GROUNDWATER MANAGEMENT PLAN

Month, day, 2019

Draft for Public Comment

LONE STAR GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

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LONE STAR GROUNDWATER CONSERVATION DISTRICT
GROUNDWATER MANAGEMENT PLAN

1. DISTRICT MISSION

The Lone Star Groundwater Conservation District (the "District") is committed to providing a regulatory program that encourages the best conservation and development practices for the groundwater resources of Montgomery County. The District will serve the public interest as outlined in Section 59, Article XVI, Texas Constitution by developing, promoting, and implementing water conservation, augmentation, and management strategies to both conserve and utilize groundwater resources for the benefit of the citizens, economy, and environment of Montgomery County. The District's mission includes honoring and protecting private property rights by affording an opportunity for a fair share to every owner of each common, subsurface reservoir underlying, in whole or in part, in Montgomery County as authorized under state law. The District will protect both public and private interests through programs designed for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and by adopting and enforcing rules as authorized by Chapter 36 of the Texas Water Code ("Chapter 36") and consistent with state law. The District will adopt and enforce fair and impartial rules including requiring permits for wells and production, imposing spacing requirements, regulating production, requiring metered production and reporting of non-exempt wells, establishing aquifer management standards, creating and maintaining aquifer monitoring programs, encouraging conservation, and/or making appropriate adjustments to allowable and permitted production, as warranted, to achieve aquifer management standards over the long-term. The District also believes the intelligence and independent decision making of each groundwater owner and water user are integral to the long-term success of the District's mission. To assist these stakeholders, the District will work diligently to collect data, perform analyses, and report groundwater conditions and regulatory policy so each stakeholder can make independent and informed decisions that support their interests. The Board of Directors of the District believes it is in this collective manner whereby the future of Montgomery County is best served.

2. TIME PERIOD OF THIS PLAN

This management plan will remain in effect from the date of approval by the Executive Administrator at the Texas Water Development Board ("TWDB") until the Plan is readopted. In accordance with Chapter 36, the District's management plan shall be reviewed annually and readopted with or without revisions at least once every five years.

3. DISTRICT INFORMATION

In 2001, the creation of the District was authorized by the 77th Texas Legislature through House Bill 2362,[1] and was confirmed by the voters of Montgomery County on November 6, 2001. The District does not have the power to tax and receives all of its revenue from water use fees. The District's original management plan was adopted on October 14, 2003, and submitted to the TWDB within two years of the confirmation election, and then amended and re-adopted on

[1] Chapter 1321, Acts of the 77th Legislature, Regular Session, 2001.

October 14, 2008 and November 12, 2013. As such, this update to the District's management plan represents the fourth management plan since creation of the District in 2001.

The District is located in Montgomery County in southeastern Texas. The boundaries of the District are coterminous with the boundaries of Montgomery County, Texas. The District is bordered by Walker County on the north, San Jacinto and Liberty Counties on the east, Harris County on the south, and Waller and Grimes Counties on the west (Figures 1 and 2). Peach Creek forms the boundary with San Jacinto County, and Spring Creek forms most of the boundary with Harris County. The District comprises an area of approximately 1,077 square miles.

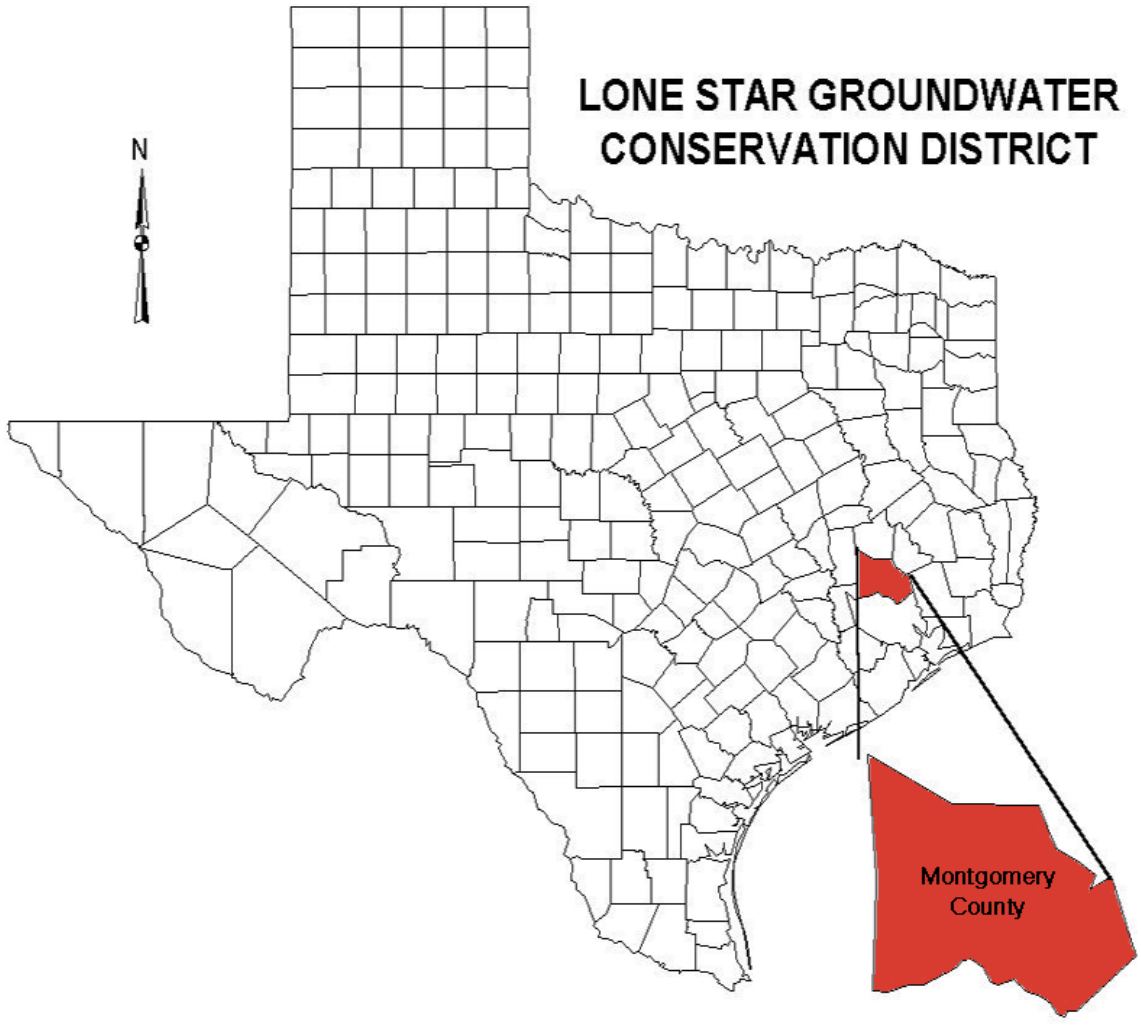

Figure 1 – District State location map.

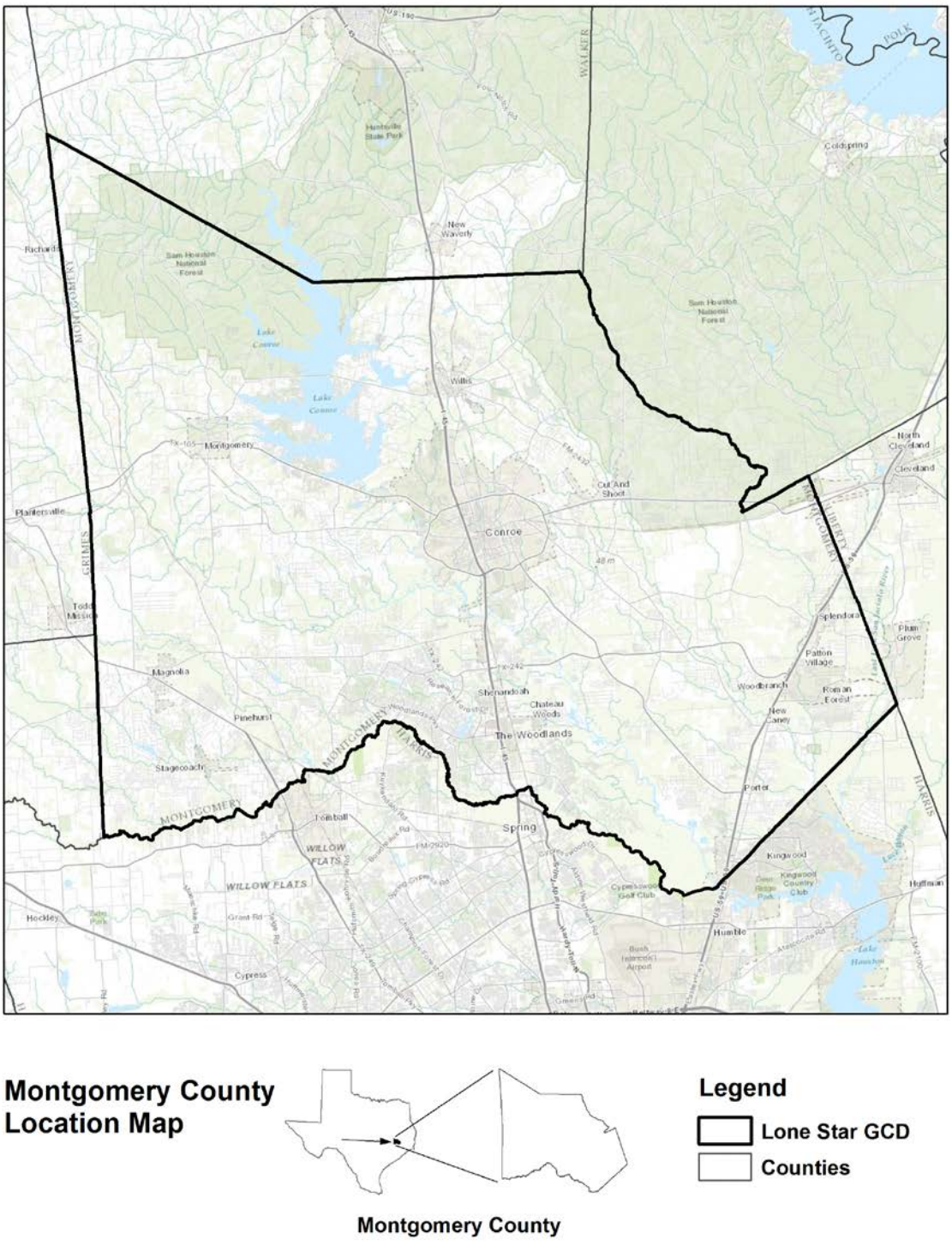

Figure 2 – Detailed location map of the District.

4. ELECTION OF BOARD

Due to the passage of House Bill 1982 by the 85th Texas Legislature (Regular Session) in 2017, the District's Board of Directors changed from a nine member appointed board to a seven-member elected board. Four of the directors are elected from each of the four county commissioners precincts by the voters of the applicable precinct (Place Nos. 1-4), one director is elected by the voters at large (Place No. 5), one director is elected from the City of Conroe by the voters of the municipality (Place No. 6), and one director is elected from the Woodlands Townships by the voters of that township (Place No. 7). The first election under the new board structure was held on November 6, 2018, and the newly elected Board was sworn in to office on November 16, 2018. Permanent directors serve staggered four-year terms. Directors of Place Nos. 1, 5, and 6 shall serve a two-year term ending on December 1, 2020, and the Directors of Place Numbers 2, 3, 4, and 7 shall serve a four-year term ending on December 1, 2022. A director may not serve more than three full terms. The initial two-year terms of the Directors of Place Nos. 1, 5, and 6 do not count toward the three full term limitation.

5. GROUNDWATER RESOURCES OF MONTGOMERY COUNTY

In Montgomery County, the groundwater resources include the Gulf Coast aquifer system and the Catahoula Sandstone. The Gulf Coast aquifer system consists of the Chicot Aquifer, the Evangeline Aquifer, the Burkeville confining unit, and the Jasper Aquifer. Although publications such as the Oden and Truini (2013)[2] also include portions of the Catahoula Sandstone as part of the Gulf Coast aquifer system, for regulatory purposes the District considers the Catahoula Sandstone to be a separate hydrogeologic system (the Catahoula confining system) and manages it accordingly.

Table 1 – Geologic and Hydrologic Units of the Gulf Coast Aquifer in Montgomery County (as modified from Baker (1979)[3] and Young and others (2012)[4]).

	Series	Geologic Unit	Hydrologic Unit
Quaternary	Holocene	Alluvium	Chicot Aquifer
	Pleistocene	Beaumont Clay Lissie/Alta Loma	
Tertiary	Pliocene	Willis Sand	

[2] Oden, T. D., and Truini, M., 2013, Estimated rates of groundwater recharge to the Chicot, Evangeline, and Jasper aquifers by using environmental tracers in Montgomery and adjacent counties, Texas, 2008 and 2011: U. S. Geological Survey, Scientific Investigations Report No. 2013-5024, 49 p.

[3] Baker, E. T., Jr., 1979, Stratigraphic and hydrogeologic framework of part of the Coastal Plain of Texas: Texas Department of Water Resources Report 236, 43 p.

[4] Young, S.C, Ewing, T, Hamlin, S., Baker, E., and Lupton, D., 2012. Final Report: Updating the Hydrogeologic Framework for the Northern Portion of the Gulf Coast Aquifer, (prepared for the Texas Water Development Board), 285 p.

	Miocene	Goliad Sand	Evangeline Aquifer
		Fleming Formation (Lagarto)	Burkeville Confining Unit
		Fleming Formation (Oakville)	Jasper Aquifer
	Oligocene	Catahoula Sandstone	Catahoula Aquifer

The water-bearing units of the Gulf Coast aquifer system support the majority of groundwater production use in Montgomery County. These water-bearing units consist of semi-consolidated or unconsolidated sands with interbedded silts and clays. The Burkeville confining unit is a relatively thick clay zone that separates the Evangeline aquifer from the Jasper aquifer.

The geologic structure of the Gulf Coast aquifer system dips from the inland areas into the subsurface towards the coast at an angle greater than the slope of the land surface. The geologic units generally thicken towards the coast in the down-dip direction. The rate of dip, measured in feet per mile, increases with depth below land surface. The base of the Chicot Aquifer dips at approximately 10 feet per mile, while the rate of dip for the Catahoula Sand below the Jasper Aquifer is approximately 90 feet per mile[5]. The increased formation dip with depth is caused by the relative location of the continental shelf during the respective depositional period of each geologic unit.

[5] Popkin, B. P., 1971, Groundwater resources of Montgomery County, Texas: Texas Water Development Board Report 136, 143 p.

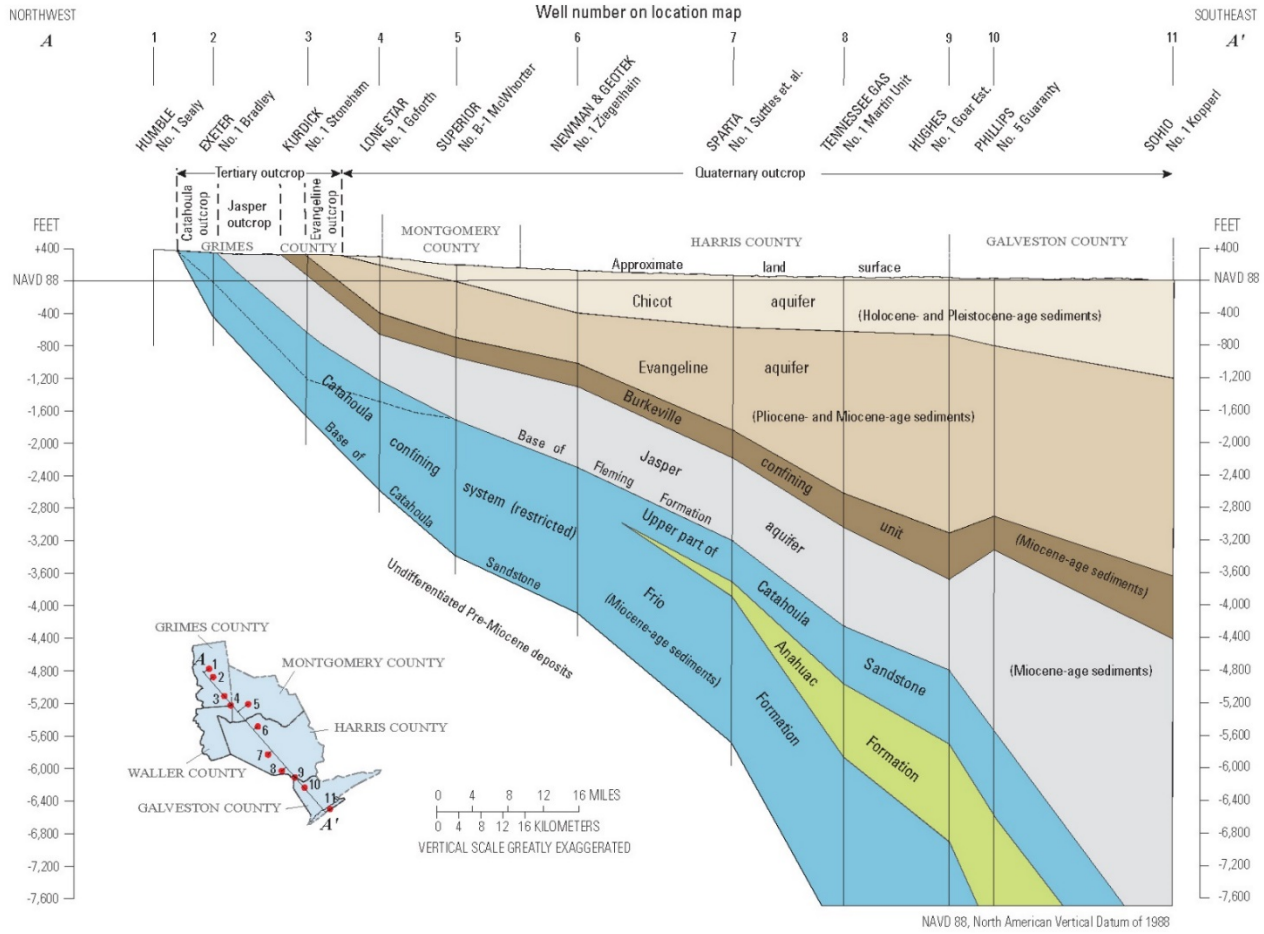

Figure 3 – Geologic cross section of the Gulf Coast Aquifer in the area of Montgomery County (as modified from Baker (1979)[13] and Oden and Truini (2013) [1]).

The topography in the District varies from almost flat near the larger streams and in the southern part of the county to hilly in the northern part. Altitudes range from about 45 feet above mean sea level in the southeastern corner of the county to about 440 feet above mean sea level in the northwestern corner.

The county is in the San Jacinto River drainage basin in which the primary drainage trends from northwest to southeast. The larger streams are the West Fork San Jacinto River, Peach, Spring, Stewart, and Caney Creeks. Secondary drainage, which is roughly west to east, is principally by Lake and Spring Creeks. The primary drainage is controlled by the southeasterly slope of the land surface, while the secondary drainage is controlled, to a large extent, by the occurrence of alternating outcrops of sand and clay.

6. MANAGEMENT AND MONITORING OF GROUNDWATER RESOURCES

The Texas Legislature has established that groundwater conservation districts, such as the District, are the state's preferred method of groundwater management. The Texas Legislature codified its policy decision in Section 36.0015 of the Texas Water Code in 1997, which establishes that groundwater conservation districts will manage groundwater resources through rules developed and implemented in accordance with Chapter 36.

In addition to the statutory authority provided to groundwater conservation districts in Chapter 36, the District has the powers expressly granted to the District by Chapter 1321, Acts of the 77th Legislature, Regular Session, 2001, and Chapter 994, Acts of the 78th Legislature, Regular Session, 2003 (collectively "the District Act"). The District has the rights and responsibilities provided for in Chapter 36, the District Act, and 31 Texas Administrative Code Chapter 356, including the rulemaking authority to implement the policies and procedures needed to manage the groundwater resources of Montgomery County.

As outlined in the District's approved 2013 Management Plan on pp. 6-9, the District previously adopted and implemented a multi-phased regulatory plan known as the District's Regulatory Plan ("DRP"). The DRP was designed to require a comprehensive conversion effort to reduce total annual groundwater production within Montgomery County to a level not to exceed 64,000 acre-feet of groundwater per year for the Gulf Coast Aquifer (see also "Desired Future Conditions" section immediately below for more information on the corresponding DFC associated with the 64,000 acre-feet per year). Under Phase IIA and IIB of the DRP, certain specified large volume groundwater users ("LVGUs") were required to reduce groundwater production by thirty percent (30%) of their Total Qualifying Demand and submit a Groundwater Reduction Plan ("GRP") to meet the conversion obligations. In August 2015, the District, the General Manager and then directors were sued by the City of Conroe, Quadvest, LP, and other investor-owned utilities (collectively, "Plaintiffs") over the validity of the regulations requiring LVGUs to reduce production by thirty-percent. In September 2018, the 284th District Court in Montgomery County granted a partial summary judgment holding that Lone Star Groundwater Conservation District's rule requiring a reduction in pumping by Large Volume Groundwater Users effective in 2016 is invalid and outside the District's authority granted by the Legislature. In January 2019, the District (by a unanimous vote of the newly elected board) entered into a Compromise and Settlement Agreement with the Plaintiffs to end the protracted litigation, which will result in a final judgment from the Court declaring the regulations void and unenforceable. In order to comply with the final judgment, the District will strike the regulations from its rules and no longer manage the resources in accordance with those regulations. After notice and hearing, the District will adopt new rule(s) to address the void and unenforceable regulations.

The District will evaluate and monitor groundwater conditions and regulate production consistent with this plan and the District Rules. Production will be regulated, as needed, to conserve groundwater, and protect groundwater users, in a manner not to unnecessarily and adversely limit production or impact the economic viability of the public, landowners and private groundwater users. In consideration of the importance of groundwater to the economy and culture of the District, the District will identify and engage in activities and practices that will permit groundwater

production and, as appropriate, protect the aquifer and groundwater in accordance with this Management Plan and the District's rules.

The District will adopt rules to regulate groundwater withdrawals by means of well spacing and production limits, as authorized in Chapter 36.116, as appropriate to implement this Plan. In issuing new permits or amending existing permits, the District will manage total groundwater production on a long-term basis to achieve an applicable desired future condition.

The District will maintain a monitoring well and subsidence station network that will be used by the District to monitor aquifer conditions over time. The District encourages well owners to volunteer wells to be used as part of the monitoring network. The District will accept wells into, or replace an existing well in, the monitoring network. The selection process will consider the well proximity to other monitoring wells, to permitted and exempt wells, to streams, and to geographic and political boundaries. If no suitable well locations can be found to meet the monitoring objectives in a specific aquifer, the District may evaluate the benefits of converting an oil and gas well to a water well, drilling and installing a new well, or using modeled or estimated water levels for that area until such time as a suitable well can be obtained for monitoring. The monitoring of the wells will be performed under the direction of the general manager, by trained personnel, using a standard operating procedure adopted by the District. The District may coordinate with the neighboring groundwater conservation districts and subsidence districts for the purpose of supplementing its monitoring data and for improving the consistency in the collection, management, and analysis of hydrogeological data in GMA 14.

The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions, as appropriate, in public meetings of the Board or public announcements. The District will undertake investigations, and cooperate with third-party investigations, of the groundwater resources within the District, and the results of the investigations will be made available to the public upon being presented at a meeting of the Board.

7. DESIRED FUTURE CONDITIONS & MODELED AVAILABLE GROUNDWATER

During the second round of joint planning with GMA 14, the District's prior Board of Directors adopted DFCs for the Gulf Coast Aquifer on August 9, 2016 as follows:

- From estimated year 2009 conditions, the average draw down of the Chicot Aquifer in Montgomery County should not exceed approximately 26 feet after 61 years;
- From estimated year 2009 conditions, the average draw down of the Evangeline Aquifer in Montgomery County should not exceed approximately -4 feet after 61 years;
- From estimated year 2009 conditions, the average draw down of the Burkeville confining unit in Montgomery County should not exceed approximately -4 feet after 61 years;
- From estimated year 2009 conditions, the average draw down of the Jasper Aquifer in Montgomery County should not exceed

approximately 34 feet after 61 years; and

- The Board also adopts as applicable to Lone Star the aquifer-wide scale average draw down numbers within GMA 14 for the Chicot Aquifer, Evangeline Aquifer, Burkeville confining unit, and the Jasper Aquifer as specifically set forth in the attached Resolution for the Approval of Desired Future Conditions for All Aquifers in Groundwater Management Area 14 (Attachment A).

Shortly after adoption, the District received two separate petitions challenging the reasonableness of the above referenced DFCs. The first petition was filed by the Cities of Conroe and Magnolia on December 2, 2016. The TWDB received a copy of this petition on December 12, 2016. The second petition, filed by Quadvest, L.P., was received by the District on December 6, 2016, and by the TWDB on December 14, 2016. The District contracted with the State Office of Administrative Hearings ("SOAH") to conduct a consolidated contested case hearing requested by the petitioners, and submitted copies of the petitions to the Office. The TWDB prepared a scientific and technical analysis of the desired future conditions and delivered their report to the SOAH Judge Casey Bell on April 10, 2017.

In October 2017, the District's prior Board of Directors received the results of the three-year Strategic Water Resources Planning Study (the "Planning Study") conducted by LBG-Guyton Associates that it was commissioned to do in October 2014. As a result of the Planning Study, on October 10, 2017, the District's prior Board of Directors unanimously adopted 1) increased pumping levels (from 64,000 acre-feet per year to 100,000 acre-feet per year through 2070) and resulting aquifer conditions included in what is referred to as groundwater availability model "Run D" from the final report for Task 3 of the Planning Study as the District's recommended model scenario; and 2) recommended that the District's General Manager and consultants present the results of the Strategic Water Resources Planning Study, including the District Board's recommendation for Run D, to the district representatives of Groundwater Management Area 14 ("GMA 14") with a request that Run D be considered in the joint planning process as either an amendment to the DFCs previously adopted in 2016 or as a new proposal.

On November 6, 2017, the District's prior Board of Directors entered into a settlement agreement and an Agreed Proposal for Decision with the Cities of Conroe and Magnolia, Texas ending the contested case hearing on the reasonableness of the District DFCs. The Agreed Proposal for Decision prepared by Administrative Law Judge Casey A. Bell, included three specific Findings of Fact. The first was a finding consistent with the District's actions approved on October 10, 2017 regarding the Strategic Water Resources Planning Study. The second finding included the sentence: "Based on results of the Strategic Water Resources Planning Study and the District's Board of Directors actions, the District's Board of Directors changed its policy goal to move away from 'sustainability,' which is one of the primary bases for the DFCs that are the subject of the petitions in this proceeding, to a groundwater management policy and goal that allows measured aquifer level declines over time." The third finding of fact states: "Because the District Board of Directors has changed its policy goal for aquifer management as set forth above and has already voted unanimously to pursue changes to the DFCs that are the subject of the DFC appeal, those DFCs are no longer reasonable."

On November 6, 2017, the District signed a Final Order adopting in full Judge Bell's Proposal for Decision and declaring the DFCs no longer reasonable. The District order instructed the General Manager to transmit a copy of the Final Order to all groundwater conservation districts comprising Groundwater Management Area 14 ("GMA 14") and convey to those districts the Board of Directors' request that GMA 14 promptly convene as required by Texas Water Code 36.1083(p) & (q) to begin the process of adopting new or amended Desired Future Conditions applicable to the District.

The District then submitted a request on November 20, 2017, to GMA 14 seeking a change in the DFCs for the aquifers to be consistent with the aquifer conditions as modeled in the "Run D" scenario approved by the prior Board of Directors. On December 8, 2017, the voting district representatives of GMA 14, unanimously approved taking up "Run D" for formal consideration as new DFCs for the third five-year joint planning cycle of DFCs, but would not support a more surgical approach to amend only the District's second-cycle DFCs. At least one representative voiced concern that a change in the DFC for Lone Star would, by necessity, require new DFCs to be adopted for their district, as well. This would require a full rework of the necessary explanatory report. The District continued to work with the GMA 14 district representatives in early 2018 to request that they take up the "Run D" request only as an amendment to the second-cycle DFCs on an expedited basis. On March 27, 2018, the GMA 14 district representatives voted down a motion to consider "Run D" only as an amendment to the second-cycle DFCs, but unanimously approved "Run D" for formal consideration both (1) in response to the District's request from the appeal of the second joint planning cycle DFCs, and (2) to develop the third cycle DFCs.

After the newly elected board took office, it prepared a statement to GMA 14 on the status of the District's DFCs, which included considering defining a common reservoir. The Board no longer supports Run D for the third round of planning. At the time of the adoption of this District Management Plan, GMA 14 has begun initial studies of the nine statutory factors the district representatives are statutorily required to consider before adopting new DFCs for the third planning cycle. Under the current schedule, GMA 14 will have proposed DFCs for adoption by May 1, 2021.

Given these circumstances, the DFCs that apply to the District remain unresolved. Thus, no reasonable DFCs are available for inclusion into this Management Plan. When the District and GMA 14 successfully adopt DFCs that are deemed reasonable, then the District will update this plan.

Similarly, Section 36.1071(e)(3) requires a management plan to include an estimate of the modeled available groundwater in the district based on the desired future conditions established under Section 36.108. On December 15, 2016, the Texas Water Development Board issued the report GAM Run 16-024 MAG, which included the modeled available groundwater specific to the District DFCs that were later ruled unreasonable. The modeled available groundwater associated with GAM Run 16-024 MAG for the District is in Table 1 in **Appendix D**. The TWDB has not issued a subsequent report reflective of the District Order in the DFC Petition Hearing. Because the modeled available groundwater in the district is to be based on the desired future conditions established under the joint planning process, and the District, at present, is working with GMA 14 to adopt new DFCs applicable to the District, the District presently does not have a justifiable

value for the Modeled Available Groundwater for the District's regulatory purpose. Within sixty (60) days of the District and GMA 14 successfully adopting DFCs that are deemed reasonable, the District will forward those to the Executive Administrator for the purpose of setting the Modeled Available Groundwater for the District.

8. ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The District will implement this plan and utilize it as a guide for the ongoing evaluation, and the planning and establishing, of priorities for all District conservation and regulatory activities. All programs, permits and related operations of the District, and any additional planning efforts in which the District may participate will be consistent with this plan.

The District will adopt rules relating to the permitting of wells, the production and transport of groundwater and managing permitted production to achieve DFCs. The rules adopted by the District shall be adopted pursuant to Chapter 36 and provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on metered production and other technical data recommended by competent professionals and accepted by the Board.

The District shall treat all citizens equally. Citizens may apply to the District for a variance in enforcement of the rules on grounds of adverse economic effect or unique local conditions. In granting a variance to any rule, the Board shall consider the potential for adverse effect on adjacent landowners and the aquifer(s). The exercise of discretion by the Board shall not be construed as limiting the power of the Board.

The District will endeavor to cooperate with other agencies in the implementation of this plan and the management of groundwater supplies within the District. All activities of the District will be undertaken in a spirit of cooperation and coordination with the appropriate state and regional agencies.

9. METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS

In order to achieve the goals, management objectives, and performance standards adopted in this management plan, the District continually works to develop, maintain, review, and update rules and procedures for the various programs and activities contained in the management plan. As a means to monitor performance, (a) the General Manager routinely meets with staff to track progress on the various goals, management objectives and performance standards adopted in this management plan, and (b) on an annual basis, the General Manager prepares and submits an annual report documenting progress made towards implementation of the management plan to the Board of Directors for their review and approval. In addition, the District's staff reviews District Rules to ensure that all provisions necessary to implement the management plan are contained in the rules. The rules are reviewed annually and on an an-needed basis. The District Board of Directors will make revisions to the rules as needed to manage and conserve groundwater resources within the District more effectively and to ensure that the duties prescribed in Chapter 36 and other applicable laws are carried out. A copy of this management plan and the District Rules may be

found on the District website at www.lonestargcd.org. The District will encourage cooperation and coordination in the implementation of this plan. All operations and activities of the District will be performed in a manner that best encourages cooperation with the appropriate state, regional, or local water entity.

10. MANAGEMENT GOALS, OBJECTIVES, AND PERFORMANCE STANDARDS

10.1. Efficient Use Of Groundwater

Management Objectives:

1. The District will maintain a monitoring well network to provide coverage across aquifers and measure water levels at least once every calendar year. A written analysis of the water level measurements from the monitoring wells will be made available through a presentation to the Board of Directors at least once every three years.

2. The District will continue to support the activities of the Gulf Coast / Montgomery County Water Efficiency Network, Water Wise Program, , and the Home Water Works, and maintain a technical library of information providing guidance on the efficient use of water.

3. The District will provide educational leadership to citizens annually through at least one printed publication, such as a brochure, and/or public speaking at service organizations and public schools as provided for in the District's public education program.

4. Each year, the District will require all new exempt or permitted wells that are constructed within the boundaries of the District to be registered or permitted with the District in accordance with the District Rules.

5. The District will maintain qualified staff and technical consultants necessary to execute and maintain the District's well registration and permitting system. This effort includes the timely processing and technical reviews of permit applications. Each year, the District will regulate the production of groundwater by maintaining a system of permitting the use and production of groundwater within the boundaries of the District in accordance with the District Rules.

Performance Standards:

1. Maintain a monitoring well network and its criteria, and measure monitoring wells at least once every calendar year and perform site inspections as necessary.

2. Program updates, notification of monthly meetings and links to specific topics to improve efficiency will be posted on the District website at: https://www.lonestargcd.org

3. The number of publications and speaking appearances by the District each year under the District's public education program and as it reported in the Annual Report.

4. Each year the District will accept, process, and review applications for the permitted use of groundwater in the District in accordance with the permitting process established by District Rules. The number and type of applications made for the permitted use of groundwater in the District and the number and type of permits issued by the District will be included in the Annual Report submitted by the General Manager to the Board of Directors of the District.

5. The District maintains a qualified staff to assist water users in protecting, preserving, and conserving groundwater resources. The Board of Directors has in the past and continues today to base its decisions on the best data available to treat all water users as equitably as possible. Once data is collected, the District utilizes a wide variety of forums to provide important information to water users throughout the District so that sound decisions regarding the efficient use of groundwater can be made.

10.2. Controlling and Preventing Waste of Groundwater

Management Objectives:

1. The District operates a waste prevention outreach strategy that focuses on enhancing the use of the District's website to provide resources applicable to the prevention of waste of groundwater. The District website provides a routinely updated link containing a *Best Management Practices Guide* (published by the Texas Water Conservation Advisory Council in partnership with the TWDB). The District will work to identify outreach opportunities with regional and local water providers so as to increase public awareness for the prevention of groundwater waste.

2. Each year, the District will apply a water use fee structure to the permitted use of groundwater in the District to encourage the elimination and reduction of waste of groundwater.

Performance Standards:

1. The District provides and will routinely update the link on the District's website to Best Management Practices, which includes helpful tips to control and prevent the waste of groundwater.

2. Each year, with the exception of wells exempt from permitting, the District will apply a water use fee to the permitted use of groundwater in the District pursuant to District Rules. The amount of fees generated by the water use fee structure and the amount of water used for each type of permitted use of groundwater will be included in the Annual Report submitted by the General Manager to the Board of Directors of the District.

10.3. Controlling and Preventing Subsidence

Management Objectives:

1. The District, in cooperation with the Harris-Galveston Subsidence District, maintains a network of 8 subsidence monitor stations to continually measure subsidence. To date, minor subsidence of less than 1 foot has been measured at monitoring stations located in the southern portion of the District.

2. Each year, the District shall participate in a joint conference with the neighboring groundwater conservation districts or subsidence districts focused on sharing information regarding subsidence and the control and prevention of subsidence through the regulation of groundwater production.

3. Controlling and preventing subsidence will be addressed during the review and processing of permits as authorized in Chapter 36 and District Rules, and in setting desired future conditions for the common reservoirs.

Performance Standards:

1. Each year, a summary of the joint conference on subsidence issues will be included in the Annual Report submitted by the General Manager to the Board of Directors of the District.

2. Results from the subsidence monitor stations will be noted in the summary of the joint conference on subsidence and included in an annual report to the District Board of Directors.

10.4. Conjunctive Surface Water Management Issues

Management Objectives:

1. Each year, the District's designated representative will participate in the regional planning process by attending at least 75 percent of the Region H – Regional Water Planning Group meetings.

2. The District will review the State Water Plan in **Appendix B** and coordinate with public water suppliers, other stakeholders and surface water management entities on conjunctive use.

Performance Standards:

1. The participation and attendance of the District's designated representative at each Region H Regional Water Planning Group will be noted in the Annual Report submitted by the General Manager to the Board of Directors of the District.

2. Each year the District will include a summary of the District's review of the State Water Plan and meeting summaries on conjunctive use in the Annual Report to the Board of Directors of the District.

10.5. Natural Resource Issues

Management Objectives:

1. The District will monitor permit applications and permit amendment applications for Class II injection wells filed with the Railroad Commission of Texas and Class I and Class V injection well permit applications and permit amendment applications filed with the Texas Commission on Environmental Quality. District staff will review these notices and brief the Board of Directors as appropriate. A summary of injection well permit activity and any actions taken by the District in response will be included in the Annual Report submitted by the General Manager to the Board of Directors of the District.

Performance Standards:

1. Beginning with the 2014 Annual Report, a summary of injection well permit activity at the Railroad Commission of Texas and the Texas Commission on Environmental Quality along with any actions taken by the District in response will be included in the Annual Report submitted by the General Manager to the Board of Directors of the District.

10.6. Drought Conditions

The aquifers within the District are substantially resistant to depletion of storage during drought conditions. As a result, the District does not have regulatory actions related to a

drought management strategy. Additionally, a well-informed public can best respond to developing drought conditions by adopting best management practices appropriate for drought conditions.

Management Objectives:

1. An important objective of the District is to provide ongoing and relevant drought-related meteorological information. Beginning in 2014, the District began making available through the District's website easily accessible drought information with an emphasis on developing droughts and on any current drought conditions. At least one of the following links will be provided: updates to the US Drought Monitor map for the region, the Drought Preparedness Council Situation Report, and the TWDB Drought Page at https://waterdatafortexas.org/drought.

Performance Standards:

1. Current drought conditions information from at least one of the following will continue to be available to the public on the District's website and noted in the Annual Report submitted by the General Manager to the Board of Directors of the District: the US Drought Monitor map for the region, the Drought Preparedness Council Situation Report, or the TWDB Drought Page at https://waterdatafortexas.org/drought.

10.7. Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, or Brush Control Where Appropriate and Cost Effective

Conservation and rainwater harvesting have been determined to be appropriate goals for the District. As part of this effort, the District sponsors and participates in water conservation programs such as the Gulf Coast/ Montgomery County Water Efficiency Network, Water Wise Program, and the Home Water Works.

A visit to the District's headquarters is all that is required to realize the commitment of the District to rainwater harvesting. The entire comprehensive water conservation demonstration facility was designed as a demonstration to the citizens of Montgomery County of the positive benefits of rainwater harvesting in reducing water consumption from the Gulf Coast Aquifer. The design and subsequent construction of the various rainwater harvesting and water conservation techniques integrated into the District headquarters have not only caught the attention of local residents, but the District was awarded the 2012 Texas Rain Catcher Award from the Texas Water Development Board for the innovation demonstrated by the design of the new comprehensive water conservation demonstration facility.

After review by the Board of Directors, the General Manager, and the District's technical consultants, it has been determined that recharge enhancement, precipitation enhancement, and brush control are not appropriate groundwater management strategies for the District.

This evaluation is based on costs of operating and maintaining these programs, lack of neighboring programs in which to participate, and probable lack of effectiveness of these programs, due to the climate, hydrogeology, and physiography of the District.

Management Objectives:

1. The District seeks to promote water conservation through an active water conservation awareness program. As part of this program, the District will maintain links to recognized water conservation awareness programs such as the Gulf Coast/Montgomery County Water Efficiency Network, Water Wise Program, and the Home Water Works programs on the District's website.

2. Educational materials specific to rainwater harvesting have been developed to highlight the various water conservation techniques that are incorporated into the design of the new District headquarters. This information will be available at the main entrance to the District headquarters for visitors to take and review for potential use in homes and businesses in Montgomery County.

3. The District added an important tool at its comprehensive water conservation demonstration facility that will collect weather data 24/7 in collaboration with Texas A&M AgriLife Extension experts. The objective of installing this equipment was to generate an Evapotranspiration ("ET") estimate to help residents use their irrigation systems more efficiently by knowing the ideal amount of water needed to sustain a healthy lawn. The District will roll out the information from the program to enable commercial and residential "users" to regulate their irrigation system controllers so that they deliver only the amount of water necessary. Current measurements of ET will be maintained on the District's website.

Performance Standards:

1. Links to at least one of the water conservation awareness programs such as the Gulf Coast/Montgomery County Water Efficiency Network, Water Wise Program, and the Home Water Works programs will be provided on the District's website and noted in the Annual Report submitted by the General Manager to the Board of Directors of the District.

2. Information on the District's headquarters and rainwater harvesting capabilities will be made available during business hours for use by visitors to the facilities. A summary of this educational opportunity will be included in the Annual Report submitted by the General Manager to the Board of Directors of the District.

3. Lawn watering guidance based on current measurements of ET will continue to be maintained on the District's website throughout the active growing season

each year and noted in the Annual Report submitted by the General Manager to the Board of Directors of the District.

10.8. Desired Future Conditions

Management Objectives:

The District is committed to continually work with other members of GMA 14 to adopt, and to achieve, the most appropriate DFCs for each relevant groundwater reservoir identified in the joint planning process. The DFCs adopted by the District will support the District regulatory mission to afford an opportunity for a fair share to each owner of a common, subsurface reservoir. Because future use and landowner's choices are uncertain, in addition to hydrologic variability and uncertainty, the actual conditions of the reservoirs in the future may change. If it is determined a DFC for a particular reservoir is not being achieved, then the District may be required to modify, as warranted, production terms of District permit holders for any permitted production in the reservoir. To demonstrate the DFCs are or are not being achieved, the District will perform a scientific evaluation, referred herein as "DFC Achievement Study", based on collected monitoring and reported pumping data to demonstrate trends in reservoir conditions and how such trends in reservoir conditions compare to each applicable DFC.

After adoption of new DFCs through the joint planning process with GMA 14, the District will complete the necessary evaluations and prepare a report documenting the analysis no later than December 1st of each calendar year thereafter. Upon adoption by the District Board of Directors, the report will be published on the District's website and a copy of the report will be distributed to members of GMA 14.

Performance Standards:

Draft rules, public meeting, and hearing announcements, and available supporting materials will be included prior to rulemaking activities by the District on the District's website at lonestargcd.org. A summary of any amendments to District rules that are adopted throughout the calendar year will be included in the Annual Report submitted by the General Manager to the Board of Directors of the District.

A presentation summarizing important findings of the DFC Achievement Study will be presented to the Board of Directors during the first Board meeting following January 1 beginning in the first year after new DFCs are adopted through the joint planning process with GMA 14. Notification of completion and publication of the DFC Achievement Study will be provided to all permit holders in the District within 30 days of publication on the District website.

11. ESTIMATED HISTORICAL GROUNDWATER USE IN DISTRICT

During the development of this management plan update, the most current groundwater use information from the TWDB's Water Use Survey, for which results are presented in the TWDB Water Use Database, was utilized. Table 2 and Figures 4 and 5 present summary information regarding groundwater use in Montgomery County from 2001 through 2016. Over this period, groundwater use represents from 95.9 percent in 2001 to 84.3 percent in 2016 of total water use in Montgomery County. The rapidly changing demography of Montgomery County is well illustrated by Figures 4 and 5. Total water use has increased by more than a factor of six from 13,137 acre-feet in 1974 to 80,945 acre-feet in 2010, with the vast majority of groundwater use going to the municipal water use sector. For a more detailed breakdown of historical water use, by year, and by sector, as required by Texas Water Code Section 36.1071(e)(3)(b), please refer to **Appendix B**.

Table 2 – Water use in Montgomery County from 2001 – 2016 in acre-feet per year (AFY), (from the TWDB Water Use Survey Database).

Year	Total Groundwater Use	Total Surface Water Use	Total Water Use
2001	51,907	2,170	54,077
2002	55,125	3,094	58,219
2003	54,571	764	55,335
2004	56,540	1,571	58,111
2005	65,672	688	66,360
2006	67,265	1,012	68,277
2007	63,163	2,433	65,596
2008	71,274	3,426	74,700
2009	76,149	4,791	80,940
2010	78,191	4,340	82,531
2011	101,178	6,349	107,527
2012	88,037	2,727	90,764
2013	82,598	4,204	86,802
2014	74,915	3,704	78,619
2015	73,785	6,833	80,618
2016	68,287	12,658	80,945

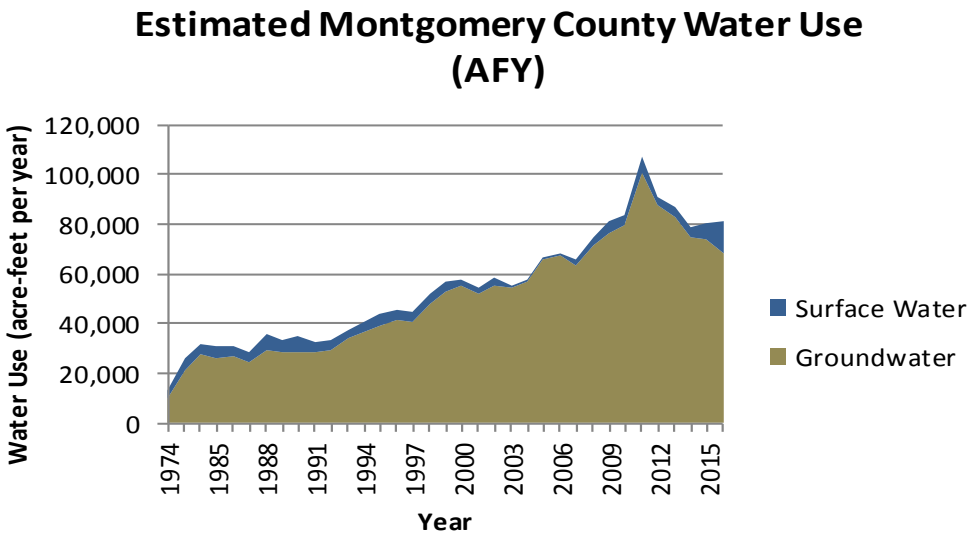

Figure 4 – Water use trends in Montgomery County from 1974 – 2016, in AFY (from the TWDB Water Use Survey Database).

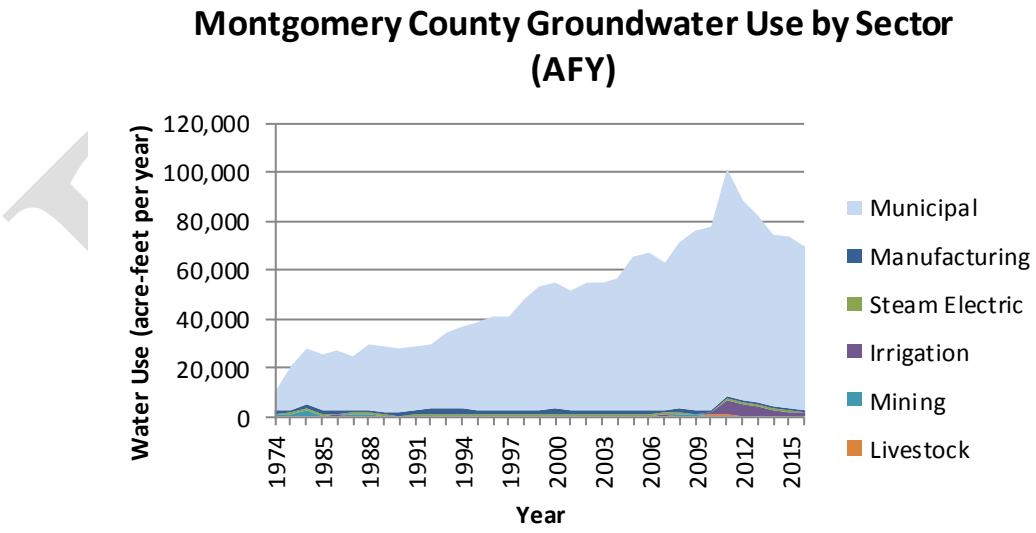

Figure 5 – Water use by sector in Montgomery County from 1974 to 2016, in AFY (from TWDB Water Use Survey Database).

12. WATER BUDGETS FOR DISTRICT

Fundamental to the management of groundwater resources is an understanding of the water budgets for the area. The Texas Water Code requires as part of developing and adopting a management plan, that information pertaining to estimates of recharge, discharge, and cross-formational flow for relevant aquifers are to be presented. This information relative to Montgomery County was provided in GAM Run 17-023[6] (see **Appendix C** for entire report).

Table 3 – Water budget estimates provided by TWDB in GAM Run 17-023.

Management Plan Requirement	Aquifer	Result (acre-feet per year)
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer	20,923
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	959
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer	26,732
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer	55,095
Estimated net annual volume of flow between each aquifer in the district	From the Catahoula Formation to the Jasper Aquifer	6,896*
	From the Yegua-Jackson subcrop to the Catahoula Formation and younger units	163

*Calculated using the groundwater availability model for the Yegua-Jackson Aquifer.

[6] Wade, S., 2018, GAM Run 17-023: Lone Star Groundwater Conservation District Management Plan: Texas Water Development Board, 10 p.

12.1. Projected Surface Water Supplies in Montgomery County

The District participates as a member of the Region H Water Planning Group, which is responsible for the development of long-range (50 year) water supply plans for the northern Gulf Coast region. As part of the Texas regional water supply planning process, estimates of water supply, water demands, water supply needs, and water management strategies to meet water supply needs are developed for a wide variety of water user groups. To ensure that groundwater conservation districts consider the comprehensive nature of the water supply landscape during development of their management plans, consideration of the planning estimates listed above are included herein.

The estimates of projected surface water supplies are taken from the 2017 State Water Plan. Summary information on projected surface water supplies is included in **Appendix B**[7]. The primary surface water supply in Montgomery County is Lake Conroe. A majority of surface water supplies are for municipal use.

12.2. Projected Water Demands in Montgomery County

As part of the Texas regional and state water planning process, estimates of water demands during drought conditions are developed on a decadal basis for the 50-year planning horizon. A summary of water demand projections for Montgomery County is included in Table 4 and provided in detail in **Appendix B**. The demographic outlook for Montgomery County is one of growth and opportunity. Population projections for Montgomery County show an increase in the population from 627,917 in 2020 to 1,946,063 in 2070, equating to a 209 percent increase in population.[8] This increase in population, along with the associated increases in industrial and other water demands, increases water demands from 110,422 acre-feet per year in 2020 to 291,791 acre-feet per year in 2070, or an approximate 164 percent increase.

Table 4 – Projected total water demands for Montgomery County included in the 2017 State Water Plan.

	Projected Total Demand for Water					
Year	2020	2030	2040	2050	2060	2070
Montgomery County	110,422	135,318	163,626	197,839	240,722	291,791

12.3. Projected Water Supply Needs in Montgomery County

During the Texas regional water planning process, after projections of water supply and water demands have been quantified, the need for additional water supplies is determined on a water user group basis and a wholesale water supply basis. The difference in projections between demands

[7] Allen, S., 2018, Estimated historical use and 2017 State Water Plan datasets: Lone Star Groundwater Conservation District: Texas Water Development Board, 5 p.

[8] Draft populations for Montgomery County from 2010 – 2070 obtained from the Texas Water Development Board Water Planning website at http://www.twdb.texas.gov/waterplanning/data/projections/2017/popproj.asp

and supplies is illustrated in Figure 6 below. Estimates of water supply needs in Montgomery County are summarized in Table 5 below and provided in detail in **Appendix B**. Estimates of projected needs are from the 2017 State Water Plan.

Table 5 – Water supply needs in the 2017 State Water Plan for Montgomery County.

	Projected Water Supply Needs					
Year	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Montgomery County	17,582	39,817	65,282	96,275	137,957	188,418

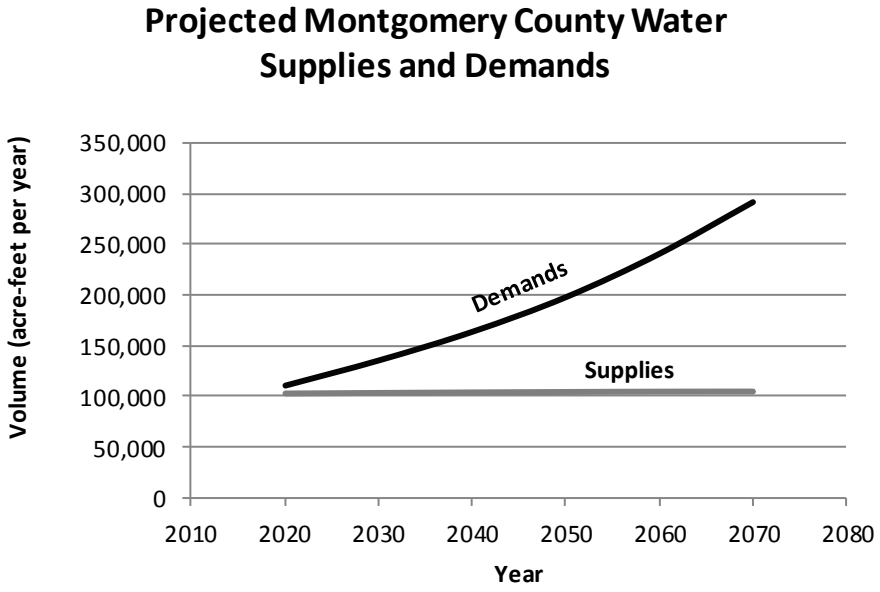

Figure 6 – Comparison of water supply demands and supplies in Montgomery County reported in the 2017 State Water Plan.

12.4. Water Management Strategies Recommended to Meet Water Supply Needs in Montgomery County

To meet the needs of water user groups in the Montgomery County, the 2017 State Water Plan includes a variety of water management strategies that, when implemented, will meet the projected water supply needs. For a complete list of water management strategies see **Appendix B**. Important water management strategies included in the 2017 State Water Plan for Montgomery County include water conservation, wastewater reclamation, the Lake Livingston/Wallisville Reservoir project, and brackish groundwater development.

Appendix A - Groundwater Conservation District Management Plan Checklist from the Texas Water Development Board

Texas Water Development Board

Groundwater Conservation District Management Plan Checklist, effective December 6, 2012

District name: ☐ Official review ☐ Prereview

Reviewing staff: **Date plan received:** **Date plan reviewed:**

A management plan shall contain, unless explained as not applicable, the following elements, 31 TAC §356.52(a):

	Citation of rule	Citation of statute	Present in plan and administratively complete	Source of data	Evidence that best available data was used	Notes
Is a paper hard copy of the plan available?	31 TAC §356.53(a)(1)					
Is an electronic copy of the plan available?	31 TAC §356.53(a)(2)					
1. Is an estimate of the modeled available groundwater in the District based on the desired future condition established under Section 36.108 included?	31 TAC §356.52(a)(5)(A)	TWC §36.1071(e)(3)(A)				p.
2. Is an estimate of the amount of groundwater being used within the District on an annual basis for at least the most recent five years included?	31 TAC §356.52(a)(5)(B); §356.10(2)	TWC §36.1071(e)(3)(B)				p.
For sections 3-5 below, each district must use the groundwater availability modeling information provided by the TWDB in conjunction with available site-specific information provided by the district when developing the required estimates, 31 TAC §356.52(c):						
3. Is an estimate of the annual amount of recharge, from precipitation, if any, to the groundwater resources within the District included?	31 TAC §356.52(a)(5)(C)	TWC §36.1071(e)(3)(C)				p.
4. For each aquifer in the district, is an estimate of the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams and rivers, included?	31 TAC §356.52(a)(5)(D)	TWC §36.1071(e)(3)(D)				p.
5. Is an estimate of the annual volume of flow						
a) into the District within each aquifer,	31 TAC §356.52(a)(5)(E)	TWC §36.1071(e)(3)(E)				p.
b) out of the District within each aquifer,						p.
c) and between aquifers in the District,						p.
if a groundwater availability model is available, included?						
6. Is an estimate of the projected surface water supply within the District according to the most recently adopted state water plan included?	31 TAC §356.52(a)(5)(F)	TWC §36.1071(e)(3)(F)				p.
7. Is an estimate of the projected total demand for water within the District according to the most recently adopted state water plan included?	31 TAC §356.52(a)(5)(G)	TWC §36.1071(e)(3)(G)				p.
8. Did the District consider and include the water supply needs from the adopted state water plan?		TWC §36.1071(e)(4)				p.
9. Did the District consider and include the water management strategies from the adopted state water plan?		TWC §36.1071(e)(4)				p.
10. Did the district include details of how it will manage groundwater supplies in the district	31 TAC §356.52(a)(4)					p.
11. Are the actions, procedures, performance, and avoidance necessary to effectuate the management plan, including specifications and proposed rules, all specified in as much detail as possible, included in the plan?		TWC §36.1071(e)(2)				p.
12. Was evidence that the plan was adopted, after notice and hearing, included? Evidence includes the posted agenda, meeting minutes, and copies of the notice printed in the newspaper(s) and/or copies of certified receipts from the county courthouse(s).	31 TAC §356.53(a)(3)	TWC §36.1071(a)				p.
13. Was evidence that, following notice and hearing, the District coordinated in the development of its management plan with regional surface water management entities?	31 TAC §356.51	TWC §36.1071(a)				p.
14. Has any available site-specific information been provided by the district to the executive administrator for review and comment before being used in the management plan when developing the estimates required in subsections 31 TAC §356.52(a)(5)(C), (D), and (E)?	31 TAC §356.52(c)	TWC §36.1071(h)				p.

Mark an affirmative response with YES
Mark a negative response with NO
Mark a non-applicable checklist item with N/A

Management goals required to be addressed unless declared not applicable	Management goal (time-based and quantifiable) 31 TAC §356.51	Methodology for tracking progress 31TAC §356.52(a)(4)	Management objective(s) (specific and time-based statements of future outcomes) 31 TAC §356.52 (a)(2)	Performance standard(s) (measures used to evaluate the effectiveness of district activities) 31 TAC §356.52 (a)(3)	Notes
Providing the most efficient use of groundwater 31 TAC 356.52(a)(1)(A); TWC §36.1071(a)(1)	15)	16)	17)	18)	p.
Controlling and preventing waste of groundwater 31 TAC 356.52(a)(1)(B); TWC §36.1071(a)(2)	19)	20)	21)	22)	p.
Controlling and preventing subsidence 31 TAC 356.52(a)(1)(C); TWC §36.1071(a)(3)	23)	24)	25)	26)	p.
Addressing conjunctive surface water management issues 31 TAC 356.52(a)(1)(D); TWC §36.1071(a)(4)	27)	28)	29)	30)	p.
Addressing natural resource issues that impact the use and availability of groundwater and which are impacted by the use of groundwater 31 TAC 356.52(a)(1)(E); TWC §36.1071(a)(5)	31)	32)	33)	34)	p.
Addressing drought conditions 31 TAC 356.52(a)(1)(F); TWC §36.1071(a)(6)	35)	36)	37)	38)	p.
Addressing	39)	40)	41)	42)	
a) conservation,	39a)	40a)	41a)	42a)	p.
b) recharge enhancement,	39b)	40b)	41b)	42b)	p.
c) rainwater harvesting,	39c)	40c)	41c)	42c)	p.
d) precipitation enhancement, and	39d)	40d)	41d)	42d)	p.
e) brush control	39e)	40e)	41e)	42e)	p.
where appropriate and cost effective 31 TAC 356.52(a)(1)(G); TWC §36.1071(a)(7)					
Addressing the desired future conditions established under TWC §36.108. 31 TAC 356.52(a)(1)(H); TWC §36.1071(a)(8)	43)	44)	45)	46)	p.
Does the plan identify the performance standards and management objectives for effecting the plan? 31 TAC §356.52(a)(2)&(3); TWC §36.1071(e)(1)			47)	48)	
Mark required elements that are present in the plan with YES Mark any required elements that are missing from the plan with NO Mark plan elements that have been indicated as not applicable to the district with N/A					

Appendix B - Estimated Historical Water Use and 2017 State Water Plan Datasets for Lone Star Groundwater Conservation District - Provided by the Texas Water Development Board

Estimated Historical Water Use And 2017 State Water Plan Datasets:

Lone Star Groundwater Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
August 13, 2018

GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in this part are:

1. Estimated Historical Water Use (checklist item 2)

   from the TWDB Historical Water Use Survey (WUS)

2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)

   from the 2017 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report for the District (checklist items 3 through 5). The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Dr. Shirley Wade, shirley.wade@twdb.texas.gov, (512) 936-0883.

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2017 SWP data available as of 8/13/2018. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2017 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2017 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317).

Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2017. TWDB staff anticipates the calculation and posting of these estimates at a later date.

MONTGOMERY COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2016	GW	65,750	633	0	385	1,048	471	68,287
	SW	7,667	0	0	3,597	1,369	25	12,658
2015	GW	70,530	695	0	480	1,612	468	73,785
	SW	1,233	46	0	4,362	1,167	25	6,833
2014	GW	70,786	502	0	632	2,518	477	74,915
	SW	239	51	0	2,344	1,045	25	3,704
2013	GW	76,952	648	0	620	3,949	429	82,598
	SW	300	56	0	2,674	1,151	23	4,204
2012	GW	81,593	685	4	653	4,675	427	88,037
	SW	0	52	0	1,686	967	22	2,727
2011	GW	93,157	669	388	597	5,753	614	101,178
	SW	0	55	415	4,000	1,847	32	6,349
2010	GW	75,478	1,248	392	3	467	603	78,191
	SW	0	51	419	3,255	583	32	4,340
2009	GW	73,630	1,502	387	2	129	499	76,149
	SW	395	43	413	3,343	571	26	4,791
2008	GW	67,806	1,779	383	620	187	499	71,274
	SW	155	51	408	2,235	551	26	3,426
2007	GW	60,270	1,443	3	657	244	546	63,163
	SW	155	341	0	1,752	156	29	2,433
2006	GW	64,244	1,857	3	727	0	434	67,265
	SW	155	66	0	232	536	23	1,012
2005	GW	62,874	1,862	4	369	65	498	65,672
	SW	155	69	0	3	435	26	688
2004	GW	54,151	1,704	5	418	50	212	56,540
	SW	1,061	53	0	2	138	317	1,571
2003	GW	51,995	1,826	4	484	50	212	54,571
	SW	134	0	0	1	311	318	764
2002	GW	52,234	1,726	91	810	66	198	55,125
	SW	277	0	11	2,509	0	297	3,094
2001	GW	48,879	1,794	161	810	66	197	51,907
	SW	288	0	0	1,586	0	296	2,170

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

MONTGOMERY COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
H	CONROE	SAN JACINTO	CONROE LAKE/RESERVOIR	8,624	8,624	8,624	8,624	8,624	8,624
H	COUNTY-OTHER, MONTGOMERY	SAN JACINTO	CONROE LAKE/RESERVOIR	1,129	1,129	1,129	1,129	1,129	1,129
H	IRRIGATION, MONTGOMERY	SAN JACINTO	CONROE LAKE/RESERVOIR	1,145	1,145	1,145	1,145	1,145	1,145
H	IRRIGATION, MONTGOMERY	SAN JACINTO	SAN JACINTO RUN-OF-RIVER	25	25	25	25	25	25
H	MONTGOMERY COUNTY WCID #1	SAN JACINTO	CONROE LAKE/RESERVOIR	195	195	195	195	195	195
H	OAK RIDGE NORTH	SAN JACINTO	CONROE LAKE/RESERVOIR	375	375	375	375	375	375
H	RAYFORD ROAD MUD	SAN JACINTO	CONROE LAKE/RESERVOIR	642	642	642	642	642	642
H	SOUTHERN MONTGOMERY COUNTY MUD	SAN JACINTO	CONROE LAKE/RESERVOIR	668	668	668	668	668	668
H	STEAM ELECTRIC POWER, MONTGOMERY	SAN JACINTO	CONROE LAKE/RESERVOIR	7,841	7,841	7,841	7,841	7,841	7,841
H	THE WOODLANDS	SAN JACINTO	CONROE LAKE/RESERVOIR	15,250	15,250	15,250	15,250	15,250	15,250
H	THE WOODLANDS	SAN JACINTO	SAN JACINTO RUN-OF-RIVER	116	116	116	116	116	116
	Sum of Projected Surface Water Supplies (acre-feet)			**36,010**	**36,010**	**36,010**	**36,010**	**36,010**	**36,010**

Projected Water Demands
TWDB 2017 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

MONTGOMERY COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
H	BENDERS LANDING WATER SYSTEM	SAN JACINTO	2,188	3,456	4,762	6,070	7,373	7,372
H	CLEVELAND	SAN JACINTO	6	8	10	14	18	23
H	CONROE	SAN JACINTO	13,336	15,705	17,863	19,899	22,144	24,564
H	COUNTY-OTHER, MONTGOMERY	SAN JACINTO	35,816	50,901	68,894	91,167	119,227	153,649
H	CUT AND SHOOT	SAN JACINTO	116	120	134	158	190	235
H	DOBBIN-PLANTERSVILLE WSC	SAN JACINTO	642	840	1,117	1,485	1,972	2,614
H	EAST PLANTATION UD	SAN JACINTO	212	213	244	278	320	331
H	HOUSTON	SAN JACINTO	981	1,375	1,810	2,233	2,654	2,776
H	INDIGO LAKE WATER SYSTEM	SAN JACINTO	1,133	1,548	2,212	3,156	4,491	6,671
H	IRRIGATION, MONTGOMERY	SAN JACINTO	737	737	737	737	737	737
H	KINGS MANOR MUD	SAN JACINTO	224	225	231	236	242	246
H	LAKE WINDCREST WATER SYSTEM	SAN JACINTO	916	1,026	1,298	1,681	2,219	2,972
H	LIVESTOCK, MONTGOMERY	SAN JACINTO	521	521	521	521	521	521
H	MAGNOLIA	SAN JACINTO	694	823	997	1,256	1,637	2,230
H	MANUFACTURING, MONTGOMERY	SAN JACINTO	2,135	2,388	2,640	2,863	3,107	3,372
H	MINING, MONTGOMERY	SAN JACINTO	1,453	1,363	1,077	921	806	728
H	MONTGOMERY	SAN JACINTO	631	1,164	1,442	1,722	2,008	2,459
H	MONTGOMERY COUNTY MUD #15	SAN JACINTO	497	525	598	699	850	1,065
H	MONTGOMERY COUNTY MUD #18	SAN JACINTO	1,285	1,644	1,861	2,080	2,302	2,842
H	MONTGOMERY COUNTY MUD #19	SAN JACINTO	261	253	247	245	247	249
H	MONTGOMERY COUNTY MUD #8	SAN JACINTO	445	462	506	554	607	728
H	MONTGOMERY COUNTY MUD #83	SAN JACINTO	281	289	298	307	316	323
H	MONTGOMERY COUNTY MUD #89	SAN JACINTO	335	337	341	366	402	415
H	MONTGOMERY COUNTY MUD #9	SAN JACINTO	507	520	584	651	720	862
H	MONTGOMERY COUNTY MUD #94	SAN JACINTO	592	595	657	720	783	782

Projected Water Demands
TWDB 2017 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
H	MONTGOMERY COUNTY UD #2	SAN JACINTO	172	168	172	183	197	217
H	MONTGOMERY COUNTY UD #3	SAN JACINTO	267	303	305	347	438	557
H	MONTGOMERY COUNTY UD #4	SAN JACINTO	509	642	637	724	923	1,184
H	MONTGOMERY COUNTY WCID #1	SAN JACINTO	255	262	274	299	328	361
H	NEW CANEY MUD	SAN JACINTO	742	774	818	889	992	1,120
H	OAK RIDGE NORTH	SAN JACINTO	559	569	595	609	616	618
H	PANORAMA VILLAGE	SAN JACINTO	585	586	617	663	730	819
H	PATTON VILLAGE	SAN JACINTO	151	159	177	199	227	263
H	POINT AQUARIUS MUD	SAN JACINTO	339	336	355	383	424	478
H	PORTER SUD	SAN JACINTO	1,693	2,116	2,543	2,963	3,383	3,731
H	RAYFORD ROAD MUD	SAN JACINTO	994	1,015	1,080	1,159	1,249	1,282
H	RIVER PLANTATION MUD	SAN JACINTO	511	534	651	767	895	944
H	ROMAN FOREST	SAN JACINTO	320	317	348	391	449	524
H	SHENANDOAH	SAN JACINTO	1,292	1,667	1,820	1,923	2,046	2,203
H	SOUTHERN MONTGOMERY COUNTY MUD	SAN JACINTO	861	865	865	870	880	894
H	SPLENDORA	SAN JACINTO	180	190	222	265	322	394
H	SPRING CREEK UD	SAN JACINTO	645	689	715	773	851	877
H	STAGECOACH	SAN JACINTO	37	44	71	110	172	279
H	STANLEY LAKE MUD	SAN JACINTO	569	630	807	1,047	1,365	1,765
H	STEAM ELECTRIC POWER, MONTGOMERY	SAN JACINTO	8,537	9,981	11,741	13,886	16,502	19,611
H	THE WOODLANDS	SAN JACINTO	23,987	25,132	26,326	27,820	30,098	32,896
H	WESTWOOD NORTH WSC	SAN JACINTO	351	369	410	451	492	551
H	WILLIS	SAN JACINTO	817	826	874	951	1,068	1,232
H	WOODBRANCH	SAN JACINTO	105	106	122	148	182	225
	Sum of Projected Water Demands (acre-feet)		**110,422**	**135,318**	**163,626**	**197,839**	**240,722**	**291,791**

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

MONTGOMERY COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
H	BENDERS LANDING WATER SYSTEM	SAN JACINTO	-516	-1,784	-3,090	-4,398	-5,701	-5,700
H	CLEVELAND	SAN JACINTO	18	16	14	10	6	1
H	CONROE	SAN JACINTO	-604	-2,973	-5,131	-7,167	-9,412	-11,832
H	COUNTY-OTHER, MONTGOMERY	SAN JACINTO	-11,751	-26,836	-44,829	-67,102	-95,162	-129,584
H	CUT AND SHOOT	SAN JACINTO	64	60	46	22	-10	-55
H	DOBBIN-PLANTERSVILLE WSC	SAN JACINTO	-216	-414	-691	-1,059	-1,546	-2,188
H	EAST PLANTATION UD	SAN JACINTO	-31	-32	-63	-97	-139	-150
H	HOUSTON	SAN JACINTO	117	0	0	0	0	0
H	INDIGO LAKE WATER SYSTEM	SAN JACINTO	-267	-682	-1,346	-2,290	-3,625	-5,805
H	IRRIGATION, MONTGOMERY	SAN JACINTO	912	912	912	912	912	912
H	KINGS MANOR MUD	SAN JACINTO	0	0	0	0	0	0
H	LAKE WINDCREST WATER SYSTEM	SAN JACINTO	-216	-326	-598	-981	-1,519	-2,272
H	LIVESTOCK, MONTGOMERY	SAN JACINTO	-123	-123	-123	-123	-123	-123
H	MAGNOLIA	SAN JACINTO	-65	-194	-368	-627	-1,008	-1,601
H	MANUFACTURING, MONTGOMERY	SAN JACINTO	-727	-980	-1,232	-1,455	-1,699	-1,964
H	MINING, MONTGOMERY	SAN JACINTO	-343	-253	33	189	304	382
H	MONTGOMERY	SAN JACINTO	-149	-682	-960	-1,240	-1,526	-1,977
H	MONTGOMERY COUNTY MUD #15	SAN JACINTO	-117	-145	-218	-319	-470	-685
H	MONTGOMERY COUNTY MUD #18	SAN JACINTO	541	385	168	-51	-273	-813
H	MONTGOMERY COUNTY MUD #19	SAN JACINTO	98	106	112	114	112	110
H	MONTGOMERY COUNTY MUD #8	SAN JACINTO	440	423	379	331	278	157
H	MONTGOMERY COUNTY MUD #83	SAN JACINTO	48	40	31	22	13	6
H	MONTGOMERY COUNTY MUD #89	SAN JACINTO	252	250	246	221	185	172
H	MONTGOMERY COUNTY MUD #9	SAN JACINTO	329	316	252	185	116	-26
H	MONTGOMERY COUNTY MUD #94	SAN JACINTO	-140	-143	-205	-268	-331	-330
H	MONTGOMERY COUNTY UD #2	SAN JACINTO	92	96	92	81	67	47

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
H	MONTGOMERY COUNTY UD #3	SAN JACINTO	245	227	266	244	151	-72
H	MONTGOMERY COUNTY UD #4	SAN JACINTO	246	212	293	247	50	-107
H	MONTGOMERY COUNTY WCID #1	SAN JACINTO	-3	-10	-22	-47	-76	-109
H	NEW CANEY MUD	SAN JACINTO	-113	-145	-189	-260	-363	-491
H	OAK RIDGE NORTH	SAN JACINTO	-22	-32	-58	-72	-79	-81
H	PANORAMA VILLAGE	SAN JACINTO	-24	-25	-56	-102	-169	-258
H	PATTON VILLAGE	SAN JACINTO	-36	-44	-62	-84	-112	-148
H	POINT AQUARIUS MUD	SAN JACINTO	-46	-43	-62	-90	-131	-185
H	PORTER SUD	SAN JACINTO	-1,074	-1,497	-1,924	-2,344	-2,764	-3,112
H	RAYFORD ROAD MUD	SAN JACINTO	-48	-69	-134	-213	-303	-336
H	RIVER PLANTATION MUD	SAN JACINTO	177	154	37	-79	-207	-256
H	ROMAN FOREST	SAN JACINTO	-76	-73	-104	-147	-205	-280
H	SHENANDOAH	SAN JACINTO	-404	-779	-932	-1,035	-1,158	-1,315
H	SOUTHERN MONTGOMERY COUNTY MUD	SAN JACINTO	-9	-13	-13	-18	-28	-42
H	SPLENDORA	SAN JACINTO	311	301	269	226	169	97
H	SPRING CREEK UD	SAN JACINTO	-152	-196	-222	-280	-358	-384
H	STAGECOACH	SAN JACINTO	-13	-20	-47	-86	-148	-255
H	STANLEY LAKE MUD	SAN JACINTO	248	294	224	36	-282	-682
H	STEAM ELECTRIC POWER, MONTGOMERY	SAN JACINTO	5,649	4,205	2,445	300	-2,316	-5,425
H	THE WOODLANDS	SAN JACINTO	166	-979	-2,173	-3,667	-5,945	-8,743
H	WESTWOOD NORTH WSC	SAN JACINTO	-83	-101	-142	-183	-224	-283
H	WILLIS	SAN JACINTO	-193	-202	-250	-327	-444	-608
H	WOODBRANCH	SAN JACINTO	-21	-22	-38	-64	-98	-141
	Sum of Projected Water Supply Needs (acre-feet)		**-17,582**	**-39,817**	**-65,282**	**-96,275**	**-137,954**	**-188,418**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

MONTGOMERY COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
BENDERS LANDING WATER SYSTEM, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, BENDERS LANDING WATER SYSTEM	DEMAND REDUCTION [MONTGOMERY]	18	71	133	250	304	295
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	4,717	4,729
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	97	1,196	2,440	3,631	0	0
		115	**1,267**	**2,573**	**3,881**	**5,021**	**5,024**
CLEVELAND, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, CLEVELAND	DEMAND REDUCTION [MONTGOMERY]	0	0	0	1	1	1
WATER LOSS REDUCTION, CLEVELAND	DEMAND REDUCTION [MONTGOMERY]	0	0	1	1	2	3
		0	**0**	**1**	**2**	**3**	**4**
CONROE, SAN JACINTO (H)							
CONROE BRACKISH GROUNDWATER DESALINATION	GULF COAST AQUIFER [MONTGOMERY]	5,600	5,600	5,600	5,600	5,600	5,600
MUNICIPAL CONSERVATION, CONROE	DEMAND REDUCTION [MONTGOMERY]	113	321	499	821	912	981
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	2,045	3,940	5,666	7,295	9,091	10,828
		7,758	**9,861**	**11,765**	**13,716**	**15,603**	**17,409**
COUNTY-OTHER, MONTGOMERY, SAN JACINTO (H)							
BRACKISH GROUNDWATER SUPPLIES	GULF COAST AQUIFER [MONTGOMERY]	0	0	0	0	3,622	10,000
MUNICIPAL CONSERVATION, COUNTY-OTHER - MONTGOMERY COUNTY	DEMAND REDUCTION [MONTGOMERY]	305	1,040	1,921	3,759	4,913	6,137
NEW / EXPANDED CONTRACT WITH SJRA	CONROE LAKE/RESERVOIR [RESERVOIR]	631	1,606	16,235	11,771	5,344	199
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	23,542	43,304	37,613
NEW / EXPANDED CONTRACT WITH SJRA - REGIONAL RETURN FLOWS	INDIRECT REUSE [HARRIS]	0	0	0	0	0	31,422
SJRA CATAHOULA AQUIFER SUPPLIES	GULF COAST AQUIFER [MONTGOMERY]	3,920	3,920	3,920	3,920	3,920	3,920

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	5,311	7,799	4,921	1,554	2,005	0
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	4,728	7,231	9,711	10,915	12,102	12,840
WASTEWATER RECLAMATION FOR MUNICIPAL IRRIGATION	DIRECT REUSE [MONTGOMERY]	0	2,684	5,827	9,680	14,492	20,387
		14,895	**24,280**	**42,535**	**65,141**	**89,702**	**122,518**
CUT AND SHOOT, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, CUT AND SHOOT	DEMAND REDUCTION [MONTGOMERY]	1	2	4	7	8	9
WATER LOSS REDUCTION, CUT AND SHOOT	DEMAND REDUCTION [MONTGOMERY]	1	3	3	4	4	5
		2	**5**	**7**	**11**	**12**	**14**
DOBBIN-PLANTERSVILLE WSC, SAN JACINTO (H)							
BRACKISH GROUNDWATER SUPPLIES	GULF COAST AQUIFER [MONTGOMERY]	153	327	570	890	1,337	1,930
MUNICIPAL CONSERVATION, DOBBIN-PLANTERSVILLE WSC	DEMAND REDUCTION [MONTGOMERY]	5	17	31	61	81	104
WATER LOSS REDUCTION, DOBBIN-PLANTERSVILLE WSC	DEMAND REDUCTION [MONTGOMERY]	9	21	41	59	79	105
		167	**365**	**642**	**1,010**	**1,497**	**2,139**
EAST PLANTATION UD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, EAST PLANTATION UD	DEMAND REDUCTION [MONTGOMERY]	2	4	7	11	13	13
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	5	16
RIVER PLANTATION AND EAST PLANTATION JOINT GRP	DIRECT REUSE [MONTGOMERY]	0	65	65	65	65	65
		2	**69**	**72**	**76**	**83**	**94**
HOUSTON, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, HOUSTON	DEMAND REDUCTION [MONTGOMERY]	8	28	51	92	109	111
WATER LOSS REDUCTION, HOUSTON	DEMAND REDUCTION [MONTGOMERY]	14	38	71	111	134	140
		22	**66**	**122**	**203**	**243**	**251**
INDIGO LAKE WATER SYSTEM , SAN JACINTO (H)							
MUNICIPAL CONSERVATION, INDIGO LAKE WATER SYSTEM	DEMAND REDUCTION [MONTGOMERY]	10	32	62	130	185	267

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	2,464
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	344	936	1,767	2,993	2,540
WATER LOSS REDUCTION, INDIGO LAKE WATER SYSTEM	DEMAND REDUCTION [MONTGOMERY]	15	39	81	126	180	267
		25	**415**	**1,079**	**2,023**	**3,358**	**5,538**
KINGS MANOR MUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, KINGS MANOR MUD	DEMAND REDUCTION [MONTGOMERY]	2	5	6	10	10	10
		2	**5**	**6**	**10**	**10**	**10**
LAKE WINDCREST WATER SYSTEM , SAN JACINTO (H)							
MUNICIPAL CONSERVATION, LAKE WINDCREST WATER SYSTEM	DEMAND REDUCTION [MONTGOMERY]	8	21	36	69	91	119
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	733	821	1,038	1,345	1,775	2,378
WATER LOSS REDUCTION, LAKE WINDCREST WATER SYSTEM	DEMAND REDUCTION [MONTGOMERY]	12	26	47	67	89	119
		753	**868**	**1,121**	**1,481**	**1,955**	**2,616**
MAGNOLIA, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MAGNOLIA	DEMAND REDUCTION [MONTGOMERY]	6	17	28	52	67	89
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	0	110	331	681	1,229
WATER LOSS REDUCTION, MAGNOLIA	DEMAND REDUCTION [MONTGOMERY]	9	21	36	50	66	89
		15	**38**	**174**	**433**	**814**	**1,407**
MANUFACTURING, MONTGOMERY, SAN JACINTO (H)							
INDUSTRIAL CONSERVATION, MONTGOMERY COUNTY	DEMAND REDUCTION [MONTGOMERY]	26	58	96	139	187	242
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	1,287
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	266	487	701	881	1,077	0
		292	**545**	**797**	**1,020**	**1,264**	**1,529**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
MONTGOMERY, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY	DEMAND REDUCTION [MONTGOMERY]	5	24	40	71	83	98
NEW / EXPANDED CONTRACT WITH SJRA	CONROE LAKE/RESERVOIR [RESERVOIR]	0	509	771	0	0	0
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	1,020	1,294	1,730
		5	**533**	**811**	**1,091**	**1,377**	**1,828**
MONTGOMERY COUNTY MUD #15, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #15	DEMAND REDUCTION [MONTGOMERY]	4	11	17	29	35	43
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	17	84	173	318	525
		4	**28**	**101**	**202**	**353**	**568**
MONTGOMERY COUNTY MUD #18, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #18	DEMAND REDUCTION [MONTGOMERY]	11	34	52	86	95	114
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	403
		11	**34**	**52**	**86**	**95**	**517**
MONTGOMERY COUNTY MUD #19, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #19	DEMAND REDUCTION [MONTGOMERY]	2	5	7	10	10	10
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	209	202	198	196	198	199
WATER LOSS REDUCTION, MONTGOMERY COUNTY MUD #19	DEMAND REDUCTION [MONTGOMERY]	3	6	9	10	10	10
		214	**213**	**214**	**216**	**218**	**219**
MONTGOMERY COUNTY MUD #8, SAN JACINTO (H)							
MONTGOMERY COUNTY MUDS #8 AND #9 REUSE	INDIRECT REUSE [MONTGOMERY]	163	163	163	163	163	163
MONTGOMERY COUNTY MUDS #8 AND #9 REUSE	INDIRECT REUSE [WALKER]	677	677	677	677	677	677
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #8	DEMAND REDUCTION [MONTGOMERY]	4	9	14	23	25	29
		844	**849**	**854**	**863**	**865**	**869**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
MONTGOMERY COUNTY MUD #83, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #83	DEMAND REDUCTION [MONTGOMERY]	2	6	8	13	13	13
		2	**6**	**8**	**13**	**13**	**13**
MONTGOMERY COUNTY MUD #89, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #89	DEMAND REDUCTION [MONTGOMERY]	3	7	10	15	17	17
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	268	270	273	293	322	332
WATER LOSS REDUCTION, MONTGOMERY COUNTY MUD #89	DEMAND REDUCTION [MONTGOMERY]	4	9	12	15	16	17
		275	**286**	**295**	**323**	**355**	**366**
MONTGOMERY COUNTY MUD #9, SAN JACINTO (H)							
MONTGOMERY COUNTY MUDS #8 AND #9 REUSE	INDIRECT REUSE [MONTGOMERY]	163	163	163	163	163	163
MONTGOMERY COUNTY MUDS #8 AND #9 REUSE	INDIRECT REUSE [WALKER]	677	677	677	677	677	677
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #9	DEMAND REDUCTION [MONTGOMERY]	4	11	16	27	30	34
		844	**851**	**856**	**867**	**870**	**874**
MONTGOMERY COUNTY MUD #94, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY MUD #94	DEMAND REDUCTION [MONTGOMERY]	5	12	18	30	32	31
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	0	47	98	159	159
		5	**12**	**65**	**128**	**191**	**190**
MONTGOMERY COUNTY UD #2, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY UD #2	DEMAND REDUCTION [MONTGOMERY]	1	3	5	8	8	9
		1	**3**	**5**	**8**	**8**	**9**
MONTGOMERY COUNTY UD #3, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY UD #3	DEMAND REDUCTION [MONTGOMERY]	2	6	9	14	18	22
		2	**6**	**9**	**14**	**18**	**22**
MONTGOMERY COUNTY UD #4, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY UD #4	DEMAND REDUCTION [MONTGOMERY]	4	13	18	30	38	47
		4	**13**	**18**	**30**	**38**	**47**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
MONTGOMERY COUNTY WCID #1, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, MONTGOMERY COUNTY WCID #1	DEMAND REDUCTION [MONTGOMERY]	2	5	8	12	14	14
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	9	15	24	44	67	94
WATER LOSS REDUCTION, MONTGOMERY COUNTY WCID #1	DEMAND REDUCTION [MONTGOMERY]	3	7	10	12	13	14
		14	**27**	**42**	**68**	**94**	**122**
NEW CANEY MUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, NEW CANEY MUD	DEMAND REDUCTION [MONTGOMERY]	6	16	23	37	41	45
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	0	0	29	128	252
		6	**16**	**23**	**66**	**169**	**297**
OAK RIDGE NORTH, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, OAK RIDGE NORTH	DEMAND REDUCTION [MONTGOMERY]	5	12	17	25	25	25
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	73	81	102	113	119	120
		78	**93**	**119**	**138**	**144**	**145**
PANORAMA VILLAGE, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, PANORAMA VILLAGE	DEMAND REDUCTION [MONTGOMERY]	5	12	17	27	30	33
NEW / EXPANDED CONTRACT WITH SJRA	CONROE LAKE/RESERVOIR [RESERVOIR]	19	13	39	0	0	0
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	75	139	225
		24	**25**	**56**	**102**	**169**	**258**
PATTON VILLAGE, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, PATTON VILLAGE	DEMAND REDUCTION [MONTGOMERY]	1	3	5	8	9	11
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	1	15	32	58	90
WATER LOSS REDUCTION, PATTON VILLAGE	DEMAND REDUCTION [MONTGOMERY]	2	4	6	8	9	11
		3	**8**	**26**	**48**	**76**	**112**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
POINT AQUARIUS MUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, POINT AQUARIUS MUD	DEMAND REDUCTION [MONTGOMERY]	3	7	10	16	17	19
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	0	0	0	6	56
WATER LOSS REDUCTION, POINT AQUARIUS MUD	DEMAND REDUCTION [MONTGOMERY]	5	9	13	15	17	19
		8	**16**	**23**	**31**	**40**	**94**
PORTER SUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, PORTER SUD	DEMAND REDUCTION [MONTGOMERY]	14	43	71	122	139	149
PORTER SUD JOINT GRP	INDIRECT REUSE [MONTGOMERY]	2,240	2,240	2,240	2,240	2,299	2,623
WATER LOSS REDUCTION, PORTER SUD	DEMAND REDUCTION [MONTGOMERY]	23	54	93	119	135	149
		2,277	**2,337**	**2,404**	**2,481**	**2,573**	**2,921**
RAYFORD ROAD MUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, RAYFORD ROAD MUD	DEMAND REDUCTION [MONTGOMERY]	8	21	30	48	51	51
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	153	170	222	285	357	384
		161	**191**	**252**	**333**	**408**	**435**
RIVER PLANTATION MUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, RIVER PLANTATION MUD	DEMAND REDUCTION [MONTGOMERY]	4	11	18	32	37	38
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	0	37
RIVER PLANTATION AND EAST PLANTATION JOINT GRP	DIRECT REUSE [MONTGOMERY]	0	27	27	27	27	27
WATER LOSS REDUCTION, RIVER PLANTATION MUD	DEMAND REDUCTION [MONTGOMERY]	6	8	9	11	13	14
		10	**46**	**54**	**70**	**77**	**116**
ROMAN FOREST, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, ROMAN FOREST	DEMAND REDUCTION [MONTGOMERY]	3	6	10	16	18	21
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	0	5	39	93	162
WATER LOSS REDUCTION, ROMAN FOREST	DEMAND REDUCTION [MONTGOMERY]	4	8	13	16	18	21
		7	**14**	**28**	**71**	**129**	**204**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
SHENANDOAH, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, SHENANDOAH	DEMAND REDUCTION [MONTGOMERY]	11	34	51	79	84	88
NEW / EXPANDED CONTRACT WITH SJRA	CONROE LAKE/RESERVOIR [RESERVOIR]	101	427	68	0	0	0
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	132	245	392
PANORAMA AND SHENANDOAH JOINT GRP	GULF COAST AQUIFER [MONTGOMERY]	0	0	472	472	472	472
WATER LOSS REDUCTION, SHENANDOAH	DEMAND REDUCTION [MONTGOMERY]	17	43	66	77	82	88
		129	**504**	**657**	**760**	**883**	**1,040**
SOUTHERN MONTGOMERY COUNTY MUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, SOUTHERN MONTGOMERY COUNTY MUD	DEMAND REDUCTION [MONTGOMERY]	7	18	24	36	36	36
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	21	24	24	28	36	47
		28	**42**	**48**	**64**	**72**	**83**
SPLENDORA, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, SPLENDORA	DEMAND REDUCTION [MONTGOMERY]	2	4	6	11	13	16
WATER LOSS REDUCTION, SPLENDORA	DEMAND REDUCTION [MONTGOMERY]	2	4	4	5	6	7
		4	**8**	**10**	**16**	**19**	**23**
SPRING CREEK UD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, SPRING CREEK UD	DEMAND REDUCTION [MONTGOMERY]	5	14	20	32	35	35
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	516	551	572	618	681	702
		521	**565**	**592**	**650**	**716**	**737**
STAGECOACH, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, STAGECOACH	DEMAND REDUCTION [MONTGOMERY]	0	1	2	5	7	11
NEW / EXPANDED CONTRACT WITH SJRA	CONROE LAKE/RESERVOIR [RESERVOIR]	6	11	35	0	0	0

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	70	127	226
WATER LOSS REDUCTION, STAGECOACH	DEMAND REDUCTION [MONTGOMERY]	0	1	3	4	7	11
		6	**13**	**40**	**79**	**141**	**248**
STANLEY LAKE MUD, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, STANLEY LAKE MUD	DEMAND REDUCTION [MONTGOMERY]	5	13	23	43	56	71
NEW / EXPANDED CONTRACT WITH SJRA	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	0	0	0	110	495
		5	**13**	**23**	**43**	**166**	**566**
STEAM ELECTRIC POWER, MONTGOMERY, SAN JACINTO (H)							
SJRA CATAHOULA AQUIFER SUPPLIES	GULF COAST AQUIFER [MONTGOMERY]	3,920	3,920	3,920	3,920	3,920	3,920
		3,920	**3,920**	**3,920**	**3,920**	**3,920**	**3,920**
THE WOODLANDS, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, THE WOODLANDS	DEMAND REDUCTION [MONTGOMERY]	203	514	735	1,148	1,239	1,314
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	3,940	4,856	5,811	7,006	8,828	11,067
		4,143	**5,370**	**6,546**	**8,154**	**10,067**	**12,381**
WESTWOOD NORTH WSC, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, WESTWOOD NORTH WSC	DEMAND REDUCTION [MONTGOMERY]	3	8	11	19	20	22
SJRA GRP - PARTICIPANT SURFACE WATER	CONROE LAKE/RESERVOIR [RESERVOIR]	281	295	328	361	394	441
		284	**303**	**339**	**380**	**414**	**463**
WILLIS, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, WILLIS	DEMAND REDUCTION [MONTGOMERY]	7	17	24	39	44	49
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	0	33	95	207	366
		7	**17**	**57**	**134**	**251**	**415**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
WOODBRANCH, SAN JACINTO (H)							
MUNICIPAL CONSERVATION, WOODBRANCH	DEMAND REDUCTION [MONTGOMERY]	1	2	3	6	7	9
SJRA GRP - GROUNDWATER OFFSET	GULF COAST AQUIFER [MONTGOMERY]	0	0	5	26	58	97
WATER LOSS REDUCTION, WOODBRANCH	DEMAND REDUCTION [MONTGOMERY]	1	3	4	6	7	9
		2	**5**	**12**	**38**	**72**	**115**
Sum of Projected Water Management Strategies (acre-feet)		**37,896**	**54,151**	**79,453**	**110,494**	**144,566**	**188,770**

Appendix C - GAM Run 17-023: Lone Star Groundwater Conservation District Management Plan

GAM Run 17-023: Lone Star Groundwater Conservation District Management Plan

Shirley C. Wade, Ph.D., P.G.
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Groundwater Division
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January 31, 2018

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1/31/2018

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GAM RUN 17-023: LONE STAR GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

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January 31, 2018

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2015), 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 Lone Star 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 Section. 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 and this information includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
2. for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers; 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 Lone Star Groundwater Conservation District should be adopted by the district on or before September 18, 2018, and submitted to the Executive Administrator of the TWDB on or before October 18, 2018. The current management plan for the Lone Star Groundwater Conservation District expires on December 17, 2018.

We used two groundwater availability models to estimate the management plan information for the Gulf Coast Aquifer System within the Lone Star Groundwater Conservation District. Information for interaction with the Gulf Coast Aquifer System and deeper units is from version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010). Information for the Gulf Coast Aquifer System is from version 3.01 of the groundwater availability model for the northern portion of Gulf Coast Aquifer System (Kasmarek, 2013).

This report discusses the methods, assumptions, and results from the model runs described above. This report replaces the results of GAM Run 13-007 (Kohlrenken, 2013). GAM Run 17-023 meets current standards set after the release of GAM Run 13-007 and includes results from the recently released groundwater availability model for the northern portion of the Gulf Coast Aquifer System (Kasmarek, 2013). Table 1 summarizes the groundwater availability model data required by statute and Figure 1 shows the area of the model from which the values in the table were extracted. If after review of the figure, the Lone Star 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.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models for the Yegua-Jackson Aquifer and the northern portion of the Gulf Coast Aquifer System were used to estimate information for the Lone Star Groundwater Conservation District management plan. Water budgets were extracted for the historical model periods (1980 through 1997 for interaction with deeper units and 1980 through 2009 for the Gulf Coast Aquifer System) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface-water outflow, inflow to the district, and outflow from the district for the aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Gulf Coast Aquifer System

- We used version 3.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer System for this analysis. See Kasmarek (2013) for assumptions and limitations of the model.
- The model has four layers which represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer (Layer 4).
- Water budgets for the district were determined for the Gulf Coast Aquifer System (Layers 1 through 4 collectively).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- Because this model assumes a no-flow boundary condition at the base we used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer to investigate groundwater flows between the Catahoula Formation and the Yegua-Jackson subcrop (non-aquifer) and between the Catahoula Formation and the base of the Gulf Coast Aquifer System. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model for the Yegua-Jackson Aquifer.

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability models for the Yegua-Jackson Aquifer and the northern portion of the Gulf Coast Aquifer System within Lone Star Groundwater Conservation District and averaged over the historical calibration periods, as shown in Table 1.

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 Table 1. 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 GULF COAST AQUIFER SYSTEM FOR LONE STAR GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST ONE ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer System	20,923
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	959
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	26,732
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	55,095
Estimated net annual volume of flow between each aquifer in the district	From the Catahoula Formation to the Jasper Aquifer	6,896[1]
	From the Yegua-Jackson subcrop to the Catahoula Formation and younger units	163

[1] Part of this flow represents internal flow within the Gulf Coast Aquifer System and part represents cross-formational flow because in the shallow subcrop the Catahoula Formation is part of the Gulf Coast Aquifer System.

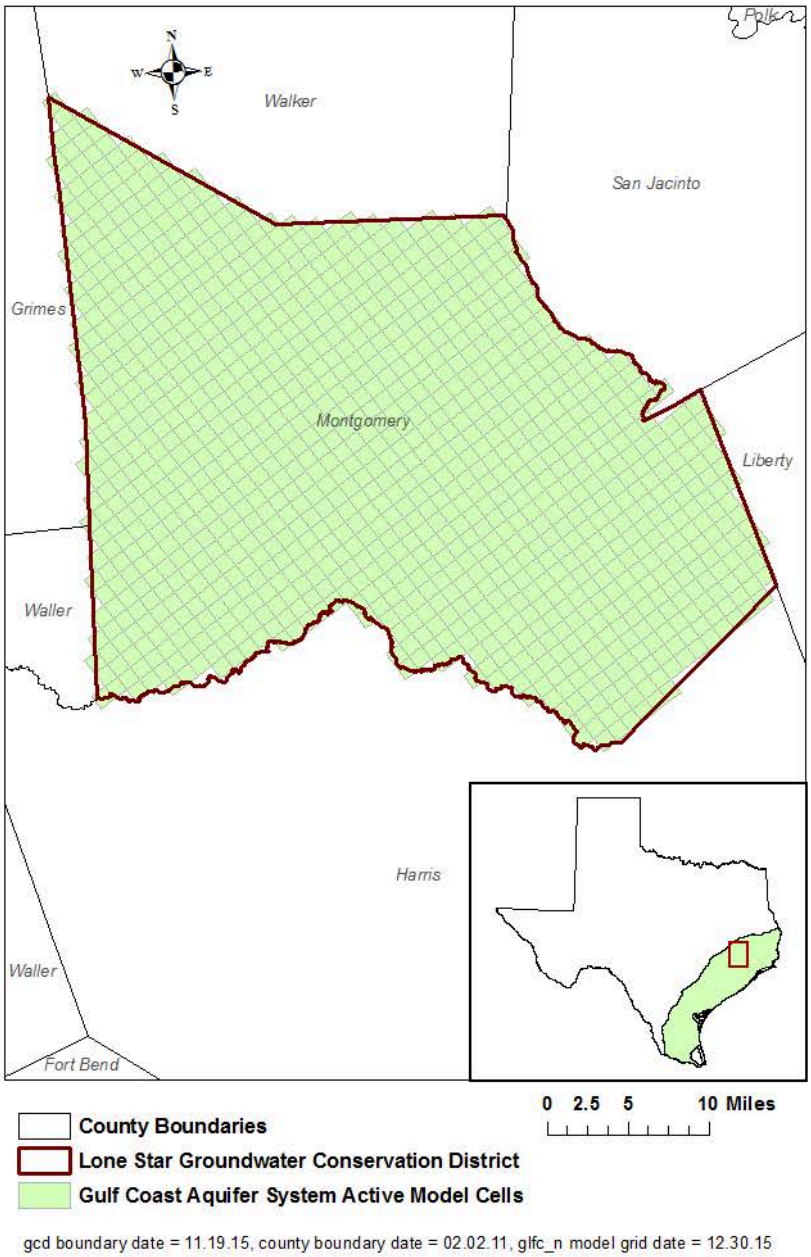

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

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 historic 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.

REFERENCES:

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National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., http://www.nap.edu/catalog.php?record_id=11972.

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Appendix D Modeled Available Groundwater GAM Run 16-024 MAG for Groundwater Management Area 14

GAM RUN 16-024 MAG: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 14

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December 15, 2016

Shirley C. Wade
12/15/16

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GAM RUN 16-024 MAG: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 14

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December 15, 2016

EXECUTIVE SUMMARY:

The modeled available groundwater for Groundwater Management Area 14 and the projected groundwater pumpage in subsidence districts for the Gulf Coast Aquifer System ranges from approximately 1,020,000 acre-feet per year in 2010 to 950,000 acre-feet per year in 2070. Table 1 presents the modeled available groundwater summarized by the decades 2010 to 2070 for groundwater conservation districts. Table 2 presents the projected groundwater pumpage in regulatory plans adopted by subsidence districts and factored into the development of desired future conditions adopted by groundwater conservation districts. Table 3 summarizes the modeled available groundwater for groundwater conservation districts and non-district counties, and the projected groundwater pumpage for subsidence districts by the decades 2020 to 2070 for use in the regional water planning process. The estimates are based on the desired future conditions for the Gulf Coast Aquifer System adopted by groundwater conservation districts in Groundwater Management Area 14 on April 29, 2016. The explanatory report and other materials submitted to the Texas Water Development Board (TWDB) were determined to be administratively complete on July 12, 2016.

REQUESTOR:

Ms. Kathy Turner Jones, chair of Groundwater Management Area 14.

DESCRIPTION OF REQUEST:

In a letter dated May 5, 2016, Ms. Kathy Turner Jones provided the TWDB with the desired future conditions of the Gulf Coast Aquifer System adopted by the groundwater

conservation districts in Groundwater Management Area 14. The desired future conditions for the Gulf Coast Aquifer System, as described in Resolution No. 2016-01-01 and adopted April 29, 2016 by the groundwater conservation districts within Groundwater Management Area 14, are described below:

Groundwater Management Area 14 [all counties]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 28.3 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 23.6 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 18.5 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 66.2 feet after 61 years.

Austin County [Bluebonnet Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 39 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 23 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 23 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 76 feet after 61 years.
- From estimated year 1890 conditions, the maximum subsidence in Austin County should not exceed approximately 2.83 feet by the year 2070.

Brazoria County [Brazoria County Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 23 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 27 feet after 61 years.

Chambers County

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 32 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 30 feet after 61 years.

Grimes County [Bluebonnet Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 5 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 5 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 6 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 52 feet after 61 years.
- From estimated year 1890 conditions, the maximum subsidence in Grimes County should not exceed approximately 0.12 feet by the year 2070.

Hardin County [Southeast Texas Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 21 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 27 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 29 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 89 feet after 61 years.

Jasper County [Southeast Texas Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 23 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 41 feet after 61 years.

- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 46 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 40 feet after 61 years.

Jefferson County

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 15 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 17 feet after 61 years.

Liberty County

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 27 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 29 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 25 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 120 feet after 61 years.

Montgomery County [Lone Star Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 26 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately -4 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately -4 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 34 feet after 61 years.

Newton County [Southeast Texas Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 35 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 45 feet after 61 years.

- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 44 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 37 feet after 61 years.

Orange County

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 14 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 16 feet after 61 years.

Polk County [Lower Trinity Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 26 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 10 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 15 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 73 feet after 61 years.

San Jacinto County [Lower Trinity Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 22 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 19 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 19 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 108 feet after 61 years.

Tyler County [Southeast Texas Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 42 feet after 61 years.

- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 35 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 30 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 62 feet after 61 years.

Walker County [Bluebonnet Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 9 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 4 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 42 feet after 61 years.
- From estimated year 1890 conditions, the maximum subsidence in Walker County should not exceed approximately 0.04 feet by the year 2070.

Waller County [Bluebonnet Groundwater Conservation District]

- From estimated year 2009 conditions, the average drawdown of the Chicot Aquifer should not exceed approximately 39 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 39 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 40 feet after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 101 feet after 61 years.
- From estimated year 1890 conditions, the maximum subsidence in Waller County should not exceed approximately 4.73 feet by the year 2070.

Washington County

- From estimated year 2009 conditions, the average drawdown of the Evangeline Aquifer should not exceed approximately 1 foot after 61 years.
- From estimated year 2009 conditions, the average drawdown of the Burkeville confining unit should not exceed approximately 16 feet after 61 years.

- From estimated year 2009 conditions, the average drawdown of the Jasper Aquifer should not exceed approximately 48 feet after 61 years.

Harris, Galveston, and Fort Bend Counties (Subsidence Districts)

Harris-Galveston Subsidence District and Fort Bend Subsidence District are not subject to the provisions of Section 36.108 of the Texas Water Code and therefore have not specified desired future conditions. Because desired future conditions were not adopted for the counties in the subsidence districts, modeled available groundwater values were not determined for those counties. The districts in Groundwater Management Area 14 incorporated the groundwater pumpage projections made by the subsidence districts in their regulatory plans so that all known regional groundwater pumping was factored into the joint planning process. The subsidence district groundwater pumpage projections are provided in Table 2 and are incorporated into the information relevant to regional water planning (Table 3).

METHODS:

The TWDB ran the groundwater availability model (version 3.01) for the northern part of the Gulf Coast Aquifer System (Figure 1) using the model files submitted with the explanatory report (GMA 14 and others, 2016; Appendix F) and an updated pumping file provided by the Groundwater Management Area 14 consultants on October 26, 2016. The modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009). Annual pumping rates were divided by county, river basin, regional water planning area, and groundwater conservation district within Groundwater Management Area 14 (Figure 2 and Tables 1 through 3).

As part of the process to calculate modeled available groundwater, the TWDB checked the model files submitted by Groundwater Management Area 14 to determine if the groundwater pumping scenarios were compatible with the adopted desired future conditions. The TWDB used these model files to extract model-calculated water levels for 2009 and 2070, and drawdown was calculated as the difference between water levels in 2009 and water levels in 2070. The results of this evaluation are provided in the Appendix. Drawdown averages were calculated for each county by aquifer and for the entire groundwater management area by aquifer. As specified in the explanatory report (GMA 14 and others, 2016; Appendix F), drawdown for cells which became dry during the simulation (water level dropped below the base of the cell) were excluded from the averaging. The calculated drawdown averages compared well with the desired future conditions and verified that the pumping scenarios defined by the districts achieved the desired future conditions. The subsidence values were also extracted from the model

results and those were also compared to subsidence-based desired future conditions for the four counties where they were specified.

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the groundwater availability are described below:

- Version 3.01 of the groundwater availability model for the northern portion of the Gulf Coast Aquifer System was used for this analysis. See Kasmarek (2013) for assumptions and limitations of the model.

- The model has four layers which represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer (Layer 4).

- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

- Drawdown averages and modeled available groundwater values are based on the extent of the model area rather than official aquifer boundaries (Figures 1 and 2).

- Drawdown for cells with water levels below the base elevation of the cell ("dry" cells) were excluded from the averaging per Appendix F of the explanatory report.

- Cells with water levels below the base are "dry" in terms of water level. However, the transmissivity of those cells remains constant and pumping from those cells continues.

- For those cells where water levels have dropped below the base we include pumping in the modeled available groundwater values.

- Estimates of modeled available groundwater from the model simulation were rounded to whole numbers.

- Starting conditions were assumed reasonable since 2009 was the final year of the calibrated model.
- A model tolerance of up to one foot was assumed when comparing desired future condition average drawdown values per county to model results (Appendix).
- A model tolerance of 0.1 foot was assumed when comparing desired future condition maximum subsidence values per county to model results (Appendix).
- Average drawdown per county may include some model cells that represent portions of surface water such as bays, reservoirs, and the Gulf of Mexico.

RESULTS:

The modeled available groundwater for the Gulf Coast Aquifer System that achieves the desired future conditions adopted by Groundwater Management Area 14 decreases from 571,007 to 544,220 acre-feet per year between 2010 and 2070 (Table 1). Projected groundwater pumpage from the three counties in the Harris Galveston Subsidence District and Fort Bend Subsidence District range between 325,226 and 545,246 acre-feet per year during the period 2010 to 2070 (Table 2). The combination of modeled available groundwater and projected groundwater pumpage has been summarized by county, river basin, and regional water planning area for use in the regional water planning process (Table 3). The modeled available groundwater is also summarized by groundwater conservation district and county (Table 1).

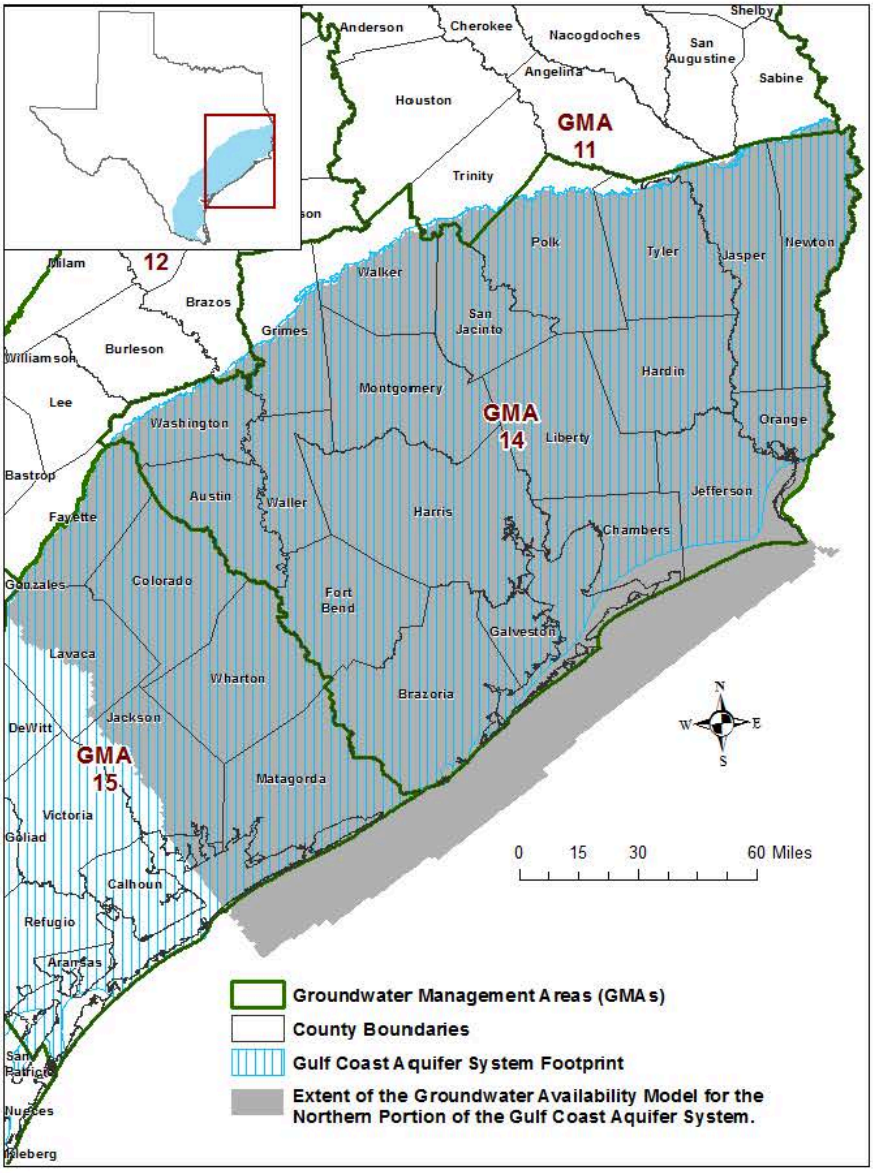

FIGURE 1. MAP SHOWING THE AREAS COVERED BY THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PART OF THE GULF COAST AQUIFER SYSTEM.

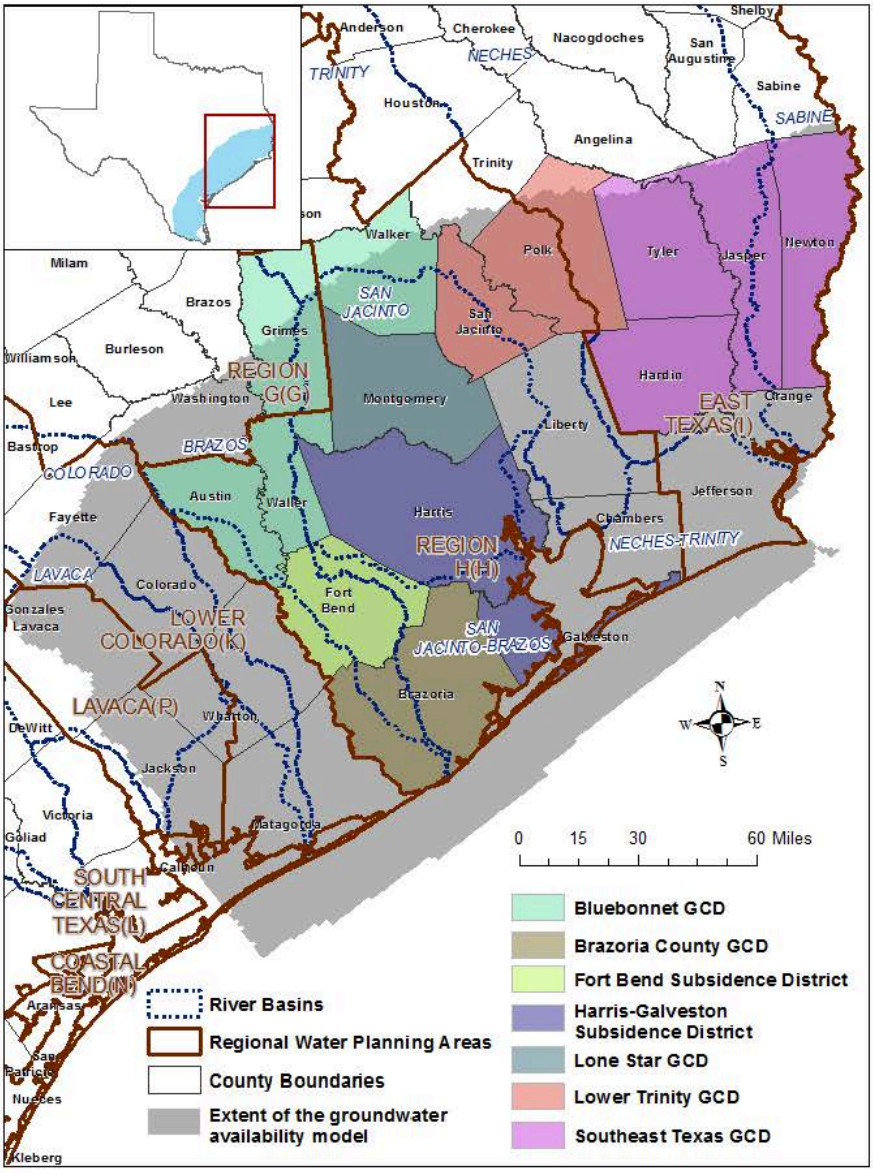

FIGURE 2. MAP SHOWING REGIONAL WATER PLANNING AREAS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), SUBSIDENCE DISTRICTS, COUNTIES, AND RIVER BASINS IN GROUNDWATER MANAGEMENT AREA 14.

TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 14 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2010 AND 2070. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
Bluebonnet GCD	Austin	Chicot Aquifer	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Bluebonnet GCD	Austin	Evangeline Aquifer	19,998	19,998	19,998	19,998	19,998	19,998	19,998
Bluebonnet GCD	Austin	Burkeville confining	0	0	0	0	0	0	0
Bluebonnet GCD	Austin	Jasper Aquifer	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Bluebonnet GCD	Grimes	Chicot Aquifer	0	0	0	0	0	0	0
Bluebonnet GCD	Grimes	Evangeline Aquifer	2,999	2,999	2,999	2,999	2,999	2,999	2,999
Bluebonnet GCD	Grimes	Burkeville confining	0	0	0	0	0	0	0
Bluebonnet GCD	Grimes	Jasper Aquifer	10,998	10,998	10,998	10,998	10,998	10,998	10,998
Bluebonnet GCD	Walker	Chicot Aquifer	0	0	0	0	0	0	0
Bluebonnet GCD	Walker	Evangeline Aquifer	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Bluebonnet GCD	Walker	Burkeville confining	0	0	0	0	0	0	0
Bluebonnet GCD	Walker	Jasper Aquifer	15,972	15,972	15,972	15,972	15,972	15,972	15,972
Bluebonnet GCD	Waller	Chicot Aquifer	300	300	300	300	300	300	300
Bluebonnet GCD	Waller	Evangeline Aquifer	40,994	40,994	40,994	40,994	40,994	40,994	40,994
Bluebonnet GCD	Waller	Burkeville confining	0	0	0	0	0	0	0
Bluebonnet GCD	Waller	Jasper Aquifer	300	300	300	300	300	300	300
Bluebonnet GCD Total		**Gulf Coast Aquifer System**	**95,859**	**95,859**	**95,859**	**95,859**	**95,859**	**95,859**	**95,859**
Brazoria County	Brazoria	Chicot Aquifer	38,994	39,042	39,164	39,208	39,251	39,295	39,345
Brazoria County	Brazoria	Evangeline Aquifer	11,376	11,376	11,376	11,376	11,376	11,375	11,376
Brazoria County GCD Total		**Gulf Coast Aquifer System**	**50,369**	**50,418**	**50,540**	**50,583**	**50,626**	**50,670**	**50,721**
Lone Star GCD	Montgomery	Chicot Aquifer	11,922	12,600	13,870	13,944	15,026	14,717	14,175
Lone Star GCD	Montgomery	Evangeline Aquifer	37,734	27,525	27,553	27,773	26,575	26,615	26,529

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
Lone Star GCD	Montgomery	Burkeville confining	0	0	0	0	0	0	0
Lone Star GCD	Montgomery	Jasper Aquifer	41,491	23,880	22,582	22,288	22,404	22,673	23,301
Lone Star GCD Total		**Gulf Coast Aquifer System**	**91,146**	**64,004**	**64,004**	**64,004**	**64,004**	**64,004**	**64,004**
Lower Trinity GCD	Polk	Chicot Aquifer	0	0	0	0	0	0	0
Lower Trinity GCD	Polk	Evangeline Aquifer	8,302	8,302	8,302	8,302	8,302	8,302	8,302
Lower Trinity GCD	Polk	Burkeville confining	743	743	743	743	743	743	743
Lower Trinity GCD	Polk	Jasper Aquifer	27,663	27,663	27,663	27,663	27,663	27,663	27,663
Lower Trinity GCD	San Jacinto	Chicot Aquifer	0	0	0	0	0	0	0
Lower Trinity GCD	San Jacinto	Evangeline Aquifer	8,170	8,170	8,170	8,170	8,170	8,170	8,170
Lower Trinity GCD	San Jacinto	Burkeville confining	2,697	2,697	2,697	2,697	2,697	2,697	2,697
Lower Trinity GCD	San Jacinto	Jasper Aquifer	10,116	10,116	10,116	10,116	10,116	10,116	10,116
Lower Trinity GCD Total		**Gulf Coast Aquifer System**	**57,691**	**57,691**	**57,691**	**57,691**	**57,691**	**57,691**	**57,691**
Southeast Texas	Hardin	Chicot Aquifer	1,262	1,262	1,262	1,262	1,262	1,262	1,262
Southeast Texas	Hardin	Evangeline Aquifer	33,665	33,665	33,665	33,665	33,665	33,665	33,665
Southeast Texas	Hardin	Burkeville confining	0	0	0	0	0	0	0
Southeast Texas	Hardin	Jasper Aquifer	0	0	0	0	0	0	0
Southeast Texas	Jasper	Chicot Aquifer	10,827	10,827	10,827	10,827	10,827	10,827	10,827
Southeast Texas	Jasper	Evangeline Aquifer	40,648	40,648	40,648	40,648	40,648	40,648	40,648
Southeast Texas	Jasper	Burkeville confining	1	1	1	1	1	1	1
Southeast Texas	Jasper	Jasper Aquifer	16,008	16,008	16,008	16,008	16,008	16,008	16,008
Southeast Texas	Newton	Chicot Aquifer	500	500	500	500	500	500	500
Southeast Texas	Newton	Evangeline Aquifer	21,343	21,343	21,343	21,343	21,343	21,343	21,343
Southeast Texas	Newton	Burkeville confining	0	0	0	0	0	0	0
Southeast Texas	Newton	Jasper Aquifer	12,376	12,376	12,376	12,376	12,376	12,376	12,376
Southeast Texas	Tyler	Chicot Aquifer	0	0	0	0	0	0	0

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
Southeast Texas	Tyler	Evangeline Aquifer	20,576	20,576	20,576	20,576	20,576	20,576	20,576
Southeast Texas	Tyler	Burkeville confining	1	1	1	1	1	1	1
Southeast Texas	Tyler	Jasper Aquifer	17,634	17,634	17,634	17,634	17,634	17,634	17,634
Southeast Texas GCD Total		**Gulf Coast Aquifer System**	**174,841**	**174,841**	**174,841**	**174,841**	**174,841**	**174,841**	**174,841**
Total (groundwater conservation districts)		**Gulf Coast Aquifer System**	**469,907**	**442,813**	**442936**	**442,979**	**443,022**	**443,066**	**443,117**
No District-County	Chambers	Chicot Aquifer	22,573	22,573	22,573	22,573	22,573	22,573	22,573
No District-County	Chambers	Evangeline Aquifer	378	378	378	378	378	378	378
No District-County	Jefferson	Chicot Aquifer	2,426	2,426	2,426	2,426	2,426	2,426	2,426
No District-County	Jefferson	Evangeline Aquifer	100	100	100	100	100	100	100
No District-County	Liberty	Chicot Aquifer	14,571	14,571	14,572	14,572	14,572	14,572	14,572
No District-County	Liberty	Evangeline Aquifer	27,654	27,654	27,656	27,655	27,656	27,656	27,656
No District-County	Liberty	Burkeville confining	215	215	215	215	215	215	215
No District-County	Liberty	Jasper Aquifer	787	787	787	787	787	787	787
No District-County	Orange	Chicot Aquifer	18,162	18,162	18,162	18,162	18,162	18,162	18,162
No District-County	Orange	Evangeline Aquifer	1,202	1,202	1,202	1,202	1,202	1,202	1,202
No District-County	Washington	Evangeline Aquifer	3,236	3,236	3,236	3,236	3,236	3,236	3,236
No District-County	Washington	Burkeville confining	367	367	367	367	367	367	367
No District-County	Washington	Jasper Aquifer	9,428	9,428	9,428	9,428	9,428	9,428	9,428
No District-County Total		**Gulf Coast Aquifer System**	**101,100**	**101,100**	**101,103**	**101,101**	**101,102**	**101,103**	**101,103**

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Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
GMA 14	Total (all areas except subsidence districts)	Gulf Coast Aquifer System	571,007	543,913	544,039	544,080	544,124	544,169	544,020

TABLE 2. GROUNDWATER PUMPAGE PROJECTIONS FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 14 FOR SUBSIDENCE DISTRICT COUNTIES FOR EACH DECADE BETWEEN 2010 AND 2070. VALUES ARE IN ACRE-FEET PER YEAR.

Subsidence District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
Fort Bend	Fort Bend	Chicot Aquifer	46,789	58,200	52,663	62,635	72,957	84,002	95,430
Fort Bend	Fort Bend	Evangeline Aquifer	75,249	71,572	51,072	56,656	61,875	66,942	71,651
Fort Bend	Fort Bend	Burkeville confining	0	0	0	0	0	0	0
Fort Bend	Fort Bend	Jasper Aquifer	0	0	0	0	0	0	0
Fort Bend Subsidence District Total		**Gulf Coast Aquifer System**	**122,038**	**129,772**	**103,735**	**119,291**	**134,832**	**150,944**	**167,081**
Harris-Galveston	Galveston	Chicot Aquifer	4,850	5,819	6,537	7,153	7,748	8,303	8,759
Harris-Galveston	Galveston	Evangeline Aquifer	167	215	254	284	314	346	371
Harris-Galveston	Harris	Chicot Aquifer	92,348	136,640	108,694	80,512	86,842	90,290	93,457
Harris-Galveston	Harris	Evangeline Aquifer	224,465	264,588	176,427	114,821	121,148	126,231	130,840
Harris-Galveston	Harris	Burkeville confining	0	0	0	0	0	0	0
Harris-Galveston	Harris	Jasper Aquifer	6,067	8,212	5,432	3,164	3,368	3,519	3,644
Harris-Galveston Subsidence District Total		**Gulf Coast Aquifer System**	**327,897**	**415,474**	**297,343**	**205,935**	**219,420**	**228,688**	**237,071**
GMA 14	**Total (subsidence districts)**	**Gulf Coast Aquifer System**	**449,935**	**545,246**	**401,078**	**325,226**	**354,252**	**379,632**	**404,152**

TABLE 3. MODELED AVAILABLE GROUNDWATER AND PROJECTED GROUNDWATER PUMPAGE VALUES (*IN ITALICS*) BY DECADE FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 14. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070
Austin	H	Brazos-Colorado	Chicot Aquifer	1,005	1,005	1,005	1,005	1,005	1,005
Austin	H	Brazos-Colorado	Evangeline Aquifer	14,517	14,517	14,517	14,517	14,517	14,517
Austin	H	Brazos-Colorado	Burkeville confining unit	0	0	0	0	0	0
Austin	H	Brazos-Colorado	Jasper Aquifer	76	76	76	76	76	76
Austin	H	Brazos	Chicot Aquifer	295	295	295	295	295	295
Austin	H	Brazos	Evangeline Aquifer	5,458	5,458	5,458	5,458	5,458	5,458
Austin	H	Brazos	Burkeville confining unit	0	0	0	0	0	0
Austin	H	Brazos	Jasper Aquifer	826	826	826	826	826	826
Austin	H	Colorado	Chicot Aquifer	0	0	0	0	0	0
Austin	H	Colorado	Evangeline Aquifer	23	23	23	23	23	23
Austin	H	Colorado	Burkeville confining unit	0	0	0	0	0	0
Austin	H	Colorado	Jasper Aquifer	98	98	98	98	98	98
Brazoria	H	Brazos-Colorado	Chicot Aquifer	9,134	8,929	8,735	8,474	8,217	7,986
Brazoria	H	Brazos-Colorado	Evangeline Aquifer	1	1	2	2	2	2
Brazoria	H	Brazos	Chicot Aquifer	3,223	3,057	2,992	2,923	2,865	2,821
Brazoria	H	Brazos	Evangeline Aquifer	0	0	0	0	0	0
Brazoria	H	San Jacinto-Brazos	Chicot Aquifer	26,684	27,178	27,481	27,854	28,213	28,537
Brazoria	H	San Jacinto-Brazos	Evangeline Aquifer	11,375	11,374	11,374	11,374	11,374	11,374
Chambers	H	Neches-Trinity	Chicot Aquifer	10,798	10,798	10,798	10,798	10,798	10,798
Chambers	H	Neches-Trinity	Evangeline Aquifer	0	0	0	0	0	0
Chambers	H	Trinity-San Jacinto	Chicot Aquifer	1,671	1,671	1,671	1,671	1,671	1,671
Chambers	H	Trinity-San Jacinto	Evangeline Aquifer	378	378	378	378	378	378
Chambers	H	Trinity	Chicot Aquifer	10,104	10,104	10,104	10,104	10,104	10,104
Chambers	H	Trinity	Evangeline Aquifer	0	0	0	0	0	0
Fort Bend	*H*	*Brazos-Colorado*	*Chicot Aquifer*	*6,338*	*7,157*	*8,493*	*10,447*	*13,307*	*17,077*
Fort Bend	*H*	*Brazos-Colorado*	*Evangeline Aquifer*	*563*	*728*	*1,079*	*1,584*	*2,310*	*3,256*

County	RWPA	River Basin	Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070
Fort Bend	*H*	*Brazos-Colorado*	*Burkeville confining unit*	*0*	*0*	*0*	*0*	*0*	*0*
Fort Bend	*H*	*Brazos-Colorado*	*Jasper Aquifer*	*0*	*0*	*0*	*0*	*0*	*0*
Fort Bend	*H*	*Brazos*	*Chicot Aquifer*	*25,117*	*24,308*	*30,446*	*36,552*	*42,837*	*49,006*
Fort Bend	*H*	*Brazos*	*Evangeline Aquifer*	*17,216*	*13,537*	*16,080*	*18,582*	*21,174*	*23,754*
Fort Bend	*H*	*Brazos*	*Burkeville confining unit*	*0*	*0*	*0*	*0*	*0*	*0*
Fort Bend	*H*	*Brazos*	*Jasper Aquifer*	*0*	*0*	*0*	*0*	*0*	*0*
Fort Bend	*H*	*San Jacinto-Brazos*	*Chicot Aquifer*	*17,810*	*15,117*	*17,542*	*19,801*	*21,707*	*23,191*
Fort Bend	*H*	*San Jacinto-Brazos*	*Evangeline Aquifer*	*35,680*	*25,524*	*28,118*	*30,370*	*32,165*	*33,366*
Fort Bend	*H*	*San Jacinto-Brazos*	*Burkeville confining unit*	*0*	*0*	*0*	*0*	*0*	*0*
Fort Bend	*H*	*San Jacinto-Brazos*	*Jasper Aquifer*	*0*	*0*	*0*	*0*	*0*	*0*
Fort Bend	*H*	*San Jacinto*	*Chicot Aquifer*	*8,936*	*6,081*	*6,153*	*6,157*	*6,151*	*6,156*
Fort Bend	*H*	*San Jacinto*	*Evangeline Aquifer*	*18,113*	*11,282*	*11,379*	*11,340*	*11,293*	*11,275*
Fort Bend	*H*	*San Jacinto*	*Burkeville confining unit*	*0*	*0*	*0*	*0*	*0*	*0*
Fort Bend	*H*	*San Jacinto*	*Jasper Aquifer*	*0*	*0*	*0*	*0*	*0*	*0*
Galveston	*H*	*Neches-Trinity*	*Chicot Aquifer*	*0*	*0*	*0*	*0*	*0*	*1*
Galveston	*H*	*San Jacinto-Brazos*	*Chicot Aquifer*	*5,819*	*6,537*	*7,153*	*7,748*	*8,303*	*8,759*
Galveston	*H*	*San Jacinto-Brazos*	*Evangeline Aquifer*	*215*	*254*	*284*	*314*	*346*	*371*
Grimes	G	Brazos	Chicot Aquifer	0	0	0	0	0	0
Grimes	G	Brazos	Evangeline Aquifer	2,256	2,256	2,256	2,256	2,256	2,256
Grimes	G	Brazos	Burkeville confining unit	0	0	0	0	0	0
Grimes	G	Brazos	Jasper Aquifer	8,624	8,624	8,624	8,624	8,624	8,624
Grimes	G	San Jacinto	Chicot Aquifer	0	0	0	0	0	0
Grimes	G	San Jacinto	Evangeline Aquifer	743	743	743	743	743	743
Grimes	G	San Jacinto	Burkeville confining unit	0	0	0	0	0	0
Grimes	G	San Jacinto	Jasper Aquifer	1,451	1,451	1,451	1,451	1,451	1,451
Grimes	G	Trinity	Jasper Aquifer	922	922	922	922	922	922
Hardin	I	Neches	Chicot Aquifer	1,262	1,262	1,262	1,262	1,262	1,262
Hardin	I	Neches	Evangeline Aquifer	33,527	33,527	33,527	33,527	33,527	33,527
Hardin	I	Neches	Burkeville confining unit	0	0	0	0	0	0

County	RWPA	River Basin	Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070
Hardin	I	Neches	Jasper Aquifer	0	0	0	0	0	0
Hardin	I	Trinity	Chicot Aquifer	0	0	0	0	0	0
Hardin	I	Trinity	Evangeline Aquifer	138	138	138	138	138	138
Hardin	I	Trinity	Burkeville confining unit	0	0	0	0	0	0
Hardin	I	Trinity	Jasper Aquifer	0	0	0	0	0	0
Harris	*H*	*San Jacinto-Brazos*	*Chicot Aquifer*	*4,331*	*4,858*	*5,405*	*5,959*	*6,383*	*6,853*
Harris	*H*	*San Jacinto-Brazos*	*Evangeline Aquifer*	*1,975*	*2,096*	*2,211*	*2,323*	*2,435*	*2,544*
Harris	*H*	*San Jacinto*	*Chicot Aquifer*	*129,749*	*101,232*	*72,499*	*78,104*	*81,042*	*83,662*
Harris	*H*	*San Jacinto*	*Evangeline Aquifer*	*262,218*	*173,938*	*112,257*	*118,444*	*123,397*	*127,883*
Harris	*H*	*San Jacinto*	*Burkeville confining unit*	*0*	*0*	*0*	*0*	*0*	*0*
Harris	*H*	*San Jacinto*	*Jasper Aquifer*	*8,212*	*5,432*	*3,164*	*3,368*	*3,519*	*3,644*
Harris	*H*	*Trinity-San Jacinto*	*Chicot Aquifer*	*2,560*	*2,604*	*2,609*	*2,779*	*2,865*	*2,942*
Harris	*H*	*Trinity-San Jacinto*	*Evangeline Aquifer*	*395*	*393*	*353*	*382*	*398*	*412*
Harris	*H*	*Trinity-San Jacinto*	*B Burkeville confining unit*	*0*	*0*	*0*	*0*	*0*	*0*
Harris	*H*	*Trinity-San Jacinto*	*Jasper Aquifer*	*0*	*0*	*0*	*0*	*0*	*0*
Jasper	I	Neches	Chicot Aquifer	7,717	7,717	7,717	7,717	7,717	7,717
Jasper	I	Neches	Evangeline Aquifer	17,407	17,407	17,407	17,407	17,407	17,407
Jasper	I	Neches	Burkeville confining unit	0	0	0	0	0	0
Jasper	I	Neches	Jasper Aquifer	12,506	12,506	12,506	12,506	12,506	12,506
Jasper	I	Sabine	Chicot Aquifer	3,110	3,110	3,110	3,110	3,110	3,110
Jasper	I	Sabine	Evangeline Aquifer	23,241	23,241	23,241	23,241	23,241	23,241
Jasper	I	Sabine	Burkeville confining unit	1	1	1	1	1	1
Jasper	I	Sabine	Jasper Aquifer	3,502	3,502	3,502	3,502	3,502	3,502
Jefferson	I	Neches-Trinity	Chicot Aquifer	1,722	1,722	1,722	1,722	1,722	1,722
Jefferson	I	Neches-Trinity	Evangeline Aquifer	0	0	0	0	0	0
Jefferson	I	Neches	Chicot Aquifer	703	703	703	703	703	703
Jefferson	I	Neches	Evangeline Aquifer	100	100	100	100	100	100
Liberty	H	Neches-Trinity	Chicot Aquifer	327	327	327	327	327	327
Liberty	H	Neches-Trinity	Evangeline Aquifer	37	37	37	37	37	37

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County	RWPA	River Basin	Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070
Liberty	H	Neches	Chicot Aquifer	2,804	2,804	2,804	2,804	2,804	2,804
Liberty	H	Neches	Evangeline Aquifer	2,267	2,267	2,267	2,267	2,267	2,267
Liberty	H	Neches	Burkeville confining unit	0	0	0	0	0	0
Liberty	H	Neches	Jasper Aquifer	0	0	0	0	0	0
Liberty	H	San Jacinto	Chicot Aquifer	753	754	753	754	754	754
Liberty	H	San Jacinto	Evangeline Aquifer	4,322	4,323	4,322	4,323	4,323	4,323
Liberty	H	San Jacinto	Burkeville confining unit	215	215	215	215	215	215
Liberty	H	San Jacinto	Jasper Aquifer	787	787	787	787	787	787
Liberty	H	Trinity-San Jacinto	Chicot Aquifer	3,160	3,160	3,160	3,160	3,160	3,160
Liberty	H	Trinity-San Jacinto	Evangeline Aquifer	5,690	5,690	5,690	5,690	5,690	5,690
Liberty	H	Trinity-San Jacinto	Burkeville confining unit	0	0	0	0	0	0
Liberty	H	Trinity-San Jacinto	Jasper Aquifer	0	0	0	0	0	0
Liberty	H	Trinity	Chicot Aquifer	7,528	7,528	7,528	7,528	7,528	7,528
Liberty	H	Trinity	Evangeline Aquifer	15,339	15,339	15,339	15,339	15,339	15,339
Liberty	H	Trinity	Burkeville confining unit	0	0	0	0	0	0
Liberty	H	Trinity	Jasper Aquifer	0	0	0	0	0	0
Montgomery	H	San Jacinto	Chicot Aquifer	12,600	13,870	13,944	15,026	14,717	14,175
Montgomery	H	San Jacinto	Evangeline Aquifer	27,525	27,553	27,773	26,575	26,615	26,529
Montgomery	H	San Jacinto	Burkeville confining unit	0	0	0	0	0	0
Montgomery	H	San Jacinto	Jasper Aquifer	23,880	22,582	22,288	22,404	22,673	23,301
Newton	I	Neches	Jasper Aquifer	176	176	176	176	176	176
Newton	I	Sabine	Chicot Aquifer	500	500	500	500	500	500
Newton	I	Sabine	Evangeline Aquifer	21,343	21,343	21,343	21,343	21,343	21,343
Newton	I	Sabine	Burkeville confining unit	0	0	0	0	0	0
Newton	I	Sabine	Jasper Aquifer	12,200	12,200	12,200	12,200	12,200	12,200
Orange	I	Neches-Trinity	Chicot Aquifer	256	256	256	256	256	256
Orange	I	Neches-Trinity	Evangeline Aquifer	0	0	0	0	0	0
Orange	I	Neches	Chicot Aquifer	2,162	2,162	2,162	2,162	2,162	2,162
Orange	I	Neches	Evangeline Aquifer	1,125	1,125	1,125	1,125	1,125	1,125

County	RWPA	River Basin	Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070
Orange	I	Sabine	Chicot Aquifer	15,744	15,744	15,744	15,744	15,744	15,744
Orange	I	Sabine	Evangeline Aquifer	77	77	77	77	77	77
Polk	I	Neches	Chicot Aquifer	0	0	0	0	0	0
Polk	I	Neches	Evangeline Aquifer	3,582	3,582	3,582	3,582	3,582	3,582
Polk	I	Neches	Burkeville confining unit	118	118	118	118	118	118
Polk	I	Neches	Jasper Aquifer	11,197	11,197	11,197	11,197	11,197	11,197
Polk	H	Trinity	Chicot Aquifer	0	0	0	0	0	0
Polk	H	Trinity	Evangeline Aquifer	4,720	4,720	4,720	4,720	4,720	4,720
Polk	H	Trinity	Burkeville confining unit	625	625	625	625	625	625
Polk	H	Trinity	Jasper Aquifer	16,465	16,465	16,465	16,465	16,465	16,465
San Jacinto	H	San Jacinto	Chicot Aquifer	0	0	0	0	0	0
San Jacinto	H	San Jacinto	Evangeline Aquifer	5,744	5,744	5,744	5,744	5,744	5,744
San Jacinto	H	San Jacinto	Burkeville confining unit	0	0	0	0	0	0
San Jacinto	H	San Jacinto	Jasper Aquifer	4,636	4,636	4,636	4,636	4,636	4,636
San Jacinto	H	Trinity	Chicot Aquifer	0	0	0	0	0	0
San Jacinto	H	Trinity	Evangeline Aquifer	2,426	2,426	2,426	2,426	2,426	2,426
San Jacinto	H	Trinity	Burkeville confining unit	2,697	2,697	2,697	2,697	2,697	2,697
San Jacinto	H	Trinity	Jasper Aquifer	5,480	5,480	5,480	5,480	5,480	5,480
Tyler	I	Neches	Chicot Aquifer	0	0	0	0	0	0
Tyler	I	Neches	Evangeline Aquifer	20,576	20,576	20,576	20,576	20,576	20,576
Tyler	I	Neches	Burkeville confining unit	1	1	1	1	1	1
Tyler	I	Neches	Jasper Aquifer	17,634	17,634	17,634	17,634	17,634	17,634
Walker	H	San Jacinto	Chicot Aquifer	0	0	0	0	0	0
Walker	H	San Jacinto	Evangeline Aquifer	2,000	2,000	2,000	2,000	2,000	2,000
Walker	H	San Jacinto	Burkeville confining unit	0	0	0	0	0	0
Walker	H	San Jacinto	Jasper Aquifer	7,107	7,107	7,107	7,107	7,107	7,107
Walker	H	Trinity	Jasper Aquifer	8,866	8,866	8,866	8,866	8,866	8,866
Waller	H	Brazos	Chicot Aquifer	256	256	256	256	256	256
Waller	H	Brazos	Evangeline Aquifer	14,363	14,363	14,363	14,363	14,363	14,363

County	RWPA	River Basin	Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070
Waller	H	Brazos	Burkeville confining unit	0	0	0	0	0	0
Waller	H	Brazos	Jasper Aquifer	300	300	300	300	300	300
Waller	H	San Jacinto	Chicot Aquifer	44	44	44	44	44	44
Waller	H	San Jacinto	Evangeline Aquifer	26,630	26,630	26,630	26,630	26,630	26,630
Waller	H	San Jacinto	Burkeville confining unit	0	0	0	0	0	0
Waller	H	San Jacinto	Jasper Aquifer	0	0	0	0	0	0
Washington	G	Brazos	Evangeline Aquifer	3,236	3,236	3,236	3,236	3,236	3,236
Washington	G	Brazos	Burkeville confining unit	367	367	367	367	367	367
Washington	G	Brazos	Jasper Aquifer	9,356	9,356	9,356	9,356	9,356	9,356
Washington	G	Colorado	Jasper Aquifer	72	72	72	72	72	72
GMA 14 Total			**Gulf Coast Aquifer System**	**1,089,160**	**945,116**	**869,306**	**898,377**	**923,801**	**948,373**

LIMITATIONS:

The groundwater model used in completing this analysis is the best available scientific tool 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 historic 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 streamflow are specific to a particular historic time period.

Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating 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 groundwater levels in 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.

Model "Dry" Cells

The predictive model run for this analysis results in water levels in some model cells dropping below the base elevation of the cell during the simulation. In terms of water level the cells have gone dry. However, as noted in the model assumptions the transmissivity of the cell remains constant and will produce water.

A total of 591cells out of 10,968 cells (five percent) go "dry" in the Chicot Aquifer (Layer 1) along the thinnest part of the outcrop. There are 19 dry cells out of 8,184 total cells (0.02 percent) in the thinnest part of the Burkeville confining unit (Layer 3), and 18 dry cells out of 10,815 total cells (0.02 percent) in the thinnest part of the Jasper Aquifer (Layer 4) outcrop. As noted in the model assumptions pumping from dry cells is included in the modeled available groundwater values. Total pumping from dry cells in the Chicot Aquifer in model year 2070 is 77 acre-feet in Montgomery County. There are no dry cells for the model run in the Evangeline Aquifer. Total pumping from dry cells in the Burkeville Confining unit in model year 2070 is 2,697 acre-feet in San Jacinto County. The total pumping from dry cells in the Jasper Aquifer in model year 2070 is 5,084 acre-feet in Grimes, Jasper, Newton, Polk, Trinity, Tyler, and Walker counties.

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APPENDIX

TABLE A.1 MODEL-CALCULATED AVERAGE DRAWDOWN VALUES (DDN) AND MODELED MAXIMUM SUBSIDENCE COMPARED WITH DESIRED FUTURE CONDITIONS (DFCS) BY COUNTY FOR THE NORTHERN PORTION OF THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 14. ALL VALUES ARE IN FEET.

County	Chicot Aquifer DDN	Evangeline Aquifer DDN	Burkeville Confining Unit DDN	Jasper Aquifer DDN	Maximum Subsidence (model estimate)	Chicot Aquifer DFC	Evangeline Aquifer DFC	Burkeville Unit DFC	Jasper Aquifer DFC	Maximum Subsidence DFC
Austin	40	23	23	76	2.82	39	23	23	76	2.83
Brazoria	23	28	na	na	na	23	27	na	na	ns
Chambers	33	30	na	na	na	32	30	na	na	ns
Fort Bend*	54	56	60	108	na	ns	ns	ns	ns	ns
Galveston*	34	31	na	na	na	ns	ns	ns	ns	ns
Grimes	5	5	6	53	0.10	5	5	6	52	0.12
Hardin	21	27	29	90	na	21	27	29	89	ns
Harris*	30	5	-15	63	na	ns	ns	ns	ns	ns
Jasper	24	42	46	40	na	23	41	46	40	ns
Jefferson	16	17	na	na	na	15	17	na	na	ns
Liberty	28	29	25	121	na	27	29	25	120	ns
Montgomery	26	-4	-4	35	na	26	-4	-4	34	ns
Newton	35	45	45	37	na	35	45	44	37	ns

County	Chicot Aquifer DDN	Evangeline Aquifer DDN	Burkeville Confining Unit DDN	Jasper Aquifer DDN	Maximum Subsidence (model estimate)	Chicot Aquifer DFC	Evangeline Aquifer DFC	Burkeville Unit DFC	Jasper Aquifer DFC	Maximum Subsidence DFC
Orange	14	16	na	na	na	14	16	na	na	ns
Polk	26	10	16	73	na	26	10	15	73	ns
San Jacinto	22	19	20	109	na	22	19	19	108	ns
Tyler	42	36	30	62	na	42	35	30	62	ns
Walker	0	9	4	42	0.10	na	9	4	42	0.04
Waller	39	40	40	102	4.71	39	39	40	101	4.73
Washington	na	1	16	48	na	na	1	16	48	ns
GMA average	**28.7**	**23.9**	**18.7**	**66.7**	**na**	**28.3**	**23.6**	**18.5**	**66.2**	**ns**

*Desired Future Conditions were not specified for counties located in the subsidence districts

na = not applicable

ns = not specified

DFC = adopted desired future condition

DDN = average model calculated drawdown based on pumping scenario provided by districts in GMA 14

Appendix E – Certified copy of the Lone Star Groundwater Conservation District Resolution Adopting This Management Plan

Appendix F – Evidence of Management Plan Adoption after Notice and Hearing

Appendix G – Evidence of Coordination with Surface Water Management Entities

Appendix H – Professional Geoscientist Seal