

Simulation and Analysis of Brazos Valley GCD New Permits



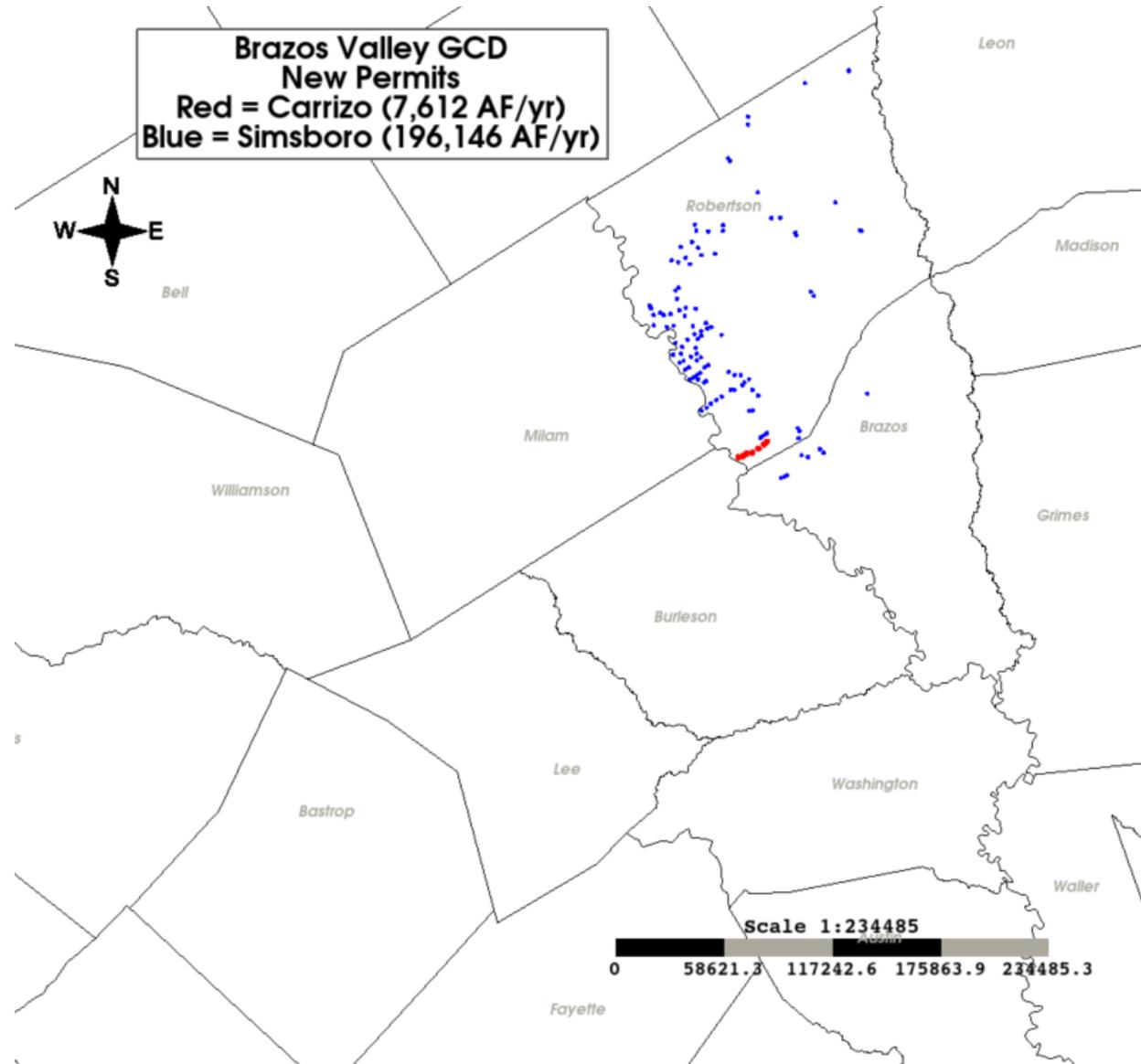
Bill Hutchison

September 18, 2024

Lost Pines Board Meeting

Background

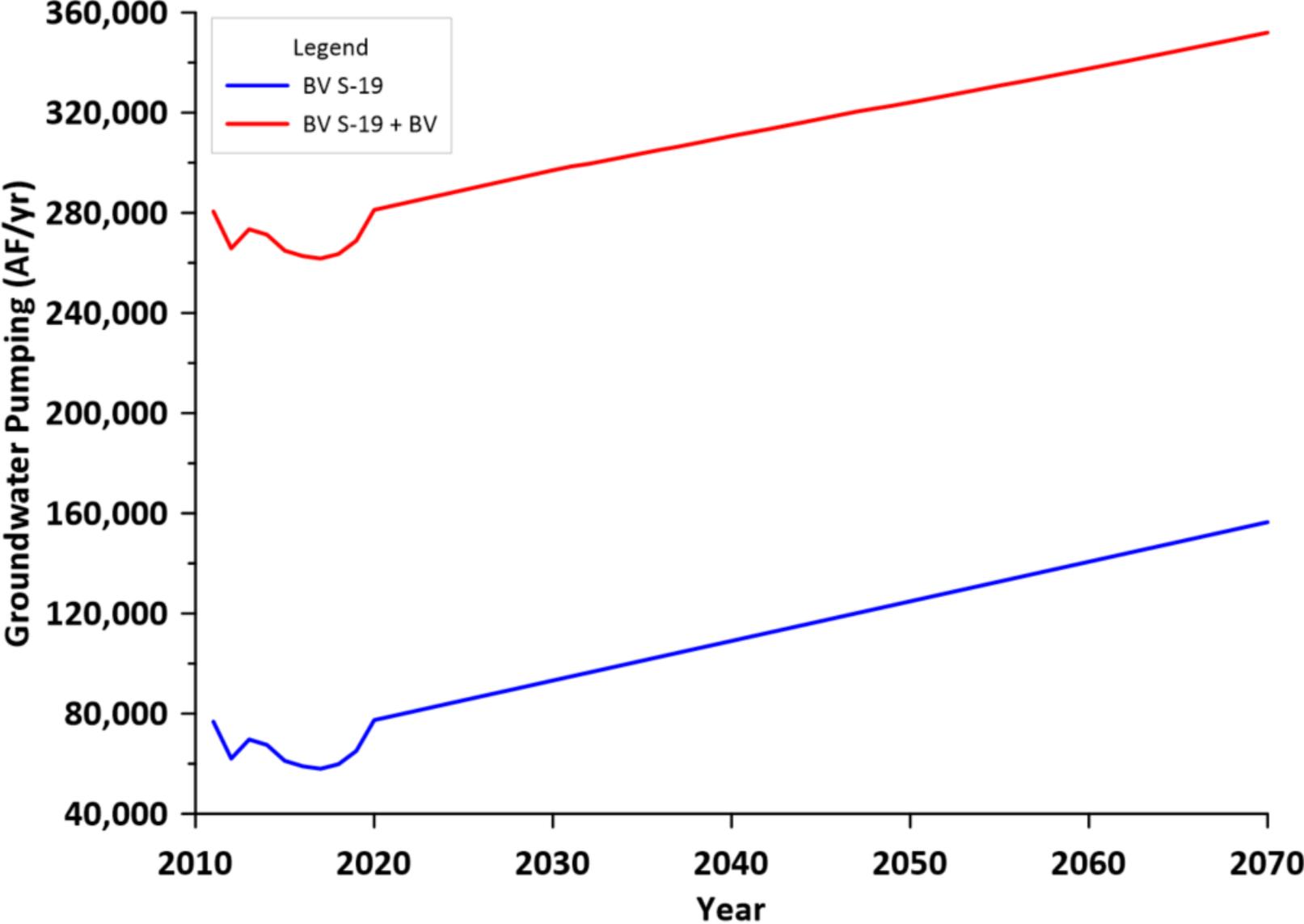
- Current DFC based on GAM Simulation known as “S-19”
- BVGCD recently approved permits in Carrizo and Simsboro Aquifers
 - Documented in Power Point by AGS dated January 11, 2024
- BVGCD forwarded details of 129 wells not in S-19
 - Latitude, longitude, annual permit limit, aquifer completion
- New permit totals:
 - Carrizo Aquifer (7 wells, 7,612 AF/yr)
 - Simsboro Aquifer (122 wells, 196,146 AF/yr)



Objective

- Add new permitted amounts (and locations) to S-19 simulation
- Complete evaluations related to:
 - Changes in average drawdown in each GCD
 - Location and extent of additional drawdown (contour maps)
 - Impacts to artesian head
 - Source of increased pumping (groundwater budgets on GCD level)
 - Effects on LPGCD registered wells

Brazos Valley GCD Groundwater Pumping Carrizo-Wilcox Aquifer



Average Drawdown from 2011 to 2070 (ft)

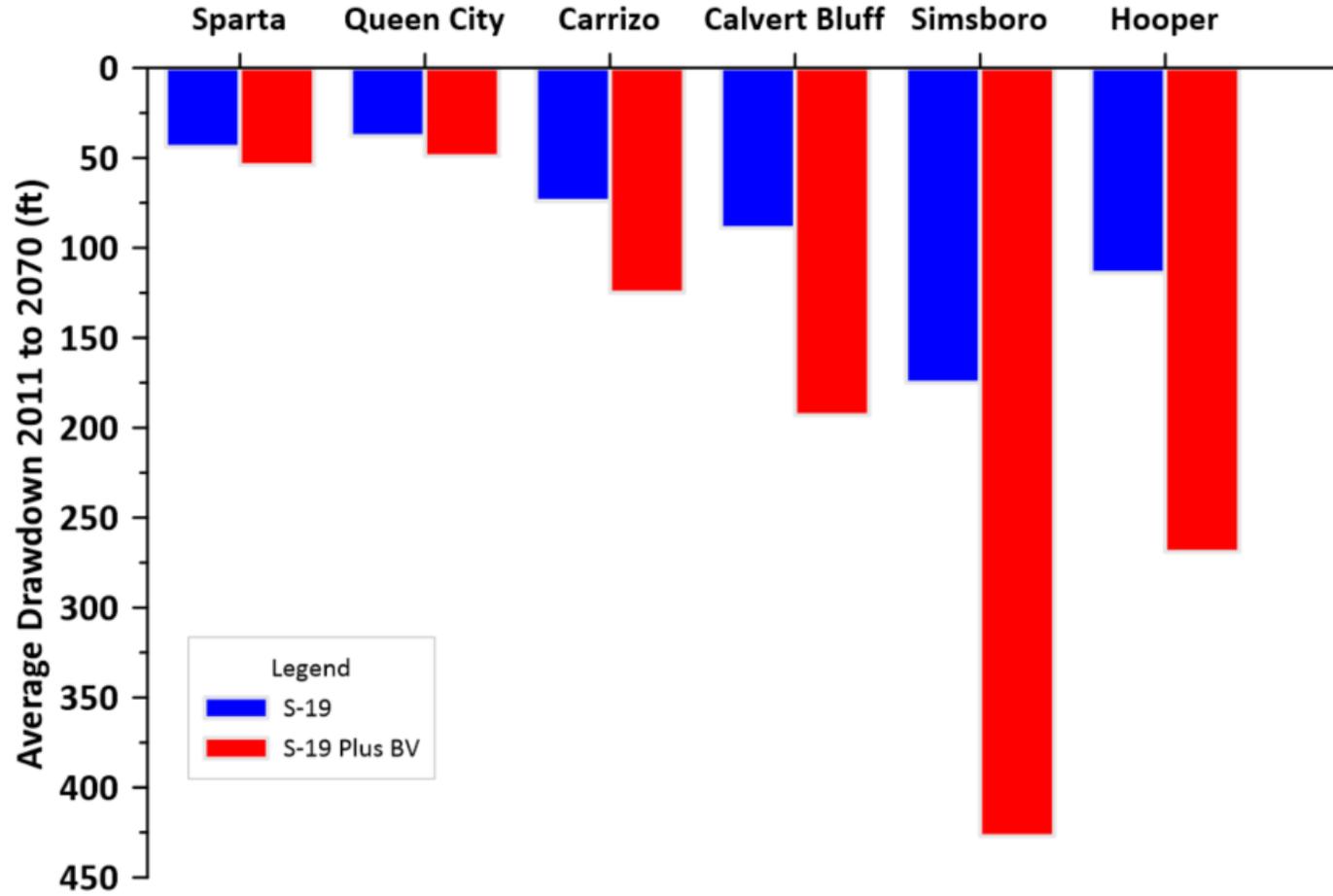
S-19

Aquifer	FCGCD	BVGCD	LPGCD	METGCD	POSGCD
Sparta	41	44	25	19	35
Queen City	67	38	28	19	28
Carrizo	140	74	141	99	135
Calvert Bluff	142	89	137	81	162
Sim sboro	208	175	246	79	287
Hooper	120	114	135	67	166

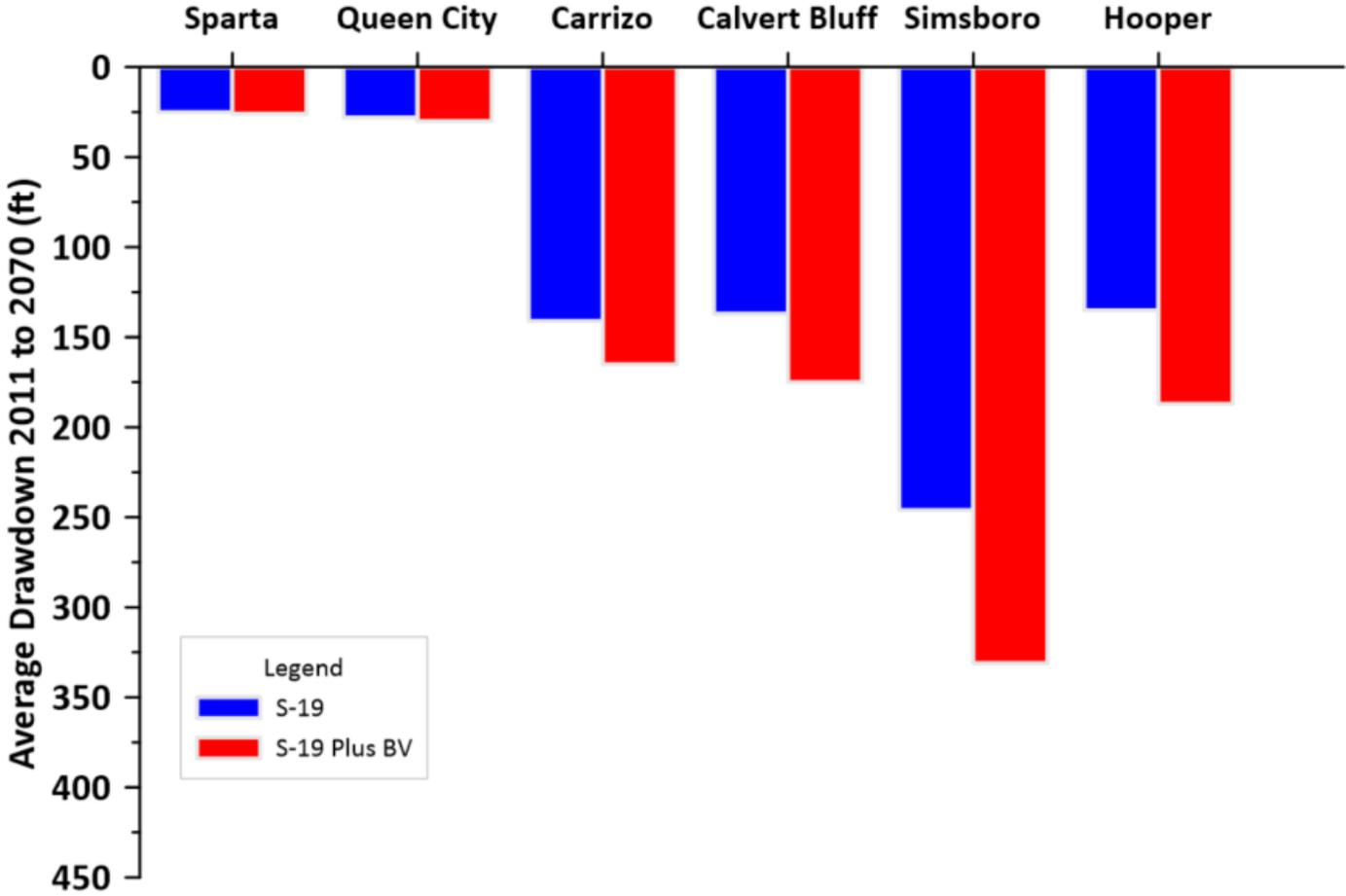
S-19 Plus New BVGCD Permits

Aquifer	FCGCD	BVGCD	LPGCD	METGCD	POSGCD
Sparta	43	54	26	23	38
Queen City	72	49	30	21	32
Carrizo	155	125	165	107	179
Calvert Bluff	178	193	175	92	268
Sim sboro	297	427	331	98	524
Hooper	166	269	187	82	313

GCD Average Drawdown - Dwndip Cells Brazos Valley GCD

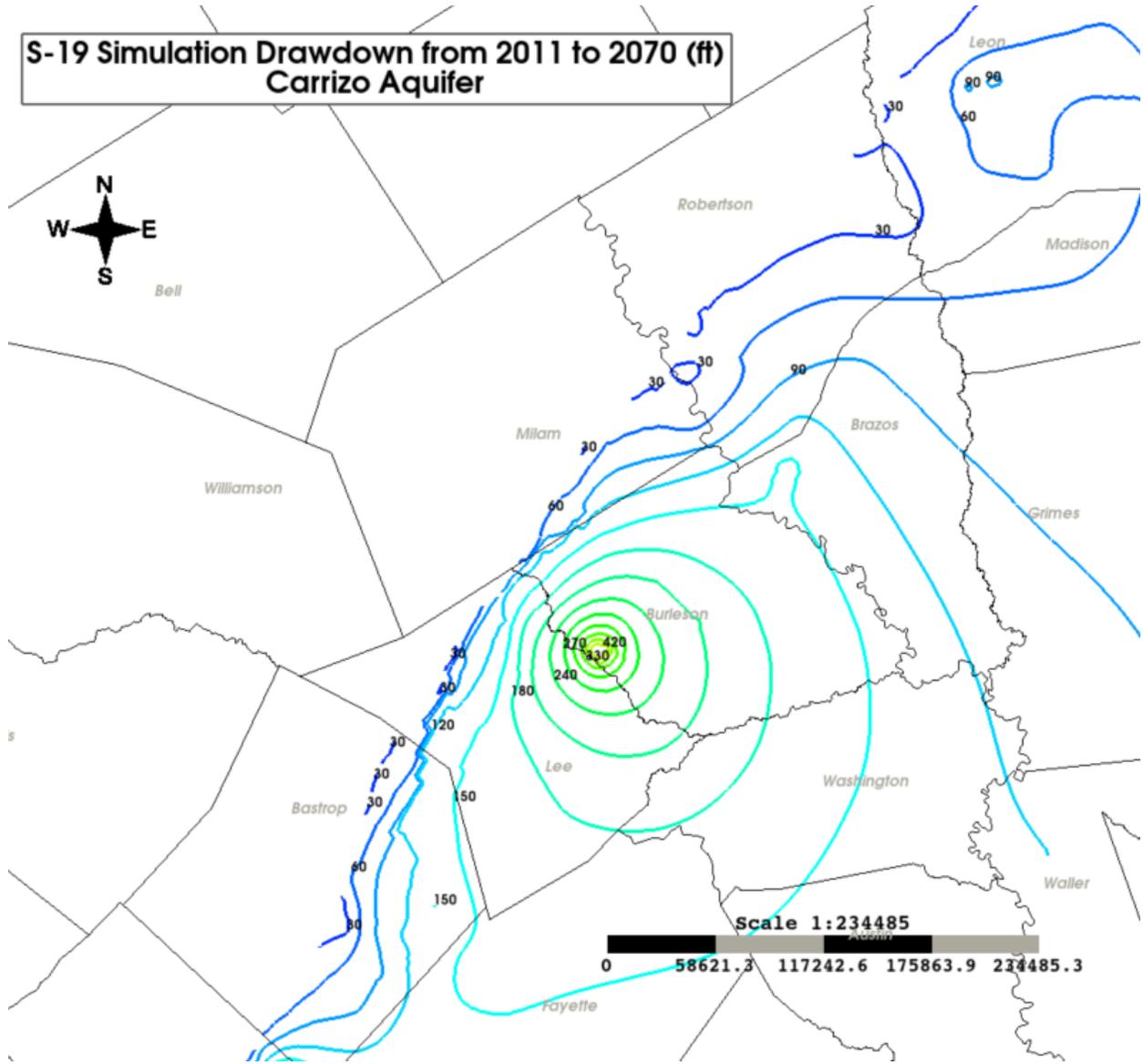
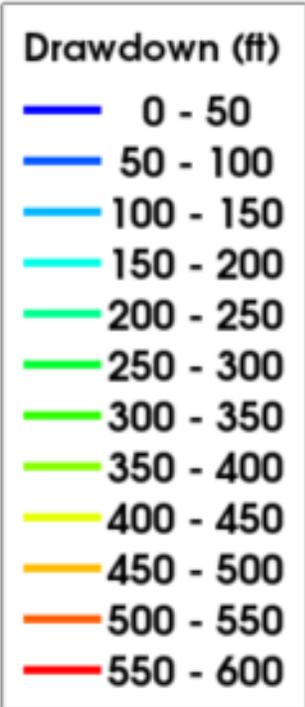


GCD Average Drawdown - Dwndip Cells Lost Pines GCD



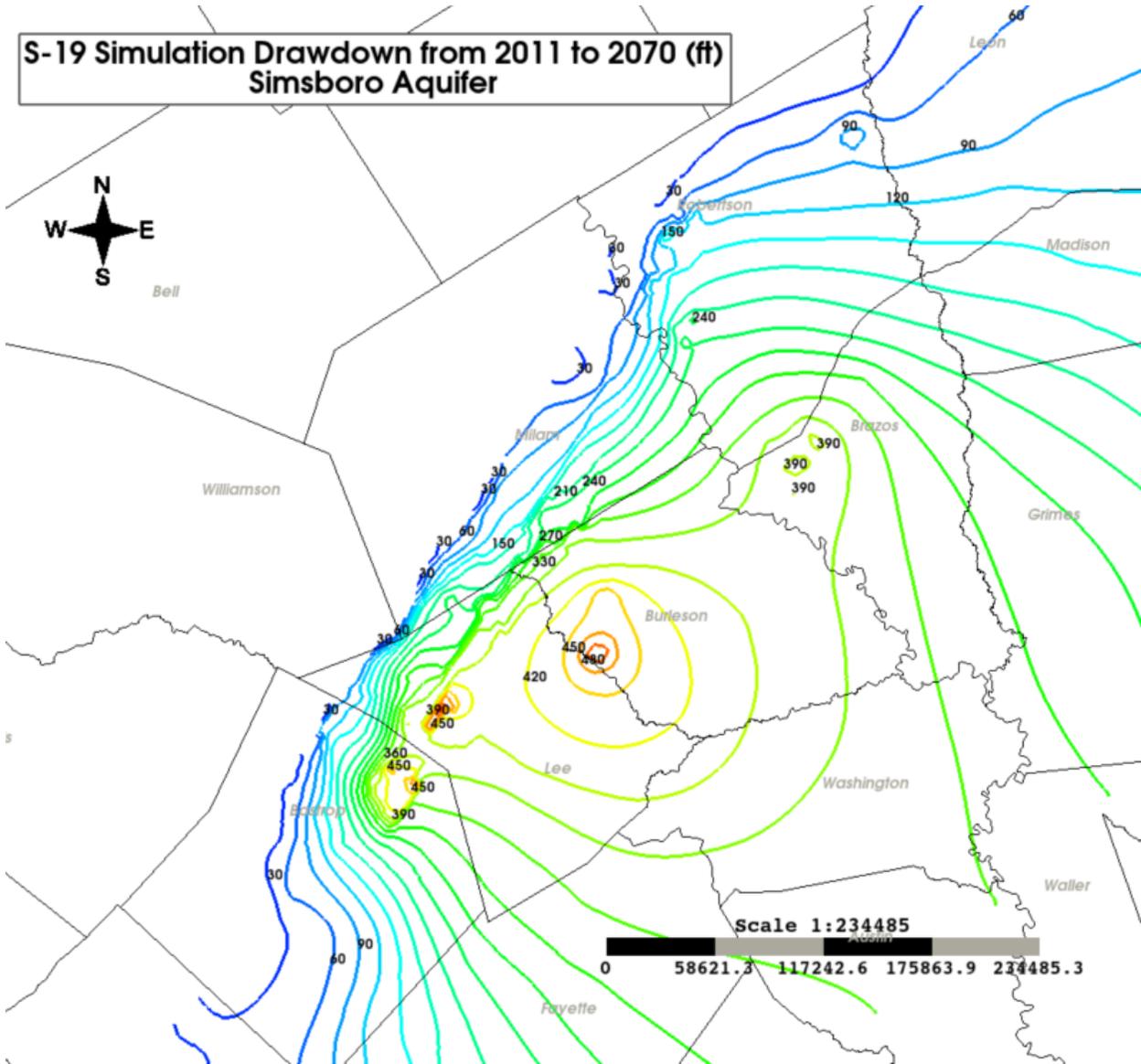
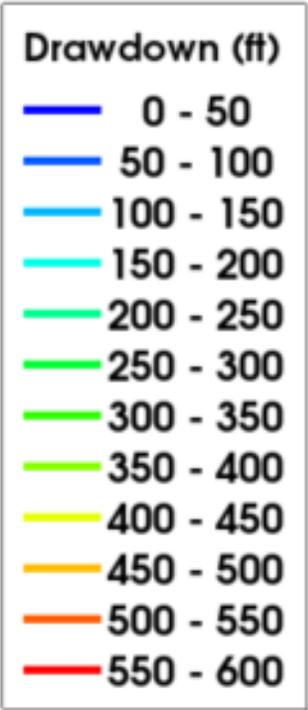
Maximum = 597 ft

**S-19 Simulation Drawdown from 2011 to 2070 (ft)
Carrizo Aquifer**



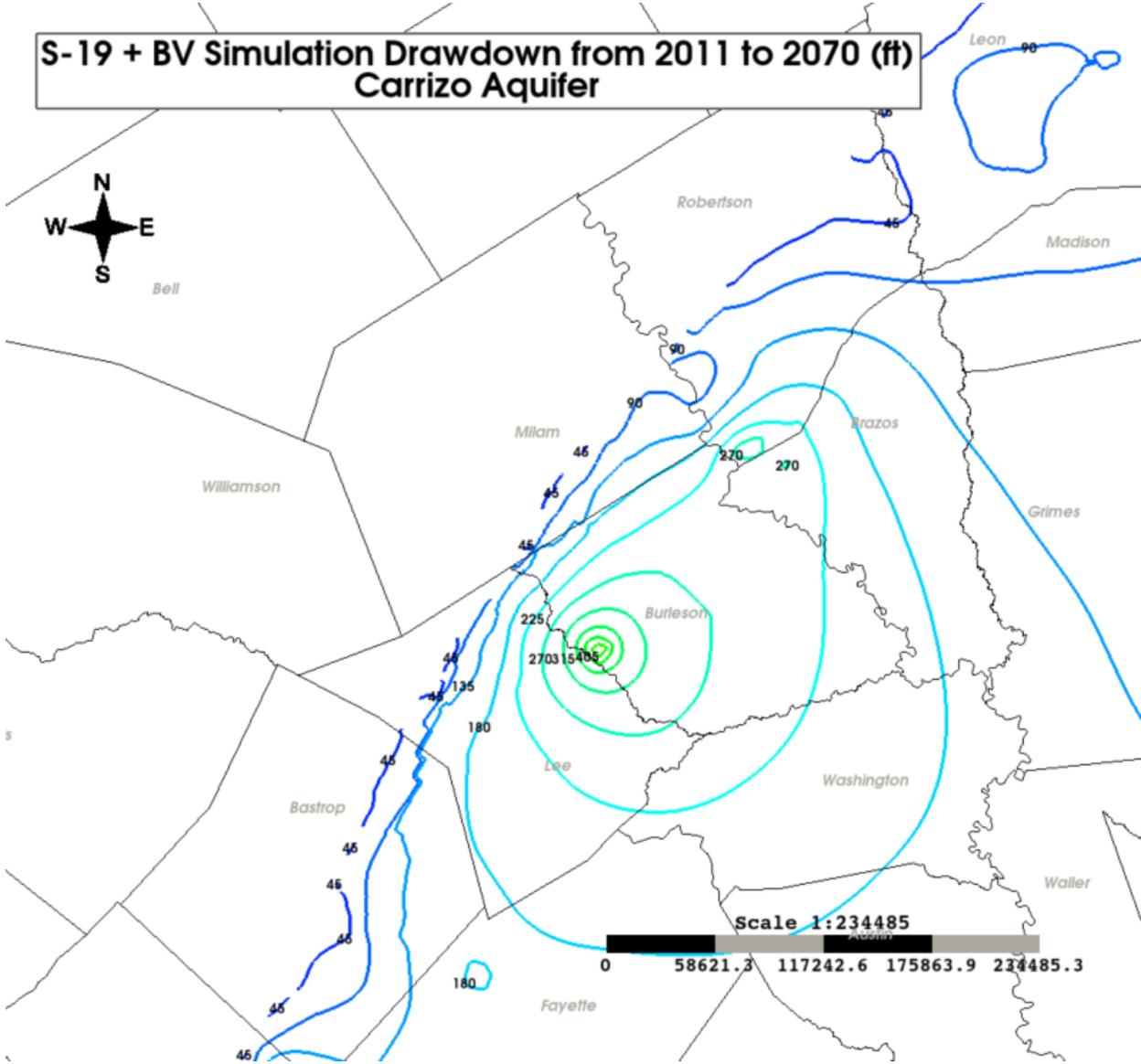
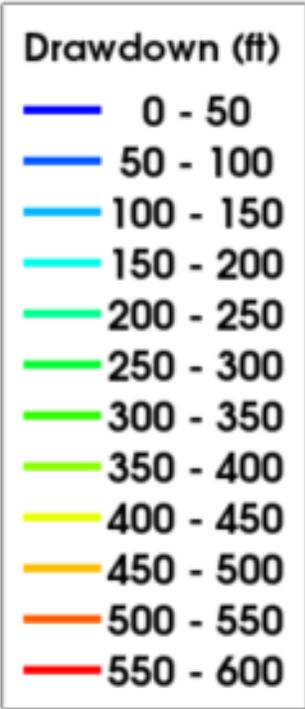
Maximum = 572 ft

**S-19 Simulation Drawdown from 2011 to 2070 (ft)
Simsboro Aquifer**



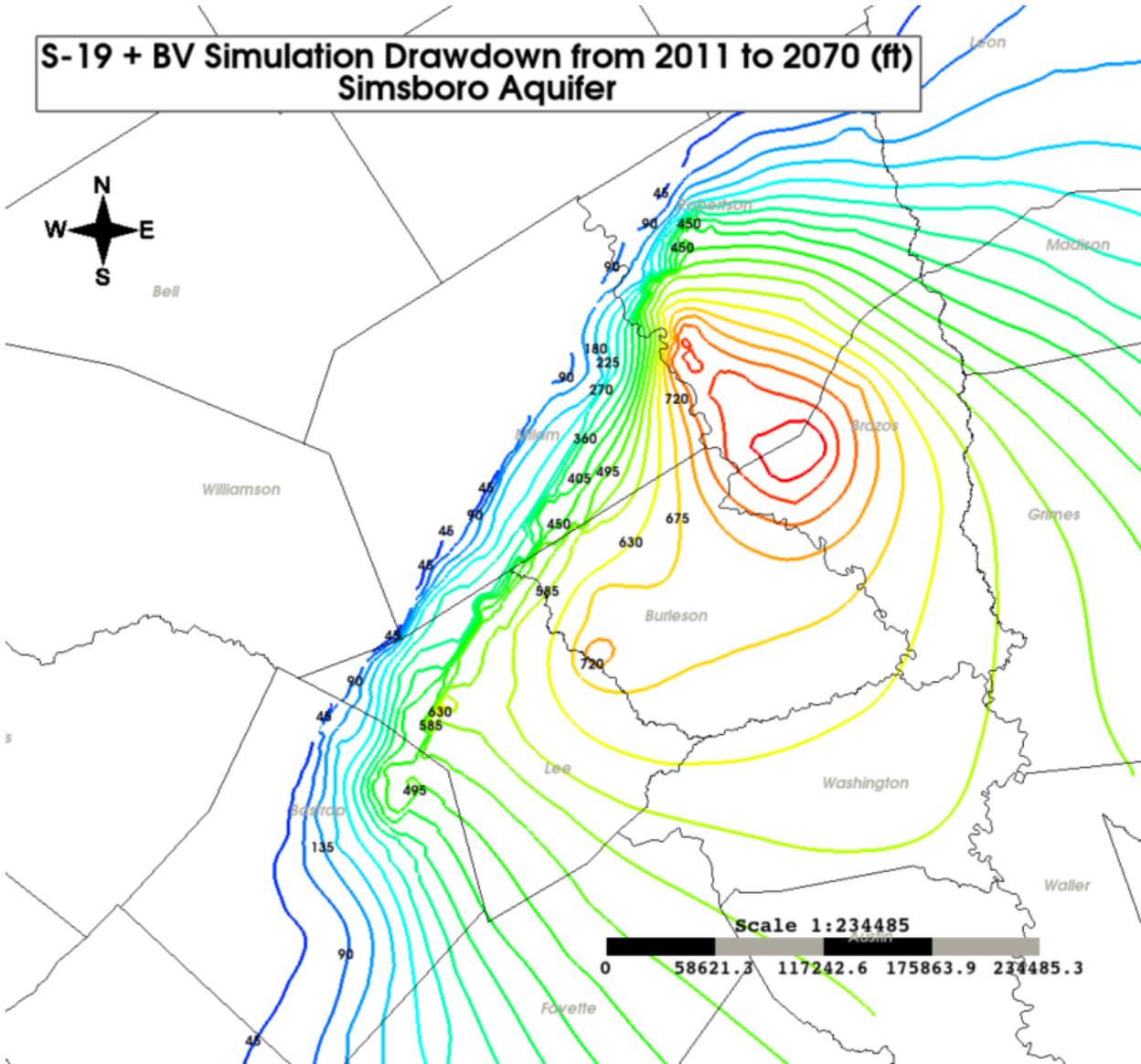
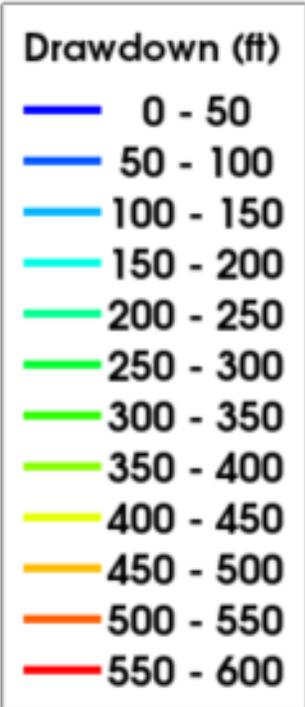
Maximum = 600 ft

S-19 + BV Simulation Drawdown from 2011 to 2070 (ft)
Carrizo Aquifer



Maximum = 904 ft

**S-19 + BV Simulation Drawdown from 2011 to 2070 (ft)
Simsboro Aquifer**

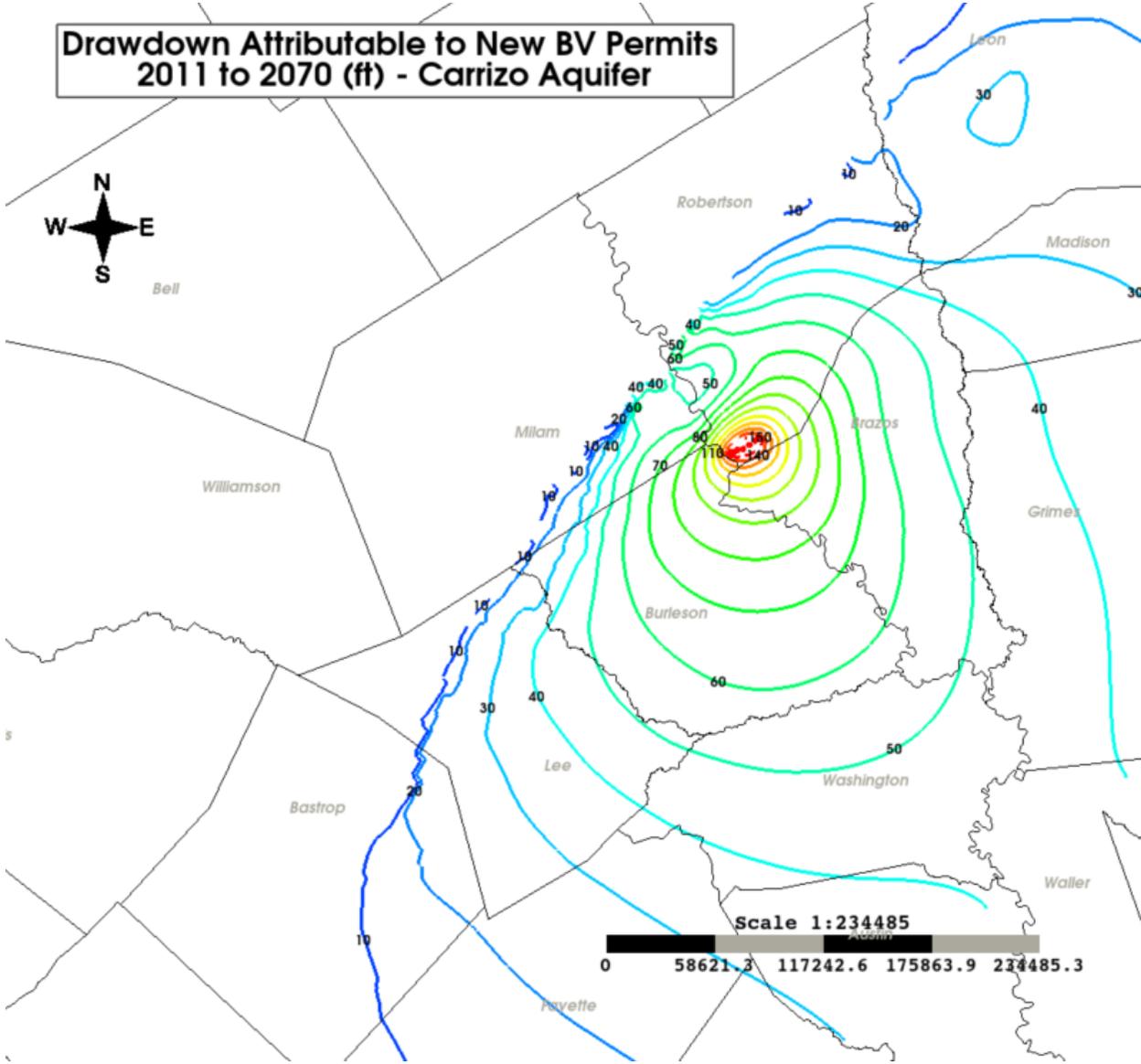


Maximum = 174 ft

**Drawdown Attributable to New BV Permits
2011 to 2070 (ft) - Carrizo Aquifer**

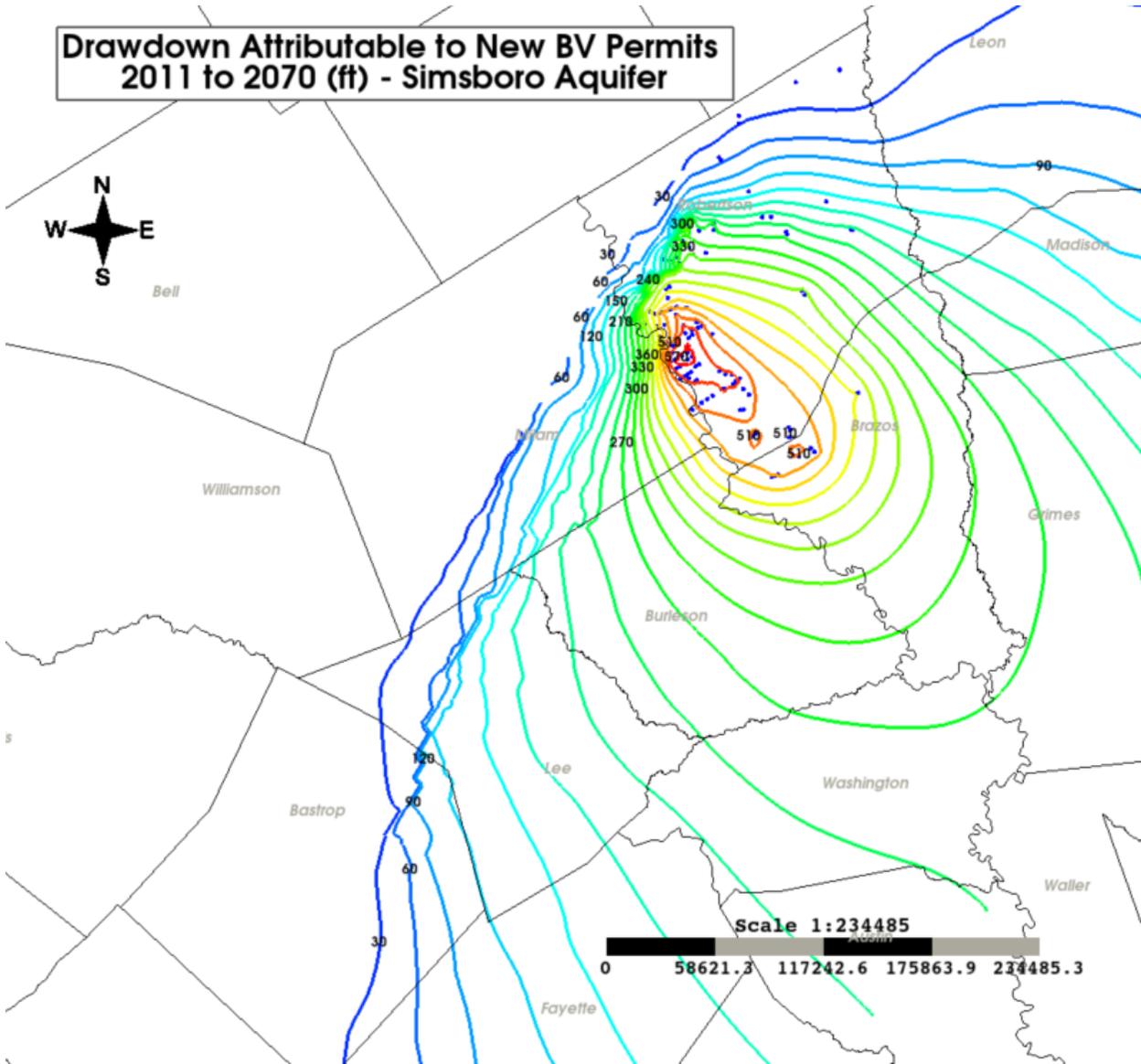
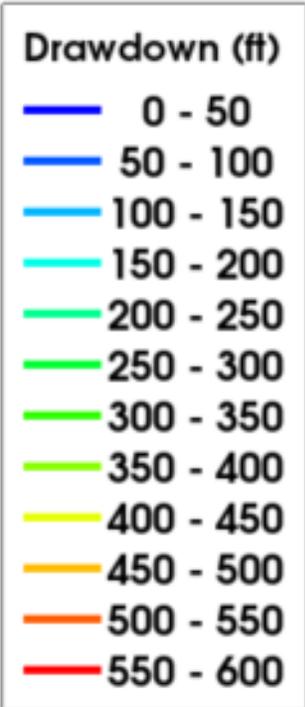


Drawdown (ft)	
0 - 50	Blue
50 - 100	Light Blue
100 - 150	Medium Blue
150 - 200	Cyan
200 - 250	Light Green
250 - 300	Green
300 - 350	Light Green
350 - 400	Yellow-Green
400 - 450	Yellow
450 - 500	Orange
500 - 550	Red-Orange
550 - 600	Red



Maximum = 585 ft

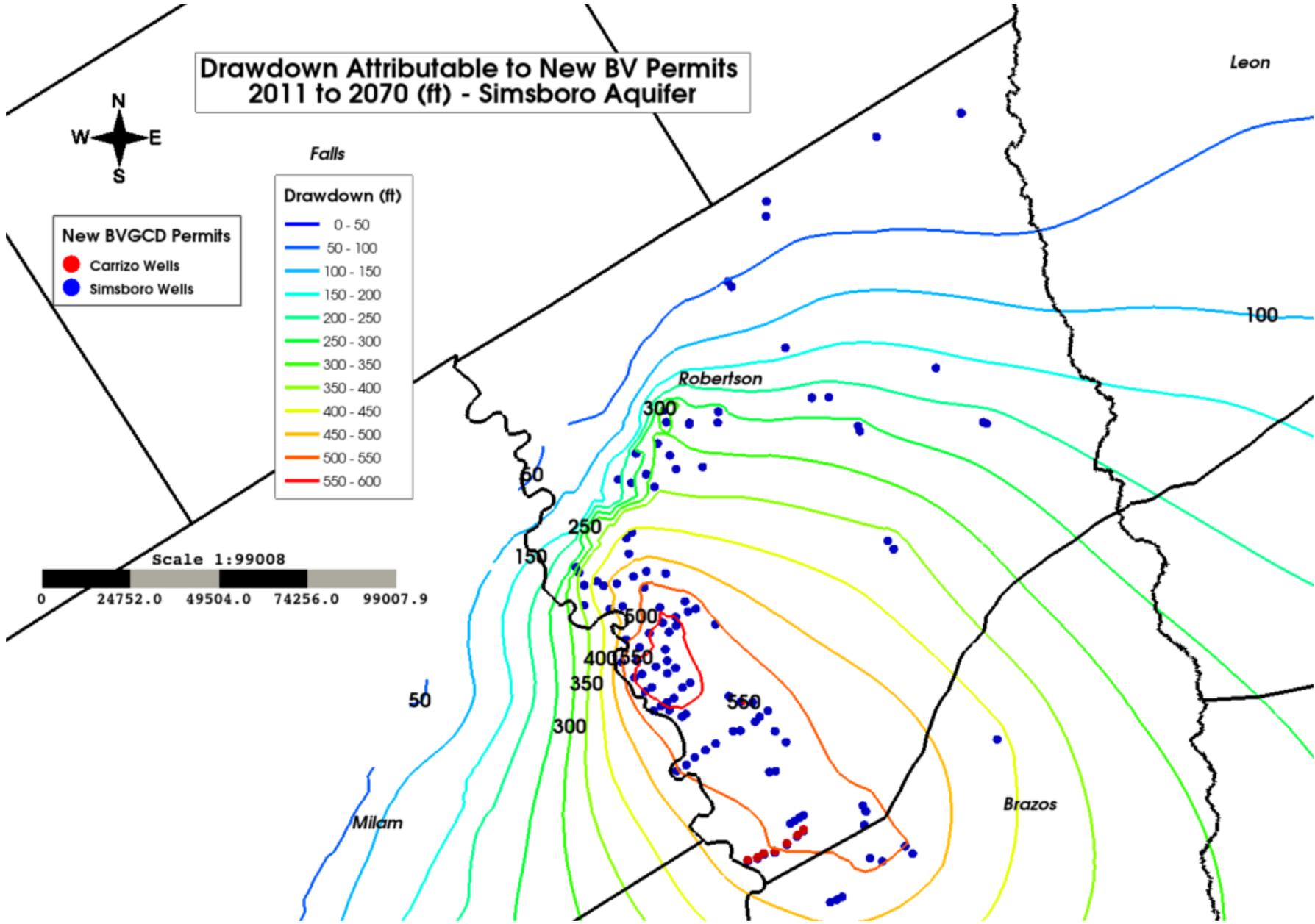
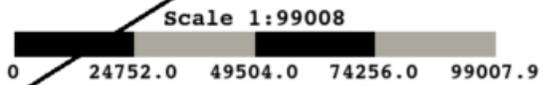
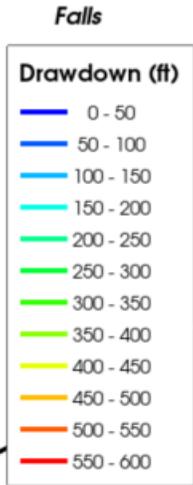
**Drawdown Attributable to New BV Permits
2011 to 2070 (ft) - Simsboro Aquifer**



Drawdown Attributable to New BV Permits 2011 to 2070 (ft) - Simsboro Aquifer

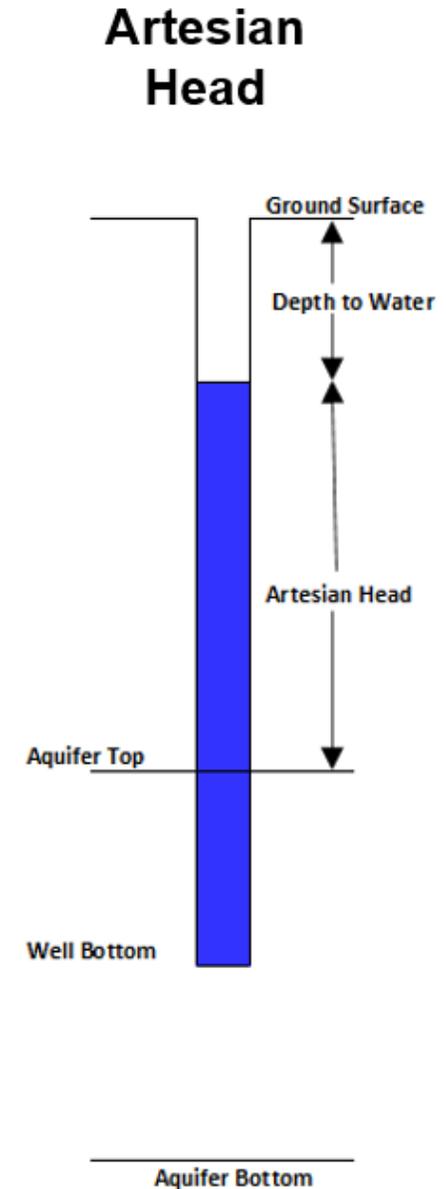


New BVGCD Permits
● Carrizo Wells
● Simsboro Wells

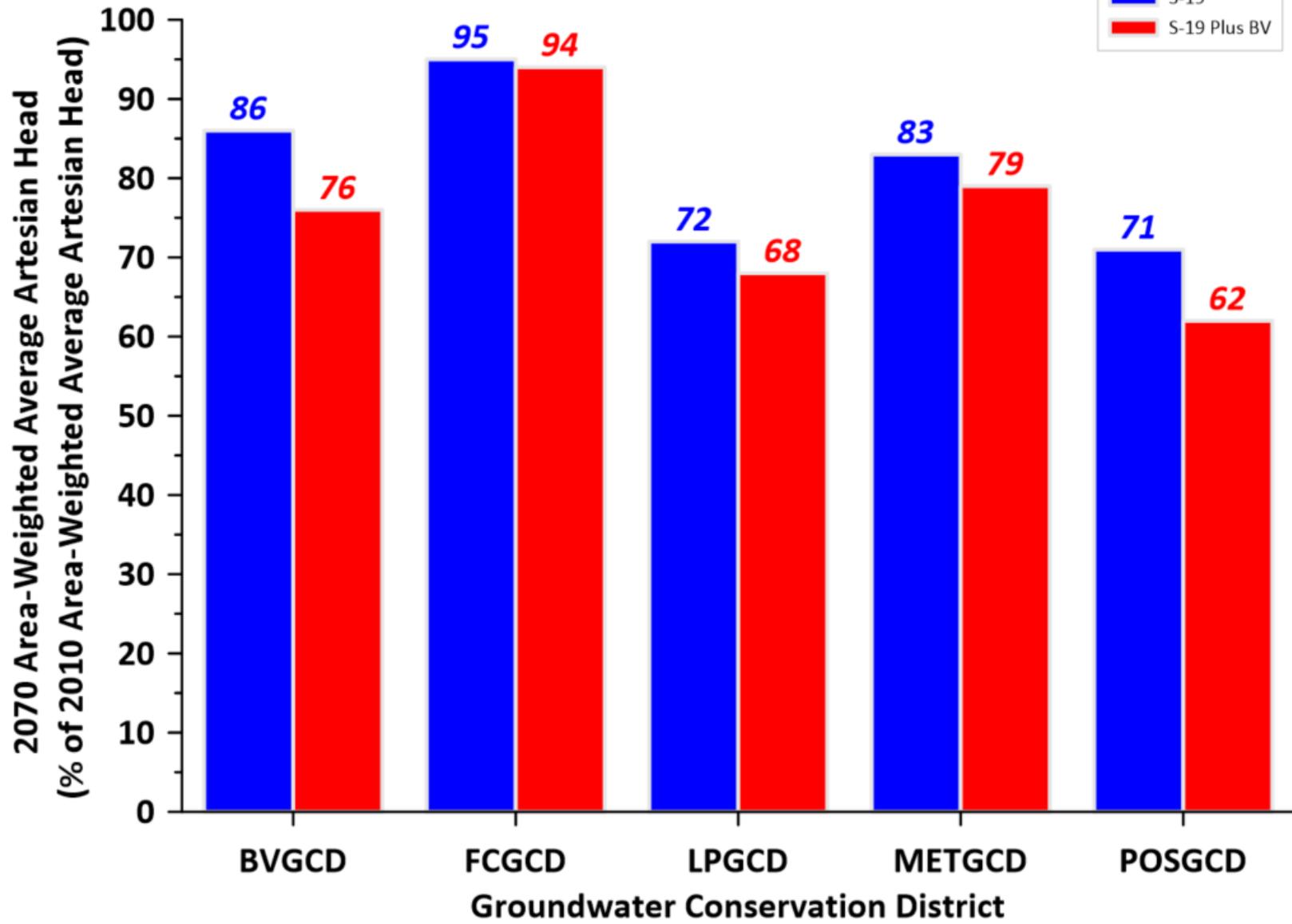
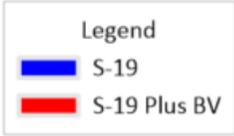


Impacts to Artesian Head

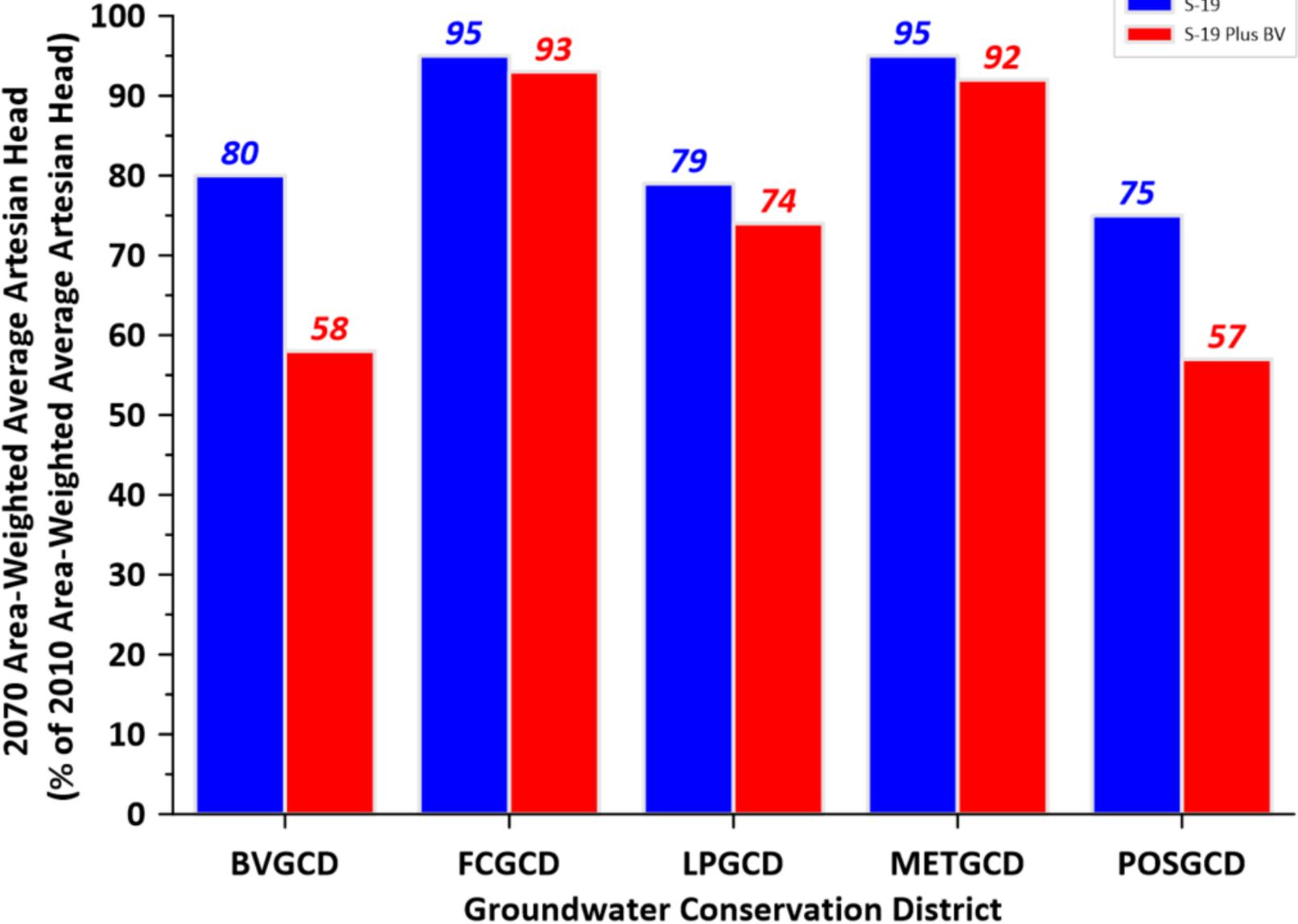
- Summarized by Aquifer and GCD
 - Report = Complete Set
 - Presentation = Selected



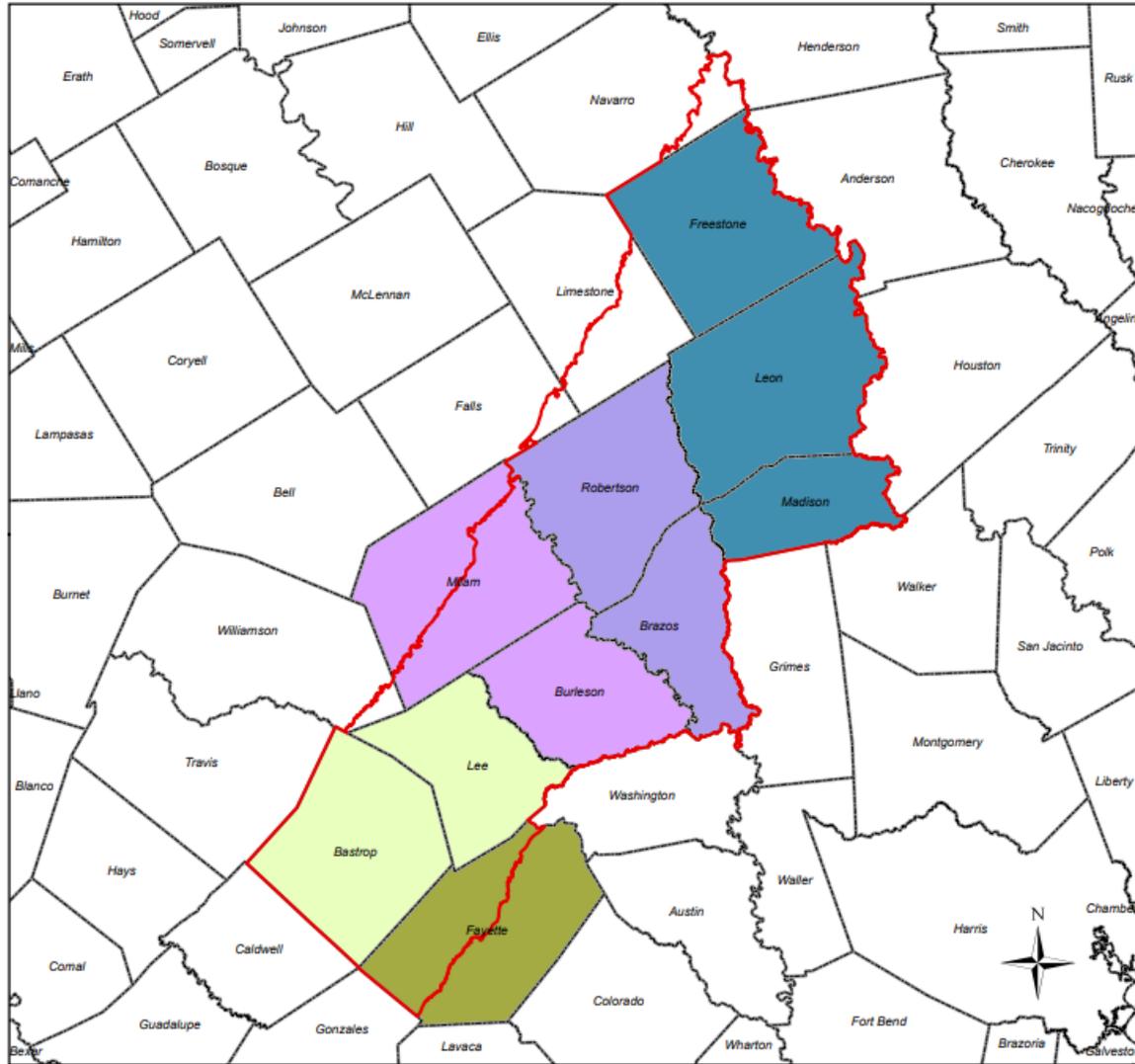
Carrizo Aquifer (S-19 and S-19 Plus BV)



Simsboro Aquifer (S-19 and S-19 Plus BV)



Groundwater Management Area 12



MAP LEGEND

- Groundwater Management Area 12
- Counties
- Groundwater Conservation Districts**
 - Brazos Valley GCD
 - Fayette County GCD
 - Lost Pines GCD
 - Mid-East Texas GCD
 - Post Oak Savannah GCD

DISCLAIMER
This map was generated by the Texas Water Development Board. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Boundaries for groundwater conservation districts are approximate and may not accurately depict legal descriptions.
Updated 8/26/2015



0 5 10 20 30 40 Miles

1 in = 14 miles

**LPGCD Groundwater Budget Layered,
Carrizo-Wilcox****Calibrated
GAM (1930 to
2010) (AF/yr)****S-19 (2011 to
2070) (AF/yr)****Difference
(AF/yr)****Inflows**

From Alluvium (Layer 1)	NA	126	126
From Shallow Flow System (Layer 2)	7,226	56,470	49,244
From Reklaw (Layer 6)	517	10,262	9,745
From Caldwell County	1,631	NA	-1,631
From Washington County	NA	2,459	2,459
From Williamson County	998	2,447	1,449
Total Inflow	10,372	71,764	61,392

Outflows

Pumping	5,279	70,815	65,536
To Alluvium (Layer 1)	266	NA	-266
To POSGCD	3,734	17,485	13,752
To Caldwell County	NA	638	638
To Fayette County	1,684	4,618	2,934
To Washington County	450	NA	-450
Total Outflow	11,412	93,557	82,145

Storage

Inflow minus Outflow	-1,040	-21,793	-20,753
Model Storage Change	-1,040	-21,793	-20,753

Water Balance Error

0

0

0

**BVGCD Groundwater Budget Layered,
Carrizo-Wilcox****Calibrated
GAM (1930 to
2010) (AF/yr)****S-19 (2011 to
2070) (AF/yr)****Difference
(AF/yr)****Inflows**

From Alluvium (Layer 1)	NA	56	56
From Shallow Flow System (Layer 2)	6,604	43,639	37,035
From Reklaw (Layer 6)	NA	3,184	3,184
From METGCD	NA	1,516	1,516
From POSGCD	10,942	36,117	25,175
From Falls County	754	1,360	606
From Grimes County	NA	7,545	7,545
From Limestone County	3,565	5,623	2,058
From Washington County	426	244	-182
Total Inflow	22,290	99,284	76,994

Outflows

Pumping	17,719	109,062	91,342
To Alluvium (Layer 1)	139	NA	-139
To Reklaw (Layer 6)	2,880	NA	-2,880
To METGCD	2,316	NA	-2,316
To Grimes County	383	NA	-383
Total Outflow	23,437	109,062	85,625

Storage

Inflow minus Outflow	-1,147	-9,778	-8,631
Model Storage Change	-1,147	-9,778	-8,631

Water Balance Error

0

0

0

BVGCD Groundwater Budget Layered, Carrizo-Wilcox	S-19 (2011 to 2070) (AF/yr)	S-19 Plus BV (2011 to 2070) (AF/yr)	Difference (AF/yr)	Source of Increased Pumping (% of Pumping)
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Inflows

From Alluvium (Layer 1)	56	277	221	0.11
From Shallow Flow System (Layer 2)	43,639	78,882	35,243	17.56
From Reklaw (Layer 6)	3,184	11,377	8,192	4.08
From METGCD	1,516	10,935	9,418	4.69
From POSGCD	36,117	122,892	86,775	43.23
From Falls County	1,360	1,758	399	0.20
From Grimes County	7,545	17,208	9,663	4.81
From Limestone County	5,623	7,327	1,704	0.85
From Washington County	244	1,051	807	0.40
Total Inflow	99,284	251,707	152,423	75.93

Outflows

Pumping	109,062	309,800	200,738	100.00
Total Outflow	109,062	309,800	200,738	100.00

Storage

Inflow minus Outflow	-9,778	-58,093	-48,315	24.07
Model Storage Change	-9,778	-58,093		

Water Balance Error

0 0

**LPGCD Groundwater Budget Layered,
Carrizo-Wilcox**

	S-19 (2011 to 2070) (AF/yr)	S-19 Plus BV (2011 to 2070) (AF/yr)	Difference (AF/yr)	Source of Increased Pumping (% of Pumping)
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Inflows

From Alluvium (Layer 1)	126	151	26	0.01
From Shallow Flow System (Layer 2)	56,470	60,779	4,310	2.15
From Reklaw (Layer 6)	10,262	12,027	1,765	0.88
From Washington County	2,459	2,541	82	0.04
From Williamson County	2,447	2,596	149	0.07
Total Inflow	71,764	78,095	6,331	3.15

Outflows

Pumping	70,815	70,767	-47	-0.02
To POSGCD	17,485	27,677	10,191	5.08
To Caldwell County	638	448	-190	-0.09
To Fayette County	4,618	5,718	1,100	0.55
Total Outflow	93,557	104,611	11,054	5.51

Storage

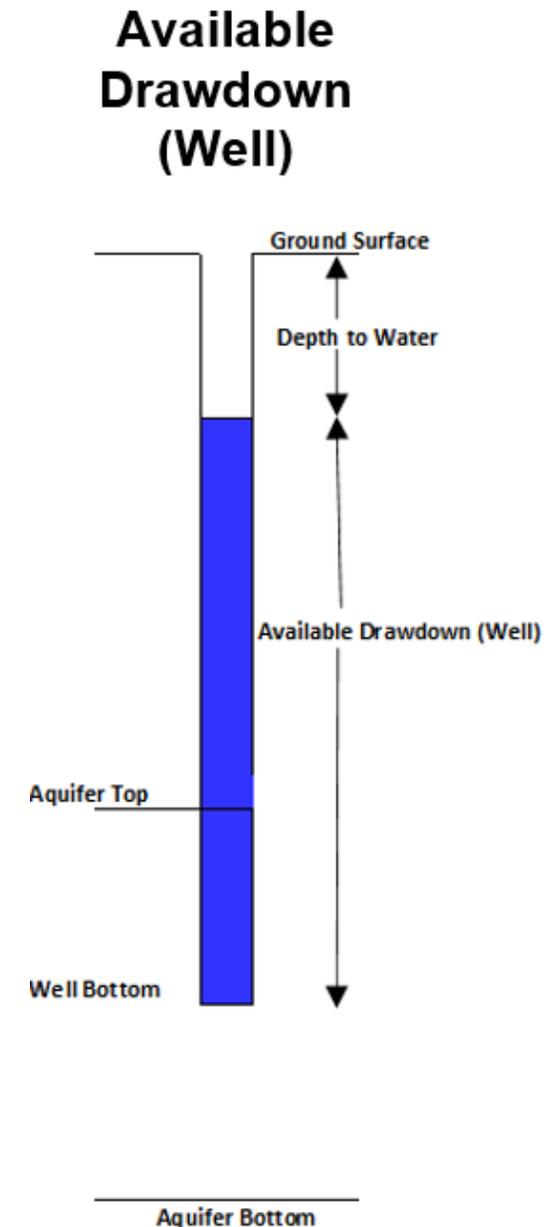
Inflow minus Outflow	-21,793	-26,516	-4,723	2.35
Model Storage Change	-21,793	-26,516		

Water Balance Error

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Impacts to Available Drawdown (Well) in LPGCD

- Based on LPGCD Registered Wells
 - Database is currently being updated/improved



LPGCD Registered Wells

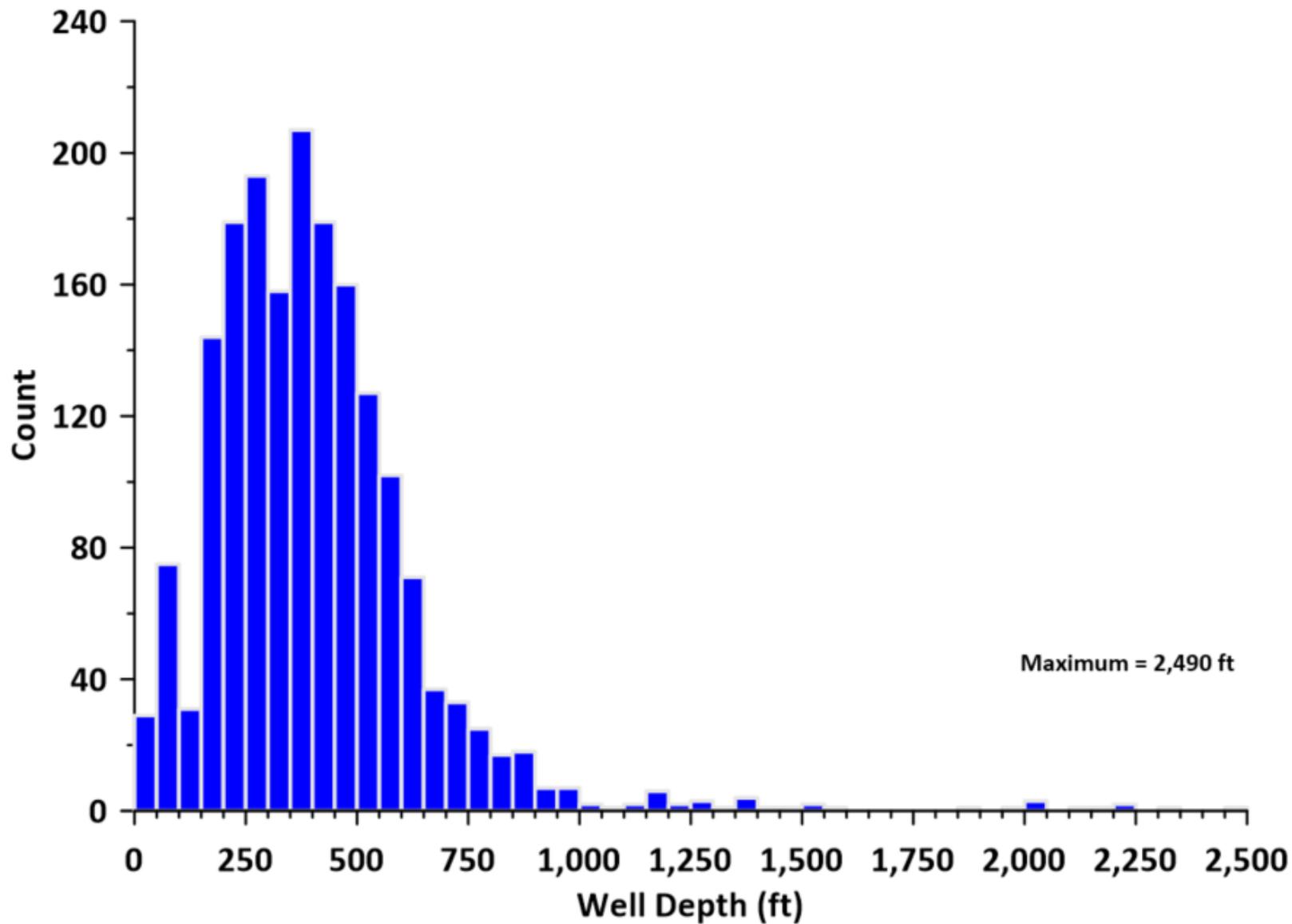
- 3,513 Registered Wells
 - 1,836 “useable” (52%)
- Wells not used pending update to database
 - 355 with coordinate issues
 - 323 with depth issues
 - 802 with surface elevation issues
 - 197 outside of model grid

Registered Wells

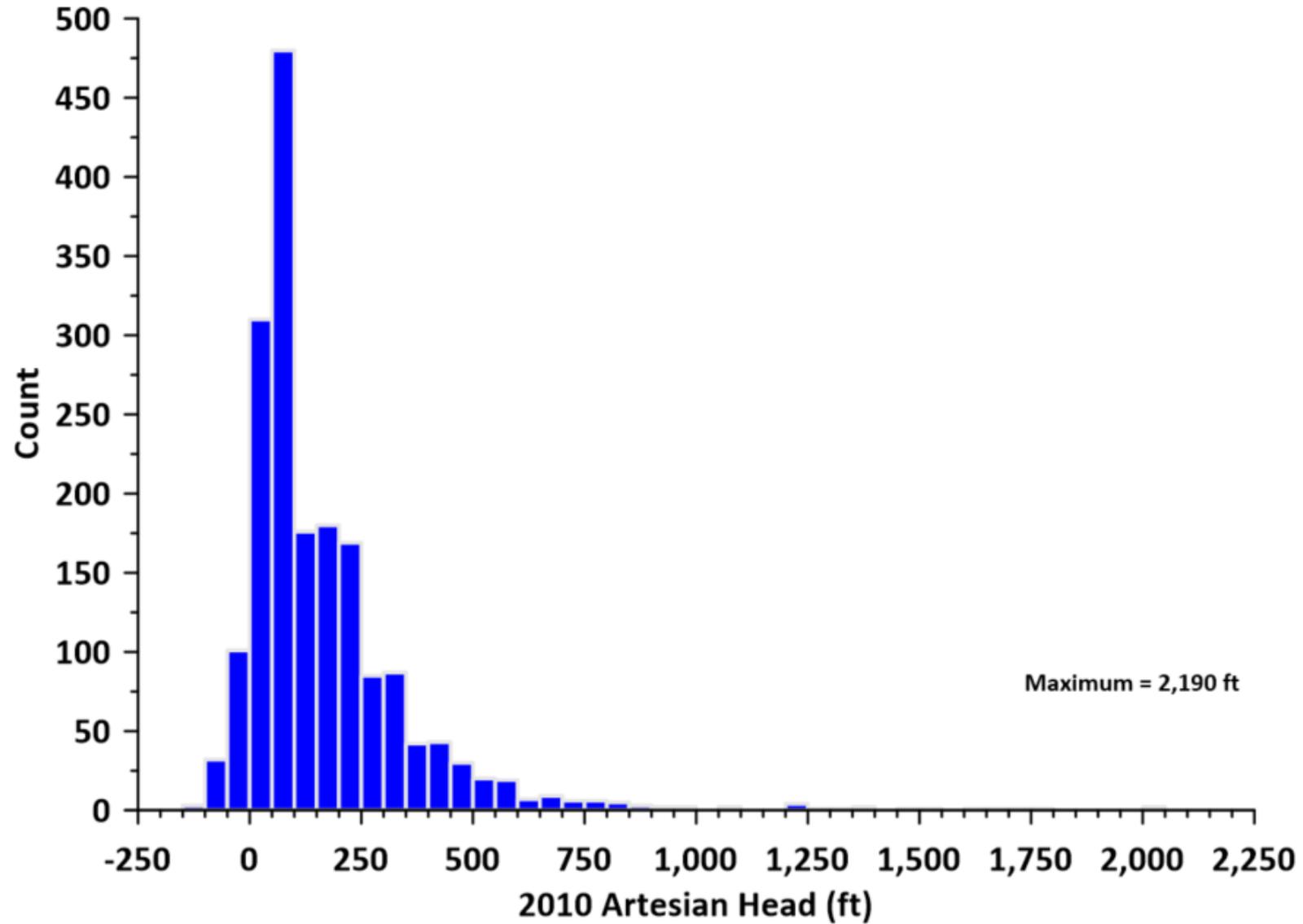
- GAM cell (and layer) assignment
 - Based on latitude, longitude, surface elevation, well depth
- Outcrop or downdip designation
- 2010 groundwater elevation (from GAM)
- 2010 Artesian Head
 - 2010 GWE – Top of model cell
 - + = downdip, - = outcrop
- 2010 Available Drawdown (Well)
 - 2010 GWE – Well Bottom Elevation
- 2010 Available Drawdown (Aquifer)
 - 2010 GWE – Cell Bottom Elevation

Frequency Distribution - LPGCD Registered Wells

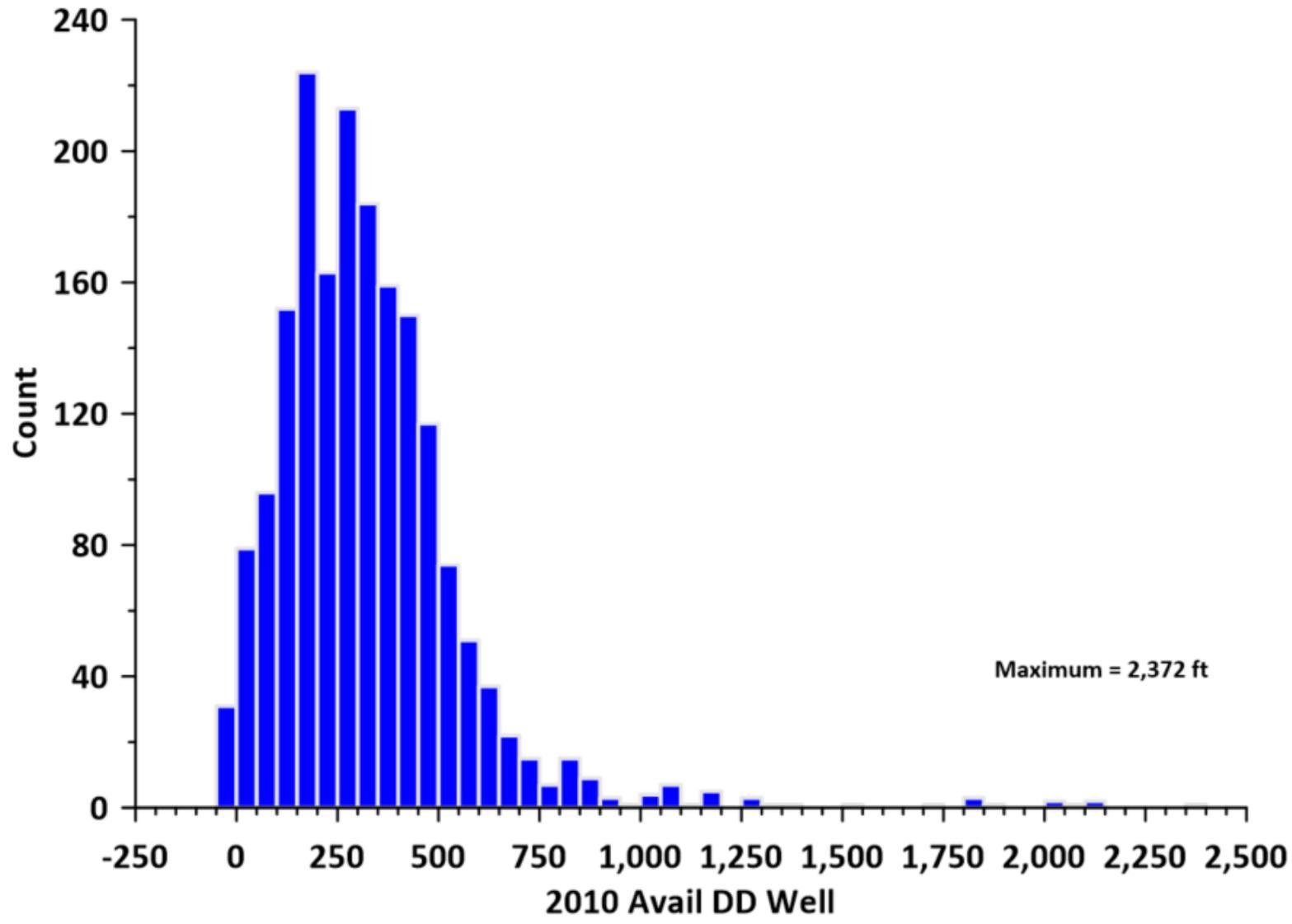
Well Depth



Frequency Distribution - LPGCD Registered Wells 2010 Artesian Head



Frequency Distribution - LPGCD Registered Wells 2010 Available Drawdown (Well)



Based on 2010 Available Drawdown (Well)

- 31 wells have negative available drawdown (dry wells)
 - Average well depth = 77 feet
 - Model limitation (?)
- 51 wells have 0 – 30 feet of available drawdown
 - Average depth = 90 feet
- Ignore these 82 wells for purposes of S-19 and S-19 + BV analyses

Based on 2070 Available Drawdown (Well)

- S-19
 - 19 wells will have “negative” available drawdown (dry wells)
 - Average depth = 245 feet
 - 38 wells will have available drawdown less than 30 feet
 - Average depth = 176 feet
- S-19 + BV
 - No additional wells have “negative” available drawdown (dry wells)
 - 3 additional wells have available drawdown less than 30 feet
 - Average depth 121 feet

Summary of Impacts

- Pumping increase is small in Carrizo and large in Simsboro
- Largest impact to artesian head is in BVGCD
- Impact on artesian head in POSGCD is larger than impact in LPGCD and METGCD
- Impact in FCGCD is minimal (deep aquifers)
- Results are an example of how artesian head impacts could be “balanced”
 - Does a proposed DFC yield nearly equal artesian head in BVGCD, LPGCD, and POSGCD?