KIMBLE COUNTY
GROUNDWATER CONSERVATION DISTRICT

MANAGEMENT PLAN

Adopted

____ May 2014

Table of Contents

KIMBLE COUNTY GROUNDWATER CONSERVATION DISTRICT

MANAGEMENT PLAN

2014-2024

District Mission

The mission of the Kimble County Groundwater Conservation District is to develop, promote and implement water conservation and management strategies to conserve, preserve, and protect the groundwater supplies of the District, to protect and enhance recharge, prevent waste and pollution, and to effect efficient use of groundwater.. The District seeks to protect the owners of water rights within the District from impairment of their groundwater quality and quantity, pursuant to the powers and duties granted under Chapter 36, Subchapter D of the Texas Water Code.

Time Period for this Plan

This plan becomes effective upon adoption by the Board of Directors and approval by the Texas Water Development Board. The plan remains in effect for ten years after the date of adoption by the Board of Directors and approval by the TWDB, or until such time as a revised or amended plan is approved. Per Texas Water Code 36.1072(e), the district must review and readopt the plan with or without revisions at least once every five years and resubmit the plan to the TWDB for an administrative completeness review.

Statement of Guiding Principles

The District recognizes that its groundwater resources are of utmost importance to the economy and environment, first to the citizens of Kimble County and then to the region.

The District is created for the purpose of conserving, preserving and protecting groundwater supply quantity and quality in the District by:

- Acquiring, understanding and beneficially employing scientific data about the District's aquifers and their hydrogeologic qualities and identifying the extent and location of water supply within the District, for the purpose of developing sound management procedures;
- Preventing depletion of the aquifers underlying the District;
- Protecting the private property rights of landowners in groundwater by ensuring that such landowners shall continue to have the opportunity to use the groundwater underlying their land;
- Promulgating rules for permitting and regulation of spacing, production and transportation of groundwater resources in the District to protect the quantity and quality of the resource;

- Educating the public and regulating for conservation and beneficial use of the water;
- Educating the public and regulating to prevent pollution of groundwater resources;
- Cooperating and coordinating with other groundwater conservation districts with which the District shares aquifer resources.

GENERAL DESCRIPTION OF THE DISTRICT

History

The enabling legislation creating the District, Senate Bill 2, was passed during the 77th Regular Legislative Session (2001). The confirmation election was held on May 4, 2002 with the majority of the votes cast in favor of confirming the creation of the District. On the same ballot, the proposition authorizing the District to levy taxes and setting the maximum tax rate at twenty cents ($.20) per $100 ad valorem value was passed.

The District is governed by a five member locally elected Board of Directors. The directors serve staggered four year terms, with the three directors elected in May of even numbered years and the other two directors elected to four year terms two years later. The initial directors' terms were chosen by drawing lots in accordance with the provisions of the District's enabling legislation enacted in 2001. With elections of directors taking place every two years, the District is very responsive to voters' approval or disapproval of the local management of their groundwater and/or the services provided by the District.

Location, Extent, and Topography

The Kimble County Groundwater Conservation District comprises 97.45% of the Kimble County area, which is not included within the boundaries of the Hickory Underground Water Conservation District No. 1, and covers an area of approximately 766,864 acres (1198 square miles) in the west-central part of Texas. Kimble County ranges in elevation from approximately 1783 to 2372 feet above mean sea level. Total population in 2000 was 4356 including the county seat, the City of Junction (population 2771).

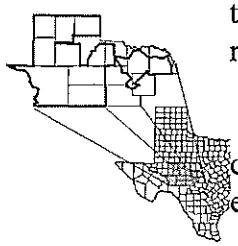
Drainage

The District lies within the Colorado River Basin and is bisected by the Llano River which arises, on the North Llano River, in Sutton County and, on the South Llano River, in Edwards County. The North and South Llano join within the District to become the Llano River at the city of Junction. Within the District there are numerous creeks which are tributaries of the Llano. Drainage of the river is in a generally eastward direction.

REGIONAL COOPERATION AND COORDINATION

West Texas Regional Groundwater Alliance

As a groundwater conservation district within the boundaries of the Region F Regional Water Planning Group, the District is a cooperating member of the West Texas Regional Groundwater Alliance. In 1988, four groundwater conservation districts; Coke County UWCD, Glasscock County UWCD, Irion County WCD, and Sterling County UWCD signed an original Cooperative Agreement. In the fall of 1996, the original Cooperative Agreement was redrafted and the West Texas Regional Groundwater Alliance was created.



The regional alliance presently has a membership of eighteen locally created and locally funded groundwater conservation districts that encompass almost 9.34 million acres or 14,594 square miles of West Texas. This West Texas region is very diverse in aquifer characteristics, aquifer yields, types of agricultural production, water quality and other factors which make it necessary for each member district to develops its own unique management programs to best serve its constituents. At the same time, however, the member districts share data and technical information, co-ordinate management strategies, develop certain uniform procedures and forms, and conduct policy discussions.

The current member districts are:

Coke County UWCD	Crockett County GCD
Glasscock County UWCD	Hickory UWCD # 1
Hill Country UWCD	Irion County WCD
Jeff Davis County UWCD	Kimble County GCD
Lipan-Kickapoo WCD	Lone Wolf GCD
Menard County UWD	Middle Pecos GCD
Permian Basin UWCD	Plateau UWC & SD
Santa Rita UWCD	Sterling County UWCD
Sutton County UWCD	Wes-Tex GCD

GROUNDWATER RESOURCES

The Hickory Aquifer

The Hickory Aquifer is the primary source of the District's groundwater, which is used for irrigation, public water supply, industrial, stock, and the domestic needs of the people and entities served.

The Hickory Aquifer occurs in parts of the counties in the Llano uplift region of Central Texas. Discontinuous outcrops of the Hickory Sandstone overlie or flank exposed Precambrian rocks that form the central core of the uplift. The down dip artesian portion of the aquifer encircles the uplift and extends to maximum depths approaching 4000 ft. Most of the water pumped from the aquifer is used for irrigation. The largest capacity wells, however, have been completed for municipal water supply and industrial purposes in the Mason, Eden and Brady area.

The Hickory Sandstone Member of the Cambrian Riley Formation is composed of some of the oldest sedimentary rocks found in Texas. In most of the northern and western portions of the aquifer, the Hickory can be differentiated into lower, middle, and upper units, which reach a maximum thickness of 480 feet in southwestern McCulloch County. In the southern and eastern extent of the aquifer, the Hickory consists of only two units. Extensive block faulting has compartmentalized the Hickory Aquifer, thus restricting hydrologic connection from one area to another.

Edwards-Trinity (Plateau) Aquifer

The Edwards-Trinity (Plateau) aquifer is made up of early Cretaceous age Trinity Group formations and overlying limestones and dolomites of the Comanche Peak, Edwards, and the Georgetown formations. It ranges in thickness from 0 to 750 feet in the District, with the largest area being from 100 to 500 feet thick. Springs issuing from the aquifer form the headwaters for the Llano River, which flows eastward, and for numerous creeks which are tributary to it.

The Edwards-Trinity (Plateau) is the principle aquifer in the District and underlies more than 797,000 acres of Kimble County. Most of the groundwater production in the District is from the Edwards-Trinity (Plateau) Aquifer.

The saturated thickness of the formation is from 100–300 feet throughout most of county. Water levels have generally remained constant or have fluctuated only with seasonal use. The formation is very fractured, with the water supply lying in joints and fractures of the limestone. The limestone is porous, and recharge to the aquifer is rapid because of the formation of horizontal and vertical dissolution channels in the limestone.

Water quality is good, though generally very hard, with 97.9% of the water supply in the District from this formation having Total Dissolved Solids (TDS) concentrations below 1000 mg/l.[1]

The Edwards Limestone and the Trinity Group crop out over the majority of the area in the District with exception of the alluvial areas along the Llano River and its tributaries and a very small area in the northeastern corner of the county. Underlying the Edwards-Trinity (Plateau)

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[1] Table 3-2, Edwards Trinity (Plateau) Aquifer, Water for Texas - 2002, TWDB 2002

aquifer in the eastern half of the county is a down-dip portion of the Hickory aquifer, which does not have a significant amount of production within the district, and a down-dip portion of the Ellenburger-San Saba aquifer which has a small amount of production within the District.

Ellenburger-San Saba Aquifer

The Ellenburger-San Saba Aquifer underlies 4,000 square miles in parts of 15 counties in the Llano Uplift area of Central Texas. Discontinuous outcrops of the aquifer generally encircle older rocks in the core of the Uplift. The remaining down-dip portion contains fresh to slightly saline water to depths of approximately 3,000 feet below land and surface. Water produced from the aquifer has a range in dissolved solids between 200 and 3,000 mg/l, but usually less than 1,000 mg/l. The quality of water deteriorates rapidly away from the outcrop areas. Approximately, 20 miles or more down-dip from the outcrop, water is typically unsuitable for most uses.[2]

MODELED AVAILABLE GROUNDWATER IN DISTRICT AQUIFERS 2010-2060

AQUIFER	YEAR					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Edwards-Trinity (Plateau)	1,283	1,283	1,283	1,283	1,283	1,283
Ellenburger-San Saba	100	100	100	100	100	100
Hickory	6	6	6	6	6	6
Total (excluding non-district areas)	**1,389**	**1,389**	**1,389**	**1,389**	**1,389**	**1,389**

Source: GAM Run 10-043 MAG (Version 2) Table 7
http://www.twdb.texas.gov/groundwater/docs/GAMRuns/GR10-043 _MAG_v.2.pdf
GTA Aquifer Assessment 10-10 MAG Ellenburger Aquifer November 1, 2011 Table 5
http: www.twdb.texas.gov/groundwater/docs/AA/AA10-10_MAG.pdf
GTA Aquifer Assessment 10-11 MAG Hickory Aquifer November 1, 2011 Table 6
http: www.twdb.texas.gov/groundwater/docs/AA/AA10-11_MAG.pdf

[2] Ellenburger-San Saba Aquifer information obtained from TWDB website: http://www.twdb.state.tx.us/publications/reports/GroundWaterReports/GWReports/Brackish%20GW%20Manual/26-Ellenburger-SanSaba.pdf Report by LBG-Guyton Associates

ESTIMATES OF RECHARGE FROM PRECIPITATION, DISCHARGES TO SURFACE WATER BODIES, AND FLOWS INTO, OUT OF AND BETWEEN EDWARDS AND TRINITY GROUPS IN THE EDWARDS-TRINITY (PLATEAU) AQUIFER WITHIN DISTRICT BOUNDARIES

(results in acre-feet)

Management Plan Requirement	Aquifer or confining unit	Edwards-Trinity (Plateau) Aquifer (acre-feet)
Estimated annual recharge to the District from precipitation	Edwards-Trinity (Plateau) Aquifer	31,493
Estimated annual volume of water that discharges from the aquifer to springs and surface water bodies, including lakes, streams and rivers	Edwards-Trinity (Plateau) Aquifer	57,624
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	29,767
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	10,852
Estimated net annual volume of flow between each aquifer in the district	Edwards-Trinity (Plateau) Aquifer to underlying hydro-geologic units	0

Source: GAM Run 13-018: Kimble County GCD Management Plan
TWDB, July 3, 2013
See Appendix A for full text of GAM Run 13-018

ESTIMATES OF RECHARGE FROM PRECIPITATION, DISCHARGES TO SURFACE WATER BODIES, AND FLOWS INTO, OUT OF AND BETWEEN AQUIFERS WITHIN THE ELLENBURGER-SAN SABA AQUIFER WITHIN DISTRICT BOUNDARIES

Although a Groundwater Availability Model has not yet been developed for the Ellenburger-San Saba Aquifer and therefore estimates of discharges to surface water bodies, and flows into, out of and between aquifers are not available, The Texas Water Development Board estimates annual recharge to the Ellenburger-San Saba Aquifer within the District to be 60 acre-feet/year.

Source: GTA Aquifer Assessment 08-08 Ellenburger- San Saba Aquifer Table 1
http: www.twdb.texas.gov/groundwater/docs/AA/AA08-08.pdf

ESTIMATES OF RECHARGE FROM PRECIPITATION, DISCHARGES TO SURFACE WATER BODIES, AND FLOWS INTO, OUT OF AND BETWEEN AQUIFERS WITHIN THE HICKORY AQUIFER WITHIN DISTRICT BOUNDARIES

Although a Groundwater Availability Model has not yet been developed for the Hickory Aquifer and therefore estimates of discharges to surface water bodies, and flows into, out of and between aquifers are not available, The Texas Water Development Board estimates annual recharge to the Hickory Aquifer in the District to be 0 acre-feet/year as the aquifer has no outcrop area within in District boundaries.

Source: GTA Aquifer Assessment 08-07 Hickory Aquifer Table 1
http: www.twdb.texas.gov/groundwaterdocs/AA/AA08-07.pdf

Methodology for Calculating Values in Water Data Tables

Since 2.55% of the area of Kimble County lies outside the District boundaries in the northeast corner of the county, 97.45% of the projected surface water supplies, projected county-wide water demands (county other, manufacturing, steam electric power, irrigation, mining and livestock) in the water data tables in the Appendix are modified using the multiplier. WUG vales for municipalities, water supply corporations, and utility districts are not apportioned.

The other State Water Plan tables in the Appendix, Projected Water Supply Needs and Projected Water Management Strategies, are not apportioned because district-specific values are not statutorily required. (See Appendix, page 2)

Fractional acre-feet are rounded up to a full acre-foot.

HISTORICAL GROUNDWATER USE WITHIN THE DISTRICT

Historical groundwater use within the district between 2000 and 2011 has varied between 509 acre-feet in 2006 and 1,203 acre-feet in 2009.

See Appendix B, Table 1.
Estimated Historical Water Use

SURFACE WATER RESOURCES

There are 12,056 acre-feet of water rights permitted by the TCEQ in the Llano River and its tributaries in Kimble County, of which 1,000 acre-feet are permitted for municipal use, 2,466 for industrial, 100 for mining and the remaining 8,490 acre-feet are permitted for irrigation purposes.[3]

PROJECTED SURFACE WATER SUPPLY

Total surface water supply for the district is projected to be 1,537 acre-feet annually for the period 2010-2060. The largest amount of surface water use is for irrigation.

See Appendix B, Table. 2
Projected Surface Water Supplies

PROJECTED WATER DEMANDS
(in acre-feet)

Total water demands within district boundaries are projected to range from 3,507-3,570 acre-feet/year for the period 2010-2060.

See Appendix B, Table 3.
Projected Water Demands

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[3] Data from 1999 TNRCC water rights list

PROJECTED WATER SUPPLY NEEDS

Total projected water supply needs in Kimble County are projected to range from 1,644 acre-feet in 2010 to 1,909 acre-feet in 2060. The supply needs are primarily for the City of Junction and for manufacturing.

See Appendix B, Table 4.
Projected Water Supply Needs

PROJECTED WATER MANAGEMENT STRATEGIES

Total projected water management strategies for Kimble County for the period 2010-2060 range from 2,000 acre-feet in 2010 to 2,147 acre-feet for the period 2030-2060. Strategies include subordination of Colorado River run-of-river rights for City of Junction municipal supplies and manufacturing, and irrigation conservation.

See Appendix B, Table 5.
Projected Water Management Strategies

DISTRICT IMPLEMENTATION OF WATER MANAGEMENT STRATEGIES

The District will permit additional wells in the Edwards-Trinity Plateau aquifer as needed for manufacturing, as surplus supply is available.

The District will implement the irrigation conservation strategy through its Management Goal 1.0.

The remaining water management strategies are related to surface water rights subordination agreements and are outside the powers and jurisdiction of the District.

ANNUAL AMOUNT OF ADDITIONAL NATURAL OR ARTIFICIAL RECHARGE THAT COULD RESULT FROM IMPLEMENTATION OF A FEASIBLE METHOD FOR RECHARGE

Brush control

Historical accounts of Kimble County and historical photographs in the possession of the District make it apparent that during the period from 1850 through 1885, when Kimble County was experiencing the beginning of European settlement, the country was mostly open grassland with little brush and few trees, and there was considerably greater flow of water in the Llano River and its creeks and tributaries than occurs at present. Now there is extensive invasion of brush, particularly mesquite and juniper, over large areas of the district.

District personnel have observed that in the late Spring when brush and trees come out of dormancy creeks (including those from which there are no irrigation withdrawals at any time) and sections of the Llano River dry up and remain in that condition throughout the summer during droughts. In the Fall, when brush and trees become dormant, creeks begin to flow again, regardless of whether or not there has been rainfall.

A current study demonstrates that for the entire watershed of the North Concho river, which lies within the same region, average annual water yield level increases by 81%, or about 48,523 acre feet with removal of all growths of mesquite and juniper in areas with heavy and moderate brush coverage (leaving areas with light brush growth intact)[4]. The average annual water yield increase in subbasin 8 of the study, being the subbasin closest to Kimble County, is 89,889 gallons per acre, or 0.27 acre-foot/acre, annually.[5] Average annual rainfall for the Main Concho River basin averages 23.6 inches annually, compared with Kimble County's 23 inches. The study finds that the average annual evapo-transpiration for land in the Main Concho River basin with heavy to moderate brush on it is 22.04 inches (93% of precipitation) while it is 20.89 inches (89% of precipitation) for the no-brush condition.[6]

The Edwards-Trinity aquifer outcrops at the surface of subbasin 8 of the Main Concho basin and over all of Kimble County. The authors of the study believe that the re-evaporation coefficient of such shallow aquifers is higher for brush than other types of cover than it is in deeper aquifers because brush is deeper rooted. They base their assumptions on a re-evaporation coefficient for brush-covered units of 0.4, while non-brush units were estimated at a coefficient of 0.1.[7]

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[4] "Main Concho River Watershed" in Brush Management/Water Yield Feasibility Studies of Eight Watersheds in Texas, TWRI Study 182, p. 3

[5] Ibid., p. 3

[6] Ibid., p. 3

[7] Ibid. p. 2

Applying those coefficients to areas of Kimble County heavily infested with brush, and assuming removal of only half the brush from those areas, and that Kimble County would, overall, only increase yield by the same average as the entire North Concho basin, (as opposed to the higher yield found in subbasin 8) surface water yield could be increased by 40%, and re-evaporation from the aquifer sufficiently reduced to result in the equivalent of a 70% increase in total annual recharge.

NOTE ON PROJECTED DEMANDS FOR GROUNDWATER IN KIMBLE COUNTY

The Texas Water Development Board projects that total demand for water within the district will remain static at 3,507-3,570 acre-feet year over the 2010-2060 period. (Appendix B, Table 3). However, the experience of the District in the last decade suggests that the character of water use in the county may be changing to the extent that there will be substantial reason for concern about supplies. The District has observed that:

a) New subdivision plats continue to be filed.

b) According to the Kimble County Appraisal District, over 60% of the landowners in the District are now non-residents. These non-residents utilize their properties in the District for hunting, recreational and vacation home purposes, using water that is not taken into account by the TWDB, which bases some estimates for projected demand, especially "county-other" on resident population.

c) Newcomers appear to be coming from areas where they are accustomed to higher levels of water use than the long-time residents. The District has experienced a significant increase in numbers of inquiries about irrigation wells from new county residents for properties that have not previously had irrigation.

d) New residents have impounded riparian waters for domestic and livestock use, pursuant to the 200 acre-foot statutory exemption, on creeks and streams where water was formerly withdrawn for those purposes on a daily-need basis, but not impounded.

e) Even though studies indicate that Kimble County has adequate water supplies, in the most recent several years of below-average rainfall the District has received a number of reports of wells going dry and drastic declines in surface water flows. There is increased drilling in the county, but driller's logs submitted to the District have indicated as many dry holes as successful wells.

It is apparent, then, that there is need for management of the groundwater resource, and, above all, for better information on the characteristics, recoverable supplies, and recharge of the aquifers.

MANAGEMENT OF GROUNDWATER SUPPLIES

A primary function of the District is to obtain data about aquifer supplies and conditions in order to develop more effective management of the resource. The District has established monitor wells to gather baseline data in order to monitor changing storage conditions of groundwater supplies within the District. The District will obtain data from the monitor wells on a regular basis, make reports thereon to the Board of Directors, and maintain cumulative records of the water levels in the wells.

The District has adopted rules to regulate groundwater withdrawal by means of spacing regulation and production limits. If regular monitoring indicates that aquifer levels are declining, the District will amend those rules, within the limitations imposed by Chapter 36 of the Texas Water Code, to protect the aquifer resources.

The District may deny a well permit or limit a high production permit in accordance with the provisions of the District Rules and this Management Plan. The relevant factors to be considered in denying or limiting a permit shall be:

1) the purpose of the District Rules, including but not limited to preserving and protecting the quality and quantity of the aquifer resources, and protecting existing uses
2) the equitable distribution of resources
3) the economic hardship resulting from denial or limitation of a permit.

The District will enforce the terms and conditions of permits and the Rules of the District.

The District recognizes the importance of public education to encourage efficient use, implement conservation practices, prevent waste, and preserve the integrity of groundwater, and will seek opportunities to educate the public on water conservation issues and other matters relevant to the protection of the aquifer resources through public meetings, newspaper articles, and other means which may become available.

ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The District will implement the provisions of this plan and will utilize the provisions of this plan as a guide for determining the direction and/or priority for all District activities. All operations of the District and all agreements entered into by the District will be consistent with the provisions of this plan.

The District has adopted rules for the management of groundwater resources through permitting of wells and production of groundwater, pursuant to Chapter 36 of the Texas Water Code and the provisions of this Plan, and will amend those rules as necessary to implement District management objectives.. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best scientific and technical evidence available.

For good cause shown the District, in its discretion, and after notice and hearing, may grant an exception to the District Rules. In doing so, the Board shall consider the potential for adverse effect on adjacent landowners. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

The District will seek cooperation in the implementation of this plan and the management of groundwater supplies within the District. The District will co-operate and co-ordinate with other water districts managing water resources from the same aquifers, and with other local water management entities.

Coordination with Surface Water Entities

The Board of Directors and Manager of the District will meet at least once yearly with the Kimble County Water Control and Improvement District to discuss conjunctive use issues and joint water management goals.

Methodology for Tracking Progress

The District will hold regular Board Meetings for the purpose of conducting District business. Each month, the Manager's Report will reflect the number of meetings attended; number of water levels monitored; articles published concerning water issues; number of water analysis samples collected and analyzed; resulting action regarding potential contamination, or remediation of actual contamination; reports on any school or civic group programs; meetings with the surface water management district; and other matters of district importance.

During the last monthly Board of Directors' meeting each fiscal year, beginning with October 1, 2001, The District manager will prepare and present an annual report to the Board of Directors on District performance in regards to achieving management goals and objectives. The annual report will be maintained on file at the District Office.

GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

Goal 1.0 - Providing the Most Efficient Use of Groundwater

1.1. Management Objective
At least once each year the District will provide, in a public meeting or forum, available information on water conservation practices for the efficient use of water. These will include but are not limited to publications from the Texas Water Development Board, Texas Commission on Environmental Quality, Texas Agricultural Extension Service, and other sources

1.1 Performance Standard
Report to the Board of Directors on distribution of informational material on water conservation practices in a public meeting or forum at least once each year.

Goal 2.0 - Controlling and Preventing the Waste of Groundwater

2.1 Management Objective
At least twice each year the District will publish the availability of water analysis services in the local newspaper.

2.1 Performance Standard
Two advertisements for water testing services published each year.

2.2 Management Objective
To monitor water quality in the district, the District will sample and conduct water quality tests on selected monitor wells at least once each year for possible contamination which would jeopardize the integrity of the groundwater supply.

2.2 Performance Standard
Four water quality analysis tests performed each year on selected monitor wells.

Goal 3.0 - Addressing Conjunctive Surface Water Management Issues

3.0 Management Objective
Each year the District shall conduct a joint planning and/or policy meetings with the City of Junction to discuss conjunctive use issues.

3.0 Performance Standard
One joint planning and/or policy meeting conducted jointly with the City of Junction each year.

Goal 4.0 - Addressing Natural Resource Issues Which Impact the Use and Availability of Groundwater, and Which are Impacted by the Use of Groundwater

4.1. Management Objective
Although there is very little oil production in Kimble County the District will monitor one or more selected wells within areas of the District where there is

oil or gas production, for possible contamination problems which would jeopardize the integrity of the groundwater resource.

4.1 Performance Standard

Once each year two well samples will be collected and analyzed for petroleum- related contamination in areas of the district where there is oil or gas production.

Goal 5.0 - Addressing Drought Conditions.

5.1 Management Objective

Each month the District will monitor the TWDB Texas Drought Report http://www.twdb.texas.gov/newsmedia/drought/doc/weekly_drought_report.pdf If the report indicates that the District is in D2 (severe drought) or worse conditions, the District will publish quarterly a notice or article in the local paper bringing attention to the severity of the drought and the need to practice water conservation.

5.1 Performance Standard

Annual report to Board of Directors listing number of months the TWDB Texas Drought Report indicated D2 or worse drought conditions for the District and the number of times a quarterly notice was published in the local newspaper.

Goal 6.1 - Conservation.

6.1 Management Objective

At least once each year the District will distribute water conservation literature in a public forum such as a soil and water conservation district meeting, a livestock show, or a county function.

6.1 Performance Standard

Annual report to Board of Directors listing when and where water conservation information was distributed during the year.

Goal 6.2- Addressing rainwater harvesting

6.2 Management Objective

Include literature on rainwater harvesting in one public education presentation annually.

6.2 Performance Standard

Annual report to Board including the number of presentations of rainwater harvesting literature at educational presentation.

Goal 6.3 - Addressing brush control

6.3 Management Objective

Include literature on brush control in one public education presentation annually.

6.3 Performance Standards

Annual report to Board including the number of presentations on brush control literature at educational presentation

Goal 7.0 Addressing Desired Future Conditions Established under TWC 36.108

7.1 Management Objective

The District will, over the next five years, develop a network of 12 monitor wells in locations that will represent aquifer levels across the district and measure water levels in each well quarterly. The District annual report will show the change in water levels in the monitor wells from the previous year.

7.1 Performance Standard

Annual report to the board on the change in water levels in each monitor well from the previous year.

Goals Not Applicable to the Kimble County Groundwater Conservation District.

Goal 1.0 - Controlling and preventing subsidence.

There is no history of subsidence of aquifer formations within the district upon water level depletion and available scientific information is that the formations are of sufficient rigidity that subsidence will not occur.

Goal 2.0 - Addressing Precipitation Enhancement

The District Manager has reported to the Board of Directors on Precipitation Enhancement programs conducted by neighboring groundwater conservation districts, but the Board of Directors has determined that there is not sufficient funding available to the district to participate in such a program.

Goal 3.0 – Addressing Recharge Enhancement

Although the Board of Directors has discussed the benefits of spreader dams for recharge enhancement within the District, there are currently no state or federal programs available to share with agricultural producers the cost of building them. The Board of Directors has concluded that there is no sufficient funding available within the District to participate in a recharge enhancement program.

Definitions and Concepts

"Board" - the Board of Directors of the Kimble County Groundwater Conservation District.

"District" - the Kimble County Groundwater Conservation District.

"Effective recharge" - the amount of water that enters the aquifer and is available for development

"Groundwater" - means water percolating below the surface of the earth.

"Integrity" - means the preservation of groundwater quality.

"Ownership" - pursuant to TWC Chapter 36, §36.002, means the recognition of the rights of the owners of the land pertaining to groundwater.

"Recharge" - the addition of water to an aquifer.

"Surface Water Entity" - TWC Chapter 15 Entities with authority to store, take divert, or supply surface water for use within the boundaries of a district.

"TCEQ" - Texas Commission on Environmental Quality.

"TWDB" - Texas Water Development Board.

"Waste" - pursuant to TWC Chapter 36, §36.001(8), means any one or more of the following:

(1) withdrawal of groundwater from a groundwater reservoir at a rate and in an amount that causes or threatens to cause intrusion into the reservoir of water unsuitable for agricultural, gardening, domestic, or stock raising purposes;

(2) the flowing or producing of wells from a groundwater reservoir if the water produced is not used for a beneficial purpose;

(3) escape of groundwater from a groundwater reservoir to any other reservoir or geologic strata that does not contain groundwater;

(4) pollution or harmful alteration of groundwater in a groundwater reservoir by saltwater or by other deleterious matter admitted from another stratum or from the surface of the ground;

(5) willfully or negligently causing, suffering, or allowing groundwater to escape into any river, creek, natural watercourse, depression, lake, reservoir, drain, sewer, street, highway, road, or road ditch, or onto any land other than that of the owner of the well unless such discharge is authorized by permit, rule, or order issued by the commission under Chapter 26;

(6) groundwater pumped for irrigation that escapes as irrigation tailwater onto land other than that of the owner of the well unless permission has been granted by the occupant of the land receiving the discharge; or

(7) for water produced from an artesian well, "waste" has the meaning assigned by Section 11.205.

"Well" - means an artificial excavation that is dug or drilled for the purpose of producing groundwater.

APPENDIX A

GAM RUN 13-018: KIMBLE COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

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Groundwater Resources Division
Groundwater Availability Modeling Section
July 3, 2013

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LICENSED
PROFESSIONAL GEOSCIENTIST

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Chelsea Seiter-Weatherford under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on July 3, 2013.

GAM RUN 13-018: KIMBLE COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

By Chelsea Seiter-Weatherford
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
July 3, 2013

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the executive administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the executive administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

- the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
- 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
- the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

This report (Part 2 of a two-part package of information from the TWDB to Kimble County Groundwater Conservation District) fulfills the requirements noted above. Part 1 of the two-part package is the Historical Water Use/State Water Plan data report. The District will receive this report from the TWDB Groundwater Technical Assistance Section. Questions about the data report can be directed to Mr. Stephen Allen, Stephen.Allen@twdb.texas.gov, (512) 463-7317.

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The groundwater management plan for the Kimble County Groundwater Conservation District should be adopted by the district on or before May 12, 2014 and submitted to the executive administrator of the TWDB on or before June 11, 2014. The current management plan for the Kimble County Groundwater Conservation District expires on August 10, 2014.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer. Table 1 summarizes the groundwater availability model data required by the statute, and Figure 1 shows the area of the model from which the values in the table were extracted. This model run replaces the results of GAM Run 08-74. GAM Run 13-018 meets current standards set after the release of GAM Run 08-74 including a use of the extent of the official aquifer boundaries within the district instead of the entire active area of the model within the district boundaries. If after review of the figures, Kimble County Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately. Per statute, TWDB is required to provide the districts with data from the official groundwater availability models; however, the TWDB has also approved, for planning purposes, an alternative 1-layer model for the Edwards-Trinity (Plateau) and Pecos Valley aquifers (Hutchison and others, 2011). Please contact Cindy Ridgeway at (512)936-2386 or cindy.ridgeway@twdb.texas.gov if a comparison table using this alternative model is desired.

The Llano Uplift aquifer system, which include the Marble Falls, Hickory, and Ellenburger-San Saba aquifers, also underlie the Kimble County Ground Water Conservation District. Groundwater availability models have not yet been completed for these minor aquifers. If the district would like information for these aquifers, they may request it from Mr. Stephen Allen, Stephen.Allen@twdb.texas.gov, (512) 463-7317.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer was run for this analysis. Kimble County Groundwater Conservation District Water budgets were extracted for the historical model periods using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portion of the aquifer located within the district is summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Edwards-Trinity (Plateau) Aquifer

- We used Version 1.01 of the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer. See Anaya and Jones (2004) for assumptions and limitations of the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer.
- This groundwater availability model includes two layers which generally represent the Fredericksburg-Washita Groups(Layer 1) and the Trinity Group (Layer2).
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

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 run in the district, as shown in Table 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.
- 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 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 (Figure 1).

TABLE 1: SUMMARIZED INFORMATION FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER THAT IS NEEDED FOR THE KIMBLE COUNTY GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	*Aquifer or confining unit*	*Edwards-Trinity (Plateau) Aquifer*
Estimated annual amount of recharge from precipitation to the district	Edwards-Trinity (Plateau) Aquifer	31,493
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards-Trinity (Plateau) Aquifer	57,624
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	29,767
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (Plateau) Aquifer	10,852
Estimated net annual volume of flow between each aquifer in the district	Edwards-Trinity (Plateau) Aquifer to underlying hydro-geologic units	0

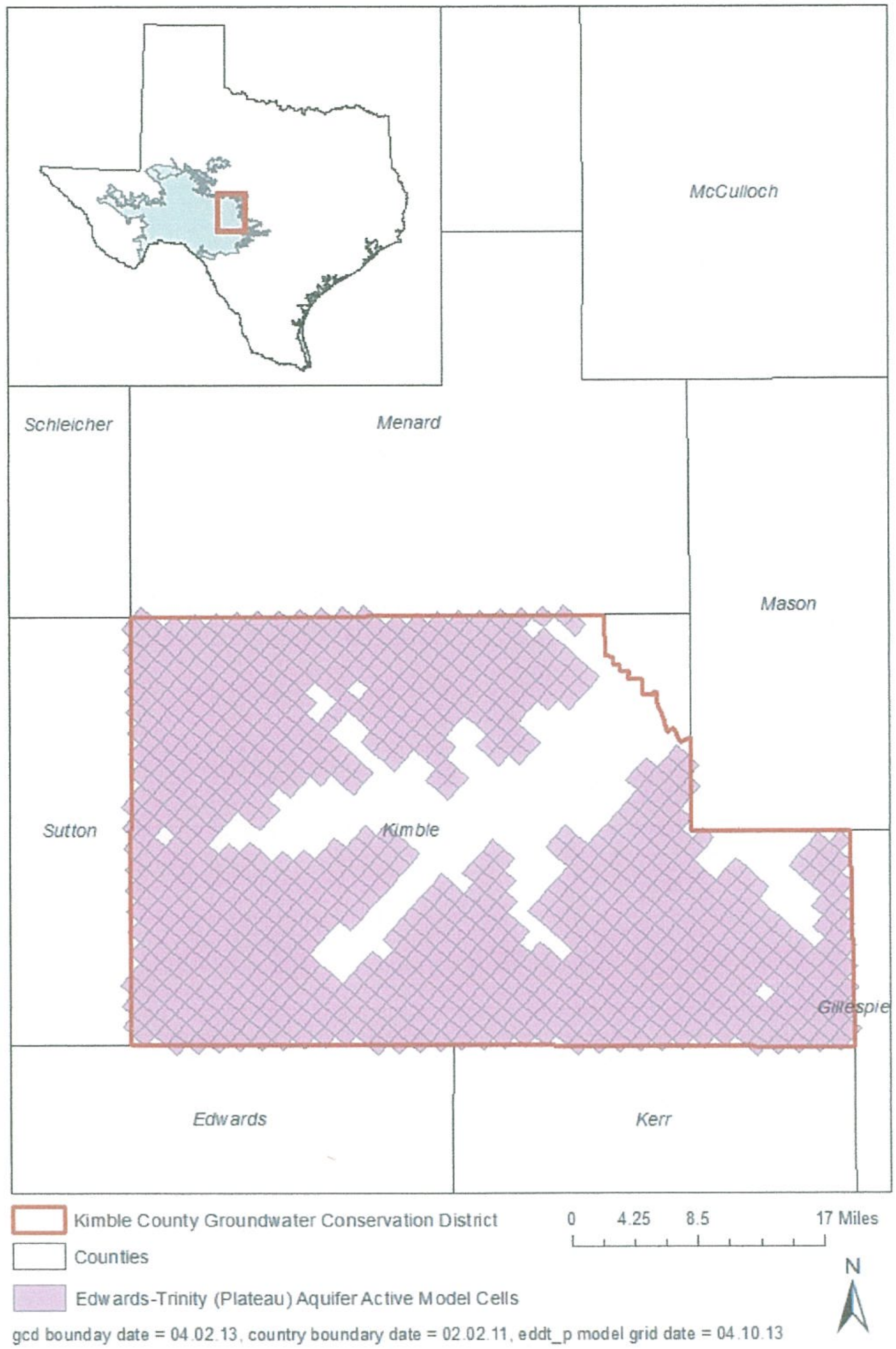

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE EDWARDS-TRINITY (PLATEAU) AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE EDWARDS-TRINITY (PLATEAU) AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

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 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:

Anaya, R., and Jones., 2004, Groundwater availability model for the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium aquifer systems, Texas: Texas Water Development Board, GAM Report, 208 p., http://www.twdb.state.tx.us/gam/eddt_p/eddt_p.htm.

Aschenbach, Eric, 2008, GAM Run 08-74: Texas Water Development Board, GAM Run 08-74 Report, 4 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR08-74.pdf

Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing subregional water budgets for MODFLOW ground-water flow models, U.S. Geological Survey Groundwater Software.

Harbaugh, A. W., and McDonald, M. G., 1996, User's documentation for MODFLOW-96, an update to the U.S. Geological Survey modular finite-difference groundwater-water flow model: U.S. Geological Survey Open-File Report 96-485, 56 p.

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.

APPENDIX B

Estimated Historical Groundwater Use And 2012 State Water Plan Datasets:

Kimble County Groundwater Conservation District

by Stephen Allen
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Groundwater Resources Division
Groundwater Technical Assistance Section
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March 26, 2014

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 part 1 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)
   reports 2-5 are from the 2012 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report. 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 2012 SWP data available as of 3/26/2014. Although it does not happen frequently, neither of these datasets are static so they are subject to change pending the availability of more accurate WUS data or an amendment to the 2012 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 2012 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 district conditions. 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 locations).

The other two 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 those 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) or Rima Petrossian (rima.petrossian@twdb.texas.gov or 512-936-2420).

Table 1.
Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2012. TWDB staff anticipates the calculation and posting of these estimates at a later date.

KIMBLE COUNTY *97.43 % (multiplier)* All values are in acre-fee/year

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2011	GW	256	2	9	0	301	313	881
	SW	626	571	10	0	2,327	134	3,668
2010	GW	227	2	10	0	523	309	1,071
	SW	596	503	11	0	2,375	133	3,618
2009	GW	218	2	5	0	751	227	1,203
	SW	607	469	6	0	2,190	97	3,369
2008	GW	210	2	0	0	182	228	622
	SW	560	12	1	0	2,657	97	3,327
2007	GW	191	2	0	0	447	275	915
	SW	560	12	0	0	1,070	117	1,759
2006	GW	229	2	0	0	23	255	509
	SW	608	64	0	0	2,952	109	3,733
2005	GW	215	2	0	0	160	265	642
	SW	608	63	0	0	2,300	114	3,085
2004	GW	198	3	0	0	86	294	581
	SW	608	63	0	0	2,148	73	2,892
2003	GW	205	2	0	0	51	284	542
	SW	667	11	0	0	2,552	71	3,301
2002	GW	207	2	0	0	50	322	581
	SW	703	28	0	0	572	80	1,383
2001	GW	206	2	0	0	50	355	613
	SW	760	2	0	0	572	88	1,422
2000	GW	204	2	0	0	47	367	620
	SW	760	565	0	0	574	92	1,991

Table 2.
Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

KIMBLE COUNTY *97.43 % (multiplier)* All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
F	COUNTY-OTHER	COLORADO	LLANO RIVER RUN-OF-RIVER CITY OF JUNCTION	0	0	0	0	0	0
F	IRRIGATION	COLORADO	LLANO RIVER COMBINED RUN-OF-RIVER IRRIGATION	1,437	1,437	1,437	1,437	1,437	1,437
F	JUNCTION	COLORADO	LLANO RIVER RUN-OF-RIVER CITY OF JUNCTION	0	0	0	0	0	0
F	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	87	87	87	87	87	87
F	MANUFACTURING	COLORADO	LLANO RIVER COMBINED RUN-OF-RIVER MANUFACTURING	0	0	0	0	0	0
F	MINING	COLORADO	LLANO RIVER COMBINED RUN-OF-RIVER MINING	13	13	13	13	13	13
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,537**	**1,537**	**1,537**	**1,537**	**1,537**	**1,537**

Table 3.
Projected Water Demands
TWDB 2012 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.

KIMBLE COUNTY *97.43 % (multiplier)* All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
F	LIVESTOCK	COLORADO	651	651	651	651	651	651
F	IRRIGATION	COLORADO	960	924	890	854	819	786
F	MINING	COLORADO	69	65	63	61	59	58
F	MANUFACTURING	COLORADO	684	747	802	857	908	976
F	COUNTY-OTHER	COLORADO	207	202	198	191	189	189
F	JUNCTION	COLORADO	936	935	926	917	910	910
	Sum of Projected Water Demands (acre-feet/year)		**3,507**	**3,524**	**3,530**	**3,531**	**3,536**	**3,570**

Table 4.
Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

KIMBLE COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
F	COUNTY-OTHER	COLORADO	-9	-7	-3	4	6	6
F	IRRIGATION	COLORADO	786	823	858	894	930	964
F	JUNCTION	COLORADO	-936	-935	-926	-917	-910	-910
F	LIVESTOCK	COLORADO	0	0	0	0	0	0
F	MANUFACTURING	COLORADO	-699	-764	-820	-877	-929	-999
F	MINING	COLORADO	33	37	39	41	43	44
	Sum of Projected Water Supply Needs (acre-feet/year)		**-1,644**	**-1,706**	**-1,749**	**-1,794**	**-1,839**	**-1,909**

Table 5.
Projected Water Management Strategies
TWDB 2012 State Water Plan Data

KIMBLE COUNTY

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

Water Management Strategy	Source Name [Origin]	2010	2020	2030	2040	2050	2060
COUNTY-OTHER, COLORADO (F)							
SUBORDINATION	LLANO RIVER RUN-OF-RIVER CITY OF JUNCTION [KIMBLE]	9	9	9	9	9	9
IRRIGATION, COLORADO (F)							
IRRIGATION CONSERVATION	CONSERVATION [KIMBLE]	0	74	147	147	147	147
JUNCTION, COLORADO (F)							
SUBORDINATION	LLANO RIVER RUN-OF-RIVER CITY OF JUNCTION [KIMBLE]	991	991	991	991	991	991
MANUFACTURING, COLORADO (F)							
SUBORDINATION	LLANO RIVER COMBINED RUN-OF-RIVER MANUFACTURING [KIMBLE]	1,000	1,000	1,000	1,000	1,000	1,000
Sum of Projected Water Management Strategies (acre-feet/year)		**2,000**	**2,074**	**2,147**	**2,147**	**2,147**	**2,147**