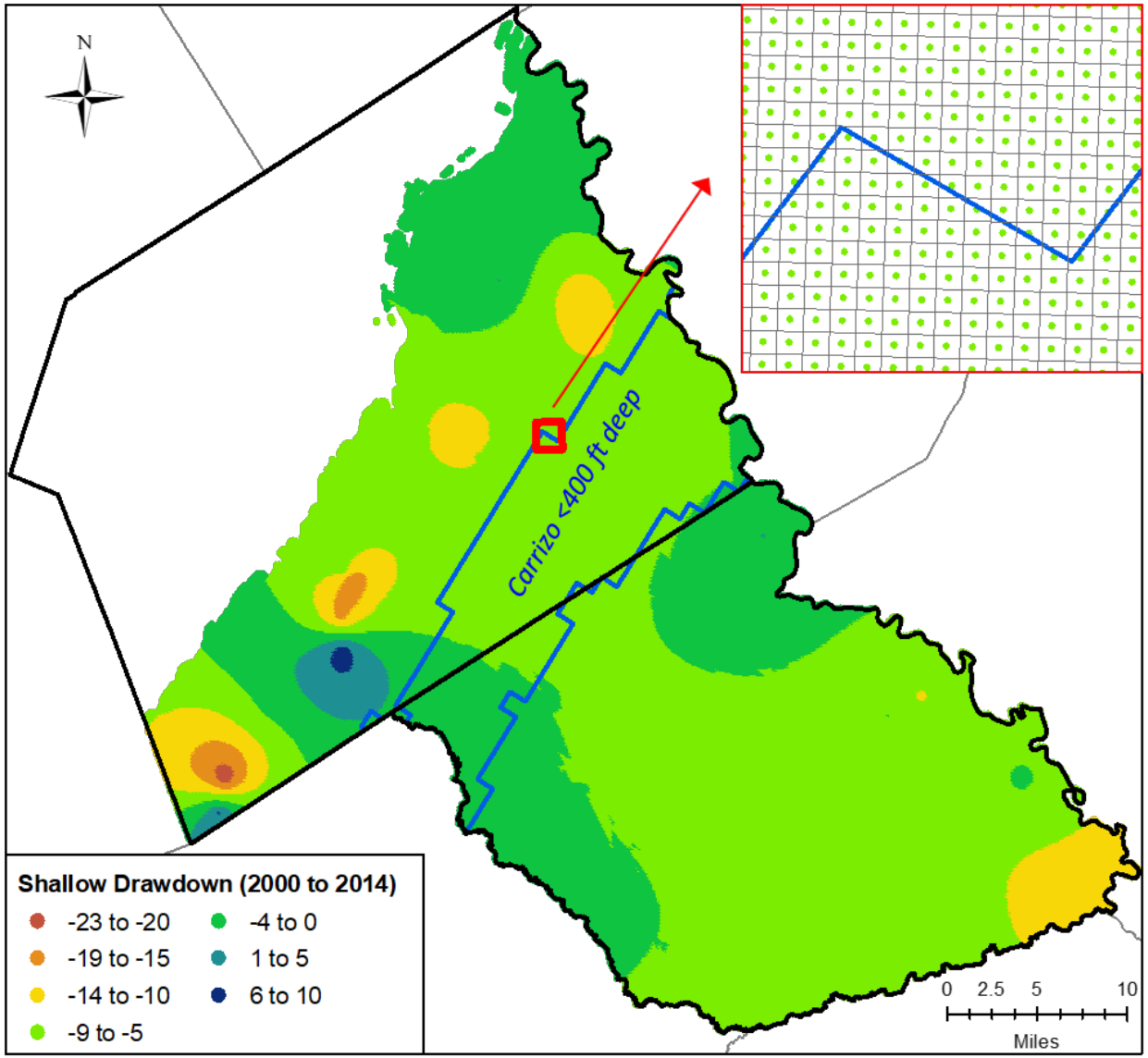
2000-2014 Drawdown Values Mapped onto a Two-Dimensional Grid



Each Grid Block is 500 ft by 500 ft

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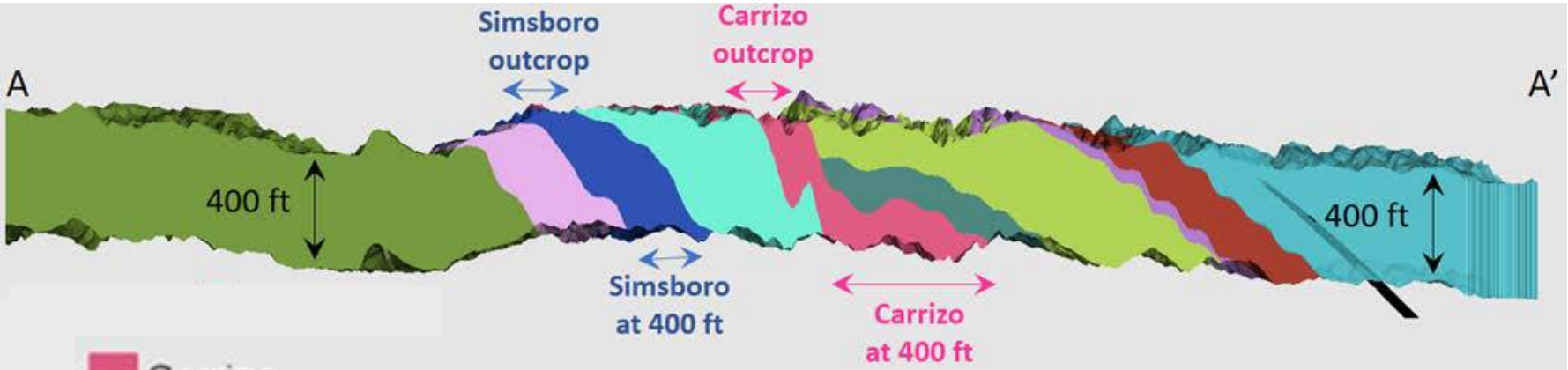
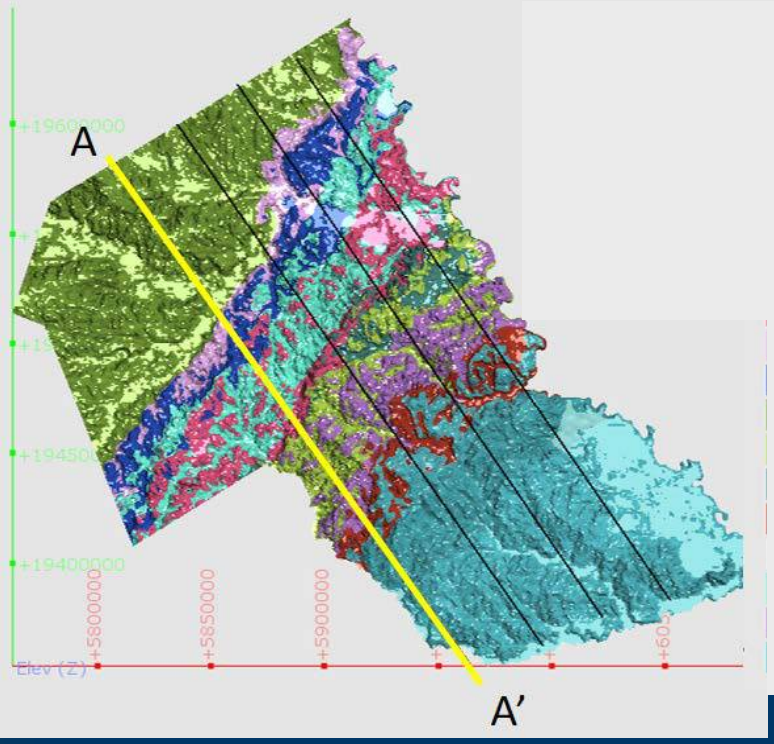
Vertical Cross Section A-A



- Carrizo
- Lower Wilcox
- Middle Wilcox
- Midway
- Queen City
- Reklaw
- Sparta
- Unknown
- Upper Wilcox
- Weches
- Yegua-Jackson



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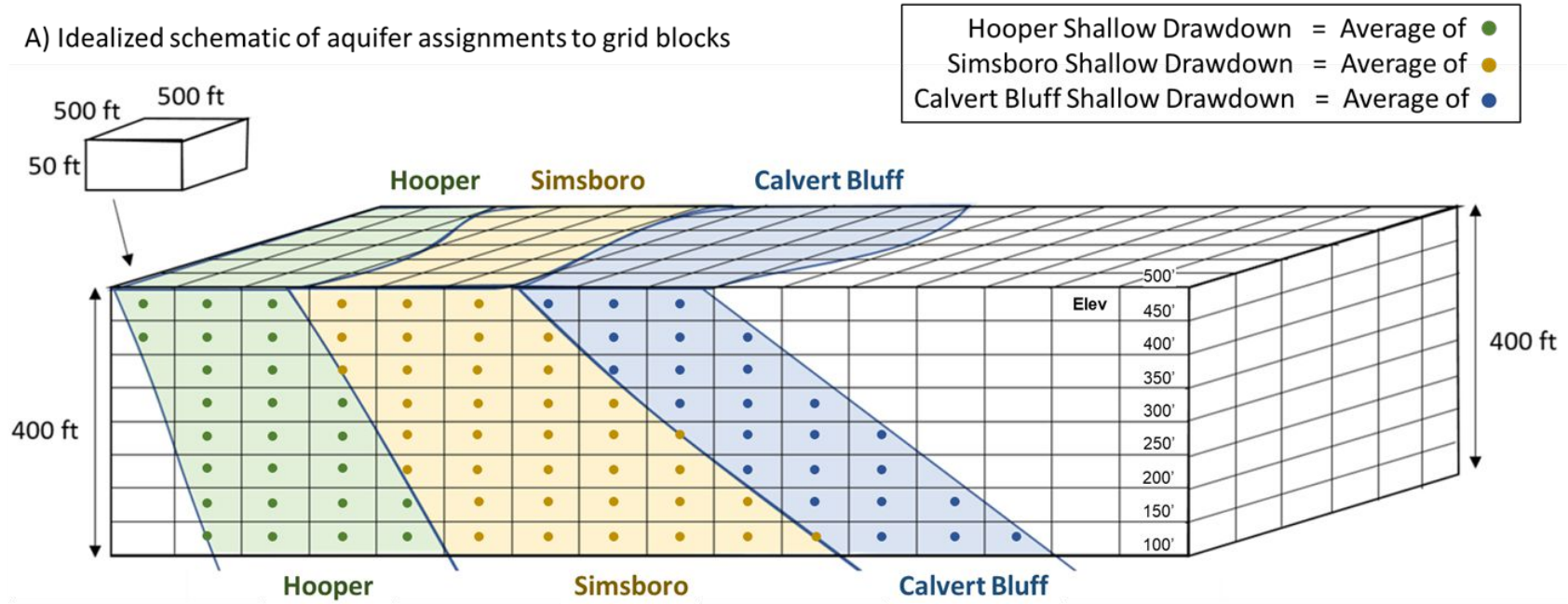
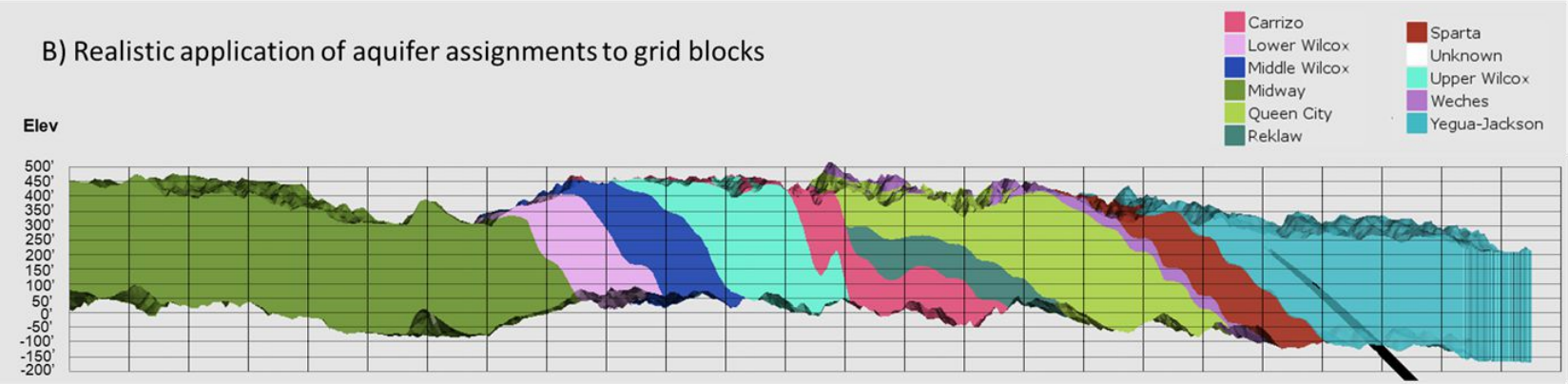
Two-Dimensional Grid Used to Create a Network of Three-Dimensional Blocks





Each column of blocks has the same amount of drawdown

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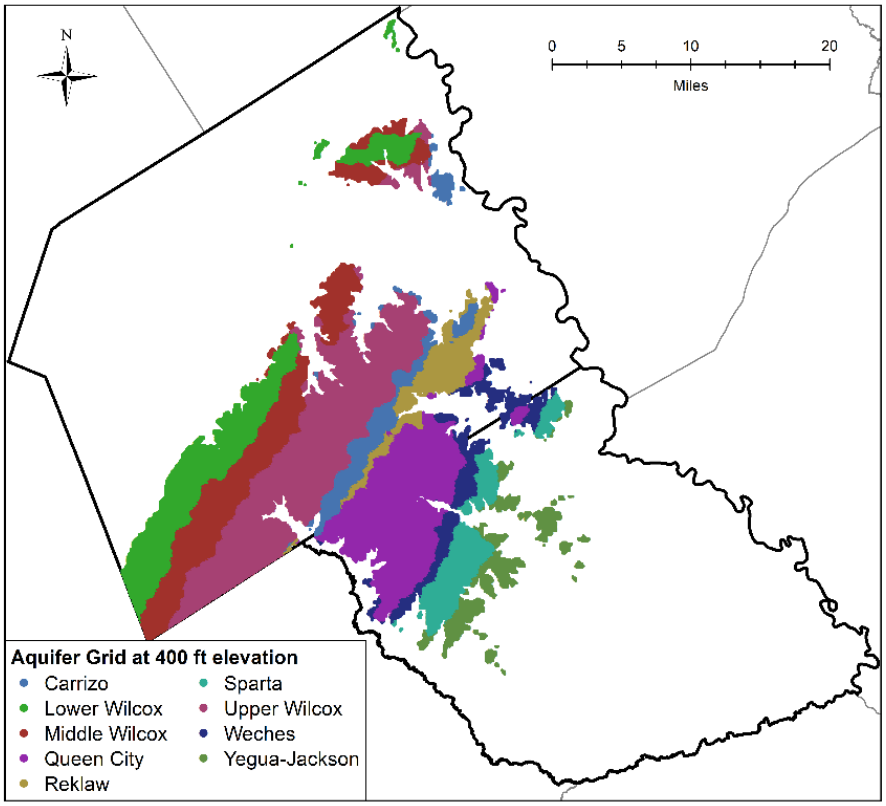
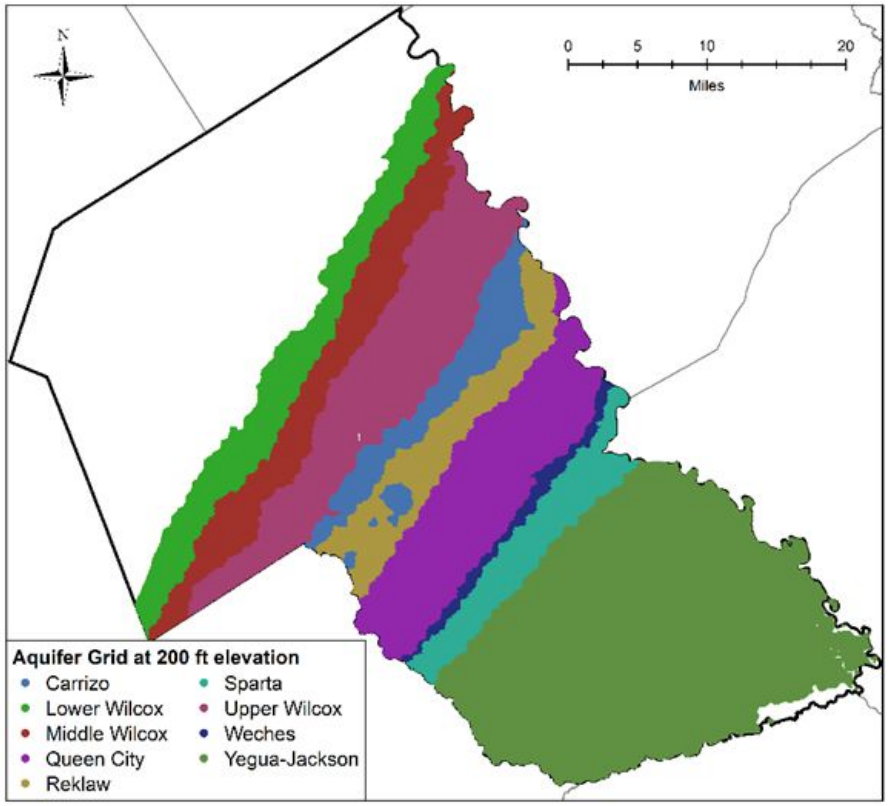
Aquifer Coverage at Constant Elevations of 400 ft msl and 200 ft msl





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Aquifer Coverage For Each of the 50-ft Layers Comprising the Three-Dimensional Grid

Elevation	Hooper	Simsboro	Calvert Bluff	Carrizo	Queen City	Sparta	Yegua-Jackson
500	677	3,047	1,292	1,337	1,432	198	165
450	3,058	5,096	7,058	2,243	5,404	1,384	556
400	6,806	7,562	12,587	2,681	8,687	3,200	2,294
350	11,825	9,415	14,455	4,355	13,708	4,691	9,199
300	13,354	10,637	15,784	4,615	15,852	5,977	20,746
250	11,799	11,728	18,386	5,627	16,429	7,065	31,681
200	11,264	11,331	18,455	6,876	16,296	6,908	47,254
150	10,373	10,869	18,620	8,736	16,481	6,384	47,264
100	7,902	10,203	17,508	8,600	15,775	6,150	45,930
50	4,856	7,410	13,408	7,017	13,894	6,226	44,544
0	3,103	4,024	8,783	4,848	9,600	6,114	43,108
-50	1,491	1,909	5,872	2,189	4,918	4,171	38,857
-100	647	874	3,255	656	1,951	2,091	29,043
-150	0	5	114	87	319	1,308	17,354
-200	0	0	0	0	0	0	1,403
TOTAL	*87,155*	*94,110*	*155,577*	*59,867*	*140,746*	*61,867*	*379,398*

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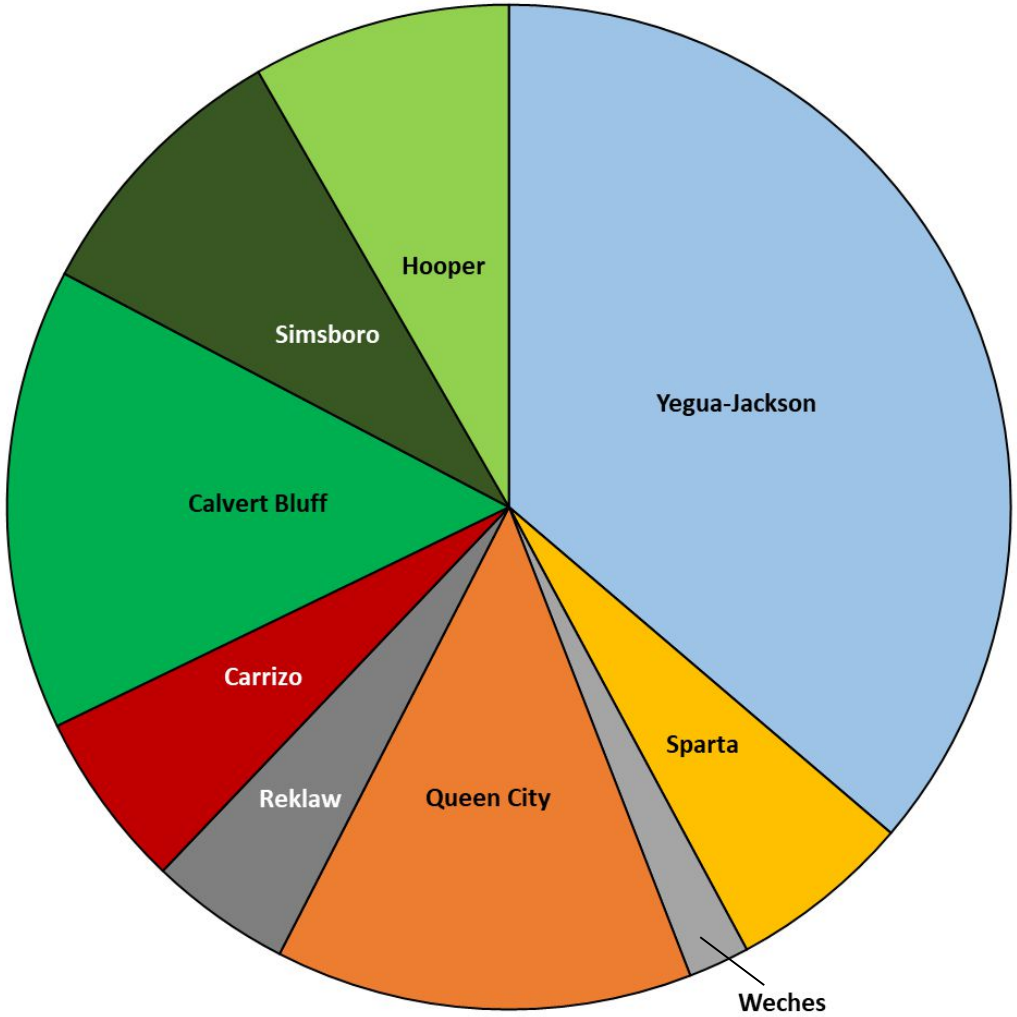
Aquifer Volumes in the Three-Dimensional Grid

Aquifer	Volume	
	# Blocks	% Blocks
Yegua-Jackson	379,398	36%
Sparta	61,867	6%
Weches	20,636	2%
Queen City	140,746	13%
Reklaw	47,699	5%
Carrizo	59,867	6%
Calvert Bluff	155,577	15%
Simsboro	94,110	9%
Hooper	87,155	8%
Total	1,047,055	100%



Example Calculation of the Average Drawdown: Simsboro Aquifer

Layer	Number of Grid Blocks	Sum of Drawdown	Average Drawdown
500	3047	-25898	-8.5
450	5096	-37053	-7.3
400	7562	-54488	-7.2
350	9415	-69132	-7.3
300	10637	-71970	-6.8
250	11728	-75140	-6.4
200	11331	-71908	-6.3
150	10869	-67504	-6.2
100	10203	-62046	-6.1
50	7410	-46049	-6.2
0	4024	-29176	-7.3
-50	1909	-13501	-7.1
-100	874	-6571	-7.5
-150	5	-28	-5.6
-200	0	0	
Total	94110	-630462	-6.7

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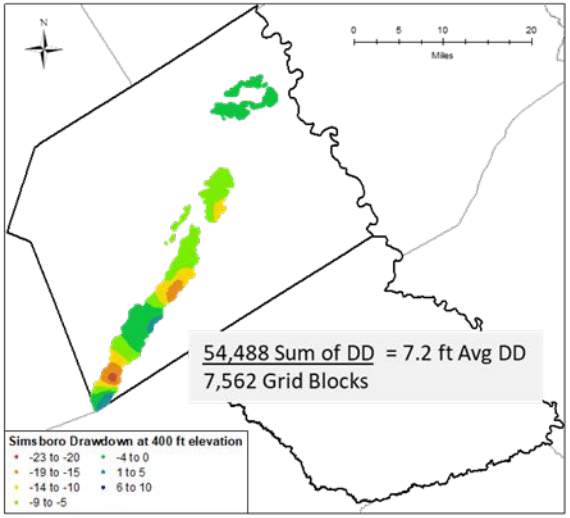
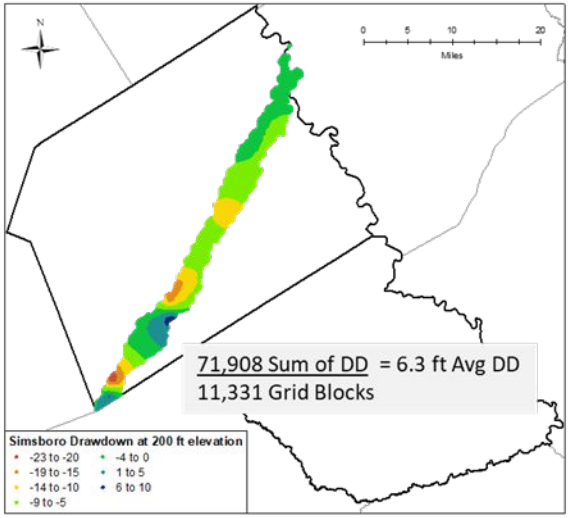
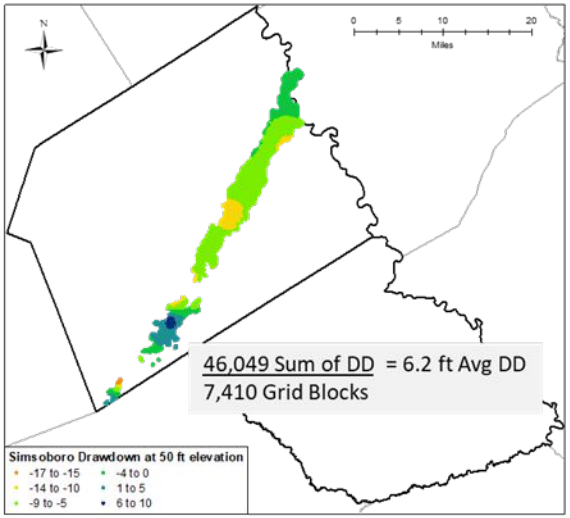
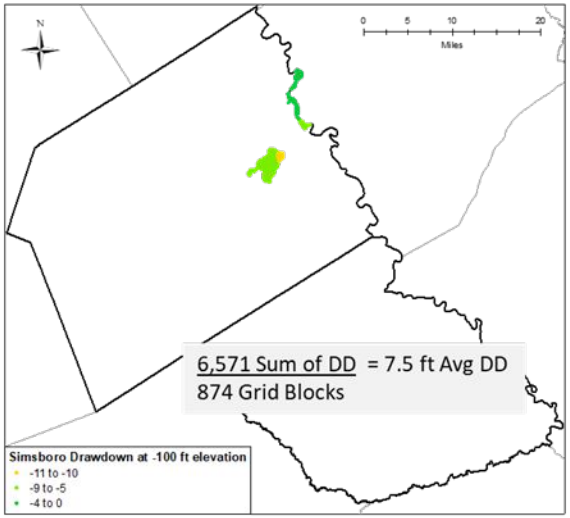
Grid Blocks in Four Layers Used for Calculating Drawdown in the Simsboro Aquifer









$$\frac{\text{Total Sum of Simsboro DD}}{\text{Total \# Simsboro Grid Blocks}} = \frac{630{,}462}{94{,}110} = \textbf{6.7 ft Avg DD}$$

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Compliance with POSGCD Shallow PDLs

Shallow Management Zone	PDL	Drawdown from 2000 to 2012		Drawdown from 2000 to 2013		Drawdown from 2000 to 2014		Drawdown from 2000 to 2015*		Drawdown from 2000 to 2016*	
		Calculated Drawdown	*Percent of PDL*	*Calculated Drawdown*	*Percent of PDL*	*Calculated Drawdown*	*Percent of PDL*	*Calculated Drawdown*	*Percent of PDL*	*Calculated Drawdown*	*Percent of PDL*
Yegua Jackson	15	5.7	**38%**	6.4	**42%**	6.8	**46%**	7.3	**49%**	4.4	**29%**
Sparta	10	4.0	**40%**	4.5	**45%**	4.9	**49%**	4.5	**45%**	3.3	**33%**
Queen City	10	3.4	**34%**	4.1	**41%**	4.6	**46%**	4.2	**42%**	2.3	**23%**
Carrizo	20	4.7	**23%**	5.8	**29%**	6.2	**31%**	5.8	**29%**	3.4	**17%**
Calvert Bluff (Upper Wilcox)	20	5.9	**29%**	7.0	**35%**	7.2	**36%**	7.0	**35%**	5.7	**28%**
Simsboro (Middle Wilcox)	20	6.0	**30%**	6.6	**33%**	6.7	**33%**	6.5	**33%**	5.9	**30%**
Hooper (Lower Wilcox)	20	6.0	**30%**	6.2	**31%**	6.3	**32%**	6.4	**32%**	6.0	**30%**

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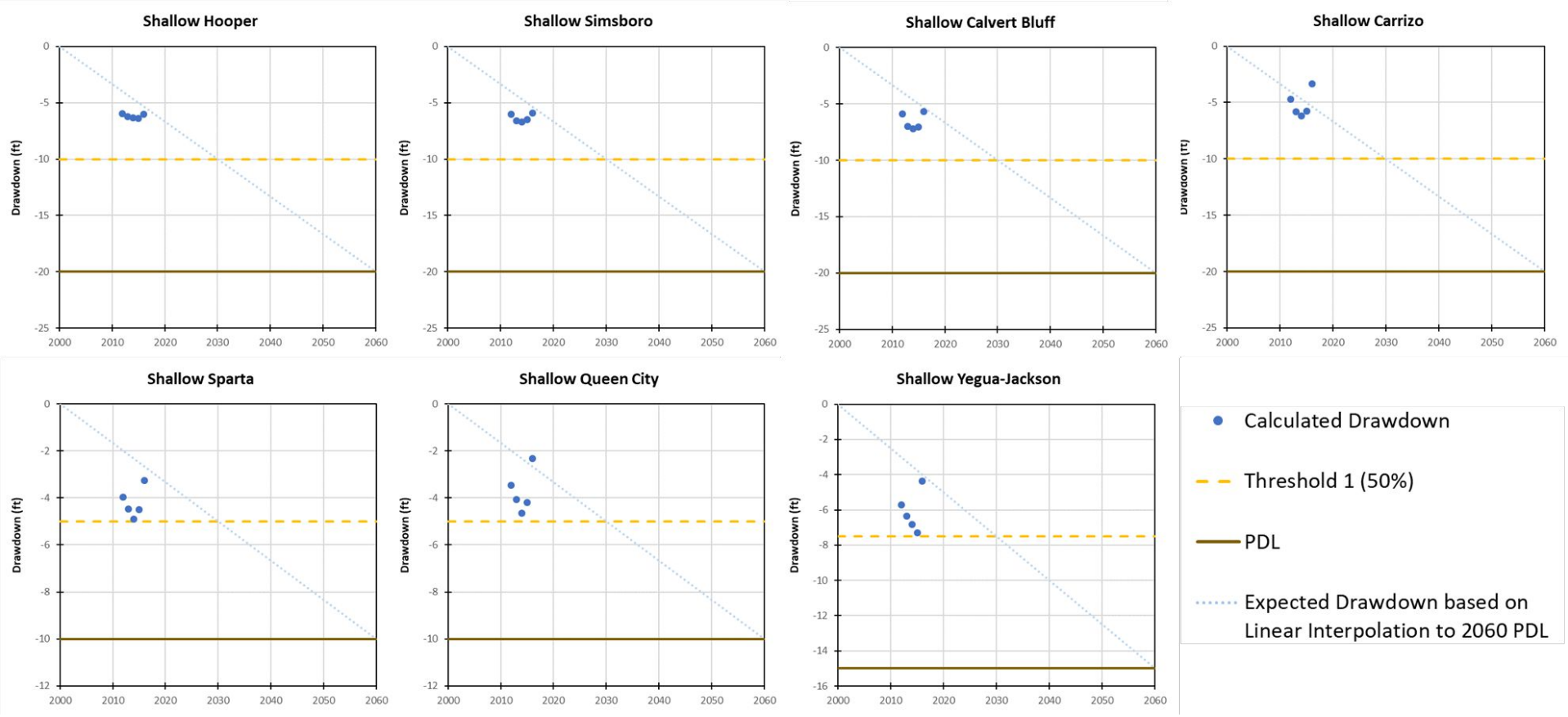
Compliance with POSGCD Shallow PDLs



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