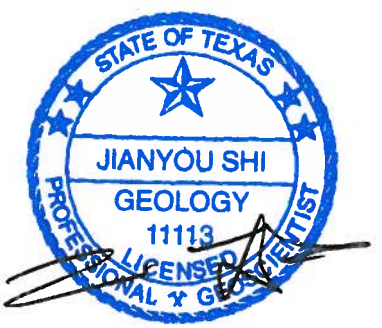
# GAM RUN 11-012: MODELED WATER BUDGET FOR THE GULF COAST AQUIFER IN MONTGOMERY COUNTY

by Jerry Shi, Ph.D.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5076
August 17, 2012

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## *EXECUTIVE SUMMARY:*

This report documents the water budget information for the northern portion of the Gulf Coast Aquifer in Montgomery County (the sole county in the Lone Star Groundwater Conservation District) from the groundwater availability model run documented in GAM Run 10-038 MAG. This model run incorporates the desired future conditions in Groundwater Management Area 14 for the Chicot, Evangeline, Burkeville, and Jasper layers of the Gulf Coast Aquifer. (The desired future conditions for Montgomery and other counties in Groundwater Management Area 14 can be found in Hassan (2011)) The water budgets include lateral flow between Montgomery and adjacent counties, vertical flow between overlying and underlying units, and the change in the volume of water stored in each unit. The water budgets also account for groundwater recharge due to precipitation, interaction with surface water and groundwater release related to aquifer subsidence.

## *BACKGROUND AND METHODS:*

On July 27, 2011, Ms. Kathy Turner Jones, General Manager of Lone Star Groundwater Conservation District, submitted the following request by e-mail to the Texas Water Development Board:

> "For GAM Run 10-038 MAG, within Montgomery County and for each layer in the model (Chicot, Evangeline, Burkeville and Jasper), please provide an annual accounting of:
>
> - Each inflow component

- Each outflow component
- Change in storage

The annual accounting should cover the historical and predictive portion of the simulation. Please identify each inflow component from County of origin and each outflow component into County receiving water."

In response to this request, water budget information from GAM Run 10-038 MAG (Hassan, 2011) was extracted from the groundwater availability model. This was then summarized for Montgomery County as requested above in draft form in September 2011. This document represents the final submittal of the water budget to satisfy the request made by the Lone Star Groundwater Conservation District. For certain groundwater flow components, flows into and out of simulated hydrogeologic units are presented as net flows. In addition, flows from stress periods with monthly intervals are averaged to obtain annual flows.

## *PARAMETERS AND ASSUMPTIONS:*

- Version 2.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer was used for this analysis. See Kasmarek and Robinson (2004) and Kasmarek and others (2005) for assumptions and limitations of the groundwater availability model.

- The results in this report are based on the model run documented in GAM Run 10-038 MAG (Hassan, 2011), which is also reported as Scenario 3 of GAM Run 10-023 (Oliver, 2010). See Hassan (2011) and Oliver (2010) for additional details about the methods and assumptions of the model run.

- The model run contains 129 transient stress periods. Stress Period 1 has a length of 10,000 days to simulate the pseudo-steady state, pre-development water levels (prior to 1891). Stress Periods 2 through 15 represent the early historical period 1891 through 1979 with limited pumping data available. Stress Periods 16 through 65 represent the historical calibration period 1980 through 1996. Stress Periods 66 through 77 represent the interim period 1997 through 2008 described in Oliver (2010) with the original pumping rates adjusted to better match measured water levels. Stress periods 78 through 129 represent the predictive period 2009 through 2060.

- The groundwater availability model includes four layers which generally correspond to the following units (from top to bottom):

  - the Chicot Aquifer (Layer 1),
  - the Evangeline Aquifer (Layer 2),
  - the Burkeville Confining Unit (Layer 3), and
  - the Jasper Aquifer including parts of the Catahoula Formation (Layer 4).

- The model grid file dated June 2, 2011 was used to associate the model grid to political and natural boundaries for the northern portion of the Gulf Coast Aquifer.

- The recharge used for the model run represents average recharge as described in Kasmarek and Robinson (2004) and Kasmarek and others (2005).

## *RESULTS:*

As requested, details of the individual flow components are summarized in tables with average values for the historical calibration period (1980 through 1996) and predictive period (2009 through 2060) presented at the end of each table. The historical period (1980 through 1996) is selected representing a timeframe when relatively reliable pumping data was available. Positive values represent net flow into Montgomery County or an individual hydrogeologic unit. Negative values represent net flow out of Montgomery County or an individual hydrogeologic unit. Additional details about each of the components of the water budget are included below

- Head Dependent Boundary – this is the net inflow or outflow that occurs to/from the aquifer in outcrop areas (where the aquifer is exposed at land surface) due to recharge from precipitation, inflows from surface water features such as rivers and streams, outflows to surface water features, spring flow, direct evaporation, or plant transpiration. In the groundwater availability model for the northern portion of the Gulf Coast Aquifer these components are modeled collectively using the MODFLOW General Head Boundary package.

- Wells – water produced from wells in each aquifer. This component is always shown as a negative value since it is outflow from the aquifer. Wells are simulated in the model using the MODFLOW Well package.

- Subsidence – describes the water made available to the flow system due to compaction of clay layers. This is separate from the change in storage term

described below. This compaction, and subsequent loss of storage volume in the aquifer, is considered to be largely permanent. A positive value for subsidence indicates that subsidence is occurring and that volume of water is made available to the flow system. Subsidence is simulated in the groundwater availability model using the MODFLOW Interbed Storage package.

- Lateral flow (indicated by county name) – describes the net lateral flow within each unit of the aquifer between Montgomery County and a neighboring county.

- Vertical leakage (indicated by hydrogeologic unit name) – describes the vertical flow, or leakage between two aquifers. This interaction can take place with both the overlying and underlying units and show either a net upward or downward flow. The direction and amount of flow is controlled by the water levels in each aquifer and the aquifer properties that define the amount of leakage that can occur.

- Change in Storage – the net change in the water stored in the aquifer. A positive value indicates that water is added to storage (that is, water levels rise. A negative value indicates that water is removed from storage (that is, water levels fall).

The water budgets for each of the units of the Gulf Coast Aquifer in Montgomery County are described below:

### *Chicot Aquifer*

Figure 1 shows the cells in the groundwater availability model representing the Chicot Aquifer in and around Montgomery County. The water budget for the Chicot Aquifer in Montgomery County is presented in Table 1. The water budget for the Chicot Aquifer in Montgomery County is described below:

Inflow – The modeled groundwater flow into the Chicot Aquifer in Montgomery County is primarily through the head dependent boundaries for both the historical (1980 through 1996) and predictive (2009 through 2060) periods. Head dependent boundaries occur in the outcrop area and allow both inflows and outflows including groundwater recharge due to precipitation, groundwater loss to evapotranspiration and springs, and groundwater/surface water interaction. The average inflows through head dependent boundaries are approximately 40,000 and 59,000 acre-feet per year for the historical and predictive periods, respectively. If it is assumed that recharge

and evapotranspiration do not change significantly, the net groundwater inflow increase from the historical to predictive periods through the head dependent boundaries likely comes from reduced flow to springs and enhanced leakage from surface water bodies. Average inflows due to aquifer subsidence and from Liberty, San Jacinto, and Waller counties range from approximately 200 to 1,000 acre-feet per year. Average inflows from Grimes and Walker counties are predicted to be minimal with little changes between the historical and predictive periods (Table 1).

Outflow – The main outflow components for the Chicot Aquifer in Montgomery County are predicted to be downward flow to the Evangeline Aquifer and lateral flow to Harris County. The average outflow to the Evangeline Aquifer is predicted to increase from approximately 19,000 acre-feet per year during the historical period to 34,000 acre-feet per year during the predictive period. The outflow to Harris County decreases from approximately 41,000 to 33,000 acre-feet per year during the same simulated timeframe. The modeled average groundwater withdrawal due to pumping increases from approximately 280 acre-feet per year during the historical period to 1,700 acre-feet per year during the predictive period (Table 1).

Storage – The aquifer storage loss for the Chicot Aquifer is predicted to decrease from an average of approximately 19,000 acre-feet per year during the historical period to 6,800 acre-feet per year during the predictive period (Table 1).

### *Evangeline Aquifer*

Figure 2 shows the cells in the groundwater availability model representing the Evangeline Aquifer in and around Montgomery County. The water budget for the Evangeline Aquifer in Montgomery County is presented in Table 2. The water budget of the Evangeline Aquifer in Montgomery County is described below:

Inflow – The modeled groundwater flow into the Evangeline Aquifer in Montgomery County is predominated by the downward flow from the Chicot Aquifer and, to a lesser degree, by water released due to aquifer subsidence. Note that subsidence is shown as an inflow inTable 2. This is because water released as clay units are compacted is made available to the aquifer flow system. The average inflow from the Chicot Aquifer is predicted to increase from approximately 19,000 acre-feet per year during the historical period to 34,000 acre-feet per year during the predictive period. The water released due to aquifer subsidence, however, slightly decreases from approximately 6,100 to 4,000 acre-feet per year over the same time periods. Average groundwater flow from San Jacinto and Waller counties is predicted to be approximately 1,100 to 1,200 acre-feet per year. Head dependent boundaries

(representing outcrop flow components such as recharge, evapotranspiration, and surface water interaction), Grimes County, Liberty County, and Walker County each contributes less than 1,000 acre-feet per year (Table 2).

Outflow – The main outflow components for the Evangeline Aquifer in Montgomery County are predicted to be groundwater pumping and lateral flow to Harris County. The average groundwater pumping in the Evangeline Aquifer in the simulation increases from approximately 18,000 acre-feet per year during the historical period to 39,000 acre-feet per year during the predictive period, while the average outflow to Harris County declines from approximately 13,000 to 4,800 acre-feet per year over the same timeframe (Table 2).

In the simulation, groundwater primarily flows from the Burkeville confining unit into the Evangeline Aquifer during the historical period. Though this flow direction is reversed during the predictive period, the amount of groundwater involved may be insignificant (Table 2).

Storage – The average aquifer storage loss for the Evangeline Aquifer ranges from approximately 1,700 during the historical period to 1,600 acre-feet per year during the predictive period (Table 2).

### *Burkeville Confining Unit*

Figure 3 below shows the cells in the groundwater availability model representing the Burkeville confining unit in and around Montgomery County. The water budget for the Burkeville confining unit in Montgomery County is presented in Table 3. The water budget of the Burkeville confining unit in Montgomery County is described below:

Overall, groundwater flow through the Burkeville confining unit is predicted to be vertical and relatively small. On average, the groundwater flow direction is upward from the Jasper Aquifer to the Burkeville confining unit and to the Evangeline Aquifer during the historical period. This flow direction is reversed and becomes downward from the Evangeline Aquifer to the confining unit and to the Jasper Aquifer during the predictive period. The average vertical flow through the Burkeville confining unit is estimated less than 1,000 acre-feet per year (Table 3).

Storage – The average storage losses are predicted to be small at approximately 150 acre-feet per year during both the historical and predictive periods (Table 3).

### *Jasper Aquifer*

Figure 4 below shows the cells in the groundwater availability model representing the Jasper Aquifer (and parts of the Catahoula Formation) in and around Montgomery County. The water budget information for the Jasper Aquifer in Montgomery County is presented in Table 4. The water budget of the Jasper Aquifer in Montgomery County is described below:

Inflow –The modeled groundwater flow into the Jasper Aquifer in Montgomery County is dominated by lateral flow from Walker County. On average, inflow from Walker County is approximately 5,000 acre-feet per year during the historical period and 10,000 acre-feet per year during the predictive period. Other surrounding counties and release of water due to subsidence also contribute groundwater to Montgomery County, ranging from 160 to 2,600 acre-feet per year. Vertical inflow from the Burkeville confining unit is predicted to be less than 1,000 acre-feet per year during the predictive period (Table 4).

Outflow – The main outflow component for the Jasper Aquifer in Montgomery County is groundwater pumping, averaging approximately 11,000 acre-feet per year during the historical period and 23,000 acre-feet per year during the predictive period. A small amount of vertical leakage to the Burkeville confining unit also occurs during the historical period (Table 4).

Storage – The average aquifer storage losses are predicted to be approximately 3,600 acre-feet per year during the historical period and 3,300 acre-feet per year during the predictive period (Table 4).

### *Summary*

The groundwater availability model for the northern portion of the Gulf Coast Aquifer suggests the groundwater flow in Montgomery County is primarily impacted by pumping and the Burkeville confining unit. As simulated in the model, the pumping primarily occurs in the Evangeline and Jasper aquifers, separated by the Burkeville confining unit. As a result, groundwater recharge due to precipitation and leakage from surface water bodies received by the Chicot Aquifer in the outcrop area will likely move downward to the Evangeline Aquifer and be collected by groundwater pumping. The Burkeville confining unit is predicted to limit the groundwater vertical flow. Thus, the pumping in the Jasper Aquifer tends to withdraw groundwater from surrounding counties (especially Walker County). In addition, changes in pumping rate also influence groundwater flow direction and magnitude. For instance, an

increase of pumping in the Evangeline Aquifer may induce more vertical flow from the Chicot Aquifer and reduce lateral flow from Montgomery to Harris counties in the Evangeline Aquifer. For the Jasper Aquifer, the increase of pumping in Montgomery County may also induce more lateral flow from the surrounding counties and, for the case of Harris County, to reverse the groundwater flow from outflow to inflow. To illustrate the overall groundwater flow relationships in Montgomery County, a simplified conceptual model is presented on Figure 5.

It is important for the Lone Star Groundwater Conservation District to monitor future groundwater pumping and overall conditions of the aquifer, and work with the TWDB to refine this analysis as available data enable an improved understanding of how the aquifer responds to the actual amount and location of current and future pumping.

## *LIMITATIONS:*

Although the groundwater flow model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. 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."

Parameters related to this specific groundwater flow model include aquifer geometry and properties, pumping rates and locations, and the use of a general head boundary to represent lumped impacts of recharge, evapotranspiration, and groundwater/surface water interaction. During model development, certain assumptions have to be made regarding these parameters. Uncertainty of the parameters will cause non-uniqueness of model predictions. As a result, users of this information are cautioned that the magnitude and change of each modeled groundwater component should not be considered definitive and permanent. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer/confining unit at a particular location or at a particular time.

## *REFERENCES:*

Hassan, M. M. H., 2011, GAM Run 10-038 MAG: Texas Water Development Board Managed Available Groundwater GAM Run Report, 19 p.

Kasmarek, M.C., and Robinson, J.L., 2004, Hydrogeology and simulation of groundwater flow and land-surface subsidence in the northern part of the Gulf Coast aquifer system, Texas: U.S. Geological Survey Scientific Investigations Report 2004-5102, 111 p.

Kasmarek, M.C., Reece, B.D., and Houston, N.A., 2005, Evaluation of groundwater flow and land-surface subsidence caused by hypothetical withdrawals in the northern part of the northern part of the Gulf Coast aquifer system, Texas: U.S. Geological Survey Scientific Investigations Report 2005-5024, 70 p.

Oliver, W., 2010, GAM Run 10-023: Texas Water Development Board GAM Run Report, 32 p.

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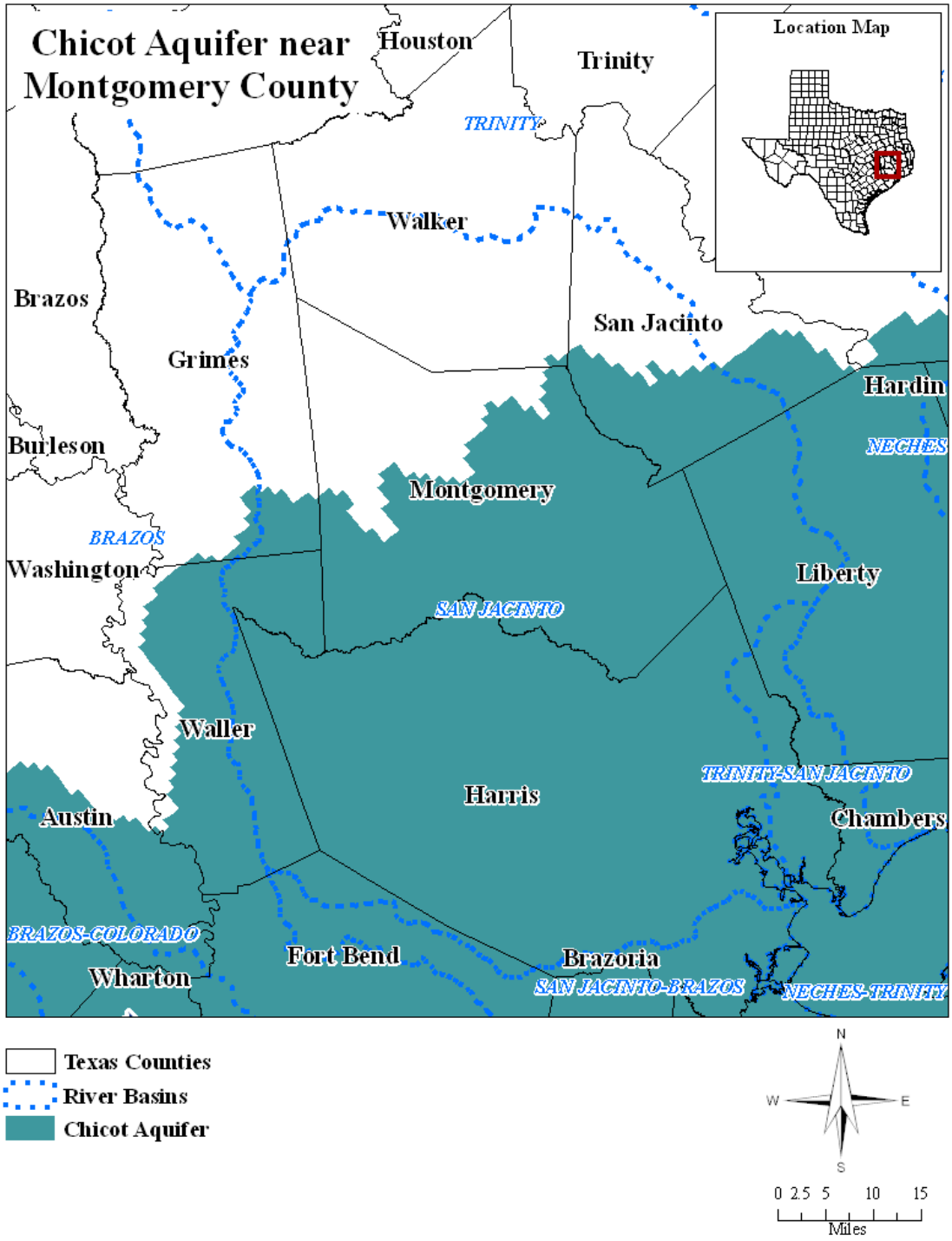


FIGURE 1. GROUNDWATER AVAILABILITY MODEL CELLS REPRESENTING THE CHICOT AQUIFER IN MONTGOMERY COUNTY AND NEARBY AREAS.

TABLE 1: SIMULATED WATER BUDGET OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE CHICOT AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre-1891 | 10,597 | 0 | 0 | -880 | 5 | -10,426 | -106 | 169 | 1 | 640 | 0 |
| 1891-1900 | 11,425 | 12 | 0 | -1,969 | 5 | -12,510 | -83 | 170 | 1 | 644 | -2,300 |
| 1901-1930 | 13,510 | 4 | 0 | -2,661 | 5 | -13,078 | -36 | 174 | 1 | 657 | -1,358 |
| 1931-1940 | 15,864 | 36 | -1 | -4,539 | 5 | -19,293 | 25 | 177 | 1 | 663 | -7,062 |
| 1941-1945 | 17,152 | 31 | -1 | -5,254 | 5 | -20,157 | 63 | 177 | 1 | 668 | -7,312 |
| 1946-1953 | 20,518 | 51 | -1 | -8,079 | 5 | -25,630 | 141 | 182 | 1 | 662 | -12,151 |
| 1954-1960 | 23,903 | 53 | -224 | -10,029 | 5 | -28,890 | 203 | 186 | 1 | 664 | -14,129 |
| 1961-1962 | 24,877 | 55 | -187 | -10,754 | 5 | -29,646 | 226 | 188 | 1 | 662 | -14,575 |
| 1963-1970 | 28,966 | 54 | -193 | -12,058 | 5 | -32,784 | 312 | 194 | 1 | 665 | -14,839 |
| 1971-1973 | 30,570 | 60 | -251 | -13,068 | 5 | -34,248 | 342 | 196 | 1 | 676 | -15,717 |
| 1974-1975 | 31,693 | 63 | -278 | -13,594 | 5 | -35,440 | 360 | 197 | 1 | 685 | -16,307 |
| 1976 | 32,235 | 61 | -294 | -13,477 | 5 | -35,523 | 363 | 198 | 1 | 689 | -15,741 |
| 1977 | 32,804 | 65 | -304 | -13,917 | 5 | -36,103 | 367 | 199 | 1 | 693 | -16,191 |
| 1978 | 33,390 | 66 | -315 | -14,454 | 5 | -36,723 | 373 | 201 | 1 | 696 | -16,762 |
| 1979 | 33,988 | 67 | -326 | -14,784 | 5 | -37,263 | 381 | 201 | 1 | 700 | -17,030 |

TABLE 1: SIMULATED WATER BUDGET OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE CHICOT AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 34,309 | 71 | -209 | -14,948 | 5 | -37,558 | 388 | 201 | 1 | 701 | -17,039 |
| 1981 | 35,227 | 114 | -210 | -16,226 | 5 | -38,404 | 405 | 203 | 1 | 708 | -18,178 |
| 1982 | 35,580 | 118 | -208 | -16,523 | 5 | -38,784 | 402 | 204 | 1 | 711 | -18,495 |
| 1983 | 36,566 | 125 | -284 | -17,314 | 5 | -39,594 | 416 | 205 | 1 | 720 | -19,155 |
| 1984 | 37,251 | 141 | -199 | -17,839 | 5 | -40,120 | 430 | 206 | 1 | 727 | -19,397 |
| 1985 | 37,936 | 181 | -206 | -18,314 | 5 | -40,658 | 445 | 207 | 1 | 733 | -19,671 |
| 1986 | 38,632 | 226 | -331 | -18,849 | 5 | -41,085 | 468 | 208 | 1 | 739 | -19,987 |
| 1987 | 39,308 | 255 | -286 | -18,850 | 5 | -41,502 | 485 | 210 | 1 | 744 | -19,631 |
| 1988 | 39,660 | 272 | -374 | -18,838 | 5 | -41,743 | 493 | 210 | 1 | 745 | -19,569 |
| 1989 | 40,632 | 296 | -288 | -19,683 | 5 | -42,282 | 513 | 211 | 1 | 751 | -19,843 |
| 1990 | 41,314 | 298 | -311 | -20,287 | 5 | -42,562 | 531 | 212 | 1 | 756 | -20,044 |
| 1991 | 41,972 | 298 | -350 | -20,338 | 5 | -42,661 | 544 | 213 | 1 | 761 | -19,557 |
| 1992 | 42,613 | 349 | -297 | -20,758 | 5 | -42,730 | 557 | 214 | 1 | 766 | -19,281 |
| 1993 | 43,274 | 361 | -233 | -21,316 | 5 | -43,017 | 570 | 215 | 1 | 773 | -19,365 |
| 1994 | 43,957 | 416 | -308 | -22,372 | 5 | -43,191 | 587 | 216 | 1 | 779 | -19,909 |
| 1995 | 44,642 | 454 | -314 | -22,970 | 5 | -43,314 | 605 | 218 | 1 | 786 | -19,888 |
| 1996 | 45,350 | 508 | -308 | -24,032 | 5 | -43,513 | 626 | 219 | 1 | 792 | -20,354 |
| 1997 | 45,923 | 581 | -76 | -22,919 | 5 | -43,419 | 641 | 220 | 1 | 798 | -18,245 |
| 1998 | 46,465 | 845 | -77 | -23,100 | 5 | -43,624 | 654 | 221 | 1 | 804 | -17,805 |
| 1999 | 46,999 | 986 | -77 | -23,419 | 5 | -43,896 | 673 | 222 | 1 | 809 | -17,696 |
| 2000 | 47,475 | 1,344 | -1,363 | -24,841 | 5 | -43,884 | 715 | 221 | 1 | 815 | -19,510 |
| 2001 | 47,833 | 637 | -1,385 | -25,858 | 5 | -41,318 | 754 | 222 | 1 | 821 | -18,287 |
| 2002 | 48,227 | 476 | -1,407 | -26,867 | 5 | -40,197 | 783 | 224 | 1 | 827 | -17,928 |

TABLE 1: SIMULATED WATER BUDGET OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE CHICOT AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 48,662 | 441 | -1,428 | -27,776 | 5 | -39,529 | 806 | 225 | 1 | 834 | -17,761 |
| 2004 | 49,082 | 306 | -1,450 | -28,222 | 5 | -38,514 | 824 | 226 | 1 | 841 | -16,901 |
| 2005 | 49,561 | 379 | -1,471 | -29,246 | 5 | -38,489 | 841 | 227 | 1 | 849 | -17,344 |
| 2006 | 50,024 | 322 | -1,492 | -29,689 | 5 | -37,885 | 855 | 228 | 1 | 857 | -16,775 |
| 2007 | 50,442 | 209 | -1,513 | -29,839 | 5 | -36,899 | 867 | 230 | 1 | 865 | -15,632 |
| 2008 | 50,841 | 163 | -1,513 | -30,008 | 5 | -36,091 | 878 | 230 | 1 | 873 | -14,620 |
| 2009 | 51,325 | 217 | -1,542 | -31,773 | 5 | -36,358 | 844 | 233 | 1 | 879 | -16,168 |
| 2010 | 51,841 | 341 | -1,482 | -32,075 | 5 | -36,645 | 816 | 235 | 1 | 886 | -16,077 |
| 2011 | 52,365 | 516 | -1,519 | -32,685 | 5 | -36,782 | 794 | 235 | 1 | 892 | -16,176 |
| 2012 | 52,893 | 612 | -1,555 | -33,259 | 5 | -36,846 | 778 | 236 | 1 | 899 | -16,234 |
| 2013 | 53,423 | 701 | -1,591 | -33,794 | 5 | -36,835 | 764 | 237 | 1 | 905 | -16,182 |
| 2014 | 53,952 | 766 | -1,627 | -34,311 | 5 | -36,759 | 754 | 237 | 1 | 911 | -16,072 |
| 2015 | 54,625 | 1,036 | -2,359 | -38,509 | 5 | -36,505 | 767 | 239 | 1 | 922 | -19,779 |
| 2016 | 55,161 | 864 | -1,722 | -34,712 | 5 | -36,422 | 753 | 239 | 1 | 927 | -14,905 |
| 2017 | 55,639 | 842 | -1,722 | -34,503 | 5 | -36,219 | 743 | 239 | 1 | 932 | -14,044 |
| 2018 | 56,086 | 806 | -1,722 | -34,357 | 5 | -36,003 | 735 | 238 | 1 | 937 | -13,274 |
| 2019 | 56,505 | 778 | -1,722 | -34,213 | 5 | -35,780 | 728 | 238 | 1 | 942 | -12,517 |
| 2020 | 56,898 | 732 | -1,722 | -34,068 | 5 | -35,545 | 722 | 238 | 1 | 946 | -11,793 |
| 2021 | 57,269 | 676 | -1,722 | -33,987 | 5 | -35,305 | 716 | 239 | 1 | 950 | -11,159 |
| 2022 | 57,617 | 617 | -1,722 | -33,908 | 5 | -35,058 | 711 | 238 | 1 | 954 | -10,545 |
| 2023 | 57,943 | 561 | -1,722 | -33,842 | 5 | -34,801 | 706 | 238 | 1 | 958 | -9,953 |
| 2024 | 58,248 | 500 | -1,722 | -33,776 | 5 | -34,535 | 701 | 238 | 1 | 962 | -9,376 |
| 2025 | 58,534 | 431 | -1,722 | -33,703 | 5 | -34,256 | 697 | 238 | 1 | 966 | -8,810 |

TABLE 1: SIMULATED WATER BUDGET OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE CHICOT AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2026 | 58,801 | 360 | -1,722 | -33,630 | 5 | -33,966 | 692 | 238 | 1 | 969 | -8,252 |
| 2027 | 59,048 | 299 | -1,722 | -33,557 | 5 | -33,666 | 688 | 238 | 1 | 972 | -7,695 |
| 2028 | 59,277 | 242 | -1,722 | -33,482 | 5 | -33,357 | 685 | 237 | 1 | 974 | -7,139 |
| 2029 | 59,485 | 193 | -1,722 | -33,402 | 5 | -33,042 | 681 | 237 | 1 | 978 | -6,586 |
| 2030 | 59,674 | 154 | -1,722 | -33,317 | 5 | -32,720 | 677 | 237 | 1 | 980 | -6,030 |
| 2031 | 59,851 | 128 | -1,722 | -33,299 | 5 | -32,456 | 673 | 237 | 1 | 983 | -5,598 |
| 2032 | 60,018 | 111 | -1,722 | -33,295 | 5 | -32,240 | 669 | 237 | 1 | 985 | -5,230 |
| 2033 | 60,177 | 99 | -1,722 | -33,299 | 5 | -32,057 | 665 | 238 | 1 | 987 | -4,905 |
| 2034 | 60,328 | 90 | -1,722 | -33,306 | 5 | -31,901 | 662 | 238 | 1 | 988 | -4,615 |
| 2035 | 60,472 | 84 | -1,722 | -33,317 | 5 | -31,764 | 658 | 238 | 1 | 991 | -4,357 |
| 2036 | 60,609 | 82 | -1,722 | -33,333 | 5 | -31,646 | 654 | 237 | 1 | 993 | -4,120 |
| 2037 | 60,739 | 77 | -1,722 | -33,350 | 5 | -31,542 | 651 | 237 | 1 | 994 | -3,908 |
| 2038 | 60,865 | 74 | -1,722 | -33,368 | 5 | -31,449 | 649 | 237 | 1 | 995 | -3,713 |
| 2039 | 60,985 | 72 | -1,722 | -33,389 | 5 | -31,367 | 645 | 237 | 1 | 997 | -3,537 |
| 2040 | 61,099 | 71 | -1,722 | -33,411 | 5 | -31,293 | 642 | 237 | 1 | 998 | -3,372 |
| 2041 | 61,209 | 69 | -1,722 | -33,424 | 5 | -31,224 | 639 | 237 | 1 | 999 | -3,210 |
| 2042 | 61,315 | 67 | -1,722 | -33,435 | 5 | -31,162 | 637 | 237 | 1 | 999 | -3,056 |
| 2043 | 61,416 | 66 | -1,722 | -33,446 | 5 | -31,104 | 634 | 237 | 1 | 1,000 | -2,911 |
| 2044 | 61,513 | 65 | -1,722 | -33,458 | 5 | -31,052 | 632 | 237 | 1 | 1,001 | -2,776 |
| 2045 | 61,605 | 66 | -1,722 | -33,468 | 5 | -31,004 | 630 | 237 | 1 | 1,002 | -2,647 |
| 2046 | 61,695 | 65 | -1,722 | -33,478 | 5 | -30,960 | 628 | 237 | 1 | 1,003 | -2,525 |
| 2047 | 61,780 | 67 | -1,722 | -33,487 | 5 | -30,918 | 626 | 237 | 1 | 1,003 | -2,409 |
| 2048 | 61,861 | 67 | -1,722 | -33,498 | 5 | -30,880 | 625 | 237 | 1 | 1,004 | -2,300 |

TABLE 1: SIMULATED WATER BUDGET OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE CHICOT AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE CHICOT AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2049 | 61,939 | 68 | -1,722 | -33,508 | 5 | -30,844 | 622 | 238 | 1 | 1,004 | -2,196 |
| 2050 | 62,014 | 72 | -1,722 | -33,519 | 5 | -30,811 | 621 | 238 | 1 | 1,005 | -2,096 |
| 2051 | 62,086 | 72 | -1,722 | -33,540 | 5 | -30,780 | 620 | 238 | 1 | 1,005 | -2,016 |
| 2052 | 62,155 | 75 | -1,722 | -33,563 | 5 | -30,752 | 618 | 238 | 1 | 1,005 | -1,941 |
| 2053 | 62,220 | 78 | -1,722 | -33,586 | 5 | -30,726 | 617 | 238 | 1 | 1,005 | -1,870 |
| 2054 | 62,284 | 80 | -1,722 | -33,610 | 5 | -30,703 | 615 | 238 | 1 | 1,005 | -1,806 |
| 2055 | 62,345 | 81 | -1,722 | -33,634 | 5 | -30,680 | 615 | 238 | 1 | 1,006 | -1,745 |
| 2056 | 62,404 | 84 | -1,722 | -33,657 | 5 | -30,660 | 614 | 238 | 1 | 1,006 | -1,686 |
| 2057 | 62,461 | 85 | -1,722 | -33,681 | 5 | -30,639 | 613 | 238 | 1 | 1,006 | -1,634 |
| 2058 | 62,516 | 87 | -1,722 | -33,705 | 5 | -30,622 | 612 | 238 | 1 | 1,006 | -1,583 |
| 2059 | 62,570 | 88 | -1,722 | -33,729 | 5 | -30,605 | 611 | 238 | 1 | 1,006 | -1,536 |
| 2060 | 62,622 | 91 | -1,722 | -33,752 | 5 | -30,591 | 610 | 238 | 1 | 1,006 | -1,491 |
| Average (1980-1996) | 39,895 | 264 | -277 | -19,380 | 5 | -41,336 | 498 | 210 | 1 | 747 | -19,374 |
| Average (1999-2060) | 59,265 | 281 | -1,715 | -33,642 | 5 | -32,920 | 676 | 237 | 1 | 974 | -6,838 |

Note: Head dependent boundary includes groundwater flow related to recharge, evapotranspiration, springs, and surface water bodies.

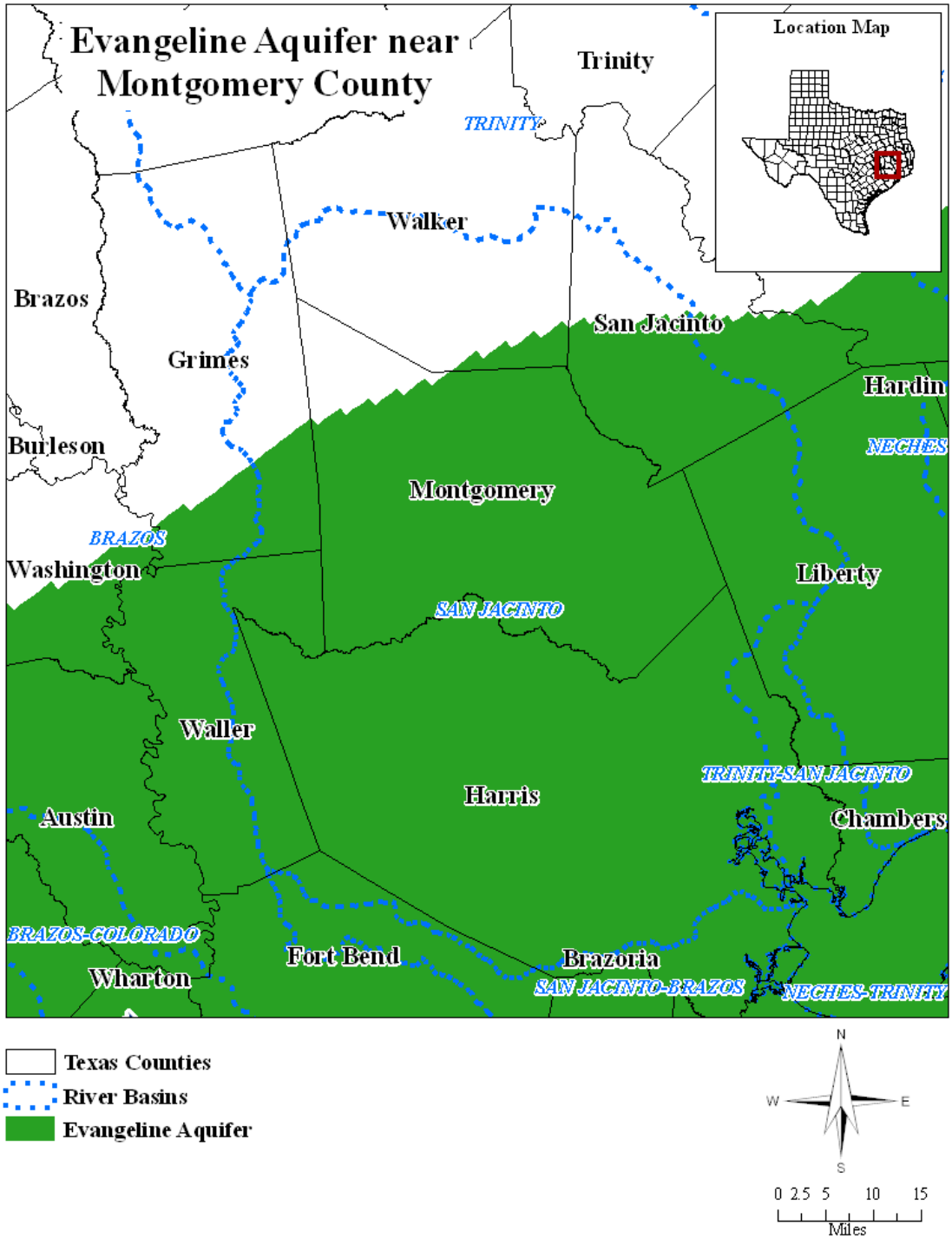


FIGURE 2. GROUNDWATER AVAILABILITY MODEL CELLS REPRESENTING EVANGELINE AQUIFER IN MONTGOMERY COUNTY AND NEARBY AREAS.

TABLE 2: SIMULATED WATER BUDGET FOR THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Chicot Aquifer* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre-1891 | -367 | 0 | 0 | 880 | 409 | 96 | -2,460 | -110 | 703 | 62 | 786 | 0 |
| 1891-1900 | -350 | 14 | -1,047 | 1,969 | 411 | 98 | -2,771 | -79 | 721 | 63 | 804 | -166 |
| 1901-1930 | -292 | 13 | -1,849 | 2,661 | 402 | 99 | -2,812 | -49 | 763 | 68 | 831 | -154 |
| 1931-1940 | -266 | 38 | -2,793 | 4,539 | 410 | 100 | -4,058 | 13 | 785 | 70 | 853 | -307 |
| 1941-1945 | -248 | 47 | -3,547 | 5,254 | 386 | 102 | -4,188 | 40 | 804 | 71 | 870 | -411 |
| 1946-1953 | -212 | 176 | -4,913 | 8,079 | 320 | 103 | -5,991 | 123 | 838 | 74 | 877 | -524 |
| 1954-1960 | -89 | 704 | -6,931 | 10,029 | 390 | 104 | -7,012 | 179 | 877 | 77 | 938 | -733 |
| 1961-1962 | -81 | 854 | -7,843 | 10,754 | 399 | 106 | -7,104 | 209 | 891 | 77 | 921 | -818 |
| 1963-1970 | -33 | 1,011 | -8,823 | 12,058 | 398 | 107 | -7,764 | 287 | 937 | 81 | 959 | -781 |
| 1971-1973 | 10 | 1,610 | -10,134 | 13,068 | 411 | 108 | -8,362 | 327 | 959 | 82 | 1,010 | -911 |
| 1974-1975 | 34 | 1,966 | -10,838 | 13,594 | 411 | 109 | -8,695 | 347 | 974 | 83 | 1,029 | -987 |
| 1976 | 54 | 2,512 | -11,296 | 13,477 | 419 | 110 | -8,771 | 314 | 983 | 84 | 1,010 | -1,104 |
| 1977 | 70 | 2,772 | -12,124 | 13,917 | 430 | 111 | -8,772 | 323 | 993 | 85 | 1,011 | -1,183 |
| 1978 | 86 | 2,925 | -12,246 | 14,454 | 439 | 112 | -9,471 | 337 | 1,004 | 85 | 1,014 | -1,260 |
| 1979 | 99 | 3,300 | -12,773 | 14,784 | 446 | 112 | -9,775 | 354 | 1,015 | 86 | 1,041 | -1,310 |

TABLE 2: SIMULATED WATER BUDGET FOR THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Chicot Aquifer* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 183 | 5,030 | -14,570 | 14,948 | 455 | 113 | -10,167 | 345 | 1,019 | 87 | 1,029 | -1,528 |
| 1981 | 322 | 4,573 | -15,384 | 16,226 | 418 | 114 | -10,517 | 387 | 1,041 | 88 | 1,067 | -1,664 |
| 1982 | 356 | 4,955 | -15,752 | 16,523 | 433 | 115 | -10,839 | 399 | 1,046 | 89 | 1,067 | -1,609 |
| 1983 | 422 | 5,215 | -16,660 | 17,314 | 402 | 117 | -11,238 | 406 | 1,067 | 91 | 1,110 | -1,754 |
| 1984 | 455 | 5,664 | -17,027 | 17,839 | 350 | 118 | -11,828 | 441 | 1,079 | 92 | 1,114 | -1,704 |
| 1985 | 484 | 5,864 | -17,263 | 18,314 | 333 | 118 | -12,297 | 477 | 1,089 | 93 | 1,120 | -1,668 |
| 1986 | 509 | 6,003 | -17,808 | 18,849 | 352 | 119 | -12,538 | 495 | 1,100 | 94 | 1,139 | -1,687 |
| 1987 | 529 | 5,993 | -17,345 | 18,850 | 323 | 119 | -12,909 | 475 | 1,107 | 95 | 1,143 | -1,620 |
| 1988 | 539 | 5,940 | -16,472 | 18,838 | 307 | 118 | -13,449 | 475 | 1,105 | 95 | 1,107 | -1,397 |
| 1989 | 561 | 6,144 | -17,566 | 19,683 | 301 | 120 | -13,827 | 496 | 1,126 | 97 | 1,158 | -1,708 |
| 1990 | 576 | 6,201 | -17,920 | 20,287 | 297 | 120 | -14,183 | 508 | 1,137 | 98 | 1,163 | -1,715 |
| 1991 | 591 | 6,085 | -18,141 | 20,338 | 316 | 120 | -13,887 | 517 | 1,145 | 99 | 1,182 | -1,633 |
| 1992 | 606 | 6,207 | -18,485 | 20,758 | 282 | 121 | -14,108 | 529 | 1,156 | 100 | 1,195 | -1,640 |
| 1993 | 620 | 6,375 | -19,434 | 21,316 | 287 | 122 | -14,103 | 546 | 1,171 | 101 | 1,234 | -1,766 |
| 1994 | 637 | 7,270 | -21,544 | 22,372 | 287 | 124 | -14,314 | 582 | 1,192 | 102 | 1,246 | -2,047 |
| 1995 | 654 | 7,462 | -22,432 | 22,970 | 303 | 125 | -14,376 | 600 | 1,210 | 103 | 1,284 | -2,096 |
| 1996 | 673 | 7,883 | -23,478 | 24,032 | 298 | 128 | -14,991 | 639 | 1,229 | 105 | 1,271 | -2,212 |
| 1997 | 685 | 6,068 | -19,749 | 22,919 | 274 | 123 | -15,073 | 770 | 1,208 | 106 | 1,278 | -1,389 |
| 1998 | 696 | 6,325 | -19,749 | 23,100 | 288 | 123 | -15,643 | 784 | 1,215 | 106 | 1,287 | -1,468 |
| 1999 | 707 | 6,384 | -19,749 | 23,419 | 294 | 123 | -16,052 | 799 | 1,220 | 107 | 1,268 | -1,481 |
| 2000 | 554 | 16,382 | -32,717 | 24,841 | 319 | 108 | -13,989 | 827 | 1,230 | 106 | 1,275 | -1,064 |
| 2001 | 560 | 11,229 | -33,742 | 25,858 | 251 | 105 | -9,306 | 870 | 1,247 | 105 | 1,305 | -1,520 |
| 2002 | 656 | 10,623 | -34,767 | 26,867 | 175 | 104 | -9,033 | 898 | 1,259 | 104 | 1,336 | -1,779 |

TABLE 2: SIMULATED WATER BUDGET FOR THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Chicot Aquifer* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 800 | 10,313 | -35,790 | 27,776 | 103 | 103 | -8,920 | 923 | 1,269 | 103 | 1,363 | -1,958 |
| 2004 | 965 | 9,530 | -36,812 | 28,222 | 26 | 103 | -7,790 | 937 | 1,281 | 101 | 1,390 | -2,049 |
| 2005 | 1,147 | 10,203 | -37,834 | 29,246 | -19 | 102 | -8,845 | 965 | 1,291 | 100 | 1,409 | -2,238 |
| 2006 | 1,351 | 9,556 | -38,855 | 29,689 | -85 | 102 | -7,849 | 978 | 1,302 | 99 | 1,437 | -2,277 |
| 2007 | 494 | 8,964 | -38,329 | 29,839 | -151 | 101 | -6,703 | 989 | 1,313 | 98 | 1,452 | -1,935 |
| 2008 | 497 | 8,529 | -38,329 | 30,008 | -205 | 101 | -6,376 | 993 | 1,319 | 97 | 1,462 | -1,903 |
| 2009 | 512 | 9,733 | -40,188 | 31,773 | -227 | 101 | -7,892 | 902 | 1,484 | 86 | 1,474 | -2,244 |
| 2010 | 528 | 9,052 | -39,381 | 32,075 | -311 | 100 | -8,162 | 878 | 1,464 | 79 | 1,481 | -2,197 |
| 2011 | 548 | 9,434 | -40,555 | 32,685 | -392 | 99 | -7,981 | 879 | 1,466 | 75 | 1,498 | -2,243 |
| 2012 | 568 | 9,753 | -41,727 | 33,259 | -473 | 99 | -7,689 | 881 | 1,469 | 72 | 1,513 | -2,275 |
| 2013 | 588 | 10,039 | -42,900 | 33,794 | -552 | 99 | -7,335 | 885 | 1,473 | 69 | 1,528 | -2,313 |
| 2014 | 609 | 10,298 | -44,072 | 34,311 | -628 | 99 | -6,941 | 890 | 1,477 | 67 | 1,540 | -2,349 |
| 2015 | 667 | 12,256 | -52,772 | 38,509 | -600 | 99 | -6,153 | 1,103 | 1,634 | 65 | 1,689 | -3,503 |
| 2016 | 680 | 4,639 | -38,293 | 34,712 | -715 | 99 | -6,880 | 913 | 1,496 | 64 | 1,573 | -1,712 |
| 2017 | 695 | 4,452 | -38,293 | 34,503 | -658 | 97 | -6,654 | 906 | 1,498 | 62 | 1,577 | -1,814 |
| 2018 | 708 | 4,318 | -38,293 | 34,357 | -613 | 97 | -6,415 | 900 | 1,499 | 61 | 1,582 | -1,800 |
| 2019 | 721 | 4,196 | -38,293 | 34,213 | -576 | 97 | -6,175 | 894 | 1,501 | 60 | 1,586 | -1,774 |
| 2020 | 736 | 4,079 | -38,293 | 34,068 | -546 | 97 | -5,930 | 889 | 1,504 | 58 | 1,590 | -1,748 |
| 2021 | 748 | 4,001 | -38,293 | 33,987 | -522 | 97 | -5,796 | 885 | 1,507 | 58 | 1,596 | -1,732 |
| 2022 | 760 | 3,925 | -38,293 | 33,908 | -503 | 97 | -5,655 | 881 | 1,509 | 57 | 1,601 | -1,713 |
| 2023 | 772 | 3,834 | -38,293 | 33,842 | -488 | 97 | -5,508 | 878 | 1,513 | 56 | 1,606 | -1,691 |
| 2024 | 784 | 3,743 | -38,293 | 33,776 | -477 | 97 | -5,359 | 877 | 1,515 | 56 | 1,610 | -1,673 |
| 2025 | 795 | 3,660 | -38,293 | 33,703 | -468 | 97 | -5,207 | 874 | 1,519 | 55 | 1,614 | -1,652 |

TABLE 2: SIMULATED WATER BUDGET FOR THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Chicot Aquifer* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2026 | 806 | 3,574 | -38,293 | 33,630 | -461 | 97 | -5,050 | 871 | 1,523 | 55 | 1,618 | -1,632 |
| 2027 | 816 | 3,488 | -38,293 | 33,557 | -456 | 96 | -4,888 | 868 | 1,525 | 54 | 1,621 | -1,612 |
| 2028 | 827 | 3,401 | -38,293 | 33,482 | -453 | 96 | -4,724 | 864 | 1,529 | 53 | 1,624 | -1,592 |
| 2029 | 837 | 3,319 | -38,293 | 33,402 | -450 | 96 | -4,557 | 861 | 1,533 | 53 | 1,627 | -1,573 |
| 2030 | 847 | 3,238 | -38,293 | 33,317 | -449 | 96 | -4,386 | 858 | 1,536 | 53 | 1,629 | -1,555 |
| 2031 | 855 | 3,195 | -38,293 | 33,299 | -447 | 96 | -4,328 | 856 | 1,539 | 53 | 1,632 | -1,546 |
| 2032 | 864 | 3,147 | -38,293 | 33,295 | -446 | 96 | -4,279 | 853 | 1,542 | 52 | 1,635 | -1,533 |
| 2033 | 873 | 3,101 | -38,293 | 33,299 | -445 | 96 | -4,234 | 851 | 1,546 | 52 | 1,637 | -1,520 |
| 2034 | 882 | 3,055 | -38,293 | 33,306 | -445 | 96 | -4,195 | 849 | 1,549 | 52 | 1,640 | -1,506 |
| 2035 | 890 | 3,012 | -38,293 | 33,317 | -446 | 96 | -4,160 | 847 | 1,553 | 52 | 1,642 | -1,492 |
| 2036 | 898 | 2,968 | -38,293 | 33,333 | -446 | 96 | -4,128 | 846 | 1,556 | 51 | 1,644 | -1,479 |
| 2037 | 905 | 2,925 | -38,293 | 33,350 | -447 | 96 | -4,100 | 844 | 1,559 | 51 | 1,645 | -1,466 |
| 2038 | 913 | 2,885 | -38,293 | 33,368 | -449 | 96 | -4,072 | 842 | 1,562 | 51 | 1,647 | -1,452 |
| 2039 | 920 | 2,843 | -38,293 | 33,389 | -450 | 96 | -4,047 | 840 | 1,565 | 51 | 1,648 | -1,439 |
| 2040 | 927 | 2,802 | -38,293 | 33,411 | -452 | 96 | -4,025 | 839 | 1,568 | 51 | 1,650 | -1,426 |
| 2041 | 934 | 2,755 | -38,293 | 33,424 | -454 | 96 | -3,983 | 837 | 1,571 | 51 | 1,650 | -1,411 |
| 2042 | 941 | 2,712 | -38,293 | 33,435 | -456 | 96 | -3,943 | 836 | 1,574 | 51 | 1,651 | -1,398 |
| 2043 | 947 | 2,669 | -38,293 | 33,446 | -458 | 96 | -3,905 | 834 | 1,577 | 51 | 1,652 | -1,385 |
| 2044 | 954 | 2,629 | -38,293 | 33,458 | -461 | 96 | -3,869 | 834 | 1,580 | 51 | 1,652 | -1,370 |
| 2045 | 960 | 2,590 | -38,293 | 33,468 | -464 | 96 | -3,835 | 833 | 1,583 | 51 | 1,652 | -1,359 |
| 2046 | 967 | 2,553 | -38,293 | 33,478 | -467 | 96 | -3,800 | 832 | 1,585 | 51 | 1,653 | -1,346 |
| 2047 | 973 | 2,515 | -38,293 | 33,487 | -469 | 96 | -3,767 | 831 | 1,588 | 50 | 1,653 | -1,335 |
| 2048 | 978 | 2,478 | -38,293 | 33,498 | -472 | 96 | -3,734 | 830 | 1,591 | 50 | 1,653 | -1,324 |

TABLE 2: SIMULATED WATER BUDGET FOR THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE EVANGELINE AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Chicot Aquifer* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2049 | 984 | 2,442 | -38,293 | 33,508 | -475 | 96 | -3,701 | 829 | 1,593 | 50 | 1,653 | -1,312 |
| 2050 | 990 | 2,407 | -38,293 | 33,519 | -477 | 96 | -3,669 | 829 | 1,596 | 50 | 1,653 | -1,301 |
| 2051 | 996 | 2,380 | -38,293 | 33,540 | -480 | 96 | -3,659 | 828 | 1,598 | 50 | 1,653 | -1,292 |
| 2052 | 1,001 | 2,353 | -38,293 | 33,563 | -483 | 96 | -3,649 | 828 | 1,601 | 50 | 1,653 | -1,282 |
| 2053 | 1,006 | 2,325 | -38,293 | 33,586 | -485 | 95 | -3,640 | 827 | 1,603 | 50 | 1,653 | -1,271 |
| 2054 | 1,012 | 2,299 | -38,293 | 33,610 | -488 | 95 | -3,630 | 827 | 1,606 | 50 | 1,653 | -1,260 |
| 2055 | 1,016 | 2,273 | -38,293 | 33,634 | -491 | 95 | -3,621 | 827 | 1,608 | 50 | 1,653 | -1,250 |
| 2056 | 1,022 | 2,246 | -38,293 | 33,657 | -494 | 95 | -3,612 | 825 | 1,612 | 51 | 1,653 | -1,240 |
| 2057 | 1,026 | 2,218 | -38,293 | 33,681 | -497 | 95 | -3,603 | 825 | 1,614 | 51 | 1,653 | -1,230 |
| 2058 | 1,031 | 2,192 | -38,293 | 33,705 | -500 | 95 | -3,594 | 825 | 1,616 | 51 | 1,653 | -1,220 |
| 2059 | 1,035 | 2,167 | -38,293 | 33,729 | -503 | 95 | -3,587 | 825 | 1,618 | 51 | 1,653 | -1,211 |
| 2060 | 1,040 | 2,143 | -38,293 | 33,752 | -506 | 95 | -3,579 | 825 | 1,620 | 51 | 1,652 | -1,200 |
| Average (1980-1996) | 513 | 6,051 | -18,075 | 19,380 | 338 | 119 | -12,916 | 489 | 1,119 | 96 | 1,155 | -1,732 |
| Average (1999-2060) | 852 | 3,975 | -38,938 | 33,642 | -482 | 97 | -4,832 | 859 | 1,551 | 56 | 1,620 | -1,601 |

Note: Head dependent boundary includes groundwater flow related to recharge, evapotranspiration, springs, and surface water bodies.

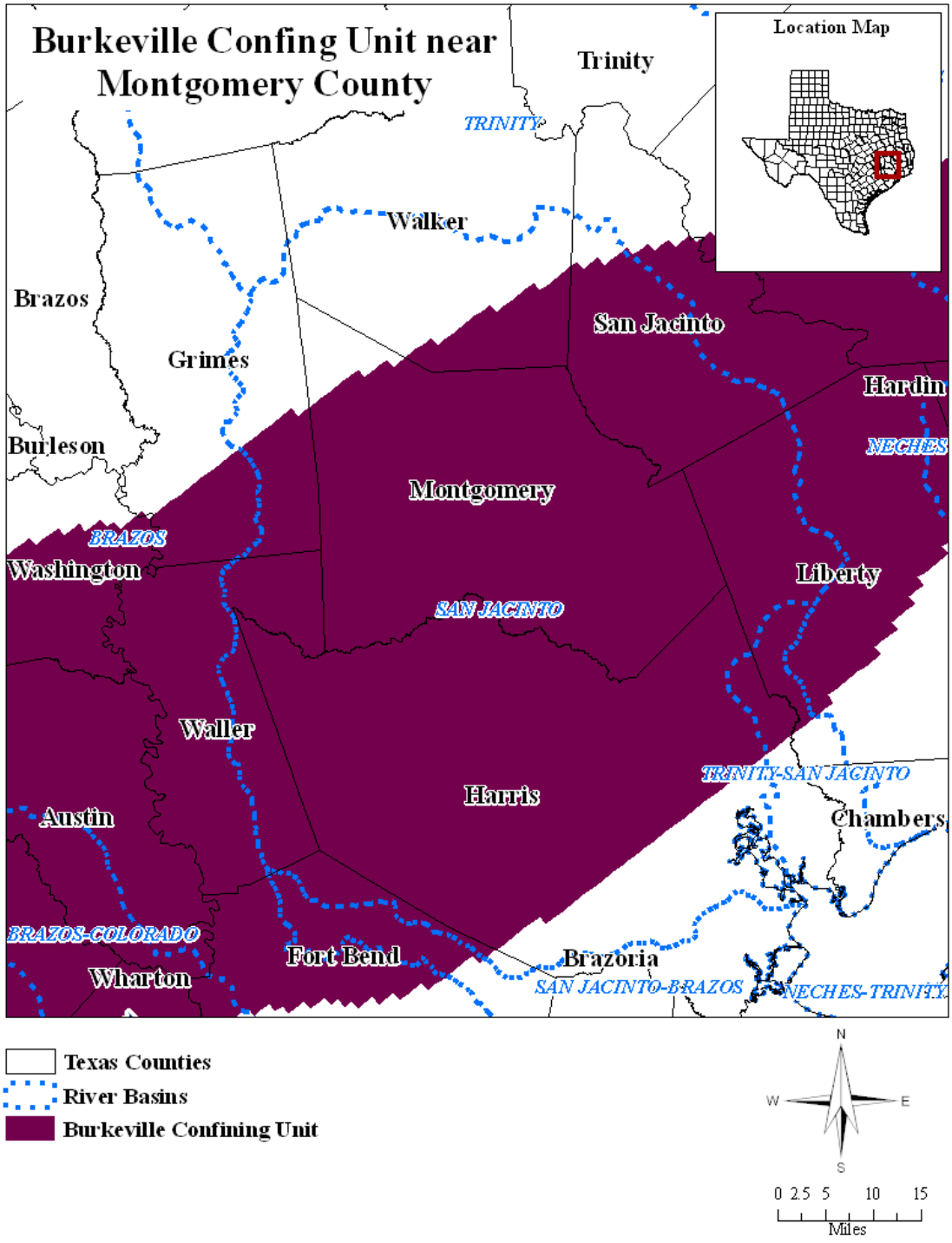


FIGURE 3. GROUNDWATER AVAILABILITY MODEL CELLS REPRESENTING THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY AND NEARBY AREAS.

TABLE 3: SIMULATED WATER BUDGET FOR THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Jasper Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre-1891 | 1 | 0 | 0 | -409 | 402 | 3 | -1 | 0 | 2 | 1 | 1 | 0 |
| 1891-1900 | 1 | 0 | 0 | -411 | 393 | 3 | -2 | 0 | 2 | 1 | 1 | -12 |
| 1901-1930 | 1 | 0 | 0 | -402 | 384 | 3 | -2 | 0 | 3 | 1 | 1 | -10 |
| 1931-1940 | 1 | 0 | 0 | -410 | 371 | 3 | -2 | 0 | 3 | 1 | 1 | -33 |
| 1941-1945 | 1 | 0 | 0 | -386 | 339 | 3 | -3 | 0 | 3 | 1 | 1 | -41 |
| 1946-1953 | 1 | 0 | -1 | -320 | 254 | 3 | -3 | 0 | 3 | 1 | 1 | -62 |
| 1954-1960 | 1 | 0 | -1 | -390 | 313 | 3 | -4 | 0 | 3 | 1 | 1 | -74 |
| 1961-1962 | 1 | 0 | -2 | -399 | 322 | 3 | -4 | 0 | 3 | 1 | 1 | -74 |
| 1963-1970 | 1 | 0 | -2 | -398 | 321 | 3 | -4 | 0 | 3 | 1 | 1 | -74 |
| 1971-1973 | 1 | 0 | -2 | -411 | 323 | 3 | -5 | 0 | 3 | 1 | 1 | -86 |
| 1974-1975 | 1 | 0 | -2 | -411 | 318 | 3 | -5 | 0 | 3 | 1 | 1 | -90 |
| 1976 | 1 | 0 | -1 | -419 | 319 | 3 | -5 | 0 | 3 | 1 | 1 | -97 |
| 1977 | 1 | 0 | -1 | -430 | 328 | 3 | -5 | 0 | 3 | 1 | 1 | -101 |
| 1978 | 1 | 0 | -1 | -439 | 333 | 3 | -6 | 0 | 3 | 1 | 1 | -103 |
| 1979 | 1 | 0 | -1 | -446 | 341 | 3 | -6 | 0 | 3 | 1 | 1 | -103 |

TABLE 3: SIMULATED WATER BUDGET FOR THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Jasper Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 1 | 0 | -1 | -455 | 332 | 3 | -6 | 0 | 3 | 1 | 1 | -121 |
| 1981 | 1 | 0 | -25 | -418 | 308 | 3 | -7 | 0 | 3 | 1 | 1 | -131 |
| 1982 | 1 | 0 | 0 | -433 | 298 | 3 | -7 | 0 | 3 | 1 | 1 | -132 |
| 1983 | 1 | 0 | 0 | -402 | 262 | 3 | -7 | 0 | 3 | 1 | 1 | -138 |
| 1984 | 1 | 0 | -16 | -350 | 243 | 3 | -8 | 0 | 3 | 1 | 1 | -122 |
| 1985 | 1 | 0 | -24 | -333 | 229 | 3 | -8 | 0 | 3 | 1 | 1 | -127 |
| 1986 | 1 | 0 | 0 | -352 | 221 | 3 | -8 | 0 | 3 | 1 | 1 | -129 |
| 1987 | 1 | 0 | -19 | -323 | 213 | 3 | -9 | 0 | 3 | 1 | 1 | -128 |
| 1988 | 1 | 0 | -200 | -307 | 210 | 3 | -9 | 0 | 3 | 1 | 1 | -296 |
| 1989 | 1 | 0 | -20 | -301 | 193 | 3 | -10 | 0 | 3 | 1 | 1 | -129 |
| 1990 | 1 | 0 | -21 | -297 | 183 | 3 | -10 | 0 | 3 | 1 | 1 | -136 |
| 1991 | 1 | 0 | 0 | -316 | 174 | 3 | -10 | 0 | 3 | 1 | 1 | -142 |
| 1992 | 1 | 0 | -20 | -282 | 165 | 3 | -10 | 0 | 3 | 1 | 1 | -137 |
| 1993 | 1 | 0 | -10 | -287 | 155 | 3 | -10 | 0 | 3 | 1 | 2 | -142 |
| 1994 | 1 | 0 | -20 | -287 | 144 | 3 | -11 | 0 | 3 | 1 | 2 | -164 |
| 1995 | 1 | 0 | 0 | -303 | 136 | 3 | -11 | 0 | 3 | 1 | 2 | -168 |
| 1996 | 1 | 0 | 0 | -298 | 128 | 3 | -11 | 0 | 4 | 1 | 2 | -170 |
| 1997 | 1 | 0 | 0 | -274 | 141 | 2 | -12 | 0 | 3 | 1 | 2 | -136 |
| 1998 | 1 | 0 | 0 | -288 | 147 | 2 | -12 | 0 | 4 | 1 | 2 | -142 |
| 1999 | 1 | 0 | 0 | -294 | 153 | 2 | -13 | 0 | 4 | 1 | 2 | -144 |
| 2000 | 1 | 0 | 0 | -319 | 131 | 2 | -12 | 0 | 4 | 1 | 2 | -192 |
| 2001 | 1 | 0 | 0 | -251 | 51 | 2 | -13 | 0 | 4 | 1 | 2 | -204 |
| 2002 | 1 | 0 | 0 | -175 | -32 | 2 | -14 | 0 | 4 | 1 | 2 | -212 |

TABLE 3: SIMULATED WATER BUDGET FOR THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Jasper Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 1 | 0 | 0 | -103 | -110 | 2 | -14 | 0 | 4 | 1 | 2 | -216 |
| 2004 | 1 | 0 | 0 | -26 | -182 | 2 | -12 | 0 | 4 | 1 | 2 | -213 |
| 2005 | 1 | 0 | 0 | 19 | -245 | 2 | -13 | 0 | 4 | 1 | 2 | -229 |
| 2006 | 1 | 0 | 0 | 85 | -305 | 2 | -13 | 0 | 4 | 1 | 2 | -223 |
| 2007 | 1 | 0 | 0 | 151 | -362 | 1 | -12 | 0 | 4 | 1 | 2 | -214 |
| 2008 | 1 | 0 | 0 | 205 | -412 | 1 | -12 | 0 | 4 | 2 | 2 | -209 |
| 2009 | 1 | 0 | 0 | 227 | -468 | 1 | -12 | 0 | 4 | 2 | 2 | -244 |
| 2010 | 1 | 0 | 0 | 311 | -545 | 1 | -12 | 0 | 4 | 2 | 2 | -237 |
| 2011 | 1 | 0 | 0 | 392 | -629 | 1 | -12 | 0 | 4 | 2 | 2 | -241 |
| 2012 | 1 | 0 | 0 | 473 | -714 | 1 | -12 | 0 | 3 | 2 | 2 | -244 |
| 2013 | 1 | 0 | 0 | 552 | -796 | 1 | -11 | 0 | 3 | 2 | 2 | -246 |
| 2014 | 1 | 0 | 0 | 628 | -875 | 1 | -11 | 0 | 3 | 2 | 2 | -249 |
| 2015 | 1 | 0 | 0 | 600 | -907 | 1 | -10 | 0 | 4 | 2 | 2 | -308 |
| 2016 | 1 | 0 | 0 | 715 | -883 | 1 | -9 | 0 | 3 | 2 | 2 | -169 |
| 2017 | 1 | 0 | 0 | 658 | -830 | 1 | -9 | 0 | 4 | 2 | 2 | -172 |
| 2018 | 1 | 0 | 0 | 613 | -781 | 1 | -9 | 0 | 4 | 2 | 2 | -169 |
| 2019 | 1 | 0 | 0 | 576 | -741 | 1 | -8 | 0 | 4 | 2 | 2 | -165 |
| 2020 | 1 | 0 | 0 | 546 | -709 | 1 | -8 | 0 | 4 | 2 | 2 | -162 |
| 2021 | 1 | 0 | 0 | 522 | -683 | 1 | -8 | 0 | 4 | 2 | 2 | -160 |
| 2022 | 1 | 0 | 0 | 503 | -662 | 1 | -7 | 0 | 4 | 2 | 2 | -158 |
| 2023 | 1 | 0 | 0 | 488 | -645 | 1 | -7 | 0 | 4 | 2 | 2 | -156 |
| 2024 | 1 | 0 | 0 | 477 | -632 | 1 | -7 | 0 | 4 | 2 | 2 | -153 |
| 2025 | 1 | 0 | 0 | 468 | -621 | 1 | -7 | 0 | 4 | 2 | 2 | -151 |

TABLE 3: SIMULATED WATER BUDGET FOR THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Jasper Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2026 | 1 | 0 | 0 | 461 | -612 | 1 | -7 | 0 | 4 | 2 | 2 | -148 |
| 2027 | 1 | 0 | 0 | 456 | -605 | 1 | -7 | 0 | 4 | 2 | 2 | -146 |
| 2028 | 1 | 0 | 0 | 453 | -600 | 1 | -6 | 0 | 4 | 2 | 2 | -144 |
| 2029 | 1 | 0 | 0 | 450 | -595 | 1 | -6 | 0 | 4 | 2 | 2 | -141 |
| 2030 | 1 | 0 | 0 | 449 | -592 | 1 | -6 | 0 | 4 | 2 | 2 | -139 |
| 2031 | 1 | 0 | 0 | 447 | -590 | 1 | -6 | 0 | 4 | 2 | 2 | -139 |
| 2032 | 1 | 0 | 0 | 446 | -588 | 1 | -6 | 0 | 4 | 2 | 2 | -138 |
| 2033 | 1 | 0 | 0 | 445 | -586 | 1 | -6 | 0 | 4 | 2 | 2 | -136 |
| 2034 | 1 | 0 | 0 | 445 | -585 | 1 | -6 | 0 | 4 | 2 | 2 | -136 |
| 2035 | 1 | 0 | 0 | 446 | -585 | 1 | -6 | 0 | 4 | 2 | 2 | -135 |
| 2036 | 1 | 0 | 0 | 446 | -584 | 1 | -6 | 0 | 4 | 2 | 2 | -134 |
| 2037 | 1 | 0 | 0 | 447 | -584 | 1 | -6 | 0 | 4 | 2 | 2 | -132 |
| 2038 | 1 | 0 | 0 | 449 | -585 | 1 | -6 | 0 | 4 | 2 | 2 | -131 |
| 2039 | 1 | 0 | 0 | 450 | -585 | 1 | -6 | 0 | 4 | 2 | 2 | -130 |
| 2040 | 1 | 0 | 0 | 452 | -586 | 1 | -6 | 0 | 4 | 2 | 2 | -129 |
| 2041 | 1 | 0 | 0 | 454 | -587 | 1 | -6 | 0 | 4 | 2 | 2 | -128 |
| 2042 | 1 | 0 | 0 | 456 | -588 | 1 | -5 | 0 | 4 | 2 | 2 | -127 |
| 2043 | 1 | 0 | 0 | 458 | -590 | 1 | -5 | 0 | 4 | 2 | 2 | -126 |
| 2044 | 1 | 0 | 0 | 461 | -591 | 1 | -5 | 0 | 4 | 2 | 2 | -125 |
| 2045 | 1 | 0 | 0 | 464 | -593 | 1 | -5 | 0 | 4 | 2 | 2 | -124 |
| 2046 | 1 | 0 | 0 | 467 | -594 | 1 | -5 | 0 | 4 | 2 | 2 | -122 |
| 2047 | 1 | 0 | 0 | 469 | -596 | 1 | -5 | 0 | 4 | 2 | 2 | -122 |
| 2048 | 1 | 0 | 0 | 472 | -598 | 1 | -5 | 0 | 5 | 2 | 2 | -120 |

TABLE 3: SIMULATED WATER BUDGET FOR THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE BURKEVILLE CONFINING UNIT IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Evangeline Aquifer* | *Jasper Aquifer* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2049 | 1 | 0 | 0 | 475 | -600 | 1 | -5 | 0 | 5 | 2 | 2 | -120 |
| 2050 | 1 | 0 | 0 | 477 | -602 | 1 | -5 | 0 | 5 | 2 | 2 | -119 |
| 2051 | 1 | 0 | 0 | 480 | -604 | 1 | -5 | 0 | 5 | 2 | 2 | -118 |
| 2052 | 1 | 0 | 0 | 483 | -606 | 1 | -5 | 0 | 5 | 2 | 2 | -117 |
| 2053 | 1 | 0 | 0 | 485 | -608 | 1 | -5 | 0 | 5 | 2 | 2 | -116 |
| 2054 | 1 | 0 | 0 | 488 | -610 | 1 | -5 | 0 | 5 | 2 | 2 | -115 |
| 2055 | 1 | 0 | 0 | 491 | -612 | 1 | -5 | 0 | 5 | 2 | 2 | -115 |
| 2056 | 1 | 0 | 0 | 494 | -614 | 1 | -5 | 0 | 5 | 2 | 2 | -114 |
| 2057 | 1 | 0 | 0 | 497 | -617 | 1 | -5 | 0 | 5 | 2 | 2 | -113 |
| 2058 | 1 | 0 | 0 | 500 | -619 | 1 | -5 | 0 | 5 | 3 | 2 | -112 |
| 2059 | 1 | 0 | 0 | 503 | -621 | 1 | -5 | 0 | 5 | 3 | 2 | -112 |
| 2060 | 1 | 0 | 0 | 506 | -623 | 1 | -5 | 0 | 5 | 3 | 2 | -111 |
| Average (1980-1996) | 1 | 0 | -22 | -338 | 211 | 3 | -9 | 0 | 3 | 1 | 1 | -148 |
| Average (1999-2060) | 1 | 0 | 0 | 482 | -636 | 1 | -7 | 0 | 4 | 2 | 2 | -150 |

Note: Head dependent boundary includes groundwater flow related to recharge, evapotranspiration, springs, and surface water bodies.

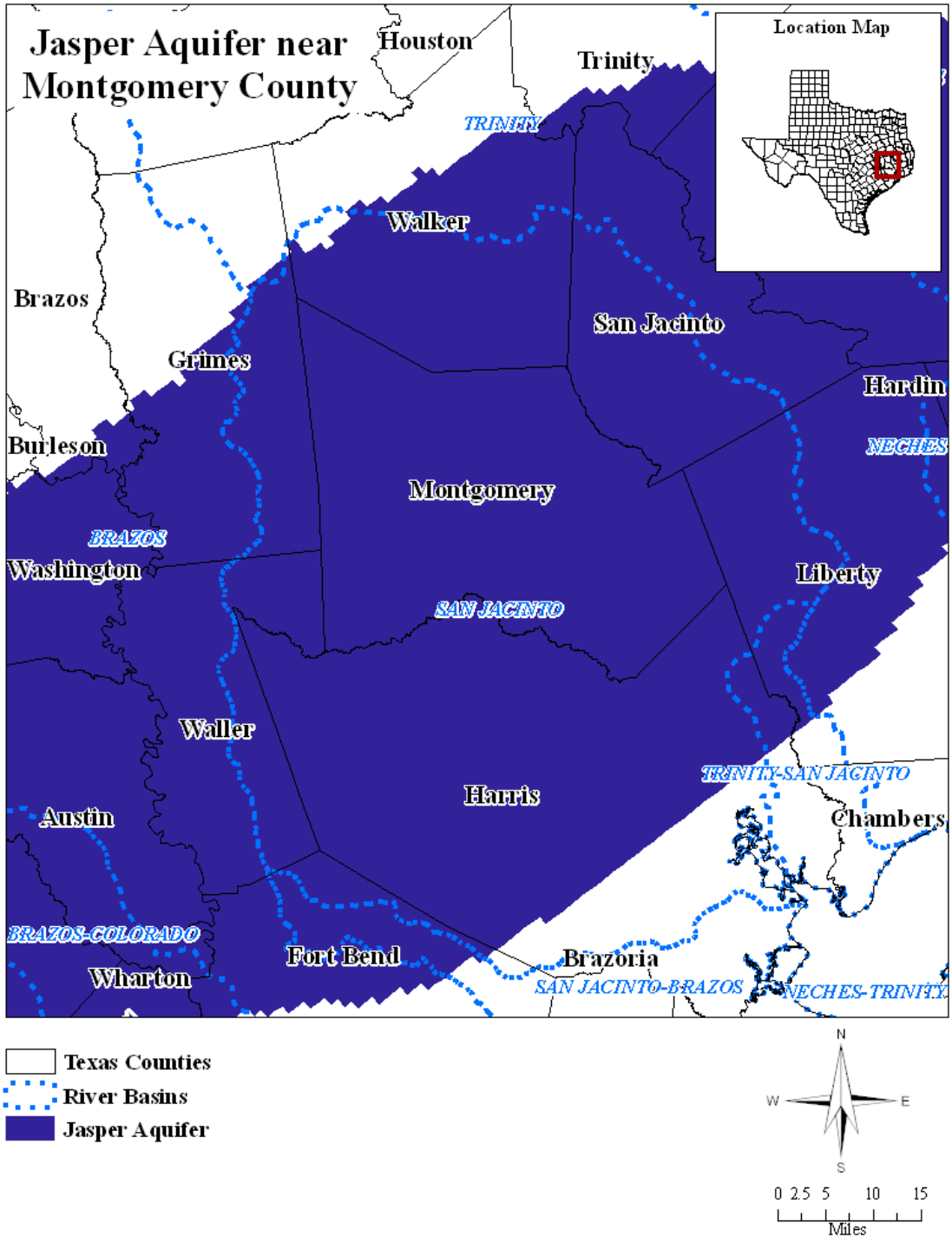


FIGURE 4. GROUNDWATER AVAILABILITY MODEL CELLS REPRESENTING THE JASPER AQUIFER IN MONTGOMERY COUNTY AND NEARBY AREAS. NOTE: THE JASPER INCLUDES PARTS OF THE CATAHOULA FORMATION.

TABLE 4: SIMULATED WATER BUDGET FOR THE JASPER AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE JASPER AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE JASPER AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR. NOTE: THE JASPER INCLUDES PARTS OF THE CATAHOULA FORMATION.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pre-1891 | 316 | 0 | 0 | -402 | 351 | -639 | -202 | -194 | 730 | 39 | 0 |
| 1891-1900 | 320 | 0 | -712 | -393 | 411 | -588 | -188 | -122 | 977 | 54 | -237 |
| 1901-1930 | 341 | 0 | -1,106 | -384 | 468 | -574 | -174 | -77 | 1,131 | 68 | -271 |
| 1931-1940 | 352 | 0 | -2,112 | -371 | 548 | -512 | -145 | 65 | 1,510 | 99 | -565 |
| 1941-1945 | 364 | 0 | -3,874 | -339 | 684 | -403 | -120 | 222 | 2,060 | 131 | -1,262 |
| 1946-1953 | 385 | 0 | -6,089 | -254 | 829 | -162 | -38 | 629 | 3,003 | 211 | -1,472 |
| 1954-1960 | 396 | 0 | -3,625 | -313 | 713 | -487 | -55 | 381 | 2,240 | 180 | -570 |
| 1961-1962 | 398 | 0 | -3,693 | -322 | 707 | -511 | -53 | 399 | 2,242 | 179 | -651 |
| 1963-1970 | 411 | 0 | -4,282 | -321 | 757 | -509 | -30 | 496 | 2,481 | 203 | -790 |
| 1971-1973 | 415 | 0 | -4,516 | -323 | 771 | -516 | -24 | 539 | 2,548 | 210 | -895 |
| 1974-1975 | 419 | 0 | -5,021 | -318 | 803 | -508 | -19 | 586 | 2,710 | 219 | -1,128 |
| 1976 | 422 | 0 | -3,685 | -319 | 674 | -536 | -4 | 465 | 2,522 | 203 | -259 |
| 1977 | 424 | 0 | -3,878 | -328 | 663 | -585 | -16 | 432 | 2,444 | 185 | -659 |
| 1978 | 426 | 0 | -4,325 | -333 | 677 | -618 | -26 | 443 | 2,500 | 180 | -1,075 |
| 1979 | 429 | 0 | -4,668 | -341 | 818 | -634 | -28 | 458 | 2,574 | 190 | -1,201 |

TABLE 4: SIMULATED WATER BUDGET FOR THE JASPER AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE JASPER AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE JASPER AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR. NOTE: THE JASPER INCLUDES PARTS OF THE CATAHOULA FORMATION.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 431 | 0 | -8,858 | -332 | 937 | -614 | -43 | 668 | 3,145 | 209 | -4,458 |
| 1981 | 439 | 0 | -9,160 | -308 | 1,082 | -469 | -4 | 818 | 3,765 | 250 | -3,584 |
| 1982 | 442 | 0 | -9,403 | -298 | 1,102 | -429 | -35 | 863 | 3,868 | 251 | -3,640 |
| 1983 | 451 | 0 | -10,332 | -262 | 1,196 | -302 | 117 | 960 | 4,199 | 289 | -3,682 |
| 1984 | 457 | 0 | -11,227 | -243 | 1,235 | -222 | 121 | 1,091 | 4,532 | 304 | -3,922 |
| 1985 | 463 | 0 | -10,826 | -229 | 1,263 | -182 | 127 | 1,116 | 4,616 | 315 | -3,324 |
| 1986 | 470 | 0 | -9,948 | -221 | 1,285 | -194 | 126 | 1,018 | 4,549 | 319 | -2,603 |
| 1987 | 476 | 0 | -10,443 | -213 | 1,291 | -216 | 134 | 1,055 | 4,551 | 325 | -3,031 |
| 1988 | 479 | 0 | -11,024 | -210 | 1,277 | -220 | 140 | 1,118 | 4,597 | 328 | -3,516 |
| 1989 | 488 | 0 | -11,398 | -193 | 1,346 | -193 | 198 | 1,191 | 4,900 | 334 | -3,323 |
| 1990 | 495 | 0 | -11,954 | -183 | 1,383 | -174 | 219 | 1,240 | 5,030 | 345 | -3,594 |
| 1991 | 501 | 0 | -11,915 | -174 | 1,405 | -162 | 224 | 1,266 | 5,095 | 356 | -3,370 |
| 1992 | 508 | 0 | -12,245 | -165 | 1,430 | -150 | 242 | 1,327 | 5,188 | 365 | -3,486 |
| 1993 | 515 | 0 | -12,929 | -155 | 1,476 | -128 | 259 | 1,381 | 5,441 | 376 | -3,760 |
| 1994 | 522 | 0 | -13,378 | -144 | 1,545 | -104 | 277 | 1,399 | 5,627 | 389 | -3,861 |
| 1995 | 531 | 0 | -13,606 | -136 | 1,591 | -90 | 291 | 1,429 | 5,693 | 398 | -3,876 |
| 1996 | 540 | 0 | -14,363 | -128 | 1,643 | -78 | 306 | 1,480 | 5,931 | 407 | -4,249 |
| 1997 | 546 | 0 | -12,418 | -141 | 1,553 | -115 | 309 | 1,432 | 5,719 | 412 | -2,702 |
| 1998 | 552 | 0 | -12,418 | -147 | 1,552 | -152 | 320 | 1,434 | 5,675 | 416 | -2,768 |
| 1999 | 559 | 0 | -12,418 | -153 | 1,555 | -181 | 325 | 1,440 | 5,660 | 417 | -2,794 |
| 2000 | 561 | 0 | -21,658 | -131 | 1,501 | 1,717 | 426 | 1,756 | 6,245 | 491 | -9,062 |
| 2001 | 564 | 0 | -22,572 | -51 | 1,725 | 2,241 | 547 | 2,168 | 7,189 | 625 | -7,562 |
| 2002 | 569 | 0 | -23,489 | 32 | 1,895 | 2,542 | 671 | 2,462 | 7,980 | 737 | -6,589 |

TABLE 4: SIMULATED WATER BUDGET FOR THE JASPER AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE JASPER AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE JASPER AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR. NOTE: THE JASPER INCLUDES PARTS OF THE CATAHOULA FORMATION.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 575 | 0 | -24,406 | 110 | 2,036 | 2,731 | 771 | 2,681 | 8,667 | 820 | -5,999 |
| 2004 | 581 | 0 | -25,324 | 182 | 2,160 | 2,858 | 850 | 2,872 | 9,198 | 885 | -5,738 |
| 2005 | 587 | 0 | -26,243 | 245 | 2,272 | 2,946 | 914 | 3,037 | 9,700 | 938 | -5,592 |
| 2006 | 594 | 0 | -27,164 | 305 | 2,378 | 3,014 | 969 | 3,184 | 10,212 | 984 | -5,513 |
| 2007 | 603 | 0 | -28,085 | 362 | 2,478 | 3,075 | 1,018 | 3,327 | 10,692 | 1,026 | -5,500 |
| 2008 | 611 | 0 | -28,085 | 412 | 2,538 | 3,133 | 1,063 | 3,407 | 10,867 | 1,059 | -4,993 |
| 2009 | 620 | 0 | -29,684 | 468 | 2,615 | 3,149 | 894 | 3,049 | 11,224 | 1,086 | -6,573 |
| 2010 | 630 | 0 | -32,401 | 545 | 2,664 | 3,701 | 900 | 3,048 | 11,590 | 1,130 | -8,183 |
| 2011 | 640 | 0 | -33,612 | 629 | 2,761 | 4,128 | 950 | 3,161 | 12,001 | 1,193 | -8,139 |
| 2012 | 650 | 0 | -34,825 | 714 | 2,861 | 4,497 | 1,010 | 3,297 | 12,380 | 1,259 | -8,144 |
| 2013 | 661 | 0 | -36,037 | 796 | 2,961 | 4,833 | 1,073 | 3,442 | 12,738 | 1,326 | -8,195 |
| 2014 | 673 | 0 | -37,250 | 875 | 3,058 | 5,150 | 1,139 | 3,590 | 13,083 | 1,392 | -8,278 |
| 2015 | 685 | 0 | -29,614 | 907 | 3,256 | 3,273 | 1,168 | 3,394 | 13,896 | 1,410 | -1,626 |
| 2016 | 695 | 0 | -21,614 | 883 | 2,972 | 2,490 | 1,070 | 2,794 | 11,815 | 1,294 | 2,376 |
| 2017 | 705 | 0 | -21,614 | 830 | 2,804 | 2,020 | 943 | 2,492 | 11,002 | 1,178 | 356 |
| 2018 | 713 | 0 | -21,614 | 781 | 2,708 | 1,731 | 851 | 2,340 | 10,536 | 1,103 | -874 |
| 2019 | 722 | 0 | -21,614 | 741 | 2,649 | 1,563 | 789 | 2,252 | 10,242 | 1,056 | -1,622 |
| 2020 | 730 | 0 | -21,614 | 709 | 2,613 | 1,470 | 749 | 2,197 | 10,046 | 1,025 | -2,098 |
| 2021 | 739 | 0 | -21,614 | 683 | 2,588 | 1,421 | 720 | 2,161 | 9,907 | 1,005 | -2,414 |
| 2022 | 747 | 0 | -21,614 | 662 | 2,571 | 1,400 | 701 | 2,135 | 9,802 | 991 | -2,624 |
| 2023 | 755 | 0 | -21,614 | 645 | 2,560 | 1,395 | 686 | 2,117 | 9,721 | 980 | -2,766 |
| 2024 | 763 | 0 | -21,614 | 632 | 2,552 | 1,401 | 674 | 2,104 | 9,657 | 972 | -2,865 |
| 2025 | 771 | 0 | -21,614 | 621 | 2,546 | 1,412 | 666 | 2,093 | 9,603 | 966 | -2,935 |

TABLE 4: SIMULATED WATER BUDGET FOR THE JASPER AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE JASPER AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE JASPER AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR. NOTE: THE JASPER INCLUDES PARTS OF THE CATAHOULA FORMATION.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2026 | 779 | 0 | -21,614 | 612 | 2,542 | 1,427 | 659 | 2,085 | 9,559 | 961 | -2,986 |
| 2027 | 787 | 0 | -21,614 | 605 | 2,540 | 1,445 | 653 | 2,080 | 9,521 | 957 | -3,022 |
| 2028 | 795 | 0 | -21,614 | 600 | 2,538 | 1,463 | 649 | 2,075 | 9,487 | 954 | -3,048 |
| 2029 | 802 | 0 | -21,614 | 595 | 2,538 | 1,481 | 644 | 2,072 | 9,457 | 952 | -3,067 |
| 2030 | 810 | 0 | -21,614 | 592 | 2,539 | 1,500 | 641 | 2,069 | 9,431 | 950 | -3,078 |
| 2031 | 818 | 0 | -21,614 | 590 | 2,538 | 1,518 | 638 | 2,066 | 9,406 | 948 | -3,083 |
| 2032 | 825 | 0 | -21,614 | 588 | 2,539 | 1,533 | 636 | 2,064 | 9,383 | 947 | -3,088 |
| 2033 | 833 | 0 | -21,614 | 586 | 2,540 | 1,548 | 633 | 2,062 | 9,362 | 946 | -3,090 |
| 2034 | 841 | 0 | -21,614 | 585 | 2,542 | 1,563 | 632 | 2,061 | 9,342 | 945 | -3,091 |
| 2035 | 848 | 0 | -21,614 | 585 | 2,543 | 1,576 | 630 | 2,060 | 9,323 | 944 | -3,090 |
| 2036 | 856 | 0 | -21,614 | 584 | 2,545 | 1,589 | 629 | 2,060 | 9,305 | 944 | -3,088 |
| 2037 | 863 | 0 | -21,614 | 584 | 2,546 | 1,600 | 629 | 2,059 | 9,287 | 943 | -3,086 |
| 2038 | 871 | 0 | -21,614 | 585 | 2,549 | 1,611 | 627 | 2,059 | 9,272 | 943 | -3,082 |
| 2039 | 878 | 0 | -21,614 | 585 | 2,551 | 1,621 | 627 | 2,059 | 9,256 | 943 | -3,077 |
| 2040 | 886 | 0 | -21,614 | 586 | 2,553 | 1,631 | 627 | 2,059 | 9,241 | 943 | -3,072 |
| 2041 | 893 | 0 | -21,614 | 587 | 2,555 | 1,641 | 626 | 2,059 | 9,227 | 943 | -3,065 |
| 2042 | 900 | 0 | -21,614 | 588 | 2,558 | 1,649 | 627 | 2,060 | 9,213 | 944 | -3,059 |
| 2043 | 909 | 0 | -21,614 | 590 | 2,560 | 1,659 | 626 | 2,060 | 9,200 | 944 | -3,052 |
| 2044 | 916 | 0 | -21,614 | 591 | 2,562 | 1,667 | 626 | 2,060 | 9,187 | 944 | -3,044 |
| 2045 | 923 | 0 | -21,614 | 593 | 2,565 | 1,674 | 626 | 2,062 | 9,175 | 945 | -3,037 |
| 2046 | 930 | 0 | -21,614 | 594 | 2,567 | 1,681 | 627 | 2,062 | 9,162 | 945 | -3,028 |
| 2047 | 938 | 0 | -21,614 | 596 | 2,571 | 1,688 | 626 | 2,063 | 9,150 | 946 | -3,020 |
| 2048 | 945 | 0 | -21,614 | 598 | 2,573 | 1,695 | 627 | 2,064 | 9,140 | 946 | -3,004 |

TABLE 4: SIMULATED WATER BUDGET FOR THE JASPER AQUIFER IN MONTGOMERY COUNTY. POSITIVE VALUES REPRESENT GROUNDWATER FLOW INTO THE JASPER AQUIFER IN MONTGOMERY COUNTY. NEGATIVE VALUES REPRESENT GROUNDWATER FLOW OUT OF THE JASPER AQUIFER IN MONTGOMERY COUNTY. ALL VALUES ARE IN ACRE-FEET PER YEAR. NOTE: THE JASPER INCLUDES PARTS OF THE CATAHOULA FORMATION.

| *Year* | *Head Dependent Boundary* | *Subsidence* | *Well* | *Burkeville Confining Unit* | *Grimes County* | *Harris County* | *Liberty County* | *San Jacinto County* | *Walker County* | *Waller County* | *Storage Change* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2049 | 952 | 0 | -21,614 | 600 | 2,576 | 1,702 | 628 | 2,065 | 9,127 | 947 | -3,003 |
| 2050 | 959 | 0 | -21,614 | 602 | 2,578 | 1,708 | 628 | 2,066 | 9,117 | 947 | -2,986 |
| 2051 | 966 | 0 | -21,614 | 604 | 2,581 | 1,714 | 628 | 2,066 | 9,107 | 948 | -2,978 |
| 2052 | 973 | 0 | -21,614 | 606 | 2,583 | 1,719 | 628 | 2,067 | 9,096 | 949 | -2,969 |
| 2053 | 980 | 0 | -21,614 | 608 | 2,586 | 1,725 | 629 | 2,067 | 9,086 | 949 | -2,959 |
| 2054 | 987 | 0 | -21,614 | 610 | 2,588 | 1,729 | 630 | 2,069 | 9,076 | 950 | -2,950 |
| 2055 | 994 | 0 | -21,614 | 612 | 2,591 | 1,735 | 630 | 2,069 | 9,066 | 951 | -2,942 |
| 2056 | 1,001 | 0 | -21,614 | 614 | 2,593 | 1,739 | 630 | 2,071 | 9,056 | 951 | -2,933 |
| 2057 | 1,008 | 0 | -21,614 | 617 | 2,595 | 1,745 | 632 | 2,071 | 9,047 | 952 | -2,924 |
| 2058 | 1,015 | 0 | -21,614 | 619 | 2,598 | 1,749 | 632 | 2,072 | 9,037 | 953 | -2,922 |
| 2059 | 1,022 | 0 | -21,614 | 621 | 2,601 | 1,754 | 632 | 2,073 | 9,029 | 954 | -2,905 |
| 2060 | 1,029 | 0 | -21,614 | 623 | 2,603 | 1,758 | 633 | 2,073 | 9,019 | 954 | -2,896 |
| Average (1980-1996) | 483 | 0 | -11,353 | -211 | 1,323 | -231 | 159 | 1,142 | 4,749 | 327 | -3,605 |
| Average (1999-2060) | 839 | 0 | -23,193 | 636 | 2,624 | 1,967 | 714 | 2,269 | 9,850 | 1,011 | -3,276 |

Note: Head dependent boundary includes groundwater flow related to recharge, evapotranspiration, springs, and surface water bodies.

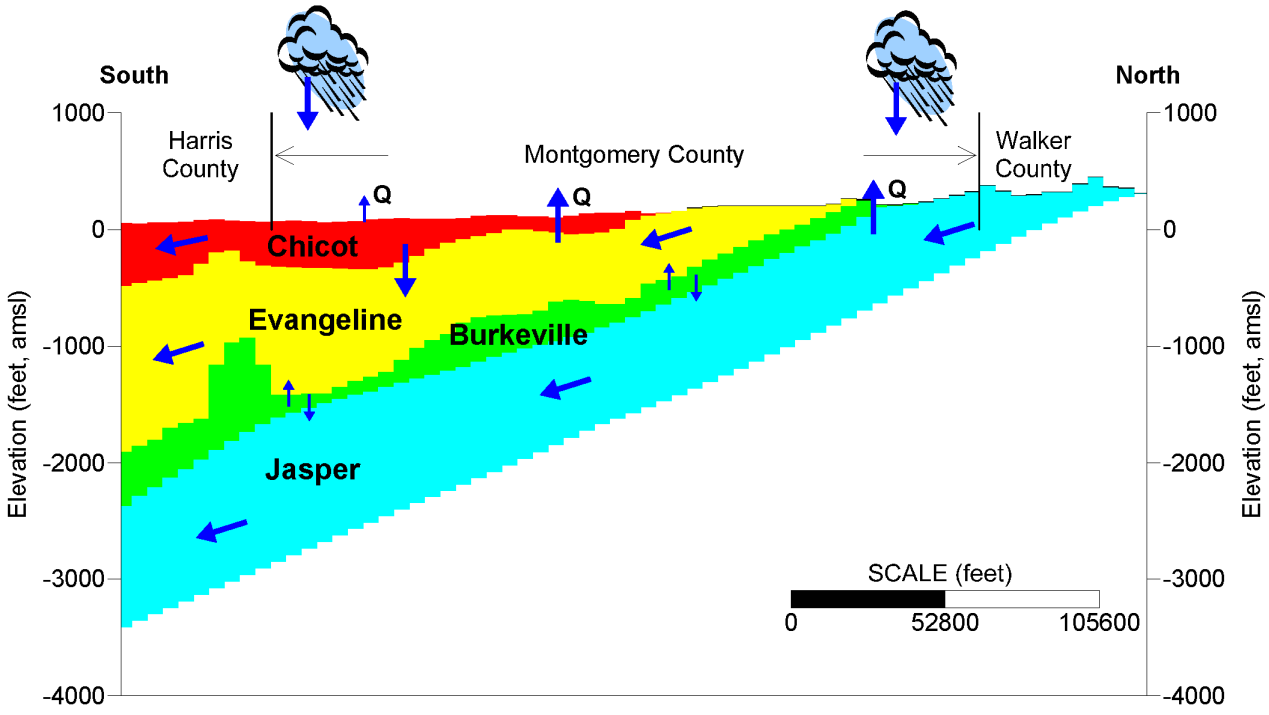


FIGURE 5. CONCEPTUAL MODEL OF GROUNDWATER FLOW IN MONTGOMERY COUNTY. NOTE: THE JASPER INCLUDES PARTS OF THE CATAHOULA FORMATION.