South Plains Underground Water Conservation District

South Plains UWCD

Management Plan

2008-2013

Effective

September 2008

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District Mission Statement

The South Plains Underground Water Conservation District (the District) will develop, promote, and implement management strategies to provide for the conservation, preservation, protection, recharging and prevention of waste of the groundwater resources, over which it has jurisdictional authority, for the benefit of the people that the District serves.

Time Period for this Plan

This plan becomes effective September 9, 2008, upon adoption by the Board of Directors (the Board) of the District and remains in effect until a revised plan is approved or until August 31, 2013, whichever is earlier.

Guiding Principles

The District was formed, and has been operated from its inception, with the guiding belief that the ownership and production of groundwater is a private property right. It is understood that, without the District, there is no protection of private property rights. The methods of protecting private property rights in groundwater are implemented using the policies adopted by the locally elected board members.

The Board understands the responsibilities of the District, and creates programs necessary for meeting them. The Board believes that the District should be more knowledgeable of its groundwater resources than any other entity.

Additionally, the Board realizes that the aquifer extends beyond the District's boundaries, and the sharing of information, programs and ideas with neighboring districts is important. As a result, the District will consider the joint administration of certain programs when practical.

This management plan is a tool which provides continuity in the management of the District. The District staff uses this guide to insure that the goals of the District are met. The Board uses it for planning, as well as measuring the performance of the staff.

Conditions change over time which requires that the Board modify this document. The dynamic nature of this plan shall be maintained such that the District continues serving the needs of the constituents. At the very least, the Board will review and readopt this plan every five years, or as specified by Chapter 36, Texas Water Code.

In the opinion of the Board, the goals, management objectives, and performance standards in this planning document have been set at a reasonable level considering existing and future fiscal and technical resources. Evolving conditions may change the management objectives defined to reach the stated goals. Whatever the future holds, the following guidelines are used to insure the management objectives are set at a sufficient level to be realistic and effective:

- The District's constituents will determine if the District's goals are set at a level that is both meaningful and attainable; through their voting right, the public will appraise the District's overall performance in the process of electing or re-electing Board members.
- The duly elected Board will guide and direct the District staff and will gauge the achievement of the goals set forth in this document.
- The interests and needs of the District's constituents shall control the direction of the management of the District.
- The Board will maintain local control of the privately owned resource over which the District has jurisdictional authority, as provided by Chapter 36, Texas Water Code.
- The Board will evaluate District activities on a fiscal year basis. That is, the District budgets operations on a September 1 – August 31 fiscal year. When considering stated goals, management objectives, and performance standards, any reference to the terms annual, annually, or yearly will refer to the fiscal year of the District.

General Description, Location and Extent

The District was created by HB 281 (72nd Legislature) during 1991. The District was confirmed by voter approval, the initial Board elected, and an ad valorem tax rate cap of $0.025/$100 valuation was set in an election held in August 1992. Table 1 lists the current Board of Directors, office held, occupation, and term.

Table 1: Board of Directors of the South Plains Underground Water Conservation District

Office	Name	Occupation	Term Ends
President	Doyle Moss	Active Farmer	May 2012
Vice-President	Scott Hamm	Active Farmer	May 2010
Secretary	Matt Hogue	Active Farmer	May 2010
Member	Larry Yowell	Agri-Business	May 2012
Member	Dan A. Day, Jr.	Active Farmer/Rancher	May 2012

Originally, the jurisdictional extent of the District was the same as Terry County, Texas. However, in 1994 the District annexed about 1,500 acres of Hockley County from individual landowner petitions. As a result, the District includes about .26% of the land area in Hockley County.

The District now covers approximately 902 square miles of the Southern High Plains of Texas (Figure 1). Brownfield, the Terry county seat, is the largest municipality in the District, having a population of about 9,488. Meadow (pop. 658) and Wellman (pop. 245) are the other two incorporated communities in the District.

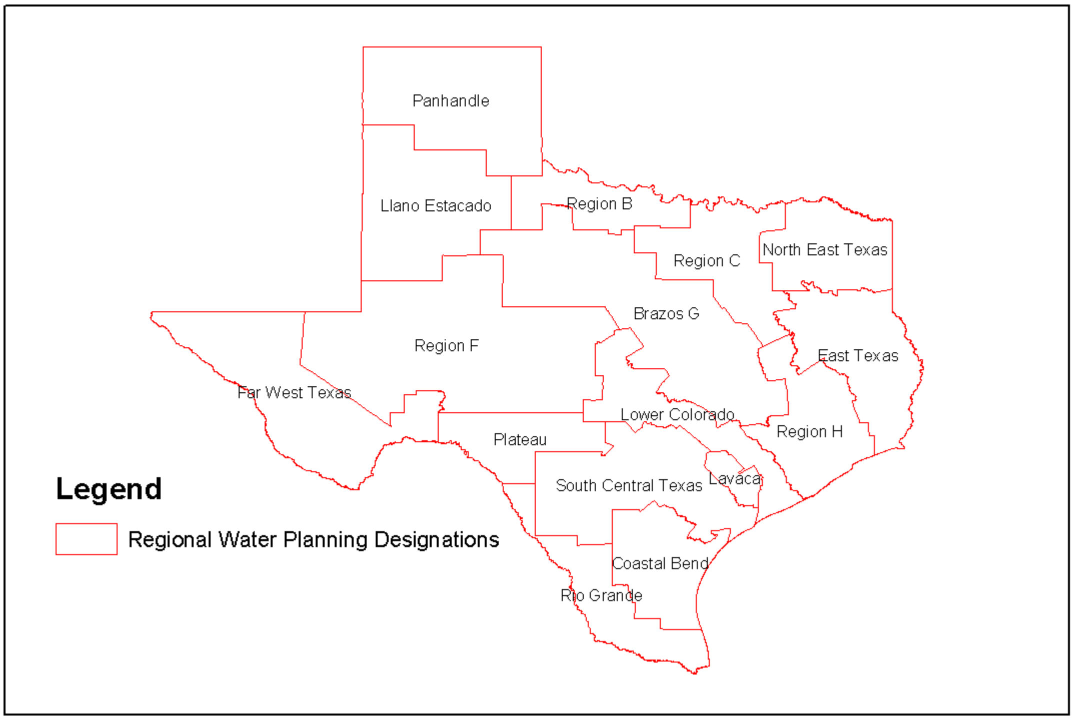
Four other groundwater districts border the South Plains Underground Water Conservation District. These include High Plains UWCD #1, Llano Estacado UWCD, Mesa UWCD and the Sandy Land UWCD.

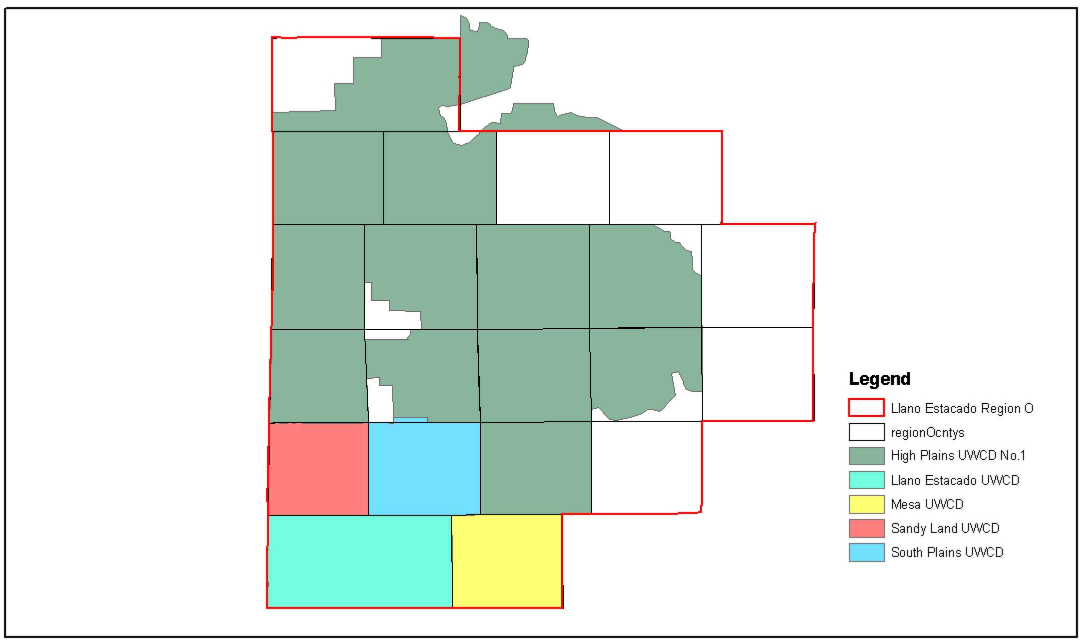
The economy of the District is supported predominately by row crop agriculture. The 150,000 plus acres of irrigated cropland (out of total row crop acreage of 500,000) affords economic stability to the area covered by the District. The major crops cultivated within the District include: cotton, peanuts, grain sorghum and wheat and, to a lesser extent, watermelons, sunflowers, alfalfa, guar and hay crops.

Recently, the dairy industry has also shown interest here. This has resulted in the building of two facilities, each milking about 2,000 cows. It is not expected there will be much more expansion within the District.

As oil prices have risen, the petroleum industry has again gained prominence in local economies. The production of low volume wells is more feasible at this time due to this recent trend. A significant portion of the District's tax-based revenues are generated by mineral valuation.

Figure 1: Location of the South Plains Underground Water Conservation District





Topography and Drainage

The land surface in the District is a nearly level to very gently undulating constructional plain that has little dissection. The northwestern part of the District is the most undulating, largely because eolian deposits of sand have been shifted and reworked by wind.

The elevation ranges from about 3150 feet above sea level in the southeastern part of the District to 3600 feet in the northwestern part. Brownfield, which is near the center of the District, has an approximate elevation of 3300 feet. There is a general slope of about 10 feet per mile from the northwest to southeast.

Two relic drainage ways, Sulfur Springs Draw and Lost Draw, cross the District from northwest to southeast. These draws are shallow and are usually dry; they seldom carry runoff water.

Rick Lake and Mound Lake are the largest salt lakes in the District. Around these lakes is the sharpest topographical relief. The eolian hills that border the east sides of these lakes are sometimes 100 feet or more higher than the lakebeds.

Playas, or shallow lakes, are more common in the northeastern part of the district. Playas are not prevalent in the sandier areas. The playas range in size from 2 to 40 acres and provide the only surface drainage in many areas. Aquifer recharge occurs through these playa basins during and after significant rainfall events. Recharge is limited once the clays in the basins swell and effectively stop percolation of groundwater (Sanders, 1961).

Groundwater Resources

The District has jurisdictional authority over all groundwater that lies within the District's boundaries. Three aquifers, the Ogallala, the Cretaceous, and the Dockum occur within the District. The following is a description of these formations that may be beneficial to District constituents by providing useable quantities of groundwater.

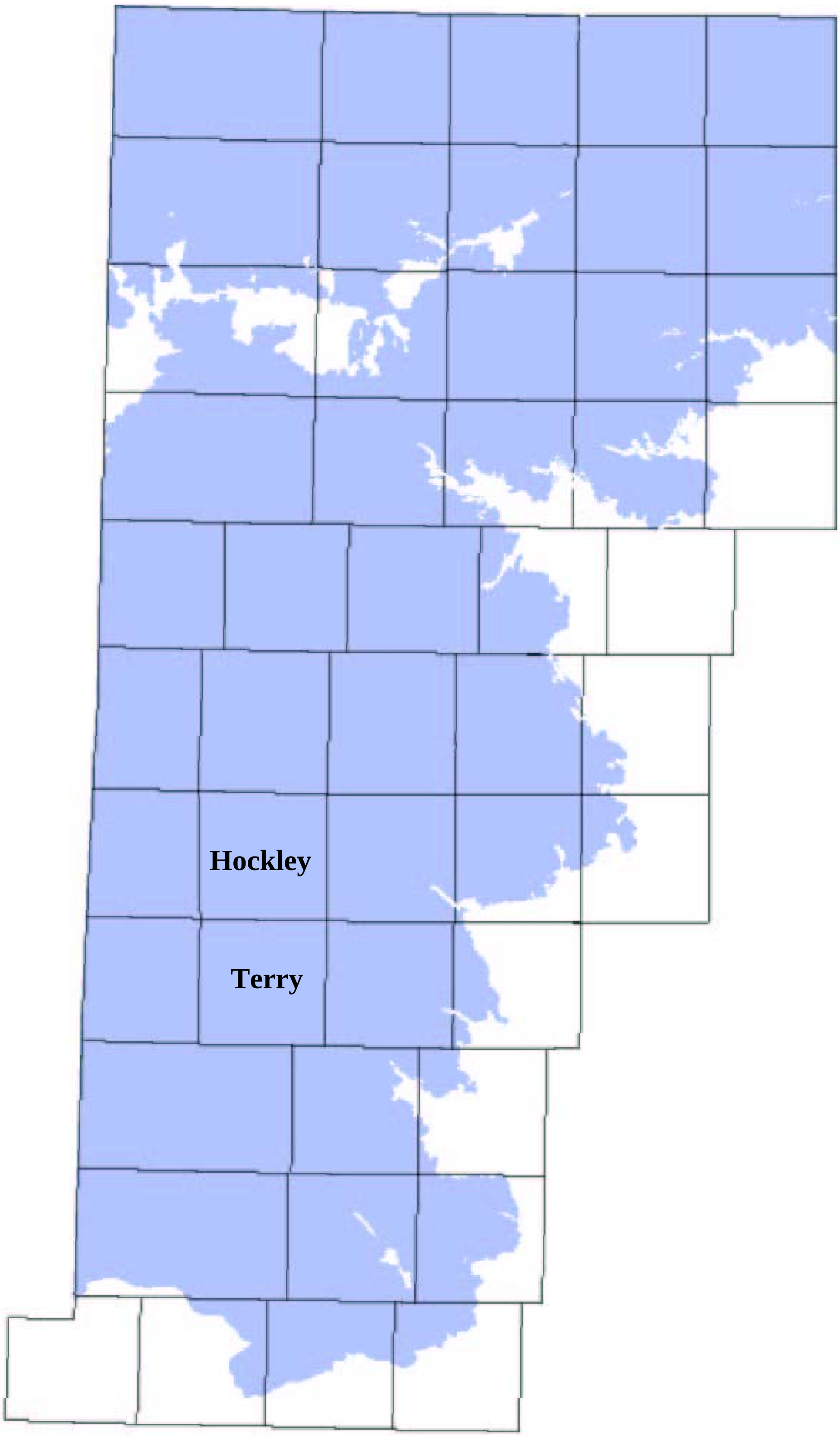
Ogallala Aquifer

The Ogallala Aquifer is the primary source of groundwater in the District (Figure 2). The aquifer extends from the ground surface downward, ranging in thickness from 80 feet to more than 200 feet in the area covered by the District.

The formation consists of heterogeneous sequences of clay, silt, sand and gravel. These sediments are thought to have been deposited by eastward flowing aggrading streams that filled and buried valleys eroded into pre-Ogallala rocks. A resistant layer of calcium carbonate-cemented caliche known locally as the "caprock" occurs near the surface of much of the area. (Ashworth and Hopkins, 1995).

Water levels in the Ogallala Aquifer are influenced by the rate of recharge and discharge. Recharge occurs primarily by infiltration of precipitation. GAM studies show that recharge is

Figure 2: Extent of the Ogallala Aquifer in Texas
(Adapted from Ashworth and Hopkins, 1995)



greater beneath irrigated lands. To a lesser extent, recharge may also occur by upward leakage from underlying Cretaceous units that, in places, have a higher water table elevation than the Ogallala. Generally, only a small percentage of water from precipitation actually reaches the water table due to a combination of limited annual precipitation (17.59 inches per year), high evaporation rate (60-70 inches per year), and slow infiltration rate. However, where deep sands are prevalent and the water table is shallow, precipitation may affect recharge rather quickly.

Groundwater in the aquifer generally flows from northwest to southeast, normally at right angles to water level contours. Velocities of less than one foot per day are typical, but higher velocities may occur along filled erosional valleys where coarser grained deposits have greater permeability.

Discharge from the Ogallala aquifer within the District primarily occurs through the pumping of irrigation wells. Groundwater usage typically exceeds recharge and results in water-level declines (Ashworth and Hopkins, 1995).

The chemical quality of Ogallala groundwater varies greatly across the District. Electrical conductance (EC) varies from less than 1.0 dS/m to over 4.0 dS/m. Generally, groundwater in the eastern and southeastern parts of the District exhibits the highest EC. Isolated occurrences of high EC values elsewhere in the District may be due to pollution through oil field salt water disposal pits or upward leakage and mixing from the underlying Cretaceous aquifer.

The suitability of groundwater for irrigation purposes is largely dependent on the chemical composition of the water and is determined primarily by the total concentration of soluble salts. Some farm acreage in the District is already limited to certain varieties of salt tolerant crops due to limiting or damaging total salt levels.

Cretaceous Aquifer

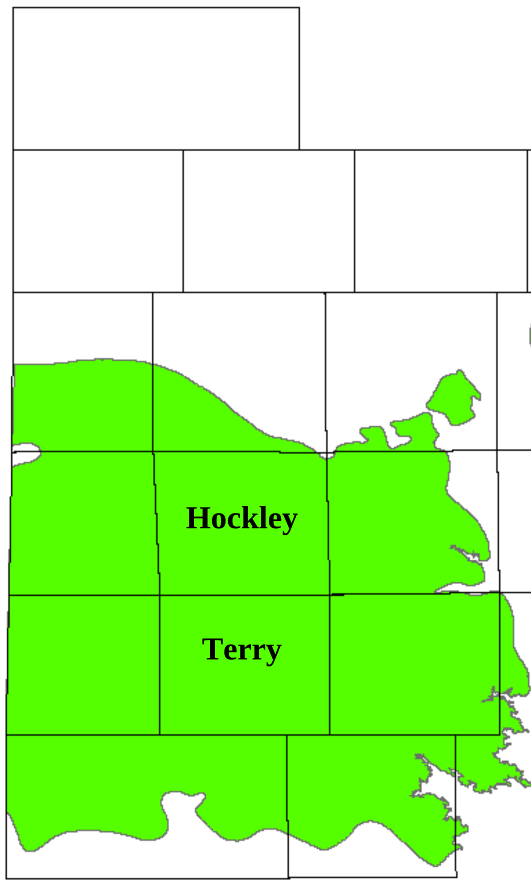
The Edwards-Trinity (High Plains) Aquifer, commonly referred to as the Cretaceous Aquifer, underlies the Ogallala Aquifer throughout the District (Figure 3). In some areas of the District, the Cretaceous and Ogallala Aquifers may be hydrologically connected. Groundwater in the Cretaceous is generally fresh to slightly saline. Water quality deteriorates where Cretaceous formations are overlain by saline lakes.

Studies performed by the District suggest that water quality in Cretaceous units is generally similar to that of the Ogallala. However, there are some instances where it has been discovered that lower Cretaceous units have poor quality water. This work is a continual investigation, and limited by the sparse locations of Cretaceous water wells. Further work should provide additional understanding of this issue.

As Ogallala water levels decline, it is expected that there will be greater interest in this minor aquifer. The District is implementing a water level measurement program for this minor aquifer, and is committing additional resources to the study of Cretaceous units.

Recharge of the Cretaceous occurs directly from the bounding Ogallala formation. Some upward movement of groundwater from the underlying Triassic Dockum formation may also occur, affecting recharge of the Cretaceous (Ashworth and Hopkins, 1995). As mentioned earlier, in some places the water table elevation in the Cretaceous Aquifer is higher than the Ogallala Aquifer, resulting in the upward leakage from the Cretaceous Aquifer. Movement of water in the Cretaceous is generally east to southeast.

Figure 3: Extent of the Edwards-Trinity (High Plains) Aquifer in Texas
(Adapted from Ashworth and Hopkins, 1995)



Dockum Aquifer

The Dockum Aquifer underlies the Cretaceous and Ogallala formations throughout the District. The primary water-bearing zone in the Dockum group, commonly called the “Santa Rosa”, consists of up to 700 feet of sand and conglomerate interbedded with layers of silt and shale (Ashworth and Hopkins, 1995). Aquifer permeability is typically low and well yields normally do not exceed 300 gpm.

Water quality in the Dockum is the main limiting factor when considering its use within the District (Ashworth and Hopkins, 1995). EC values for Dockum groundwater range from 15.0 dS/m to over 50.0 dS/m. Even the most salt tolerant row crops grown cannot withstand such levels of salinity.

Currently, it seems the only practical use of Dockum groundwater may be for make-up water in secondary recovery operations of crude oil. By using water from this aquifer, oil companies could reduce their use of Ogallala and/or Cretaceous groundwater, thereby relieving some pressure from the freshwater sources.

At some point, it may be feasible to treat Dockum water for use as municipal supply. As desalination technology evolves, this process might be feasible for meeting some needs within the District. However, due to the limited productivity of this aquifer, it is likely best suited (using this scenario) for stock or municipal supply. These uses permit a storage system for water that is not available for agricultural irrigation usage.

Surface Water Resources

The only fresh surface water in the District exists as playa lakes. The playas play an important role in aquifer recharge and support some wildlife when rainfall accumulates in these naturally occurring depressions. Playas are rarely, if ever, used to support irrigation activities.

As previously mentioned, Rich Lake and Mound Lake are naturally occurring salt lakes within the District. Each of these naturally occurring impoundments support limited wildlife populations, primarily migratory waterfowl and opportunistic predators.

Perhaps the most significant surface water resource of benefit to the District is Lake Meredith located on the Canadian River in the Texas Panhandle. The lake is managed by the Canadian River Municipal Water Authority and provides water to the City of Brownfield, and starting 2009, the City of Meadow.

According to statute, (TWC 36.1071) the District offers the following data for its Management Plan: *(Note: When referencing the 2007 State Water Plan, the resulting figures were calculated using the percentage of Hockley County included in the District* ***(0.26%)****, and applied to the corresponding data.)*

1. <u>Estimates of MAG</u>

No DFC has yet been adopted, although the District is currently involved in the process. Hence, there is no estimate of MAG.

2. <u>Estimates of Annual Groundwater Usage</u>

Table 2 contains estimates of annual usage for various water user groups in the District. The domestic use is shown for each community in the District, as well as those rural residents owning private wells.

Table 2: Estimates of Annual Usage
Source: SPUWCD/TWDB Water Use Survey

	2003	**2004**	**2005**	**2006**	**2007**
Irrigation	153,165	111,650	133,041	171,197	92,580
Brownfield—Municipal	221	283	134	178	353
Meadow—Municipal	n/a	57	55	62	72
Wellman—Municipal	31	30	28	31	28
Rural—Domestic	336	336	336	336	336
Stock	384	384	384	384	384
Mining	283	283	283	283	283
Totals (ac-ft)	**154,420**	**113,023**	**134,261**	**172,471**	**94,036**

Obviously, the irrigation user group comprises the largest percentage of the total for each year. The numbers for this category are taken from the District's network of meter cooperators, who report monthly usage from various flow meters installed on irrigation systems.

The municipal group numbers (Brownfield, Meadow, and Wellman) were given by each of the water suppliers within the District. The stock and rural (domestic) numbers were developed using estimates based on the District's inventory of wells.

Estimates for the mining user group were taken from the TWDB Water Use Survey data. While calculating these estimates, it was noted that Terry County mining numbers were constant for the years 1997-2003 at 263 ac-ft. So, this water use is likewise illustrated as being constant for the past five years shown. For Hockley County, the only estimate used was from 2003; therefore the annual total is the same every year, given that Terry County estimates do not vary. Because the 2003 data is the most recent year from the TWDB survey, it was decided that this approach provided the best estimates. The Hockley County portion of the total was calculated based on the percentage of the county within the District (0.26%).

Note: See attached Appendix A for GAM Report 08-18

3. Estimates of Annual Groundwater Recharge from Precipitation

Results from the Southern Ogallala Groundwater Availability Model (GAM 08-18) indicate the annual recharge for the Ogallala is 71,276 ac-ft/yr. The District has also calculated recharge figures for the Ogallala, using a volume balance approach. The average figure for the past eight years utilizing this method is about 95,000 ac-ft/yr. The volume balance approach does not provide discernment of recharge strictly from precipitation, so that may help explain some of the difference between the two figures.

4. Estimates of Annual Groundwater Discharge to Springs/Surface Water Bodies

The Southern Ogallala GAM (08-18) was again utilized for estimating spring flow discharges from the Ogallala. The predictive number supplied from the GAM is 816 ac-ft/yr. However, as water levels decline during dry years, the few springs within the District may cease altogether. The intermittent flow of these springs has been observed for years by several district residents.

5. Estimates of Annual Groundwater Flow Into/Out of the District for the Ogallala; estimates of annual groundwater flow between aquifers in the District

Data supplied from the Southern Ogallala GAM (08-18) indicates that annual flow into the District is 2,086 ac-ft/yr, while flow out of the District is about 4,237 ac/ft/yr. The GAM 08-18 report specifies that no information is provided by the model for this particular item and therefore is not available.

6. Estimates of Projected Surface Water Supply

Currently, there are two towns within the District that use surface water. The Canadian River Municipal Water Authority supplies some water to Brownfield. Recently, the town of Meadow negotiated the purchase of some CRMWA water with Brownfield. The purchase was necessary for blending the higher quality CRMWA supply with the town's groundwater wells; several of which have elevated arsenic and fluoride.

As Lake Meredith has declined, CRMWA has purchased groundwater in Roberts County as a supplement. However, the lake is so low that the groundwater supply now comprises 62% of the 2008 deliveries. Data supplied by CRMWA is included in Table 3, and indicates the yearly deliveries to Brownfield for the respective years.

Table 3: Yearly Surface Water Deliveries from CRMWA to Brownfield (ac-ft)
Source: CRMWA

2003	2004	2005	2006	2007
1,542	1,189	1,407	1,492	1,220

Additionally, there are some instances where surface water collects at locations suitable for livestock supply within the District. The 2007 State Water Plan contains estimated quantities of surface water available for livestock supply, as well as projected surface water supplies from CRMWA. This information is summarized in Table 4. *(Note: Hockley Co. numbers were incorporated using an apportionment equal to the extent of the county included in the District, which is 0.26%)*

Table 4: Projected Surface Water Supplies
Source: 2007 State Water Plan

Water User Group	2000	2010	2020	2030	2040	2050	2060
Brownfield	1,670	1,670	1,670	1,670	1,670	1,670	1,670
Livestock	186	123	125	128	131	135	138
Totals (ac-ft)	**1,856**	**1,793**	**1,795**	**1,798**	**1,801**	**1,805**	**1,808**

7. Estimates of Projected Total Demand for Water in the District According to the 2007 State Water Plan

Projecting water demand is a challenging task. Some user group projections are more accurate than others. This is an inherent part of the process. Of particular difficulty is the projection of irrigation water demand. Rainfall, commodity prices, water level changes, and federal farm policy are a few of the factors that complicate the matter.

It may be agreed that livestock, municipal and mining projections from the 2007 State Water Plan are a little more certain. However, the District has identified a discrepancy with the municipal water projections for the City of Brownfield. This discrepancy has resulted in greater than actual usage projections, which creates projected water needs that are incorrect. Specifically, city records show that total water usage for Brownfield during 2000 was 1,678 ac-ft. The 2007 State Water Plan shows 2,593 ac-ft for the same year. The difference in these two figures is the error. In short, the total effluent water applied to local crops in 2000 was reported as about 912 ac-ft. That is the source of the error. Consequently, we disagree with the projected municipal water demands for Brownfield shown in Table 4.

Now, the irrigation demand numbers were calculated using one drought year as the basis for projections. The average irrigation demand for the past eight years is about 135,000 ac-ft/year. The District believes that the longer term average is more indicative of the irrigation demand. Nevertheless, as required by statute, the data in Table 5 is presented as the projected total demand for water in the District, according to the 2007 State Water Plan. *(Note: Hockley Co. numbers were incorporated using an apportionment equal to the extent of the county included in the District, which is 0.26%)*

Table 5: SPUWCD Projected Groundwater Demand
Source: 2007 State Water Plan

Water User Group	2000	2010	2020	2030	2040	2050	2060
Brownfield	2,593	2,805	3,003	3,191	3,375	3,394	3,375
Meadow	70	76	81	86	91	92	91
County Other	377	407	436	463	490	492	490
Mining	941	562	271	158	67	0	0
Irrigation	203,596	193,162	183,264	173,875	164,965	156,512	148,491
Livestock	120	203	285	288	291	295	298
Manufacturing	1	1	1	1	1	1	1
Totals (ac-ft)	**207,698**	**197,216**	**187,341**	**178,063**	**169,280**	**160,786**	**152,746**

Water Supply Needs and Water Management Strategies

It is required that the District Management Plan consider the water supply needs and water management strategies included in the 2007 State Water Plan (TWC 36.1071(e)(4)). Table 6 is a summary of the projected water needs (i.e. demand exceeds supply) for certain District water user groups, according to the 2007 State Water Plan. *(Note: Hockley Co. numbers were incorporated using an apportionment equal to the extent of the county included in the District, which is 0.26%)*

Table 6: SPUWCD Projected Water Needs
Source: 2007 State Water Plan

Water User Group	2010	2020	2030	2040	2050	2060
Brownfield	0	-115	-280	-435	-458	-457
Meadow	0	0	0	0	0	0
County Other	0	0	0	0	0	0
Mining	0	0	0	0	0	0
Irrigation	-75,018	-92,295	-101,553	-106,877	-98,379	-90,358
Livestock	0	0	0	0	0	0
Manufacturing	0	0	0	0	0	0
Totals (ac-ft)	**-75,018**	**-92,410**	**-101,833**	**-107,312**	**-98,837**	**-90,815**

To meet the needs shown in Table 6, the 2007 State Water Plan includes the strategies shown in Table 7. *(Note: Hockley Co. numbers were incorporated using an apportionment equal to the extent of the county included in the District, which is 0.26%)*

Table 7: Projected Groundwater Management Strategies
Source: 2007 State Water Plan

Water User Group	Water Management Strategy	Source Name	Source County	2010	2020	2030	2040	2050	2060
Brownfield	CRMWA expand groundwater supply	Ogallala Aquifer	Roberts	494	494	494	494	494	494
Brownfield	Municipal Water Conservation	Conservation	Terry	211	448	687	802	793	788
Irrigation	Irrigation Water Conservation	Conservation	Terry	2,135	1,922	1,729	1,556	1,401	1,261
Irrigation	Irrigation Water Conservation	Conservation	Hockley	78	70	63	56	51	46
			Totals (ac-ft)	**2,918**	**2,934**	**2,973**	**2,908**	**2,739**	**2,589**

Examining the various needs and management strategies for the District, it is evident that an unmet need still remains for the irrigation water user group. The need listed for the City of Brownfield has been discussed earlier, and is not viewed as realistic, based on actual usage data.

Now, it seems necessary that the issue of irrigation needs be discussed. While the District understands that there is need for more irrigation supply than is currently available, the demand figures are not indicative of the average usage. Consequently, the unmet needs, while real, are not as great as shown.

Actions, Procedures, Performance and Avoidance for Plan Implementation

The District currently employs a set of rules governing the spacing and production of wells, as well as production limitations based on tract size. It is expected that this approach will remain the foundation of the Board's strategies for groundwater management. As conditions dictate, and as the DFC process is completed, it may require that the specific provisions within the existing rules be modified. The District's Board of Directors is responsible for that determination.

Additional water management strategies the District may consider, when applicable, are listed below.

A. Conversion to Dryland Farming—As water supplies decline, there are some landowners that may exercise this option. There are incentive payments available through the USDA NRCS for those interested in this option. The District supports the use of these incentive payments to help those landowners interested in this program.

B. Increased study of Minor Aquifers—Some future needs may be addressed using the two minor aquifers within the District. At this time, it is uncertain what additional amount of water may be available from minor aquifers. The District supports the continued and further investigation of these resources, and is committed to the monitoring and study of them.
C. Conservation Programs—The implementation of educational programs and resources regarding conservation remains top priority for the District. The Board supports the expansion of resources pertaining to those programs, which include, but are not limited to: maximizing crop water use efficiency, minimizing irrigation water evaporative losses, rainwater harvesting, use of water wise plants and drought tolerant landscaping, wise water use, and device give-aways.

Drought Contingency Plan

Drought is a normal, recurrent feature of climate, although many erroneously consider it a rare and random event. Drought is also a temporary aberration, and differs from aridity, which is restricted to low rainfall regions and is a permanent feature of climate ("What is Drought?" National Drought Mitigation Center). The South Plains Underground Water Conservation District is in an arid region that also experiences drought. However, even in the midst of a drought, rainfall at crucial times of the growing season may significantly reduce irrigation water demand.

Drought response conservation measures typically used in other regions of Texas (i.e. rationing) cannot and are not used in this region due to extreme economic impact potential. In the District, groundwater conservation is stressed at all times. The Board recognizes that irrigated agriculture provides the economic stability to the communities within the District. Therefore, through the notice and hearing provisions required in the development and adoption of this management plan, the Board adopts the official position that, in times of precipitation shortage, irrigated agricultural producers will not be limited to any less usage of groundwater than is provided for by District rules.
In order to treat all other groundwater user groups fairly and equally, the District will encourage more stringent conservation measures, where practical, but likewise, will not limit groundwater use in any way not already provided for by District rules.

Regional Water Planning

The Board of Directors recognizes the regional water plan requirements listed in Ch. 36, TWC, §36.1071. Namely, the District's management plan must be forwarded to the regional water planning group for their consideration in their planning process, and the plan must address water supply needs such that there is no conflict with the approved regional water plan. It is the Board's belief that no such conflict exists.

The Board agrees that the regional water plan should include the District's best data. The Board also recognizes that the regional water planning process provides a necessary overview of the region's water supply and needs. However, the Board also believes it is the duty of the District to develop the best and most accurate information concerning groundwater within the District.

Goals, Management Objectives and Performance Standards

Method for Tracking the District's Progress in Achieving Management Goals

The District Manager will prepare an annual report of the District's performance achieving management goals and objectives. The report will be prepared in a format that will be reflective of the performance standards listed following each management objective. The report will be presented to the Board within 60 days of the end of each fiscal year. The report will be maintained on file in the open records of the District.

The District will actively enforce all rules of the District in order to conserve, preserve, protect and prevent the waste of the groundwater resources over which the District has jurisdictional authority. The Board may periodically review the District's rules, and may modify the rules, with public approval, to better manage the groundwater resources within the District and to carry out the duties prescribed in Chapter 36, Texas Water Code.

Goal 1.0 Providing the most efficient use of groundwater

Management Objective—Water Level Monitoring

1.01 Measure the depth to water in the District's water level monitoring network; record measurements and/or observations; enter measurements into District's computer data base; maintain a network of measurement wells of 100 or more wells.

Performance Standards

1.01a Number of water level monitoring wells for which measurements were recorded each year

1.01b Number of water level monitoring wells for which field notes were written describing reason for inability to obtain measurements each year

1.01c Number of data records entered into District's data base each year

1.01d Number of wells in the water level measurement network each year

1.01e Number of wells added to the network, if required, each year

Management Objective—Technical Field Services

1.02 Provide technical field services including, but not limited to: flow testing, draw down measurement, sprinkler pattern efficiency testing, and water management strategy consultation. Record any observations, measurements, etc. in field log. Enter recorded information in District's database.

Performance Standards

1.02a Number of field services tests performed, as evidenced by field log, each year

1.02b Number of records entered into District's computer database each year

Management Objective—Laboratory Services

1.03 Provide basic water quality testing services. Maintain a record of tests performed by entering the results in the District's computer database. Communicate results of analyses to well owners.

Performance Standards

1.03a Number of laboratory service tests.

1.03b Number of records entered into District's computer database each year

1.03c Number of results communicated to well owners

Management Objective—Irrigation Monitoring

1.04 Monitor seasonal irrigation applications using a network of cooperative producers. Prepare monthly reports for cooperators that include the seasonal irrigation applications. Acquire yield data and analyze crop water use efficiency.

Performance Standards

1.04a Number of irrigation systems in the cooperative program

1.04b Number and type of crops monitored

1.04c Average irrigation application by crop

Management Objective—Center Pivot Inventory

1.05 Beginning in 2003, and again every five years thereafter, perform a physical inventory of the center pivot irrigation systems in the District. Note which center pivot irrigation systems have Low Energy Precision Application (LEPA) spaced nozzles as a measure of adoption of more efficient irrigation technology. Enter data in District's data base file by block and section.

Performance Standards

1.05a Number of irrigation systems recorded each documenting period

1.05b Percentage of center pivot irrigation systems with LEPA spaced nozzles each documenting period

1.05c Number of active irrigation systems by type in District's database

Goal 2.0 Controlling and preventing waste of groundwater

Management Objective—Well Permitting and Well Completion

2.01 Issue temporary water well drilling permits for the drilling and completion of non-exempt water wells, and well registrations for the drilling of exempt water wells. Inspect all well sites to be assured that the District's completion and spacing standards are met. Send written notification to the well owner if the well initially fails to meet standards. The Board will vote on final approval of the permit at the next regularly scheduled meeting after the well site has been inspected and District well standards have been met.

Performance Standards

2.01a Number of water well drilling permits issued each year

2.01b Number of well sites inspected after well completion each year

2.01c Number of well sites that initially fail to meet the standards of the District each year

Management Objective—Open, Deteriorated or Uncovered Wells

2.02 If an open, deteriorated or uncovered well is found, the District will insure that the open hole is properly closed according to District rules and, in so doing, prevent potential contamination of the groundwater resource. The reports shall be filed on forms provided by the District in order to track the progress of the closure process. The District will contact the party responsible for the open, deteriorated or uncovered well within 30 days of same being reported. The site will be inspected after notification to insure the well closure process occurs within 60 days of the initial contact with the responsible party. If the well is not closed by the end of the 60-day period, the District will pursue the available options at its disposal and remedy the well violation.

Performance Standards

2.02a Number of open, deteriorated or uncovered wells
2.02b Number of initial inspections accomplished each year
2.02c Average number of days required to make initial contact with responsible party each year
2.02d Average number of days required to complete closure of open or uncovered wells each year
2.02e Number of wells remaining open or uncovered after 60 day period that are closed in accordance with District rules each year

Management Objective—Maximum Allowable Production

2.03 The District will investigate reports of usage of groundwater in excess of the maximum production allowable under the District's rules. Investigation of each occurrence shall occur within 30 days of receiving the report. Each case will be remedied in accordance with District rules.

Performance Standards

2.03a Number of reports
2.03b Average amount of time taken to investigate reports each year
2.03c Number of incidences where violations occurred and violators were required to change operations to be in compliance with District rules each year.

Management Objective—Water Quality Monitoring

2.04 Conduct a District-wide water quality testing program. The results of the tests will be published in map form, entered into the District's computer database and will be made available to the public.

Performance Standards

2.04a Number of samples collected and analyzed each year
2.04b Percent of previously sampled wells that were sampled in the current testing year
2.04c Number of maps made available to the public each year
2.04d Number of analyses entered into District's computer database each year

<u>Goal 3.0</u> **Controlling and preventing subsidence**
(not applicable)

<u>Goal 4.0</u> **Conjunctive surface water management issues**
(not applicable)

<u>Goal 5.0</u> **Natural resource issues**
(not applicable)

<u>Goal 6.0</u> **Drought Conditions**

<u>Management Objective</u>—Rain Gages

6.01 Maintain a network of rain gages in the District. Publish monthly and yearly rainfall totals on the District's web site

Performance Standards

6.01a Number of rain gages in the network

6.01b Number of monthly rain gage readings

<u>Goal 7.0</u> **Conservation**

<u>Management Objective</u>—Classroom Education

7.01 The District will sponsor the *"Major Rivers"* (or similar) water conservation education curriculum, for 4th grade schools within the District. Annually, the District will sponsor water conservation education book covers for public schools within the District.

Performance Standards

7.01a Number of 4th grade schools where *"Major Rivers"* (or similar) curriculums are distributed each year

7.01b Number of book covers distributed to each school each year

<u>Management Objective</u>—Newsletter

7.02 The District will produce a minimum of four newsletter editions. Newsletters will be distributed to District constituents and other interested parties. At a minimum, two articles per year will be included that address methods of enhancing and protecting the quantity of useable quality groundwater within the District.

Performance Standards

7.02a Number of newsletter editions published each year

7.02b Number of newsletters distributed each year

7.02c Number of articles that address methods of enhancing and protecting the quantity of useable quality groundwater each year

<u>Management Objective</u>—News Releases

7.03 District staff will prepare a minimum of four news releases addressing groundwater protection and/or conservation.

Performance Standards

7.03a Number of news releases prepared for publication in local newspapers.

<u>Management Objective</u>—Public Speaking Engagements

7.04 The District staff and/or directors shall present a minimum of four programs concerning groundwater protection and/or conservation.

Performance Standards

7.04a Number of programs.

<u>Management Objective</u>—Printed Material Resource Center and Technical File

7.05 Maintain a self-service printed material resource center in the District office. Conduct an annual inventory of these items. Through the inventory process, determine the number and type of materials obtained by the public each year. Maintain a technical filing system of resource materials and annually record the number of copies obtained by the public

Performance Standards

7.05a Number of items, by type, obtained by the public from the resource center each year

7.05b Number of items copied and given to the public from the technical file each year

<u>Management Objective</u>—Saturated Thickness Maps

7.06 Every 5 years, beginning 2005, provide saturated thickness maps that show the varying thickness of groundwater remaining in storage.

Performance Standards

7.06a Number of saturated thickness maps displayed and/or printed at the District office

<u>Management Objective</u>—Conservation Literature

7.07 Maintain a portion of the District's material resource center devoted to water conservation. Stock this portion with conservation tips for both home water conservation and agricultural irrigation conservation.

Performance Standards

7.07a Number of brochures/periodicals dedicated to conservation

7.07b Number of conservation brochures/periodicals obtained by the public

Goal 8.0 **Recharge Enhancement**

8.01 A review of past work conducted by others indicates this goal is not appropriate at present. Therefore this goal is not applicable.

Goal 9.0 **Rainwater Harvesting**

Management Objective—Public Awareness Program

9.01 The District will conduct an educational program for this conservation strategy at least once a year.

Performance Standards

9.01a Document the type of program conducted (i.e. newsletter article, public presentation)

Goal 10.0 **Precipitation Enhancement**

10.01 While the District did participate in this program for eleven years, the Board has since determined it is not cost-effective. Therefore this goal is not applicable.

Goal 11.0 **Brush Control**

11.01 Existing programs administered by the USDA-NRCS are sufficient for addressing this goal. The Board does not believe that this activity is cost-effective and applicable for the District at this time. Therefore this goal is not applicable.

Goal 12.0 **Desired future condition of the aquifers**

12.01 Although the District is currently involved in establishing DFCs for the relevant aquifers, the DFC has not been approved at this time. Therefore this goal is not applicable.

References

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GAM Run 08-18

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May 30, 2008

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, groundwater conservation districts shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board 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 groundwater management plans include:

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

The purpose of this model run is to provide information to the South Plains Underground Water Conservation District for its groundwater management plan. The groundwater management plan for the South Plains Underground Water Conservation District is due for approval by the executive administrator of the Texas Water Development Board before November 7, 2008. This report discusses the methods, assumptions, and results from model runs using the groundwater availability model for the southern part of the Ogallala Aquifer. Table 1 summarizes the groundwater availability model data required by statute for the South Plains Underground Water Conservation Districts groundwater management plan.
The Edwards-Trinity (High Plains) Aquifer also underlies the South Plains Underground Water Conservation District. A groundwater availability model has not yet been completed for this minor aquifer. If the district would like information for the Edwards-Trinity (High Plains) Aquifer, they may request it from the Groundwater Technical Assistance Section of the Texas Water Development Board.

METHODS:

We ran the groundwater availability models for the southern part of the Ogallala Aquifer, and (1) extracted water budgets for each year of the 1980 through 1999 period and (2) averaged the 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 Ogallala Aquifer located within the district.

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability models for the southern portion of the Ogallala Aquifer.

- See Blandford and others (2003) for assumptions and limitations of the model for the southern part of the Ogallala Aquifer. Root mean squared error for this model is 47 feet. This error will have more of an effect on model results where the aquifer is thin.

- The groundwater availability model for the southern part of the Ogallala Aquifer has only one single layer representing the Ogallala hydrostratigraphic unit in the district.

- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output results.

RESULTS:

A groundwater budget summarizes the water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget and averaged over the duration of the calibrated portion of the model run (1980 through 1999). The components of the modified budgets shown in Table 1 include:

- Precipitation recharge—This is 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—This is the total water exiting the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).

- Flow into and out of district—This component describes lateral flow within the aquifer between the district and adjacent counties.

- Flow between aquifers—This describes the vertical flow, or leakage, 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 district or county boundaries, 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.

REFERENCES:

Blandford, T.N., Blazer, D.J., Calhoun, K.C., Dutton, A.R., Naing, T., Reedy, R.C., and Scanlon, B.R., 2003, Groundwater availability of the southern Ogallala aquifer in Texas and New Mexico—Numerical Simulations Through 2050: Final Report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 158 p.

Environmental Simulations, Inc. 2007, Guide to Using Groundwater Vistas Version 5, 381 p.

Table 1: Summarized information needed for the South Plains Underground Water Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot. Negative values indicate water is leaving the aquifer system using the parameters or boundaries listed in the table.

Management Plan requirement	**Aquifer or confining unit**	**Results**
Estimated annual amount of recharge from precipitation to the district	Ogallala Aquifer	71,276*
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Ogallala Aquifer	-816
Estimated annual volume of flow into the district within each aquifer in the district	Ogallala Aquifer	2,086
Estimated annual volume of flow out of the district within each aquifer in the district	Ogallala Aquifer	-4,237
Estimated net annual volume of flow between each aquifer in the district	Flow in or out of the Ogallala Aquifer	0**

* Estimated value may also include return flow from irrigation.
**The model does not consider flow into or out of the Ogallala Aquifer from other formations.