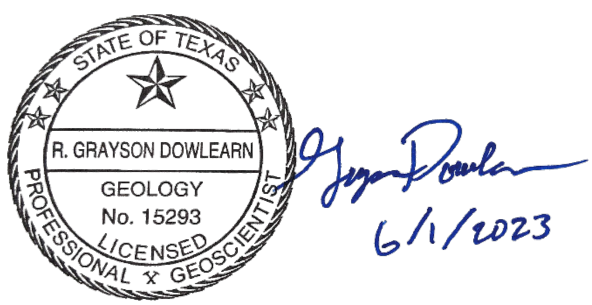
GAM RUN 23-009: BRAZOS VALLEY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Tim Cawthon, GIT and Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-463-5076
June 1, 2023



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EXECUTIVE SUMMARY:

Texas Water Code § 36.1071(h), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator.

The TWDB provides data and information to the Brazos Valley Groundwater Conservation District in two parts. Part 1 is the Estimated Historical Water Use/State Water Plan dataset report, which will be provided to you separately by the TWDB Groundwater Technical Assistance Department. Please direct questions about the water data report to Mr. Stephen Allen at 512-463-7317 or stephen.allen@twdb.texas.gov. Part 2 is the required groundwater availability modeling information, which includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
2. the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers, for each aquifer within the district; and
3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

The groundwater management plan for the Brazos Valley Groundwater Conservation District should be adopted by the district on or before February 13, 2024 and submitted to the TWDB Executive Administrator on or before March 14, 2024. The current management plan for the Brazos Valley Groundwater Conservation District expires on May 13, 2024.

The management plan information for the aquifers within the Brazos Valley Groundwater Conservation District was extracted from four groundwater availability models. We used the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Young and Kushnereit, 2020, and Young and others, 2018) to estimate the management plan information for the Carrizo-Wilcox, Queen City, and Sparta aquifers. We used the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010) to estimate the management plan information for the Yegua-Jackson Aquifer. We used the groundwater availability model for the northern portion of the Gulf Coast Aquifer System (Kasmarek, 2013) to estimate the management plan information for the Gulf Coast Aquifer System. Last, we used the groundwater availability model for the Brazos River Alluvium Aquifer (Ewing and Jigmond, 2016) to estimate the management plan information for the Brazos River Alluvium Aquifer.

This report replaces the results of GAM Run 18-021 (Wade, 2019) and includes results from the updated groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers. Values may differ from the previous report as a result of routine updates to the spatial grid file used to define county, groundwater conservation district, and aquifer boundaries, which can impact the calculated water budget values. Additionally, the approach used for analyzing model results is reviewed during each update and may have been refined to better delineate groundwater flows. Tables 1 through 6 summarize the groundwater availability model data required by statute. Figures 1, 3, 5, 7, 9, and 11 show the areas of the respective models from which the values in Tables 1 through 6 were extracted. Figures 2, 4, 6, 8, 10, and 12 provide a generalized diagram of the groundwater flow components provided in Tables 1 through 6. If, after review of the figures, the Brazos Valley Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

The flow components presented in this report do not represent the full groundwater budget. If additional inflow and outflow information would be helpful for planning purposes, the district may submit a request in writing to the TWDB Groundwater Modeling Department for the full groundwater budget.

METHODS:

In accordance with Texas Water Code § 36.1071(h), the groundwater availability models mentioned above were used to estimate information for the Brazos Valley Groundwater Conservation District management plan. Water budgets for the historical calibration period for the Carrizo-Wilcox, Queen City, and Sparta aquifers groundwater availability model (1980 through 2010) and the Brazos River Alluvium Aquifer groundwater availability model (1980 through 2012) were extracted using ZONEBUDGET for MODFLOW USG Version 1.0 (Panday and others, 2013). Water budgets for the historical calibration period for the Yegua-Jackson Aquifer (1980 through 1997) and the Gulf Coast Aquifer System (1980 through 2009) groundwater availability models were extracted using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface-water outflow, inflow to the district, outflow from the district, and the flow between aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used version 3.02 of the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Young and Kushnereit, 2020, and Young and others, 2018) to analyze the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Young and Kushnereit (2020) and Young and others (2018) for assumptions and limitations of the model.
- The groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers contains the following ten layers:
    - Layer 1 represents the Colorado River and Brazos River alluvium.
    - Layer 2 represents the shallow flow system of all units in Layers 3 through 10.
    - Layer 3 represents the Sparta Aquifer and equivalent units.
    - Layer 4 represents the Weches Formation.
    - Layer 5 represents the Queen City Aquifer and equivalent units.
    - Layer 6 represents the Reklaw Formation.
    - Layers 7 through 10 represent the Carrizo-Wilcox Aquifer and equivalent units.

- Individual water budgets for the district were determined for the Sparta Aquifer (Layers 2 and 3), the Queen City Aquifer (Layers 2 and 5), and the Carrizo-Wilcox Aquifer (Layers 2 and 7 through 10, collectively).
- The MODFLOW River package was used to simulate the groundwater exchange with major rivers and perennial streams. Outflow from ephemeral streams, intermittent streams, and seeps were simulated using the MODFLOW Drain package. The evapotranspiration package was used to simulate groundwater evapotranspiration from the model.
- Water budget terms were averaged for the period 1980 through 2010 (stress periods 52 through 82).
- The model was run with MODFLOW-USG (Panday and others, 2013).

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010) to analyze the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the model.
- The groundwater availability model for the Yegua-Jackson Aquifer contains the following five layers:
    - Layer 1 represents the Yegua-Jackson Aquifer outcrop, the Catahoula Formation, and other younger overlying units.
    - Layer 2 represents the upper portion of the Jackson Group.
    - Layer 3 represents the lower portion of the Jackson Group.
    - Layer 4 represents the upper portion of the Yegua Group.
    - Layer 5 represents the lower portion of the Yegua Group.
- An overall water budget for the district was determined for the Yegua-Jackson Aquifer (layers 1 through 5, collectively, for the portions of the model that represent the Yegua-Jackson Aquifer).
- The Catahoula Formation within the Brazos Valley Groundwater Conservation District falls within the Gulf Coast Aquifer System, which allows us to estimate the exchange between the Yegua-Jackson Aquifer and the Gulf Coast Aquifer System in this assessment.
- Water budget terms were averaged for the period 1980 through 1997 (stress periods 10 through 27).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Gulf Coast Aquifer System

- We used version 1.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer System (Kasmarek, 2013) to analyze the Gulf Coast Aquifer System. See Kasmarek (2013) for assumptions and limitations of the model.
- The groundwater availability model for the northern portion of the Gulf Coast Aquifer System contains the following four layers:
    - Layer 1 represents the Chicot Aquifer.
    - Layer 2 represents the Evangeline Aquifer.
    - Layer 3 represents the Burkeville Confining Unit.
    - Layer 4 represents the Jasper Aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer.
- Water budgets for the district were determined for the Gulf Coast Aquifer System (layers 1 through 4, collectively).
- Water budget terms were averaged for the period 1980 through 2009 (stress periods 16 through 78).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Brazos River Alluvium Aquifer

- We used version 1.01 of the groundwater availability model for the Brazos River Alluvium Aquifer (Ewing and Jigmond, 2016) to analyze the Brazos River Alluvium Aquifer. See Ewing and Jigmond (2016) for assumptions and limitations of the model.
- The groundwater availability model for the Brazos River Alluvium Aquifer contains the following three layers:
    - Layers 1 and 2 represent the Brazos River Alluvium Aquifer.
    - Layer 3 represents the surficial portions of the Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Gulf Coast aquifers as well as various underlying confining units.
- The MODFLOW Streamflow-Routing package was used to simulate the groundwater exchange with perennial rivers and streams. Ephemeral streams were simulated using the MODFLOW River package. Springs were simulated using the MODFLOW Drain package.

- Water budget terms were averaged for the period 1980 through 2012 (stress periods 32 through 427).
- The model was run with MODFLOW-USG (Panday and others, 2013).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving an aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the aquifers located within the Brazos Valley Groundwater Conservation District and averaged over the historical calibration period, as shown in Tables 1 through 6.

1. Precipitation recharge—the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.
2. Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.
3. Flow into and out of district—the lateral flow within the aquifer between the district and adjacent counties.
4. Flow between aquifers—the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district's management plan is summarized in Tables 1 through 6. Figures 1, 3, 5, 7,9, and 11 show the area of the model from which the values in Tables 1 through 6 were extracted. Figures 2, 4, 6, 8, 10, and 12 provide a generalized diagram of the groundwater flow components provided in Tables 1 through 6. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

Table 1: Summarized information for the Carrizo-Wilcox Aquifer for the Brazos Valley Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	46,908
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	54,346
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	33,140
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	10,125
Estimated net annual volume of flow between each aquifer in the district	To Carrizo-Wilcox Aquifer from Carrizo-Wilcox equivalent units	2,149
	From Carrizo-Wilcox Aquifer to Reklaw confining unit	2,454
	From Carrizo-Wilcox Aquifer to Queen City Aquifer	5
	From Carrizo-Wilcox Aquifer to Brazos River Alluvium Aquifer*	2,286

* Estimated from the groundwater availability model for the Brazos River Alluvium Aquifer.

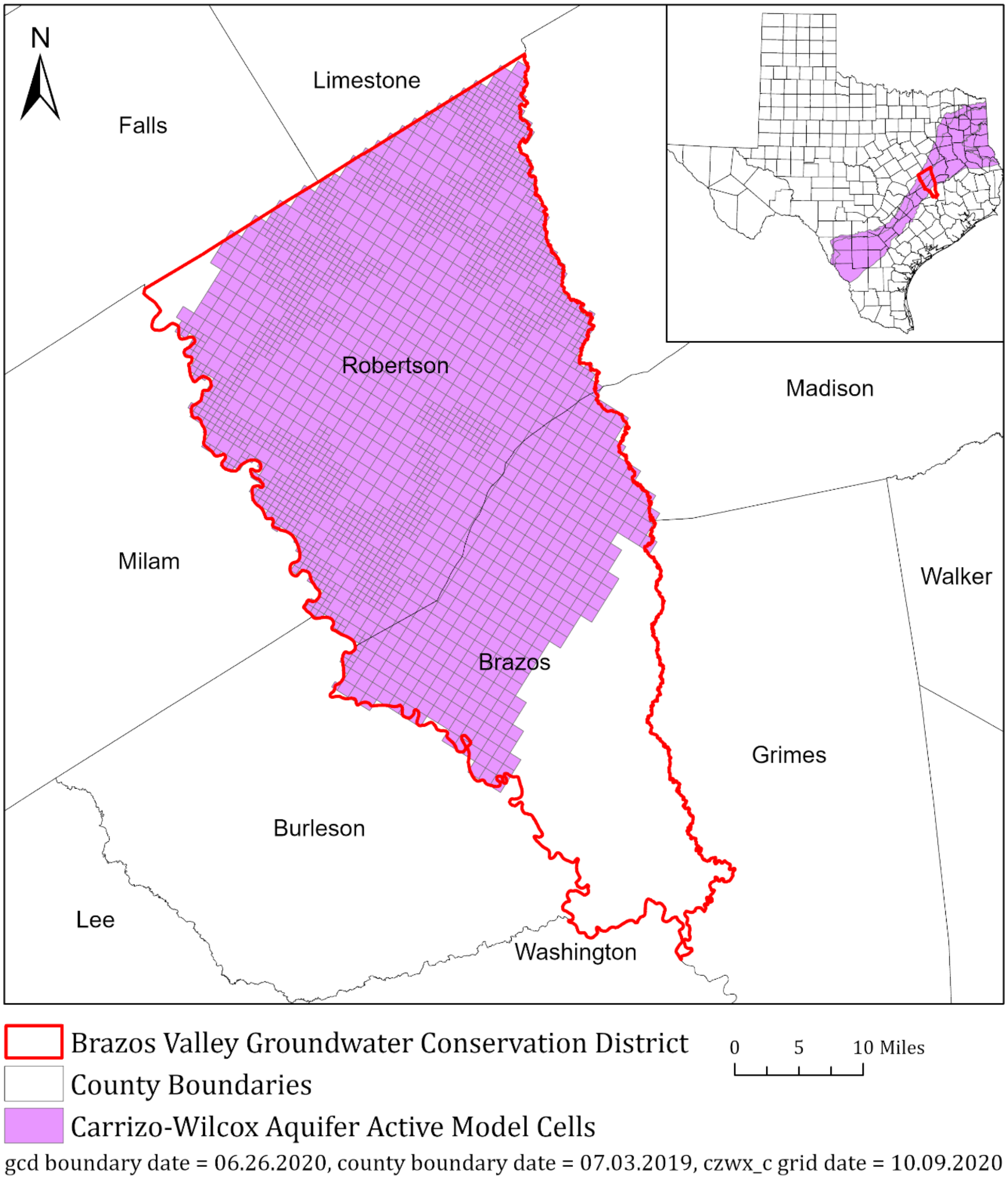
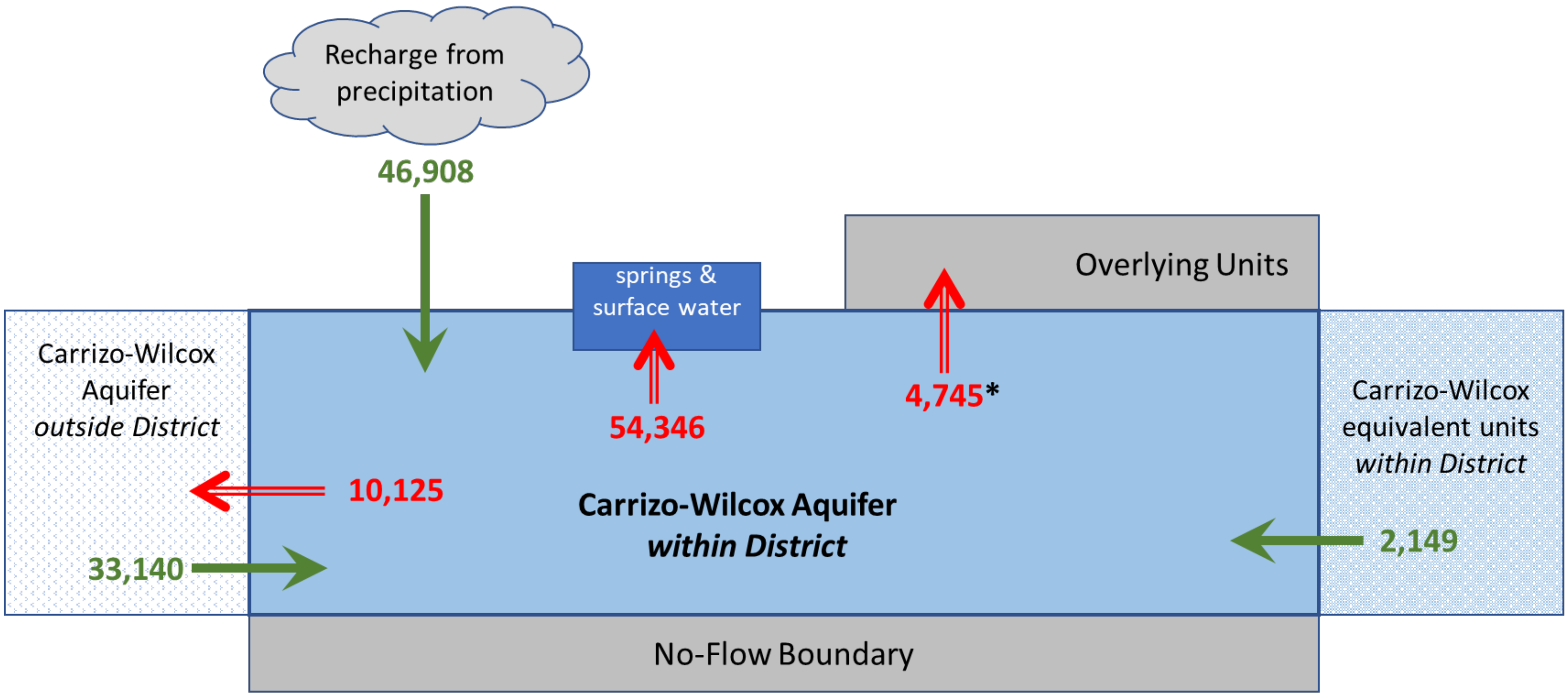


Figure 1: Area of the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers from which the information in Table 1 was extracted (the Carrizo-Wilcox Aquifer extent within the district boundary).



* Flow to overlying units includes net outflow of 2,454 acre-feet per year to the Reklaw confining unit, net outflow of 5 acre-feet per year to the Queen City Aquifer, and net outflow of 2,286 acre-feet per year to the Brazos River Alluvium Aquifer.

Caveat: This diagram only includes the water budget items provided in Table 1. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 2: Generalized diagram of the summarized budget information from Table 1, representing directions of flow for the Carrizo-Wilcox Aquifer within the Brazos Valley Groundwater Conservation District. Flow values are expressed in acre-feet per year.

Table 2: Summarized information for the Queen City Aquifer for the Brazos Valley Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	10,105
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	9,923
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	2,976
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	1,228
Estimated net annual volume of flow between each aquifer in the district	To Queen City Aquifer from Queen City equivalent units	33
	To Queen City Aquifer from Carrizo-Wilcox Aquifer	5
	To Queen City Aquifer from Reklaw confining unit	451
	From Queen City Aquifer to Weches confining unit	2,372
	To Queen City Aquifer from Sparta Aquifer	153
	From Queen City Aquifer to Brazos River Alluvium Aquifer*	6,262

* Estimated from the groundwater availability model for the Brazos River Alluvium Aquifer.

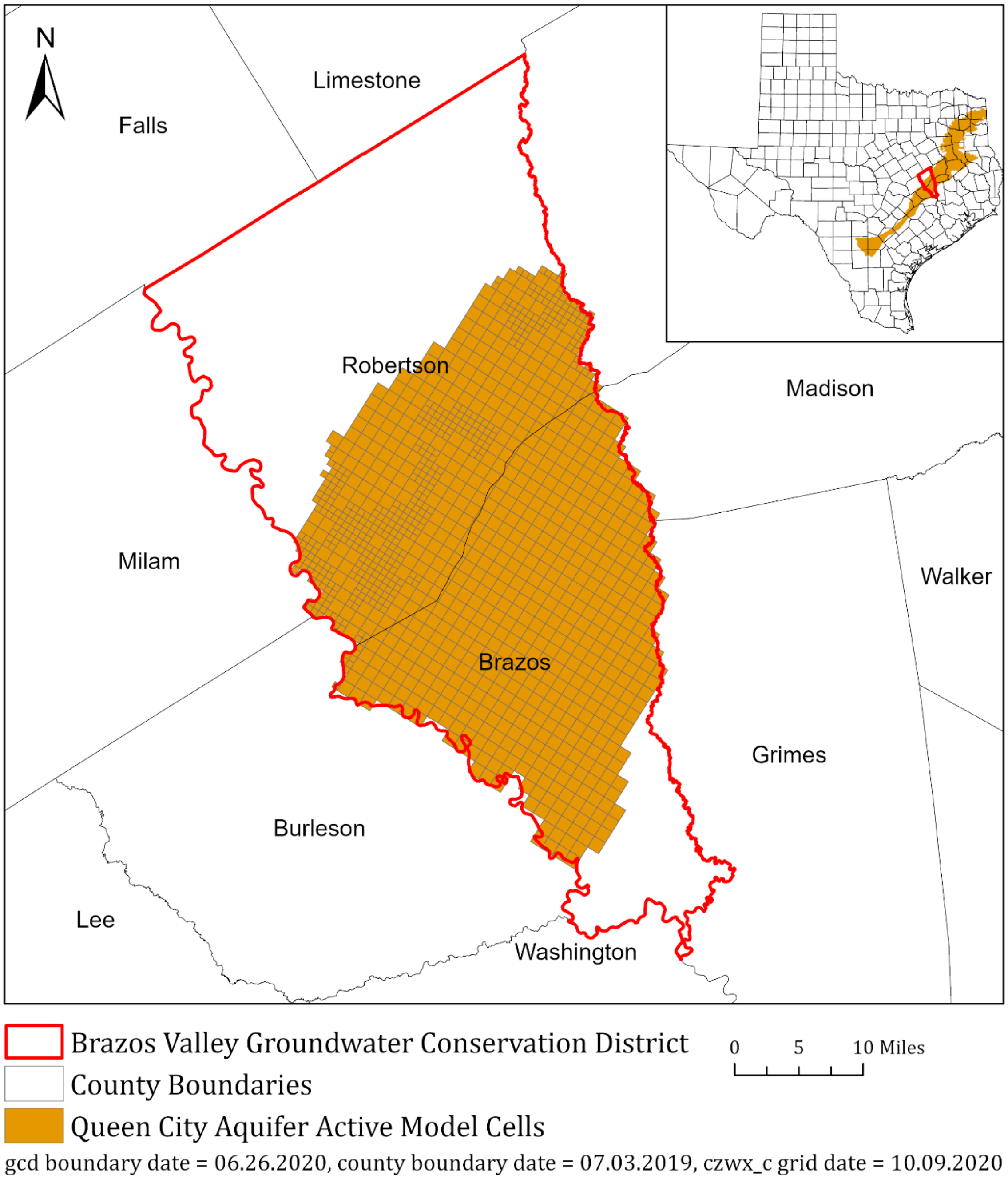
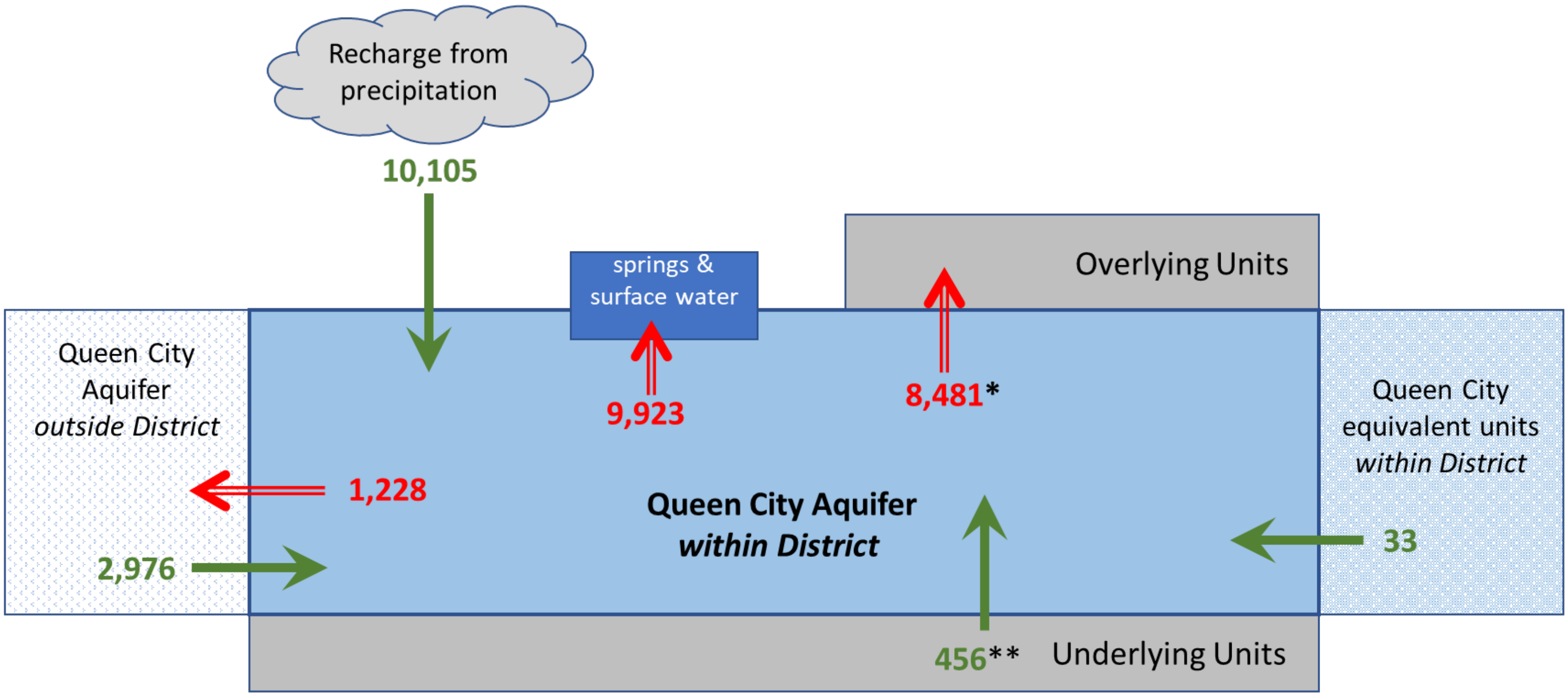


Figure 3: Area of the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers from which the information in Table 2 was extracted (the Queen City Aquifer extent within the district boundary).



* Flow to overlying units includes net outflow of 2,372 acre-feet per year to the Weches confining unit, net inflow of 153 acre-feet per year from the Sparta Aquifer, and net outflow of 6,262 acre-feet per year to the Brazos River Alluvium Aquifer.

** Flow from underlying units includes net inflow of 451 acre-feet per year from the Reklaw confining unit and 5 acre-feet per year from the Carrizo Wilcox Aquifer.

Caveat: This diagram only includes the water budget items provided in Table 2. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 4: Generalized diagram of the summarized budget information from Table 2, representing directions of flow for Queen City Aquifer within Brazos Valley Groundwater Conservation District. Flow values expressed in acre-feet per year.

Table 3: Summarized information for the Sparta Aquifer for the Brazos Valley Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	8,333
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	12,662
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	1,176
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	466
Estimated net annual volume of flow between each aquifer in the district	From Sparta Aquifer to Sparta equivalent units	5
	From Sparta Aquifer to Queen City Aquifer	153
	To Sparta Aquifer from Weches confining unit	3,138
	From Sparta Aquifer to overlying units	165
	From Sparta Aquifer to Brazos River Alluvium Aquifer*	3,860

* Estimated from the groundwater availability model for the Brazos River Alluvium Aquifer.

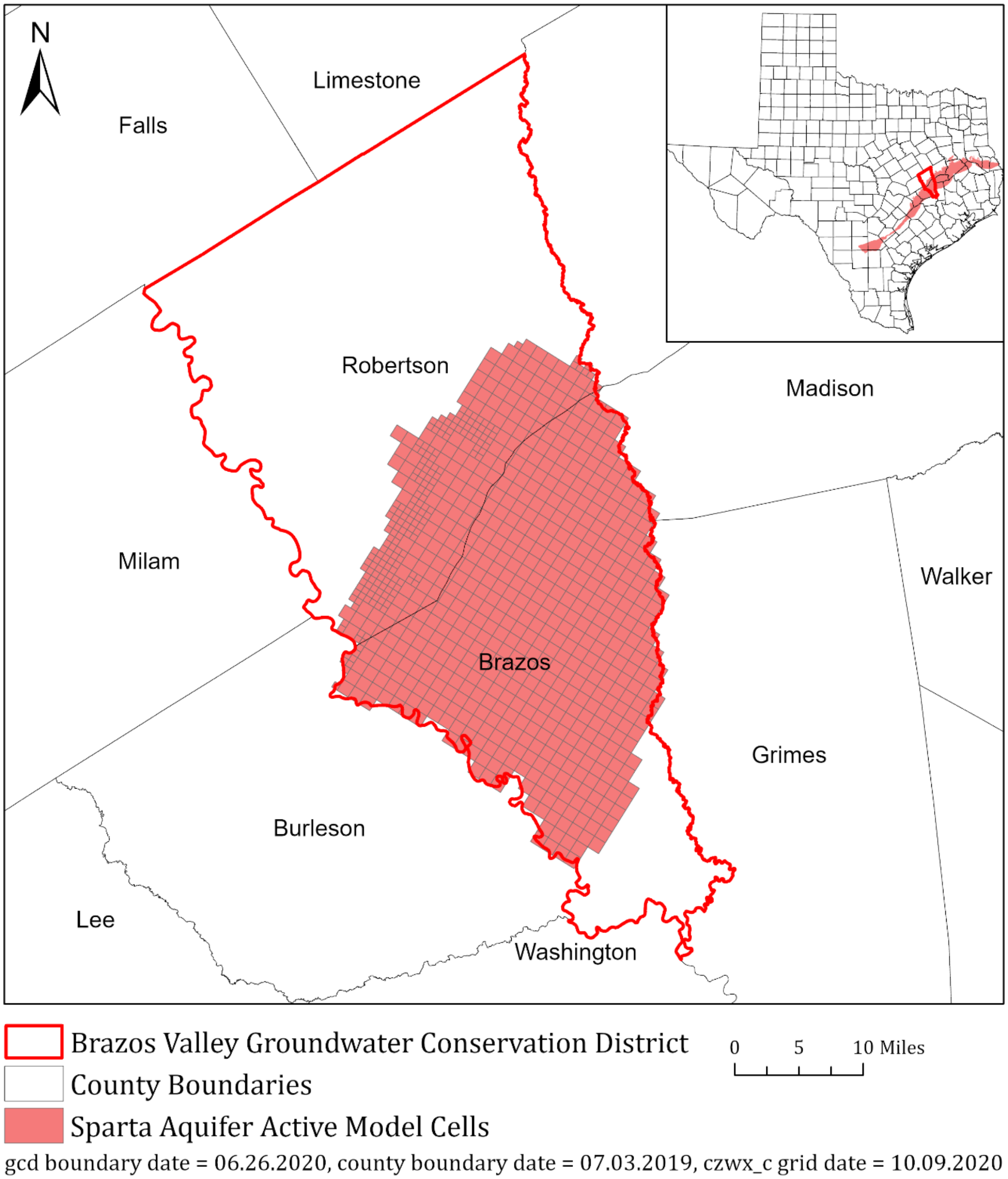
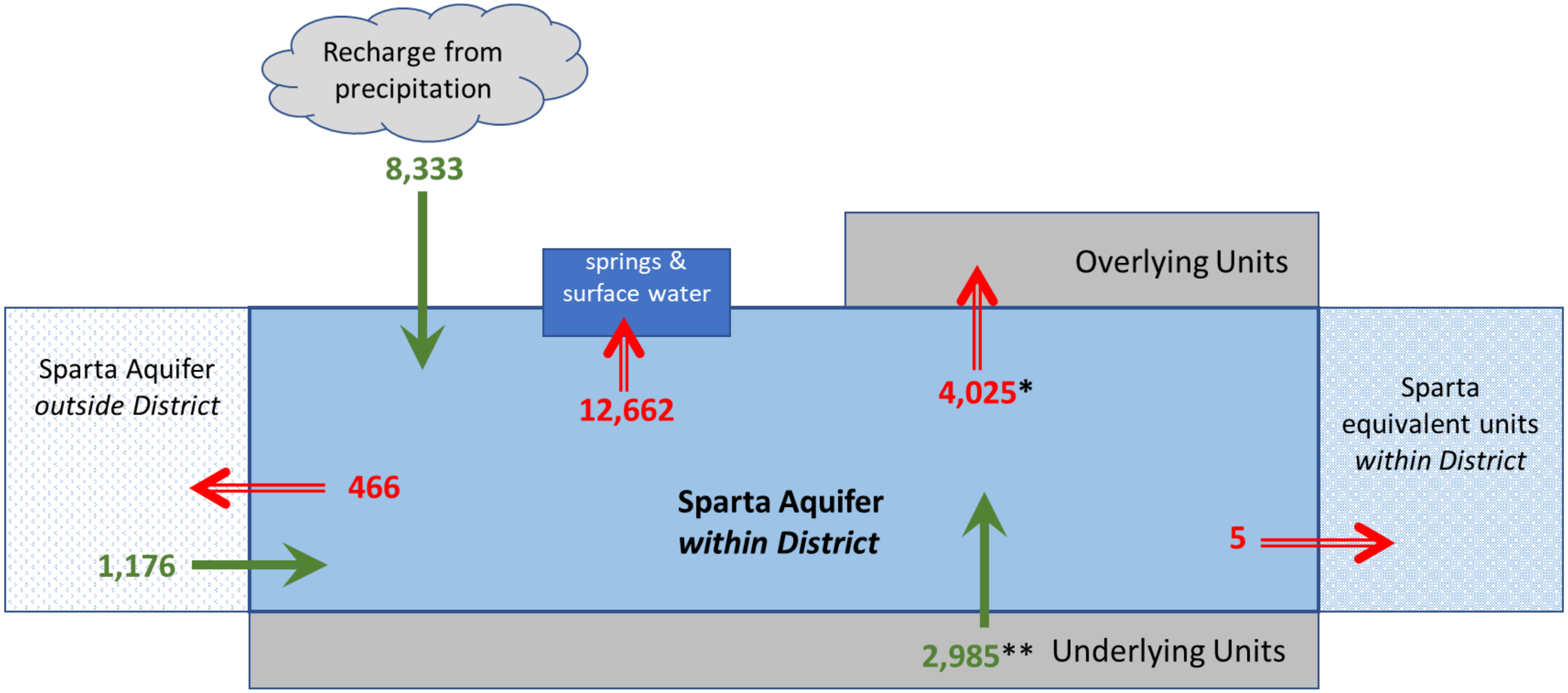


Figure 5: Area of the groundwater availability model for the central portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers from which the information in Table 3 was extracted (the Sparta Aquifer extent within the district boundary).



* Flow to overlying units includes net outflow of 165 acre-feet per year to the overlying younger units and net outflow of 3,860 acre-feet per year to the Brazos River Alluvium Aquifer.

** Flow from underlying units includes net outflow of 153 acre-feet per year to the Queen City Aquifer and net inflow of 3,138 acre-feet per year from the Weches confining unit.

Caveat: This diagram only includes the water budget items provided in Table 3. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 6: Generalized diagram of the summarized budget information from Table 3, representing directions of flow for the Sparta Aquifer within the Brazos Valley Groundwater Conservation District. Flow values are expressed in acre-feet per year.

Table 4: Summarized information for the Yegua-Jackson Aquifer for the Brazos Valley Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	26,560
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	42,656
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	12,578
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	7,122
Estimated net annual volume of flow between each aquifer in the district	To Yegua-Jackson Aquifer from Yegua-Jackson equivalent units	134
	To Yegua-Jackson Aquifer from the Gulf Coast Aquifer System	17
	From Yegua-Jackson Aquifer to Brazos River Alluvium Aquifer*	2,431

* Estimated from the groundwater availability model for the Brazos River Alluvium Aquifer.

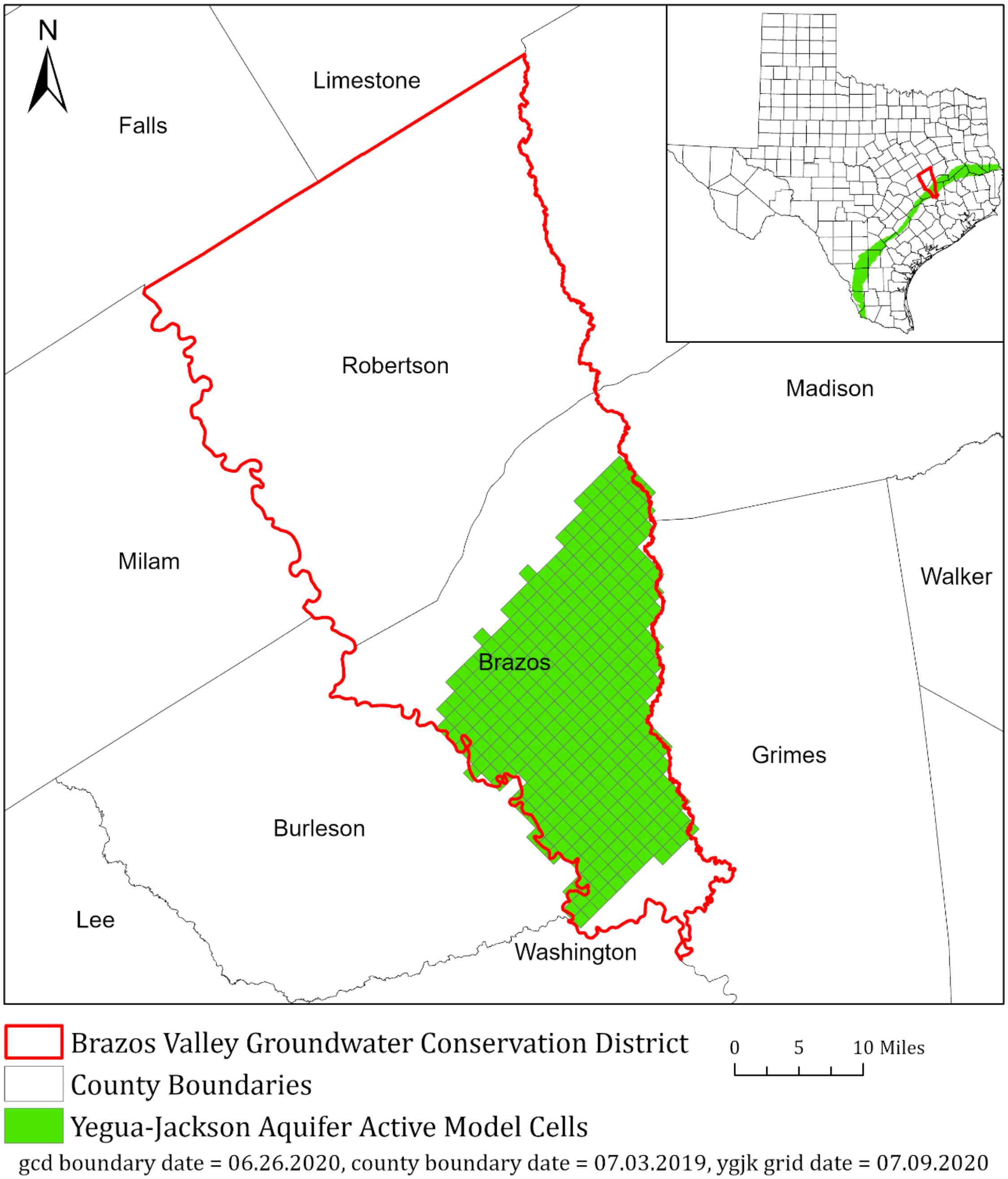
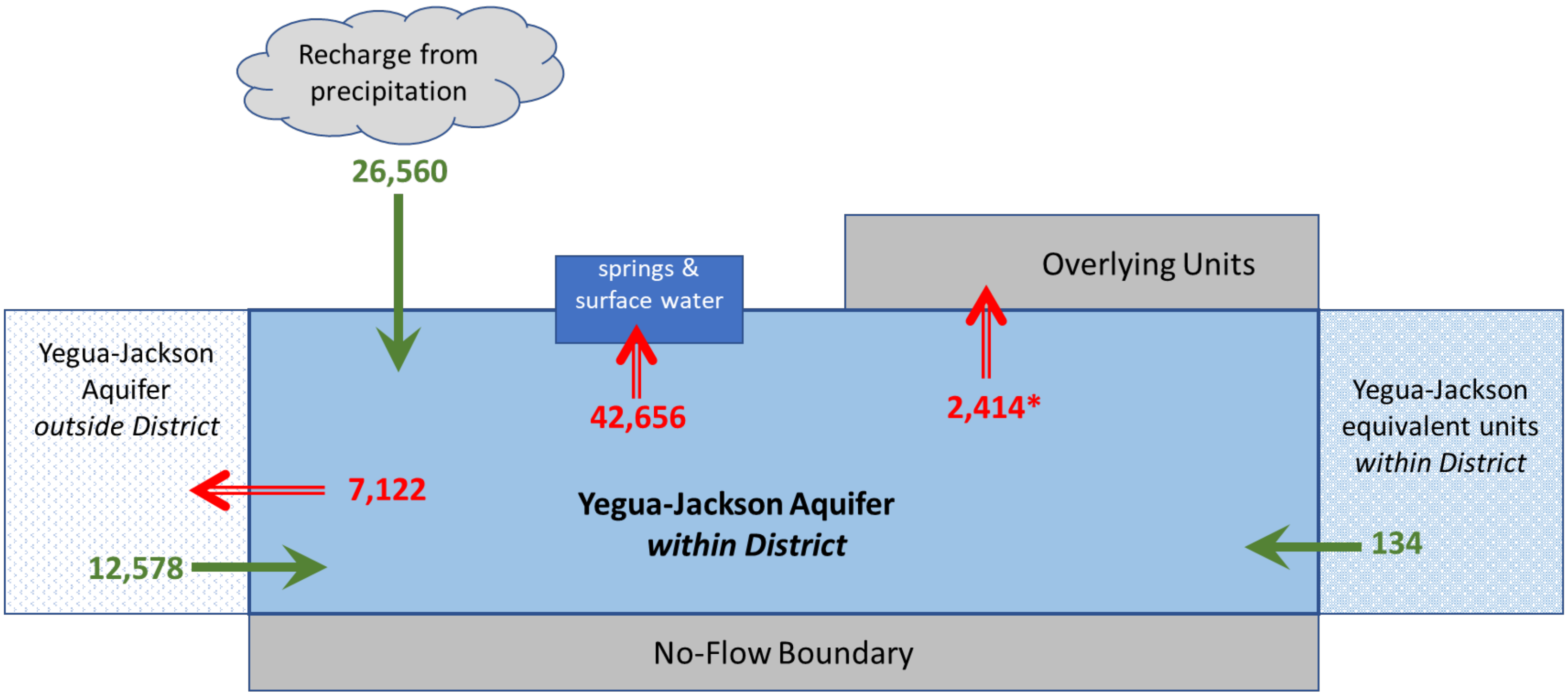


Figure 7: Area of the groundwater availability model for the Yegua-Jackson Aquifer from which the information in Table 4 was extracted (the Yegua-Jackson Aquifer extent within the district boundary).



* Flow to overlying units includes net outflow of 2,431 acre-feet per year to the Brazos River Alluvium Aquifer and a net inflow of 17 acre-feet per year from the Gulf Coast Aquifer System.

Caveat: This diagram only includes the water budget items provided in Table 4. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 8: Generalized diagram of the summarized budget information from Table 4, representing directions of flow for the Yegua-Jackson Aquifer within the Brazos Valley Groundwater Conservation District. Flow values are expressed in acre-feet per year.

Table 5: Summarized information for the Gulf Coast Aquifer System for the Brazos Valley Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	40
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Gulf Coast Aquifer System	255
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	332
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	48
Estimated net annual volume of flow between each aquifer in the district	From Gulf Coast Aquifer System to Yegua-Jackson Aquifer*	17
	From Gulf Coast Aquifer System to Brazos River Alluvium Aquifer**	2,176

* Estimated from the groundwater availability model for the Yegua-Jackson Aquifer.

** Estimated from the groundwater availability model for the Brazos River Alluvium Aquifer.

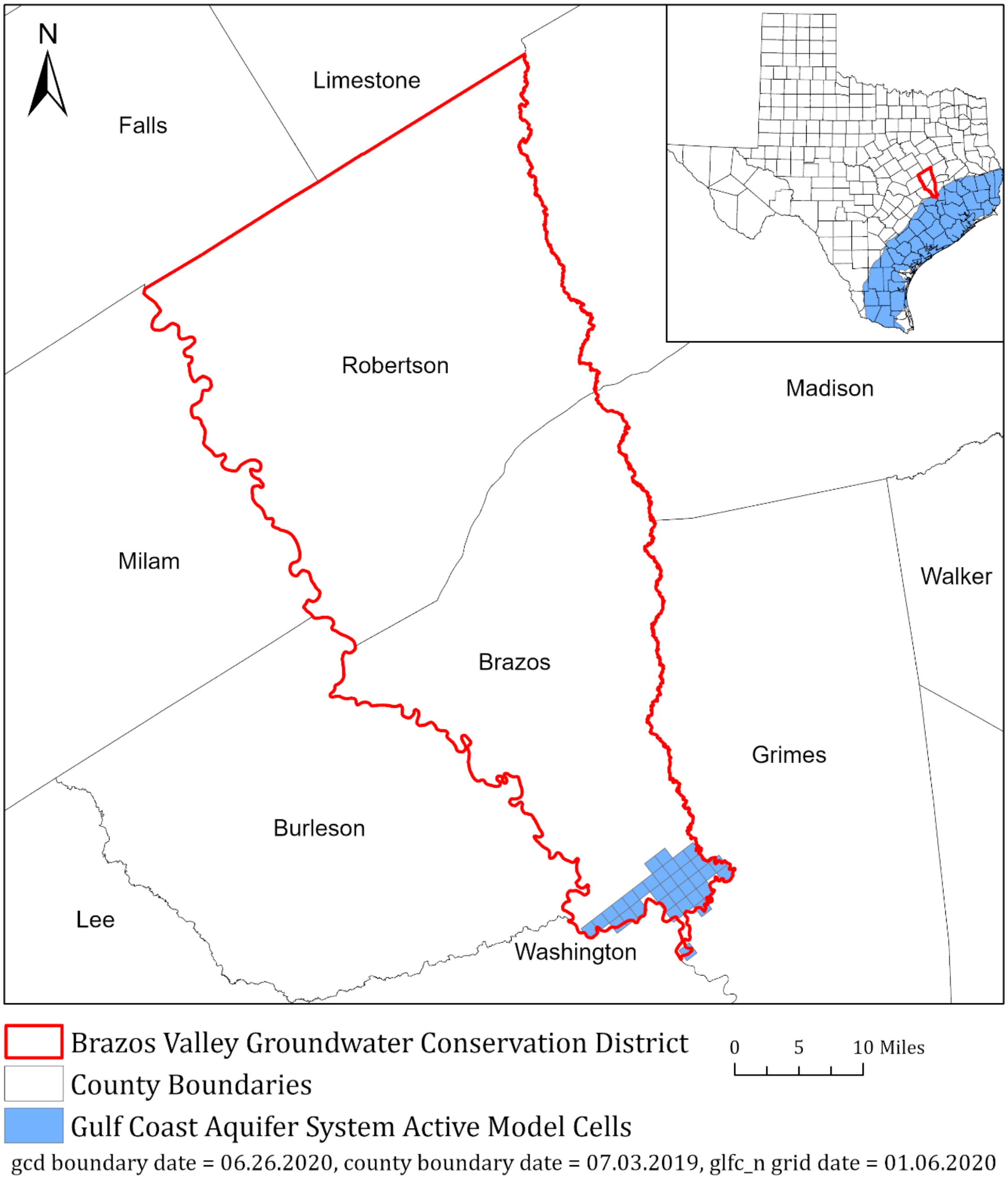
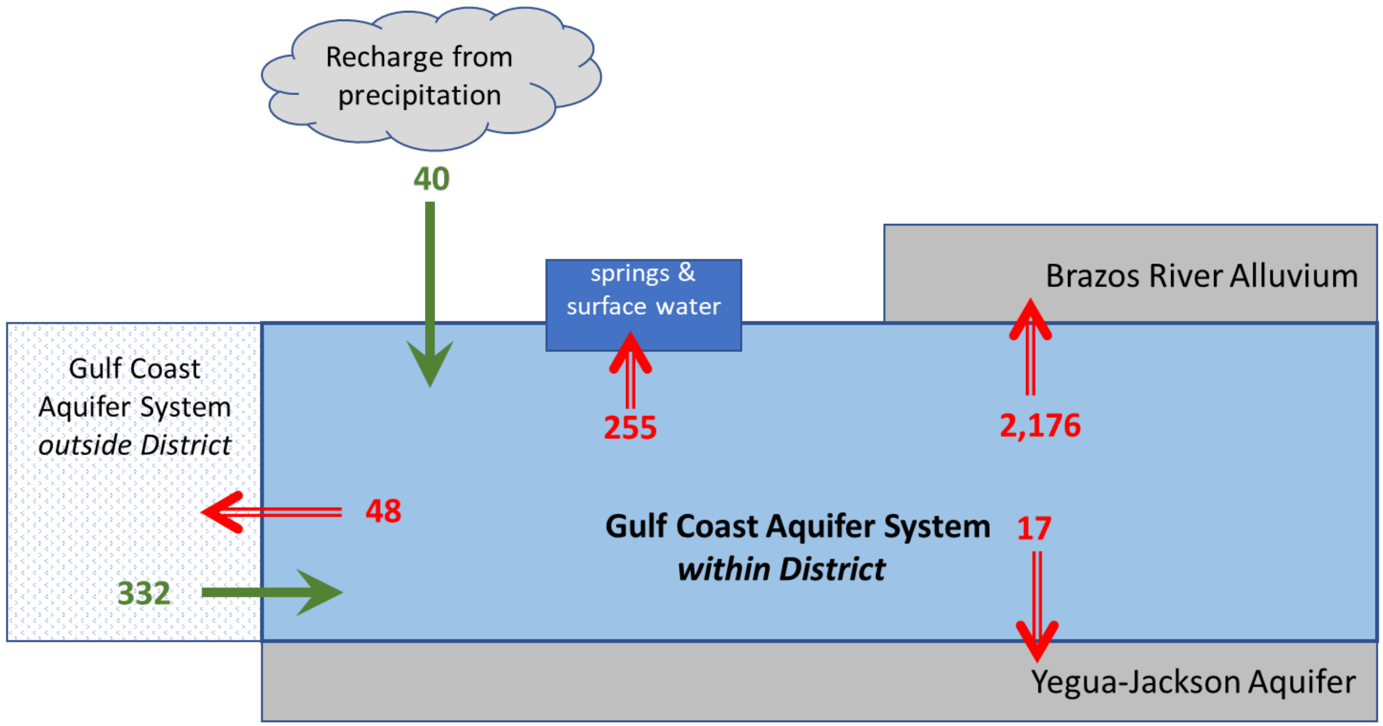


Figure 9: Area of the groundwater availability model for the northern portion of the Gulf Coast Aquifer System from which the information in Table 5 was extracted (the Gulf Coast Aquifer System extent within the district boundary).



Caveat: This diagram only includes the water budget items provided in Table 5. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 10: Generalized diagram of the summarized budget information from Table 5, representing directions of flow for the Gulf Coast Aquifer System within the Brazos Valley Groundwater Conservation District. Flow values are expressed in acre-feet per year.

Table 6: Summarized information for the Brazos River Alluvium Aquifer for the Brazos Valley Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Brazos River Alluvium Aquifer	23,418
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Brazos River Alluvium Aquifer	34,326
Estimated annual volume of flow into the district within each aquifer in the district	Brazos River Alluvium Aquifer	24,831
Estimated annual volume of flow out of the district within each aquifer in the district	Brazos River Alluvium Aquifer	21,921
Estimated net annual volume of flow between each aquifer in the district	To Brazos River Alluvium Aquifer from Carrizo-Wilcox Aquifer	2,286
	To Brazos River Alluvium Aquifer from Queen City Aquifer	6,262
	To Brazos River Alluvium Aquifer from Sparta Aquifer	3,860
	To Brazos River Alluvium Aquifer from Yegua-Jackson Aquifer	2,431
	To Brazos River Alluvium Aquifer from Gulf Coast Aquifer System	2,176
	To Brazos River Alluvium Aquifer from older confining units	771

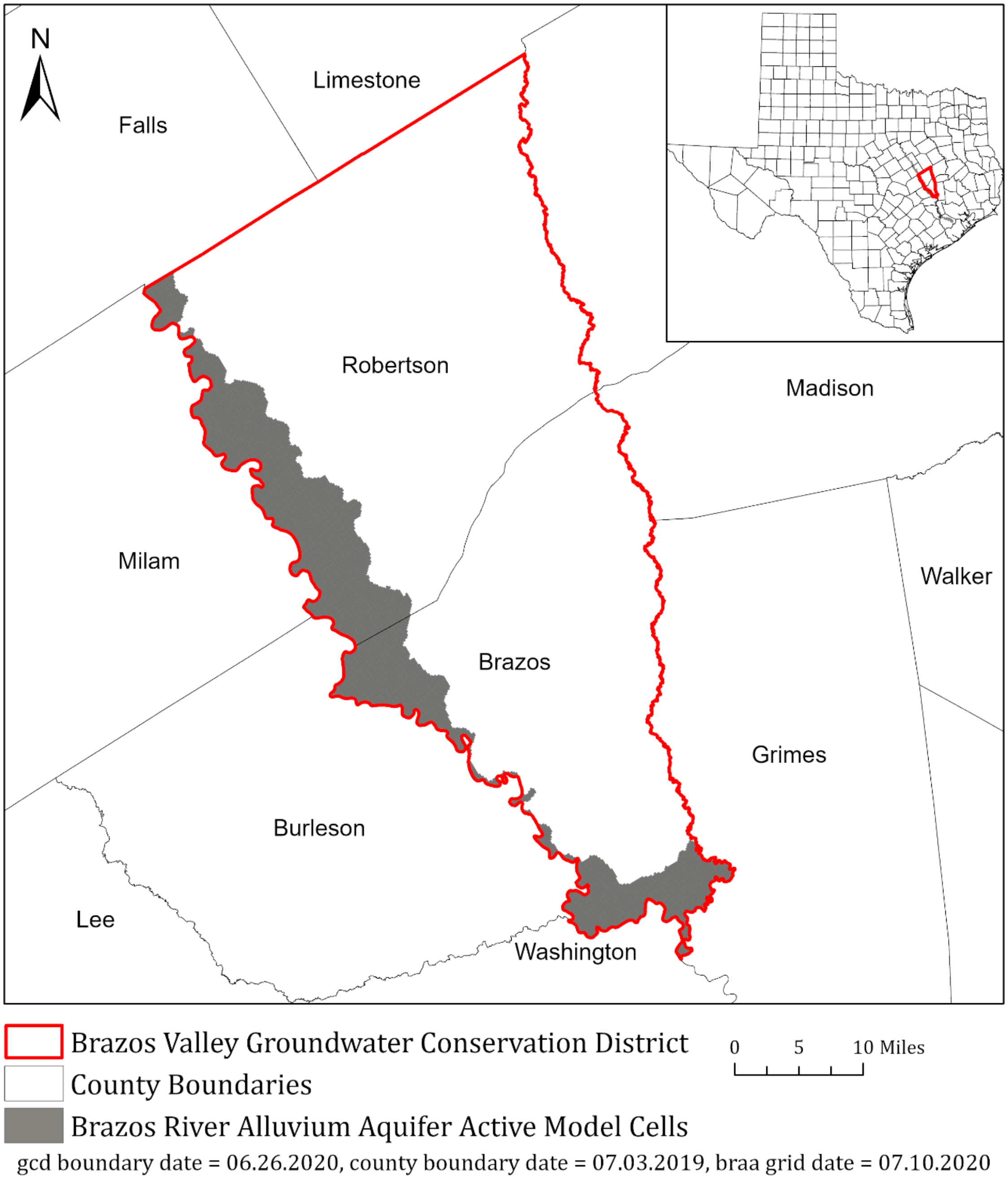
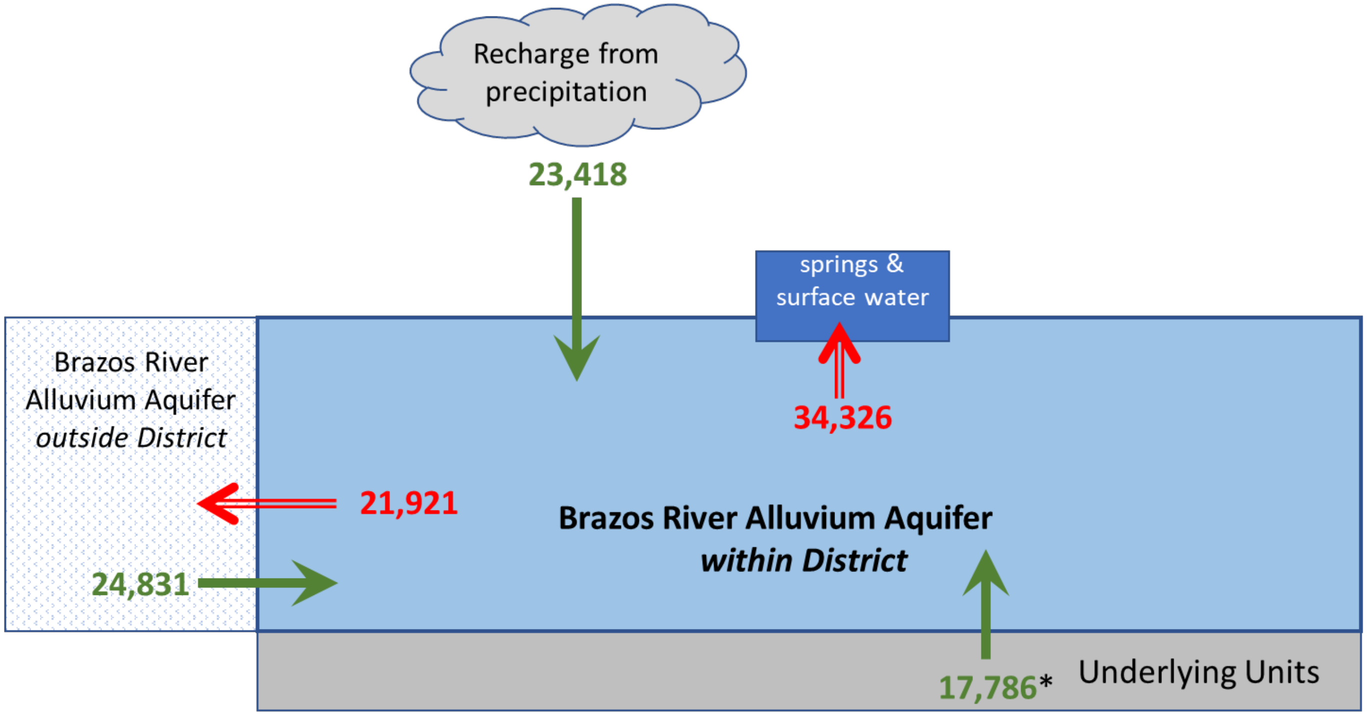


Figure 11: Area of the groundwater availability model for the Brazos River Alluvium Aquifer from which the information in Table 6 was extracted (the Brazos River Alluvium Aquifer extent within the district boundary).



* Flow from underlying units includes net inflow of 2,286 acre-feet per year from the Carrizo-Wilcox Aquifer, net inflow of 6,262 acre-feet per year from the Queen City Aquifer, net inflow of 3,860 acre-feet per year from the Sparta Aquifer, net inflow of 2,431 acre-feet per year from the Yegua-Jackson Aquifer, net inflow of 2,176 acre-feet per year from the Gulf Coast Aquifer System, and net inflow of 771 acre-feet per year from older confining units.

Caveat: This diagram only includes the water budget items provided in Table 6. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 12: Generalized diagram of the summarized budget information from Table 6, representing directions of flow for the Brazos River Alluvium Aquifer within the Brazos Valley Groundwater Conservation District. Flow values are expressed in acre-feet per year.

LIMITATIONS:

The groundwater models used in completing this analysis are the best available scientific tools that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historical pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.
Because the application of the groundwater models was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

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