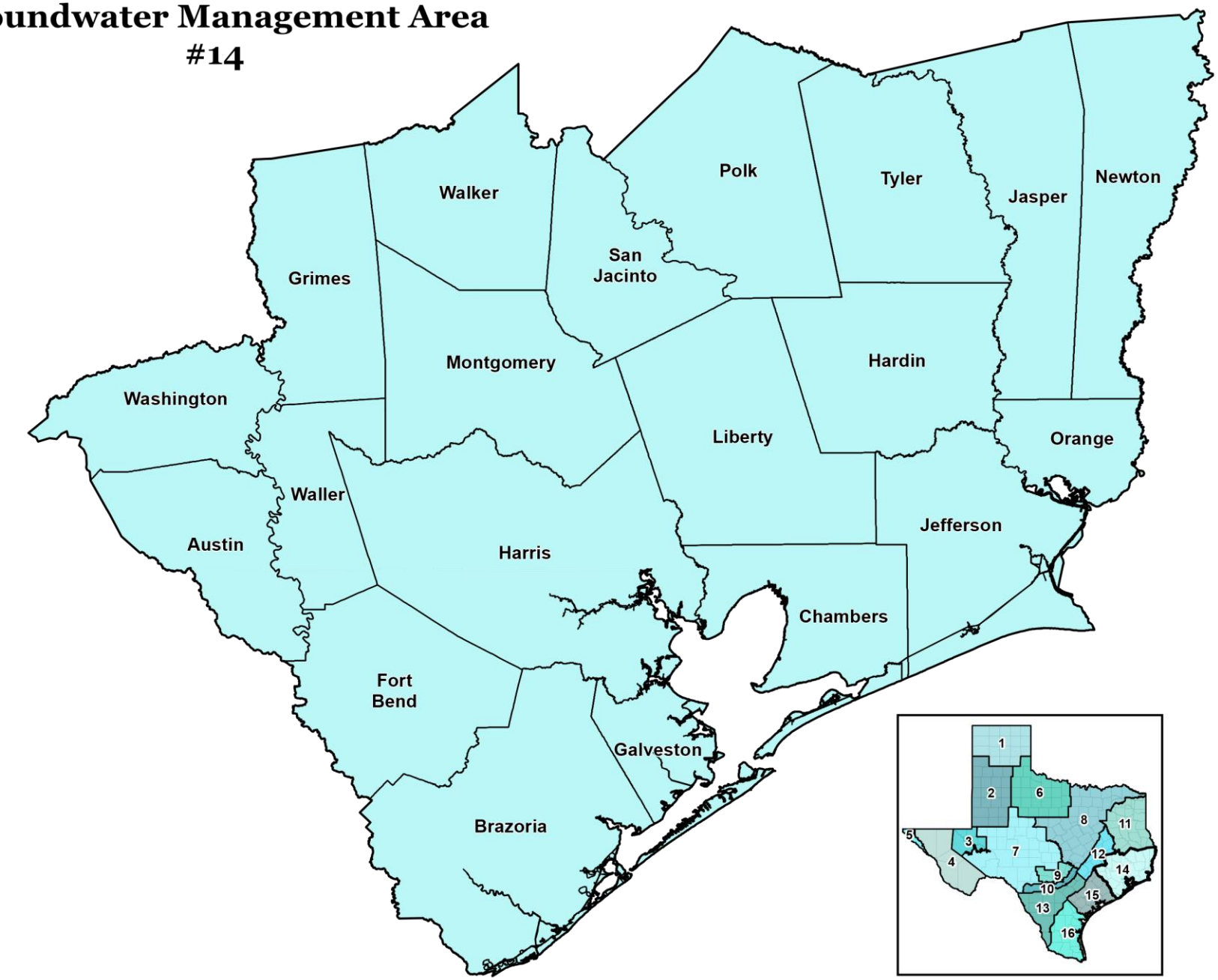
Status of Current Round of Joint Planning in Groundwater Management Area 14

Lone Star Groundwater Conservation District Water Planning Workshop

March 2, 2015

Groundwater Management Area #14



TEXAS WATER DEVELOPMENT BOARD
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Austin, Texas 78711-3231
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Miles

MISSION: The Texas Water Development Board's (TWDB) mission is to provide leadership, planning, financial assistance, information, and education for the conservation and responsible development of water for Texas.

Current Round of Joint-Planning

- Planning period is from September 1, 2010 – May 1, 2016
- Preliminary information for all eight factors included in Texas Water Code Section 36.108 (d) (1 – 8) have been presented to and considered by GCDs and interlocal participants in GMA 14
- Remaining efforts include
  - adopting proposed statements of desired future conditions – deadline May 1, 2016
  - 90 day public comment period, public hearing, and preparation of summary report in each GCD
  - Final adoption of statements of desired future conditions, preparation and submittal of explanatory report to TWDB, and TWDB review and calculation of estimates of modeled available groundwater, ’

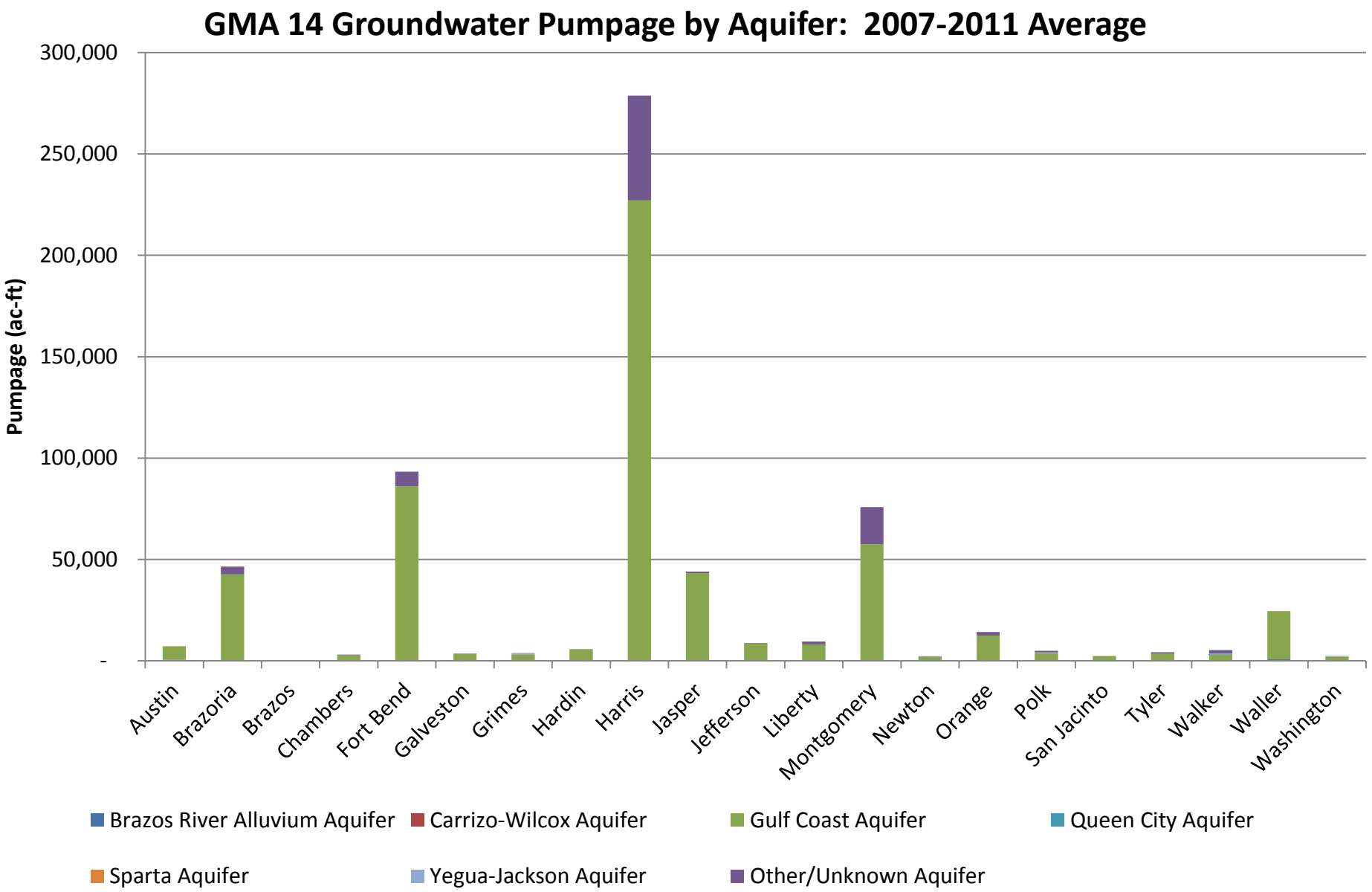
Texas Water Code Section 36.108 (d)(1-9)

- Preliminary Consideration of Nine Factors
  - Aquifer uses and conditions
  - Water supply needs and strategies
  - Hydrological conditions
  - Other environmental impacts
  - Impacts on subsidence
  - Socioeconomic impacts
  - Impacts on private property
  - Feasibility of achieving DFCs
  - Other relevant factors

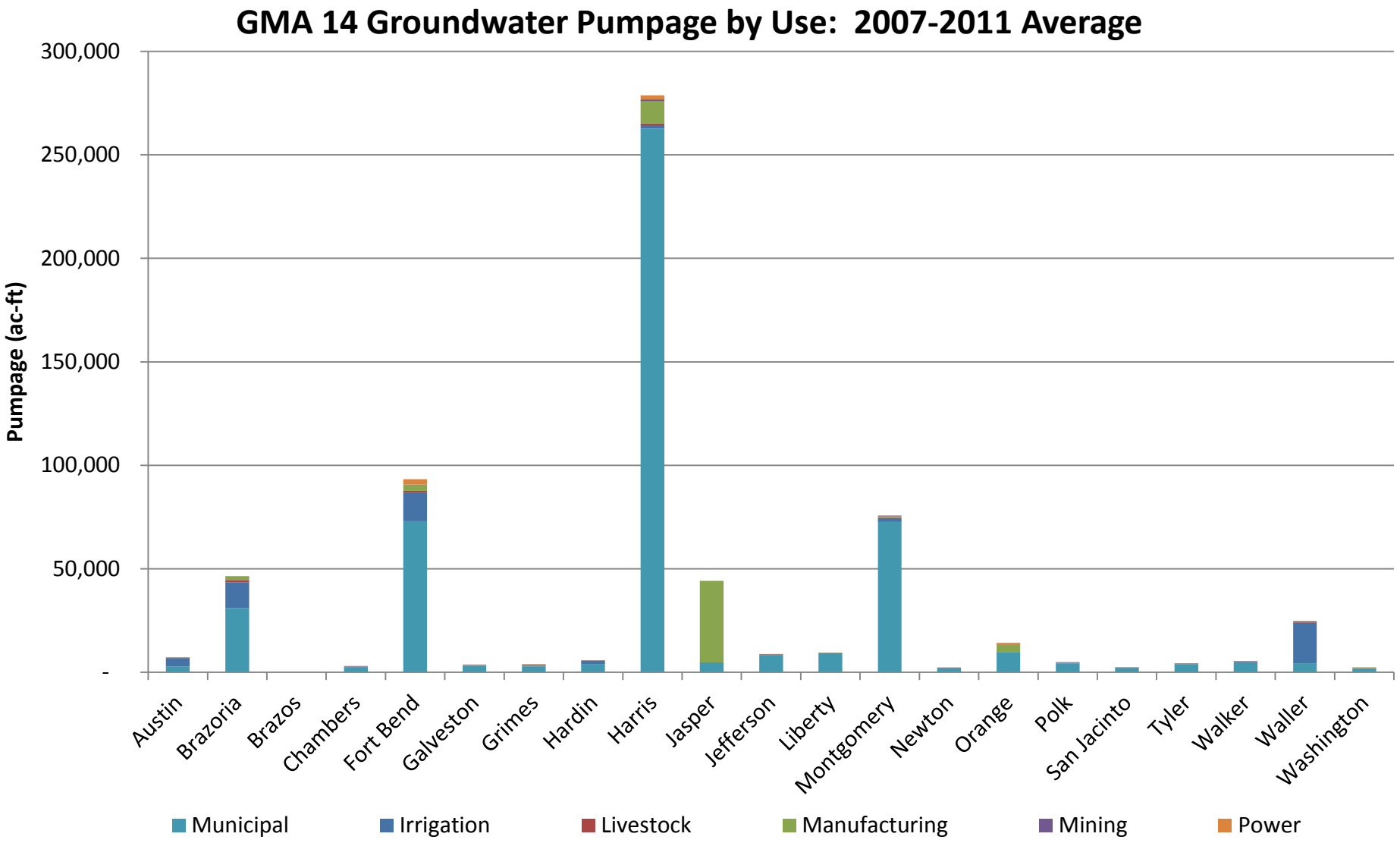
Texas Water Code Section 36.108 (d) (1)

- Consider aquifer uses or conditions within the management area, including conditions that differ substantially from one geographic area to another
  - Water Use Data from TWDB – Water Use Survey
  - Year 2000 to 2011
  - Summarized by County, Aquifer, and Use

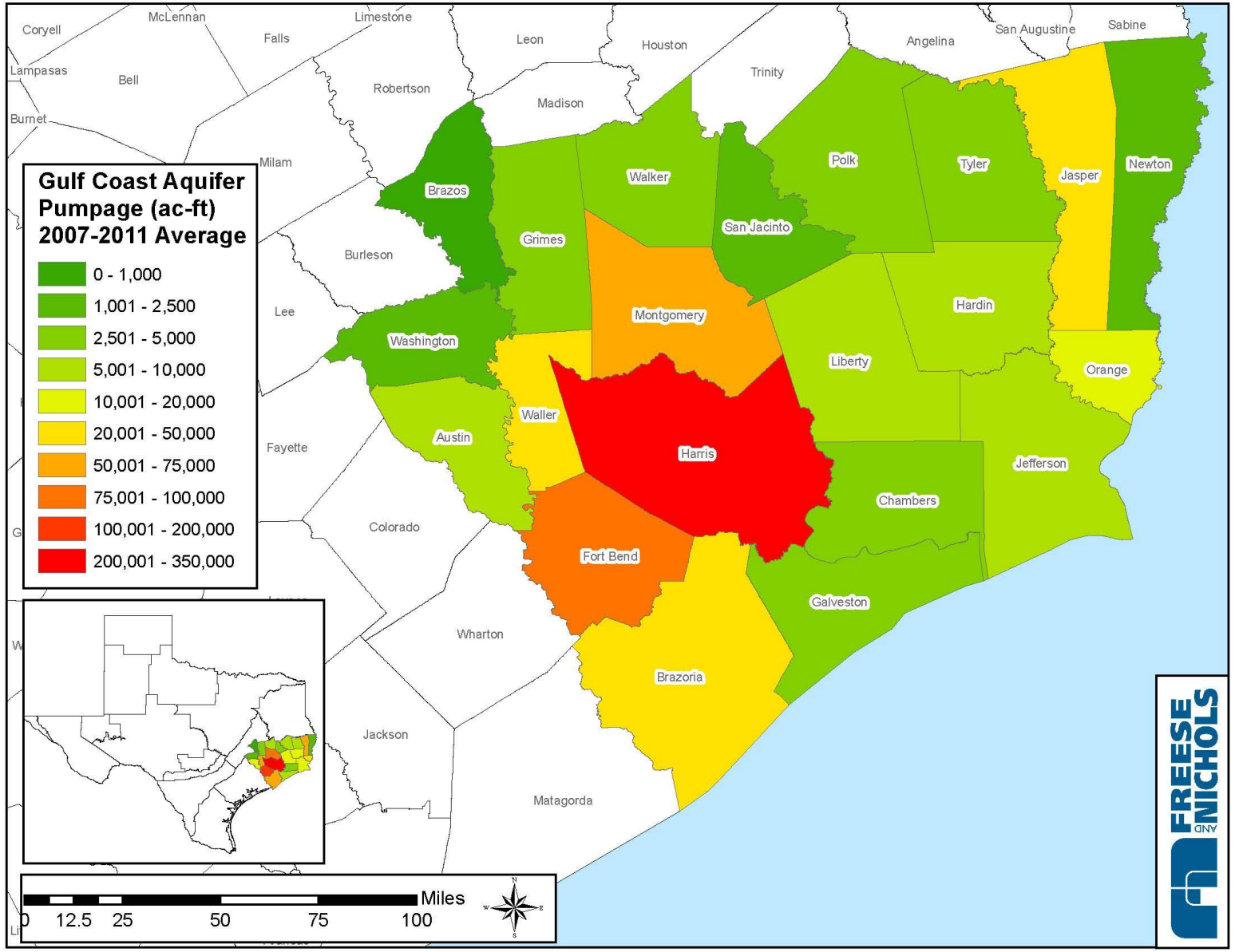
Aquifer Uses and Conditions



Aquifer Uses and Conditions



Aquifer Uses and Conditions



County	Aquifer	Groundwater Pumpage by County and Formation (ac-ft)												2007-2011 Summary (ac-ft)		
		2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Average	Median	Maximum
Austin	Brazos River Alluvium Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unknown	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Austin	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brazoria	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	[illegible]	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Brazoria	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Brazos	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]
	Subtotal Brazos	[illegible]	[illegible]	[illegible]	[illegible]	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]
Chambers	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Unknown	-	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Subtotal Chambers	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fort Bend	Brazos River Alluvium Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-	-	-	-	-	-
	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	-	[illegible]	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Fort Bend	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Galveston	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Galveston	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Grimes	Brazos River Alluvium Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Sparta Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	-	-	-	-	-	-	-	-
	Unknown	-	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Yegua-Jackson Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Grimes	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hardin	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Hardin	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Harris	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Harris	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jasper	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unknown	-	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Subtotal Jasper	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jefferson	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Jefferson	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Liberty	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	[illegible]	-	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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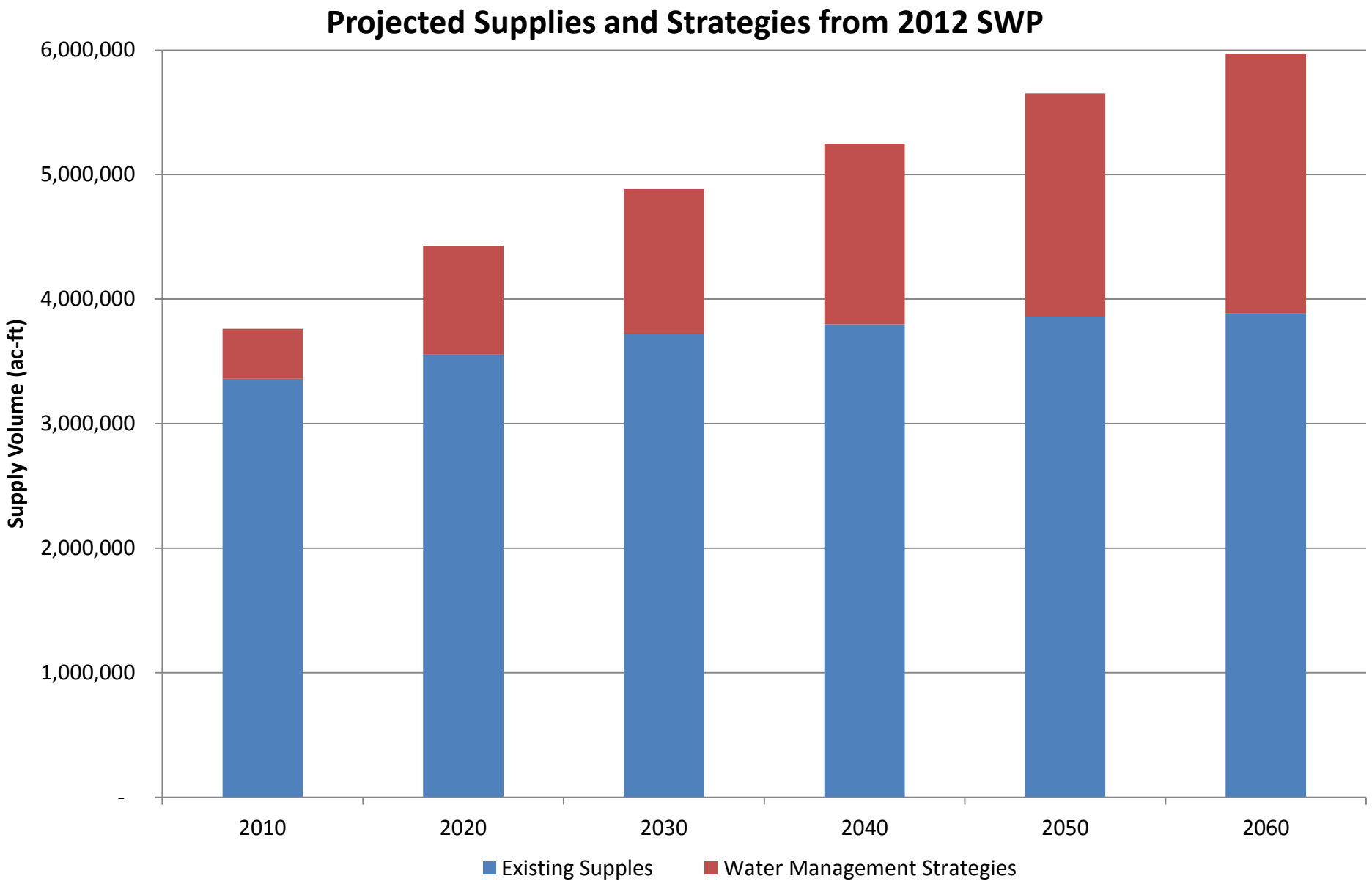
Montgomery	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Montgomery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Newton	Gulf Coast Aquifer	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other Aquifer	-	-	-	-	-	-	[illegible]	-	-	-	[illegible]	[illegible]	[illegible]	-	[illegible]
	Unknown	-	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Subtotal Newton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

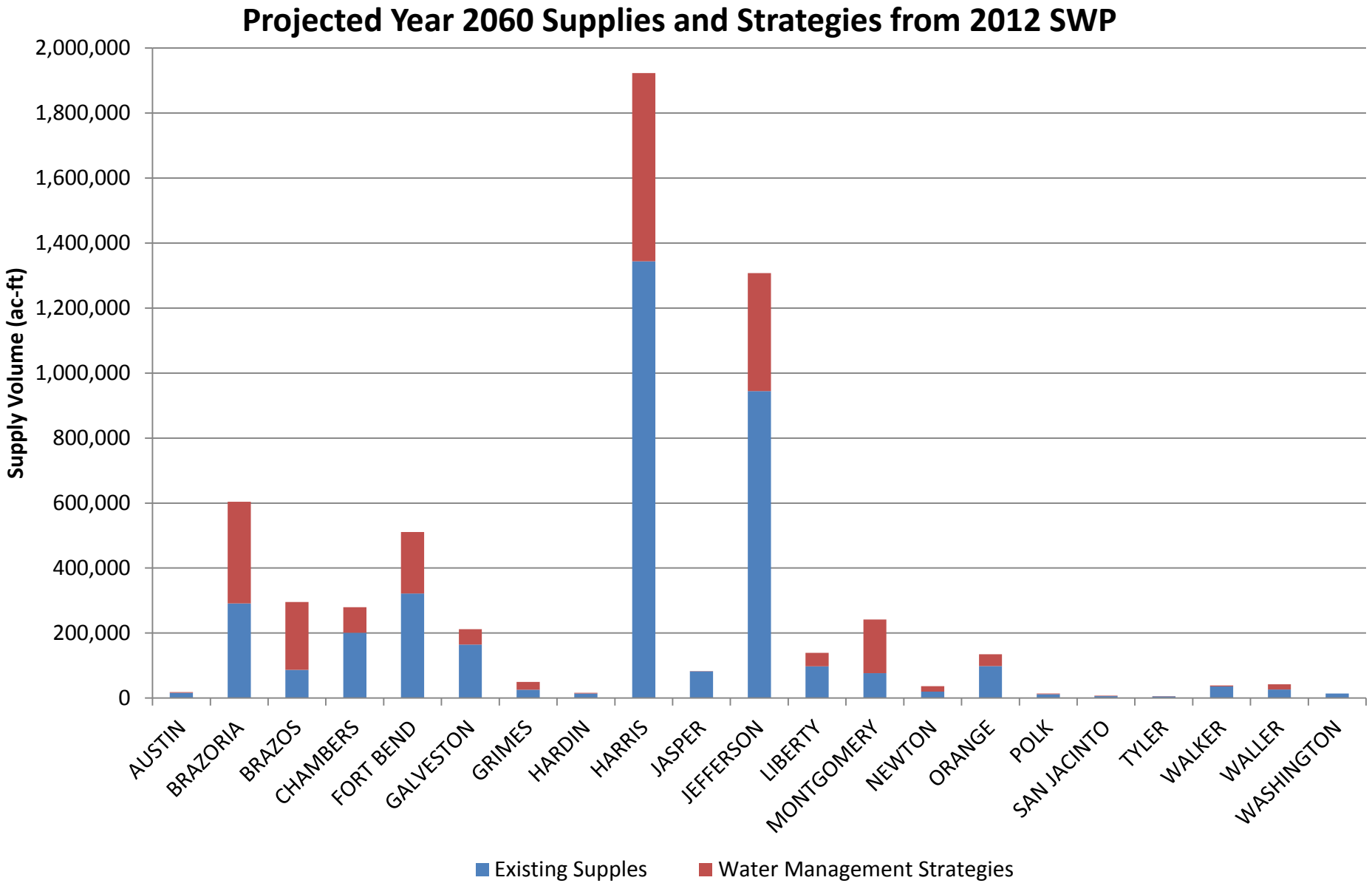
Texas Water Code Section 36.108 (d) (2)

- Consider the water supply needs and water management strategies included in the state water plan
  - 2012 State Water Plan
  - Year 2010 to 2060
  - Summarized by counties

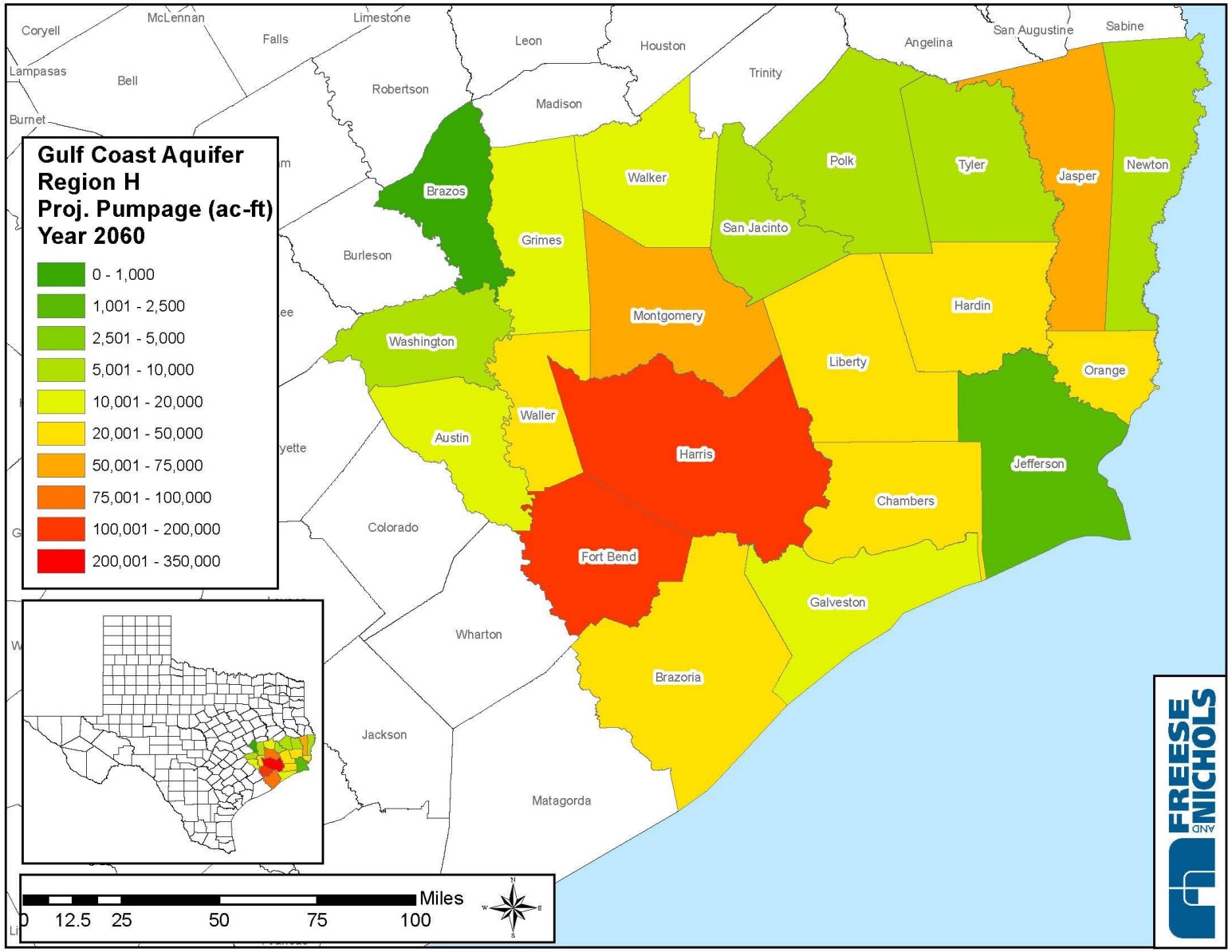
Water Supply Needs and Water Management Strategies



Water Supply Needs and Water Management Strategies



Water Supply Needs and Water Management Strategies



Consideration of Water Supply Needs and Water Management Strategies Included in the State Water Plan

County	2012 State Water Plan Needs and Strategies (ac-ft)																							
	2012 State Water Plan Projected Demands						Current Supplies						Needs						Water Management Strategies					
	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
AUSTIN	16,616	17,179	17,571	17,757	17,863	18,058	16,616	16,440	16,331	16,261	16,228	16,193	0	739	1,240	1,496	1,635	1,865	0	962	1,491	1,761	1,908	2,150
BRAZORIA	448,174	469,308	494,392	520,853	548,263	580,660	314,198	293,474	292,812	292,221	291,719	291,202	150,907	186,760	211,634	238,588	266,405	299,199	164,817	203,768	226,635	252,523	280,159	312,961
BRAZOS	*43,477*	*47,767*	*51,608*	*54,583*	*58,251*	*59,564*	*86,959*	*86,979*	*87,000*	*87,020*	*87,040*	*87,060*	*0*	*0*	*259*	*2,547*	*5,417*	*6,422*	*1,445*	*2,278*	*102,220*	*207,889*	*208,588*	*208,749*
CHAMBERS	176,883	181,120	185,435	189,737	194,119	198,800	202,657	201,973	201,850	201,646	201,412	201,130	42,520	47,412	50,831	54,251	57,612	61,065	59,891	64,828	68,257	71,685	75,056	78,520
FORT BEND	240,394	275,964	319,304	367,722	427,839	497,448	337,890	342,739	317,249	318,771	320,825	321,419	86	11,410	52,608	84,380	123,623	178,948	6,632	29,461	67,587	99,325	135,967	189,347
GALVESTON	103,061	106,679	110,509	113,658	116,855	121,863	164,440	164,596	164,629	164,595	164,559	164,541	16,307	16,466	17,787	18,758	19,884	21,276	16,374	41,817	43,534	44,488	45,634	47,026
GRIMES	17,538	37,650	39,317	40,986	43,168	46,377	25,763	25,755	25,752	25,750	25,753	25,755	0	15,300	16,862	18,497	20,608	23,718	960	17,058	17,791	23,496	23,636	23,846
HARDIN	19,376	20,713	21,416	22,126	22,941	23,705	14,296	14,296	14,296	14,296	14,296	14,271	8,955	9,931	10,540	11,148	11,790	12,317	1,270	1,422	1,422	1,423	1,576	1,577
HARRIS	1,130,740	1,255,987	1,363,515	1,470,305	1,575,123	1,663,105	1,304,458	1,250,335	1,260,704	1,297,813	1,337,286	1,343,683	51,413	194,925	270,301	323,711	375,414	458,509	78,503	217,852	288,712	377,301	433,195	579,144
JASPER	69,903	73,490	76,061	78,166	79,767	79,830	72,835	76,218	78,731	80,928	82,575	82,638	374	470	488	430	405	403	635	636	637	638	639	639
JEFFERSON	542,945	628,270	810,782	839,355	868,899	900,391	414,903	686,525	866,571	892,088	918,150	944,597	0	13,426	15,696	18,464	21,843	25,960	20,000	194,951	197,951	199,951	362,956	362,960
LIBERTY	106,213	108,875	110,898	113,089	115,651	118,751	107,218	105,109	103,549	101,851	99,848	97,594	11,846	15,142	18,687	22,539	27,061	32,363	27,533	30,649	32,839	35,196	37,948	41,248
MONTGOMERY	83,018	110,901	135,888	162,727	198,439	240,475	73,231	67,616	69,198	82,416	79,057	76,277	17,728	47,619	69,513	81,350	120,398	165,162	17,728	48,656	69,961	81,927	120,413	165,254
NEWTON	9,013	17,357	19,812	22,838	26,523	31,004	19,908	19,908	19,908	19,908	19,908	19,908	149	264	2,713	5,734	9,382	13,805	1,100	1,100	16,100	16,500	16,500	16,500
ORANGE	79,374	84,947	91,594	98,343	104,875	112,431	98,484	98,484	98,484	98,484	98,484	98,484	132	5,136	10,989	16,789	22,021	27,894	5,140	15,343	20,343	25,343	30,343	36,343
POLK	7,561	8,498	9,212	9,730	10,260	10,842	11,944	11,933	11,929	11,929	11,938	11,945	208	598	947	1,222	1,494	1,790	208	917	1,227	1,734	1,853	1,993
SAN JACINTO	4,182	4,648	4,999	5,158	5,247	5,296	6,064	6,083	6,099	6,109	6,107	6,003	0	300	533	695	793	869	19	690	1,091	1,158	1,188	1,244
TYLER	3,079	3,406	3,599	3,632	3,603	3,608	5,328	5,328	5,328	5,328	5,328	5,328	0	142	239	251	232	232	0	551	551	551	551	551
WALKER	20,784	20,981	22,088	21,562	21,781	21,959	39,021	36,864	36,944	36,249	36,091	35,780	0	815	1,655	1,975	2,384	2,853	0	884	1,725	2,052	2,464	2,935
WALLER	29,799	31,101	32,578	34,204	36,223	38,595	29,717	29,175	29,638	29,625	28,046	26,240	82	1,926	2,940	4,579	8,177	12,355	82	2,097	3,137	4,802	13,447	15,854
WASHINGTON	9,142	9,483	9,670	9,755	9,878	10,030	13,686	13,686	13,686	13,686	13,686	13,686	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2,961,272	3,514,324	3,930,248	4,196,286	4,485,568	4,782,792	3,359,616	3,553,516	3,720,688	3,796,974	3,858,316	3,883,734	300,707	568,781	756,462	907,382	1,096,576	1,347,005	402,337	875,920	1,163,211	1,449,741	1,793,961	2,088,841

*Values for Brazos County include the portions of the county outside of GMA 14.

Consideration of Water Supply Needs and Water Management Strategies Included in the State Water Plan

County	Water Management Strategy	Water Management Strategy Supply Volume (ac-ft)					
		2010	2020	2030	2040	2050	2060
Harris	Expanded Use of Groundwater	-	15,481	27,659	27,693	27,727	27,560
	Interim Strategies	15	-	-	-	-	-
	Subtotal Groundwater	*15*	*15,481*	*27,659*	*27,693*	*27,727*	*27,560*
	Allens Creek Lake/Reservoir	-	15	83	336	384	622
	CDH Groundwater Reduction Plan	-	-	-	-	-	-
	Contract Expansions	-	108,852	66,039	51,840	42,538	31,971
	Houston Indirect Reuse	-	-	-	66,420	114,679	128,801
	Missouri City Groundwater Reduction Plan	-	386	386	386	386	386
	Municipal Conservation	37,292	46,836	51,902	56,748	61,656	66,947
	New Contract From Existing Supply	23,008	31,264	38,732	54,777	54,805	54,849
	NHCRWA Groundwater Reduction Plan	-	-	-	-	-	-
	NHCRWA Indirect Reuse	-	-	-	7,300	16,300	16,300
	Reallocate Existing Supply	18,253	15,276	7,308	19,232	30,220	96,881
	TRA to Houston Contract	-	-	93,744	86,519	75,164	75,164
	Wastewater Reclamation For Mun. Irrigation	-	-	3,268	6,616	10,027	13,431
	Wastewater Reuse For Industry	-	-	-	-	-	67,200
	WHCRWA Groundwater Reduction Plan	(65)	(258)	(409)	(566)	(751)	(968)
	Subtotal Other Supplies	*78,488*	*202,371*	*261,053*	*349,608*	*405,408*	*551,584*
	Total Harris County	***78,503***	***217,852***	***288,712***	***377,301***	***433,135***	***579,144***
Jasper	New Wells - Gulf Coast Aquifer	82	82	82	82	82	82
	Overdraft Gulf Coast Aquifer	550	550	550	550	550	550
	Subtotal Groundwater	*632*	*632*	*632*	*632*	*632*	*632*
	Municipal Conservation	3	4	5	6	7	7
	Subtotal Other Supplies	*3*	*4*	*5*	*6*	*7*	*7*
	Total Jasper County	**635**	**636**	**637**	**638**	**639**	**639**
Jefferson	New Wells - Gulf Coast Aquifer	-	-	-	-	5	9
	Subtotal Groundwater	-	-	-	-	*5*	*9*
	Permit Ammendment For Sam Rayburn	-	28,000	28,000	28,000	28,000	28,000
	Purchase Water From Provider (1)	-	25,951	25,951	25,951	25,951	25,951
	Purchase Water From Provider (2)	-	-	-	-	36,000	36,000
	Reallocation Of Flood Storage (Rayburn)	-	-	-	-	122,000	122,000
	Saltwater Barrier Conjunctive Operation With Rayburn/Steinhagen	-	111,000	111,000	111,000	111,000	111,000
	Wholesale Customer Conservation	20,000	30,000	33,000	35,000	40,000	40,000
	Subtotal Other Supplies	*20,000*	*194,951*	*197,951*	*199,951*	*362,951*	*362,951*
	Total Jefferson County	***20,000***	***194,951***	***197,951***	***199,951***	***362,956***	***362,960***
Liberty	Expanded Use of Groundwater	-	2,537	4,590	6,809	9,399	12,544
	Subtotal Groundwater	-	*2,537*	*4,590*	*6,809*	*9,399*	*12,544*
	Irrigation Conservation	20,876	20,876	20,876	20,876	20,876	20,876
	Municipal Conservation	-	539	641	744	868	995
	Reallocate Existing Supply	6,657	6,697	6,732	6,767	6,805	6,833
	Subtotal Other Supplies	*27,533*	*28,112*	*28,249*	*28,387*	*28,549*	*28,704*
	Total Liberty County	***27,533***	***30,649***	***32,839***	***35,196***	***37,948***	***41,248***
Montgomery	Expanded Use of Groundwater	-	5,615	4,471	5,614	9,034	11,820
	Interim Strategies	13,268	-	-	-	-	-
	MUD 8 And 9 Reuse	-	657	816	1,120	1,120	1,120
	Subtotal Groundwater	*13,268*	*6,272*	*5,287*	*6,734*	*10,154*	*12,940*
	Municipal Conservation	4,460	6,007	7,384	8,838	10,795	13,089
	SJRA WMP	-	36,377	55,538	54,582	53,581	52,534
	TRA to SJRA Contract	-	-	-	7,935	39,096	76,476
	Wastewater Reclamation For Mun. Irrigation	-	-	1,752	3,838	6,787	10,215
	Subtotal Other Supplies	*4,460*	*42,384*	*64,674*	*75,193*	*110,259*	*152,314*

Texas Water Code Section 36.108 (d) (3)

- Consider hydrological conditions, including for each aquifer in the management area, the total estimated recoverable storage as provided by the executive administrator, and the annual average recharge, inflows, and discharge
  - Location
  - Water surfaces
  - Long-term trends
  - Water budget (recharge, discharge to surface, inflows/outflows)
  - Total Estimated Recoverable Storage (from TWDB)

Texas Water Code Section 36.108 (d) (3)

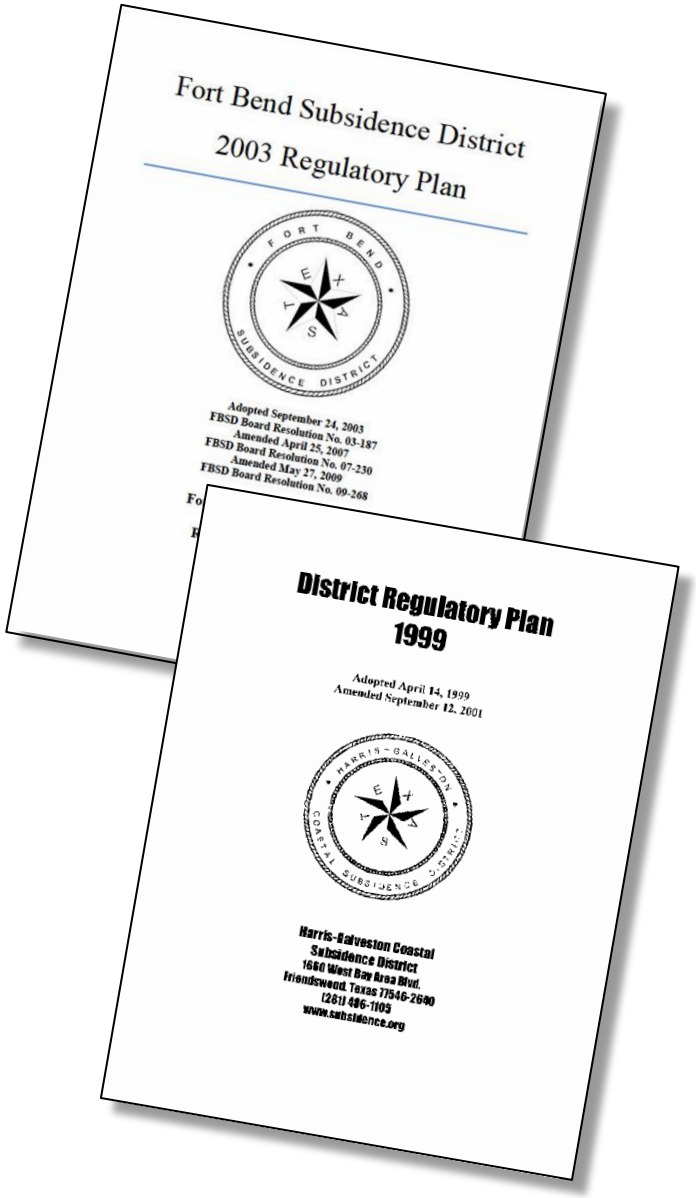
- Consider hydrological conditions, including for each aquifer in the management area, the total estimated recoverable storage as provided by the executive administrator, and the annual average recharge, inflows, and discharge
  - Hydrogeology and Simulation of Groundwater Flow and Land-Surface Subsidence in the Northern Part of the Gulf Coast Aquifer (USGS, Rev. 2012)
  - Northern Gulf Coast GAM Run
  - TWDB GAM Task 13-037

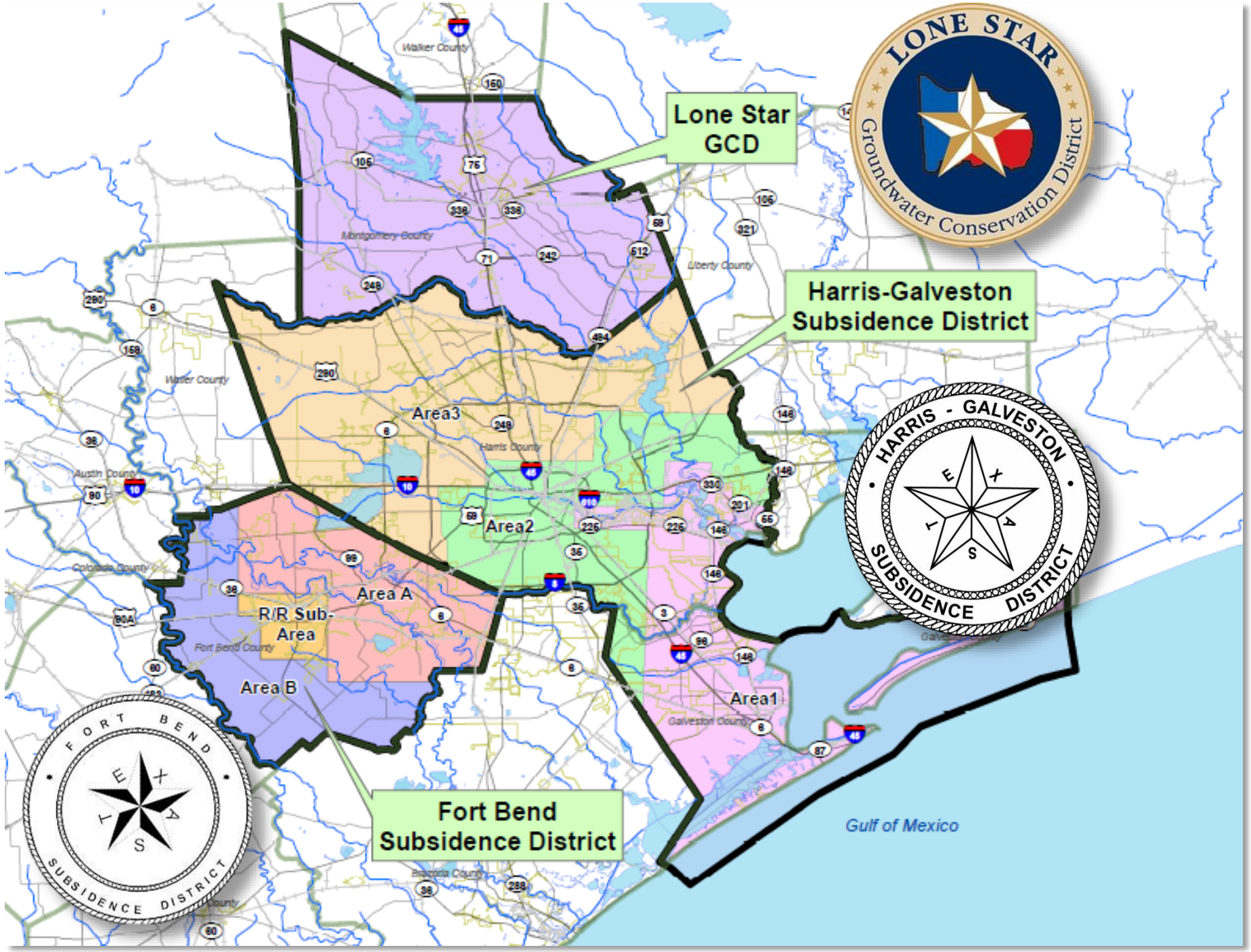
Regional Groundwater Update Project (RGUP)
GMA 14
April 24, 2013

- Initiated by HGSD and FBSD in 2010, with Lone Star GCD participation later
- Also referred to as the Houston Area Groundwater Model and now officially the North Gulf Coast Groundwater Availability Model
- Utilizes latest data and models as basis for evaluating current and future regulations
  - 2010 U.S. Census
  - Improved groundwater modeling capability
  - 10 additional years of water level and subsidence data

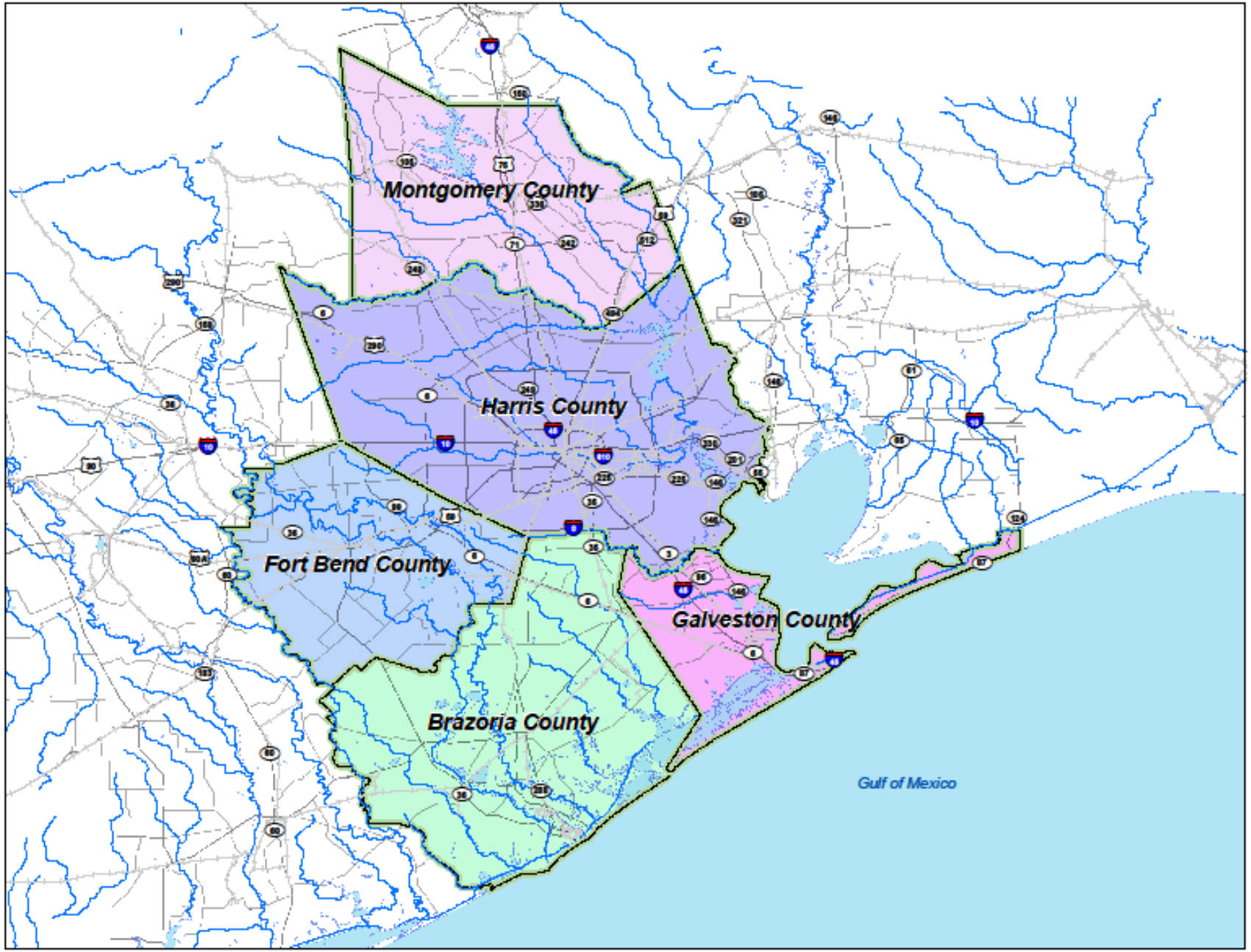
RGUP Drivers

- The landscape has changed since the HGSD 1999 Regulatory Plan:
  - Adoption of the FBSD 2003 Regulatory Plan
  - Creation of the Lone Star Groundwater Conservation District
  - Creation of the Brazoria County Groundwater Conservation District
  - Creation of the Bluebonnet Groundwater Conservation District
  - Establishment of Groundwater Management Areas (GMA-14)
  - TWDB Northern Gulf Coast Groundwater Availability Model (NGC-GAM)
  - Mature State and Regional Water Planning Process




Lone Star GCD
Harris-Galveston Subsidence District
Fort Bend Subsidence District
Area3
Area2
Area A
R/R Sub-Area
Area B
Area1
Gulf of Mexico
Walker County
Montgomery County
Liberty County
Waller County
Harris County
Austin County
Colorado County
Fort Bend County
Galveston County
Brazoria County

Project Focus Area



RGUP Objectives

- Updates population and water demand projections in the project focus area
- Recalibrate the parameters in the groundwater availability and subsidence models
- HGSD/FBSD: Updated data and models to evaluate the 1999 & 2003 Regulatory Plans and make any necessary changes to the regulations for the upcoming decades

Hydrogeology and Simulation of Groundwater Flow and Land-Surface Subsidence in the Northern Part of the Gulf Coast Aquifer System, Texas, 1891–2009

April 30, 2014

by Mark C. Kasmarek

http://pubs.usgs.gov/sir/2012/5154/

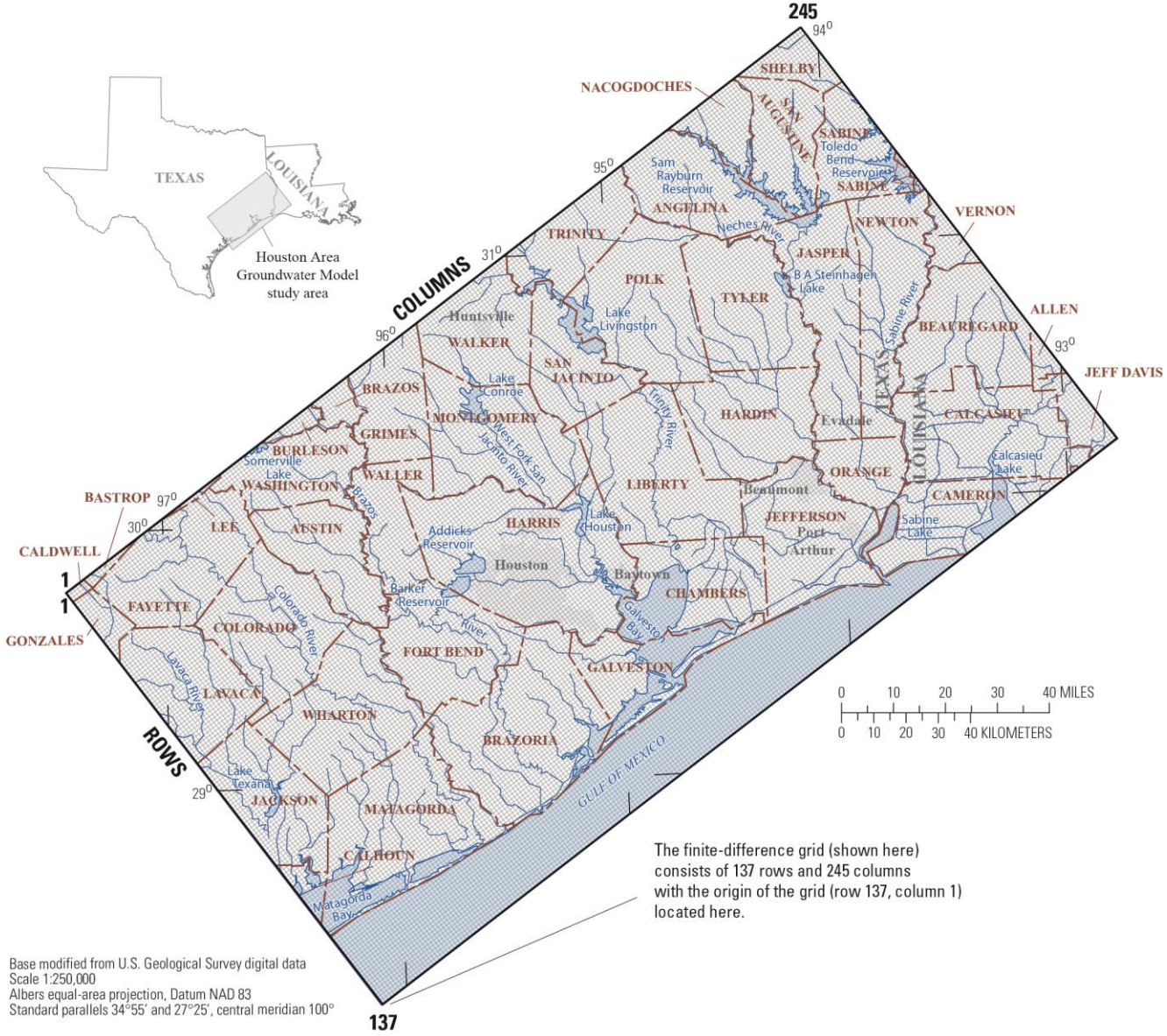
Prepared in cooperation with the
Harris-Galveston Subsidence District,
Fort Bend Subsidence District, and
Lone Star Groundwater Conservation District

Acknowledgements:
Brazoria County Groundwater Conservation District
Texas Water Development Board
LBG-Guyton Associates
Freese and Nichols, Inc.
Fugro–McClelland (Southwest), Inc.

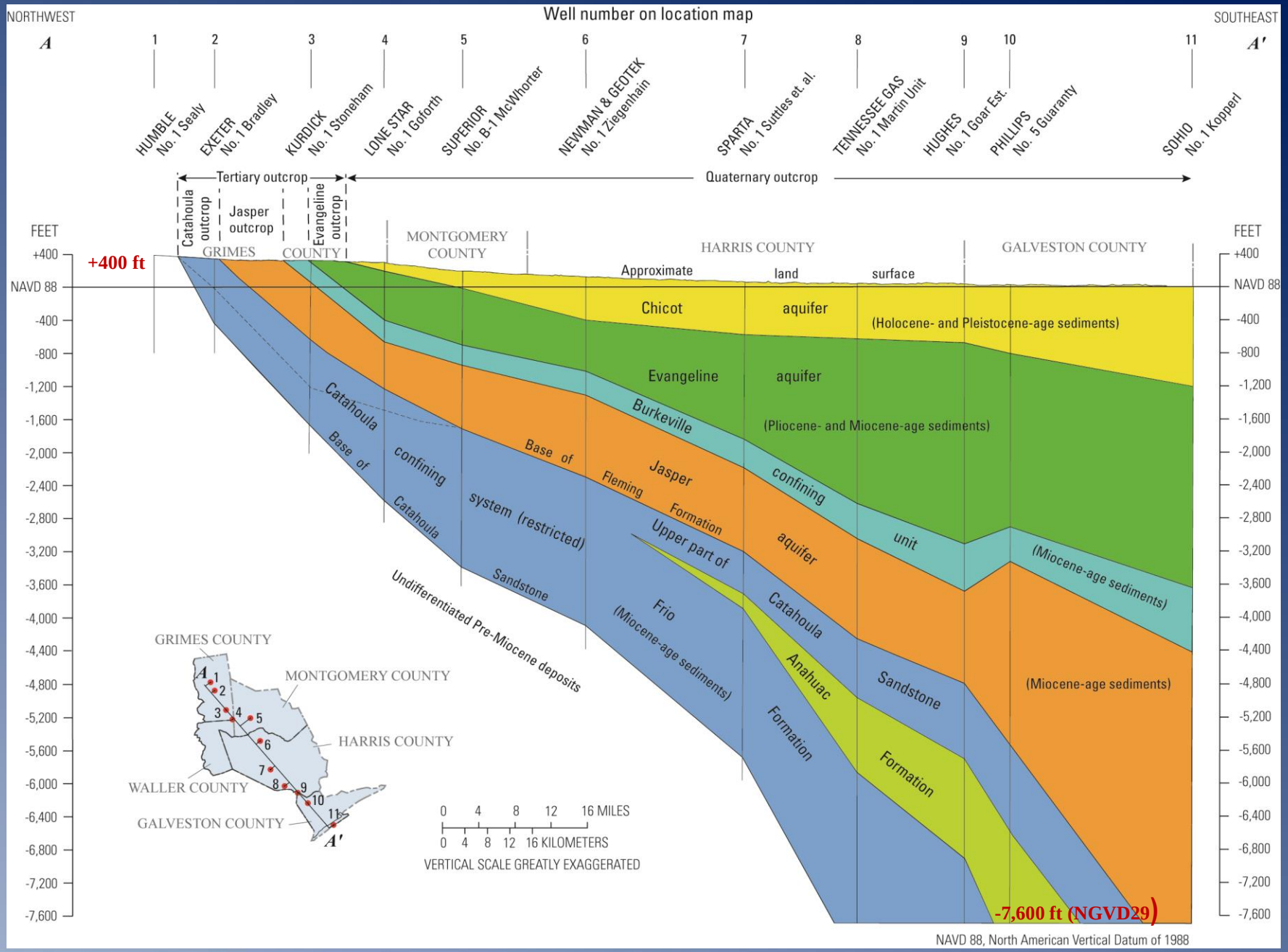
Houston Area Groundwater Model (HAGM 2012)

- Finite-difference computer code MODFLOW-2000 (Harbaugh and others, 2000)
- Simulates groundwater flow, land-surface subsidence, and drawdown on a regional scale in the northern Gulf Coast Aquifer System
- Predevelopment (1891) through 2009
- Subsidence and Aquifer-System Compaction (SUB) package designed for the MODFLOW-2000 model (Hoffman and others, 2003)
  - Simulation of clay compaction and storage
  - Chicot aquifer (Layer 1)
  - Evangeline aquifer (Layer 2)
  - Burkeville confining unit (Layer 3)
  - Jasper aquifer (Layer 4)

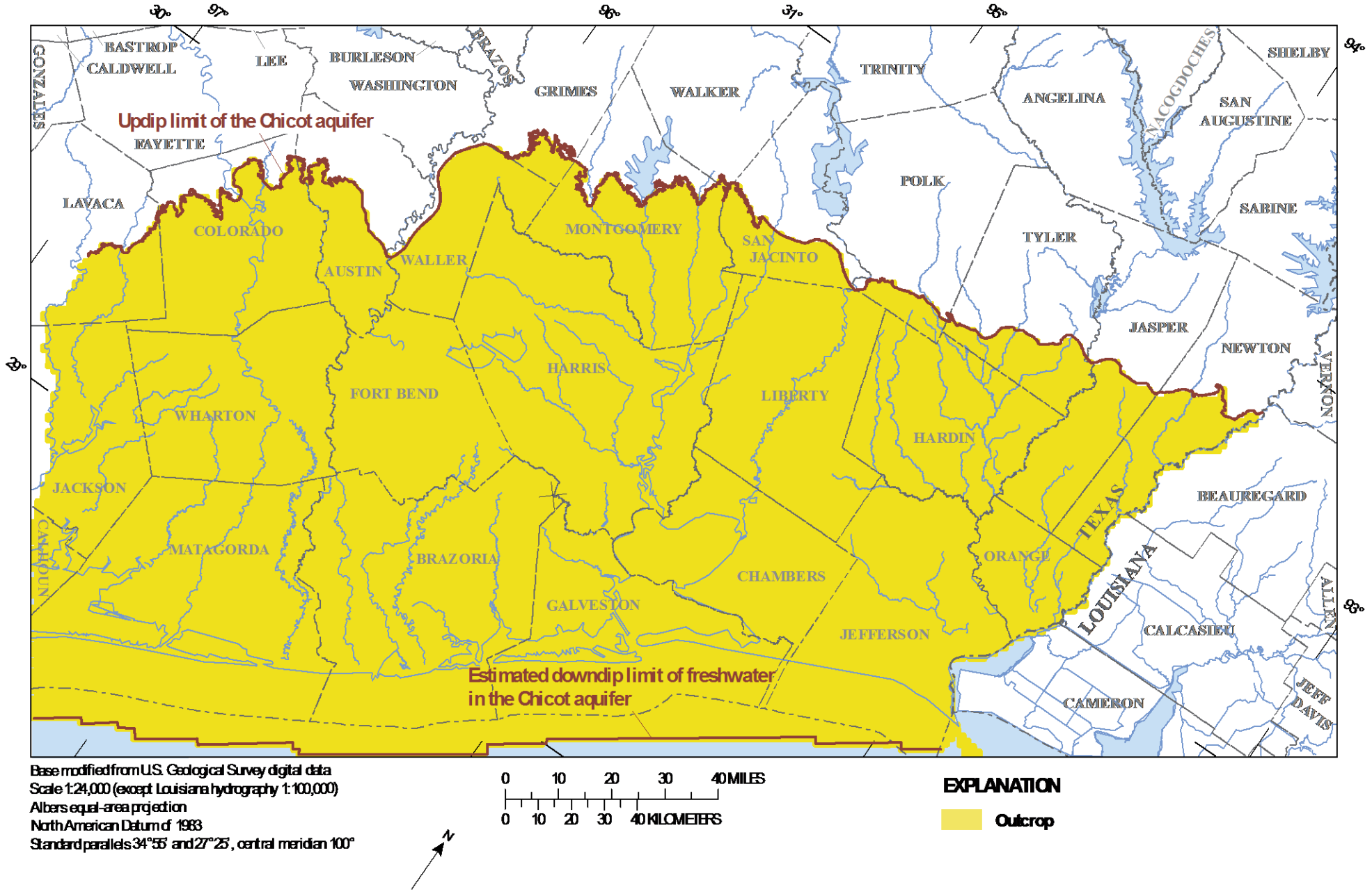
HAGM finite-difference grid, 33,565 cells, and 1-square-mile grid cell size



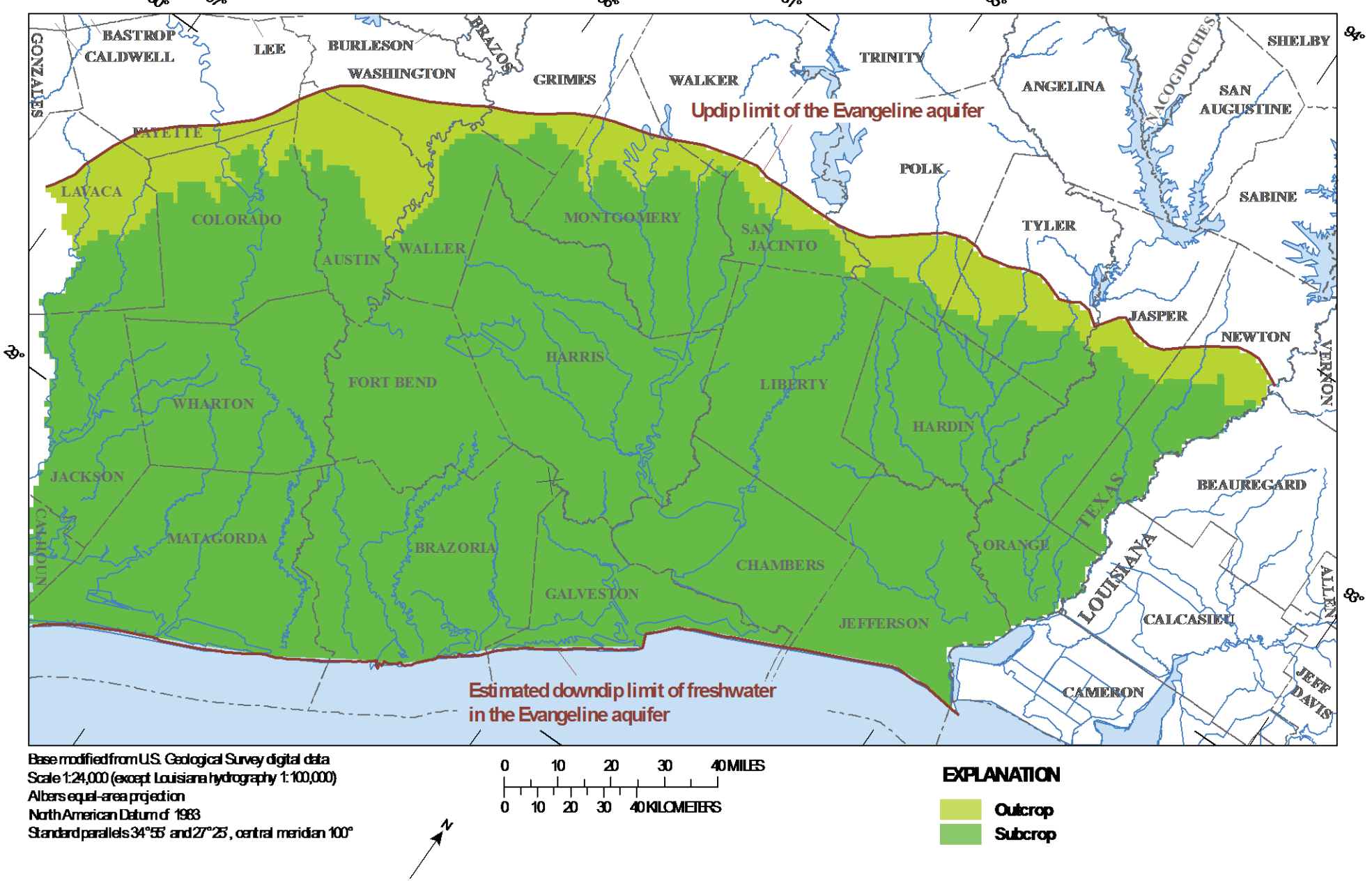
Geologic (stratigraphic) units			Hydrogeologic units	Model layer
System	Series	Formation	Aquifers and confining units	
Quaternary	Holocene	Alluvium	Chicot aquifer	1
	Pleistocene	Beaumont Formation		
		Montgomery Formation		
		Bentley Formation		
		Willis Formation		
Tertiary	Pliocene	Goliad Sand	Evangeline aquifer	2
	Miocene	Fleming Formation	Burkeville confining unit	3
		Oakville Sandstone	Jasper aquifer	4
		Catahoula Sandstone		
		Anahuac Formation[1]		
		Frio Formation[1]	Catahoula confining system	



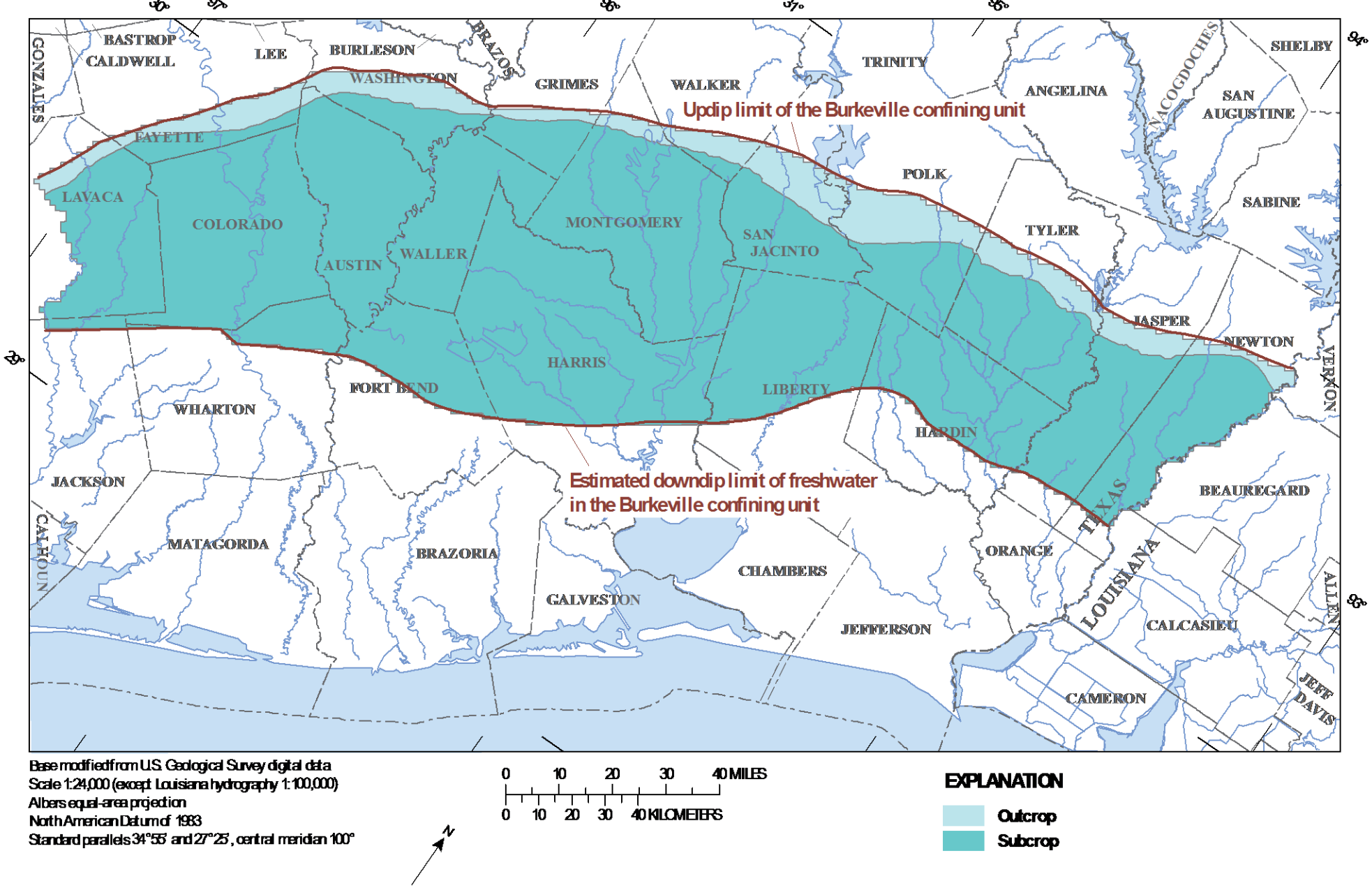
Hydrogeologic Section A–A’ (modified from Baker, 1979)



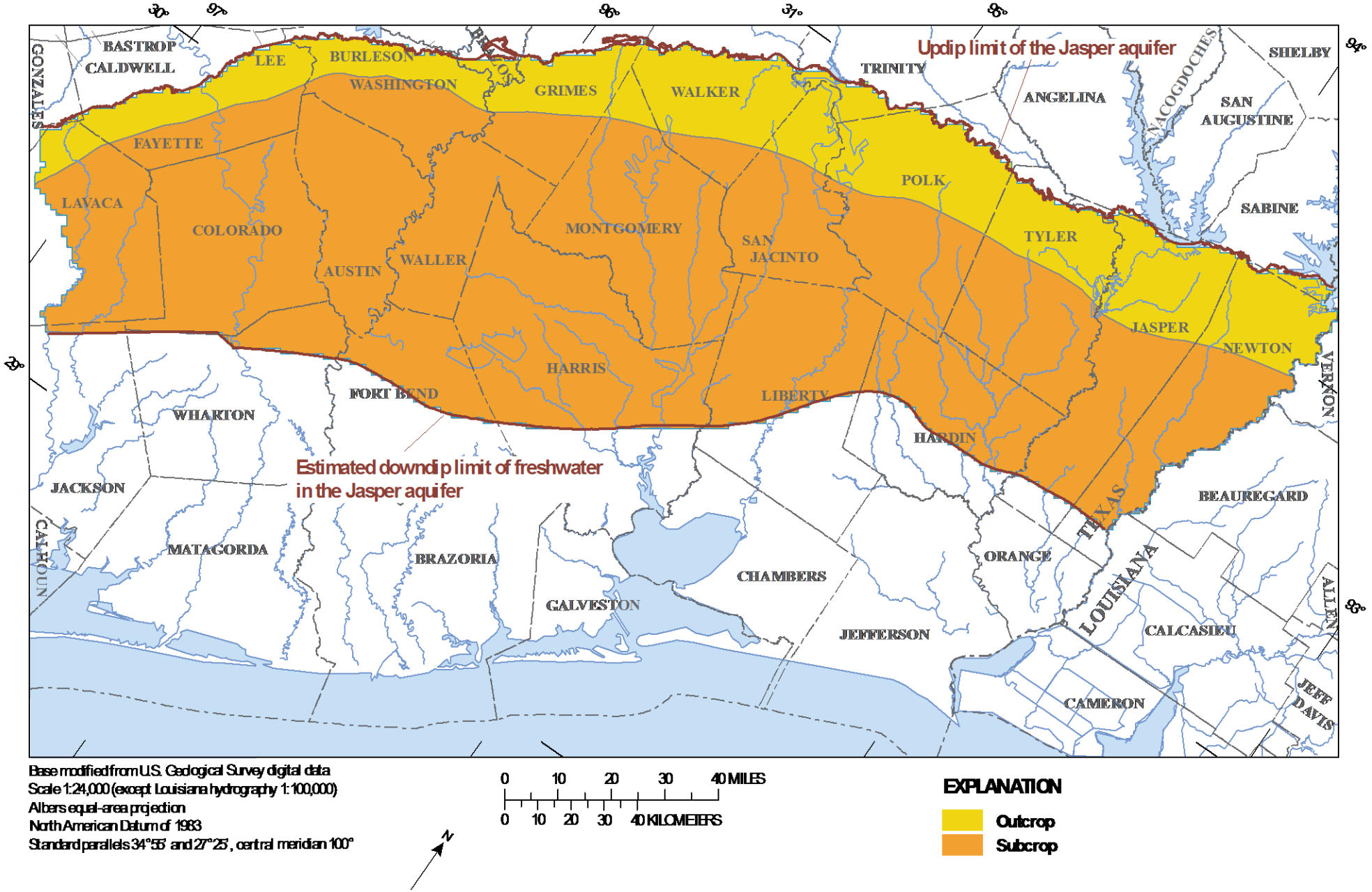
Chicot Aquifer Outcrop



Evangeline Aquifer Outcrop and Subcrop



Burkeville Confining Unit Outcrop and Subcrop



Jasper Aquifer Outcrop and Subcrop

HAGM/GAM Differences

- The HAGM was constructed from the previously published USGS Northern Gulf Coast Aquifer System Groundwater Availability Model (GAM) based on a regional scale. (http://pubs.usgs.gov/sir/2004/5102/)

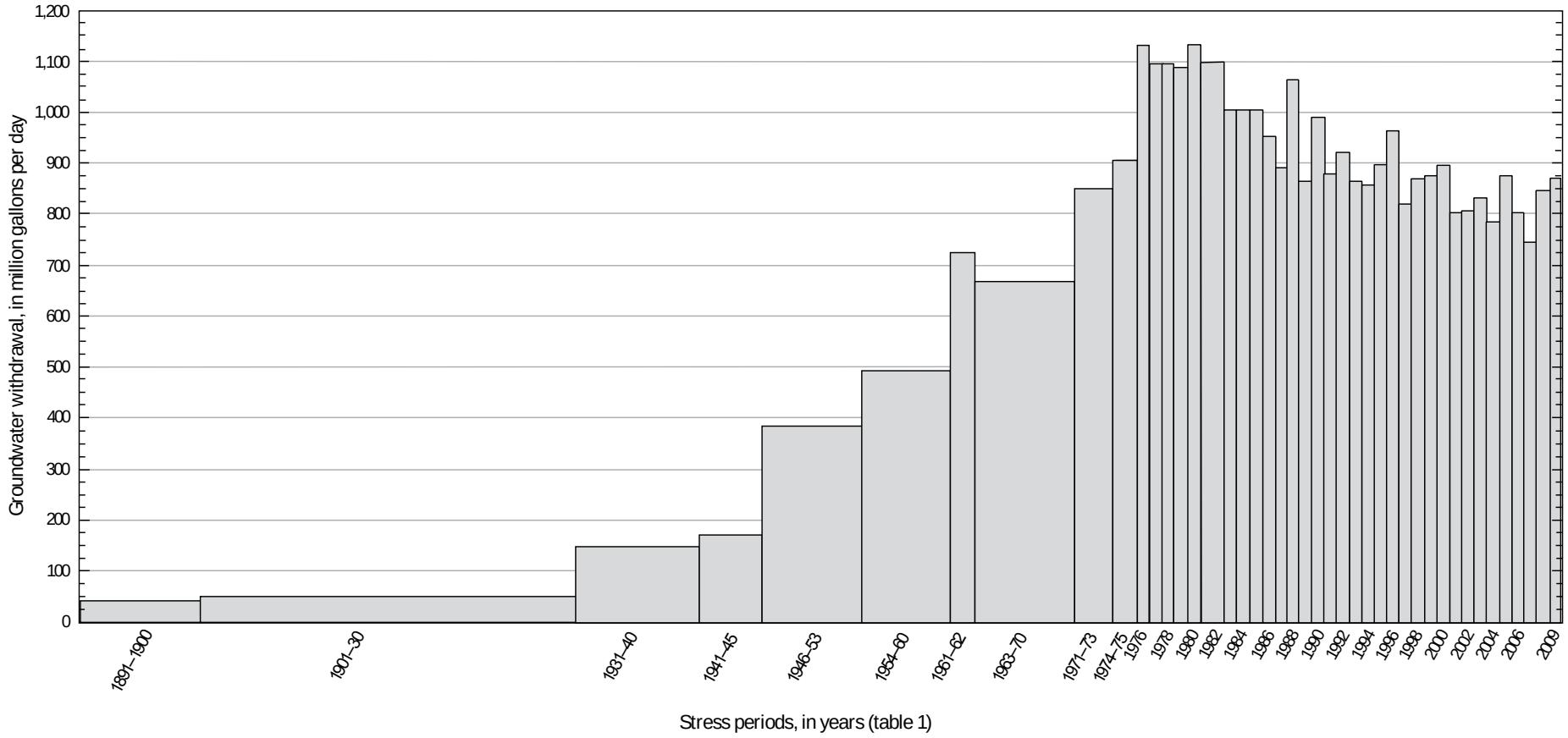
HAGM (2012)	GAM (2004)
MODFLOW-2000	MODFLOW-96
MODFLOW SUB Package	MODFLOW Interbed-Storage (IBS) package
Period 1891–2009	Period 1891–2000
497 Head Targets (2009)	422 Head Targets (2000)
Simulated Subsidence in layers 1–4	Simulated Subsidence in layers 1–2

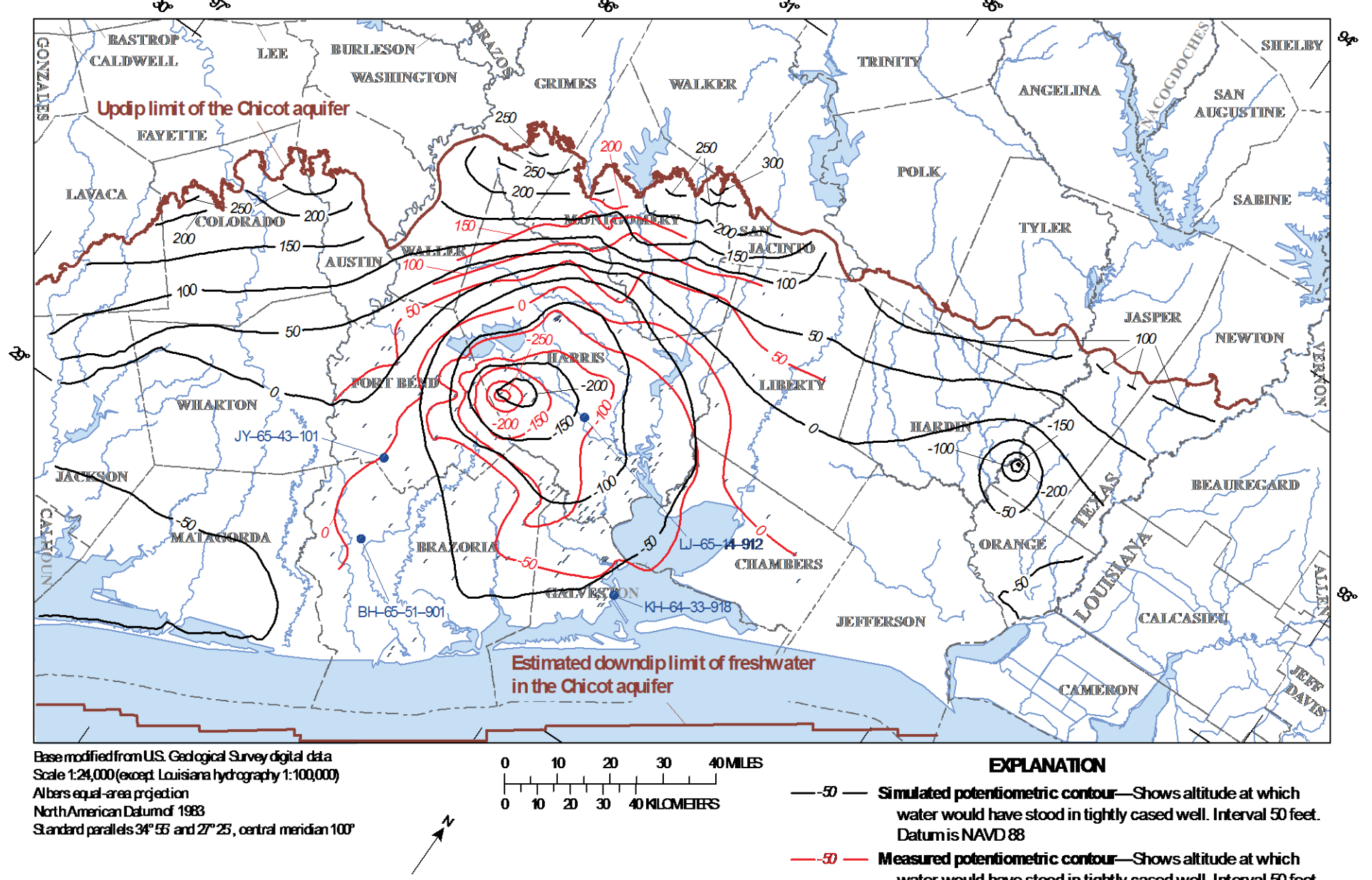
HAGM/GAM Modifications

- Updated 2001–09 Primary Water-Use Data Sources:
  - Harris–Galveston Subsidence District (Harris and Galveston Counties)
  - Fort Bend Subsidence District (Fort Bend County)
  - Lone Star Groundwater Conservation District (Montgomery County)
  - Texas Water Development Board (TWDB) (multiple counties and years)
  - San Jacinto River Authority (Montgomery County)

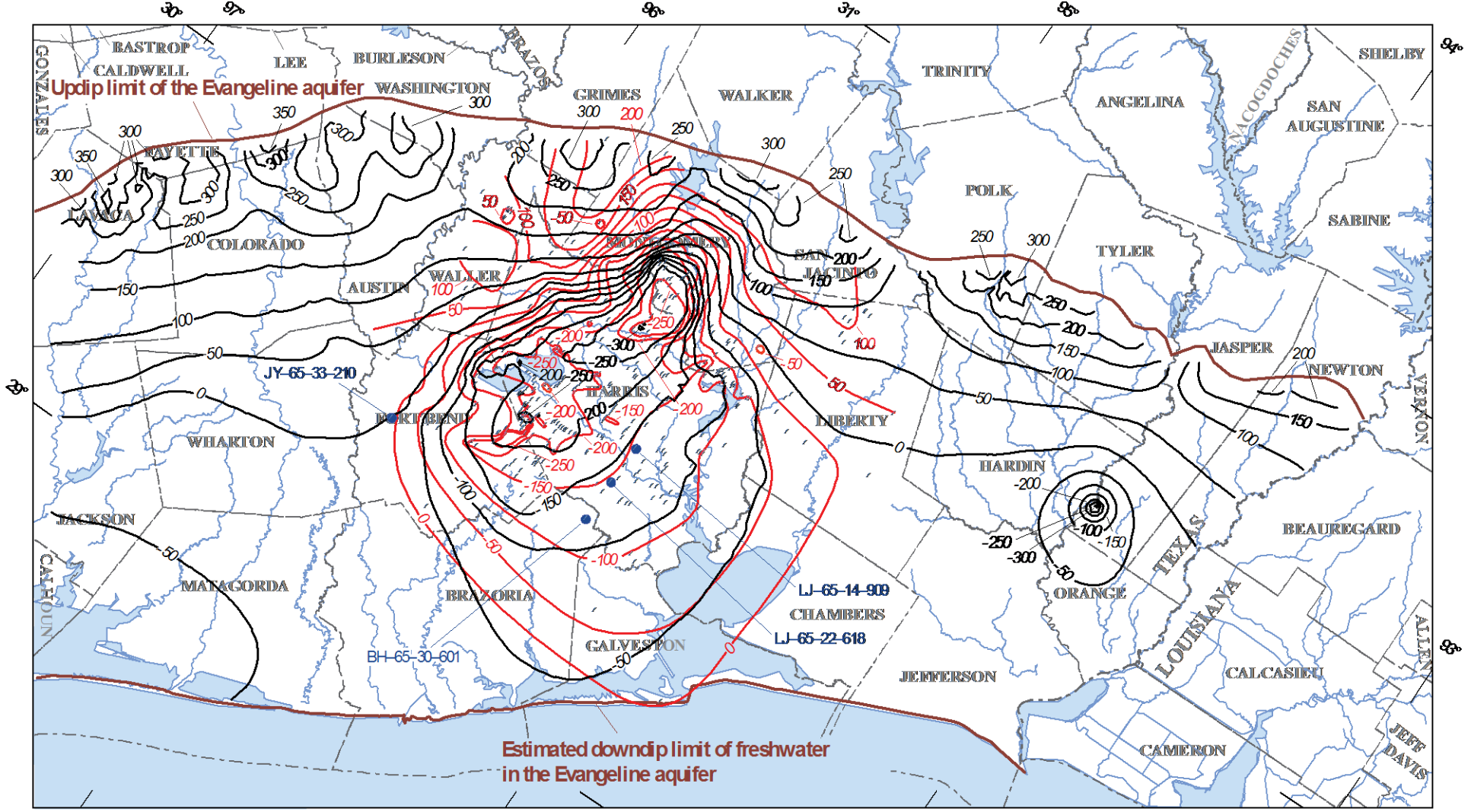
HOUSTON AREA GROUNDWATER MODEL MODIFICATIONS AND CALIBRATION RESULTS

HAGM Water-Use by Stress Periods, 1891–2009





2009 Chicot Aquifer Potentiometric Surfaces



Base modified from U.S. Geological Survey digital data
Scale 1:24,000 (except Louisiana hydrography 1:100,000)
Albers equal-area projection
North American Datum of 1983
Standard parallels 34° 55' and 27° 25', central meridian 100°

0 10 20 30 40 MILES
0 10 20 30 40 KILOMETERS

N

2009 Evangeline Aquifer Potentiometric Surfaces

EXPLANATION

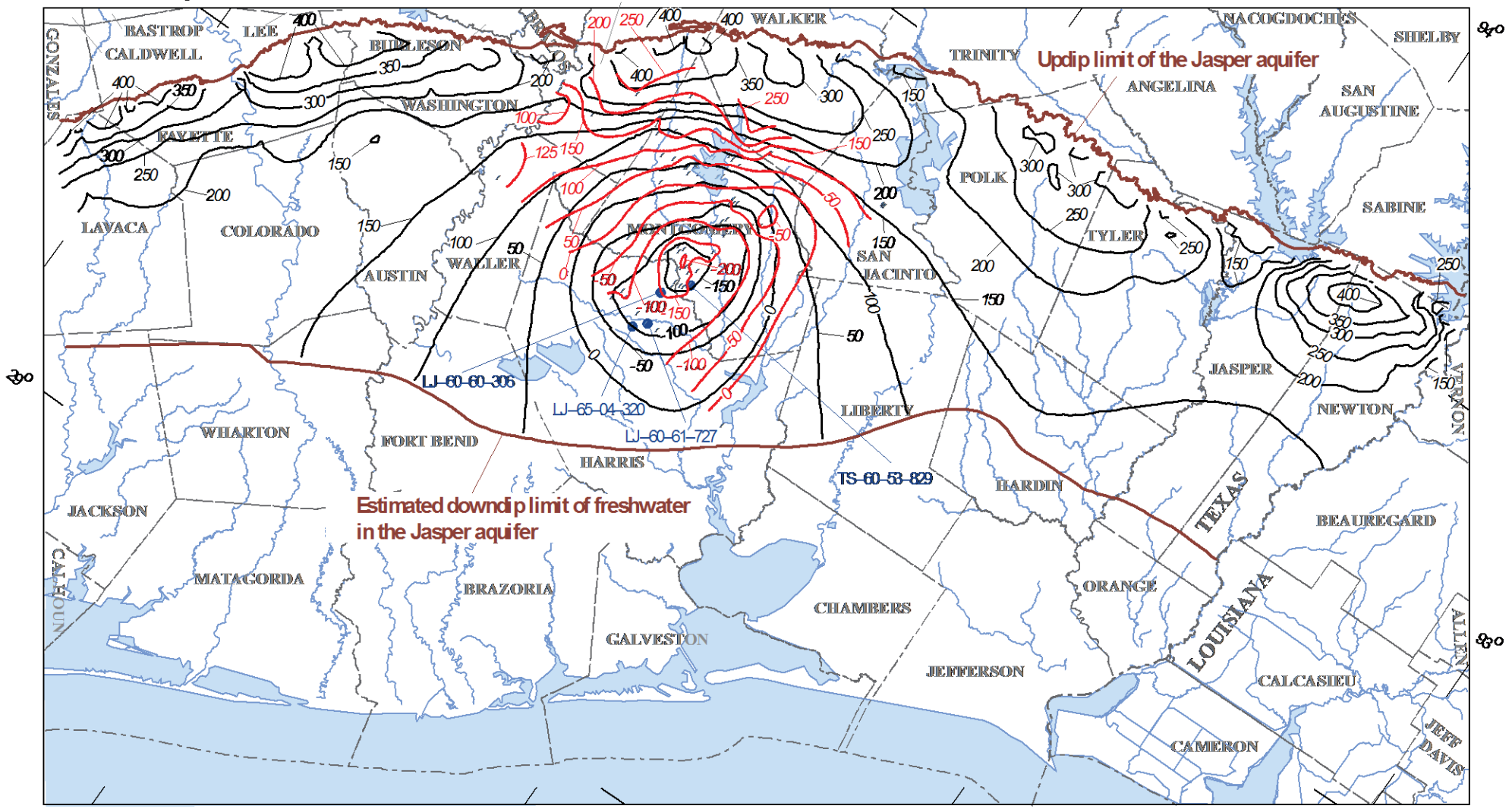
—50— **Simulated potentiometric contour**—Shows altitude at which water would have stood in tightly cased well. Interval 50 feet. Datum is NAVD 88

—50— **Measured potentiometric contour**—Shows altitude at which water would have stood in tightly cased well. Interval 50 feet. Datum is NAVD 88

Data point—Well in which water-level measurement was made

LJ-65-14-909 **Data point and well number**—Well in which water-level measurement was made and for which hydrograph is shown on figure 27

NAVD88, North American Vertical Datum of 1988



Base modified from U.S. Geological Survey digital data
Scale 1:24,000 (except Louisiana hydrography 1:100,000)
Albers equal-area projection
North American Datum of 1983
Standard parallels 34°55' and 27°25', central meridian 100°

0 10 20 30 40 MILES
0 10 20 30 40 KILOMETERS

N

2009 Jasper Aquifer Potentiometric Surfaces

EXPLANATION

—50— **Simulated potentiometric contour**—Shows altitude at which water would have stood in tightly cased well. Interval 50 feet. Datum is NAVD 88

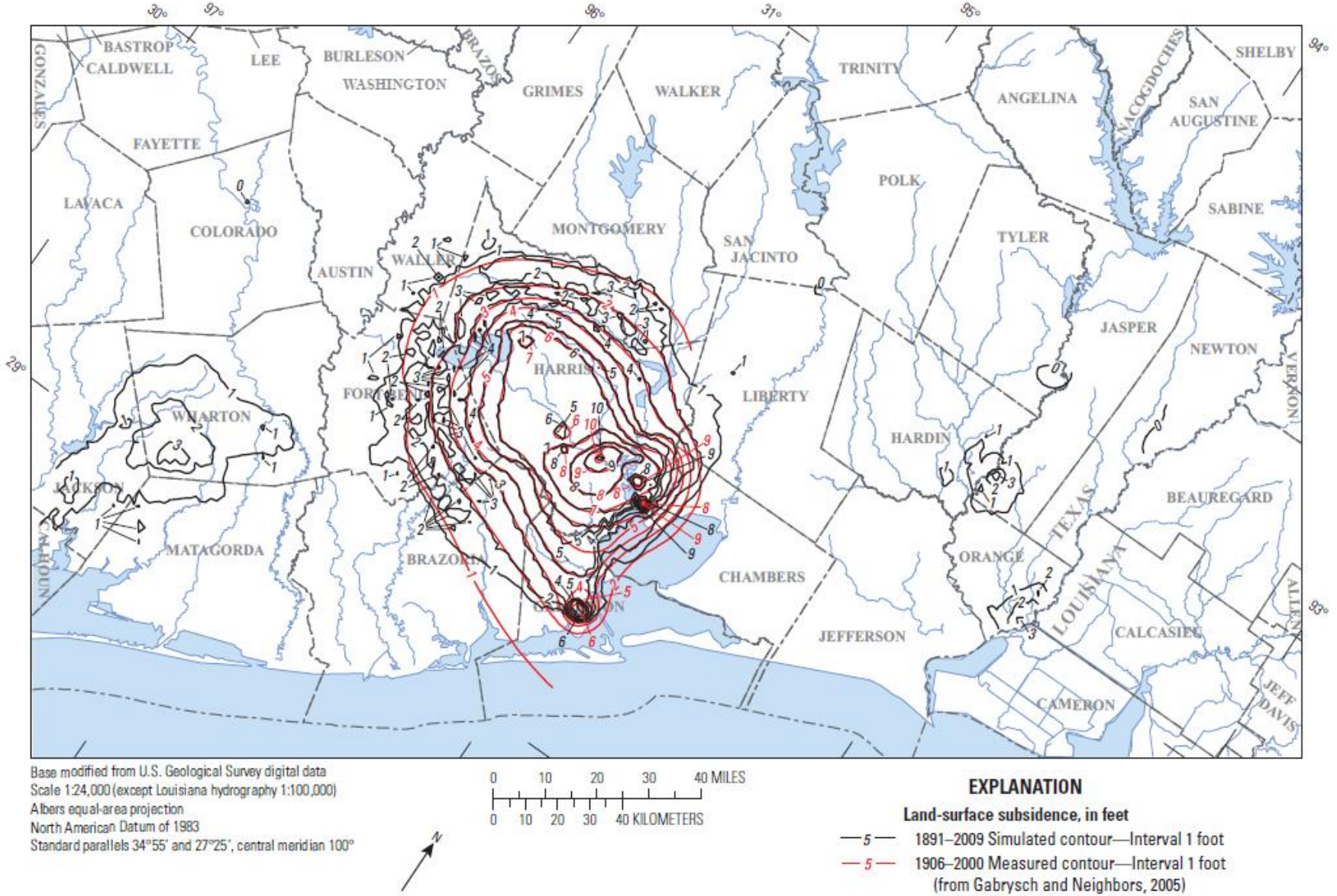
—50— **Measured potentiometric contour**—Shows altitude at which water would have stood in tightly cased well. Interval 50 feet. Datum is NAVD 88

Data point—Well in which water-level measurement was made

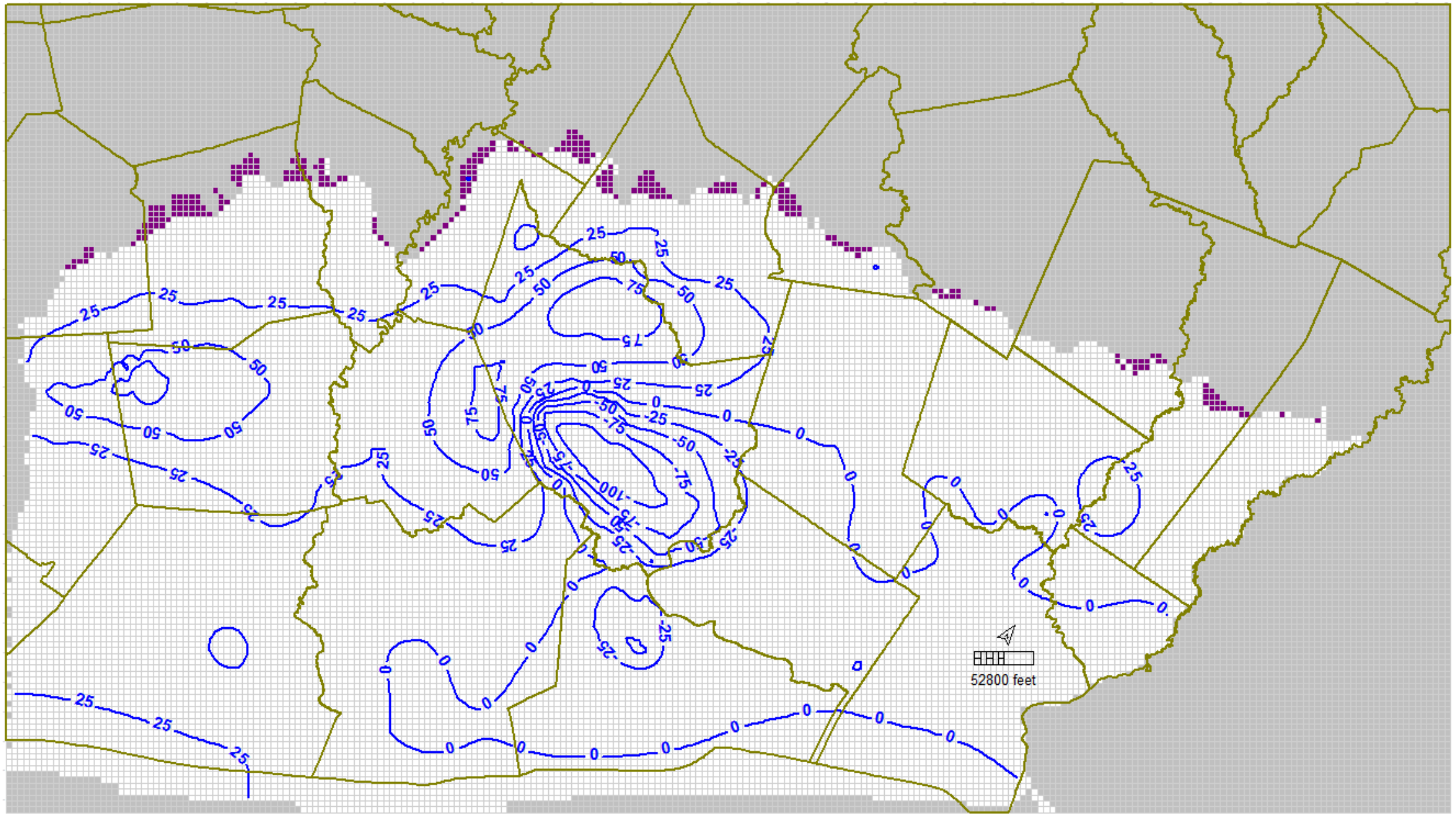
LJ–60–60–306 **Data point and well number**—Well in which water-level measurement was made and for which hydrograph is shown on figure 28

NAVD 88, North American Vertical Datum of 1988

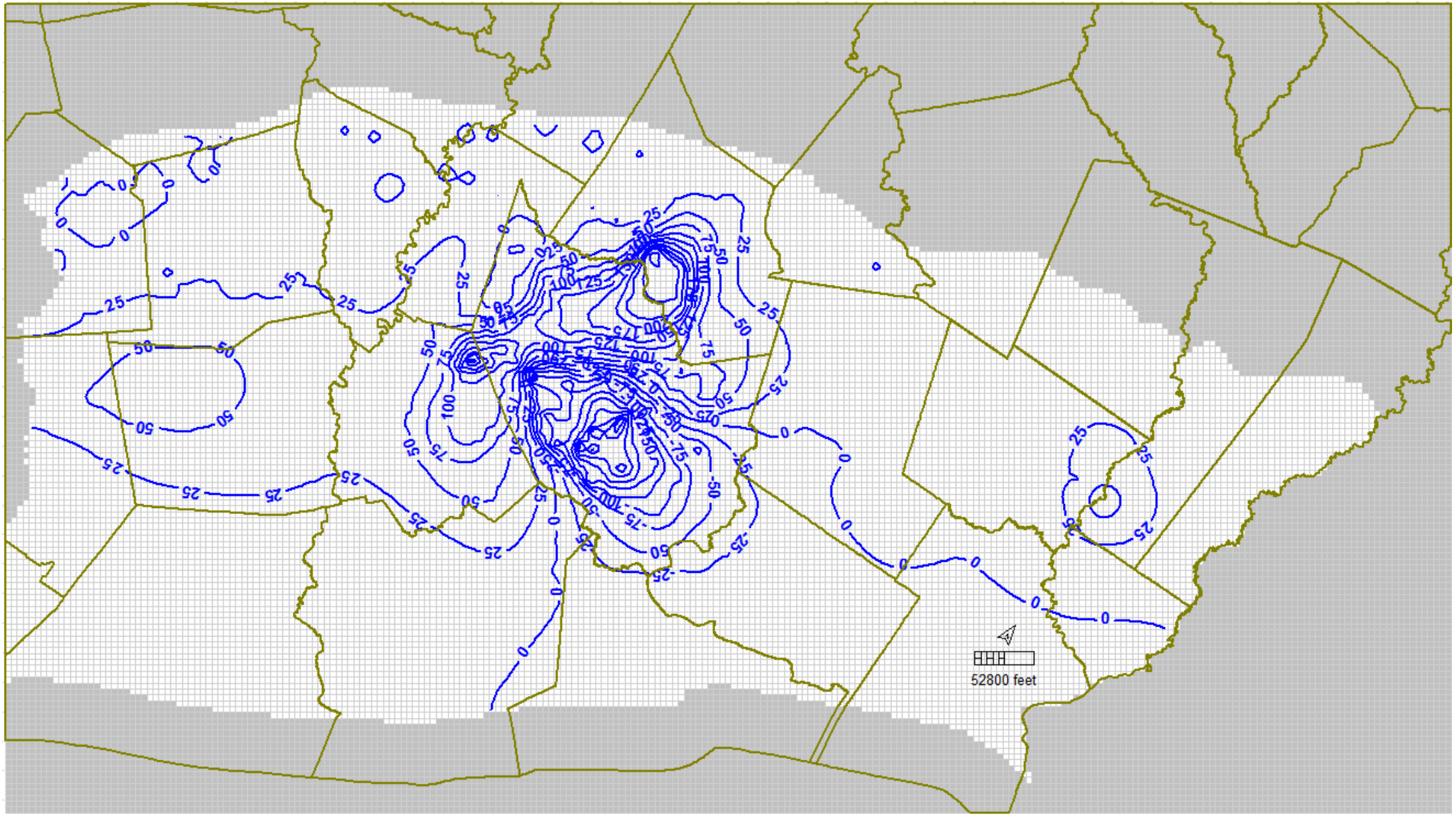
Simulated (1891–2009) and Measured (1906–2000) Land-Surface Subsidence



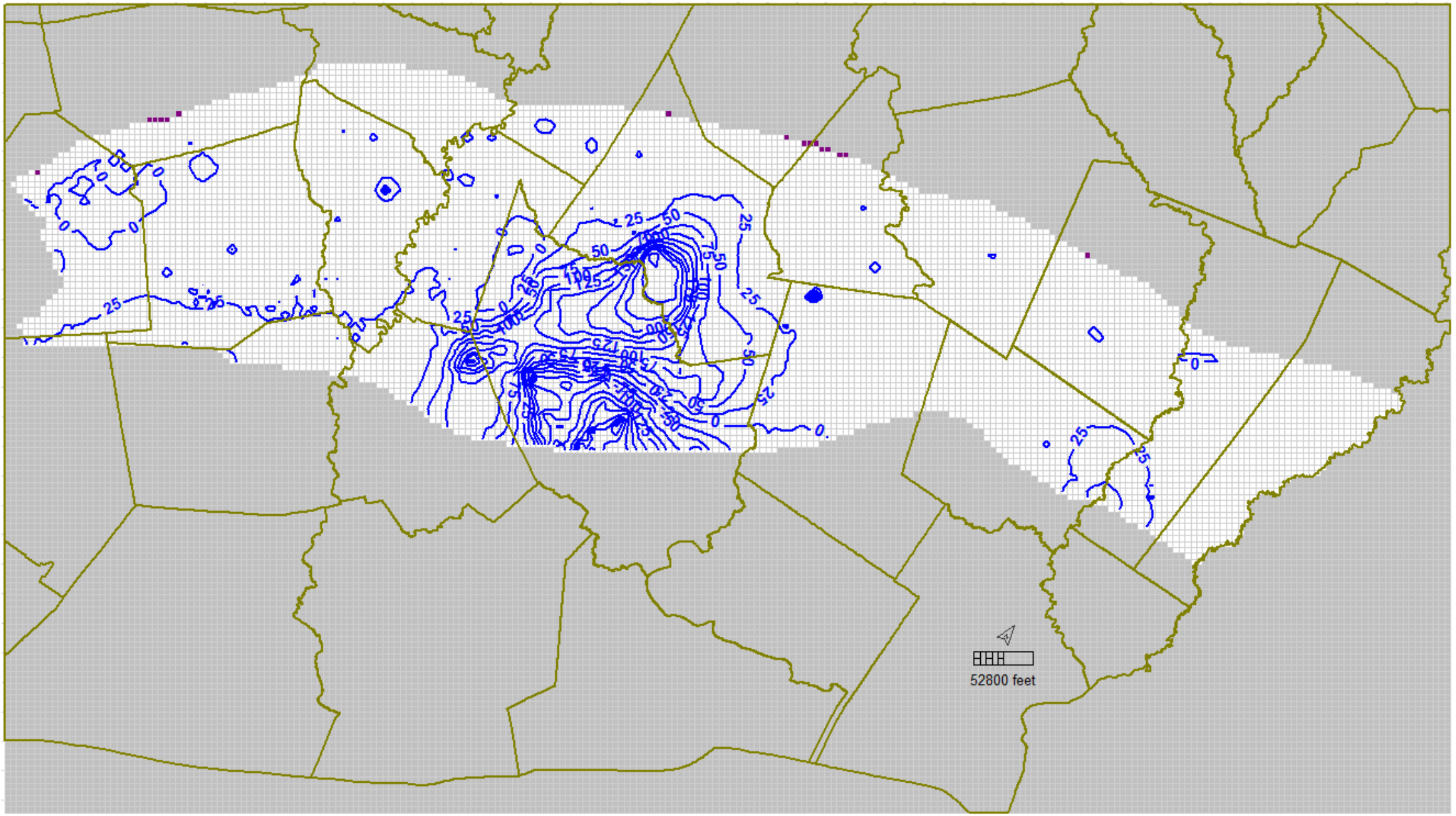
1980-2009 Drawdown – Chicot Aquifer



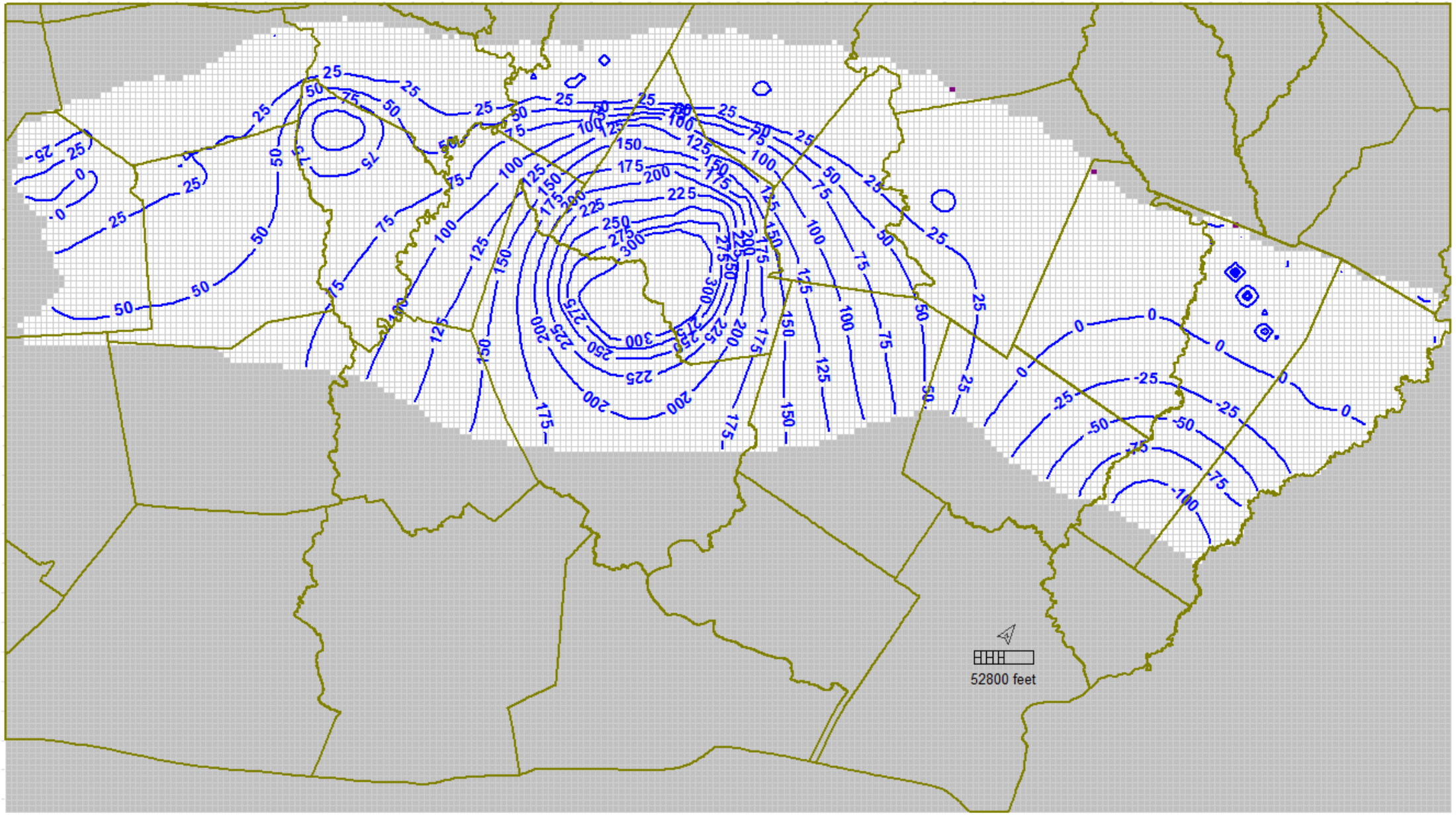
1980-2009 Drawdown – Evangeline Aquifer



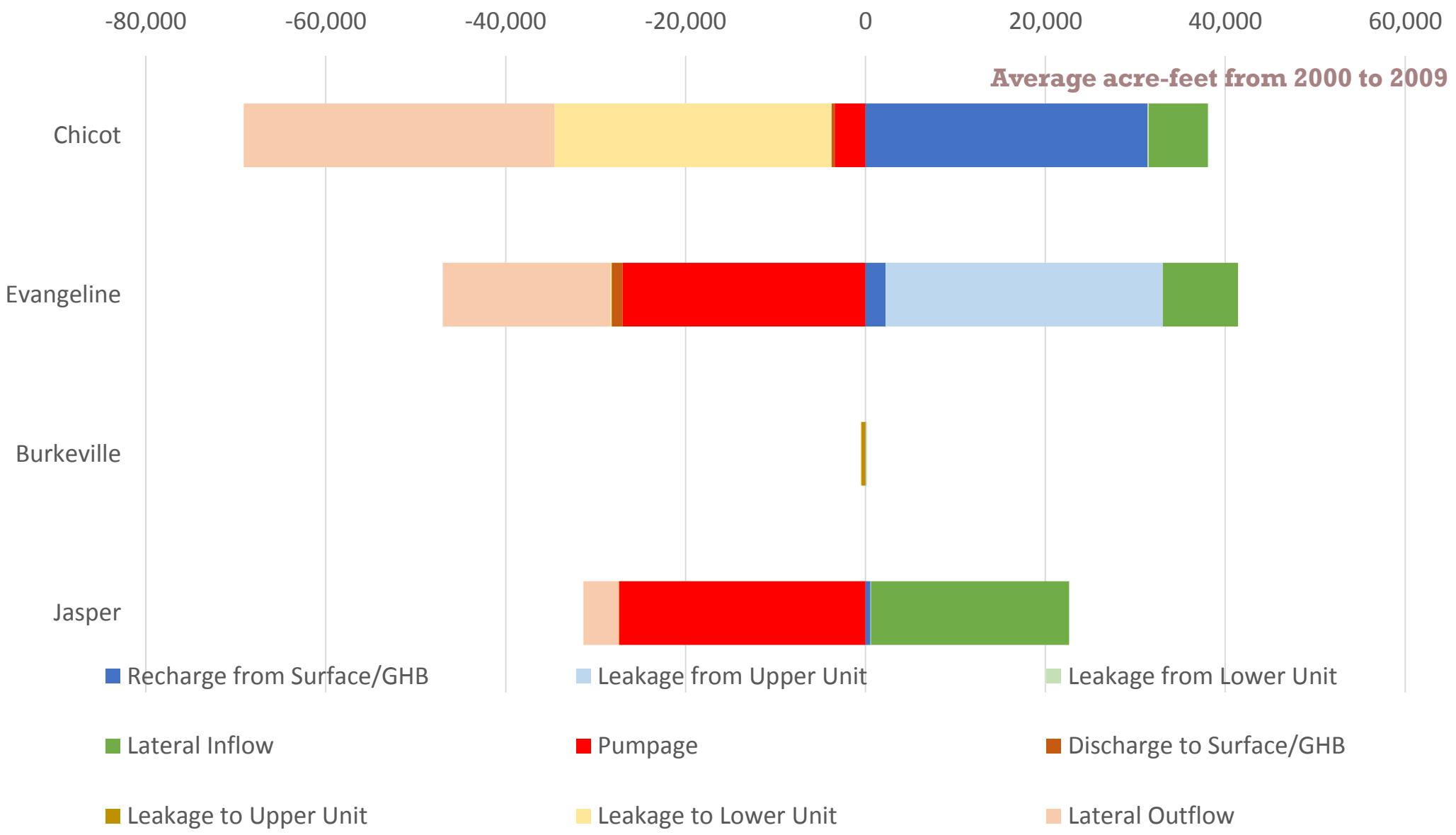
1980-2009 Drawdown – Burkeville Confining Unit

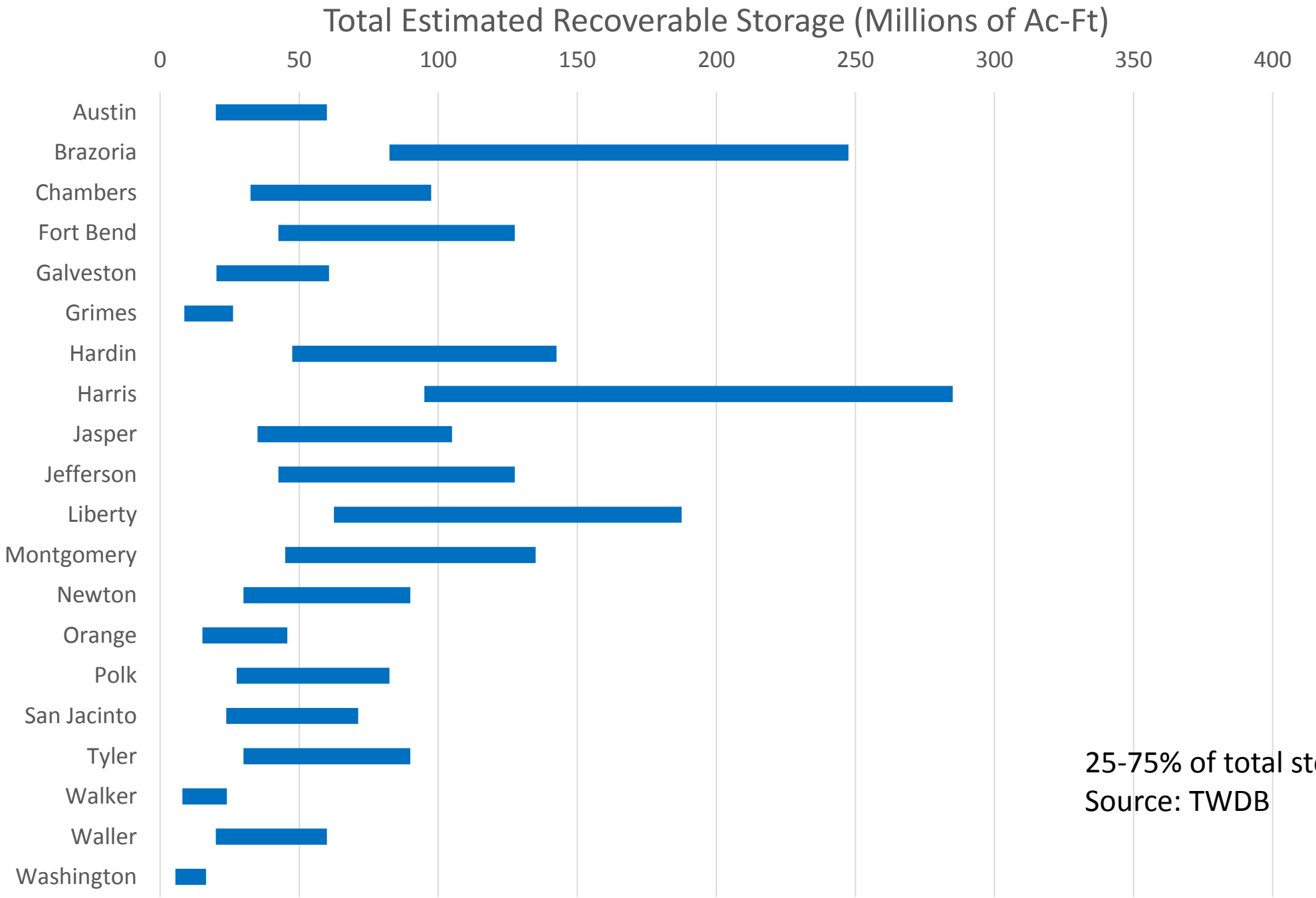


1980-2009 Drawdown – Jasper Aquifer



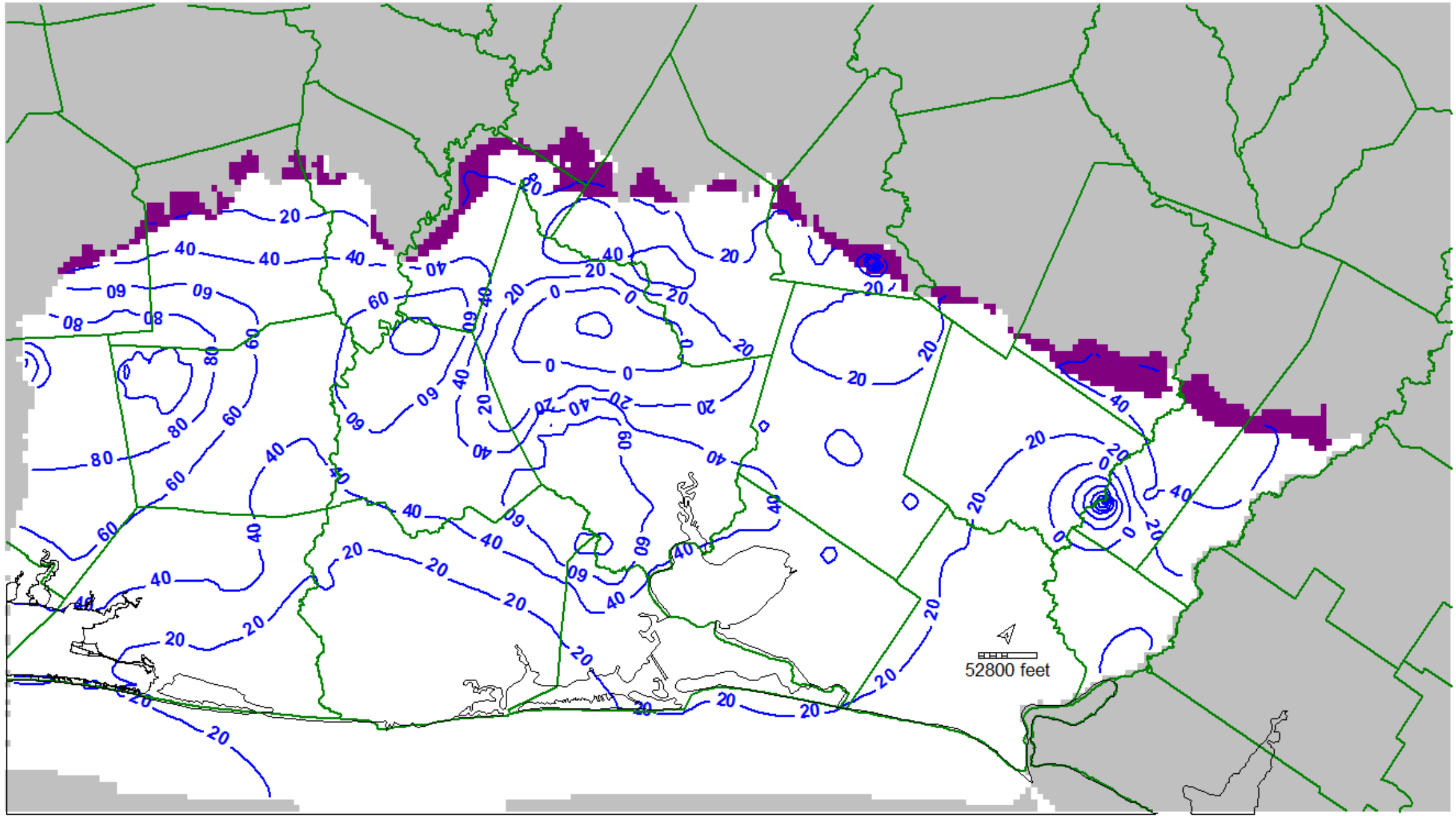
Montgomery County (LSGCD) Water Budget



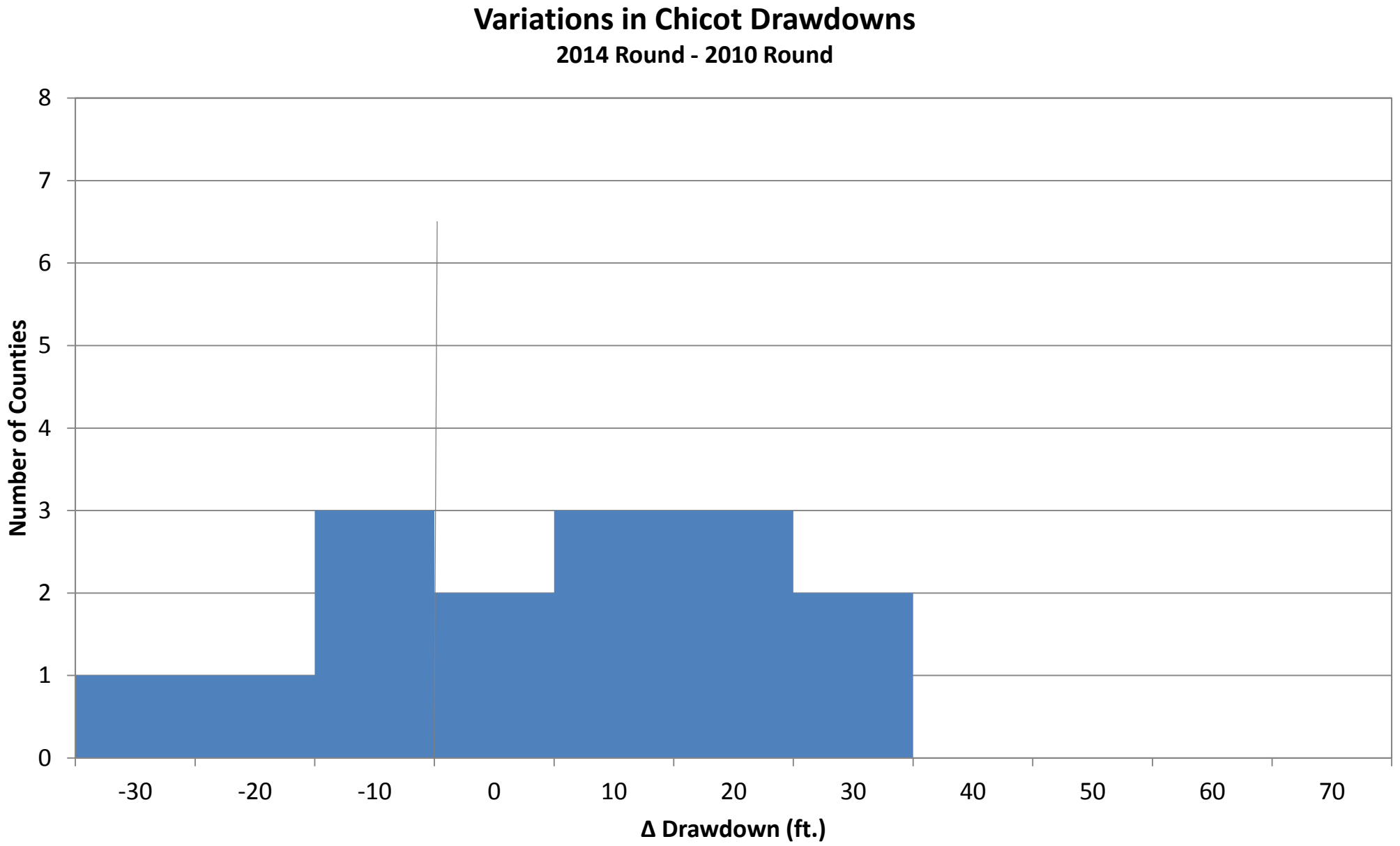


25-75% of total storage
Source: TWDB

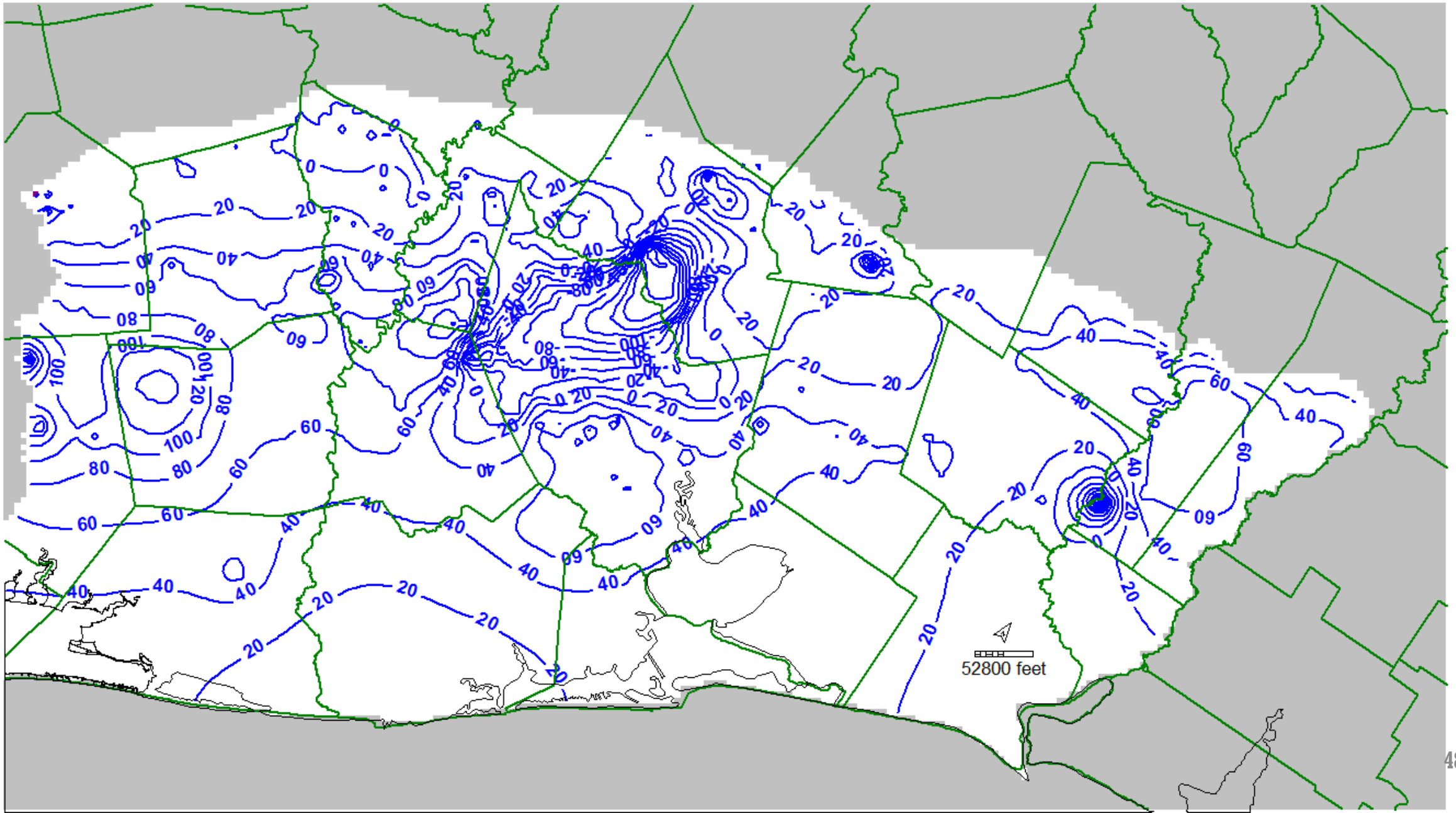
GAM Results (2014/06) – Chicot



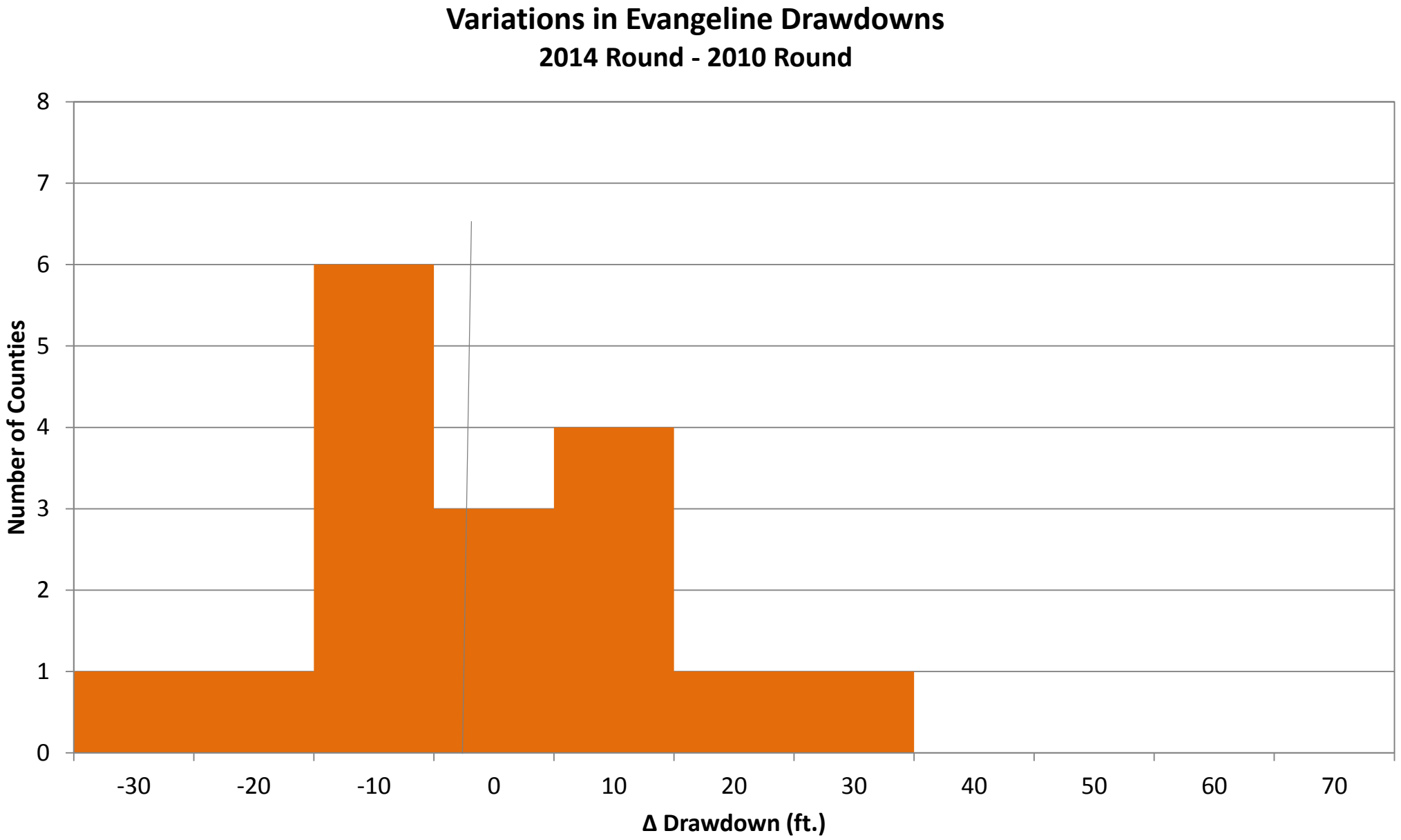
GAM Results - Chicot



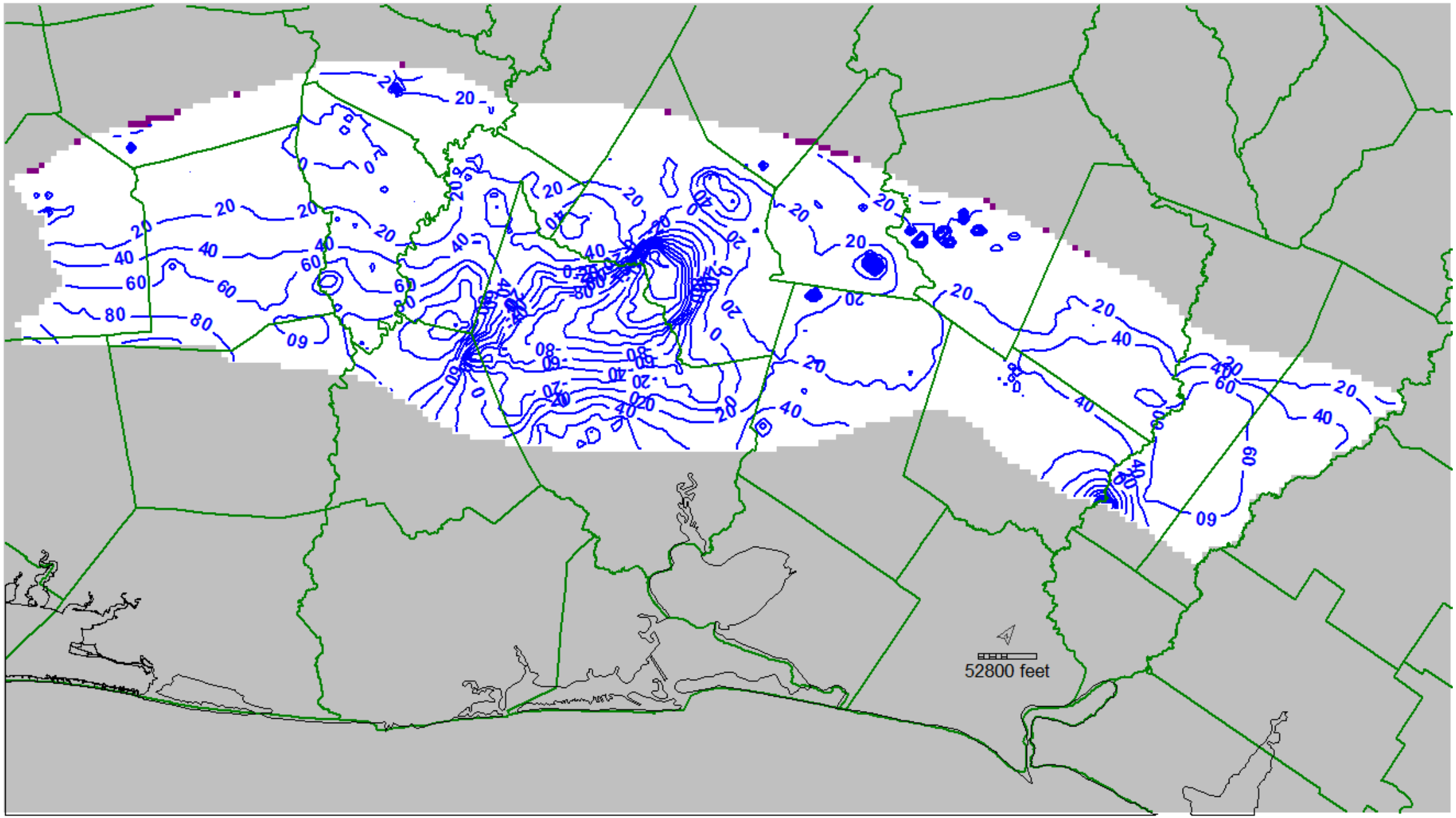
GAM Results (2014/06) – Evangeline



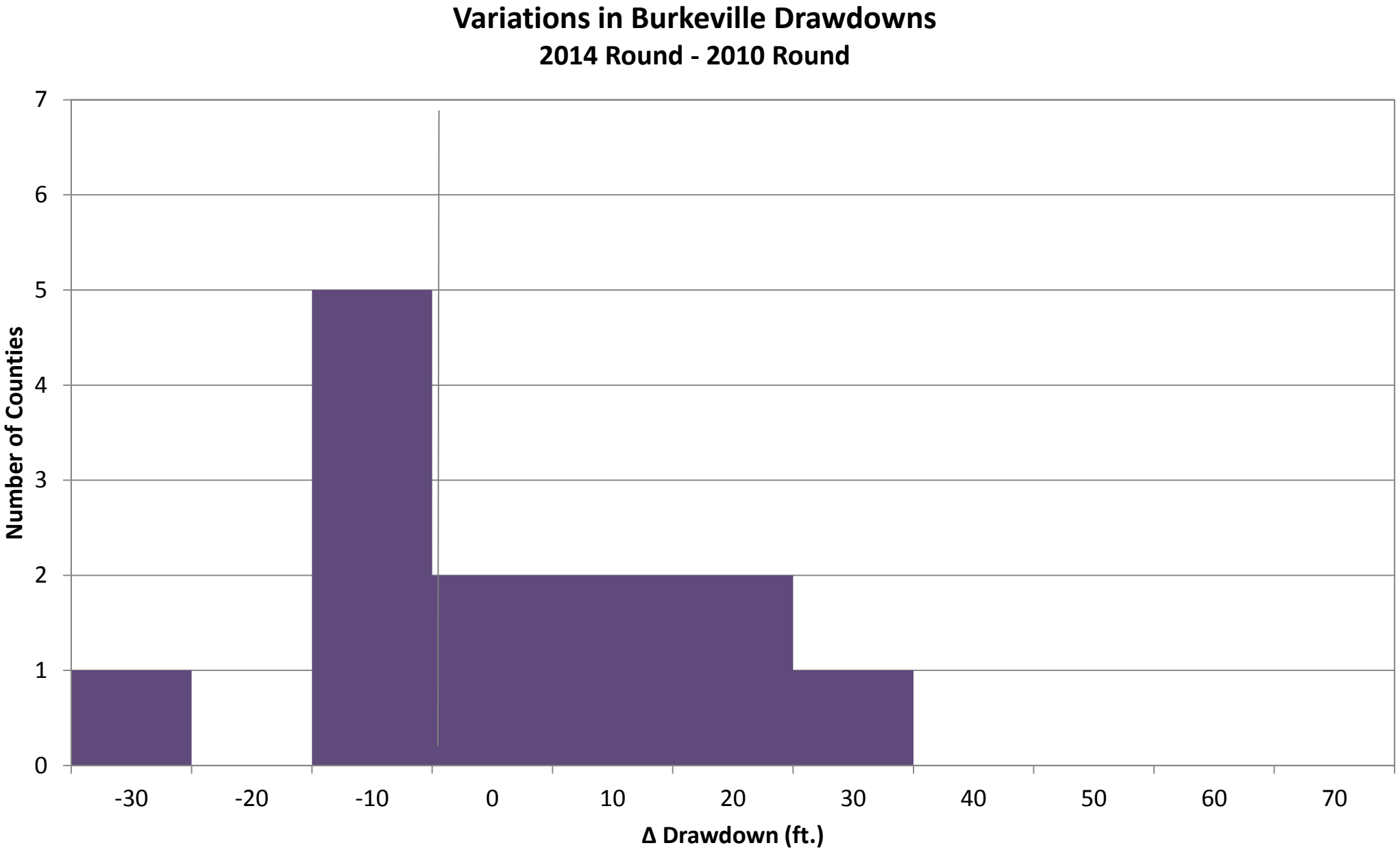
GAM Results - Evangeline



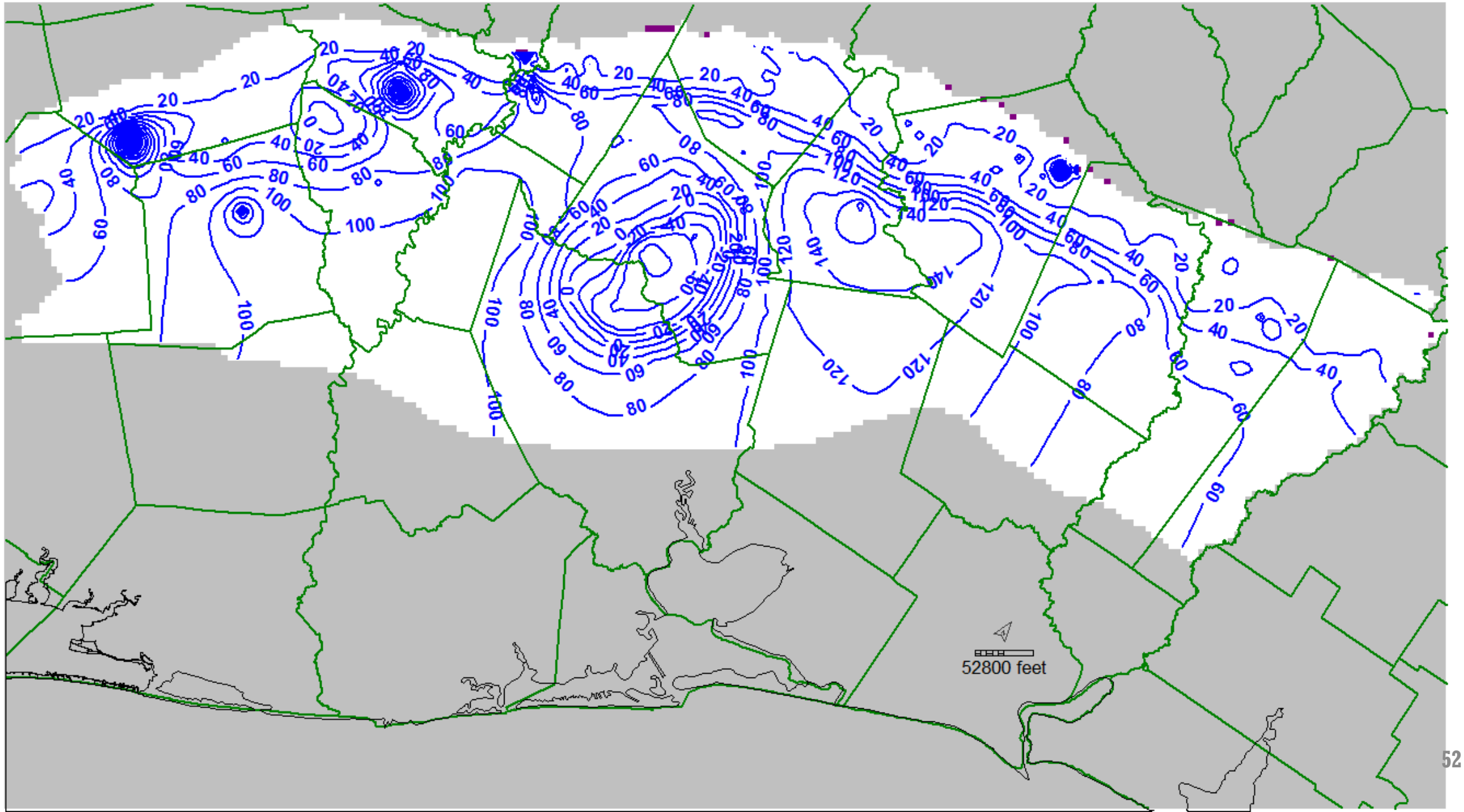
Model Results (2014/06) – Burkeville Confining Unit



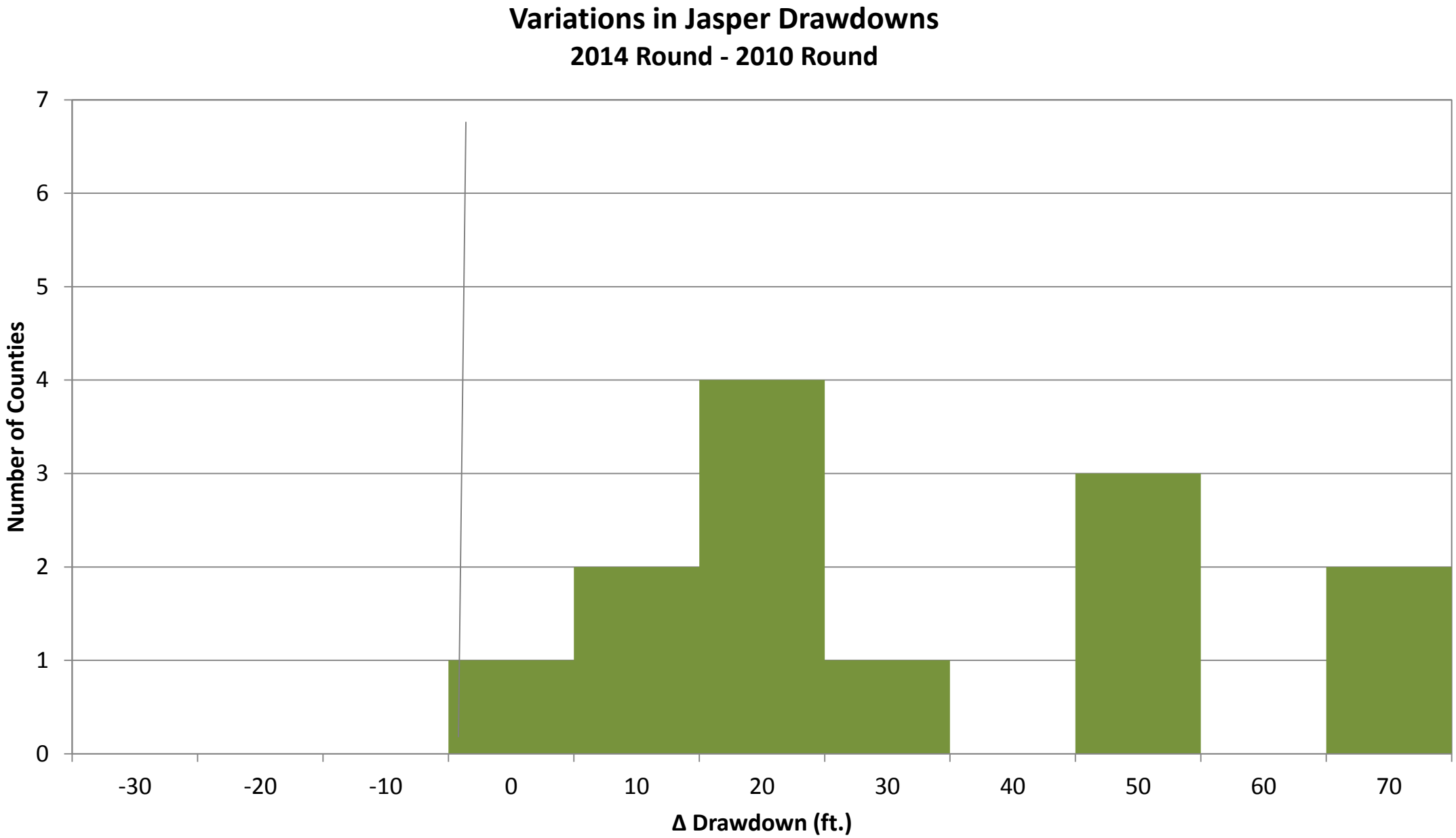
Model Results - Burkeville



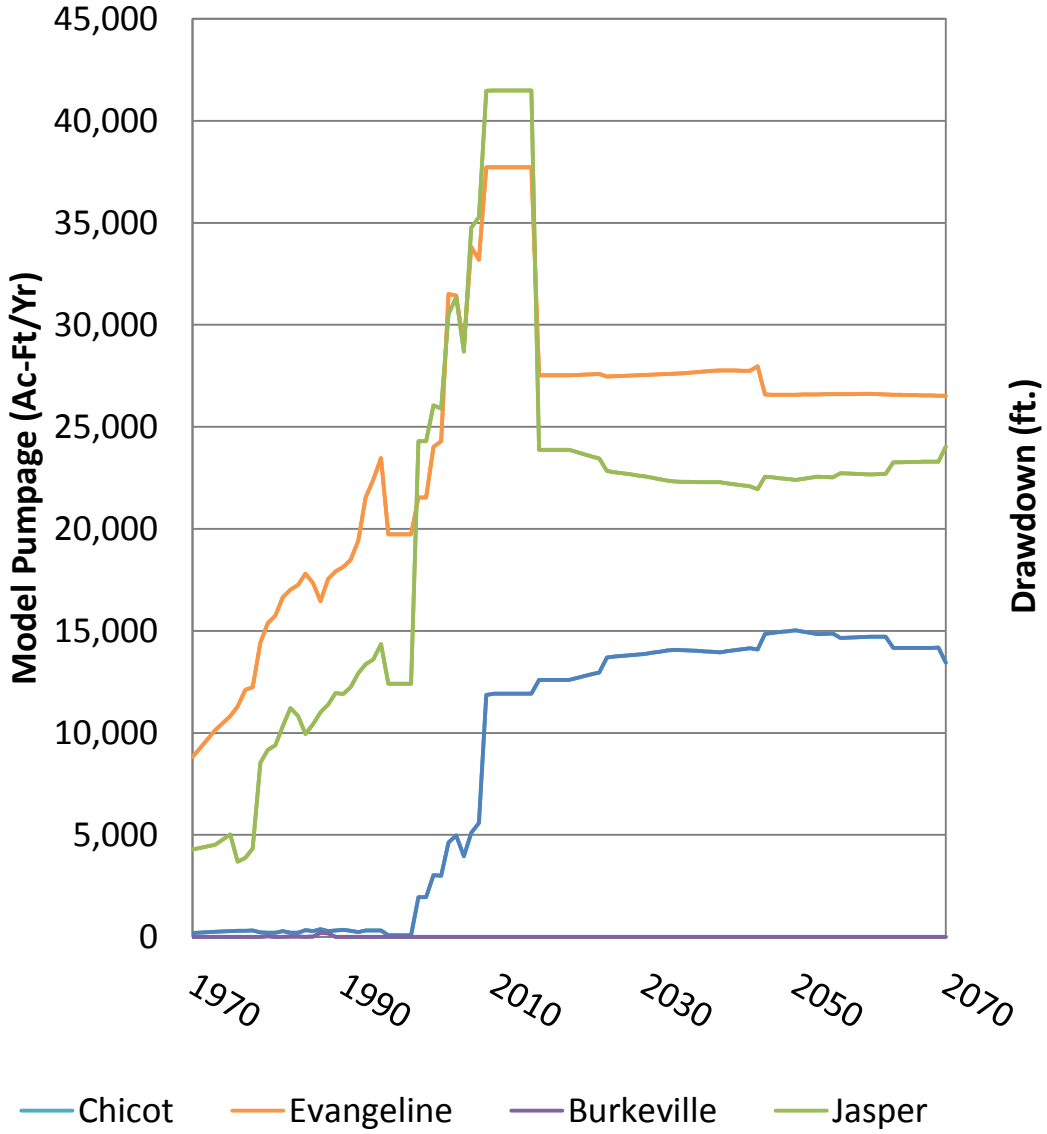
Model Results (2014/06) – Jasper

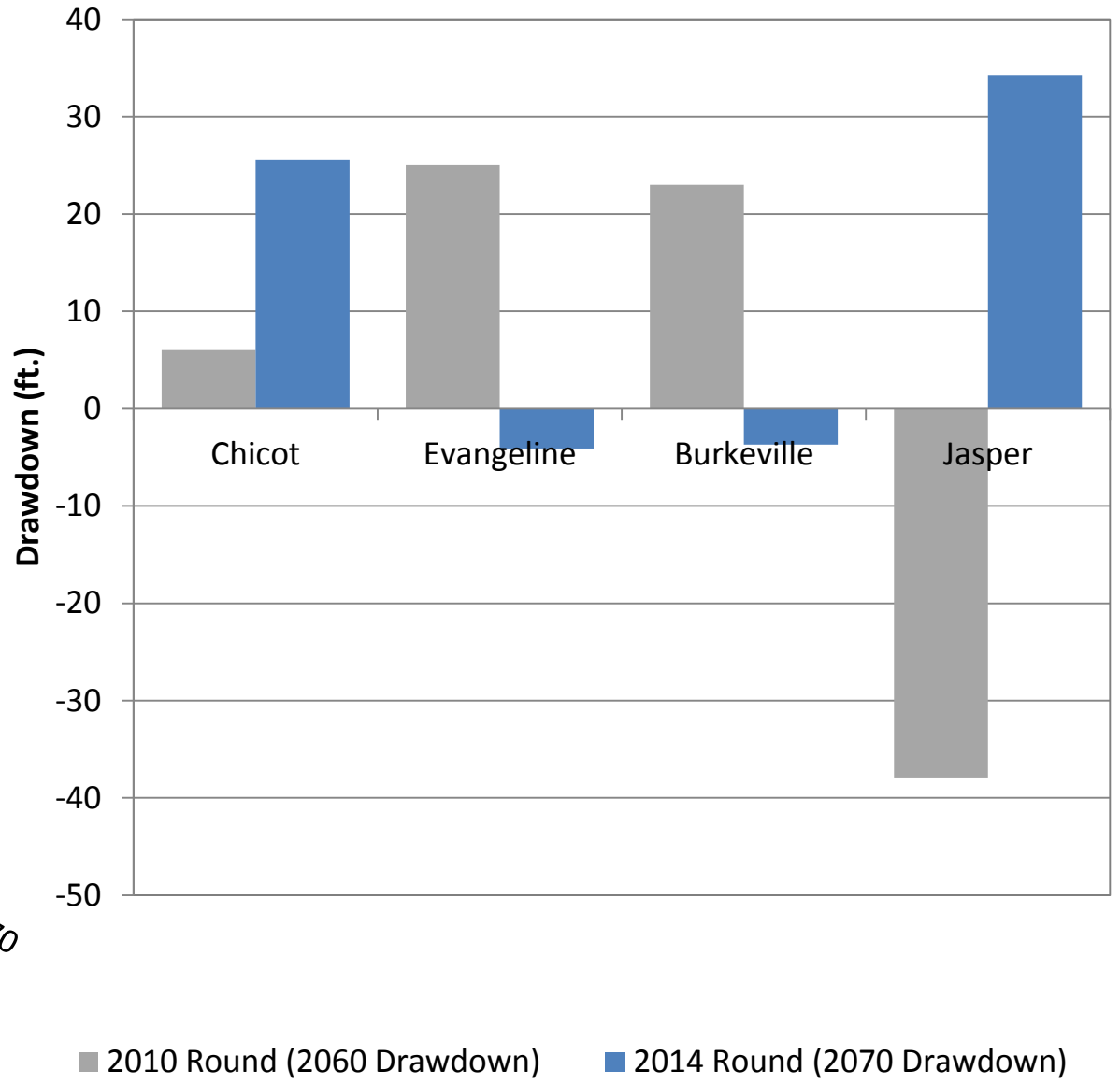


GAM Results - Jasper



GAM Results – Montgomery County (LSGCD)





Water Budget from NGC GAM

Montgomery County				
Inflow	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Recharge/Stream Loss (GHB)	31,407	2,251	1	548
Storage	31,140	5,783	413	8,690
Leakage From Upper Unit	—	30,813	105	64
Leakage From Lower Unit	98	—	—	—
Lateral Flow From Grimes	26	343	3	3,379
Lateral Flow From Harris	2,694	3,595	2	3,889
Lateral Flow From Liberty	2,475	1,169	0	806
Lateral Flow From Waller	987	1,027	1	1,166
Lateral Flow From San Jacinto	366	1,556	4	1,943
Lateral Flow From Walker	12	477	4	10,845
Total Inflow	69,207	47,213	534	31,331

Outflow	**Chicot**	**Evangeline**	**Burkeville**	**Jasper**
Wells	3,426	27,017	—	27,377
Evapotranspiration/Stream Gain (GHB)	343	1,141	0	12
Storage	92	704	60	85
Leakage To Upper Unit	—	98	470	69
Leakage To Lower Unit	30,813	105	64	—
Lateral Flow To Grimes	—	7	0	20
Lateral Flow To Harris	33,337	17,670	8	3,637
Lateral Flow To Liberty	1,009	423	0	27
Lateral Flow To San Jacinto	110	328	0	140
Lateral Flow To Waller	76	190	0	—
Lateral Flow To Walker	1	—	0	79
Total Outflow	69,207	47,683	603	31,446
Inflow - Outflow	0	-470	-69	-115
Storage Increase (+)/Decrease(-)	-31,048	-5,079	-353	-8,605

All values are average acre-feet per year from 2000 through 2009.

Montgomery County draft DFCs and MAGs from NGC GAM

County	Aquifer	Formation	2010 Planning Cycle							Proposed Current Planning Cycle							
			Drawdown (ft.)	Modeled Available Groundwater (MAG) (Ac-Ft/Yr)						Drawdown (ft.)	Model Groundwater Pumpage (Ac-Ft/Yr)						
				2010	2020	2030	2040	2050	2060		2010	2020	2030	2040	2050	2060	2070
Montgomery	Gulf Coast	Chicot	6	1,482	1,722	1,722	1,722	1,722	1,722	26	11,921	12,599	13,869	13,943	15,025	14,716	13,445
		Evangeline	25	39,381	38,293	38,293	38,293	38,293	38,293	-4	37,731	27,523	27,551	27,771	26,573	26,613	26,522
		Burkeville	23	0	0	0	0	0	0	-4	0	0	0	0	0	0	0
		Jasper	-38	32,401	21,614	21,614	21,614	21,614	21,614	34	41,488	23,878	22,580	22,286	22,402	22,671	24,033
	Total			73,264	61,629	61,629	61,629	61,629	61,629		91,140	64,000	64,000	64,000	64,000	64,000	64,000
Totals	Gulf Coast			73,264	61,629	61,629	61,629	61,629	61,629		91,140	64,000	64,000	64,000	64,000	64,000	64,000
	TOTAL			73,264	61,629	61,629	61,629	61,629	61,629		91,140	64,000	64,000	64,000	64,000	64,000	64,000

Texas Water Code Section 36.108 (d) (4)

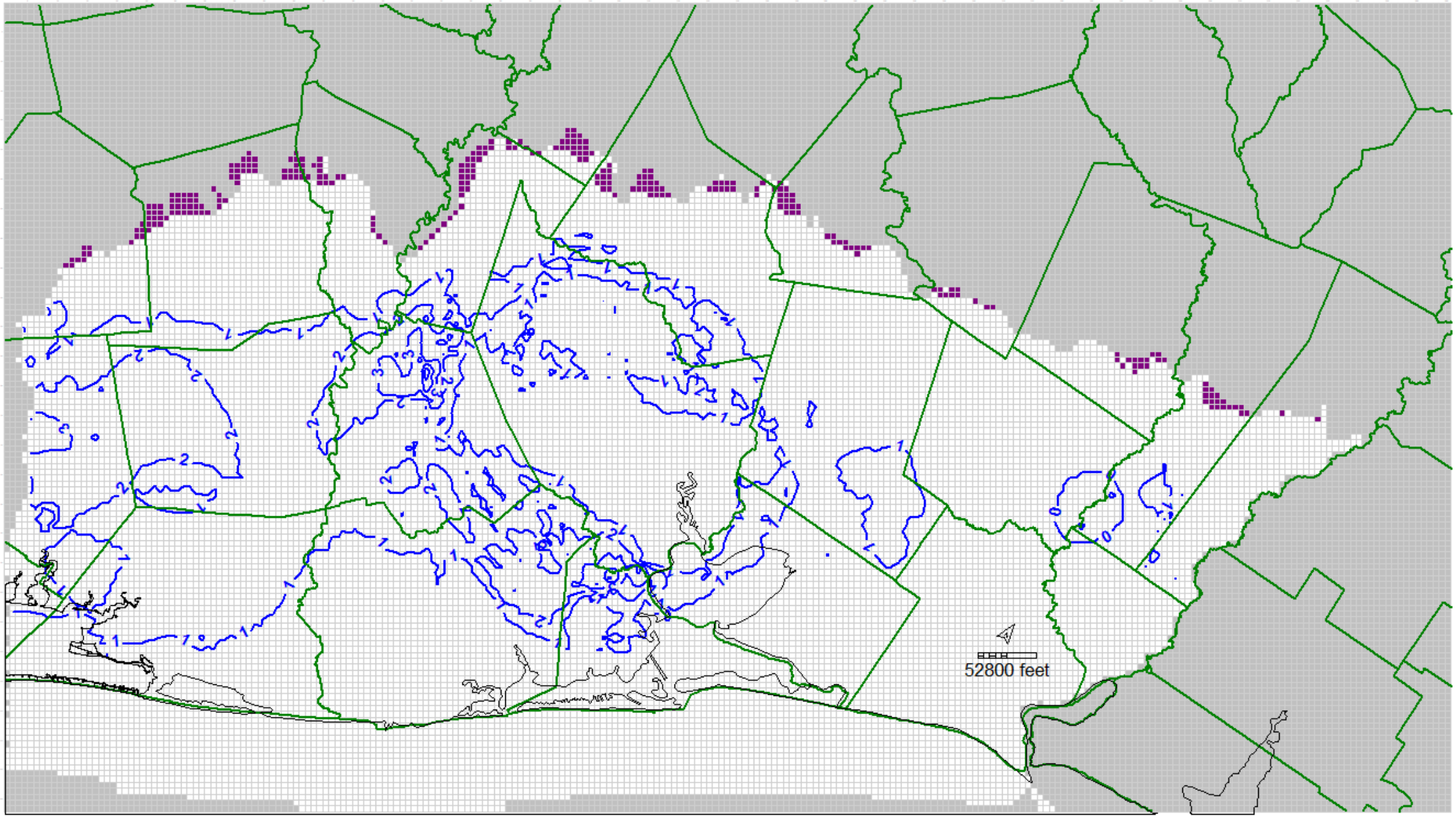
- Consider other environmental impacts, including impacts on spring flow and other interactions between groundwater and surface water
  - Available literature and studies
  - Northern Gulf Coast GAM
  - Central Carrizo-Wilcox GAM
  - Yegua-Jackson GAM

- Gulf Coast Aquifer
  - NGC GAM does not include the “stream package” used to estimate groundwater and surface water interaction
  - Groundwater and surface water interaction occurs based on USGS and TWDB studies
  - LCRA studies show groundwater and surface water interaction limited to the shallow groundwater system and the river, similar conditions could occur in GMA-14

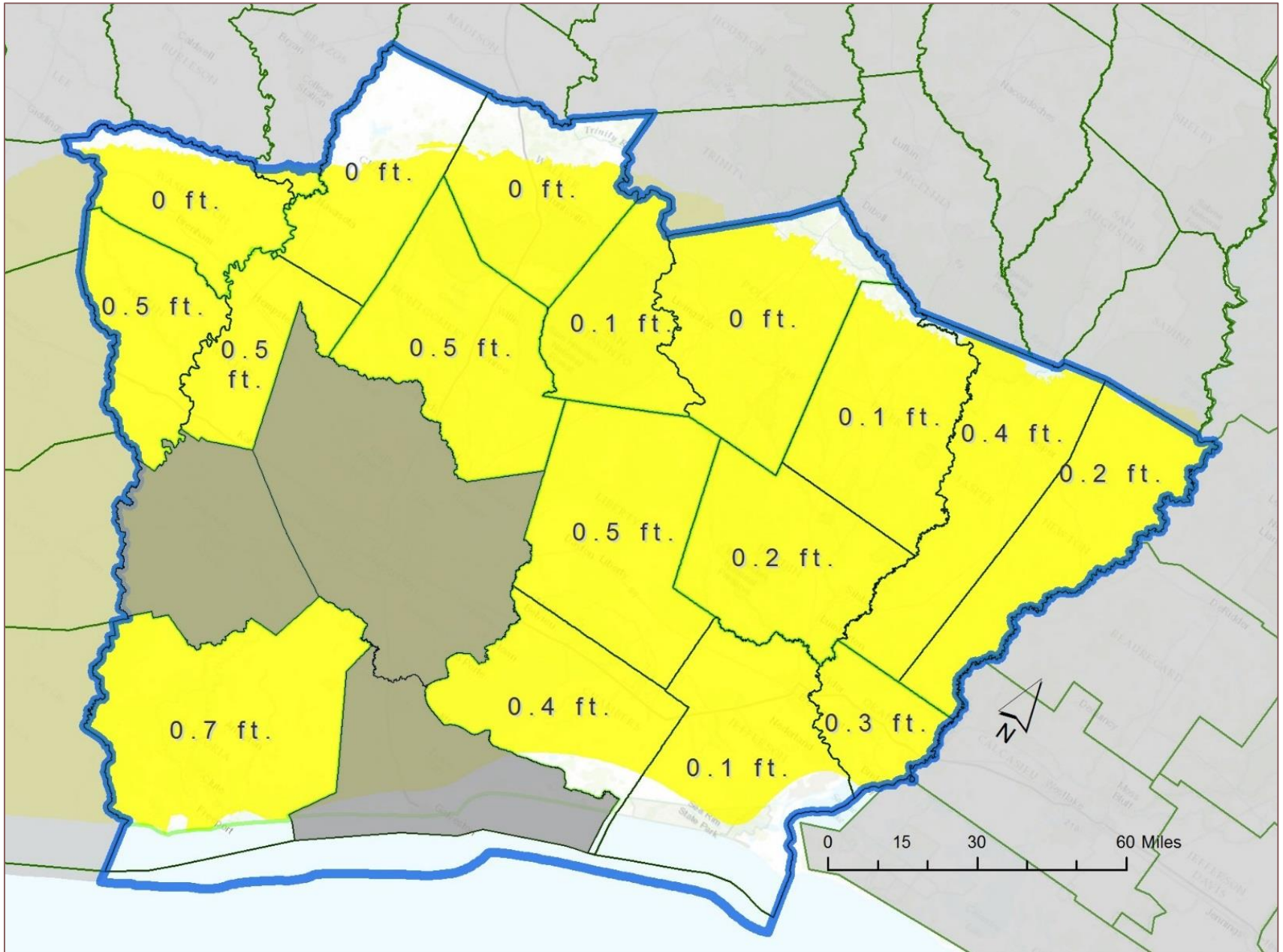
Texas Water Code Section 36.108 (d) (5)

- Consider the impact on subsidence
  - Fort Bend, Galveston, and Harris Counties
    - PRESS model results
  - All Other Counties
    - Results from NGC GAM (SUB package)

NGC GAM SUB Results (predicted subsidence 2010-2070)



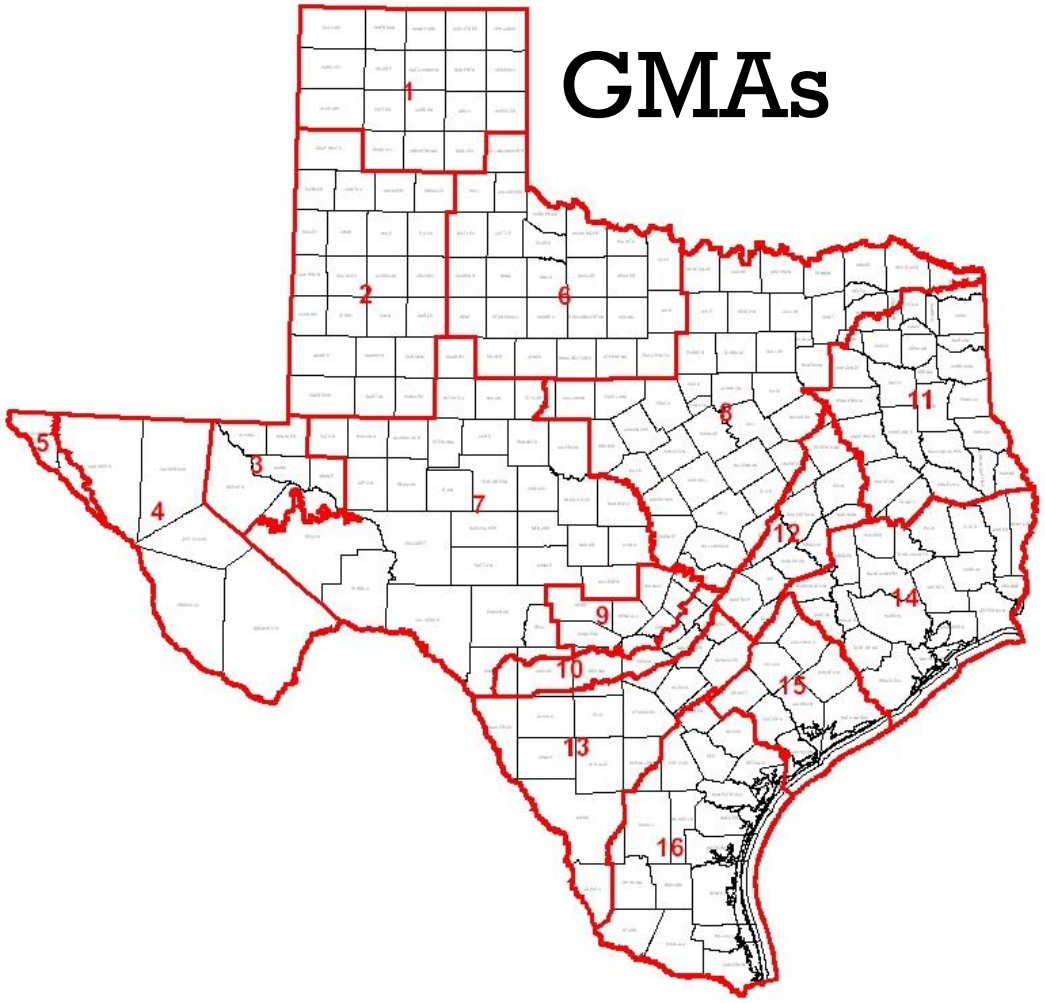
NGC GAM SUB Results (predicted subsidence 2010-2070)



Texas Water Code Section 36.108 (d) (6)

- Consider socioeconomic impacts reasonably expected to occur
  - Socioeconomic impact analysis from 2011 Regional Water Plans for G, H, and I
  - Qualitative versus quantitative approach

GMAs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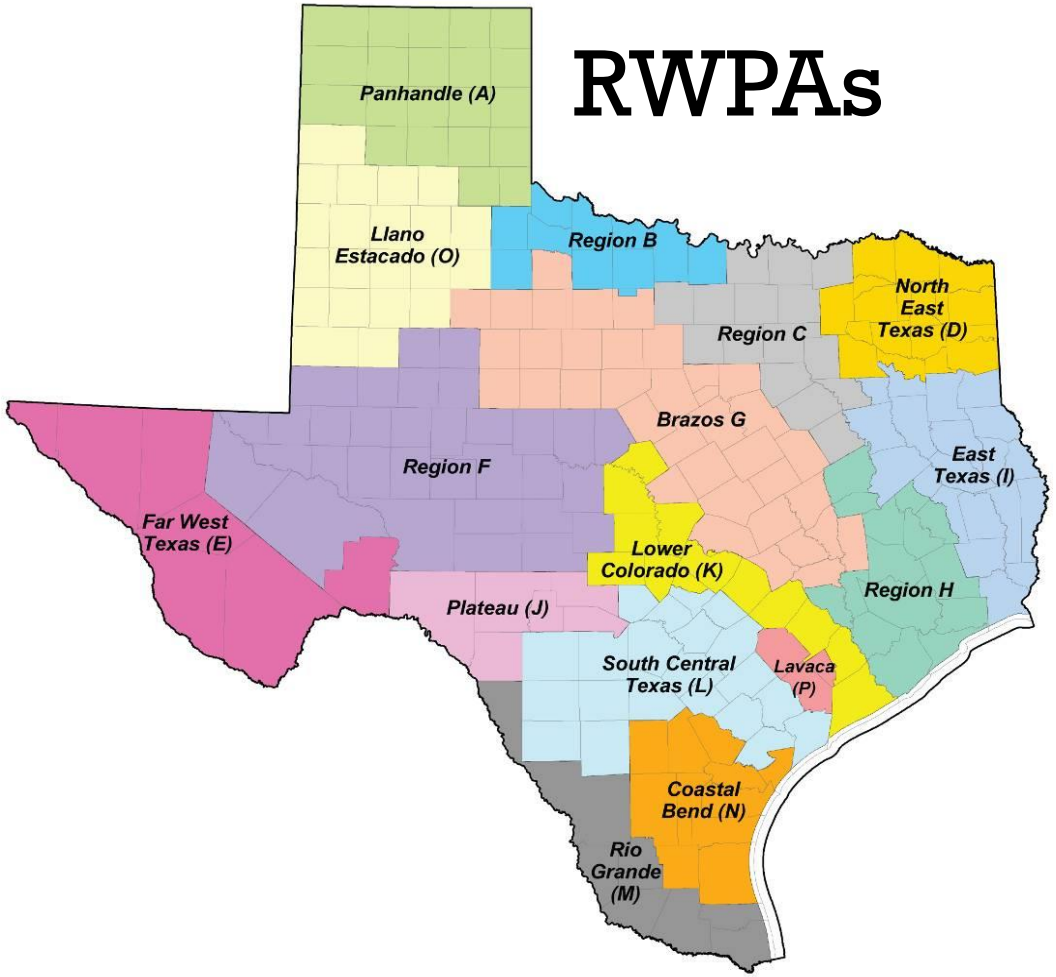
RWPAs


Panhandle (A)
Llano Estacado (O)
Region B
North East Texas (D)
Region C
Brazos G
East Texas (I)
Region F
Far West Texas (E)
Lower Colorado (K)
Region H
Plateau (J)
South Central Texas (L)
Lavaca (P)
Coastal Bend (N)
Rio Grande (M)

Potential socioeconomic impact of proposed DFCs

- From a qualitative perspective, both positive and negative socioeconomic impacts may potentially result from implementation of proposed DFCs.
  - Proposed DFCs may require conversion to alternative supply, which may have increased costs associated to infrastructure, operation, and maintenance.
  - Proposed DFCs may reduce/eliminate the costs of lowering pumps and either drilling or deepening of wells.
  - Proposed DFCs may reduce/eliminate the costs associated with subsidence (including legal costs assigned to parties determined to be liable).

Potential socioeconomic impact of proposed DFCs

- Positive and negative socioeconomic impacts potentially resulting from implementation of proposed DFCs:
  - Proposed DFCs may serve to sustain/enhance economic growth due to assurances provided by diversified water portfolio.
  - Alternatives to proposed DFCs may result in short-term reduction in utility rates due to reduction in cost of water management strategy implementation.
  - Alternatives to proposed DFCs may result in significant but unquantified production costs due to transition from confined to unconfined conditions in local aquifers.

Texas Water Code Section 36.108 (d) (7)

- Consider the impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater, as recognized under Texas Water Code Section 36.002
  - Analysis and discussion of the impacts of GCD management plans and rules on the interests and rights in private property

Texas Water Code Section 36.108 (d) (7)

For reference, Texas Water Code Section 36.002 states:

(a) The legislature recognizes that a landowner owns the groundwater below the surface of the landowner's land as real property.

(b) The groundwater ownership and rights described by this section:

(1) entitle the landowner, including a landowner's lessees, heirs, or assigns, to drill for and produce the groundwater below the surface of real property, subject to Subsection (d), without causing waste or malicious drainage of other property or negligently causing subsidence, but does not entitle a landowner, including a landowner's lessees, heirs, or assigns, to the right to capture a specific amount of groundwater below the surface of that landowner's land; and

Texas Water Code Section 36.108 (d) (7)

For your reference, Texas Water Code Section 36.002 states (cont.):

(2) do not affect the existence of common law defenses or other defenses to liability under the rule of capture.

(c) Nothing in this code shall be construed as granting the authority to deprive or divest a landowner, including a landowner's lessees, heirs, or assigns, of the groundwater ownership and rights described by this section.

Texas Water Code Section 36.108 (d) (7)

(d) This section does not:

(1) prohibit a district from limiting or prohibiting the drilling of a well by a landowner for failure or inability to comply with minimum well spacing or tract size requirements adopted by the district;

(2) affect the ability of a district to regulate groundwater production as authorized under Section 36.113, 36.116, or 36.122 or otherwise under this chapter or a special law governing a district; or

(3) require that a rule adopted by a district allocate to each landowner a proportionate share of available groundwater for production from the aquifer based on the number of acres owned by the landowner.

Texas Water Code Section 36.108 (d) (7)

(e) This section does not affect the ability to regulate groundwater in any manner authorized under:

(1) Chapter 626, Acts of the 73rd Legislature, Regular Session, 1993, for the Edwards Aquifer Authority;

(2) Chapter 8801, Special District Local Laws Code, for the Harris-Galveston Subsidence District; and

(3) Chapter 8834, Special District Local Laws Code, for the Fort Bend Subsidence District.

The Consideration of Private Property Rights by GCDs in GMA 14

The procedural requirements for what should be considered in reviewing the private property rights factor are not prescribed in statute nor do TWDB rules provide any additional guidance. The following list of topics are suggested for discussion:

- Existing uses within the GCD
- Projected future uses within the GCD
- Investment-backed expectations of existing users and property owners within the GCD

The Consideration of Private Property Rights by GCDs in GMA 14

(Continued)

- Long-term viability of groundwater resources in area
- Availability of water to all properties and ability to allocate MAG through rules after DFC adoption
- Whether immediate cutbacks would be required in setting a particular DFC or whether cutbacks, if any, would need to occur over a certain timeframe

The Consideration of Private Property Rights by GCDs in GMA 14

(Continued)

- For outcrop areas, how the outcrop depletes rapidly in dry times, and whether drought rules or triggers based on the DFC/MAG for the outcrop could be beneficial to ensure viability of the resource during dry times

- Economic consequences to existing users (i.e., cost to drop pumps, reconfigure or drill new wells upon water table dropping, etc.). Also consider the reverse—economic consequences of less water available to protect the existing users from the economic consequences relevant to existing users—reaching a balance between these two dynamics.

The Consideration of Private Property Rights by GCDs in GMA 14

(Continued)

- Those GCDs with existing rules developed based on the current DFC might find it helpful to review the rules that the GCD considers relevant as we work to adopt DFCs over the next year. For example, the rules and Management Plan in place based on the current DFCs can help determine how a GCD currently impacts private property rights and whether those same interests are important as we work to adopt DFCs over the next 2 years.

- Focusing on finding a balance, as that balance is defined by each GCD, between all of these considerations

Texas Water Code Section 36.108 (d) (8)

- Consider the feasibility of achieving the desired future conditions

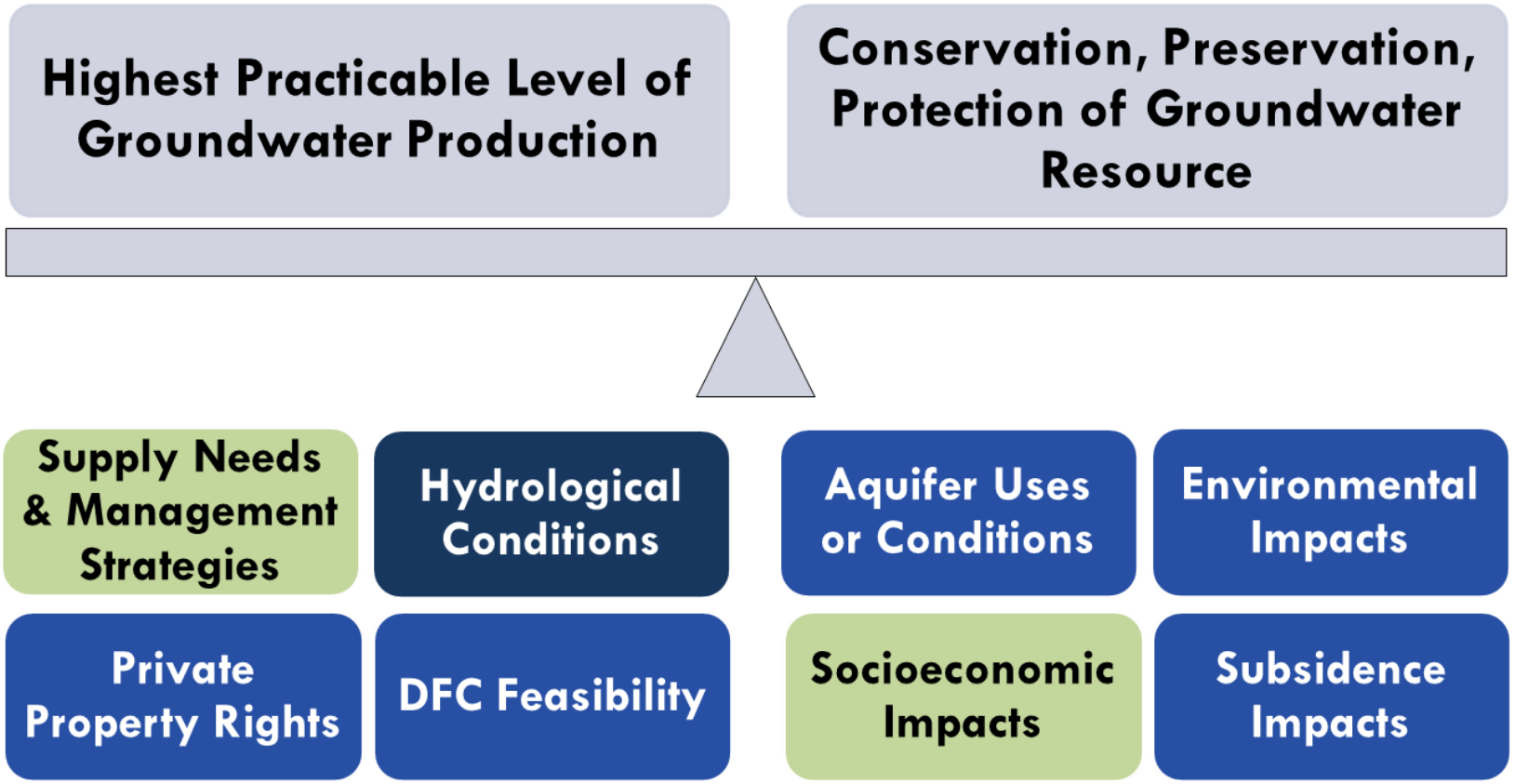
RESOLUTION FOR THE ADOPTION OF THE DESIRED FUTURE CONDITIONS FOR ALL AQUIFERS IN GROUNDWATER MANAGEMENT AREA 14

Whereas, pursuant to Section 35.004 of the Texas Water Code, the Texas Water Development Board ("TWDB") has designated groundwater management areas that, together, cover all major and minor aquifers in the state; and

Whereas, each groundwater management area was designated with the objective of providing the most suitable area for the management of groundwater resources; and

Whereas, through title 31, Section 356.23 of the Texas Administrative Code, the TWDB has designated the area encompassing all of Austin, Brazoria, Chambers, Fort Bend, Galveston, Grimes, Hardin, Harris, Jasper, Jefferson, Liberty, Montgomery, Newton, Orange, Polk, San Jacinto, Tyler, Walker, Waller, and Washington counties as Groundwater Management Area No. 14 ("GMA 14"); and

Joint Planning Process - Balance



Questions