BRACKISH GROUNDWATER IN THE EASTERN PORTION OF THE SPARTA AQUIFER

TWDB Report 390 Snapshot | August 2023

BACKGROUND on BRACKISH GROUNDWATER STUDIES

The Texas Water Development Board (TWDB) Brackish Resources Aquifer Characterization System (BRACS) Program was established in 2009 to map and characterize the brackish portions of Texas aquifers to provide useful information and data to regional water planning groups and other entities interested in using brackish groundwater as a water supply. Both Texas industry and public water supply planners are looking at brackish groundwater to supplement stressed freshwater resources.

Brackish groundwater is a significant water supply component that can be used to meet future water demands. Groundwater desalination strategies in the 2022 State Water Plan (TWDB, 2023) represent additional new groundwater supply for nine of the regional planning groups. Development of these strategies would create an additional supply volume of approximately 19,000 acre-feet per year estimated to be online by 2020, with an additional 157,000 acre-feet per year of brackish groundwater recommended to be in service by 2070.

What is brackish groundwater?

Brackish groundwater contains dissolved minerals with a concentration between 1,000 and 9,999 milligrams per liter of total dissolved solids.

EAST SPARTA AQUIFER STUDY AREA

TWDB Report 390 characterizes only the portion of the Sparta Aquifer located east of the Colorado River (Figure 1). The study area includes all or part of 28 counties within the Upper Coastal Plains encompassing portions of regional water planning areas G, H, I, and K, and groundwater management areas 11, 12, 14, and 15. There are 14 groundwater conservation districts located within the East Sparta aquifer study area.

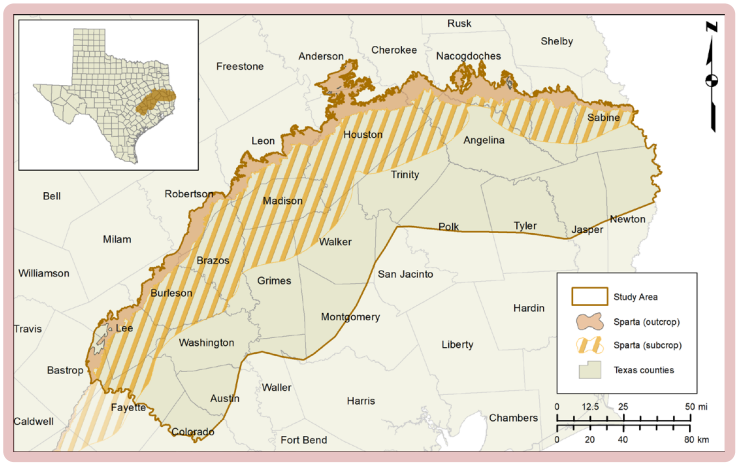

Figure 1. East Sparta aquifer brackish groundwater study area.

The predominant groundwater use of Sparta Aquifer groundwater is for domestic and livestock purposes, but the aquifer is also relied upon by municipal, industrial, and irrigation users (George and others, 2011). Currently, there are 19 public water supply systems that have active wells completed in the East Sparta aquifer.

The East Sparta aquifer study area includes the outcrop and extends approximately fifteen miles beyond the downdip extent of the official TWDB-designated Sparta Aquifer boundary. The width of the Sparta Formation outcrop ranges from one mile wide south of Bastrop County and ten miles wide in Houston and Anderson counties.

BRACKISH GROUNDWATER VOLUMES in EAST SPARTA AQUIFER

SLIGHTLY SALINE **22.2** million acre-feet

MODERATELY SALINE **27.8** million acre-feet

TOTAL BRACKISH **50** million acre-feet

The water-bearing portion of the East Sparta aquifer is composed primarily of sand and has a total aquifer storage volume of approximately 50 million acre-feet of brackish groundwater with total dissolved solid concentrations between 1,000 and 9,999 milligrams per liter. The total brackish aquifer storage volume (50 million acre-feet) is comprised of 22.2 and 27.8 million acre-feet of slightly saline and moderately saline groundwater, respectively. Table 1 shows total brackish groundwater storage volumes in the East Sparta aquifer for groundwater management areas 11, 12, 14, and 15 and for regional water planning areas G, H, I, and K.

The volumes calculated in this study are estimates to provide insight into the magnitude and distribution of this important resource. We recommend that site-specific studies be conducted to support projects and efforts that will incorporate brackish groundwater resources into water resources planning. It is also important to note that these volume estimates are not the same as the TWDB-calculated total estimated recoverable storage (TERS) volumes, which are confined to the aquifer boundaries used by TWDB groundwater availability models. Furthermore, the area, saturated thickness, and storage parameters used in the calculations for this study are different from those used in TERS reports. (Wade and others, 2014a, Wade and Shi, 2014b).

The aggregate volume calculations from BRACS studies that have been completed to date (including this study), indicate that a cumulative storage volume of more than 3.8 billion acre-feet of slightly saline and moderately saline groundwater is available in Texas. The BRACS staff recalculates this volume every time a BRACS study is completed. Not all brackish groundwater in storage can be produced or economically developed.

Groundwater management area
Brackish groundwater storage volume in acre-feet

	Slightly saline	Moderately saline
11	8,858,600	11,733,600
12	5,780,200	1,852,400
14	6,307,000	13,183,100
15	1,238,800	1,073,600

Regional water planning area
Brackish groundwater storage volume in acre-feet

	Slightly saline	Moderately saline
G	8,743,200	9,485,400
H	2,572,000	7,870,200
I	8,662,100	9,393,100
K	2,207,400	1,094,100

Table 1. Brackish groundwater storage volumes by groundwater management area (left) and regional water planning area (right). Values are in acre-feet. Volumes from additional salinity classes in these areas can be found in Laughlin and others (2023).

SALINITY SPATIAL DISTRIBUTIONS

A total of 426 wells were used for total dissolved solids concentration calculations. The salinity zones are delineated at 1,000, 3,000, 10,000, and 35,000 milligrams per liter of total dissolved solids concentration.

The brackish portion of the Sparta is comprised of both slightly saline (yellow in Figure 2) and moderately saline (orange area in Figure 2) groundwater (Figure 2).

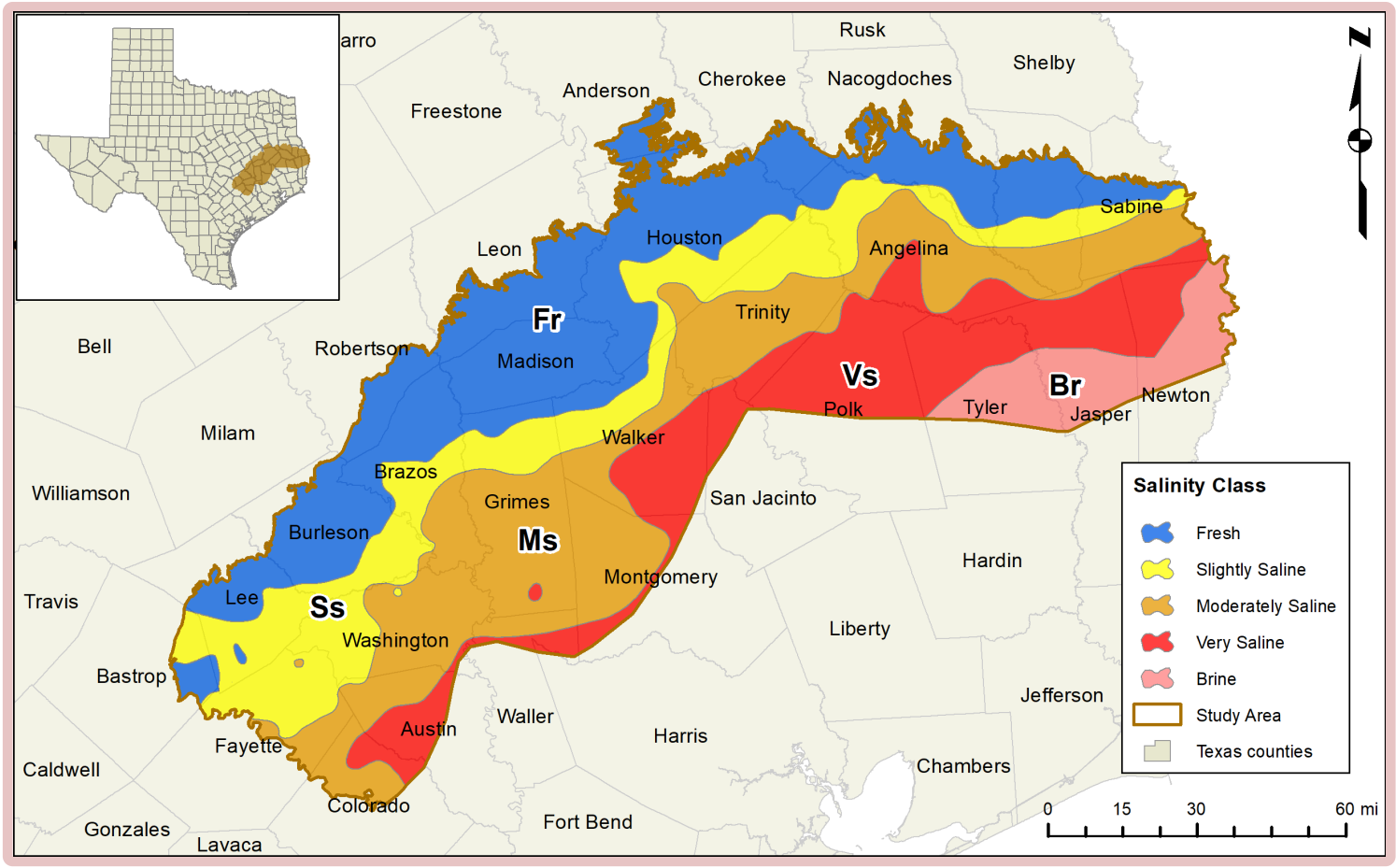

Figure 2. East Sparta aquifer salinity zones.

The salinity distribution in Bastrop, Lee, and Fayette counties reflects reduced recharge within and downdip of a fault zone with large -offset faults where both measured and estimated total dissolved solids concentration values are slightly saline (1,000 to 3,000 milligrams per liter). The slightly saline portion of the aquifer extends approximately 25 miles downdip from the outcrop in this portion of the study area.

The distribution of moderately saline waters in the East Sparta study area encompasses a relatively wide swath of the Sparta Formation under Grimes, Montgomery, Walker, and Washington counties. A narrower band of moderately saline groundwater underlies Austin, Colorado, Trinity, Angelina, San Augustine, and Sabine counties.

The net sand thickness at the southern extent of the 10,000 milligrams per liter contour is less than 50 feet, and the assumption of nearly stagnant groundwater flow can be attributed to the low sand content in this part of the study area. The portion of the study area that is classified as very saline is primarily located in Walker, Polk, Tyler, Jasper, and Newton counties.

GEOLOGICAL CROSS-SECTION of EAST SPARTA AQUIFER

BRACS staff used published geophysical logs to illustrate stratigraphy, general structure, and formation thickness for the East Sparta aquifer.

Figure 3 shows a strike-oriented cross section from Lee County to Sabine County to characterize stratigraphy across the study area.

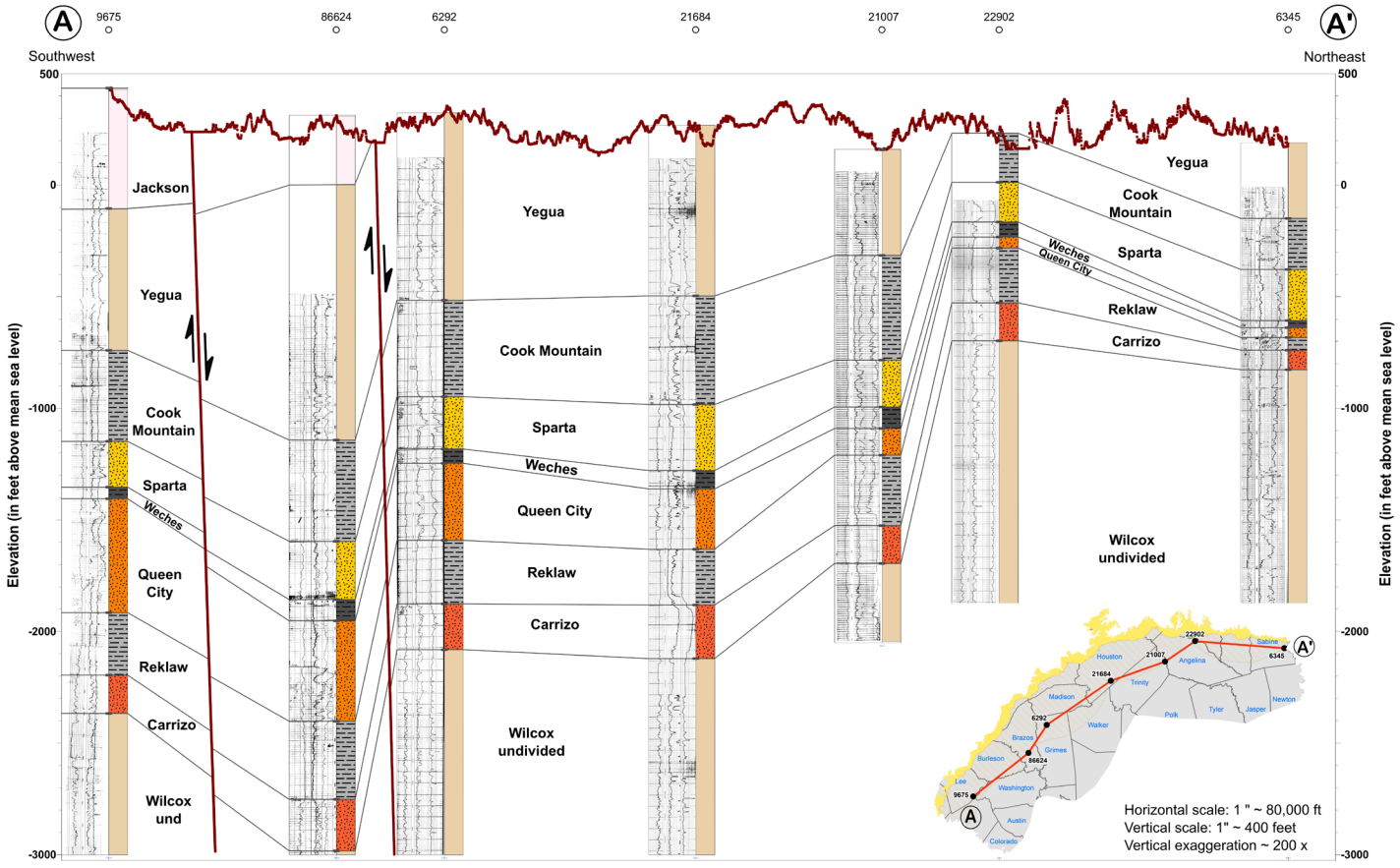

Figure 3. Geological cross section through study area type logs.

REFERENCES

George, P.G., Mace, R.E., and Petrossian, R., 2011, Aquifers of Texas: Texas Water Development Board Report 380, 172 p.

Laughlin, K., Weitkunat, S., and Bauer, O., 2023, Brackish groundwater in the eastern portion of the Sparta Aquifer of the Upper Coastal Plains: Texas Water Development Board Report No 390, 131 p

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Wade, S., Ph.D., Shi, J., Ph.D., and Selter-Weatherford, C., 2014a, Total estimated recoverable storage for aquifers in groundwater management area 11: Texas Water Development Board 13–034, 30 p.

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