PLUM CREEK CONSERVATION DISTRICT

Groundwater Management Plan

Adopted as Amended 11-21-2017

PLUM CREEK CONSERVATION DISTRICT

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Adopted ,

Groundwater Management Plan

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PLUM CREEK CONSERVATION DISTRICT

GROUNDWATER MANAGEMENT PLAN

1. DISTRICT MISSION

The Plum Creek Conservation District (PCCD) mission for groundwater management is to conserve and preserve groundwater availability and protect permitted and exempt groundwater users, by gathering information about groundwater conditions and uses within the District; obtaining information from surrounding Groundwater Districts to assist in understanding groundwater availability within Plum Creek's area; by using that information to adopt Rules consistent with state law in order to maximize the beneficial development and use of the groundwater resources on a sustainable basis in keeping with the desired future conditions of aquifers within Plum Creek Conservation District's jurisdictional area; and by then enforcing these adopted Rules. The District will accomplish this mission by identifying aquifers within the District; and then by (1) determining zones of the various aquifers within the District, (2) imposing spacing requirements, (3) limiting production, (4) requiring permits for non-exempt wells and groundwater production, (5) noting information on exempt wells, (6) establishing water drawdown levels, (7) monitoring aquifer levels and production, (8) making appropriate adjustments to allowable and permitted production as more data become available, and (9) encouraging conservation to limit pumping. These actions are designed to extend the quantity and preserve the quality of the water available in the aquifers in Caldwell and Hays counties regulated by the District. PCCD is committed to protecting, conserving, and preventing waste of the groundwater resources in its District for the benefit of the citizens, economy and environment.

2. TIME PERIOD OF THIS PLAN

This plan will become effective upon adoption by the PCCD Board of Directors and approval as administratively complete by the Texas Water Development Board. The plan will remain in effect for five (5) years after the date of approval or until a revised plan is adopted and approved, or as otherwise directed by the Texas Legislature.

3. BACKGROUND

The PCCD is situated in parts of Caldwell and Hays Counties. The District was created as a Water Control and Improvement District in the 55th Texas Regular Legislative Session in 1957 with the passage of Senate Bill 289 under the provisions of Section 59, Article XVI of the Texas Constitution. The enabling statute provided the District with the power to control, conserve, protect, distribute and utilize the storm and floodwaters and unappropriated flow of Plum Creek and its tributaries as a Water Control and Improvement District. In 1989 the original 1957 legislation was amended to additionally authorize the District, upon approval of the qualified voters of the District, to exercise the powers and duties imposed under what is now Chapter 36 of the Texas Water Code, for the preservation, conservation, protection, recharge, and prevention of waste and pollution of the underground water of the District except in those areas of the District that were part of the Barton Springs-Edwards Aquifer Conservation District or the Edwards Underground Water District on January 1, 1989. The voters in the District approved the implementation of the powers granted by the Legislature after the 1989 amendment was passed in the Legislature.

1. Introduction: The District recognizes that the groundwater resources of the region are of vital importance not only within the District but to areas outside the District. The District was created, in part, to conserve, preserve, protect, and prevent waste of all of the water resources within its jurisdiction. The District believes that the groundwater resources in the District can be managed in a prudent and cost effective manner through education and conservation, coupled with reasonable regulation, including permitting of new and existing non-exempt wells and registering of exempt wells. Although the District has undertaken studies and has developed information about the occurrence and quality of groundwater in various geologic formations in and near the District, the District continues to conclude that one of the greatest threats to prevent the District from achieving the stated mission are inadequate information about groundwater occurrence, quality, groundwater production volumes, groundwater production rates, groundwater movement and groundwater uses within and from aquifers regulated by the District based in part on a lack of knowledge about groundwater production from exempt wells both within the District and groundwater occurrence and production from all aquifers in areas without groundwater districts adjacent to or in close proximity with the area of Plum Creek Conservation District. The District has concerns about the potential for groundwater quality degradation in some areas of the District related to existing groundwater pumping and to old oil and gas activities. The District continually needs to develop more information to understand how groundwater production, recharge, and flow into and out of the District are interrelated with

production, recharge and flow in areas surrounding the District. Basic knowledge of the aquifers and their hydrogeological properties, a quantification of resources, and development of data on groundwater quality are the foundation from which to build prudent planning measures. This Management Plan is intended as a tool to focus the thoughts and actions of those given the responsibility for the execution of the District's activities in developing information and in driving activities implementing the District's goals.

2. Policy: It shall be the policy of the Board of Directors that the most beneficial use of groundwater in the District is to maintain present non-wasteful groundwater uses of those in the District and then to provide for future groundwater needs of citizens. Groundwater shall be beneficially used, conserved, preserved, protected, and waste prevented within the District to maintain the viability of those resources for current users and for users in the future who are in the District's area. , The Board of Directors, with the cooperation of the citizens of the District and of surrounding political subdivisions, shall implement this management plan and any necessary modifications thereof to achieve this goal.

3. Governing Board: The District is governed by an appointed six member Board of Directors.

4. Daily Operations: The day-to-day management of District activities is carried out currently by a three-member staff led by Johnie Halliburton, Executive Manager and Daniel Meyer, Assistant Manager.

5. Topography: The land surface of Caldwell County ranges from nearly flat to hilly. The minimum elevation, about 295 feet, is at the southern tip of the County where Plum Creek joins the San Marcos River. The maximum elevation in Caldwell County, about 725 feet, is in the area of the so-called "Iron Mountains" peaks, approximately 2.5 miles southeast of McMahan, a small community approximately 9 miles southeast of Lockhart. Regionally, the topographic elevations increase from southeast to northwest.

The portion of District located in Hays County generally exhibits the same type of terrain, although the elevation differences are more pronounced. Some of the surface of the District's area extends into Hays County, which overlies the Balcones Escarpment, and provides drainage to a portion of Plum Creek.

Plum Creek drains about 310 square miles, or about 60% of Caldwell County. In addition, a portion of Hays County that is drained by Plum Creek is also in the boundaries of the District. There is a small area of Travis County that drains into Plum Creek but that area is not within the District's boundaries.

6. Location and Extent: The District is situated within parts of Caldwell and Hays Counties, but the District's boundaries are not conterminous with those of either Caldwell or Hays Counties. The original boundaries of the District are described in Section 3 of the enabling statute that first created the District. In 2008 there were additional properties located in the southeastern portion of Caldwell County annexed into PCCD at the request of the landowners of the properties, however; the area where those properties were located was also annexed into the Gonzales County Underground Water Conservation District. S.B 1225 of the 82nd legislature enacted in 2011 was passed to and allowed the property owners annexed by Plum Creek to choose which district they wanted to belong to with the result that the original boundaries of the District were expanded by approximately 4672 acres. The most downstream point of the boundaries of the District is in the most southerly southeast corner of Caldwell County near the confluence of Plum Creek and the San Marcos River. The calls in the original description of the boundaries of Plum Creek Conservation District are, generally, along tract or survey lines.

7. Water Resources: The District does not hold, own or otherwise control any groundwater or surface water rights. The District is located within the territory of the Guadalupe-Blanco River Authority ("GBRA"), which controls substantial surface water rights associated with GBRA owned or operated facilities and reservoirs, including Canyon Lake. Some water supply corporations providing retail water service within the District have access to surface water supplies either through direct ownership, through lease, or through long term supply contracts. Most of the permitted surface water rights in the vicinity of Plum Creek Conservation District are from the San Marcos River, which is not in the Boundaries of the District. There are few surface water rights permits for diversions from Plum Creek and none known for diversion from Plum Creek for any purpose other than agricultural use.

As a part of this Plan, each year the District will confer at least once with GBRA on cooperative opportunities for conjunctive resource management between ground and surface water suppliers to retail providers and other users.

4. GROUNDWATER RESOURCES

The PCCD has within its surface area boundaries the following geological formations: Quaternary Alluvium, Leona Gravel, Austin-Pecan Gap, Navarro, Midway, Wilcox Group, Queen City, Reklaw, Saline Edwards, Trinity Group and the Carrizo Sands. A geologic map of the area of the District is appended as Appendix C. The Texas Water Development Board recently ran a groundwater availability model for the Southern portions of the Carrizo-Wilcox, Queen City, and Sparta, aquifers within the District. No information on discharges from, exchanges among aquifers, or flow into or out of the Leona Gravel, or from recent alluvium deposits in the District is currently available from the Texas Water Development Board. The full modeling report, GAM Run 12-001-Plum Creek Conservation District Management Plan, is appended to this Plan as Appendix B.

5. MANAGEMENT ZONES

1. **Alluvium** – occurs along present day streams and rivers. Consists of sand, silt and clay. Serves as a limited household and livestock aquifer within the predominant sand facies.

2. **Leona** – occurs along scattered outcrops perpendicular to the Balcones Fault System and the IH-35 corridor. Serves as a shallow limited aquifer utilized manly as a small lot irrigation aquifer. Cotton and grain farming has polluted much of the aquifer with nitrates, which are not recommended for human or livestock consumption.

3. **Weches** – is primarily a glauconitic marine clay and is seldom utilized as stray sand or silt aquifer.

4. **Queen City** – occurs as a shallow limited sand and silt aquifer with lesser amounts of clay. The completed wells are generally utilized for household and livestock.

5. **Reklaw** – primarily consists of clay with broken silt and sand intervals that can serve as shallow household and livestock aquifers in limited areas.

6. **Carrizo** – occurs as a major irrigation and municipal aquifer. Consists of ancient barrier island loose fine-coarse sand bodies separated by thin estuary silty clays. It is the major aquifer along the Upper Gulf Coastal Plain across southern Texas capable of high production rates of fresh water.

7. **Wilcox** – often studied and associated with the overlying Carrizo aquifer. It is separated from the Carrizo by a regional disconformity and exhibits some very different deltaic facies as compared to the Carrizo. It is utilized as a household, livestock and municipal source of fresh water over a wide area.
8. **Midway** – occurs primarily as a thick clay with minor amounts of silt near the top of the unit. It does not generally serve as a reliable aquifer, even in limited silty zones.

9. **Navarro** – consists mainly as a thick sequence of expansive clay. It does not serve as an aquifer within the boundaries of the Plum Creek District.

10. **Pecan Gap** – this limestone and chalk unit does serve as a very limited household and livestock fractured low yield aquifer along and parallel to the southeast side of the IH-35 corridor. Many of the wells eventually go dry.

11. **Austin Chalk** – this very limited limestone and chalk aquifer immediately underlies the Pecan Gap and exhibits similar characteristics.

12. **Eagle Ford** – this unit is a petroliferous thin clay and does not serve as an aquifer.

13. **Buda** – occurs as a dense limestone unit in the PCCD area and does not serve as any known aquifer. It does serve as an aquifer in the Uvalde County area.

14. **Del Rio** – does not serve as an aquifer in Texas. It occurs a weathered volcanic ash expansive clay.

15. **Georgetown** – occurs a dense limestone and is not expected to serve as a brackish or saline aquifer in the PCCD area.

16. **Edwards** – this limestone and dolomite karst aquifer is the major fresh water source for the cities, towns and industries along the IH-35 corridor which partially fall within the PCCD area. The unit is also a very strong future candidate of brackish and saline water southeast of the IH-35 corridor that may eventually rival the Carrizo aquifer.

17. **Glen Rose** – certain areas within the Glen Rose along the axis of the San Marcos Arch do harbor large carbonate patch reefs that do contain substantial amounts of brackish and saline water. These Glen Rose patch reefs will undoubtedly be utilized as desalination targets.

18. **Bexar** – occurs as a thin clay and does not serve as an aquifer.

19. **James (Cow Creek)** – does serve as a highly-used household and livestock aquifer along the northwest side of the IH-35 corridor in the Hill Country Balcones Fault System. Recently discovered higher yield Cow Creek wells have been tested in a limited area of the Balcones Fault System.

20. **Pine Island** – occurs as natural gas charged expansive clay that does not serve as an aquifer.

21. **Sligo** – occurs as sandy glauconitic limestone that may serve as a future limited brackish and saline aquifer.

22. **Hosston** – occurs as a sand and basal gravel aquifer, it serves most of the small town fresh water municipal needs across the Texas Hill Country. The future desalination era will undoubtedly target the brackish and saline portions of the Hosston clastics with the PCCD boundaries.

Management Zone Descriptive Table:

Period	Epoch	Group/Formation/Member	Description
Quaternary	Holocene	Alluvium	Sand, silt, clay
	Pleistocene	Leona	Gravel, sand, silt, clay
Tertiary	Eocene/Paleocene	Weches	Clay, silt, sand
		Queen City	Sand, clay
		Reklaw	Clay, sand, silt
		Carrizo	Sand, clay
		Wilcox	Sand, clay. silt
		Midway	Clay, silt, sand
Cretaceous	Upper	Navarro	Clay, silt, sand
		Pecan Gap	Limestone, clay
		Austin Chalk	Limestone, clay
		Eagle Ford	Clay
	Lower	Buda	Limestone
		Del Rio	Clay
		Georgetown	Limestone
		Edwards	Limestone, dolomite
		Glen Rose	Limestone, dolomite, clay
		Bexar	Clay
		James (Cow Creek)	Limestone
		Pine Island (Hammett)	Clay
		Sligo	Limestone, silt
		Hosston	Sand, clay

6. PRODUCTION AND SPACING OF WELLS

Production and spacing of all wells within the District is regulated by the District according to the Rules of the District. As noted, the Rules may be changed from time to time. The District has recently revised its Rules, with the latest revision becoming effective as of August 1, 2012, to take into account knowledge gained through its geologic studies that have been ongoing and to address anticipated increases in demands on the aquifers in and regulated by the District.

7. MANAGEMENT OF GROUNDWATER SUPPLIES

The District evaluates and monitors groundwater availability, and regulates production consistent with the District Rules, the GMAs(10 & 13) adopted Desired Future Conditions, ("DFC") and the Modeled Available Groundwater determination of the Texas Water Development Board. In consideration of the importance of groundwater availability to the economy and welfare of those in the District, the District anticipates that in the future, groundwater production will be regulated as needed to conserve groundwater, preserve groundwater availability, and protect permitted and exempt groundwater users, in a manner not to unnecessarily and adversely limit production or impact the economic viability of public and private groundwater users. The District will identify and engage in such activities and practices that will permit groundwater production and, as appropriate, will protect the aquifer and groundwater availability by restricting future requested pumping quantities, if necessary, according to the best information then available to the District.

Currently there are a number of monitoring wells that are in PCCD's Aquifer Water Level Observation Program that are being used in order to monitor aquifer conditions within the district and to track compliance with the DFCs. On an annual basis, in accord with advice from its technical consultant, PCCD will, if necessary, modify the program. The District will make a regular assessment of water supply and groundwater storage conditions as observed in data from its network and will report those conditions to the Board and to the public. The District will undertake investigations, and co-operate with third-party investigations including neighboring districts, 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. The District will manage the available groundwater based on the *"Desired Future Conditions"* and Modeled Available Groundwater determination of the aquifers.

The District has adopted Rules to regulate groundwater withdrawals by means of well spacing and production limits or, alternatively, in accord with a study of the effects of the proposed well on the targeted aquifer. The District may deny a water well production permit or limit groundwater withdrawals in accordance with the Rules of the District. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the available data and evidence and then weigh the public benefit against the individual needs and hardship in accord with State law.

The relevant factors to be considered in a determination to grant or deny a well or a production permit or limit groundwater withdrawals are stated in the District's Rules and information furnished can include:

1. Whether the application contains all the information required to be submitted to the District pursuant to these Rules;
2. Whether the application is in conformance with any applicable requirements under Rule 20 – Classification, Spacing and Production Provisions established by the District;
3. Whether the proposed use of groundwater unreasonably affects existing groundwater or surface water resources;
4. Whether the proposed use of groundwater is a beneficial use consistent with District's Certified Groundwater Management Plan;
5. Whether the applicant has agreed to avoid waste and achieve water conservation;
6. Whether the proposed use of the groundwater will result in subsidence;
7. Whether the applicant has agreed that reasonable diligence will be used to protect groundwater quality, and that the applicant will follow well plugging guidelines at the time of well closure;
8. The equitable distribution of the resource; and
9. The potential effect the permit may have on the aquifer, sustainability of the recharge on the aquifer as a whole, and potential impacts to prior existing permitted groundwater users and exempt groundwater users.
10. The modeled available groundwater determined by the executive administrator;
11. The executive administrator's estimate of the current and projected amount of groundwater produced under exemptions granted by district rules and Section 36.117;
12. The amount of groundwater authorized under permits previously issued by the district
13. A reasonable estimate of the amount of groundwater that is actually produced under permits issued by the district;
14. Yearly precipitation and production patterns.
15. Estimated Average Annual Recharge

The transport of groundwater out of the District is regulated by the District according to the Rules of the District.

In pursuit of the District's mission of protecting the resource to facilitate its maximum beneficial use, the District may require reduction of permitted groundwater withdrawals to amounts that, based on then available current information, will not knowingly cause permanent harm to an aquifer. To achieve this purpose, the District may, at the Board's discretion and after notice and hearing, amend or revoke any permit for non-compliance, or reduce the production authorized by permit based upon reliable scientific data for the purpose of protecting the aquifer and groundwater availability. The determination to seek the amendment of a permit will be based on aquifer conditions observed by the District confirmed by reliable scientific analysis. The determination to seek revocation of a permit will be based on compliance and non-compliance with the District's Rules and regulations, and reliable scientific evidence. The District will enforce the terms and conditions of permits and the Rules of the District, as necessary, by fine and/or enjoining the permit holder, or non-permit holder, in a court of competent jurisdiction as provided for in Chapter 36, Texas Water Code.

A drought management plan has been adopted by the Board to cope with the effects of water supply deficits due to climatic or other conditions. In its annual review of the drought management plan, the District, in establishing drought triggers and stages, anticipates consideration of the economic effect of conservation measures upon all water resource user groups, the local implications of the degree and effect of changes in water storage conditions, the unique hydrogeological conditions of the aquifers within the District and the appropriate conditions under which to implement the drought management plan.

The District will employ reasonable and necessary technical resources at its disposal to evaluate the groundwater resources available within the District and to determine the effectiveness of regulatory or conservation measures. The District anticipates that its drought management plan will provide that a public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit drought management plan on grounds of adverse economic hardship or unique local conditions. The exercise of discretion by the Board, shall not be construed as limiting the power of the Board.

8. ACTIONS, PROCEDURES, PERFORMANCE AND PLAN IMPLEMENTATION

The District will implement the provisions of this Plan and will utilize the provisions of this Plan as a guidepost for on-going evaluation determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District and any additional planning efforts in which the District may participate will be consistent with the provisions of this Plan.

The District has adopted Rules relating to the permitting of wells, production and transport of groundwater. The Rules adopted by the District will be modified to take into account this Plan once it has been approved and shall be amended as necessary, pursuant to Chapter 36 of the TEXAS WATER CODE consistent with the provisions of this Plan based upon reliable scientific evidence. All Rules will be enforced. The promulgation and enforcement of the Rules will be based on the best technical data reasonably available. A link to the District rules is provides as follows:
http://www.pccd.org/PCCD%20GW%20Management%20&%20Protection%20Rules.pdf

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 rights of other groundwater owners and users within the District. The exercise of said discretion by the Board, shall not be construed as limiting the power of the Board.

The District will seek cooperation with other agencies in the implementation of this Plan and the management of groundwater supplies within the District.

The District believes that there is a significant issue that affects groundwater within its boundaries and affects the District's ability to effectively manage the groundwater resources within the District. That issue is that there are very productive regions of aquifers that are near but not within Plum Creek Conservation District's regulatory authority. Should there be large volume water production from aquifers in these areas, there is significant potential that such production will impact water quantity and/or water quality of users in the District.

The fact that Plum Creek Conservation District's surface boundaries also includes areas that are within the Barton Springs Edwards Aquifer Conservation District and the Edwards Aquifer Authority [the District does have authority over any

aquifers in Hays and Caldwell County within its boundary that are not regulated by either the Edwards Aquifer Authority or the Barton Springs-Edwards Aquifer Conservation District -] indicates that Plum Creek should cooperate with [and provide some assistance to] the EAA and the Barton Springs-Edwards District while developing plans for understanding and use of water resources to the fast growing area along Interstate 35 between San Antonio and Austin. PCCD's territory extends from Northwest of IH 35 to IH 10 and encompasses much of an area that is projected to have rapid growth. The completion of SH 130, along with other regional projects is considered by many to be a necessary infrastructure component to allow for population and economic growth. Developers and retail water suppliers are already searching for additional water supplies to meet growing demand.

Finally, there are significant long-existing oil and gas operations in the southern part of the District along with the possible future exploration and development of gas-liquids shale plays. Should those activities continue to increase as the price for oil and gas resources stays high, there may be significant consumption of water, or other groundwater impacts such as the potential for pollution, related to such activities that is outside the scope of regulatory power of any groundwater district.

For these reasons, all activities of the District will be undertaken in co-operation and coordinated with the appropriate state, regional or local water management entities where they are present. However, simply stated, in Hays County there are many such agencies looking at management of groundwater; in Caldwell County the absence of a groundwater agency in the eastern and western part of the county makes management of the groundwater resources in the District more challenging.

9. METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS

The Groundwater Manager of the District will prepare and present an annual report to the Board of Directors on the performance of the District with respect to achieving its management goals and objectives. The presentation of the report will occur during the last monthly Board meeting each fiscal year, beginning after the adoption and approval of this Plan. The report will include an enumeration and listing of activities furthering the District's management objectives during the fiscal year. Each activity will be referenced to the estimated expenditure of staff time and District resources used in accomplishment of the activity. The notations of activity frequency, staff time and resources used will be referenced to the appropriate performance standard for each management objective describing the activity, so that the effectiveness and efficiency of the District's operations may be evaluated. The Board will maintain the adopted report on file, for public

inspection, at the District's offices. This methodology will apply to all management goals contained within this plan.

10. MANAGEMENT GOALS, OBJECTIVES, & PERFORMANCE STANDARDS

10.1 Providing the Most Efficient Use of Groundwater

Management Objectives:

1. The PCCD Aquifer Water Level Observation Well Program will have at least 6 observation wells located according to management zones within the District, and measure those wells at least one time a year.

2. As part of the Aquifer Water Level Observation Program, the District will geographically divide the surface area overlying the aquifers of Plum Creek Conservation District into a grid-type network of units.

3. The district will have a goal of establishing at least one monitoring water well in each of these units.

4. The District will provide educational leadership to citizens within the District concerning this subject. The activity will be accomplished annually through at least one printed publication, such as a brochure, and public speaking at service organizations and public schools as provided for in the District's Public Education Program.

5. The District will use its best efforts to obtain information on water being produced from areas in Caldwell County that are outside the boundaries of the District.

6. The District will use its best efforts to obtain information on groundwater being produced from groundwater aquifers in counties surrounding the District as well as in areas close to the District that are not in a groundwater conservation district in order to develop information about impacts of such production on groundwater in the District.

Performance Standards:

1. The PCCD Aquifer Water Level Observation Well Program will have at least 6 observation wells located according to management zones within the District.

2. Water levels at these observation wells will be measured a minimum of one time during the year.

3. As part of the Aquifer Water Level Observation Program the District will geographically divide the surface area overlying the aquifers of Plum Creek Conservation District into a grid type network of units within one year of the adoption of this plan.

4. On an annual basis the district will assess the District's progress of establishing at least one monitoring well in each of these units.

5. PCCD representatives will circulate at least one publication and participate in one speaking engagement each year.

6. PCCD representatives will attend and participate in GMA meetings appropriate to the District's regulatory authority.

7. PCCD will periodically seek information from nearby groundwater districts not in the same GMA but drawing from the same aquifers regulated by the District.

10.2 Controlling and Preventing Waste of Groundwater.

Management Objective:

The District will provide educational leadership to citizens within the District concerning this subject. The activity will be accomplished annually through at least one printed publication, such as a brochure.

Performance Standard:

1. Each calendar year Representatives of Plum Creek will prepare at least one informational article listing current data related to groundwater production and well levels. The goal of the article is to make those who use and depend on the groundwater aware of their use, aware of the impacts of their use, and the need to be responsible in that use.

2. At its offices Plum Creek will maintain an inventory of publications of others, such as those prepared by the Guadalupe Blanco River Authority about the necessity for conservation, and serve as a local source for distribution of those publications.

10.3 Controlling and Preventing Subsidence

It is uncertain as to whether subsidence from the production of groundwater would likely occur in the Plum Creek Conservation District. The District historically has not, as we know, experienced any subsidence from any cause. Accordingly, the District's Plan does not contain any "Management Objective" or related "Performance Standards" to address the issue of non-existent subsidence. The TWDB has commissioned a subsidence study for the Major and Minor aquifers of Texas. If after reviewing TWDB's report, it shows scientific evidence of subsidence or the potential there of in PCCD, then the District would further investigate the possibility of whether there would be landowners negatively impacted. Alluvium is poorly consolidated, but generally too thin to experience measurable (if any) subsidence due to groundwater withdrawals.

10.4 Addressing Conjunctive Surface Water Management Issues

Management Objective:

Each year the District will seek conferral with the Guadalupe-Blanco River Authority (GBRA) and/or other local political subdivisions and water and wastewater utilities on cooperative opportunities for conjunctive resource management.

Performance Standard:

1. Each year the District will seek conferral with the GBRA, other political subdivisions or water and wastewater utilities providing retail water service within Plum Creek's boundaries, to gain information about conjunctive resource management.

2. The District will continue to participate in the quarterly meetings of the Plum Creek Watershed Project through the time of completion of the water quality management plan being developed in that effort

10.5 Addressing Drought Conditions

Management Objective:

Review the Drought Management Strategy Plan annually, and revise it if necessary based upon the availability of additional scientific data collected by or presented to the Board . The Drought Management Strategy Plan will be implemented when specified conditions require.

Performance Standards:

1. Review on an annual basis all of the conditions and requirements specified in the Drought Management Strategy Plan that would trigger its implementation.

2. Use data that are available from local weather stations monitoring rainfall, looking at the correlation between rainfall, water levels, groundwater recharge and availability.

3. Provide a link on the District's website for TWDB's drought web page. https://waterdatafortexas.org/drought

10.6 Addressing Natural Resource Issues That Impact the Use and Availability of Groundwater and Which are Impacted By the Use of Groundwater

Management Objectives:

1. Each year the District will seek conferral with a representative of the Texas Railroad Commission (RRC) on the impact of oil and gas production or waste and disposal operations associated with oil and gas production on groundwater availability and quality, as well as the impact of groundwater production on the production of oil and gas in the District.

2. Also, during each year the District will evaluate all permit applications for new production injection or disposal wells permitted by the Railroad Commission, if any are filed, and the information submitted by the applicants on those wells prior to drilling, in order to assess the impact of these wells on the groundwater resources in the District.

Performance Standards:

1. Will seek conferral annually with a representative of the Texas RRC ;

2. The addition of available RRC well data to the District's database;

3. Report to the PCCD Board of Directors when new groundwater well permit applications are filed, and the possible impacts of those new wells on the groundwater resources in the District; and

4. Annual reports to the Board about consumption and use of groundwater for commercial purposes, including irrigation uses and enhanced oil and gas production when information is available.

10.7 Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, or Brush Control where appropriate and cost-effective

Management Objectives:

1. The District will provide educational leadership and encouragement to citizens within the District on the need for water conservation and publicize the benefits of rainwater harvesting and brush control. The educational efforts and publicity will be through distribution of brochures produced either by the District or by others and made available by the District and through the presentation annually of informational articles that tabulate data developed by the District on the groundwater resources being monitored. Each of the following topics will be addressed in the publications:

   A. Conservation

   B. Rainwater Harvesting

   C. Brush Control

2. With respect to recharge enhancement, the District will continue to develop geologic data to map and gain understanding of the relationship between recharge to and discharge from various formations to each other and to Plum Creek as it flows through the District. At this time, the relationships among the aquifers and the Creek are not well documented or understood. It is known that recharge of much of the groundwater that can be found in the District, and in areas next to the District that are not in any groundwater district, originate outside the boundaries of the District. There is some natural recharge to aquifers in the District from both streams and from areas where those aquifers are at the surface. However, the formations found in the District are not readily susceptible to recharge enhancement.

3. The District has an active brush control program for the flood water retention structures that it maintains. The

District also cooperates with the US Department of Agriculture in agricultural conservation efforts and actively supports the local Soil and Water Conservation District.

4. The District has participated in the funding of a rainwater harvesting demonstration project at the Luling Foundation and will continue to monitor the results of that project and report those results in its articles.

5. The District does not believe that precipitation enhancement is appropriate and cost effective in its area. At the same time, PCCD is aware of efforts being implemented by other districts and will continue to monitor the information gathered from those and determine whether such efforts might be attempted by the District. The District will continue to assess the need and opportunity for precipitation enhancement in the District at least once every five years.

Performance Standards:

1. Preparation and distribution of at least two publications each year containing information about conservation, rainwater harvesting and brush control efforts.

2. The District staff will continue to cooperate with the Natural Resource Conservation Service to control brush on the 28 flood water retention structures maintained by the District. In addition, the District will participate in at least one meeting each year with the local soil and water conservation district to discuss brush control efforts, and will continue to support the local soil and water conservation districts efforts through and annual financial contribution.

3. The District will obtain, if available, at least one report each year about the relationship between recharge of aquifers in the District and rainfall on the surface to determine whether it would be appropriate and cost effective to develop a trial plan for recharge enhancement.

4. At least once every 5 years the staff will report to the Board on the results of nearby precipitation enhancement activities so the Board can consider the feasibility of participating in any efforts in the area of lands that are serving as sources of recharge for groundwater found in the District. If the Board determines that precipitation enhancement might be appropriate and cost effective, within two years the Board will develop and adopt a

program allowing participation in precipitation efforts ongoing in the region.

10.8. Mitigation & Desired Future Conditions of Groundwater Resources

The mitigation plan will be reviewed on an annual basis and revised if necessary in order to be compliant with the adopted DFCs and any current or new state law in effect. Further, any projects that have been mitigated will also be reviewed on an annual basis.

Review of groundwater resources in the District in comparison with the Desired Future Conditions of those resources and preparation of a recommendation for any mitigation actions within six (6) months or later if warranted.

10.9 Addressing the Desired Future Conditions established under TWC §36.108

Management Objective:

At least once every three years, the District will monitor water levels and evaluate whether the change in water levels is in conformance with the DFCs adopted by the District. The District will estimate total annual groundwater production for each aquifer based on the water use reports, estimated exempted use, and other relevant information, and compare these production estimates to the MAGs.

Performance Standard:

1. At least once every three years, the executive manager will report to the Board the measured water levels obtained from the monitoring wells within each Management Zone, the average measured drawdown for each Management Zone calculated from the measured water levels of the monitoring wells within the Management Zone, a comparison of the average measured drawdowns for each Management Zone with the DFCs for each Management Zone, and the District's progress in conforming with the DFCs.

2. At least once every three years, the executive manager will report to the Board the total permitted production and the estimated total annual production for each aquifer and compare these amounts to the MAGs for each aquifer.
4. In conjunction with information from PCCD's drought management plan, Aquifer Water Level Observation Well Program , water use production patterns, analysis from PCCD's geological consultant and other pertinent technical data, the board, at least once every three(3) years will determine if conditions are present that would jeopardize

DFC compliance and if so, schedule a hearing to address limiting water use for water well production permit holders.

10.10 Alternative Supply

Management Objective:

1. The District will assess the need and feasibility, including funding options, of developing a program to research, participate in regional studies with other groundwater conservation districts and regional agencies in order to look at the potential benefits of alternative water supply sources such as underdeveloped aquifers, one being the Trinity Aquifer, desalinization, rainwater harvesting, and aquifer recovery and storage in and around our district.

Performance Standard:

1. Assess the groundwater resources of the Trinity Group and saline Edwards. The district will assess the need to develop one or more monitoring wells in order to determine the aquifer characteristics and potential for public supply and to cooperate with GCDs that have similar goals.

2. The district will evaluate and support studies on ASR and on desalination projects through cooperative collaboration or financial assistance.

11. PROJECTED WATER DEMANDS WITHIN THE DISTRICT

Please refer to Appendix A-Estimated Historical Groundwater Use and 2017 State Water Plan Datasets

12. PROJECTED SURFACE WATER SUPPLIES WITHIN THE DISTRICT

Please refer to Appendix A-Estimated Historical Groundwater Use and 2017 State Water Plan Datasets

13. WATER NEEDS WITHIN THE DISTRICT

Please refer to Appendix A-Estimated Historical Groundwater Use and 2017 State Water Plan Datasets

14. WATER MANAGEMENT STRATEGIES WITHIN THE DISTRICT

Please refer to Appendix A-Estimated Historical Groundwater Use and 2017 State Water Plan Datasets

15. ESTIMATE OF GROUNDWATER USE IN THE DISTRICT

Please refer to Appendix A-Estimated Historical Groundwater Use and 2017 State Water Plan Datasets

16. Annual Amount of Recharge From Precipitation to the Groundwater Resources within the District

Please refer to Appendix B-GAM Run 12-001: Plum Creek Conservation District Management Plan.

17. Annual Volume of Water that Discharges from the Aquifer to Springs and Surface Water Bodies

Please refer to Appendix B-GAM Run 12-001: Plum Creek Conservation District Management Plan.

18. Estimate of the Annual Volume of Flow into the District, out of the District, and Between Aquifers in the District

Please refer to Appendix B-GAM Run 12-001: Plum Creek Conservation District Management Plan.

19. Estimate of Modeled Available Groundwater in District Based on Desired Future Conditions

Texas Water Code § 36.001 defines modeled available groundwater as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108".

The joint planning process set forth in Texas Water Code § 36.108 must be collectively conducted by all groundwater conservation districts within the same GMA. The District is a member of GMA 10 & 13. GMA 10 and GMA 13 adopted DFCs, as summarized below, and then forwarded them to the TWDB for MAG development which are also shown below.

TABLE 1: Desired Future Conditions for GMA 10 & 13

GMA	Aquifers	Adopted DFC	Adoption Date
10	Trinity Group	A regional average well drawdown during average recharge conditions that does not exceed 25 feet (including exempt and non-exempt well use)	August 23, 2010
10	Saline Edwards	Well drawdown at the saline-freshwater interface (the so called Edwards "bad water line") in the northern subdivision of GMA 10 that averages no more than 5 feet and does not exceed a maximum of 25 feet at any point on the interface.	August 4, 2010
13	Carrizo-Wilcox, Etal	In Reference to scenario 4 (GAM run 09-034), and an average drawdown of 23 ft., for the Sparta, Weches,Queen City, Reklaw, Carrizo, and Wilcox Aquifers.	April 9, 2010

TABLE 2: Modeled Available Groundwater for the Plum Creek Conservation District

GMA	Aquifers	MAG (acre-ft/ per year)	TWDB MAG Report
10	Trinity Group	238	GTA Aquifer Assessment 10-29 MAG
10	Saline Edwards	112	GTA Aquifer Assessment 10-35 MAG
13	Total Carrizo-Wilcox, Etal	2012 = 18,122 ac-ft./yr. 2060 = 17,138 ac-ft./yr.	GAM Run 10-012 MAG
13	Carrizo	3498	GAM Run 10-012 MAG
13	Wilcox Group	2012 =14,602 ac-ft./yr. 2060 =13,618 ac-ft./yr.	GAM Run 10-012 MAG
13	Queen City	22	GAM Run 10-012 MAG

20. GEOLOGY MAP OF PCCD

Please refer to Appendix C.

We the undersigned members of the Board of Directors do hereby certify and confirm the adoption of this revised and amended Groundwater Management Plan of the Plum Creek Conservation District on this the 13th day of November, 2007 as evidenced by our signatures below:

Board of Directors

_____
James A. Holt, Jr., President

_____
James O. Lipscomb, Vice President

_____
Lucy Knight, Director

_____
Peter Reinecke, Director

_____
Ben Twidwell, Director

_____
Fred Rothert, Director

Attested by: _____
Johnie Halliburton, Executive Manager

Estimated Historical Groundwater Use And 2017 State Water Plan Datasets:

Plum Creek Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
September 20, 2017

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 Groundwater 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 9/20/2017. 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).

The values presented in the data tables of this report are county-based. In cases where groundwater conservation districts cover only a portion of one or more counties the data values are modified with an apportioning multiplier to create new values that more accurately represent conditions within district boundaries. The multiplier used in the following formula is a land area ratio: (data value * (land area of district in county / land area of county)). For two of the four SWP tables (Projected Surface Water Supplies and Projected Water Demands) only the county-wide water user group (WUG) data values (county other, manufacturing, steam electric power, irrigation, mining and livestock) are modified using the multiplier. WUG values for municipalities, water supply corporations, and utility districts are not apportioned; instead, their full values are retained when they are located within the district, and eliminated when they are located outside (we ask each district to identify these entity locations).

The remaining SWP tables (Projected Water Supply Needs and Projected Water Management Strategies) are not modified because district-specific values are not statutorily required. Each district needs only "consider" the county values in these tables.

In the WUS table every category of water use (including municipal) is apportioned. Staff determined that breaking down the annual municipal values into individual WUGs was too complex.

TWDB recognizes that the apportioning formula used is not perfect but it is the best available process with respect to time and staffing constraints. If a district believes it has data that is more accurate it can add those data to the plan with an explanation of how the data were derived. Apportioning percentages that the TWDB used are listed above each applicable table.

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 2016. TWDB staff anticipates the calculation and posting of these estimates at a later date.

CALDWELL COUNTY

51.56% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2015	GW	933	0	0	0	207	82	1,222
	SW	1,511	4	0	0	27	326	1,868
2014	GW	1,053	0	1	0	335	81	1,470
	SW	1,521	3	0	0	30	322	1,876
2013	GW	1,046	0	0	0	297	77	1,420
	SW	1,509	2	0	0	20	306	1,837
2012	GW	1,207	0	0	0	390	77	1,674
	SW	1,615	0	0	0	42	305	1,962
2011	GW	1,546	0	13	0	527	86	2,172
	SW	1,624	0	27	0	41	344	2,036
2010	GW	1,357	1	2	0	368	87	1,815
	SW	1,580	0	3	0	19	349	1,951
2009	GW	1,400	1	0	0	76	85	1,562
	SW	1,486	0	0	0	9	338	1,833
2008	GW	1,278	1	0	0	134	91	1,504
	SW	1,617	0	0	0	589	360	2,566
2007	GW	914	1	0	0	32	107	1,054
	SW	1,593	0	0	0	606	427	2,626
2006	GW	1,038	1	0	0	179	99	1,317
	SW	1,393	0	0	0	0	396	1,789
2005	GW	1,131	1	0	0	155	140	1,427
	SW	1,257	0	0	0	13	558	1,828
2004	GW	1,922	1	0	0	82	39	2,044
	SW	704	0	0	0	12	503	1,219
2003	GW	1,994	1	0	0	66	36	2,097
	SW	671	0	0	0	483	462	1,616
2002	GW	2,014	3	0	0	115	36	2,168
	SW	557	0	0	0	705	458	1,720
2001	GW	1,999	4	0	0	115	33	2,151
	SW	622	0	0	0	705	425	1,752
2000	GW	2,043	5	0	0	71	47	2,166
	SW	560	0	0	0	439	426	1,425

HAYS COUNTY

9.11% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2015	GW	797	16	27	0	23	8	871
	SW	1,260	0	0	145	17	272	1,694
2014	GW	821	17	34	69	57	7	1,005
	SW	1,208	0	0	0	0	293	1,501
2013	GW	1,073	16	34	91	42	7	1,263
	SW	1,193	0	0	0	0	254	1,447
2012	GW	1,184	18	45	0	60	6	1,313
	SW	1,214	0	0	0	8	223	1,445
2011	GW	1,267	16	59	0	80	9	1,431
	SW	1,221	0	30	0	1	213	1,465
2010	GW	1,179	14	61	0	60	9	1,323
	SW	797	0	32	0	1	249	1,079
2009	GW	1,096	14	60	0	67	28	1,265
	SW	797	0	31	0	0	260	1,088
2008	GW	1,103	16	59	0	65	28	1,271
	SW	724	0	30	0	2	581	1,337
2007	GW	941	13	31	0	112	29	1,126
	SW	635	1	1	0	18	353	1,008
2006	GW	1,120	17	32	0	22	28	1,219
	SW	581	0	0	0	0	313	894
2005	GW	965	16	32	0	13	26	1,052
	SW	481	0	0	0	3	309	793
2004	GW	938	14	32	0	11	18	1,013
	SW	437	1	0	0	29	384	851
2003	GW	949	14	51	0	9	18	1,041
	SW	560	0	0	0	23	217	800
2002	GW	936	14	67	0	1	21	1,039
	SW	456	0	0	0	19	219	694
2001	GW	952	19	56	0	1	19	1,047
	SW	413	0	0	0	19	335	767
2000	GW	908	22	40	0	1	16	987
	SW	414	0	0	0	15	330	759

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

CALDWELL COUNTY

51.56% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	COUNTY LINE WSC	GUADALUPE	CANYON LAKE/RESERVOIR	103	83	61	39	18	0
L	COUNTY-OTHER, CALDWELL	GUADALUPE	GUADALUPE RUN-OF-RIVER	258	258	258	258	258	258
L	GONZALES COUNTY WSC	GUADALUPE	CANYON LAKE/RESERVOIR	19	21	22	23	25	25
L	LIVESTOCK, CALDWELL	COLORADO	COLORADO LIVESTOCK LOCAL SUPPLY	15	15	15	15	15	15
L	LIVESTOCK, CALDWELL	GUADALUPE	GUADALUPE LIVESTOCK LOCAL SUPPLY	243	243	243	243	243	243
L	MARTINDALE	GUADALUPE	CANYON LAKE/RESERVOIR	90	90	90	90	90	90
L	MARTINDALE	GUADALUPE	GUADALUPE RUN-OF-RIVER	100	100	100	100	100	100
L	MAXWELL WSC	GUADALUPE	CANYON LAKE/RESERVOIR	359	368	373	375	376	376
L	MAXWELL WSC	GUADALUPE	GUADALUPE RUN-OF-RIVER	543	557	565	568	569	569
L	SAN MARCOS	GUADALUPE	CANYON LAKE/RESERVOIR	2	2	2	3	3	3
L	UHLAND	GUADALUPE	CANYON LAKE/RESERVOIR	79	94	110	126	142	158
	Sum of Projected Surface Water Supplies (acre-feet)			**1,811**	**1,831**	**1,839**	**1,840**	**1,839**	**1,837**

HAYS COUNTY

9.11% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
K	AUSTIN	COLORADO	COLORADO RUN-OF-RIVER	13	127	249	631	1,519	2,749
K	BUDA	COLORADO	CANYON LAKE/RESERVOIR	1,381	1,292	1,181	1,041	882	701
K	COUNTY-OTHER, HAYS	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	128	128	128	128	128	128
K	DRIPPING SPRINGS	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	506	506	506	506	506	506
K	DRIPPING SPRINGS WSC	COLORADO	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM	133	280	461	691	953	1,126
K	LIVESTOCK, HAYS	COLORADO	COLORADO LIVESTOCK LOCAL SUPPLY	17	17	17	17	17	17
K	WEST TRAVIS COUNTY	COLORADO	HIGHLAND LAKES	4,521	4,521	4,521	4,521	4,521	4,521

	PUBLIC UTILITY AGENCY		LAKE/RESERVOIR SYSTEM						
L	BUDA	GUADALUPE	CANYON LAKE/RESERVOIR	299	388	499	639	798	979
L	COUNTY LINE WSC	GUADALUPE	CANYON LAKE/RESERVOIR	226	197	161	113	57	0
L	COUNTY-OTHER, HAYS	GUADALUPE	CANYON LAKE/RESERVOIR	353	353	353	353	353	353
L	CRYSTAL CLEAR WSC	GUADALUPE	CANYON LAKE/RESERVOIR	323	317	319	329	340	354
L	GOFORTH SUD	GUADALUPE	CANYON LAKE/RESERVOIR	1,050	1,050	1,050	1,050	1,050	1,050
L	IRRIGATION, HAYS	GUADALUPE	GUADALUPE RUN-OF-RIVER	12	12	12	12	12	12
L	KYLE	GUADALUPE	CANYON LAKE/RESERVOIR	5,743	5,743	5,743	5,743	5,743	5,732
L	LIVESTOCK, HAYS	GUADALUPE	GUADALUPE LIVESTOCK LOCAL SUPPLY	19	19	19	19	19	19
L	MAXWELL WSC	GUADALUPE	CANYON LAKE/RESERVOIR	101	92	87	85	84	84
L	MAXWELL WSC	GUADALUPE	GUADALUPE RUN-OF-RIVER	153	139	131	128	127	127
L	SAN MARCOS	GUADALUPE	CANYON LAKE/RESERVOIR	9,998	9,998	9,998	9,997	9,997	9,997
L	STEAM ELECTRIC POWER, HAYS	GUADALUPE	CANYON LAKE/RESERVOIR	224	224	224	224	224	224
L	UHLAND	GUADALUPE	CANYON LAKE/RESERVOIR	99	133	175	229	290	360
	Sum of Projected Surface Water Supplies (acre-feet)			**25,299**	**25,536**	**25,834**	**26,456**	**27,620**	**29,039**

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.

CALDWELL COUNTY

51.56% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	AQUA WSC	COLORADO	43	51	60	68	77	86
L	AQUA WSC	GUADALUPE	242	289	336	385	435	484
L	COUNTY LINE WSC	GUADALUPE	82	97	114	132	149	166
L	COUNTY-OTHER, CALDWELL	COLORADO	26	31	36	41	46	52
L	COUNTY-OTHER, CALDWELL	GUADALUPE	348	410	474	541	612	681
L	CREEDMOOR-MAHA WSC	COLORADO	114	133	152	172	195	216
L	CREEDMOOR-MAHA WSC	GUADALUPE	29	34	39	45	50	56
L	GOFORTH SUD	GUADALUPE	41	49	56	64	73	81
L	GONZALES COUNTY WSC	GUADALUPE	58	70	83	95	91	102
L	IRRIGATION, CALDWELL	COLORADO	10	9	8	7	6	6
L	IRRIGATION, CALDWELL	GUADALUPE	309	274	244	217	192	175
L	LIVESTOCK, CALDWELL	COLORADO	37	37	37	37	37	37
L	LIVESTOCK, CALDWELL	GUADALUPE	483	483	483	483	483	483
L	LOCKHART	GUADALUPE	2,251	2,676	3,105	3,547	4,010	4,465
L	LULING	GUADALUPE	950	1,125	1,301	1,484	1,678	1,868
L	MANUFACTURING, CALDWELL	GUADALUPE	4	5	5	6	6	7
L	MARTINDALE	GUADALUPE	187	221	256	292	330	367
L	MAXWELL WSC	GUADALUPE	414	487	561	638	720	802
L	MINING, CALDWELL	COLORADO	6	5	3	2	1	1
L	MINING, CALDWELL	GUADALUPE	58	46	34	22	9	4
L	MUSTANG RIDGE	COLORADO	69	82	95	108	122	136
L	MUSTANG RIDGE	GUADALUPE	2	2	2	3	3	3
L	NIEDERWALD	GUADALUPE	16	19	22	25	28	31
L	POLONIA WSC	COLORADO	282	333	386	440	498	554
L	POLONIA WSC	GUADALUPE	596	707	819	935	1,055	1,175
L	SAN MARCOS	GUADALUPE	2	3	4	5	6	7
L	UHLAND	GUADALUPE	79	94	110	126	142	158
	Sum of Projected Water Demands (acre-feet)		**6,738**	**7,772**	**8,825**	**9,920**	**11,054**	**12,203**

HAYS COUNTY

9.11% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
K	AUSTIN	COLORADO	13	127	249	631	1,519	2,749

K	BUDA	COLORADO	1,769	2,508	3,420	4,564	5,860	7,338
K	CIMARRON PARK WATER COMPANY	COLORADO	249	241	234	230	229	229
K	COUNTY-OTHER, HAYS	COLORADO	283	337	421	517	599	681
K	DRIPPING SPRINGS	COLORADO	479	537	610	704	813	938
K	DRIPPING SPRINGS WSC	COLORADO	533	680	861	1,091	1,353	1,652
K	GOFORTH SUD	COLORADO	85	130	185	255	334	425
K	IRRIGATION, HAYS	COLORADO	10	10	10	10	10	10
K	LIVESTOCK, HAYS	COLORADO	20	20	20	20	20	20
K	MANUFACTURING, HAYS	COLORADO	32	36	41	45	49	53
K	MINING, HAYS	COLORADO	77	98	124	132	151	172
K	MOUNTAIN CITY	COLORADO	57	56	54	54	54	54
K	PLUM CREEK WATER COMPANY	COLORADO	163	264	283	300	312	322
K	WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	COLORADO	4,093	5,758	7,795	10,343	13,226	16,508
L	BUDA	GUADALUPE	299	388	499	639	798	979
L	COUNTY LINE WSC	GUADALUPE	181	231	298	383	478	587
L	COUNTY-OTHER, HAYS	GUADALUPE	188	208	416	572	1,077	1,638
L	CREEDMOOR-MAHA WSC	GUADALUPE	10	12	15	19	23	28
L	CRYSTAL CLEAR WSC	GUADALUPE	632	717	827	973	1,143	1,338
L	GOFORTH SUD	GUADALUPE	1,384	1,753	2,220	2,818	3,504	4,287
L	IRRIGATION, HAYS	GUADALUPE	59	59	58	58	57	56
L	KYLE	GUADALUPE	5,156	7,680	9,133	9,119	9,108	9,104
L	LIVESTOCK, HAYS	GUADALUPE	37	37	37	37	37	37
L	MANUFACTURING, HAYS	GUADALUPE	10	11	13	14	15	16
L	MAXWELL WSC	GUADALUPE	117	122	131	144	160	179
L	MOUNTAIN CITY	GUADALUPE	24	30	38	48	60	73
L	NIEDERWALD	GUADALUPE	59	75	96	122	151	185
L	PLUM CREEK WATER COMPANY	GUADALUPE	736	1,068	1,048	1,032	1,019	1,009
L	SAN MARCOS	GUADALUPE	11,934	13,941	16,430	19,485	23,205	27,655
L	STEAM ELECTRIC POWER, HAYS	GUADALUPE	67	88	181	247	336	458
L	UHLAND	GUADALUPE	99	133	175	229	290	360
L	WIMBERLEY	GUADALUPE	626	800	1,018	1,300	1,622	1,990
L	WIMBERLEY WSC	GUADALUPE	450	657	919	1,247	1,617	2,039
L	WOODCREEK	GUADALUPE	282	311	349	399	458	525
	Sum of Projected Water Demands (acre-feet)		**30,213**	**39,123**	**48,208**	**57,781**	**69,687**	**83,694**

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

CALDWELL COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	AQUA WSC	COLORADO	43	35	26	18	9	0
L	AQUA WSC	GUADALUPE	242	195	148	99	49	0
L	COUNTY LINE WSC	GUADALUPE	56	19	-22	-64	-104	-141
L	COUNTY-OTHER, CALDWELL	COLORADO	182	173	163	154	143	133
L	COUNTY-OTHER, CALDWELL	GUADALUPE	1,108	986	862	732	596	462
L	CREEDMOOR-MAHA WSC	COLORADO	0	0	0	0	0	0
L	CREEDMOOR-MAHA WSC	GUADALUPE	0	0	0	0	0	0
L	GOFORTH SUD	GUADALUPE	0	0	0	0	0	0
L	GONZALES COUNTY WSC	GUADALUPE	14	11	4	-3	6	-3
L	IRRIGATION, CALDWELL	COLORADO	0	2	4	6	7	8
L	IRRIGATION, CALDWELL	GUADALUPE	34	101	160	213	261	294
L	LIVESTOCK, CALDWELL	COLORADO	0	0	0	0	0	0
L	LIVESTOCK, CALDWELL	GUADALUPE	0	0	0	0	0	0
L	LOCKHART	GUADALUPE	-188	-613	-1,042	-1,484	-1,947	-2,402
L	LULING	GUADALUPE	133	-41	-217	-400	-594	-784
L	MANUFACTURING, CALDWELL	GUADALUPE	5	4	3	2	1	0
L	MARTINDALE	GUADALUPE	3	-31	-66	-102	-140	-177
L	MAXWELL WSC	GUADALUPE	624	578	519	448	368	286
L	MINING, CALDWELL	COLORADO	0	0	0	0	0	0
L	MINING, CALDWELL	GUADALUPE	0	0	0	0	0	0
L	MUSTANG RIDGE	COLORADO	0	0	0	0	0	0
L	MUSTANG RIDGE	GUADALUPE	0	0	0	0	0	0
L	NIEDERWALD	GUADALUPE	-13	-16	-20	-23	-26	-29
L	POLONIA WSC	COLORADO	118	65	11	-45	-104	-164
L	POLONIA WSC	GUADALUPE	262	146	26	-101	-237	-377
L	SAN MARCOS	GUADALUPE	1	0	-1	-1	-2	-3
L	UHLAND	GUADALUPE	0	0	0	0	0	0
	Sum of Projected Water Supply Needs (acre-feet)		**-201**	**-701**	**-1,368**	**-2,223**	**-3,154**	**-4,080**

HAYS COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
K	AUSTIN	COLORADO	0	0	0	0	0	0
K	BUDA	COLORADO	161	-667	-1,690	-2,974	-4,429	-6,088

K	CIMARRON PARK WATER COMPANY	COLORADO	0	8	15	19	20	20
K	COUNTY-OTHER, HAYS	COLORADO	983	394	-530	-1,587	-2,489	-3,382
K	DRIPPING SPRINGS	COLORADO	27	-31	-104	-198	-307	-432
K	DRIPPING SPRINGS WSC	COLORADO	0	0	0	0	0	-126
K	GOFORTH SUD	COLORADO	0	0	0	0	0	0
K	IRRIGATION, HAYS	COLORADO	333	333	333	333	333	333
K	LIVESTOCK, HAYS	COLORADO	2	2	2	2	2	2
K	MANUFACTURING, HAYS	COLORADO	236	185	134	88	46	0
K	MINING, HAYS	COLORADO	-531	-761	-1,047	-1,131	-1,340	-1,579
K	MOUNTAIN CITY	COLORADO	0	0	0	0	0	0
K	PLUM CREEK WATER COMPANY	COLORADO	0	0	0	0	0	0
K	WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY	COLORADO	728	-937	-2,974	-5,522	-8,405	-11,687
L	BUDA	GUADALUPE	0	0	0	0	0	0
L	COUNTY LINE WSC	GUADALUPE	122	45	-56	-187	-336	-500
L	COUNTY-OTHER, HAYS	GUADALUPE	3,101	2,881	601	-1,109	-6,654	-12,812
L	CREEDMOOR-MAHA WSC	GUADALUPE	0	0	0	0	0	0
L	CRYSTAL CLEAR WSC	GUADALUPE	84	-13	-118	-243	-388	-551
L	GOFORTH SUD	GUADALUPE	2,763	2,340	1,810	1,133	358	-525
L	IRRIGATION, HAYS	GUADALUPE	88	94	100	106	112	118
L	KYLE	GUADALUPE	1,176	-1,348	-2,801	-2,787	-2,776	-2,783
L	LIVESTOCK, HAYS	GUADALUPE	0	0	0	0	0	0
L	MANUFACTURING, HAYS	GUADALUPE	573	558	542	528	515	501
L	MAXWELL WSC	GUADALUPE	176	144	120	101	83	64
L	MOUNTAIN CITY	GUADALUPE	4	-1	-7	-17	-29	-42
L	NIEDERWALD	GUADALUPE	-49	-65	-85	-111	-140	-174
L	PLUM CREEK WATER COMPANY	GUADALUPE	248	-185	-184	-185	-184	-184
L	SAN MARCOS	GUADALUPE	1,867	-140	-2,629	-5,685	-9,405	-13,855
L	STEAM ELECTRIC POWER, HAYS	GUADALUPE	4,646	4,411	3,394	2,668	1,688	353
L	UHLAND	GUADALUPE	0	0	0	0	0	0
L	WIMBERLEY	GUADALUPE	218	44	-174	-456	-778	-1,146
L	WIMBERLEY WSC	GUADALUPE	233	26	-236	-564	-934	-1,356
L	WOODCREEK	GUADALUPE	716	687	649	599	540	473
	Sum of Projected Water Supply Needs (acre-feet)		**-580**	**-4,148**	**-12,635**	**-22,756**	**-38,594**	**-57,222**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

CALDWELL COUNTY

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

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
COUNTY LINE WSC, GUADALUPE (L)							
BRACKISH WILCOX GROUNDWATER FOR CRWA	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	64	105	141
CRWA SIESTA PROJECT	DIRECT REUSE [BEXAR]	0	0	10	0	0	0
CRWA SIESTA PROJECT	SAN ANTONIO RUN-OF-RIVER [WILSON]	0	0	12	0	0	0
REUSE - KYLE/COUNTY LINE WSC	DIRECT REUSE [HAYS]	16	15	14	13	12	11
		16	**15**	**36**	**77**	**117**	**152**
COUNTY-OTHER, CALDWELL, COLORADO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**
COUNTY-OTHER, CALDWELL, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	2
		0	**0**	**0**	**0**	**0**	**2**
GOFORTH SUD, GUADALUPE (L)							
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	0	0	0	0
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**
GONZALES COUNTY WSC, GUADALUPE (L)							
LOCAL CARRIZO AQUIFER DEVELOPMENT	CARRIZO-WILCOX AQUIFER [GONZALES]	0	0	0	3	3	3
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	8	12	20	29	32	42
		8	**12**	**20**	**32**	**35**	**45**
LOCKHART, GUADALUPE (L)							
DROUGHT MANAGEMENT - LOCKHART	DEMAND REDUCTION [CALDWELL]	113	0	0	0	0	0
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	1,120	1,120	1,120	1,484	1,947	2,402
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	72
		1,233	**1,120**	**1,120**	**1,484**	**1,947**	**2,474**
LULING, GUADALUPE (L)							
GBRA - MBWSP - SURFACE WATER W/	GUADALUPE RUN-OF-	1,673	1,674	1,674	1,673	1,678	1,868

ASR (OPTION 3C)	RIVER [GONZALES]						
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	3
		1,673	**1,674**	**1,674**	**1,673**	**1,678**	**1,871**
MARTINDALE, GUADALUPE (L)							
DROUGHT MANAGEMENT - MARTINDALE	DEMAND REDUCTION [CALDWELL]	9	0	0	0	0	0
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	31	66	102	140	177
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	1
		9	**31**	**66**	**102**	**140**	**178**
MUSTANG RIDGE, COLORADO (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	1
		0	**0**	**0**	**0**	**0**	**1**
MUSTANG RIDGE, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	0	0
		0	**0**	**0**	**0**	**0**	**0**
NIEDERWALD, GUADALUPE (L)							
DROUGHT MANAGEMENT - NIEDERWALD	DEMAND REDUCTION [CALDWELL]	1	0	0	0	0	0
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	13	16	20	23	26	29
		14	**16**	**20**	**23**	**26**	**29**
POLONIA WSC, COLORADO (L)							
LOCAL CARRIZO AQUIFER WITH CONVERSION	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	0	0	45	104	164
		0	**0**	**0**	**45**	**104**	**164**
POLONIA WSC, GUADALUPE (L)							
LOCAL CARRIZO AQUIFER WITH CONVERSION	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	0	0	101	237	377
		0	**0**	**0**	**101**	**237**	**377**
SAN MARCOS, GUADALUPE (L)							
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	1	1	1	1
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	0	0	1	1	2
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	1	1
REUSE - SAN MARCOS	DIRECT REUSE [HAYS]	0	1	1	1	2	2
		0	**1**	**2**	**3**	**5**	**6**
UHLAND, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [CALDWELL]	0	0	0	0	2	6
		0	**0**	**0**	**0**	**2**	**6**
Sum of Projected Water Management Strategies (acre-feet)		**2,953**	**2,869**	**2,938**	**3,540**	**4,291**	**5,305**

HAYS COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
AUSTIN, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [HAYS]	1	13	25	63	152	275
		1	**13**	**25**	**63**	**152**	**275**
BUDA, COLORADO (K)							
DIRECT REUSE - BUDA	DIRECT REUSE [HAYS]	2,240	2,240	1,740	1,740	1,740	1,740
DROUGHT MANAGEMENT	DEMAND REDUCTION [HAYS]	177	251	342	456	586	734
EDWARDS / MIDDLE TRINITY ASR	TRINITY AQUIFER ASR [HAYS]	0	600	600	600	600	600
HCPUA PIPELINE - REGION K RECOMMENDED	CARRIZO-WILCOX AQUIFER [GONZALES]	0	667	1,690	2,467	2,467	2,467
MUNICIPAL CONSERVATION - BUDA	DEMAND REDUCTION [HAYS]	88	206	434	552	709	888
SALINE EDWARDS ASR	EDWARDS AQUIFER ASR [TRAVIS]	0	100	100	100	100	100
SALINE EDWARDS ASR (SALINE)	EDWARDS-BFZ AQUIFER [TRAVIS]	0	400	400	400	400	400
		2,505	**4,464**	**5,306**	**6,315**	**6,602**	**6,929**
COUNTY-OTHER, HAYS, COLORADO (K)							
BRUSH CONTROL	COLORADO RUN-OF-RIVER [HAYS]	425	425	425	425	425	425
DROUGHT MANAGEMENT	DEMAND REDUCTION [HAYS]	466	554	693	852	987	1,121
EDWARDS / MIDDLE TRINITY ASR	TRINITY AQUIFER ASR [HAYS]	0	200	200	200	200	200
HAYS COUNTY PIPELINE - REGION K RECOMMENDED	CARRIZO-WILCOX AQUIFER [GONZALES]	0	2,000	2,000	2,000	2,000	2,000
SALINE EDWARDS ASR	EDWARDS AQUIFER ASR [TRAVIS]	0	100	100	100	100	100
SALINE EDWARDS ASR (SALINE)	EDWARDS-BFZ AQUIFER [TRAVIS]	0	100	100	100	100	100
		891	**3,379**	**3,518**	**3,677**	**3,812**	**3,946**
DRIPPING SPRINGS, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [HAYS]	96	107	122	141	163	188
HAYS COUNTY PIPELINE - REGION K RECOMMENDED	CARRIZO-WILCOX AQUIFER [GONZALES]	0	0	0	0	134	407
MUNICIPAL CONSERVATION - DRIPPING SPRINGS	DEMAND REDUCTION [HAYS]	48	67	98	141	195	262
WATER PURCHASE	HIGHLAND LAKES LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	31	104	198	173	0
		144	**205**	**324**	**480**	**665**	**857**
DRIPPING SPRINGS WSC, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION	107	136	172	218	271	330

	[HAYS]						
HAYS COUNTY PIPELINE - REGION K RECOMMENDED	CARRIZO-WILCOX AQUIFER [GONZALES]	0	1,000	1,000	1,000	866	593
MUNICIPAL CONSERVATION - DRIPPING SPRINGS WSC	DEMAND REDUCTION [HAYS]	54	124	152	187	232	283
		161	**1,260**	**1,324**	**1,405**	**1,369**	**1,206**
GOFORTH SUD, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [HAYS]	21	33	46	64	84	106
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	0	0	0	0
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [HAYS]	0	0	0	0	0	0
		21	**33**	**46**	**64**	**84**	**106**
MINING, HAYS, COLORADO (K)							
DIRECT REUSE - BUDA	DIRECT REUSE [HAYS]	0	0	500	500	500	500
EDWARDS / MIDDLE TRINITY ASR	TRINITY AQUIFER ASR [HAYS]	0	100	100	100	100	100
EXPANSION OF CURRENT GROUNDWATER SUPPLIES - TRINITY AQUIFER	TRINITY AQUIFER [HAYS]	531	761	1,047	1,047	1,047	1,047
		531	**861**	**1,647**	**1,647**	**1,647**	**1,647**
PLUM CREEK WATER COMPANY, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [HAYS]	8	13	14	15	16	16
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	37	39	42	43	45
		8	**50**	**53**	**57**	**59**	**61**
WEST TRAVIS COUNTY PUBLIC UTILITY AGENCY, COLORADO (K)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [HAYS]	819	1,152	1,559	2,069	2,645	3,302
HAYS COUNTY PIPELINE - REGION K RECOMMENDED	CARRIZO-WILCOX AQUIFER [GONZALES]	0	1,000	1,000	1,000	1,000	1,000
LCRA - LANE CITY RESERVOIR	LCRA NEW OFF-CHANNEL RESERVOIRS (2020 DECADE) [RESERVOIR]	0	500	2,700	3,000	5,800	5,800
MUNICIPAL CONSERVATION - WEST TRAVIS COUNTY PUA	DEMAND REDUCTION [HAYS]	405	1,070	2,064	3,501	5,348	7,674
		1,224	**3,722**	**7,323**	**9,570**	**14,793**	**17,776**
COUNTY LINE WSC, GUADALUPE (L)							
BRACKISH WILCOX GROUNDWATER FOR CRWA	CARRIZO-WILCOX AQUIFER [WILSON]	0	0	0	187	335	500
CRWA SIESTA PROJECT	DIRECT REUSE [BEXAR]	0	0	25	0	0	0
CRWA SIESTA PROJECT	SAN ANTONIO RUN-OF-RIVER [WILSON]	0	0	31	0	0	0
REUSE - KYLE/COUNTY LINE WSC	DIRECT REUSE [HAYS]	34	35	36	37	38	39
		34	**35**	**92**	**224**	**373**	**539**
COUNTY-OTHER, HAYS, GUADALUPE (L)							
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	0	0	2,029	7,220
TWA REGIONAL CARRIZO AQUIFER	CARRIZO-WILCOX	0	0	0	1,169	4,685	4,388

DEVELOPMENT	AQUIFER [GONZALES]						
TWA TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [COMAL]	0	0	0	0	0	1,263
VISTA RIDGE PROJECT	CARRIZO-WILCOX AQUIFER [BURLESON]	3,781	5,000	5,000	5,000	5,000	5,000
		3,781	**5,000**	**5,000**	**6,169**	**11,714**	**17,871**
CRYSTAL CLEAR WSC, GUADALUPE (L)							
CRWA WELLS RANCH PROJECT PHASE II	CARRIZO-WILCOX AQUIFER [GUADALUPE]	75	261	317	0	0	0
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	124	296	243	577	597	621
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [HAYS]	0	0	0	0	0	22
		199	**557**	**560**	**577**	**597**	**643**
GOFORTH SUD, GUADALUPE (L)							
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	0	0	0	525
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [HAYS]	0	0	0	0	0	2
		0	**0**	**0**	**0**	**0**	**527**
KYLE, GUADALUPE (L)							
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	1,163	2,616	2,602	2,591	2,598
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [HAYS]	0	0	0	53	266	480
REUSE - KYLE/COUNTY LINE WSC	DIRECT REUSE [HAYS]	2,329	3,591	4,318	4,284	4,172	4,063
		2,329	**4,754**	**6,934**	**6,939**	**7,029**	**7,141**
MOUNTAIN CITY, GUADALUPE (L)							
DROUGHT MANAGEMENT - MOUNTAIN CITY	DEMAND REDUCTION [HAYS]	1	0	0	0	0	0
EDWARDS / MIDDLE TRINITY ASR	TRINITY AQUIFER ASR [HAYS]	0	44	44	44	44	44
LOCAL TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [HAYS]	60	60	60	60	60	60
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [HAYS]	0	0	0	0	0	1
		61	**104**	**104**	**104**	**104**	**105**
NIEDERWALD, GUADALUPE (L)							
DROUGHT MANAGEMENT - NIEDERWALD	DEMAND REDUCTION [HAYS]	3	0	0	0	0	0
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	49	65	85	111	140	174
		52	**65**	**85**	**111**	**140**	**174**
PLUM CREEK WATER COMPANY, GUADALUPE (L)							
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	148	146	143	142	140
LOCAL TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [HAYS]	0	185	185	185	185	185
		0	**333**	**331**	**328**	**327**	**325**
SAN MARCOS, GUADALUPE (L)							

GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	2,379	3,470	4,580	5,716
HAYS/CALDWELL PUA PROJECT	CARRIZO-WILCOX AQUIFER [CALDWELL]	0	0	0	1,964	4,575	7,889
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [HAYS]	179	778	1,122	1,684	2,506	3,587
REUSE - SAN MARCOS	DIRECT REUSE [HAYS]	1,932	2,886	3,959	5,206	6,654	8,339
		2,111	**3,664**	**7,460**	**12,324**	**18,315**	**25,531**
UHLAND, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [HAYS]	0	0	0	0	3	13
		0	**0**	**0**	**0**	**3**	**13**
WIMBERLEY, GUADALUPE (L)							
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	74	356	678	933
MUNICIPAL WATER CONSERVATION (RURAL)	DEMAND REDUCTION [HAYS]	10	55	78	123	187	272
TWA REGIONAL CARRIZO AQUIFER DEVELOPMENT	CARRIZO-WILCOX AQUIFER [GONZALES]	0	0	100	100	100	100
TWA TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [COMAL]	0	0	0	0	0	113
		10	**55**	**252**	**579**	**965**	**1,418**
WIMBERLEY WSC, GUADALUPE (L)							
GBRA - MBWSP - SURFACE WATER W/ ASR (OPTION 3C)	GUADALUPE RUN-OF-RIVER [GONZALES]	0	0	136	464	834	1,123
TWA REGIONAL CARRIZO AQUIFER DEVELOPMENT	CARRIZO-WILCOX AQUIFER [GONZALES]	0	0	100	100	100	100
TWA TRINITY AQUIFER DEVELOPMENT	TRINITY AQUIFER [COMAL]	0	0	0	0	0	133
		0	**0**	**236**	**564**	**934**	**1,356**
WOODCREEK, GUADALUPE (L)							
MUNICIPAL WATER CONSERVATION (SUBURBAN)	DEMAND REDUCTION [HAYS]	10	25	31	41	57	76
		10	**25**	**31**	**41**	**57**	**76**
Sum of Projected Water Management Strategies (acre-feet) 88,522		**14,073**	**28,579**	**40,651**	**51,238**	**69,741**	

APPENDIX B

GAM RUN 12-001: PLUM CREEK CONSERVATION DISTRICT MANAGEMENT PLAN

by William Kohlrenken
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Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-8279
July 2, 2012

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by William Kohlrenken under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on July 2, 2012.

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This report discusses the method, assumptions, and results from model runs using the groundwater availability model for the southern portions of the Carrizo-Wilcox, Queen City, and Sparta aquifers. Tables 1 and 2 summarize the groundwater availability model data required by the statute, and Figures 1 and 2 show the area of the model from which the values in the tables were extracted. This model run replaces the results of GAM Run 06-18. GAM Run 12-001 meets current standards set after the release of GAM Run 06-18 and it is based on the most current groundwater district boundaries. If after review of the figures, Plum Creek Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB immediately.

METHODS:

The groundwater availability model for the southern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers was run for this analysis. Water budgets for each year of 1980 through 1999 were extracted and the average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox and Queen City Aquifers

- Version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers was used for this analysis. See Deeds and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.
- This groundwater availability model includes eight layers, which generally correspond to (from top to bottom):
    1. the Sparta Aquifer,
    2. the Weches Confining Unit,
    3. the Queen City Aquifer,
    4. the Reklaw Confining Unit,
    5. the Carrizo Aquifer,

6. the Upper Wilcox Aquifer,

7. the Middle Wilcox Aquifer, and

8. the Lower Wilcox Aquifer.

- Of the eight layers listed above, individual water budgets for the district were determined for the Queen City Aquifer (Layer 3), and the combined layers of the Carrizo-Wilcox Aquifer (Layers 5 through 8). Budget terms were not determined for the Sparta Aquifer because it is not present in the Plum Creek Conservation District.

- The root mean square error (a measure of the difference between simulated and actual water levels during model calibration) in the groundwater availability model is 23 feet for the Sparta Aquifer, 18 feet for the Queen City Aquifer, and 33 feet for the Carrizo Aquifer for the calibration period (1980 to 1990) and 19, 22, and 48 feet for the same aquifers, respectively, in the verification period (1991 to 1999) (Kelley and others, 2004). These root mean square errors are between seven and ten percent of the range of measured water levels (Kelley and others, 2004).

- Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids concentrations of less than 1,000 milligrams per liter (mg/l) are considered fresh and total dissolved solids concentrations of 1,000 to 10,000 mg/l are considered brackish.

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 model results for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model runs in the district, as shown in Tables 1 and 2. The components of the modified budget shown in Tables 1 and 2 include:

- 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.
- Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).
- Flow into and out of district—The lateral flow within the aquifer between the district and adjacent counties.
- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

The information needed for the District's management plan is summarized in Tables 1 and 2. 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 (Figures 1 and 2).

TABLE 1: SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER THAT IS NEEDED FOR PLUM CREEK CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS INCLUDE BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	119
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	41
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	66
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	159
Estimated net annual volume of flow between each aquifer in the district	From Queen City Aquifer into the underlying Reklaw Formation confining unit	10

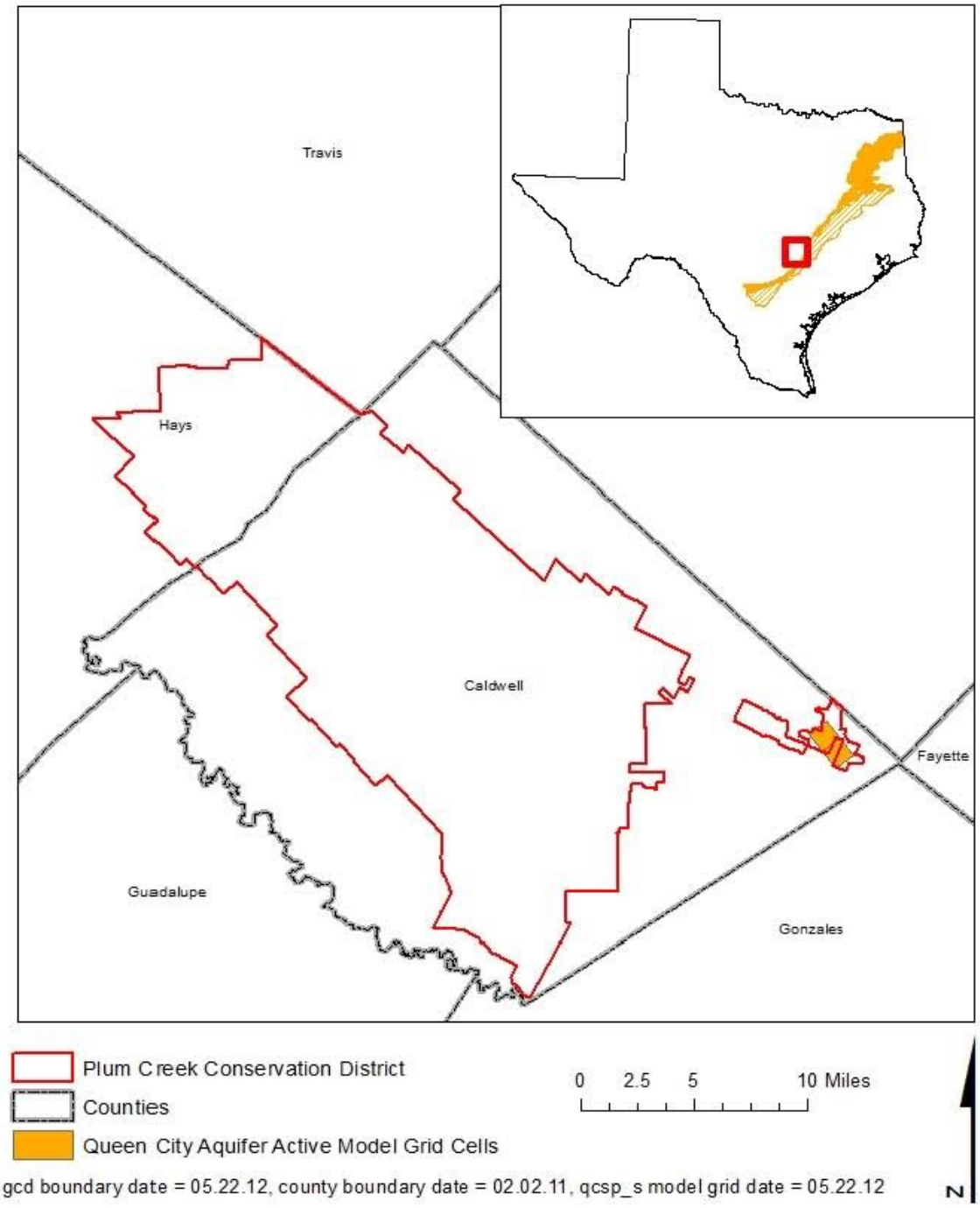

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO -WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE AQUIFER EXTENT OF THE QUEEN CITY AQUIFER WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER THAT IS NEEDED FOR PLUM CREEK CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE FRESH AND BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	5,743
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	6,847
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	4,043
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	3,616
Estimated net annual volume of flow between each aquifer in the district	From the Reklaw Formation confining unit into the Carrizo-Wilcox Aquifer	58

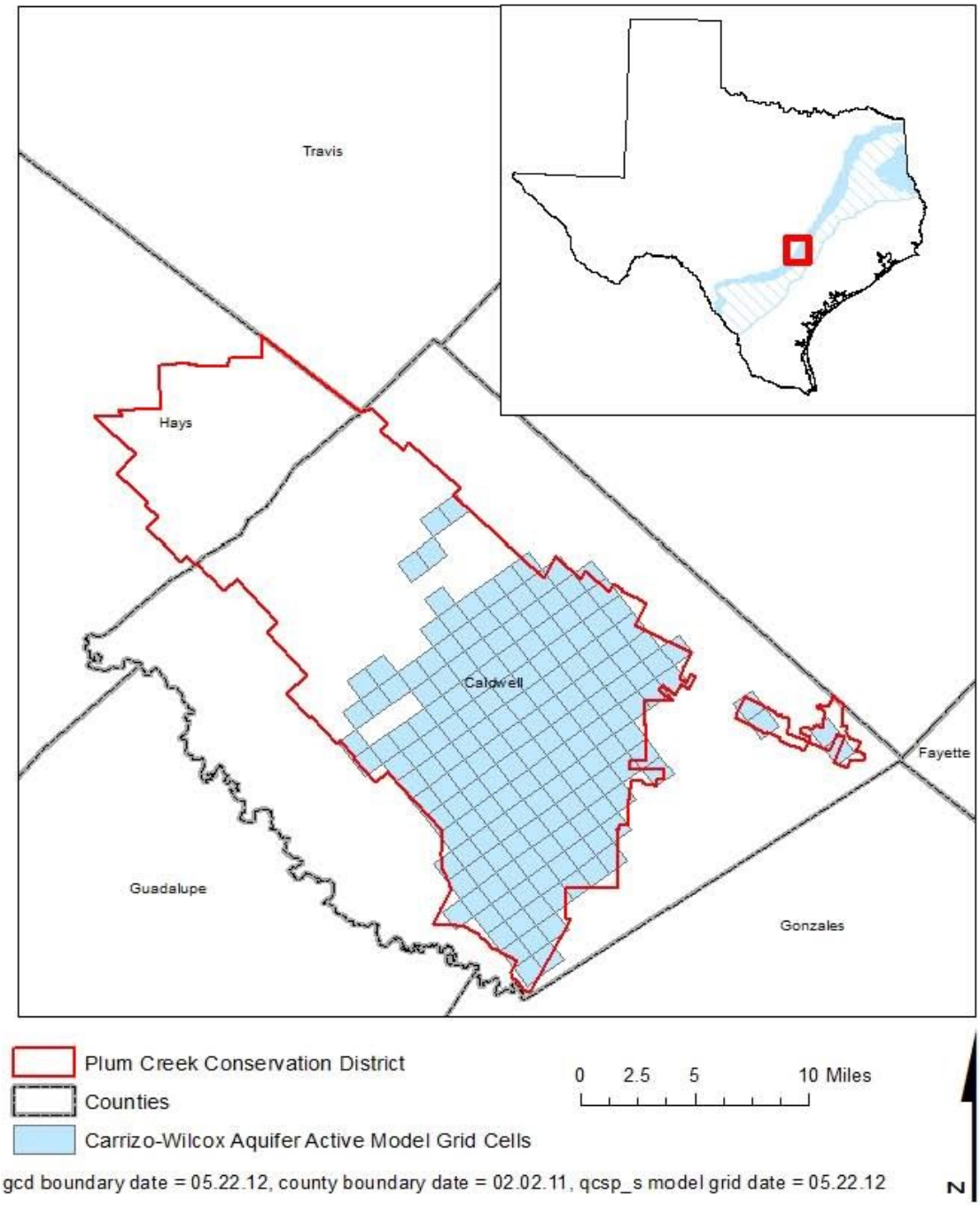

FIGURE 2: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE AQUIFER EXTENT OF THE CARRIZO-WILCOX AQUIFER WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS

The groundwater model(s) used in completing this analysis is the best available scientific tool that can be used to meet the stated objective(s). 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 model 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:

Deeds, N., Kelley, V., Fryar, D., Jones, T., Whallon, A.J., and Dean, K.E., 2003, Groundwater Availability Model for the Southern Carrizo-Wilcox Aquifer: Contract report to the Texas Water Development Board, 452 p., http://www.twdb.texas.gov/groundwater/models/gam/czwx_s/CZWX_S_Full_Report.pdf.

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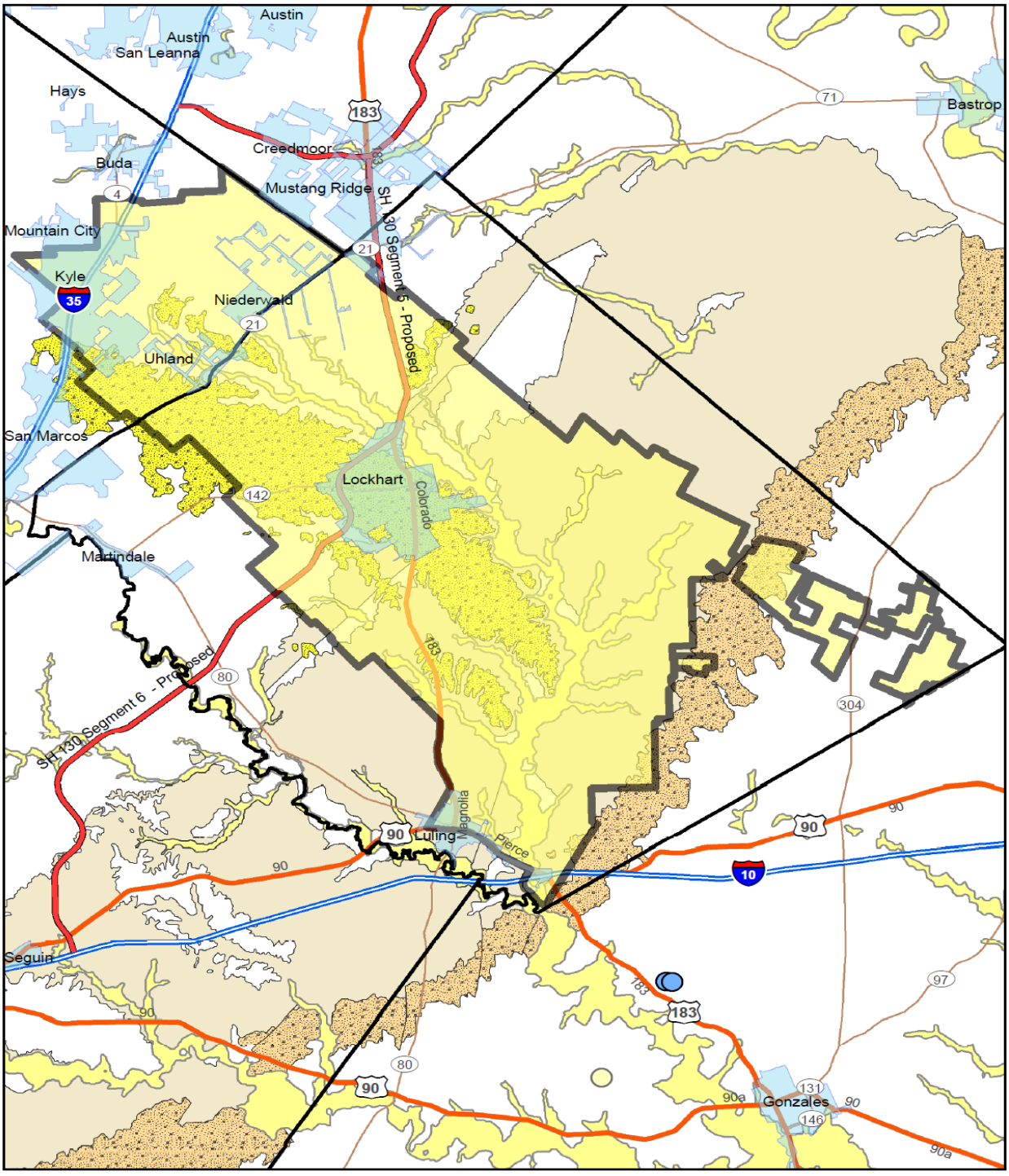
National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Smith, R., 2006, GAM Run 06-18: Texas Water Development Board, GAM Run 06-18 Report, 5 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR06-18.pdf.

APPENDIX C



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PCCD GEOLOGY

1 in = 5 miles