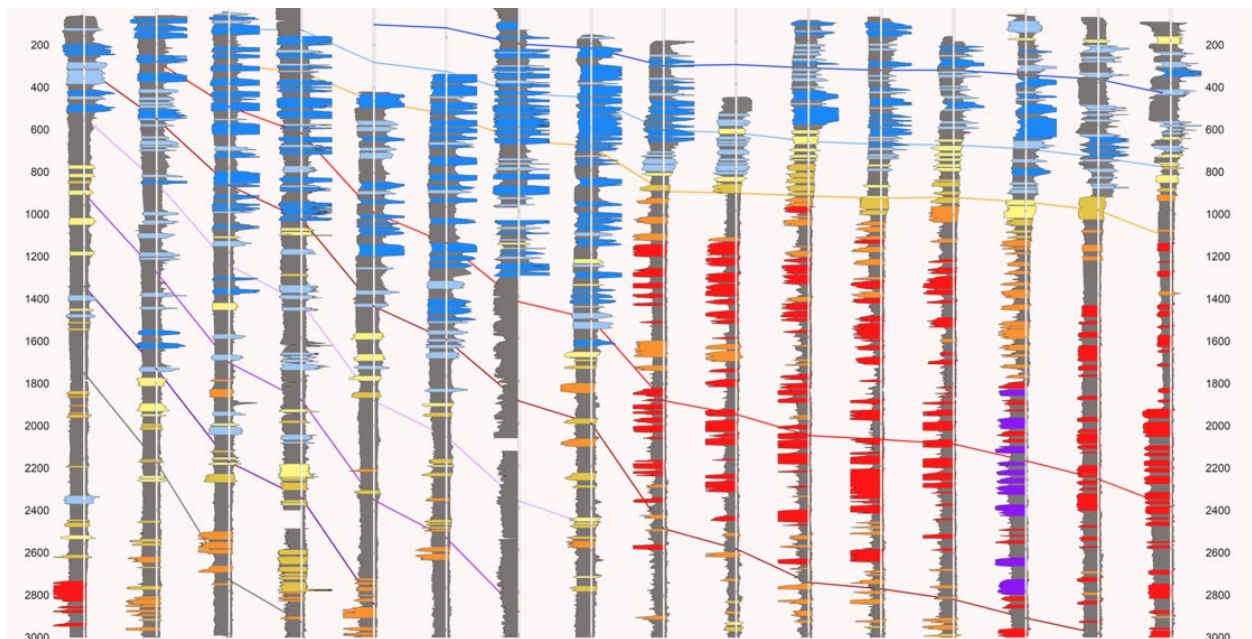


FINAL

Characterization of Brackish Groundwater Resources for Calhoun, Jackson, Refugio, and Victoria Counties

Addendum #2. Simulation of Drawdowns Caused by Brackish Groundwater Production



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JULY 2026

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Characterization of Brackish Groundwater Resources for Calhoun, Jackson, Refugio, and Victoria Counties

Addendum #2. Simulation of Drawdowns Caused by Brackish Groundwater Production

Prepared for: Calhoun County Groundwater Conservation District
Texana Groundwater Conservation District
Refugio Groundwater Conservation District
Victoria County Groundwater Conservation District

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JULY 2026

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Acronyms and Abbreviations

CGCBGWF	Central Gulf Coast Brackish Groundwater Flow
DSGMZ	Deep-saline Special Groundwater Management Zone
TDS	Total Dissolved Solids

1.0 Evaluations of Drawdown Impacts of Groundwater Development in Deep-saline Special Groundwater Management Zones

The Central Gulf Coast Brackish Groundwater Flow Model (CGCBGWF Model) was applied to simulate the drawdown as results of developing brackish groundwater in the three Deep-saline Special Groundwater Management Zones (DSGMZs): the Slightly Saline DSGMZ, the Moderately Saline DSGMZ, and the Extremely Saline DSGMZ. The the DSGMZs are spread across Victoria, Calhoun, Refugio, and Jackson counties. Production well field locations within each DSGMZ were selected based on aquifer transmissivity values derived from the model. **Figures 1-1 through 1-3** illustrate the well fields at the sites of high transmissivity ($> 5,000 \text{ ft}^2/\text{d}$), medium transmissivity ($1,000 - 5,000 \text{ ft}^2/\text{d}$), and low transmissivity ($< 1,000 \text{ ft}^2/\text{d}$). The high transmissivity site in the Slightly Saline DSGMZ is not located in the Refugio County, because the CGCBGWF Model's maximum transmissivity for Refugio County is about $3,000 \text{ ft}^2/\text{d}$. As shown in **Table 1-1**, well fields in the Slightly Saline DSGMZ, Moderately Saline DSGMZ, and Extremely Saline DSGMZ are assigned a production rate of 10,000 acre-feet per year (AFY), 7,000 AFY, and 5,000 AFY, respectively. Each well field is comprised of nine production wells with 0.5-mile spacing and evenly distributed production rates. These wells are designed to withdraw groundwater from either a single model layer or multiple model layers. The freshwater layer provided in **Table 1-1** is the deepest model layer with a Total Dissolved Solids (TDS) conceneration less than 1,000 mg/L (refer to Figure 2-39 in the report) at the well field location. The recharge and discharge processes in the CGCBGWF Model were model using the same approach that is described in Addendum #1.

The cumulative impacts of simultaneous pumping from the well fields of the same transmissivity category within the same DSGMZ are summarized in **Table 1-2**. When pumping concurrently in the Slightly Saline DSGMZ, simulated drawdown in brackish zones varies from 75 to 946 ft, depending on aquifer transmissivity. Large drawdown occurs at the well fields of low transmissivity. The corresponding drawdown in freshwater zones ranges from 3 to 41 ft, which is about 1% – 25% of the drawdown in brackish zones. The relatively small vertical hydraulic conductivity limits the propogation of drawdown impacts to the freshwater zones. Moreover, the simulation suggests less drawdown impacts when developing brackish groundwater in the Moderately Saline DSGMZ and the Extremely Saline DSGMZ, due to reduced pumping rates. The simulated drawdown in freshwater zones varies from 2 to 17 ft when pumping from the Moderately Saline DSGMZ, while it is 1 to 3 ft when pumping from the Extremely Saline DSGMZ.

Figures 1-4 through 1-12 illustrate the spatial distribution of drawdown impacts resulting from simultaneous pumping from a group of well fields. Because the pumping layers and freshwater layers vary by well field, each figure depicts the composite maximum simulated drawdown across all the pumping layers (brackish layers) or all the freshwater layers. The composite maximum drawdown is generated by creating a raster that uses the maximum drawdown that occurs in any of the layers at a specific grid cell location.

Table 1-1. Locations of well fields for brackish groundwater productions. DSGMZ: Deep-saline Special Groundwater Management Zone.

Well Field ID	County	Transmissivity Category	Transmissivity Values (ft ² /d)	Latitude	Longitude	DSGMZ	Pumping Rate (AFY)	Pumping Layers	Fresh Water Layer
1	Calhoun	High	5,980	28.647209	-96.790192	Slightly Saline	10,000	6	3
2	Jackson	High	6,870	28.822492	-96.626747	Slightly Saline	10,000	6, 7	4
3	Victoria	High	6,605	28.657758	-96.801503	Slightly Saline	10,000	6	4
4	Calhoun	High	7,216	28.669657	-96.667023	Moderately Saline	7,000	6, 7	2
5	Jackson	High	9,384	28.730546	-96.641603	Moderately Saline	7,000	6, 7, 8	2
6	Refugio	High	7,344	28.444768	-96.901544	Moderately Saline	7,000	6, 7	4
7	Victoria	High	7,199	28.700720	-96.677623	Moderately Saline	7,000	7, 8, 9	2
8	Calhoun	High	9,046	28.613424	-96.674773	Extremely Saline	5,000	7, 8	1
9	Jackson	High	7,800	28.720468	-96.461119	Extremely Saline	5,000	6, 7	1
10	Refugio	High	9,062	28.350142	-96.811573	Extremely Saline	5,000	6, 7	2
11	Victoria	High	7,925	28.880070	-96.870135	Extremely Saline	5,000	14, 15	6
12	Calhoun	Medium	2,886	28.534128	-96.782271	Slightly Saline	10,000	4	2
13	Jackson	Medium	1,696	29.042498	-96.420103	Slightly Saline	10,000	8	5
14	Refugio	Medium	1,247	28.423640	-97.320873	Slightly Saline	10,000	10	7
15	Victoria	Medium	1,702	28.864882	-97.092594	Slightly Saline	10,000	12	7
16	Calhoun	Medium	2,156	28.513919	-96.794579	Moderately Saline	7,000	6	2
17	Jackson	Medium	1,877	28.969090	-96.364326	Moderately Saline	7,000	7	3
18	Refugio	Medium	1,629	28.503848	-97.010242	Moderately Saline	7,000	9, 10	5
19	Victoria	Medium	1,834	28.828325	-97.064492	Moderately Saline	7,000	13	6

Well Field ID	County	Transmissivity Category	Transmissivity Values (ft ² /d)	Latitude	Longitude	DSGMZ	Pumping Rate (AFY)	Pumping Layers	Fresh Water Layer
20	Calhoun	Medium	3,628	28.512722	-96.748054	Extremely Saline	5,000	7, 8	1
21	Jackson	Medium	3,092	28.778298	-96.330600	Extremely Saline	5,000	5, 6	1
22	Refugio	Medium	2,767	28.202740	-97.309516	Extremely Saline	5,000	9, 10	4
23	Victoria	Medium	3,307	28.558705	-96.944507	Extremely Saline	5,000	12, 13	5
24	Calhoun	Low	582	28.429781	-96.715923	Slightly Saline	10,000	4	1
25	Jackson	Low	429	28.999497	-96.351486	Slightly Saline	10,000	6	3
26	Refugio	Low	383	28.363330	-97.380635	Slightly Saline	10,000	8	6
27	Victoria	Low	248	28.703929	-97.009928	Slightly Saline	10,000	10	7
28	Calhoun	Low	476	28.398100	-96.682105	Moderately Saline	7,000	4	1
29	Jackson	Low	505	29.122795	-96.733438	Moderately Saline	7,000	14	10
30	Refugio	Low	300	28.305566	-97.318301	Moderately Saline	7,000	8	5
31	Victoria	Low	523	28.687010	-96.946311	Moderately Saline	7,000	10	7
32	Calhoun	Low	358	28.631383	-96.773231	Extremely Saline	5,000	10	3
33	Jackson	Low	479	28.802303	-96.639124	Extremely Saline	5,000	13	4
34	Refugio	Low	626	28.373511	-97.142089	Extremely Saline	5,000	9, 10	5
35	Victoria	Low	657	28.830729	-97.169522	Extremely Saline	5,000	15	9

Table 1-2. Simulated drawdown by pumping at the well fields simultaneously in a DSGMZ with a specific transmissivity category.

DSGMZ	High Transmissivity				Medium Transmissivity				Low Transmissivity			
	Well Field ID	Pumping Rate (AFY)	Drawdown (ft) after 30 Years		Well Field ID	Pumping Rate (AFY)	Drawdown (ft) after 30 Years		Well Field ID	Pumping Rate (AFY)	Drawdown (ft) after 30 Years	
			Brackish Zone	Freshwater Zone			Brackish Zone	Freshwater Zone			Brackish Zone	Freshwater Zone
Slightly Saline	1	10,000	134	22	12	10,000	117	13	24	10,000	303	12
	2	10,000	75	19	13	10,000	207	21	25	10,000	320	17
	3	10,000	130	33	14	10,000	400	4	26	10,000	505	41
					15	10,000	267	3	27	10,000	946	5
Moderately Saline	4	7,000	78	9	16	7,000	114	4	28	7,000	241	9
	5	7,000	73	7	17	7,000	123	8	29	7,000	566	5
	6	7,000	54	13	18	7,000	230	5	30	7,000	437	17
	7	7,000	86	8	19	7,000	276	2	31	7,000	495	3
Extremely Saline	8	5,000	42	3	20	5,000	62	2	32	5,000	510	1
	9	5,000	44	1	21	5,000	58	2	33	5,000	497	1
	10	5,000	36	2	22	5,000	116	2	34	5,000	275	2
	11	5,000	84	1	23	5,000	108	3	35	5,000	327	3

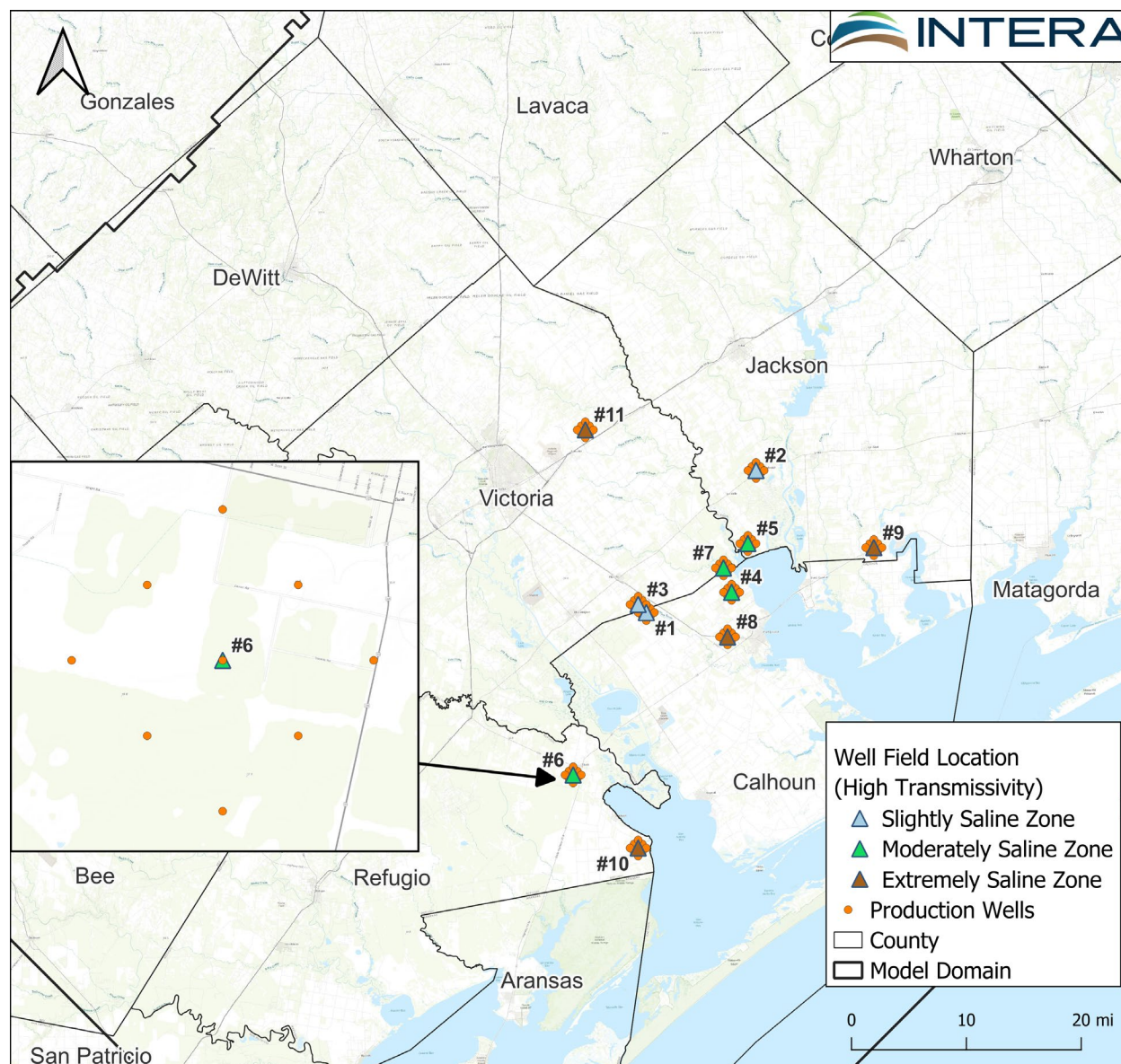


Figure 1-1. Well fields at the sites of high aquifer transmissivity values derived from the CGCBGWF Model.

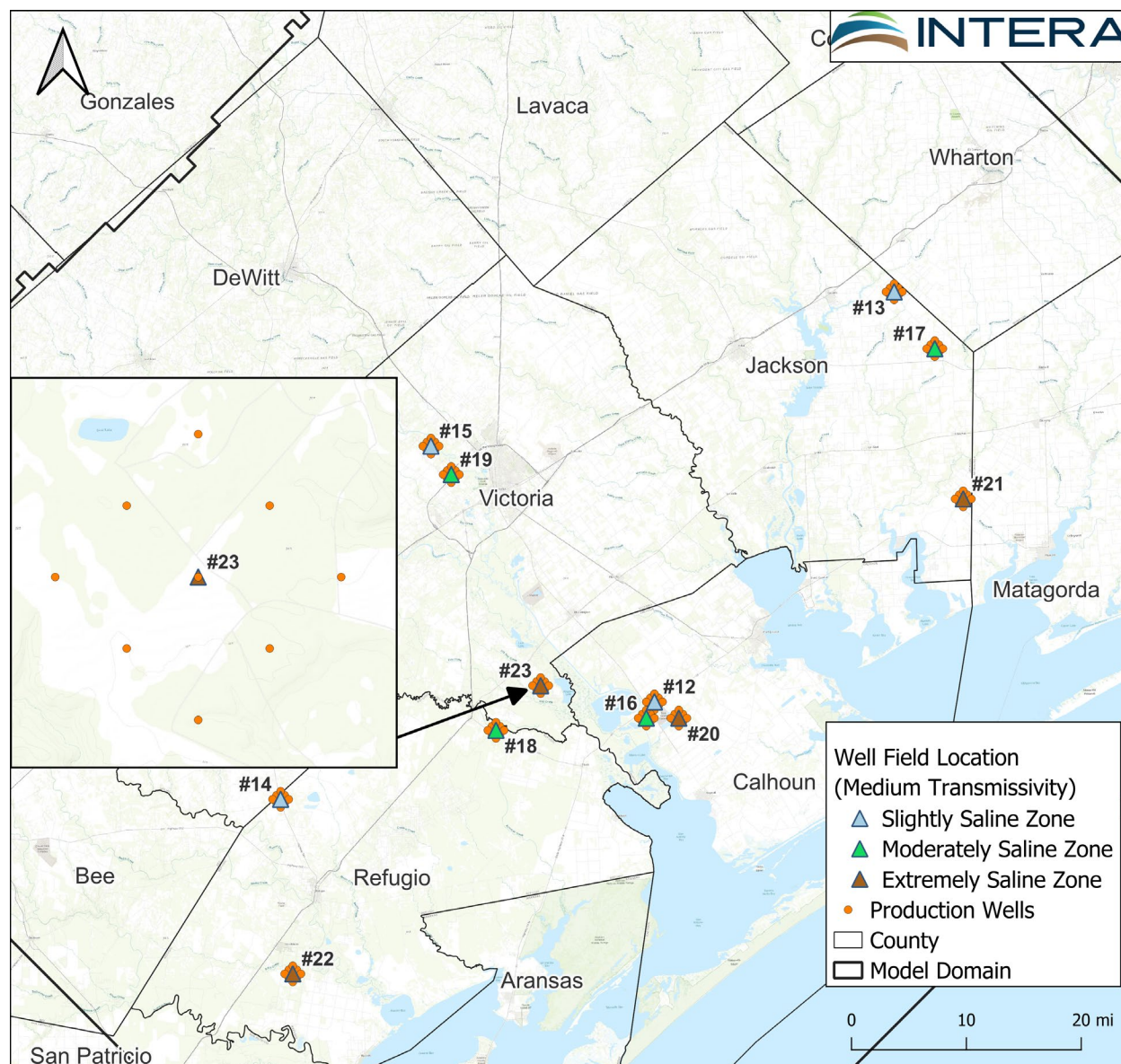


Figure 1-2. Well fields at the sites of medium aquifer transmissivity values derived from the CGCBGWF Model.

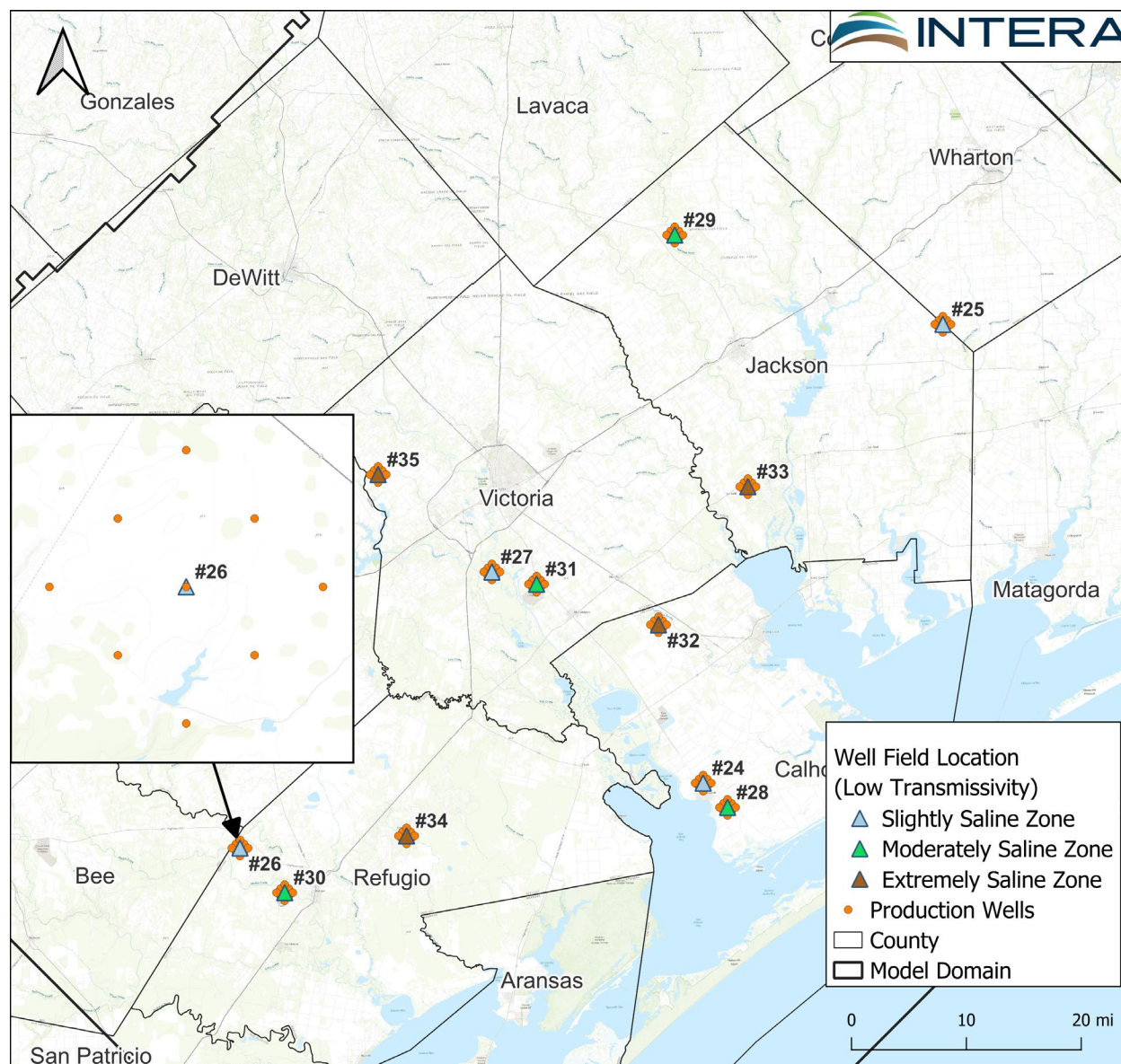


Figure 1-3. Well fields at the sites of low aquifer transmissivity values derived from the CGCBGWF Model.

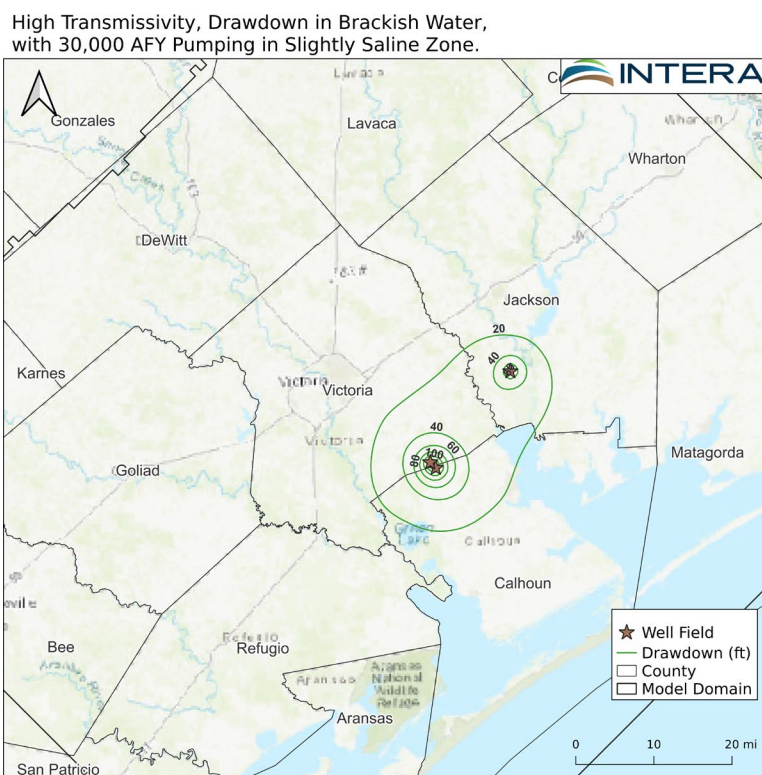
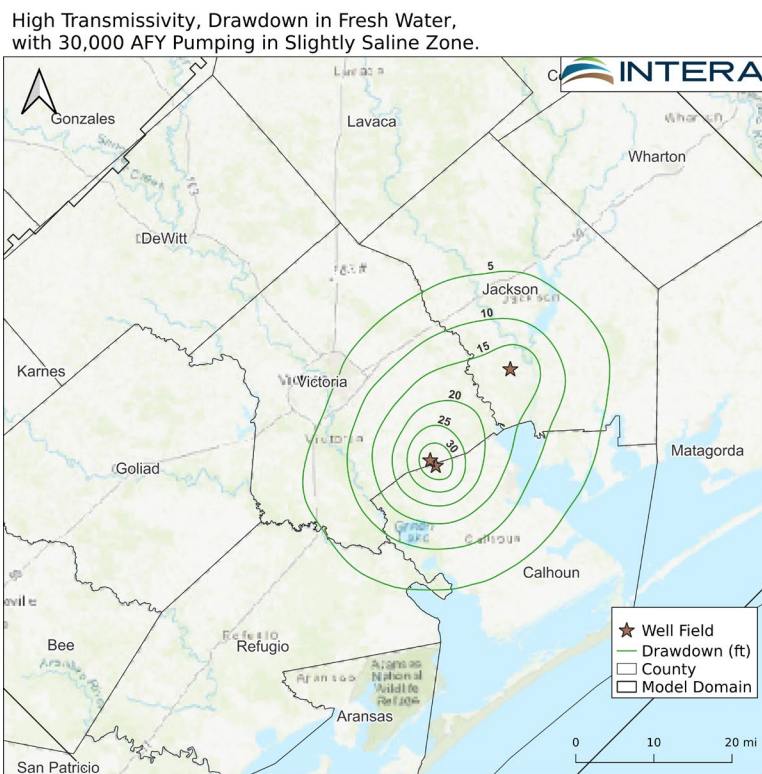
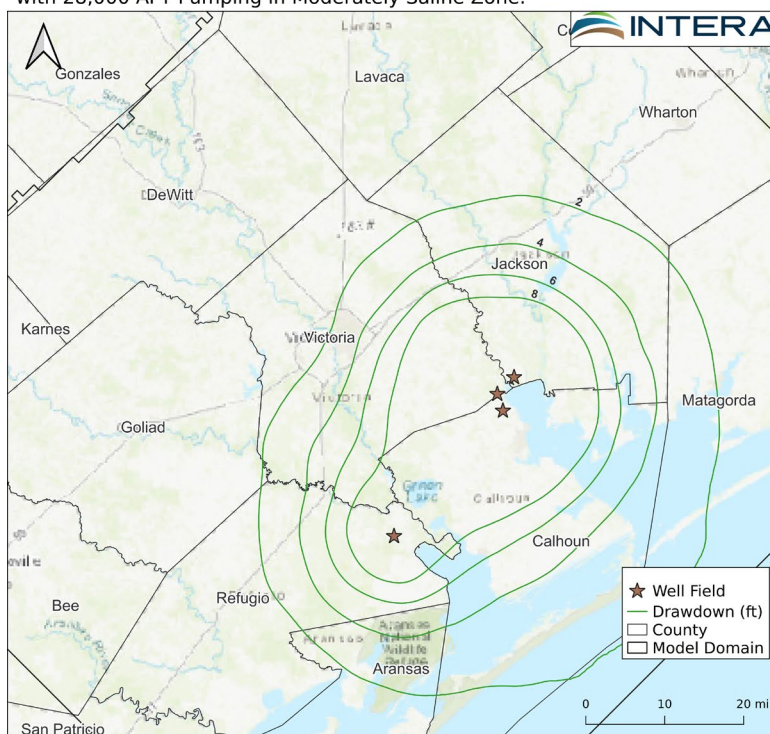


Figure 1-4. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to three well fields at sites of high transmissivity in the slightly saline DSGMZ.

High Transmissivity, Drawdown in Fresh Water, with 28,000 AFY Pumping in Moderately Saline Zone.



High Transmissivity, Drawdown in Brackish Water, with 28,000 AFY Pumping in Moderately Saline Zone.

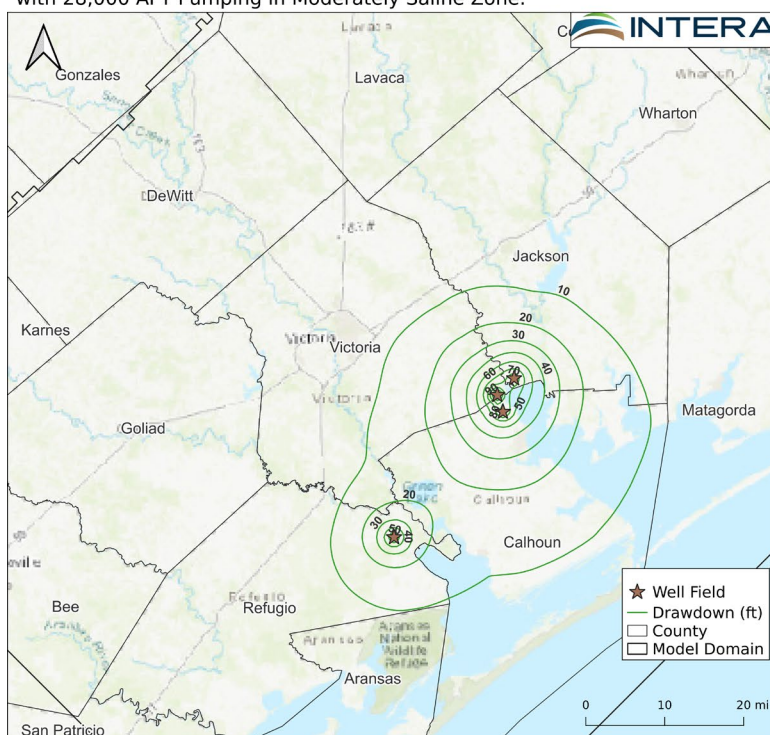
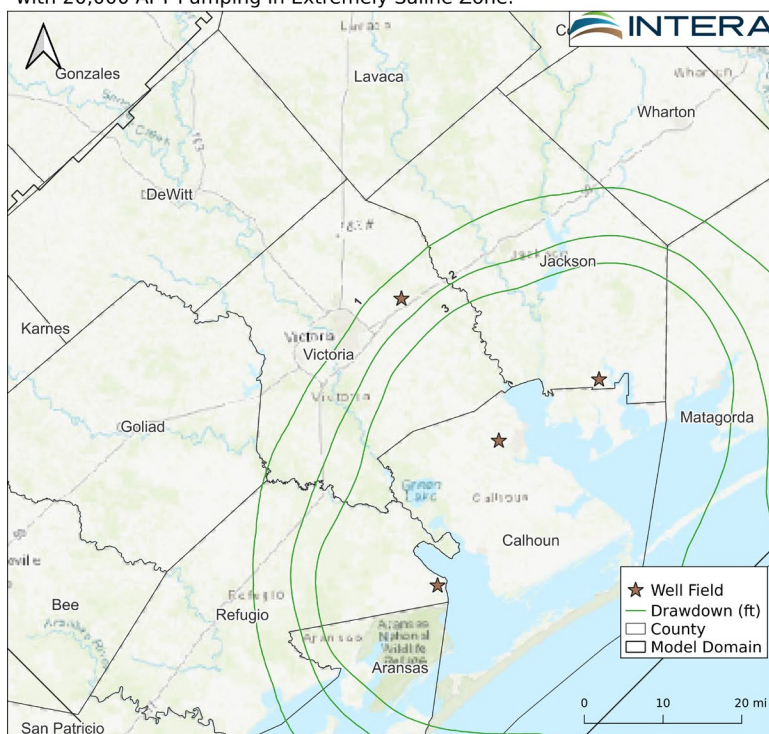


Figure 1-5. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of high transmissivity in the moderately saline DSGMZ.

High Transmissivity, Drawdown in Fresh Water, with 20,000 AFY Pumping in Extremely Saline Zone.



High Transmissivity, Drawdown in Brackish Water, with 20,000 AFY Pumping in Extremely Saline Zone.

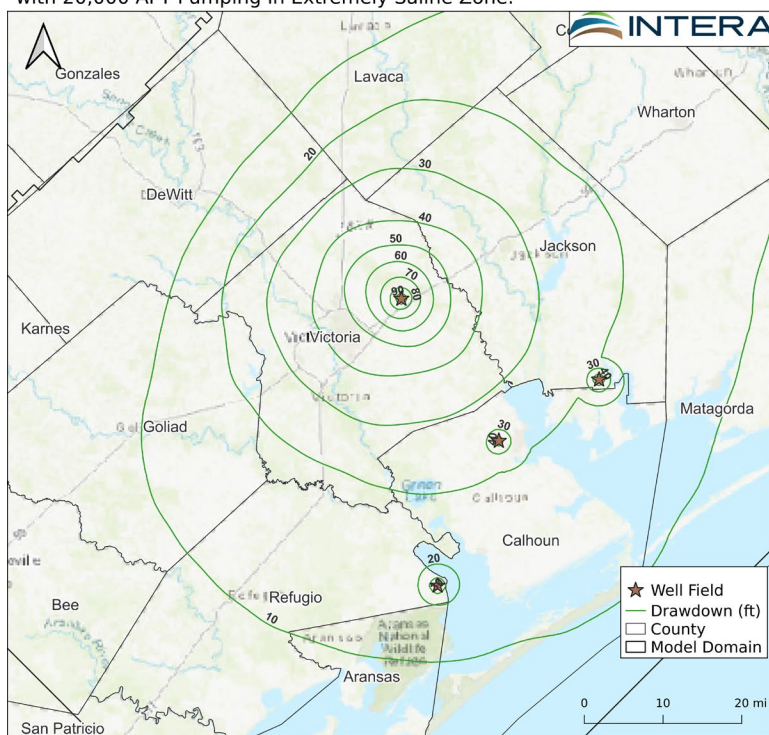
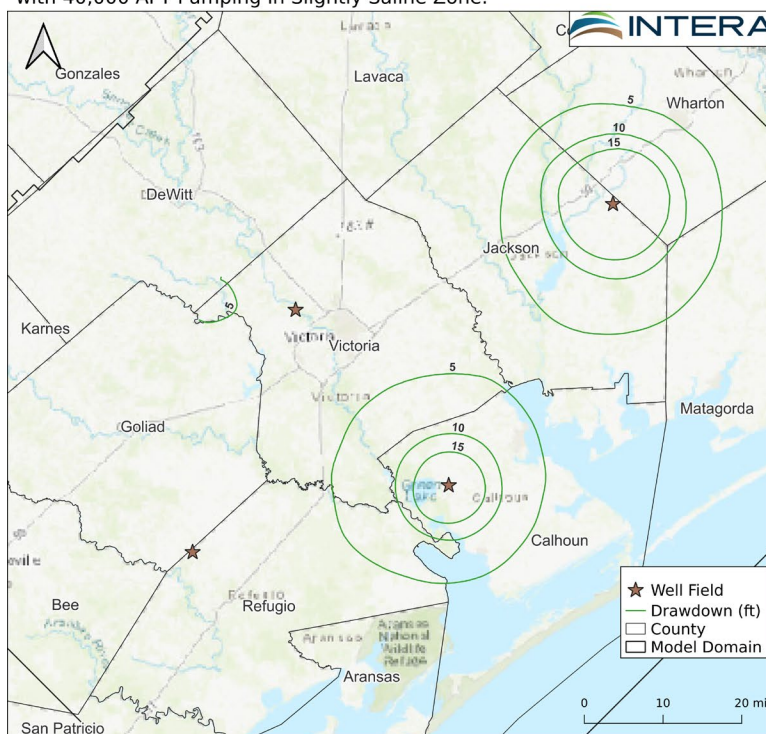


Figure 1-6. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of high transmissivity in the extremely saline DSGMZ.

Medium Transmissivity, Drawdown in Fresh Water, with 40,000 AFY Pumping in Slightly Saline Zone.



Medium Transmissivity, Drawdown in Brackish Water, with 40,000 AFY Pumping in Slightly Saline Zone.

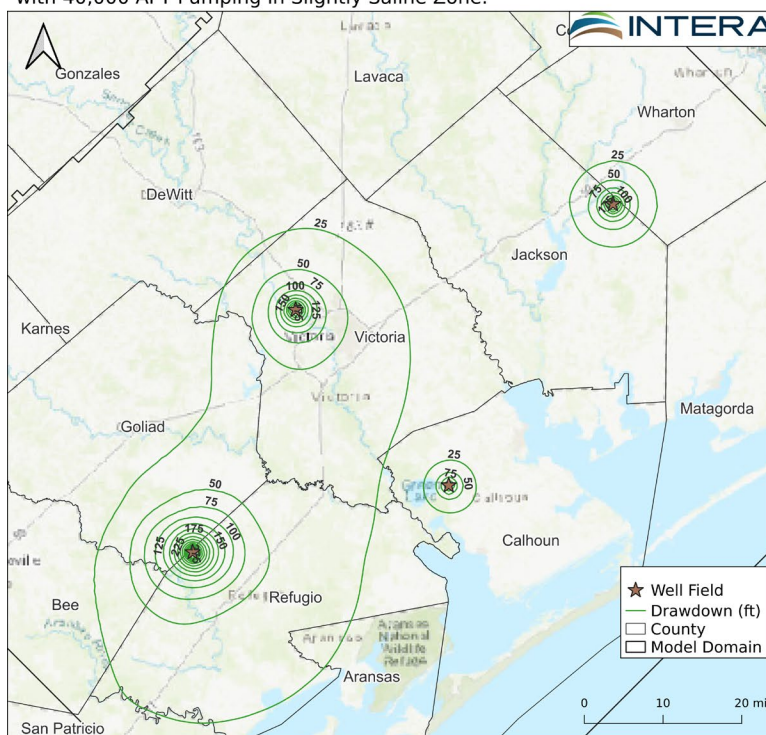
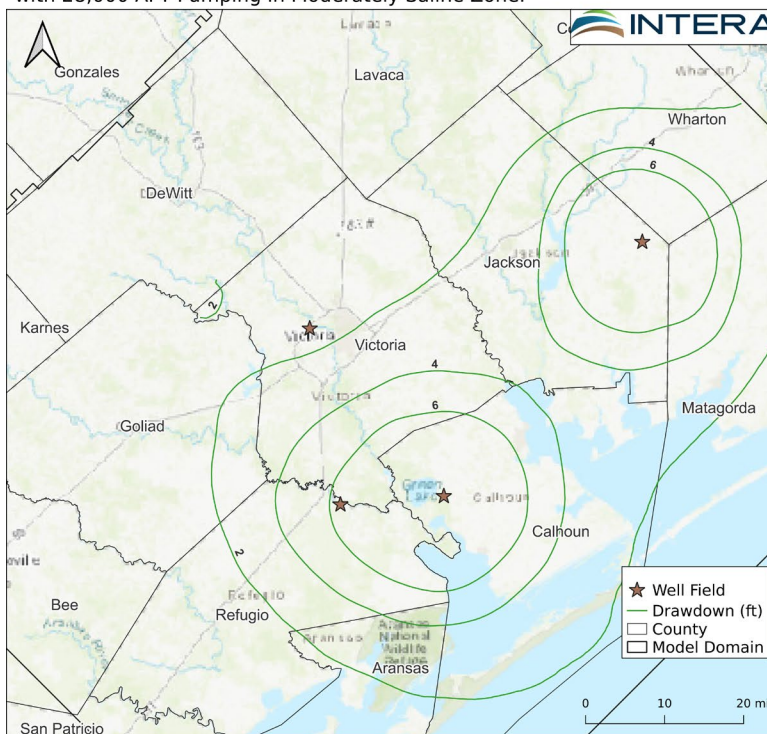


Figure 1-7. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of medium transmissivity in the slightly saline DSGMZ.

Medium Transmissivity, Drawdown in Fresh Water,
with 28,000 AFY Pumping in Moderately Saline Zone.



Medium Transmissivity, Drawdown in Brackish Water,
with 28,000 AFY Pumping in Moderately Saline Zone.

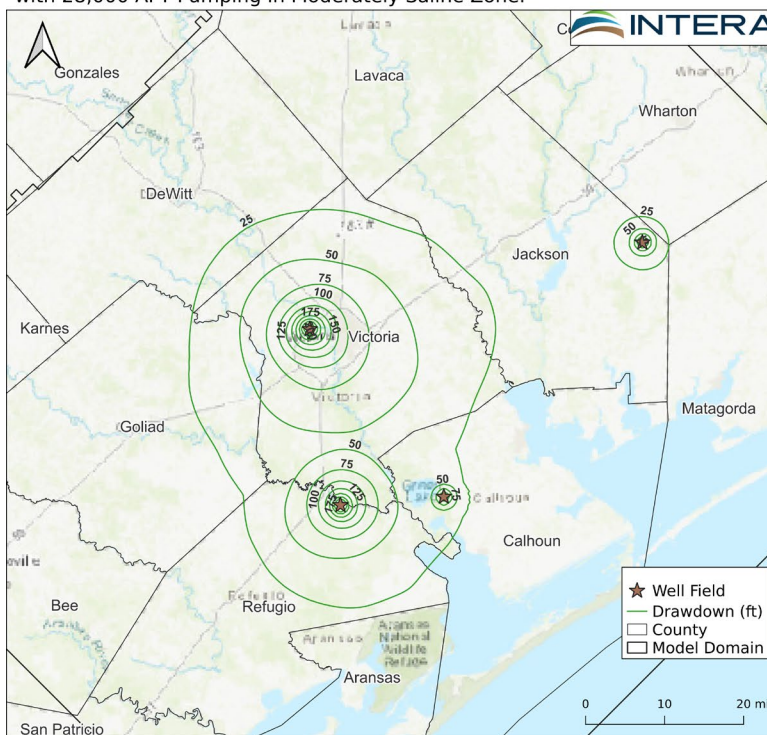
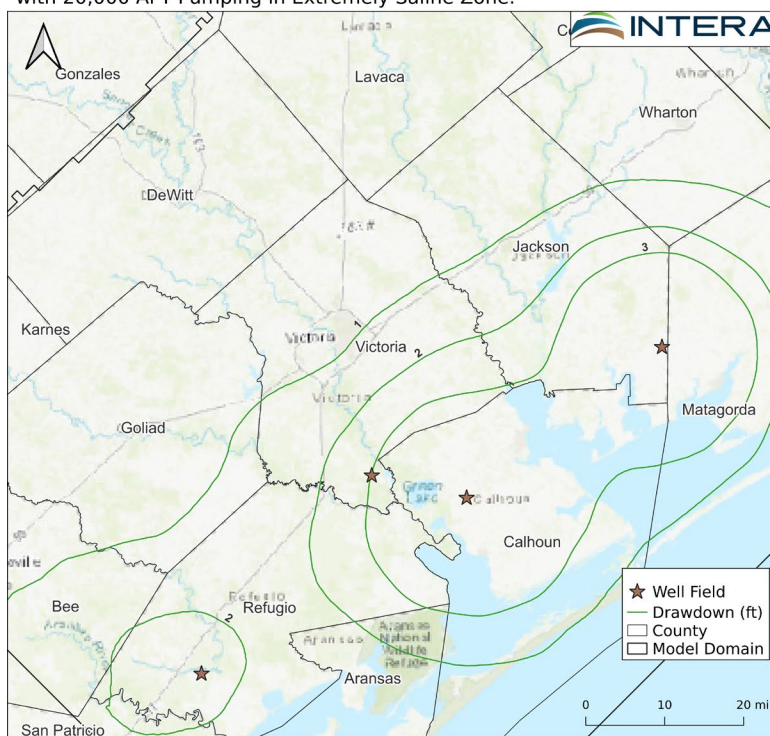


Figure 1-8. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of medium transmissivity in the moderately saline DSGMZ.

Medium Transmissivity, Drawdown in Fresh Water, with 20,000 AFY Pumping in Extremely Saline Zone.



Medium Transmissivity, Drawdown in Brackish Water, with 20,000 AFY Pumping in Extremely Saline Zone.

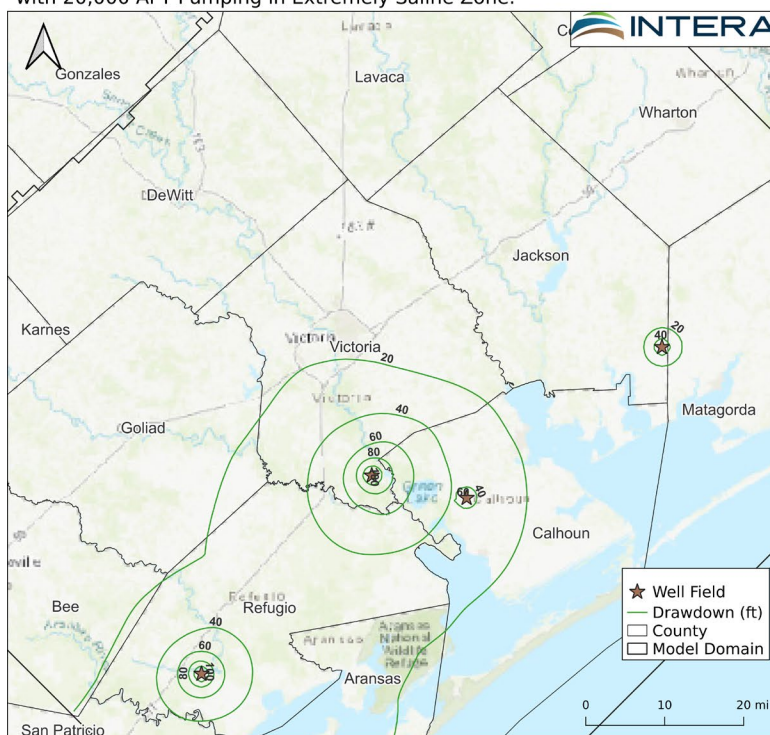
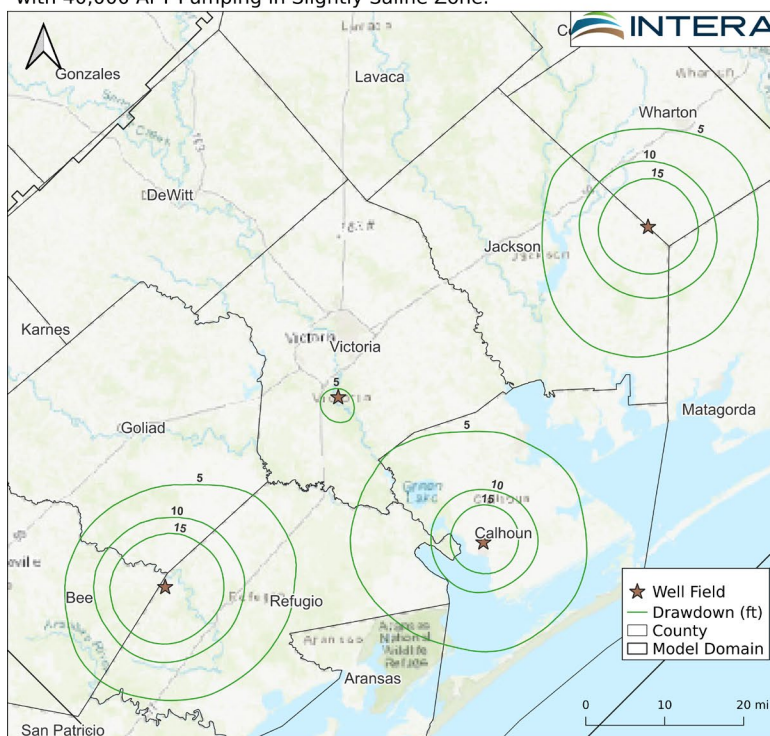


Figure 1-9. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of medium transmissivity in the extremely saline DSGMZ.

Low Transmissivity, Drawdown in Fresh Water,
with 40,000 AFY Pumping in Slightly Saline Zone.



Low Transmissivity, Drawdown in Brackish Water,
with 40,000 AFY Pumping in Slightly Saline Zone.

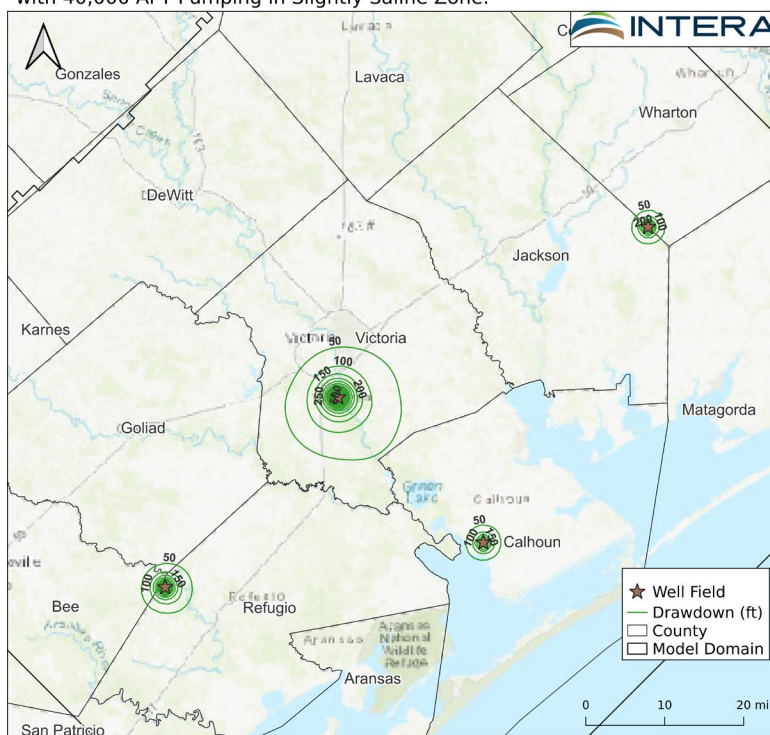
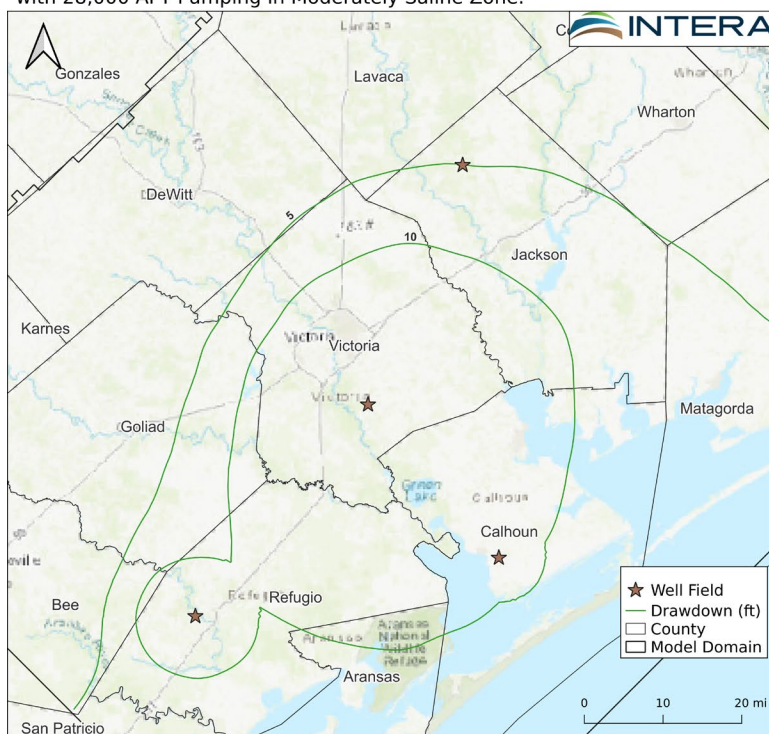


Figure 1-10. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of low transmissivity in the slightly saline DSGMZ.

Low Transmissivity, Drawdown in Fresh Water,
with 28,000 AFY Pumping in Moderately Saline Zone.



Low Transmissivity, Drawdown in Brackish Water,
with 28,000 AFY Pumping in Moderately Saline Zone.

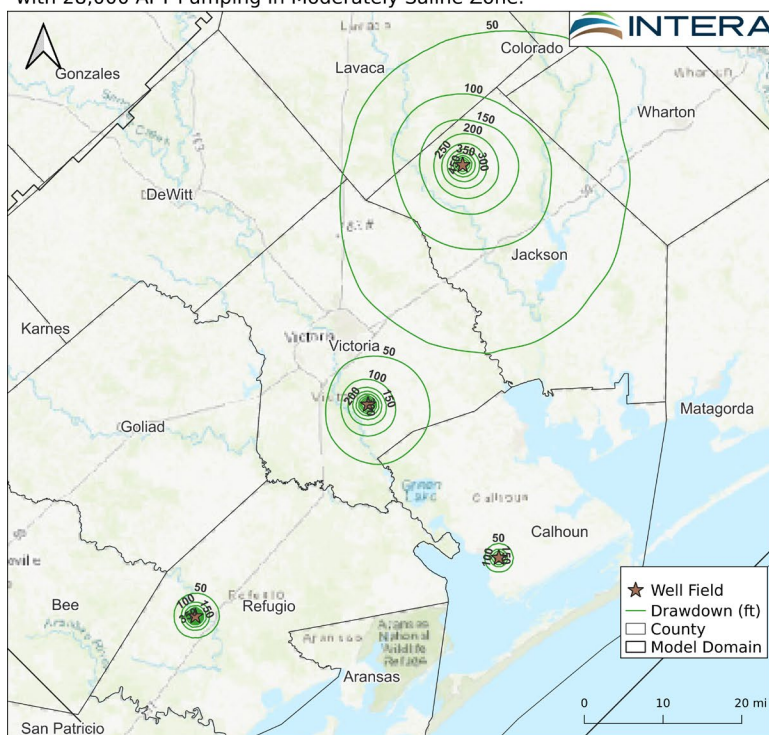
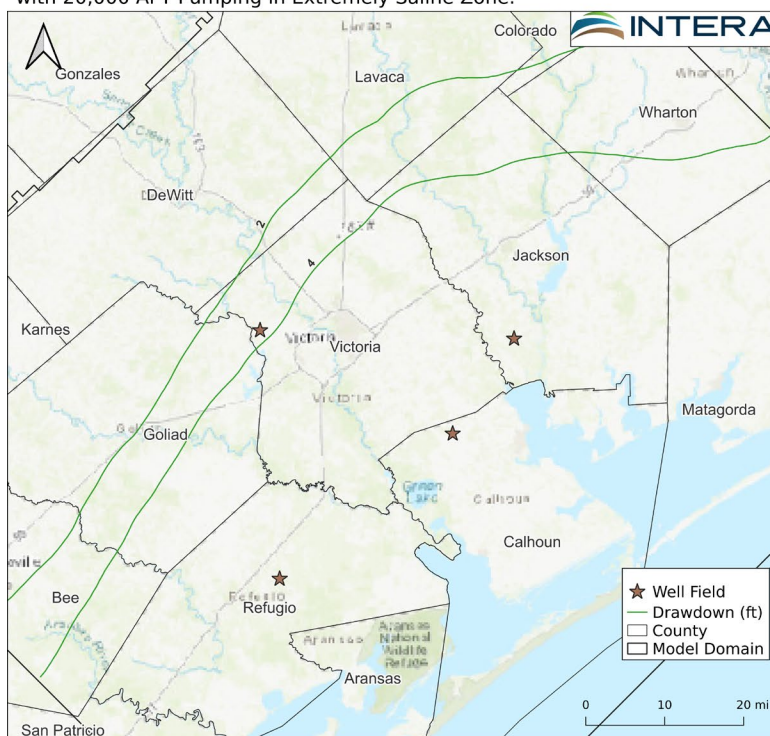


Figure 1-11. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of low transmissivity in the moderately saline DSGMZ.

Low Transmissivity, Drawdown in Fresh Water,
with 20,000 AFY Pumping in Extremely Saline Zone.



Low Transmissivity, Drawdown in Brackish Water,
with 20,000 AFY Pumping in Extremely Saline Zone.

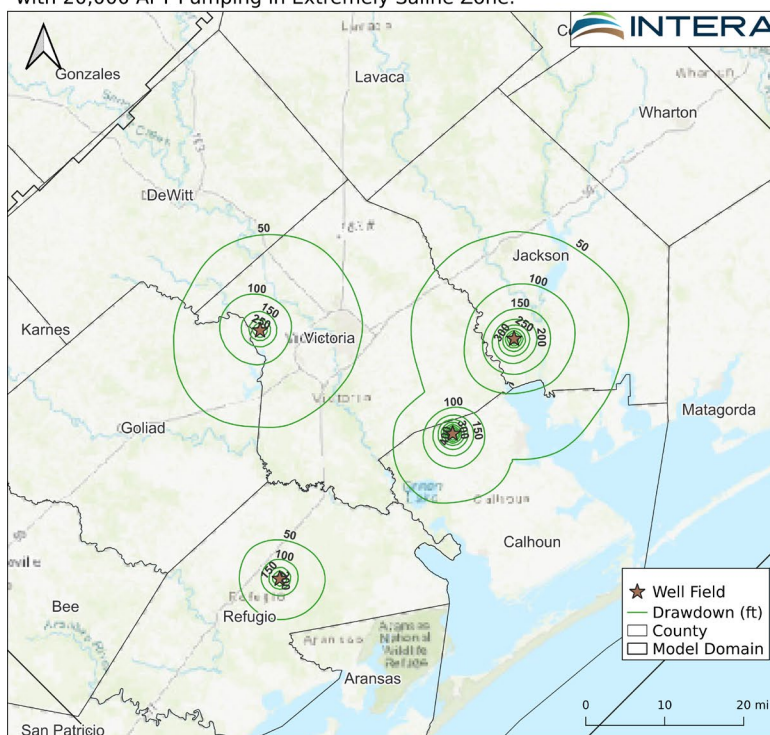


Figure 1-12. Simulated drawdown in freshwater zone (top) and brackish water zone (bottom) due to four well fields at sites of low transmissivity in the extremely saline DSGMZ.