Mesa Underground Water Conservation District Management Plan IV

This Management Plan will contain information from
MP I, MP II, MP III, and MP III amended
Historical reference #4 Certified, by Craig Pederson, August 19, 1998

District Mission

Mesa Underground Water Conservation District (Mesa UWCD) will strive for the conservation, preservation, protection, and prevention of the waste of groundwater from the Ogallala Aquifer, the groundwater reservoir over which the District has jurisdiction. The District will implement water conservation and management strategies to prevent the extreme decline of water levels for the benefit of all water right owners, the economy, our citizens, and the environment of the territory inside the District.

Time Period for this Plan

This District Management Plan IV becomes effective February 13, 2014 following it's being readopted by the local Board of Directors and is approved by the Texas Water Development Board (TWDB), executive administrator. This District Management Plan IV will remain in effect for a period of 5 years (minimum planning period), or until a revised or amended plan may be approved or February 13, 2019, whichever comes first. The local Board of Directors may review the Management Plan IV annually but must review and readopt the plan with or without revisions at least once every 5 years. The District shall provide the readopted plan to the executive administrator not later than the 60th day after the date on which the plan was readopted by the local Board of Directors.

Within 60 days of receipt of the readopted District Management Plan IV under Subsection (e) Texas Water Code Chapter 36.1072, the executive administrator shall approve the management plan if it is administratively complete. District Management Plan IV is administratively complete when it contains the information required to be submitted under Section 36.1071 (a) and (e) as well as 31 TAC 356.

Statement of Guiding Principles

The guiding principles in developing the District Management Plan I, District Management Plan II, District Management Plan III, and District Management Plan IV are to better understand groundwater conditions, to encourage the most efficient use of groundwater, to preserve and improve groundwater quality, to increase public awareness and education, and to monitor legislative activities along with rules and orders of state agencies which may affect the private ownership of groundwater including the authority to manage groundwater at the local level.

The District acknowledges that groundwater resources of the region are of vital importance. The District recognizes the private ownership and rights of the landowner, as well as the private ownership and rights in the groundwater percolating below and emphasize that nothing in the Texas Water Code shall be construed as depriving or divesting the owners their ownership or

rights, except as those rights may be limited or altered (Texas Water Code Chapter 36.002), subject to the implementation of this management plan and rules promulgated by Mesa UWCD.

The District seeks to protect the private property rights of all water rights holders, whatever group of users they may represent. The District upholds the private property right of the owner to mine that part of the aquifer which the landowner obtained at the time of purchase of the land surface. The water use must be for a beneficial purpose and without waste. The aim of the District is to assure that all water rights owners are entitled to an equal opportunity to use the groundwater beneath their land. The District asserts that during the rule making process all groundwater users shall be treated fairly and impartially.

The District believes our most valuable natural resource **WATER** can be managed at the local level in a prudent and cost effective manner by regulating the spacing of the wells and the production of water from the wells. The administrative law process of permitting and well registration is the tool necessary to facilitate the District authority and capability to manage the groundwater resource.

The District is continually searching for better methods to understanding the local conditions of the Ogallala Aquifer. An accurate understanding of the aquifer and its hydrogeologic properties, as well as a quantification of resources is the foundation from which to build sound planning measures. This management document is intended as a tool to focus on the thoughts and actions of those individuals given the responsibility for the execution and performance of District functions and activities. The District Management Plan IV is the guideline for the Board of Directors and District staff to follow in the operations of Mesa UWCD.

General Description

The District was created by the citizens of Dawson County through a local election in January 1990. The District boundaries are the same as Dawson County. The District has five board members, one member representing the residents from each single precinct from the four total county precincts and one at large member elected by and representing all of the residents in the county. The Board of Directors serve four year terms with a 2 year stagger and grouped with precinct 1 and 3 together for their elections and precinct 2, precinct 4, and the at large member grouped together for their elections 2 years later. The Board employs a General Manager, Administrative Manager, and a part time employee. The local economy is vibrantly substantiated by agriculture, ranching, and oil and gas production. The agricultural income is derived from cotton, peanuts, grain sorghums, alfalfa, and beef production. The sharp increase in irrigated agriculture 20 years ago has greatly helped to stabilize the economy and expanded the cropping possibilities for agriculture in this semi arid community.

Location and Extent

Dawson County and Mesa UWCD, a square 30 mile by 30 mile county totaling 900 square miles, is located in the southeast small portion of the enormous Ogallala Aquifer. The Caprock Escarpment squeezes off the Ogallala on, along or near the east boundary of the District. Borden County joins us on the east, Martin County on the south, Gaines County on the west, and Lynn County along with Terry County on the north. Lamesa, which is centrally located in the county, is the county seat and where the District Office is located at 212 North Avenue G.

O'Donnell, located in the northeastern part of the county with the county line dividing the largest part into Lynn County, is the next largest town in the District. O'Donnell, much like Lamesa, receive their municipal water from the Canadian River Municipal Water Authority (CRMWA) via an inter basin transfer through a pipeline networking system beginning at Lake Meredith over 240 miles away. Ackerly is located in the southeastern part of the county and it too is divided by the county line with Martin County. Ackerly depends upon a well field with three water wells, located in the District, to supply the community with groundwater for their use. Welch is located in the northwestern part of the county and they too depend on groundwater for their community water needs.

Topography and Drainage

Lamesa has a Spanish name which means "the table top". This name is true because when you climb over 100 feet almost straight up the side of the Caprock Escarpment you reach the "Mesa". The flat land slopes from NW to SE with less than a 375 feet drop over the 45 miles diagonally across the District. The altitude is 3172 feet on the Gaines, Terry, and Dawson County lines intersection. The altitude is 2800 feet on the Borden, Martin, and Dawson County lines intersection. The rainfall, when showering gently, on Mesa UWCD basically remains where the rain drops fall. This is one of the major factors which enable the dryland agricultural community to survive and flourish in our semi arid climate.

Mesa UWCD lies within the drainage system of Colorado River Basin. Tobacco Creek, originating in Dawson County and dry almost all of the time, is the headwaters of the Colorado River which empties out into Matagorda Bay and the Gulf of Mexico. There are no other surface waters in the District.

Groundwater Resources for Mesa UWCD

Historical data of water level monitor wells clearly show the water levels in Mesa UWCD were at a benchmark high in January 1993. Texas Water Development Board records were passed along to the District when TWDB staff trained district personnel to take over the monitoring program in January 1991. Historical data on well # 28-09-901 dates back to 1938 and the record clearly reflects this well never had as much water in it as was recorded in 1993. Consequently, any other data source that cannot reflect, accurately, this situation, then that data is not the best data available.

Because a complete and thorough understanding of the Ogallala Aquifer is not necessary for all the water users, the following two (2) paragraph discussion of geology and hydrology is good general information. (Bell, Ann, Morrison, Shelly, November 1978 *ANALYTICAL STUDY OF THE OGALLALA AQUIFER IN DAWSON AND BORDEN COUNTIES, TEXAS*, Texas Department of Water Resources, Report 225, 3 p.)

"Fresh groundwater in Mesa UWCD is obtained principally from the Ogallala Formation of Pliocene age. Water in the Ogallala Aquifer is unconfined and is contained in the pore spaces of unconsolidated or partly consolidated sediments.

The Ogallala Formation principally consists of interfingering bodies of fine to coarse sand, gravel, silt, and clay-material eroded from the Rocky Mountains which was carried

southeastward and deposited by streams. The earliest sediments, mainly gravel and coarse sand, filled the valleys cut in the pre-Ogallala surface. Pebbles and cobbles of quartz, quartzite, and chert are typical of these early sediments. After filling the valleys, deposition continued until the entire area that is now the Texas High Plains was covered by sediments from the shifting streams. The heavy clay material called the "red bed" serve as a nearly impermeable floor for the aquifer".

The Ogallala Formation is presumed to exist under the entire District surface except that area in the eastern part of the county, off and below the Caprock Escarpment. The Ogallala Aquifer is very different throughout the District because of the vast differences in the permeability of the interfingering bodies of water bearing sands and clay materials. Irrigation wells capable of producing large amounts of water may be found and only a short distance away the aquifer may provide hardly enough water for domestic needs: even though, the water levels in the two wells may be the same and the well depths the same. Well yields are subject to deviations caused by localized geological conditions. The Ogallala is not a homogeneous formation: that is, the silt, clay, sand, and gravel which generally comprise the formation vary from place to place in the thickness of the layers, layering position, and grain -size sorting. The porosity of the formation also contributes to determining the well yield.

The following is a new overview in District Management Plan IV

The District has been very involved in the data collection process in an effort to better understand the characteristics of the Ogallala Aquifer in Mesa UWCD. The 230 Annual Water Level Monitoring Wells coupled with the Aquifer Evaluation Program have caused us to believe there are multiple differences in the aquifer formations existing in Mesa UWCD. The 230 Annual Water Level Monitoring Wells has been reduce to 126, to better reflect the overall conditions of the aquifer in the District. The 230 monitor wells gave a weighted balance too unbalanced for the irrigated area. Through extensive data collections and evaluations we believe we can distinguish between several of these geological strata. At the local level, we have identified and named these different subdivisions such as Ogallala River Channel, West Ogallala, Edwards Aquifer of Dawson County, Alaska, Dry Land and several minor areas such as United, Cooper, Sands, Friendship and Ackerly. We believe these definite different aquifer characteristics make groundwater management in Dawson County unique and different from other parts of the Ogallala Aquifer in GMA 2. GMA 2 is a huge aquifer and we believe Mesa UWCD has adequate data to prove the management programs designed for Mesa UWCD meet the provisions of Chapter 36.108 (d-1), Chapter 36.116 (d) (e) (f). We believe the best management of the groundwater resources located in Mesa UWCD is founded that the conditions in the aquifer and the producers use of the aquifer differ substantially from one geographic area in Dawson based on each subdivision of the aquifer, as well as the geologic strata, each geographic area different from other areas of GMA #2.

The water quality in the District is as different as the water quantities. The interfingering bodies contain many different minerals and in various amounts. Consequently, the water may be of highest quality in one well and very poor quality not so far away. All wells need to be tested to determine the quality of the water produced by that well. Most of the poor quality water problems appear to be from natural causes. However, there are isolated instances where groundwater contamination from past oil field practices have occurred. The high concentration of chlorides suggest the contamination was from oil field brines, disposed in unlined surface pits prior to the statewide "no pit" order, in 1964, by the Texas Railroad Commission. Additional brine contamination may be a result of abandoned oil, gas, injection wells, and wells with

improperly cemented casings.

In the Management Plan I (August 31, 1998 – September 1, 2008) the District used the TWDB's Groundwater Availabilities Estimation Process, which uses available data-sets to generate digital descriptions of the aquifers as well as estimates of recharge and availability rates. The data-sets describe saturated thickness and yield, which the product describes as water in storage. When combined with recharge and production values, these estimates can be used by the District to derive goals for future estimates of available groundwater and the possibility of any necessary production limitations.

Surface Water Resources of Mesa UWCD

There is very little surface water available for use in the District. As a result of large fast rains, run off water is collected in natural topographical depressions referred to as playa lakes. These natural lakes allow the rainwater to percolate downward to the aquifer and create natural recharge of the aquifer. This lake water does not last very long. It evaporates and drains away so fast there is little or no time for wildlife to establish habitat patterns.

Tobacco Creek, headwaters of the Colorado River, is a very small source of surface water available for use in the District. The only surface water impounded, a very small number of dirt tanks, is used strictly for livestock drinking water. Consequently, the conjunctive surface water management issues within the District are not-applicable.

Inter-basin Transfer of Water into the District

Inter-basin transfer of water is very important to the residents of Lamesa, Texas, the county seat of Dawson County and the largest town in Mesa UWCD territory. Water, upon which the city dwellers of Lamesa have been dependent upon for the past 50 years comes from Lake Meredith, located in the Canadian River Basin. Transported water crosses the Red River Basin, Brazos River Basin and into the Colorado River Basin. Inter-basin transfer is not new or unique to the residents of Dawson County. The District supports inter-basin transfer of water. Likewise, the District supports the removal of "Junior" as passed in Senate Bill #1. This action by the legislature has resulted in **NO** surface water inter-basin transfers dated since this passage.

The City of Lamesa was an original founding member of the Canadian River Municipal Water Authority (CRMWA). Over 90% of the municipal use for the city comes from Lake Meredith. Lake Meredith is located over 240 miles to the north. Lake Meredith is basically dry and no longer a viable source of water. However, CRMWA was very pro active and developed one of finest water right acquisitions and developed a groundwater source in Roberts County. The water travels to Lamesa through an underground pipeline system connecting member cities such as Pampa, Borger, Amarillo, Plainview, Lubbock, Slaton, Levelland, Tahoka, Brownfield, O'Donnell, and Lamesa. Lamesa and O'Donnell both contract with the city of Lubbock to treat the raw water at their big efficient treatment plant. This makes the treated water less expensive for city residents. The water is then piped to Lamesa, at the end of the pipeline.

Mesa UWCD has no jurisdiction over surface water. Likewise, chapter 35.003 states "The laws and administrative rules relating to the use of surface water do not apply to groundwater".

Consequently, the city of Lamesa must work out all necessary arrangements for the present and future use of surface water with CRMWA. City officials may contract for the amount CRMWA has available and is willing to sell. The city owns several hundred acres of water rights inside the District. The city water wells provide only a small part of the total annual demand for water. The city of Lamesa, like all other water users, must follow the rules of Mesa UWCD for their production and use of groundwater. The City of Lamesa had a stakeholder on the planning committee which studied groundwater uses in Mesa UWCD prior to the rule changes of 1997. The other stakeholders were satisfied with a lesser amount such as 3 acre feet per year; but, the influence for meeting the needs of the City of Lamesa is the reason the District adopted the maximum of 4 acre feet per year.

Transfer of Groundwater Out of District

The City of Gail, county seat of Borden County, receives their municipal water supply from water wells located in the territory of Mesa UWCD. This transfer arrangement dates back to 1978. The city of Gail relies on this water supply as their soul source of municipal water.

The contract calls for an annual maximum supply of 239 acre feet per year. The amount of actual demand is much less than the supply contract. The single most important factor affecting the annual amount of use is rainfall. The average usage is generally less than 25% of the contract amount. At the current usage rate the supply of groundwater should last the city of Gail much longer than this management plan is in effect. The District will coordinate this effort with Colorado River Municipal Water District and Region F.

The following is a new overview in District Management Plan IV

Borden County has purchased the “water rights” beneath the land upon which the contract of 1978 was established. Borden County has applied for and obtained a “Transfer/Operating Permit” to transport water out of the District for 30 years. The Operating portion of the Permit is an annual permit for 4 acre feet per acre (water rights) owned, that is renewable each year, just like all other permits issued in the District.

The District is aware of the needs for municipal water use throughout Texas. Likewise, the District is mindful of the rights of groundwater owners to market their resource. As a result, the Mesa UWCD will do everything possible to protect **all** water users under our permitting process, with strict requirements that promote fair and equitable spacing and production limitations. The District supports the beneficial use of water inside or outside the District providing all conditions are consistent with the rules of Mesa UWCD.

Projected Groundwater Supplies in Mesa UWCD

The true and accurate supply of groundwater available for use in the District may be very difficult to determine. The TWDB figure 4, page 10, Report 341 shows the water level changes in this District. The 20 feet, 40 feet, and 60 feet rises continued through the year 1993. The area where the 60 feet rise is drawn on the map continued to a rise of over 83 feet. The water levels in 100% of the Districts’ measurement wells reached benchmark highs in January 1993. Historical data from one monitor well 28-09-901 dates back to 1938 and never before had the water level been as high as in January 1993. The high level in 1993 was higher than before the first gallon

of water was ever pumped from well 28-09-901.

In contrast to the 20 year trend of water level rises up through January 1993, the water levels started a decline in 1994 and have continued the downward trend through January 2003. In January 2003, 89% of the 188 monitor wells had a decline. However, in stark contrast, it is to noted that well 27-24-202 has risen every single year since the District started measuring in 1991. The historical water level average prior to 1991 was -77.60' and in 2008 the level was -25.58'. That is a 52' rise over the past 18 years. Any data set that cannot reflect this exact situation is not to be considered the best data available.

Because Mesa UWCD is so unique and different with so many variable aquifer conditions, long term assumptions are virtually impossible to make with any degree of certainty. Just as District Management Plan II was completed for certification on January 2, 2004, with an emphasis on the seemingly consistent declines of the monitor wells, the Annual Water Level Monitoring Program for the year 2005 reveals an average rise in 205 monitor wells of +1.58 foot. The Annual Water Level Monitoring Program for the year 2008 shows another year with a overall rise in 216 monitor wells of +2.71 foot. Of the first 5 years the Annual Water Level Monitoring Program represented in District Management Plan II, water rises have accounted for 40 % of the annual measurements. Basically, the only thing consistent with water levels in Mesa UWCD is their inconsistency. Therefore, any other data source that cannot reflect this situation, then that data source is assumed "not to be" the best data available.

The District will use the beginning values for the *Estimated Volume of Water in Storage*, TWDB Report 341, page 13, September 1993. The report, in millions of acre feet, as follows:

County	Unused	1990	2000	2010	2020	2030	2040	2050
Dawson	0.70	6.31	6.44	5.07	4.18	3.71	4.24	4.77

The District under Management Plan III has attempted to develop a more comprehensive methodology to determine the most accurate water in storage estimate. With the aid of TWDB, who have provided a sizeable number of water meters that are mounted on center pivot systems, the District now has 167 meters from which data is gathered to better calculate a more accurate estimate of the annual crop use. The annual irrigation use as determined by the more accurate crop use data makes it possible to better determine the amount of water used from the aquifer each year. Consequently, the District believes the volume of water in storage to more closely represent the numbers as presented above. The volume of water in storage will decline until recharge once again overcomes pumpage as it has done in the past. It appears history will continue to repeat itself. As a result of the +1.58 foot rise in 2005 and the +2.71 foot rise in 2008, true and accurate evidence is continually proving that recharge in Mesa UWCD is different from other parts of the Ogallala Aquifer.

The following is a new overview in District Management Plan IV

Mesa UWCD Management Plan IV can add another water level rise. The crop year of 2010 was a very wet year. Consequently, the water level measurements in January 2011 resulted in an aquifer rise of +0.68 feet. Recharge from rainfall is major factor.

Groundwater Use in Mesa UWCD

The following is a new overview in District Management Plan IV

During the first five years of District operations prior to District Management Plan I, annual groundwater usage in Dawson County (shown in yellow) has varied from a high of 67,117 acre-feet to a low of 39,678. The annual usage for the first five years is shown from 1991 -1995 and reflected in District Management Plan I. District Management Plan I shows an annual groundwater use (shown in green) from a low amount in 1996 of 85,925 acre-feet to a high in 1998 of 158,500 acre-feet. District Management Plan II shows an annual groundwater use (shown in blue) from a low amount in 2007 of 67,742 to a high in 2006 of 126,952. District Management Plan III (Shown in Gold) resulted in a low of 81,438 acre-feet, which was a very wet year, then followed by the most recent benchmark high water use in 2011 of 157,500 acre-feet. The year 2011 was the first year of the current three (3) year most extreme drought in history:

2012	111,657 acre-ft/year
2011	157,500 acre-ft/year
2010	81,438 acre-ft/year
2009	135,125 acre-ft/year
2008	130,171 acre-ft/year
2007	67,742 acre-ft/year
2006	126,952 acre-ft/year
2005	108,312 acre-ft/year
2004	106,455 acre-ft/year
2003	123,699 acre-ft/year
2002	125,671 acre-ft/year
2001	139,641 acre-ft/year
2000	148,856 acre-ft/year
1999	150,500 acre-ft/year
1998	158,500 acre-ft/year
1997	119,033 acre-ft/year
1996	85,925 acre-ft/year
1995	67,117 acre-ft/year
1994	51,227 acre-ft/year
1993	67,006 acre-ft/year

The following includes historical changes in Groundwater Management.

The data numbers for the first 5 years were obtained from Texas Water Development Board's ***Water Uses Survey-Groundwater Pumpage Estimates***. These numbers for Dawson County (058) include municipal, manufacturing, power, mining (oil and gas recovery) irrigation and livestock. Data was verified by contacting city of Lamesa and city of O'Donnell water utilities. Files of the Texas Railroad Commission were searched to obtain historic information on freshwater used in the production of oil and gas. The data for fresh water used in water flood projects in 1994 is estimated to be around 711 acre feet or 2.4% of the total annual pumpage within the District. These values are quite close to the numbers used by TWDB in this report.

In Management Plan I these numbers were used with the intention of gathering better data for Management Plan II. The District believes the data being gathered currently will give a more true and accurate evaluation of use and conditions of the Ogallala Aquifer in Mesa UWCD. The data from 1996-2002 is data gathered and analyzed by Mesa UWCD. Because of further development of more meters being installed, the data collected by the District from 2003-2007 is even better data. Therefore, the level of confidence, in these groundwater use numbers, is extremely high. The District will continue to add meters into the Aquifer Evaluation Program. The addition of more meters will make the information more valuable as we go forward with the implementation of District Management Plan III.

The data collected and shown in gold and collected in Management Plan III is based on meters from over 177 sites.

The District has developed a very extensive water use measurement program. The District with the assistance of the TWDB has been able to purchase over 70 water meters. These meters have been installed in center pivot systems and drip irrigation applications. In addition to these 70, there are other center pivots with meters installed on them. With the voluntary assistance of these land owners, the District is now gathering water use data from 177 sites. This data is invaluable in determining the actual amount of water applied to the irrigated acres and the different crops in the District. Likewise, this data provides the District with much more accurate numbers to be used in determining the total amount of water withdrawn from the Ogallala Aquifer on an annual basis.

The District provides this information gathered from the water meters to the TWDB not only annually but also on a monthly basis during the growing season. This activity is known as our Aquifer Evaluation Program (AEP). The intent of this program is to gather data reflecting the change in the aquifer as a result of the known irrigation applications. The data showing the change in aquifer is reflected in the 62 non-pumping monitor wells in irrigated areas.

The District has 3 special named sites in which the total amount of water pumped from that particular site is metered. In addition to the meters being read monthly during the growing season, the non pumping monitor wells in these sites are also measured to gather the data reflecting the effect on the aquifer as a result on the known amount of water being removed. The Southwest AEP has 53 metered sites. The Southwest AEP has 27 non pumping monitor wells in and around this area. The Kentucky AEP has 26 metered sites. The Kentucky AEP has 11 non pumping monitor wells in and around this area. The OK Corral AEP has 22 metered sites. The OK Corral AEP has 7 non pumping wells in and around this area. The District just had 2 of these wells drilled in September 2003 to give the OK Corral a better coverage. The District had an additional 3 monitor wells drilled in 2007 to add additional coverage to the Southwest and

Kentucky areas. The total units in the 3 named site areas is 106 meters and 45 monitor wells.

The District also had added another area for data collection. This site is known as Alaska. This area is around the Klondike School. Every single irrigation unit is metered in this site. The 16 center pivots with meters and the 7 non-pumping monitor wells give us excellent coverage for data collection in the aquifer we have named Alaska.

The District also has an expanded program that extends into all the irrigated areas through out the entire district. There are 50 other sites where meters are installed to gather data. The number of non-pumping monitor wells located in other irrigated areas account for 32 additional data collection points. This area is known as UMP.

The District feels that with 177 meters and 62 monitor wells, and the data being collected 6 times a year for a total of 1,434 data base collection sites, the information gathered is very accurate and reliable. In addition, one must remember that the 62 monitor wells measured 5 times a year during the growing season, are also a part of the annual water level monitoring program which totals 126 measurement wells that are measured in January of every year. The 126 wells make up the Annual Water Level Monitoring Program. The results of the 126 water level wells can be found at the TWDB or at our website, www.mesauwcd.org .

With the very capable assistance of the TWDB both technical and financial, the District feels that data collection in Mesa UWCD is on the brink of developing a new understanding of the Southern Ogallala Aquifer as never before experienced in hydrologic studies by many of the experts. The District is very happy with our working relationship with the TWDB and look forward to continued success.

All members of the Board of Directors are very dedicated to the data collection programs in Mesa UWCD. The belief of the District is that only through the best data collection programs possible will adequate knowledge of the aquifer in Mesa UWCD be sufficient to make decisions concerning the viable life of irrigated agriculture within the District. The District will continue to gather vital data for the evaluation of the aquifer changes and the amount of groundwater used each year. This data will be used to continually update the “Water Use and Projections” as well as the “Volume of Water in Storage”. As in the past, the District will continue to work closely with the TWDB.

Groundwater Availability Model

The following includes historical changes in Groundwater Management.

The District applauds the Texas Legislature for their foresight to provide a Groundwater Availability Model (GAM) for the Southern Ogallala Aquifer. The District congratulates the TWDB for the work they performed in allowing the interested parties to be participants in the selection process of the firm to prepare the GAM. The District appreciates the ability to work with the TWDB in awarding the contract for the GAM of the Southern Ogallala in Texas and New Mexico. Likewise, the District is very thankful to T. Neil Blandford with *Daniel B. Stephens & Associates, Inc.* for the ability to work with him and his staff during the process of developing the GAM. The District promotes the GAM as a very good tool and supports the process. The District was very active from the beginning of the process and continued input into the GAM until the final draft. Nevertheless, the Board of Directors considers and views the GAM as the basis

for developing the District Management Plan II and District Management Plan III. However, because of the extreme recent changes which have occurred and are continuing to occur on an annual basis in Mesa UWCD the GAM is seemingly unable to reflect the actual true and proven events as they are more recently and currently occurring in Mesa UWCD.

Texas Water Code Chapter 36.1071 Management Plan (h) clearly states *"In developing its' management plan, the district shall use the groundwater availability modeling information provided by the executive administrator in conjunction with any available site-specific information provided by the district and acceptable to the executive administrator".* The District trusts that the executive administrator will accept the site-specific data the District has collected and has continually shared with TWDB. The TWDB is the entity most responsible for providing the professional guidance and financial support in the development of the site-specific data the Board of Directors voted on August 23, 2003 to use for the development of Management Plan II. The Board of Directors once again voted on September 10, 2008 to use the site specific data developed by Mesa UWCD as the data to be used in developing Management Plan III.

Mesa UWCD has a very extensive Annual Water Level Monitoring Program. The total number of monitor wells the District will measure in January 2009 will be 230. Since the district was created in 1990 the District has continued to add monitor wells to the Annual Water Level Monitoring Program. There are currently 46 monitor wells in the program that the TWDB turned over to the District for measurements in January 1991 when the TWDB employee worked with District staff in providing expert training for the Annual Water Level Measurement Program. Since that time, the District has added more and more new wells into the Program (16 new wells in 2008) until we are at the 230 sites for the 2009 measurement event. The District measures these monitor wells in the first part of January and send the information to the TWDB before the end of January. TWDB staff member Dennis Jones has been working with the District handling the Annual Water Level Monitoring Program. Since the retirement of Dennis Jones, I believe we will be working with Bryan Anderson. The Annual Water Level Monitoring Program information is on line at www.twdb.state.tx.us and www.mesauwcd.org for anyone and everyone to view and utilize.

Please note how the differences in developing Management Plan II and new District Management Plan III have almost completely different scenarios of groundwater conditions to consider.

In the development of Management Plan II, the District believes the most important ingredient is the observation of exactly what the groundwater levels are actually doing at this particular time in history. The Management Plan II will use the most accurate data available. The water level information will be the measurements taken in January 2003. The District measured 188 monitor wells in 2003. However, 16 of them were new monitor wells and there was no new data results from them. Of the 172 wells comparably measured, there were 149 wells with declines. In the irrigated area there were 134 wells with declines. The average decline of the monitor wells in the irrigated area was -2.95 ft. In the dryland area there were 15 wells with declines. The average decline was only -.78 ft. In the dryland area there were 12 wells with rises at an average rate of +.86 ft. There were only 7 wells that indicated a rise in the irrigated area; but, the average rise was +4.61 ft. In conclusion there was a percentage of declining wells in Mesa UWCD at a rate of 86.6 %

A year prior, in the measurement period ended January 2002, the District measured 172 monitor wells with 21 new wells with no new data results. Of the 151 wells measured, there were 130

wells with declines. In the irrigated area there were 108 wells with declines. The average decline was -3.00 ft. In the dryland are there were 22 wells with declines. The average decline was -1.78 ft. In the dryland area there were 9 wells with rises at an average rate of +1.56 ft. There were 12 wells that indicated a rise in the irrigated area: but, the average rise was +5.81 ft. In conclusion there was a percentage of declining wells in Mesa UWCD at a rate of 86.1 %.

Two years prior, in the measurement period ended January 2001, the District measured 152 monitor wells with 16 new wells with no new data results. Of the 136 wells measured with changes, there were 73 wells with declines. In the irrigated area there were 69 wells with declines. The average decline was -3.20 ft. In the dryland are there were 4 wells with declines. The average decline was -.56 ft. In the dryland area there were 27 wells with rises at an average rate of +2.28 ft. There were 36 wells that indicated a rise in the irrigated area: but, the average rise was +2.57 ft. In conclusion there was a percentage of declining wells in Mesa UWCD at a rate of 53.5 %.

The trend of a declining water level started in 1994 and the declining water levels have continued through the measurement period in 2003. With the current measurements the District has made during the growing months of June, July, August, Sept., and Oct. 2003, there was evidence the declines would continue into the 2004 measurement period. Sure enough after the Management Plan II was adopted and approved on January 2, 2004, the annual Water Level Program revealed an average decline of -2.95 ft. Just as Management Plan I revealed a steady decline of the aquifer since the benchmark high in January 1993, Management Plan II started off with the same results.

The declining water level situation over the past 10 -11 years is a complete turn around from what was happening in the District prior to 1993 when the aquifer in Mesa UWCD reached the benchmark high. Prior to January 1993 the levels had been on a rise since the mid 1970's when the aquifer in Mesa UWCD had reached a benchmark low. Within a period of around 20 years the Ogallala Aquifer in the Southern Region had made a tremendous turnaround. However, that upward trend, regardless of how profound and significant, during the mid 1970's through 1993 seems to be no longer true. The water level measurement records since 1994 prove the aquifer to be on a declining trend.

The final report of the GAM does an excellent job of portraying the condition of the water levels in Mesa UWCD up until 1998-1999 with the illustration of well 28-09-901("The Well") labeled Dawson 2. This illustration is on the top of about page 18 of Appendix D "Simulated and Observed Hydrographs for transient Model Calibration". Historical records show the water level on this well the first time measured in 1938 to be -122.77. Between 1938 and 1950, just prior to irrigation being introduced in Dawson County in the early 1950's, the well had risen to a level of -119.87. With the beginning and continued irrigation during the 1950's, 1960's, and mid 1970's, the well reached a benchmark low in 1977 of -137.80. This well has a depth of -150. At this period in time, the aquifer was getting very low and the price of fuel to pump the wells in Dawson County was very high. Irrigation practices were basically stopped and the farmers went back to dryland farming. Al most immediately, the aquifer started to recharge and the water levels begin to rise in this well. By 1981 the level had risen 10 ft. By 1987 it was within 1 ft. of the beginning level of 1938. After the 100 year rains of 1985 and 1986 the water levels were rising fast. In 1990 the water level rose +13.63 ft. The well continued to rise an additional +11.63 and reached a benchmark high in January 1994 at -96.92. However, the well from 1994 through 2003 has declined a total of -18.08. The annual declines are: -0.33, +0.03, -3.65, -1.32, -4.14, +0.50, -3.67, -2.50, and -2.50. Of the -18.08 decline, -12.81 or 71 % has come since 1999. In

preparation of Management Plan II, the District believes this data reflects the true and accurate groundwater levels in Dawson County. At this time in history, the District believes the Graph Dawson County 2 should have an even more exaggerated decline than shown.

The final report of the GAM does an excellent job of portraying the condition of the water levels in Mesa UWCD up until 1998-1999 with the illustration of well 27-07-901(OXY Oil Patch) labeled Dawson 4. This illustration is on the top of about page 19 of Appendix D "Simulated and Observed Hydrographs for transient Model Calibration". The graph illustrates correctly the benchmark high of the aquifer in 1993 at -47.72 ft. The downward trend is quite evident through 1998. Since the last date on the graph the water level has continued the downward trend with declines of -6.83, -6.92, -7.58, -4.25, and -3.91 for the years 1999-2003. The water level in this well at the 2003 measurement is -88.46. This change represents a -40.72 ft decline. Therefore, in preparation of Management Plan II, the District believes the graph should continue to show a declining trend through 2003.

The final report of the GAM does an excellent job of portraying the condition of the water levels in Mesa UWCD up until 1998-1999 with the illustration of well 28-26-206(Stage Coach) labeled Dawson 5. This illustration is on the bottom of about page 19 of Appendix D "Simulated and Observed Hydrographs for transient Model Calibration". The observed water levels seemingly are turning downward, and very well they should be because the water level measurements from 1999-2003 went down another -2.74. The District is quite concerned that the simulated water level line seems to turn upward rather than downward as would be the case with the true and accurate measurements since 1999. However, we find that the water level in 2003 was -74.95 ft. Then with 3 years of rises in the past 5 years during the Management Plan II, the level in 2008 is -72.03. The level recorded in 2008 is the benchmark high for this well.

With all the good water level monitoring wells the TWDB were measuring prior to the creation of the District in 1990, at which time the responsibility of measuring the observation wells in Dawson County was turned over to the District, and the District has continued measuring up through the year 2008 a total of 46 of the original wells started by the TWDB. To our astonishment, we do not understand the use of Dawson 1 and Dawson 3 which indicate the water level measurements were stopped in the 1986 -1988 period. The TWDB had already stopped measuring these wells before the District was even created and there is no current data for over 30 years.

The District believes this to be the beginning or point # **1**, whereby the site specific data gathered by Mesa UWCD and shared with the TWDB becomes the best available data for the development of Management Plan II and will also be the best available data for the District Management Plan III. The final GAM report shows "Simulated Water Levels for 2010-2050, Average Conditions" on figure 70, 71, 72, 73, and 74 shows only one dry cell and a whole multitude of flooded cells. The final GAM report shows "Simulated Drawdown for 2010-2050 Average Conditions on figure 75, 76, 77, 78, and 79 shows water level rises from 0-25 with rises greater than 25 in the year 2050. The final GAM report shows "Simulated Saturated Thickness 2010-2050, Average Conditions on figure 80, 81, 82, 83, and 84 to continue to grow thicker and thicker. The final GAM report shows basically the same results with only minor reductions for Drought of Record" on figure 85-102. The GAM shows a continual increase in the availability of groundwater up through the year 2050.

The District requested a model run from the TWDB. As always the TWDB accommodated quickly and efficiently. The GAM model showed a "Volume of Water in Storage for 1996" to be

7.4 million acre-ft. Later the District requested a model run for the "Volume of Water in Storage for 2050 Drought Conditions". The results from this request were also accommodated by the TWDB quickly and efficiently and the report prepared by Richard Smith calculated the amount to be 7.5 million acre-ft.

The District believes this to be point # **2**, whereby the site specific data gathered by Mesa UWCD and shared with the TWDB becomes the best available data for the development of Management Plan II and District Management Plan III. The District has prepared a graph titled "GAM Estimated Volume of Water in Storage" at the bottom of page 25 to show the result of the GAM run. One can quickly see a steady increase in "Volume of Water in Storage" going from 7.4 up to 7.5. The GAM model run indicates that in 1996 there was 7.4 million acre-ft of groundwater in storage in Dawson County. A GAM model run using the drought of record indicates the "Volume of Water in Storage" by the year 2050 will have risen to the 7.5 million acre-ft level.

The District supports the two (2) graphs titled "Mesa UWCD Estimated Volume of Water in Storage" and "Region O Estimated Volume of Water in Storage" on page 25. The District believes the beginning values for the *Estimated Volume of Water in Storage*, TWDB Report 341, page 13, September 1993, as used in Management Plan I, reflects a more accurate estimate of the groundwater in storage. These two (2) graphs reflect the information present previously on page 8 "Projected Groundwater Supplies In Mesa UWCD".

The District believes that just as in the past, history will once again repeat it's self. The graph "Mesa UWCD" shows the "Volume of Water in Storage" to again start an upward trend in 2030. This is the same trend that occurred in the mid 1970's when the aquifer got low and irrigation virtually stopped completely and recharge could once again surpass pumpage. Providing with the great fortune, the District could once again receive the 100 year rain event like the mid 1980's, there might be a new benchmark high water level sometime out in the future.

The final report Appendix C "Historical and Future Pumping Demands for Southern Ogallala GAM" provides some very interesting and valuable information regarding the historical agricultural pumpage in Dawson County. This information is found on table C-1 page 41, 42, 43, 44, 45, 46, and 47. With the introduction of irrigated agriculture in the early 1950's there is evidence on page 41 that the amount of pumpage more than doubles by the end of 1959 when there was more than 112,000 acre-ft of water pumped. The amount of water pumped in Dawson County continued to go upward until the highest amount of water usage was reached in 1964 when a total of 148,783 acre-ft of water was used for irrigated agriculture. That water use trend then turned downward until the 1970's when the aquifer reached it's bench mark low in the mid 1970's and the total pumpage in 1979 was very low 9,700 acre-ft. The District believes this historical information to be in balance with the historical events occurring in Dawson County during this period of time.

The District believes this to be point # **3,** whereby the site specific data gathered by Mesa UWCD and shared with the TWDB becomes the best available data for the development of Management Plan II and district Management Plan III. The final report Appendix C "Historical and Future Pumping Demands for Southern Ogallala GAM" on page 44 begins the more current water usage calculations since the District was created in 1990. This information is presented on page 20 of District Management Plan III in the graph titled "GAM Water Use and Projections". The graph reflects the numbers presented in the final report. The 1996 number of 81,617 acre-ft., that amount is just less than the highest number recorded in 1997 of 95,400 acre-ft., which is

the maximum amount of usage shown in the final report for the current usage. The number for the year 2000 is 36,475 acre-ft. and the number on page 45 for 2010 is 34,074 acre-ft. Mesa UWCD has data for the year 2000 which shows usage of 148,856 acre-ft. Because of the tremendous amount of data the District and the TWDB are collecting, analyzing, and available at the TWDB, the numbers presented in the GAM are not consistent with the site specific data.

The site specific data presented in the graph titled "Mesa UWCD Water Use and Projections" on page 20 of District Management Plan III is a product of the data collection programs established by the District with the technical and financial support of the TWDB. The data presented on the chart in the "Groundwater Use in Mesa UWCD" on page 9 is the product of the data collection programs. These numbers are the very best estimates possible using the results of annual crop acreage reports and multiplying by the average water usage for the various crops for each particular year. The graph of Mesa UWCD begins basically the same as the GAM and Region O graphs. However, both these graphs have a sharp rise and fall on either side of the 1996 estimated use bar. This radical change in water use from 1990 to 1996 to 2000 was not the case. The graph of Mesa UWCD takes a much smoother contour. If one graphed the chart on page 9 the high bar would be in 1998 when the estimated usage was 158.500 acre-ft. The estimated usage in 1999 was 158,500 acre-ft. The estimated water use in 2000 is about 10,000 acre-ft less than the high two (2) years prior. The District is very confident the estimated use of irrigation water in Mesa UWCD in the year 2000 was 148,856 acre-ft. as shown on the Mesa graph not the 36,475 acre-ft as shown on the GAM graph. The water use in 2004, the first year of Management Plan II the water use was down to 102,272 acre-ft. The water use did increase to 126,951 in 2006 due to a very dry year. However, 2007 was a very wet year and the pumpage dropped to a modern era low of 67,742 acre-ft.

The water usage in Mesa UWCD will continue to decline, but maybe not to the 2007 level. This decline is a result of the three (3) points highlighted in the above section. The number 1 and most important factor to ever be considered in evaluating groundwater in Mesa UWCD is the water level of the aquifer as indicated by the water levels measured in the 230 monitor wells. The number 2 factor in evaluating the conditions of the aquifer is the sum of the water level measurements as indicated by the measurements of the 230 monitor wells to determine the "Volume of Water in Storage". The number 3 point "Water Use" is a final result of number 1 and number 2. There will always be a direct correlation between the water level of the aquifer and the possibility of the total water use. When the aquifer is full as in the benchmark year of 1993/1994, the aquifer can meet the needs for water use as indicated by1998 water use. When the level of the aquifer begins to decline, the maximum needs cannot be met and the water use will decline as indicated since the high usage benchmark of 1998. The District will be diligent in the continued collection of water level information; because, we believe that in a sand aquifer like we have in Mesa UWCD the volume of water in storage in the aquifer as illustrated by the condition of the aquifer can best be revealed by the water level monitoring program.

The District trusts the TWDB will evaluate this site specific data and conclude these numbers to be the best data available for the development of District Management Plan III, just as they did for Management Plan II. TWDB did determine the best available data was presented by the District and Management Plan III was approved. Legislation has changed since the approval of Management Plan III.

The following is a new overview in District Management Plan IV

Mesa UWCD District Management Plan IV will be evaluated under the Desired Future Condition (DFC) and resulting Modeled Available Groundwater basis. The District adopted Desired Future Conditions (DFC) for relevant aquifers in August 2010. The relevant aquifers are the Ogallala and Edwards-Trinity (High Plains) Aquifers. The Board decided the Dockum Aquifer is not a relevant aquifer for Mesa UWCD at this time and no DRC was set for it.

During the joint planning process, this District and five other GCDs along the southern end of GMA#2 adopted DFCs for the Ogallala and Edwards-Trinity (High Plains) based on an allowable amount of drawdown. The allowable drawdown is based on the average change during the 10-year period 1998-2007. For Mesa UWCD, that number is -1.58 ft/year. Based on the 50 year planning horizon, the Southern Ogallala GAM predicts the cumulative drawdown to be -74 feet for the District. However, for the purposes of this management plan, the District proposes to evaluate the cumulative drawdown in 5 year increments, which will measure our attainment of the DFC in shorter increments, and allow us to make any changes accordingly.

It is our belief that no additional rules changes are needed at this time in order to meet the adopted DFC. Our proposal may be altered if, at the end of the current 5 year period, our cumulative annual drawdown differs significantly from what is calculated to keep us on track for DFC attainment.

Texas Water Development Board has provided Mesa UWCD with GAM RUN 10-030 MAG (See Appendix I). Table 9 of this publication estimates the annual Modeled Available Groundwater to be 202,171 acre-feet for the years beginning 2010 and going through 2019. Table 8 of this publication estimates the annual Exempt Use to be 542 acre-feet. The following table on the next page illustrates the correlation between annual Modeled Available Groundwater and the estimated annual usage:

Crop Year	Ave Irrigation Applied Inches/Acre	Irrigated acres	Estimated Acre feet Water Used	January Year Measure	Average Water Level Change	DFC ave 1998-2007	Modeled Available GW	Compared to Cap = MAG-Use
1996			85,225	1997	-3.42			
1997			119,033	1998	-0.45			
1998			158,500	1999	-3.50			
1999			150,500	2000	-2.17			
2000			148,856	2001	-0.76			
2001			139,681	2002	-2.43			
2002	21.19	71,404	125,671	2003	-2.58			
2003	20.39	72,800	123,699	2004	-2.95			
2004	17.22	74,185	102,272	2005	1.58			
2005	17.33	75,000	102,025	2006	-1.58			
2006	20.92	72,821	126,951	2007	-0.98	-1.58		
2007	11.17	72,776	67,742	2008	2.71			
2008	21.56	75,000	130,171	2009	-3.12			
2009	21.62	75,000	135,125	2010	-0.98			
2010	13.03	75,000	81,438	2011	0.68	-1.58	202,713	121,275
2011	24.99	75,000	157,500	2012	-2.90	-1.58	202,713	45,213
2012	17.63	76,000	111,657	2013	-1.12	-1.58	202,713	91,056
Ave	Use		121,532					
2010							202,713	
2020							199,212	
2030							186,985	

Recharge in Mesa UWCD

The following includes historical changes in Groundwater Management.

The District is very proud of the Aquifer Evaluation Program (AEP) that has been developed with the cooperation and financial support of the TWDB. The District has gathered data in the AEP that strongly indicates the possibility of a recharge rate in Mesa UWCD that is a much higher rate than anything which has been discovered in prior studies. This data also indicates the recharge occurs in a much quicker time period, from when the rain event occurs until the aquifer shows a profound rise in the water levels, than prior studies have shown.

This example is the results of a happening that has caused the District to support a new and different recharge theory for Mesa UWCD. In the AEP, during May and the 1st part of June 2003 we received rainfall between 2 ½ and 7 inches. The irrigated crops were planted and growing. The rainfall events stopped completely by June 9. All the "non-pumping wells" (33) were measured on June 20. At this June 20 measurement, every single well of the 33 water level monitor wells showed a decline in the aquifer water levels from the January "Annual Water Level Measurement Program" All the meters were read on June 20 (68). From this date forward, all of the center pivots in the AEP (with the exception of 1 unit) and all other surrounding center pivots were running full steam ahead at maximum production capacity, which is consistent with the drought policy of the District "the drier the natural conditions the more a producer must apply through irrigation".

By July 20 the district was in day 41 of drought conditions. The 67 center pivot systems had put out an average of 3.97 inches per acre on 7,689 acres which calculates to more than 2,543 acre feet of water being pumped from the aquifer. However, the most astonishing thing was discovered when measuring the "non-pumping wells". The results of the July 20 measurement showed that 22 wells had water levels that indicated a rise in the water table of the aquifer. That is a 67% ratio for rise and a 33% decline rate. The 22 wells with rises had an average rise of +.83 ft. or 10 inches. There were four (4) wells straight across the middle (from west to east and within a 3 mile distance) of the Kentucky site with rises of +.41, +2.83, +1.00, and +1.75. The District does know for certain that these wells had more water in them on July 20 than they had in the previous measurement on June 20. This new water in the aquifer that caused this tremendous rise had to come from somewhere, no doubt about that factual data. The AEP is a 10 year plan and is the data collection tool that the District, with the coordination and support of the TWDB, will use to continue the study of "Mysterious and Occult" groundwater in Mesa UWCD. The AEP for Southwest, Kentucky and OK Corral has now grown to 106 meters and 47 monitor wells. This is tremendous amount of metering and measuring within a basically contiguous area.

The following is a new overview in District Management Plan IV

Texas Water Development Board has provided the District for preparation of District Management Plan IV, ***GAM Run 12-008 Report.*** This run shows the "Estimated annual amount of recharge from precipitation" (Appendix III, page 6) to be 62,265 acre-feet per year. No recharge for the Edwards Trinity (High Plains) Aquifer. This is the data used In MP IV.

Drought Contingency Plan

The following includes historical changes in Groundwater Management.

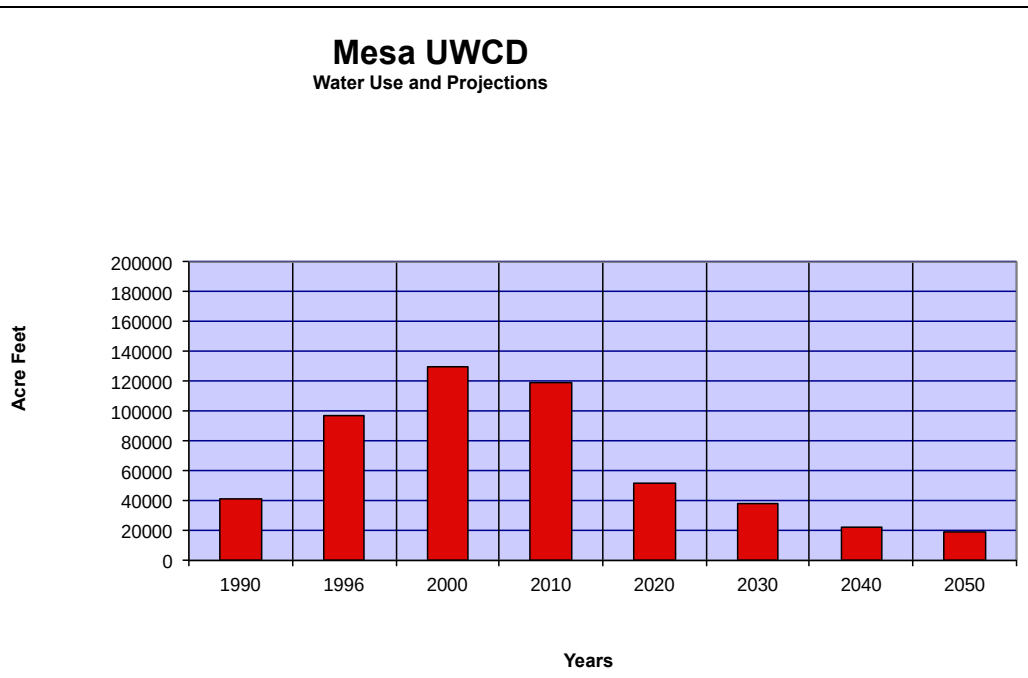
A contingency plan to cope with the effects of water supply shortages due to climatic or other conditions will be developed by the District and will be adopted by the Board after notice and hearing. In developing the contingency plan, the District will consider the economic effect of conservation measures upon all water resource user groups, the local implications of the degree and effect of changes in water storage conditions, the unique hydrogeologic conditions of the aquifer and the appropriate conditions under which to implement the drought contingency plan.

The District will employ additional technical specialists at its disposal to evaluate the resources available within the district and to determine the effectiveness of regulatory or conservation measures. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit contingency plan on grounds of adverse economic hardship or unique local conditions. The exercise of said discretion by the Board of directors shall not be construed as limiting the power of the Board.

Actions, Procedures, Performances and Avoidance for Implementation of District Management Plan and Future Board Review

The following is a new overview in District Management Plan IV

The District will implement the provisions of the approved management plan and will utilize the provisions of this plan as a guidepost for determining the direction or priority for District activities. Operations, agreements, and planning efforts of the District will be consistent with this plan. The District will seek the cooperation of all interested parties in the implementation of this plan. The District will adopt all Management Plans by means of a District Board Resolution. The District will provide "Notice and Hearing" as prescribed by District Rule 14.1 (B) (2) *"At its discretion the Board may hold a hearing and consider adoption of a new District Management Plan and provide evidence to the TWDB of such happenings".* The District will coordinate with all surface water management entities in the District that includes Canadian River Municipal Water Authority, Brazos River Authority, and Colorado River Municipal Water District. This plan is for a 5 year planning period; however, the Board of Directors of Mesa UWCD may review the plan annually and re-adopt the plan with or without revisions at least every five (5) years. At anytime the Rules of Mesa UWCD may be found on the District website www.mesauwcd.org. A digital copy of Management Plan III may also be found at the same website. Mesa UWCD Management Plan IV will be published on the same website upon approval by the TWDB.


Mesa UWCD
Water Use and Projections
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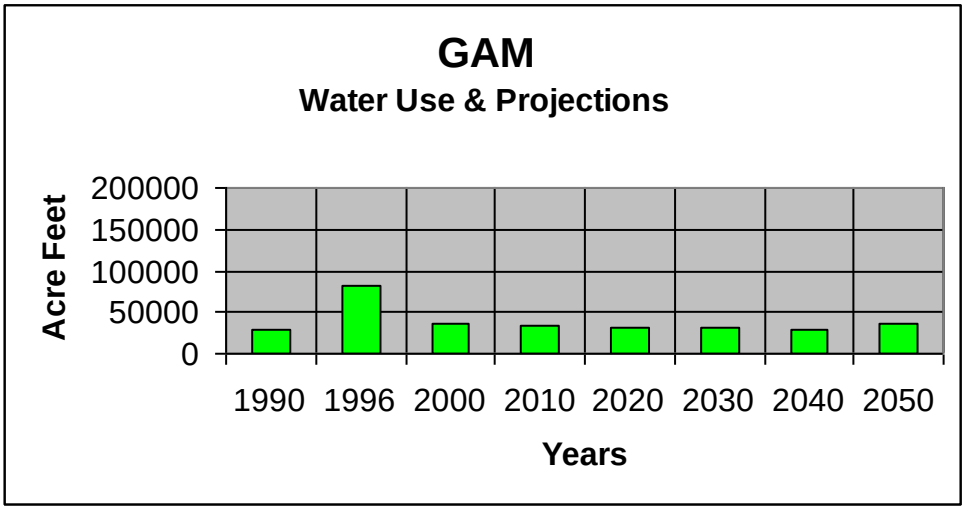
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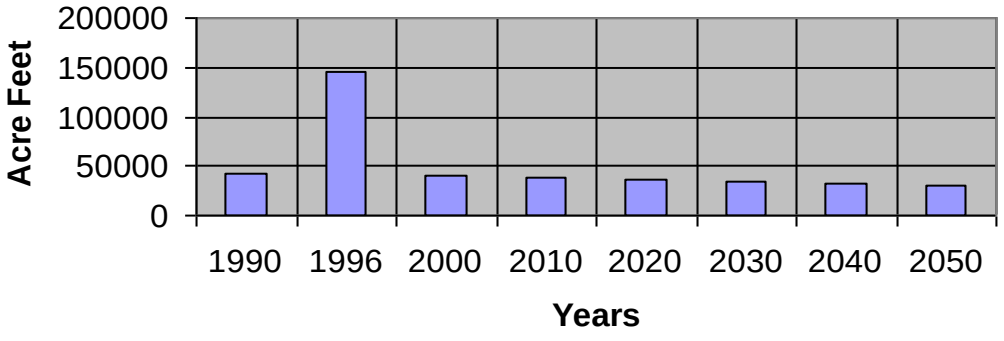
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Projected Demands for Water in Mesa UWCD

The following includes historical changes in Groundwater Management.

The TWDB published groundwater demand forecasts in their planning document "*1996 Consensus Texas Water Plan"*. The Management Plan I for Mesa UWCD was based upon this document and related files of the Texas Water Development Board. This data was necessarily used until alternative numbers could be generated by the District. The TWDB data had projected that the total water demands for Mesa UWCD to be 32,274 acre-feet per year by 2040. This estimate is based on projections of the following breakdown and population statistics. Lamesa will have a municipal demand of 2,294 acre-feet, O'Donnell, Ackerly, and Welch 386 Acre-feet. Manufacturing, Mining, and Livestock account for 311 acre-feet. Irrigation is projected to use 29,521 acre-feet.

One of the projects the District under Management Plan I sought to pursue was to develop a data base of the most current information reflecting the use and availability of groundwater in the District. Weather conditions have been so very different in the past several years and this dramatic change has caused data used in prior studies to be way out of kilter. During the mid 1980's the District experienced huge rainfall amounts. These years were known as the 100 year rains. In contrast, during the period of Management Plan I, the 100 year rains have been followed by drought conditions in the 6 of 8 years from 1996 through 2003. Management Plan II has had all conditions. The water levels in 2004 were -2.95', 2005 +1.58, 2006 -1.58', 2007 -0.98, and 2008 +2.71. This is definitely a mixed bag of data to start of District Management Plan III.

Likewise the agriculture patterns have changed drastically in the past several years. There is no possible way projections made twenty years ago, prior to the creation of the District, could have predicted the enormous increase in irrigation acres in Dawson County. The data we were using in the development of Management Plan I was the best data available and we greatly appreciate the hard work TWDB has given over the many years to perform these studies and prepare projections and overviews.

However, we believe it is imperative for the District to have and be able to use better data in preparing the Management Plan II for the year 2004 as well as for District Management Plan III for the year 2009. We trust the TWDB will continue to guide and assist our District toward developing accurate and precise overviews and projections as a result of the new and ever changing conditions: whereby, the new data the District has been able to assimilate during this period of time when changes have been running wild and rampant in the southern region of the Ogallala Aquifer. The District will continue requests for Region O water planning group to consider the southern region of the Ogallala Aquifer as an area where additional studies need to be performed.

The new development of "best available data" part of Management Plan I and Management Plan II has become a reality. With the very capable assistance of the TWDB, the Board of Directors believes, Mesa UWCD now has the "best data available" to utilize in the preparation of District Management Plan III.

The following is a new overview in District Management Plan IV

Texas Water Development Board has prepared for Mesa UWCD, as designated Dawson

County, Projected Water Demands TWDB State Water Plan. The demand numbers (Exhibit II, page 6) will decline from a high in 2010 of 142,886 acre-feet to a low in 2060 of 106,469 acre-feet. Mesa UWCD is happy to use these numbers in District Management Plan IV. Irrigation in Mesa UWCD accounts for over 95% of the total demand number. The projected demand number will be a number that the projected supply will never be able to attain. The Ogallala Aquifer in Mesa UWCD is so different from the Ogallala Aquifer in most of GMA #2 that it is literally impossible to meet the demand.

Demand and Supply Issues and Resolutions

The following includes historical changes in Groundwater Management.

Based on supply and demand calculations and projections based on estimates from available data it appears issues will arise as the Management Plan I and Management Plan II have been implemented over the past 10 years. The District used Texas Water Development Board's Report 341 *The High Plains Aquifer System of Texas, 1980 to 1990 Overview and Projections, September 1993*. Management Plan I used the Table 3. Volume of Water in Storage for Future Periods, South Model, page 13. The estimated usable amount of groundwater available projected for the year 2040 is 4.77 million acre-feet less .7 million acre-feet shown to be unrecoverable, or a estimated net volume of 4,070,000 acre-feet. Management Plan II used Table 5, page 19, reflecting USGS recharge rate of 3,921 acre feet per year for the South Model. TWDB report 288 uses 24,600 acre feet per year as the recharge rate. Estimates of annual recharge vary considerably. The District is in agreement with the authors of Report 341 which state *"The 1990 revision of the TWDB High Plains aquifer model resulted in an increased awareness that, especially in the southern region, recharge to the aquifer is more variable than previously envisioned. Further study is needed to improve simulation of the various recharge mechanisms that occur within the aquifer".*

Recharge of the Ogallala Aquifer in Mesa UWCD is very difficult to understand. Studies have suggested recharge ranging from 0.01 (Stone, 1984) to 0.833 (Knowles, 1984) inches per year. However, after the record setting rainfall in Dawson County in the mid 1980's, evidence may be discovered in future studies to increase that amount greatly. The District believes that as a result of the data collected in the Aquifer Evaluation Program (AEP) as discussed in previous text, evidence of the accelerated recharge is a great possibility.

Texas Water Development Board has provided the District for preparation of District Management Plan III, ***GAM Run 08-46 Report.*** This run shows the "Estimated annual amount of recharge from precipitation" to be 61,253 acre feet per year. This amount of recharge is more than 2 times the amount from Report 288. The estimated net inflow into the District is 5,299 acre ft. and out flow is 9,925 acre ft. The outflow is made up of 3,502 acre feet discharging to surface water and springs along with an estimated 6,423 acre-feet of flow "out of District". Using these numbers it appears that the net water balance from ***GAM Run 08-46 Report*** is a recharge of 56,627 acre feet. Be aware, the model did not consider cross-formational flow, and therefore, no estimate was provided in the ***GAM Run 08-46 Report*** nor in District Management Plan III.

The much larger question concerning "Estimated annual amount of recharge from precipitation" has to do with the water level rises in the years 2005 and 2008. The Annual Water Level Program for the year 2005 had an average rise over the entire District of +1.58 foot. The total estimated water use in the crop year prior to the January well measurements was 106,455 acre/feet. The +1.58 foot rise over the 576,000 acres amounts to 910,080 acre feet of recharge

plus the 106,455 acre feet that was pumped from the aquifer gives a net water balance of 1,016,535 acre feet.

The Annual Water Level Program for the year 2008 had an average rise over the entire District of +2.71 foot. The total estimated water use in the crop year prior to the January well measurements was 67,742acre/feet. The +2.71 foot rise over the 576,000 acres amounts to 1,560,960 acre feet of recharge plus the 67,742 acre feet of water that was pumped from the aquifer gives a net water balance of 1,628,702 acre feet.
Somewhere in this conglomerate of numbers there needs to be some sort of rational explanation for better understanding the recharge numbers. The logistics of the Annual Water Level Monitor Wells are located throughout the District represented by the 576,000 acres. However, the amount of groundwater pumped from the Ogallala Aquifer is done so over only approximately 91,000 acres. To further complicate this scenario is the fact that 187 of the Annual Water Level Monitoring Wells are within ½ mile of active irrigation systems. The remaining 29 wells are located in the dryland areas of the District. The measurements in 2008 showed that the 187 wells in irrigated area had an average rise of +2.81 feet and the rise in the dryland areas was only +1.12 feet.

The measurements in 2008 were just opposite. The dryland areas had 28 wells rise an average of +3.19 feet and only 1 well decline -5.17 feet. That was only the third time in 17 years that particular well had declined. These scenario's continue to prove the fact that "groundwater in Mesa UWCD is mysterious and occult".

The District is well aware of a large number of cases where water availability changes in Dawson County have occurred. Areas which have historically been capable of only producing stock water now have the capabilities of producing irrigation water. Residents in these particular areas, as well as through out the District, are very concerned as to where this new found irrigation water has come from. There was a large earth quake at Frankel City, Texas in the early 1990's which is less than 50 miles away. Could this have caused geological shifts underground and opened up new passage ways for groundwater to enter the District? The District is very interested in promoting additional studies in an attempt to help answer these unusual phenomenons.

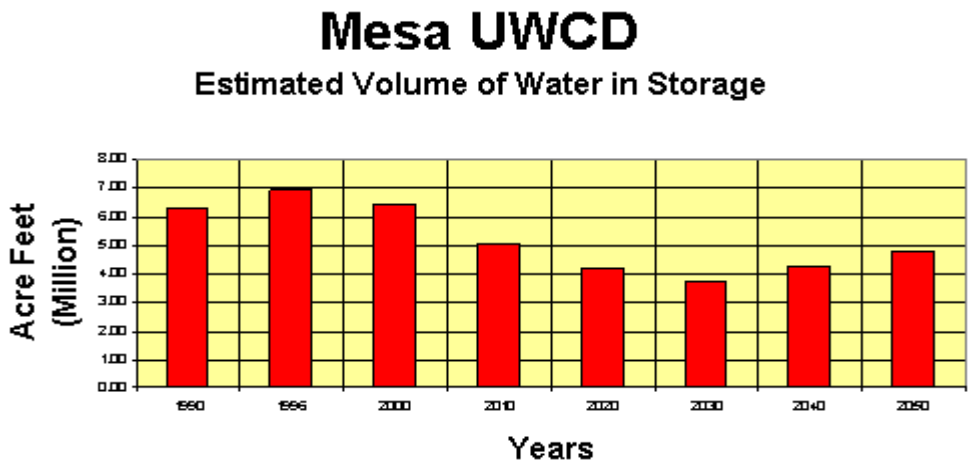
Artificial recharge in the District is not generally a planned operation. There is no recharge project designed for the purpose of increasing natural or artificial recharge. However, farming practices have changed the topography of playa lakes over the years. The bottoms of these small lakes have filled with top soil washed in from nearby farms. Consequently, these lakes are shallower and the total amount of run-off accumulations from rainfall spreads over a much larger surface area. We call this the "do nut" effect.

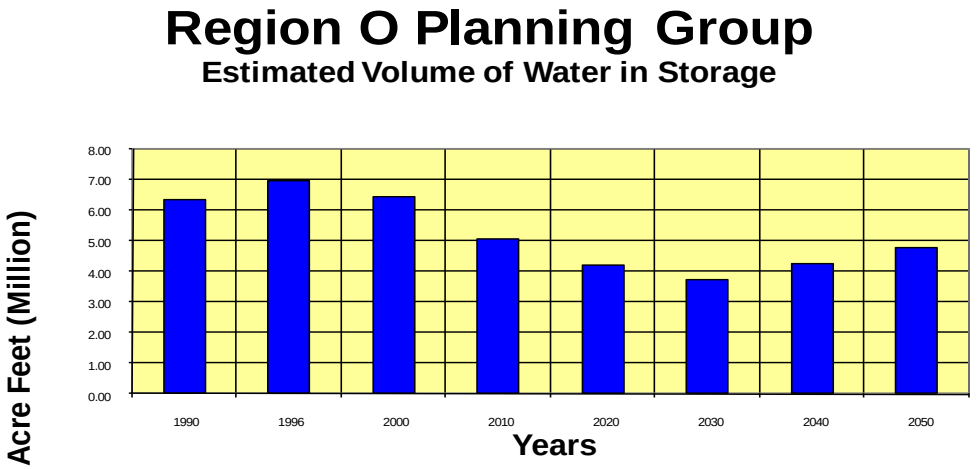
The "do nut" effect is a result of evolving playa lakes. The small clay lined bottom of a playa lake which was designed to hold and prevent the impounded water from percolating downward has changed. The lake is now much larger and there is no clay bottom under the largest portion of the run off collection lake. As a result, the water will travel through the sandy soils downward toward the aquifer at a rapid rate. The rapid rate of drying up the playa lakes adds more water to the aquifer because it reduces the amount of evaporation normally calculated for shallow water bodies in the sunshine. This much larger area of water outside the clay bottom also adds to the recharge rate caused by the very large volume of water which can be absorbed by the soils. The local producers try to prevent excessive run off water from washing across their fields toward these lakes, but it is virtually impossible. Most of the local farmers employ best

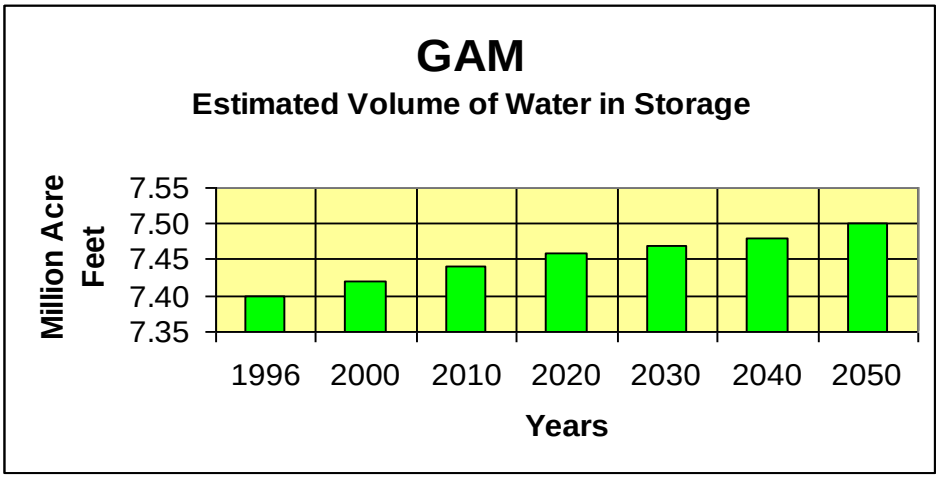
management practices such as furrow dikes, contour rows, and terracing in attempts to better control the run off problems. The lakes which form after fast heavy rainfall events will remain as the most feasible methods of increasing the natural recharge. This “do nut” natural recharge method is definitely increasing the water levels in Mesa UWCD.

In Management Plan I and Management Plan II the District was very cautious and skeptical of the projected water supply figures, not as a result of the studies TWDB has performed, but because of the tremendous changes which were occurring in the aquifer during and shortly after the studies were completed. Another major concern the District had with using these numbers was the huge increase in irrigated acres that have been converted from dryland to irrigated farming during and since the completion of the study. The number of new center pivot irrigation systems which have been added into the county, converting dryland, where no groundwater is mined, to irrigated acres, which use several acre feet/ per acre/per year, have increased by over 400%. However, the District believes that since the certification of Management Plan I, there has been adequate time to develop new numbers to be used in the approval of District Management Plan III. Therefore, the District will use the demand and supply totals for year 2050 which will appear on page on the following page in Projected Supplies of Water 2050:

Projected Supplies of Water 2050	
Groundwater in Storage-Ogallala Aquifer	4,770,000 acre feet
Surface water available to City of Lamesa	2,528 acre feet
Total Projected Supply	4,772,528 acre feet
Projected Demands for Water 2050	
Dawson County total groundwater use	32,274 acre feet
City of Lamesa Surface water use	1,795 acre feet
Total Projected Demand	33,069 acre feet
Surplus (shortage)	4,739,459 acre feet


Mesa UWCD
Estimated Volume of Water in Storage
Acre Feet (Million)
Years


Region O Planning Group
Estimated Volume of Water in Storage
Acre Feet (Million)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1990
1996
2000
2010
2020
2030
2040
2050
Years


GAM
Estimated Volume of Water in Storage
Million Acre Feet
7.55
7.50
7.45
7.40
7.35
1996
2000
2010
2020
2030
2040
2050
Years

Estimated surface water available for the City of Lamesa come from a "letter" report dated June 17, 1998 from Canadian River Municipal Water Authority. The estimated projection numbers indicating this large amount of surplus water available is very encouraging. However, the District will be continually working to conserve and protect the Ogallala Aquifer from extreme declines. Texas Water Development Board Report 341 entitled The High plains Aquifer System of Texas, 1980 to 1990, Overview and Projections, September 1993 was the basis for our Management Plan I and Management Plan II. The District agrees completely with the recommendations of the authors on page 32 of Report 341 which states: *Cooperative efforts should be made with the local underground water conservation districts to refine the base data from the model into smaller regional models. These models can be used to refine ground-water availability, evaluate efficient water-use management techniques, and demonstrate the effects of local pumpage scenarios on the aquifer. The information from such efforts would then be available to those responsible for managing this precious resource.*

The following is a new overview in District Management Plan IV

Isn't it amazing how the data used in Management Plans for Groundwater Conservation Districts have changed from the time Management Plan I and Management Plan IV have been prepared. This is the basic reason Mesa UWCD has continued to use all the language of Management Plan I and continued to add language for all the Management Plans up through Management Plan IV. Mesa UWCD has built our management process on this drastic change. Groundwater in Mesa UWCD is "Mysterious and Occult" and we have been able to gather adequate data to prove it is. Thus we contend groundwater can best be managed at the local level better than any other larger entity.

Texas Water Development Board has provided Mesa UWCD with data that shows a Projected Water Supply Needs (Appendix II, page 7) table with an unmet need of -95,628 acre-feet for the year 2010. The unmet need continues, even though it is declining until 2060 at which time it is only -73,068. Of this amount, 99.4% is an unmet need in irrigation. Irrigation from the Ogallala Aquifer in Dawson County will virtually always have an unmet need. An irrigation well in Dawson County can only pull water from a very small cone of depression surrounding the well (300 feet). It is irrelative the amount of water in storage away from the well, the aquifer will not let that water move into the well bore of the well needing more water to meet it's need. If the Ogallala Aquifer were a lake of water with soil covering the top of it, then all these numbers could mean solid management schemes. But it is an aquifer and an aquifer makes the groundwater "Mysterious and Occult". An irrigated producer has only the water on his farm that the aquifer will give up at that particular point in time.

Management of Groundwater Supplies

The following includes historical changes in Groundwater Management.

For a "base number", the District will use the figures published in Texas Water Development Board report 341, Table 3 indicates an estimate of the existing total useable amount of groundwater in the District in 1990 to be approximately 6 million acre-feet with 0.7 million acre-feet to be subtracted as unrecoverable, results in an estimated net of 5.3 million acre-feet. The District will manage the existing estimated supply of 5.654 million acre-feet of groundwater within the District for year 2008 in order to conserve the resource while seeking to maintain the economic viability of all resource users groups, public and private. In consideration of the

economic and cultural activities occurring within the District, the District will identify and engage in such activities and practices, that if implemented would result in a reduction of groundwater use.

The District has established and maintains an observation network (230 monitor wells) in order to monitor changing storage conditions of groundwater supplies within the District. The District annually makes an assessment of water supply and groundwater storage conditions and reports those conditions to the TWDB and to the public. The 6.178 million acre-feet supply was derived by taking the year 2000 volume of water in storage and subtracting the usage from graph on page 9 for the years 2001 and 2002 and adding back into the volume the recharge of 3,921 per year as described on page 17 and 18. Since the 2002 usage was calculated at a volume of 6.178 million acre feet, the use and recharge up through 2008 provides a net reduction of volume of water in storage in 2003 of 119,778, 2004 of 108,351, 2005 of 108,104, 2006 of 123,030 and 2007 of 63,821. This leaves the volume of water in storage for the beginning of District Management Plan III of 5,654,916 acre feet.

District Management Plan III will reluctantly adopt the net water balance from recharge as presented by TWDB ***GAM Run 08-46 Report*** by taking the recharge from precipitation of 61,253 acre ft. and adding to that amount the estimated inflow of 5,299 acre ft. and then subtracting the out flows totaling 9,925 acre ft. for a net annual recharge of 56,627 acre ft. The District truly believes the GAM Model we are presently working under must be up dated to the point that the annual water level results provided by this District and other GCD in GMA #2 to the TWDB will be entered into the model in order for immediate changes to be reflected in the model. One of the major concerns the District posses is what is the amount of recharge to the Ogallala Aquifer in Mesa UWCD are has there been as a result of the +1.58' feet rise in 2005 and the +2.71 feet rise in 2008. There are 576,000 acres in the District so has the rise of 1.58' all over the district resulted in a recharge amount of 910,000 acre ft. for 2005? What about the 2.71' rise in 2008, another recharge amount of 1,561,000 acre ft.? The aquifer definitely had more water in storage after 2005 and even much more after 2008. When we are able to utilize this data, then we will be able to be using the best data available. These scenarios must be addressed in the near future. The MAG numbers established by TWDB cannot be valid until the GAM takes into consideration all the factors representing change in Mesa UWCD.

The District has adopted rules to regulate groundwater withdrawals by means of spacing (Rule #5 Spacing Requirements) and production limits (Rule #6 Production Limitations). The District may deny a water well operating permit or limit groundwater withdrawals in accordance with the guidelines stated in the District (Rule 7.3 Production Use Measurement Area). In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the Rules of the District (Rule 10.3(a) Standard Operating Permit Provisions. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the public benefit against individual hardship after considering all appropriate testimony (Rule 14.1(a) Permit Hearings).

The District will enforce the terms and conditions of permits and rules of the District (Rule 15.3 Rule Enforcement). All of the District Well Registration/Water Well Drilling Permit Applications include the requirements of §36.113 and §36.1131. The District Rule Book includes all the specifications for the actions, procedures, performances and avoidance necessary for the District to effectuate the management plan.

The following is a new overview in District Management Plan IV

In the implementation of District Management Plan IV, the Board of Directors rely heavily on Mesa UWCD Rule 10.2 (E) which states:

> In deciding whether or not to issue a permit, and in setting the terms of the permit, the Board shall consider the adopted and approved Management Plan, District Rules and any pertinent information received during the due process permit hearing procedure. The District upholds the private property right of the owner to utilize that part of the aquifer which the landowner obtained at the time of purchase of the land surface as written in Chapter 36.002 *Ownership of Groundwater*, except as those rights may be limited or altered by rules promulgated by the District is to assure that all owners of water rights are entitled to an equal opportunity to develop the groundwater beneath their land and the landowner is not prohibited from seeking and acquiring their private property regardless of the aquifer conditions at other specific sites within the boundaries of the District as well as other specific sites within the boundaries of the Groundwater Management Area #2 (GMA), whereby other possible sites in the aquifer may be different (1) due to different water uses or conditions, (2) a substantial difference in geographic area, (3) a subdivision of the aquifer, (4) a geographic strata, (5) a geographic area overlying the aquifer, (6) or any other hydrological conditions which may be noted within other portions of the aquifer. Any of the provisions listed in this subchapter must be in compliance with District Rules.

Regional Water Plan

The following includes historical changes in Groundwater Management.

The Management Plan I was adopted prior to the development of the regional management plan for Region O (Llano Estacado Region). As required by §36.1071(b) this management plan and any amendments thereon shall be consistent with the regional water plan. Now that a regional water plan has been adopted, the District shall address water supply use and projections as well as groundwater in storage in a manner that very well may be in conflict with the appropriate approved regional water plan which must be approved under Section 16.053. Senate Bill # 1 intended for water management to be a bottom up approach. Therefore, the District believes the regional planning group will consider this local plan, Mesa UWCD Management Plan II in the development of the regional water plan. Considering this local Management Plan II, will hopefully, meet the intent of Senate Bill #1 and; consequently, result in a regional management plan which is consistent with Mesa UWCD local Management Plan II, resulting in the protection of the local control of groundwater management by the local people who elected the Board of Directors to operate the District. Regional Planning Group O is in the process of developing a new plan as District Management Plan III is being prepared. The new District Management Plan IV which will have the Desired Future Conditions (DFC) and Modeled Available Groundwater (MAG) will be prepared just as soon as the DFC is established by Groundwater Conservation Districts in GMA2.

Texas Water Code Chapter 36.1071 (b) clearly states *"After January 5, 2002, a district management plan, or any amendment to a district management plan, shall be developed by the district using the district's best available data and forwarded to the regional water planning group for consideration in their planning process"*. Texas Water Code Chapter 36.1071 (e) (4) further states *"address water supply needs in a manner that is not in conflict with the appropriate*

approved regional water plan if a water plan has been approved under Section 16.053". The Board of Directors believes the numbers contained in the *Llano Estacado Regional Water Planning Area, January 2001(Region O)* are in conflict with the numbers contained in the Management Plan II of Mesa UWCD. The Board of Directors in official board action on August 21,2003 voted to use the data collected and analyzed by Mesa UWCD as the best data available in preparing the amended Management Plan II.

The conflicting numbers between the Region O Plan and Management Plan II arise from the "Water Use and Projections". Look at the graphs on Page 25. The graphs are entitled Mesa UWCD (top of page) and Region O (bottom of page). One can quickly see that the major differences in the numbers occur between 1996 and 2010. Under the discussion of "Groundwater Use in Mesa UWCD" page 9, one can see that the usage of groundwater in 1996 was estimated at 85,925 acre-ft/year. This usage number was determined by the District by calculating the total number of irrigated acres of 49,100 by the average usage of 1.75 acre-ft. The 85,925 acre-ft/yr is only 18,208 acre-ft/yr greater than the 1995 pumpage total 67,117 acre-ft/yr as determined by the TWDB's *Estimated Groundwater Pumpage Summary by Major Aquifer*.

The numbers in the Region O Plan can be found on page 4-22 of the *Llano Estacado Regional Water Planning Area, January 2001(Region O)*. The number shown for 1996 amount to143,326 acre-ft/yr. The District does not believe these numbers to be accurate. Using the 49,100 acres of irrigated land in the District the application rate would need to be in excess of 2.91 acre-ft. In contrast, if one turns the numbers around the other way, then at an application rate of 1.75 acre-ft there would needed to have been 81,900 acres of irrigated land to have used this large number of water. The large spike on the graph of Region O Plan is just not understandable nor justifiable.

The District does not accept the numbers for the 2000 year as the best data available. Once again we reference the chart on page 9. For the year 2000 the usage is 148,856 acre-ft/yr. During the year 2000 there were 70,884 irrigated acres in Mesa UWCD. The average water usage was 2.10 acre-ft. The numbers in the Region O Plan found on page 4-22 of the *Llano Estacado Regional Water Planning Area, January 2001(Region O)* indicate the water use for the year 2000 as 46,475 acre-ft. This amount of water demand is just not accurate. Seemingly, there is no possible way this small amount of water could have been used in the year 2000. The District believes the numbers the District gathered, analyzed and used in Management Plan II support these beliefs.

In projecting the demand for groundwater use in the year 2010, the District believes that acreage will continue to decline as well as the quantity of groundwater necessary to grow these crops. Because the water table in Mesa UWCD continues to decline, there will be irrigators who will reduce the number of acres they irrigate. The District forecast for the year 2010 that the acreage will be reduced down to 70,000 acres. Likewise with the steady decline of water levels, the number of acres that has been growing peanuts will decline. The decline in peanut acres will in turn cause the amount of water to be used to also decline. Therefore, the amount of irrigation water used in 2010 is estimated to be 119,000 acre-ft/yr. The numbers in the Region O Plan found on page 4-22 of the *Llano Estacado Regional Water Planning Area, January 2001(Region O)* indicate the number to be only 34,418 acre-ft/yr. Once again the District believes that the usage of irrigation water will be much more than the estimated amount projected by the Region O Plan. This small amount is just not ample to support the irrigated acres that will be planted in the year 2010.

The projection for the years 2020, 2030, 2040, and 2050 the District believes that irrigated acreage will continue to decline. As time goes further into the future the numbers grow closer together as indicated on the graphs.

In conclusion, the District trusts that Region O Planning Group will accept these "Water Use and Projection" numbers as the best available data and adopt them in their new planning process. It is worthy to note that the Region O Planning Group numbers for the "Volume of Water in Storage" as shown on page 25 are consistent with those of Mesa UWCD shown on the same page.

In preparation of District Management Plan III once again the District Board of Directors voted to use the data of Mesa UWCD as the best available data and therefore not depend on the data in ***Region O Regional Water Plan January 2006***.

State Water Plan

The following is a new overview in District Management Plan IV

Chapter 36.1071 (e)(3) calls for the management plans of Groundwater Conservation Districts to include estimates of the following:

A. ***Modeled available groundwater in the district, based on the desired future condition established under Section 36.108***.

As of the date of Management Plan III, Groundwater Management Area # 2 has not established the Desired Future Condition (DFC). Therefore, the TWDB has not provided Mesa UWCD with the modeled available groundwater number. Consequently, Management Plan III cannot estimate the modeled available groundwater at this time.

Mesa UWCD District Management Plan IV is prepared to manage groundwater in a manner that will address the Modeled Available Groundwater as a result of establishing a Desired Future Condition of the Ogallala Aquifer in Dawson County.

The District adopted Desired Future Conditions for relevant aquifers in August 2010. The relevant aquifers are the Ogallala and Edwards-Trinity (High Plains) Aquifers. The Board decided the Dockum Aquifer is not a relative aquifer for Mesa UWCD at this time.

During the joint planning process, this District and five (5) other GCD's located along the Southern Boundaries of GMA #2 adopted DFC's for the Ogallala and Edwards Trinity (High Plains) based on an allowable amount of drawdown. The allowable drawdown is based on the average change in water levels during the 10-year period 1998-2007. For Mesa UWCD, that number is -1.58 ft/year. Based on the 50 year planning horizon, the Southern Ogallala GAM predicts the cumulative drawdown to be -74 feet for the District. However, for the purpose of Management Plan IV, the District proposes to evaluate the cumulative drawdown in 5 year increments, which will measure our attainment of the DFC in shorter increments, and allow the

District to make changes accordingly.

It is the belief of the Board of Directors that no additional rule changes are needed at this time in order to meet the adopted DFC. Our proposal may be altered if, at the end of the 5 year period or anytime the Board feels necessary, our cumulative annual drawdown differs significantly from what is calculated to keep the District on track for DFC attainment.

To achieve the DFC, TWDB has presented Gam Run 10-030 MAG (Appendix I, page 13) that indicates Mesa UWCD can reach and obtain the DFC by allowing pumping of 202,713 acre-feet in 2010 and a steady decline until 2060 when the allowed pumping will drop to 94,883 acre-feet.

B. ***The amount of groundwater being used within the district on an annual basis***.

The following chart reflects the data gathered by Mesa UWCD as a result of the AEP:

2012	111,657 acre-ft/year
2011	157,500 acre-ft/year
2010	81,438 acre-ft/year
2009	135,125 acre-ft/year
2008	130,171 acre-ft/year

2007	67,742 acre-ft/year
2006	126,952 acre-ft/year
2005	108,312 acre-ft/year
2004	106,455 acre-ft/year

2003	123,699 acre-ft/year
2002	125,671 acre-ft/year
2001	139,641 acre-ft/year
2000	148,856 acre-ft/year
1999	150,500 acre-ft/year
1998	158,500 acre-ft/year

1997	119,033 acre-ft/year
1996	85,925 acre-ft/year

1995	68,897 acre-ft/year
1994	51,227 acre-ft/year
1993	67,006 acre-ft/year
1992	39,678 acre-ft/year
1991	47,883 acre-ft/year

The above chart is an estimate of the groundwater used on an annual basis for irrigation as prepared by Mesa UWCD. The first five years (1991-1995) are taken from the TWDB ***Water Uses Survey-Groundwater Pumpage Estimates***. The State Water Plan for the latest year 2004 that includes an additional use of groundwater of 2,031 acre feet. Therefore, the estimated use of groundwater for 2004 would be 108,486 acre feet. The estimated use for 2005 would be 110,343 acre-feet. The estimated use for 2006 would be 128,983 acre feet. The estimated use for 2007 would be 69,773 acre feet. However, the results found the estimated actual use in 2004 was 106,455, 2005 was 108,312, 2006 was 126,952 and 2007 was 67,742. The latest data from Mesa UWCD for reference in Management Plan IV shows the use in 2008 to be 130,171, 2009 to be 135,125, 2010 to be 81,438, 2011 to be 157,500, and 2012 to be 111,657 acre-feet.

Texas Water Development Board has provided the District “Estimated Historical Water Use and 2012State Water Plan Datasets” (Appendix II) for preparation of District Management Plan IV, Historical Water Use Survey (WUS) (Appendix III, page 3,4) listed below:

2012	
2011	158,441 acre-ft/year
2010	80,154 acre-ft/year
2009	132,361 acre-ft/year
2008	138,033 acre-ft/year

2007	69,417 acre-ft/year
2006	128,021 acre-ft/year
2005	102,037 acre-ft/year
2004	103,827 acre-ft/year

2003	127,490 acre-ft/year
2002	135,840 acre-ft/year
2001	143,644 acre-ft/year
2000	148,393 acre-ft/year
1999	106,994 acre-ft/year
1998	131,708 acre-ft/year
1997	147,109 acre-ft/year
1996	144,760 acre-ft/year

1995	67,007 acre-ft/year
1994	51,161 acre-ft/year
1993	66,944 acre-ft/year
1992	39,632 acre-ft/year
1991	47,829 acre-ft/year

C. ***The amount of recharge from precipitation, if any, to the groundwater resource within the district.***

Texas Water Development Board has provided the District for preparation of District Management Plan III, ***GAM Run 08-46 Report.*** This run shows the "Estimated annual amount of recharge from precipitation" to be 61,253 acre-feet per year. No recharge for the Edwards Trinity (High Plains) Aquifer.

The following is a new overview in District Management Plan IV

Texas Water Development Board has provided the District for preparation of District Management Plan IV, ***GAM Run 12-008 Report*** (Appendix III, page 6)***.*** This run shows the "Estimated annual amount of recharge from precipitation" to be 62,265 acre-feet per year. No recharge for the Edwards Trinity (High Plains) Aquifer.

D. ***For each aquifer, the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams and rivers.***

The outflow is made up of an estimated 3,502 acre feet discharging to surface water and springs ***as shown in GAM 08-46 Report***.

This subsection applies to the Ogallala Aquifer. Texas Water Development Board has provided the District for preparation of District Management Plan IV, ***GAM Run 12-008 Report*** (appendix III)***.*** The outflow is made up of an estimated 3,141 acre feet discharging to surface water and springs ***as shown in GAM 12-008 Report*** (Appendix III, page 6)***.***

This subsection applies to the Edwards Trinity (High Plains) Aquifer. Texas Water Development Board has provided the District for preparation of District Management Plan IV, ***GAM Run 12-008 Report.*** The outflow is made up of an estimated 351 acre feet discharging to surface water and springs ***as shown in GAM 12-008 Report*** (Appendix III, page 8)***.***

E. ***The annual volume of flow into and out of the district within each aquifer and between aquifers in the district, if a GAM is available.***

The estimated net inflow into the District is 5,299 acre ft. and out flow is 9,925 acre ft. The outflow is made up of 3,502 acre feet discharging to surface water and springs along with an estimated 6,423 acre-feet of flow "out of District". Using these numbers it appears that the net water balance from ***GAM Run 08-46 Report*** is a recharge of 56,627 acre feet. Be aware, the model did not consider cross-formational flow, and therefore, no estimate was provided in the ***GAM RUN 08-46 Report*** not in District Management Plan III.

This subsection applies to the Ogallala Aquifer. Texas Water Development Board has provided the District for preparation of District Management Plan IV, ***GAM Run 12-008 Report.*** The estimated net outflow from the District is 5,906 acre ft. and out flow is 6,570 acre ft (Appendix III, page 6). This equates to a loss 664 acre-feet. The net annual volume of flow between the Ogallala into the (High Plains) and adjacent underlying areas is 1,127 acre-feet (Appendix III, page 6). Consequently, the total loss of storage due to natural causes is 1,791 acre-feet.

This subsection applies to the Edwards Trinity (High Plains) Aquifer. Texas Water Development Board has provided the District for preparation of District Management Plan IV, ***GAM Run 12-008 Report.*** The estimated volume of flow into the District is 715 acre ft. and out flow is 307 acre ft (Appendix III, page 8). This equates to an increase of 408 acre-feet. The net annual volume of flow between the Ogallala and overlying units into the (High Plains) is 1,284 acre-feet (Appendix III, page 8). Consequently, the total gain of storage due to natural causes is 1,692 acre-feet.

F. The projected surface water supply in the district according to the most recent adopted state water plan.

RWPG	Water User Group	County	River Basin	Source Name		2010	2020	2030	2040	2050	2060
O	Lamesa	Dawson	Colorado	Meredith Lake/Reservoir		843	1,062	1,062	1,062	978	978
O	O'Donnell	Dawson	Brazos	Meredith Lake/Reservoir		11	14	14	14	14	14
O	Livestock	Dawson	Brazos	Livestock Local Supply		1	2	1	2	2	2
O	Livestock	Dawson	Colorado	Livestock Local Supply		154	156	161	164	168	172
Total Projected Surface Water Supplies (acre-feet per year) =						**1,009**	**1,234**	**1,238**	**1,242**	**1,162**	**1,166**

The above Projected Surface Water Supplies table of the 2012 State Water Plan (Appendix II, page 5) indicates a very small amount of Surface Water is available in Mesa UWCD. The largest use of surface water comes from Lake Meredith. This amount may be inflated because at this time little or water is being taken from Lake Meredith. The water transported by Canadian River Municipal Water Authority (CRMWA) to member city, Lamesa, is being pumped from the Ogallala Aquifer in Roberts County. In years to come, the surface water supply for Dawson County and Mesa UWCD will surely be reduced as the Regional and State Water Plan can make the adjustments. City of Lamesa is very proud of the fact that we are an original member of CRMWA. The leadership of this regional water authority had the foresight to acquire 10's of thousands of water rights and drilled water wells and built pipelines to take care of the water needs of all the member cities of CRMWA.

G. The projected total water supply and projected total water demand for water within the district according to the most recent adopted state water plan.

PROJECTED TOTAL WATER DEMAND

RWPG	Water User Group	County	River Basin	2010	2020	2030	2040	2050	2060
O	Lamesa	Dawson	Colorado	2,540	2,573	2,602	2,603	2,529	2,433
O	O'Donnell	Dawson	Brazos	17	17	17	17	17	16
O	County Other	Dawson	Brazos	18	18	19	18	18	17
O	County Other	Dawson	Colorado	610	612	616	607	587	565
O	Manufacturing	Dawson	Colorado	119	129	137	144	150	162
O	Mining	Dawson	Colorado	1,624	779	455	195	0	0
O	Irrigation	Dawson	Brazos	1,378	1,300	1,227	1,158	1,093	1,031
O	Irrigation	Dawson	Colorado	136,425	128,736	121,478	114,628	108,168	102,071
O	Livestock	Dawson	Brazos	1	2	1	2	2	2
O	Livestock	Dawson	Colorado	154	156	161	164	168	172
Total Projected Water Demands (acre-feet per year) =				**142,886**	**134,322**	**126,713**	**119,536**	**112,731**	**106,469**

Texas Water Development Board has provided the District “Estimated Historical Water Use and 2012 State Water Plan Datasets” (Appendix II) for preparation of District Management Plan IV. The above Projected Total Water Demand table of the 2012 State Water Plan estimates the total demand for water from surface water and groundwater (Appendix II, page 6).

H. The projected water needs within the district according to the most recent adopted state water plan.

PROJECTED WATER NEEDS

RWPG	WUG	County	River Basin	2010	2020	2030	2040	2050	2060
O	Lamesa	Dawson	Colorado	553	463	383	336	169	228
O	O'Donnell	Dawson	Brazos	17	17	17	17	16	17
O	County Other	Dawson	Brazos	0	0	0	0	0	0
O	County Other	Dawson	Colorado	0	0	0	0	0	0
O	Manufacturing	Dawson	Colorado	0	0	0	0	0	0
O	Mining	Dawson	Colorado	0	0	0	0	0	0
O	Irrigation	Dawson	Brazos	-955	-945	-898	-859	-792	-730
O	Irrigation	Dawson	Colorado	-94,673	-93,712	-89,026	-85,119	-78,437	-72,338
O	Livestock	Dawson	Brazos	0	0	0	0	0	0
O	Livestock	Dawson	Colorado	0	0	0	0	0	0
Total Projected Water Needs (acre-feet per year) =				**-95,628**	**-94,657**	**-89,924**	**-85,978**	**-79,229**	**-73,068**

Texas Water Development Board has provided the District “Estimated Historical Water Use and 2012State Water Plan Datasets” (Appendix II) for preparation of District Management Plan IV. The above Projected Water Needs table of the 2012 State Water Plan indicates a very large amount of irrigation water shortages in Mesa UWCD (Appendix II, page 7). The negative numbers indicate a shortage, or the difference in the amount represented by the Projected Water Demand and Irrigation Water Supplies shown on Table 4.4-8 (page 4-110) Llano Estacado Regional Water Plan. The District understands this unmet need to be nothing more than a calculation that cannot be met by the irrigated producers. The amount of groundwater being used within the district on an annual basis as indicated in the “B” table above is more than the Irrigation Water Supply numbers indicated in the above referenced Llano Estacado Regional Water Plan**.** The shortage can be explained as a result of the supply in 2000 of 148,713 (acre-feet) dropping to a supply of only 42,842 (acre-feet) in 2010, page 4-110 Llano Estacado Regional Water Plan. Whatever “it” was that caused the loss of 100,000 (acre-feet) during that 10 year period is the “it” that is responsible for the shortages indicated in the Projected Water Needs table. The prior 5 year average irrigation usage has been 123,178 (acre-feet), so apparently there is no 95,628 (acre-feet) shortage. In a semi arid community, in which the irrigator depends on groundwater which is “mysterious and occult” and surely not a definite number, a shortage my be the fact that the producers irrigation system has dropped from a 400 GPM down to a 300 GPM. This means he can only irrigate 80 acres instead of the normal 120 acres he has been irrigating in the past. In agriculture there is no true remedy for meeting this unmet need.

I. The projected water management strategies within the district according to the most recent adopted state water plan.

Projected Water Management Strategies

RWPG	WUG	WUG County	River Basin	Water Management Strategy	Source Name	Source County	2010	2020	2030	2040	2050	2060
O	Irrigation	Dawson	Brazos	Irrigation Water Conservation	Cons	Dawson	61	55	49	44	40	36
O	Irrigation	Dawson	Colorado	Irrigation Water Conservation	Cons	Dawson	6,019	5,417	4,876	4,388	3,949	3,554
O	Lamesa	Dawson	Colorado	Municipal Conservation	Cons	Dawson	212	400	501	471	448	431
Total Projected Water Management Strategies (acre-feet per year) =							**6,292**	**5,872**	**5,426**	**4,903**	**4,437**	**4,021**

Texas Water Development Board has provided the District "Estimated Historical Water Use and 2012State Water Plan Datasets" (Appendix II) for preparation of District Management Plan IV. The above Projected Water Management Strategies table of the 2012 State Water Plan (Appendix II, page 8) which shows the acre feet of water that will be conserved by municipal and irrigation conservation strategies.

GOALS, MANAGEMENT OBJECTIVES, PERFORMANCE STANDARDS, AND METHODOLOGY TO EVALUATE PROGRESS

Goal 1.0 Implement Management Strategies by March 1 2009 to Protect and Enhance the Quantity of Usable Quality Groundwater by Providing the Most Efficient Use of Groundwater.

Management Objective

1.1A Each year the District will provide informative speakers to schools, civic groups, social clubs, and organizations for presentations to inform a minimum of 25 citizens on the activities and programs, the geology and hydrology of groundwater, and the principles of water conservation relating to the best management practices for the efficient use of groundwater.

Performance Standards

1.1aa Prepare a list indicating the names of citizens in attendance at District presentations concerning the principals of water conservation relating to the best management practices for the efficient use of groundwater each year.

Methodology

Annually, the district manager will prepare and present a report to the Board of Directors on District performances in regards to achieving Goal 1.1. The report will include the number of instances each activity was engaged in during the year, referenced to the expenditure of staff time and budget so that the effectiveness and efficiency of each activity may be evaluated. The report will be maintained on file at the District office.

Management Objective

1.2A Annually, in an effort to emphasize the efficient use of groundwater, the District will operate an Aquifer Evaluation Program (AEP) that will identify the changes in the aquifer water levels as a result of the accurate measurement of the irrigation water being pumped from the aquifer.

Performance Standards

1.2aa Establish a water use measurement program with more than 150 water use measurements devices installed in irrigation distribution systems.
1.2ab Establish an aquifer water level measurement program with more than 50 non-pumping monitor wells within ½ mile of irrigated systems.
1.2ac In addition to the measurement of the non-pumping wells in irrigated area in the "annual water level measurement program", measure the wells more than 1 time during the growing season when the application of irrigation water is most prevalent.
1.2ad Read the water use measurement devices more than 2 times during the year.
1.2ae Send to the producers a report indicating the water use for each of the measurement periods in addition to a cumulative total for a year to date usage total.
1.2af Send to the TWDB a report for each measurement period indicating the water use for each site during that period of time.
1.2ag Record the water level measurements in the field data book and record the data on a map of the district that shows the approximate location of the well site.
1.2ah Send to the TWDB a report for each measurement period indicating the water level measurement.
1.2ai Include the "non-pumping wells in irrigated area" as a part of the "annual water level monitoring program" that is sent to the TWDB in Winter or early Spring of each year.

Methodology

A. Prepare a report reflecting the results of the AEP monitoring program.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Management Objective

1.3A The District will annually operate the Aquifer Evaluation Program at an average cost to the District of less than $75 per well.

Performance Standards

1.3aa Record the total miles driven, to measure the "non-pumping wells in irrigated area" and to read the measuring devices, for the vehicles used.
1.3ab Record the hours spent measuring the wells and reading the meters.
1.3ac Record other expenses necessary to operate the program
1.3ad Prepare a report that shows the average cost per site to operate the program.

Methodology

A. Prepare a report reflecting the results of the AEP monitoring program.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Goal 2.0 Implement Management Maneuvers to Control and Prevent the Waste of Groundwater by March 1, 2009.

Management Objective

2.1A The District will annually inventory, inspect, and evaluate 25% of the new well sites the District has permitted or registered to control and prevent pollution to the groundwater from deleterious matter admitted from the ground surface because of sub standard well completion practices.

Performance Standards

2.1aa Record the number of new well sites in the District each year.
2.1ab Record the number of new well sites the District inventoried, inspected, and evaluated during the year to control and prevent pollution a waste of groundwater each year.

Methodology

A. Prepare a report reflecting the total number of new well sites in the District for the year.
B. The report will reflect the number of new well sites the District Inventoried,

inspected, and evaluated during the year to control and prevent pollution a waste of groundwater for the year. The report will show the percentage of new well sites the District has permitted or registered to control and prevent pollution to the groundwater from deleterious matter admitted from the ground surface because of sub standard well completion practices.

C. Present the annual report to the Board.

D. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Management Objective

2.2A Annually the District will insure the proper closure of 75% of the open or uncovered wells that have been discovered or reported to prevent and control waste as a result of polluting the groundwater.

Performance Standards

2.2aa Record the number of wells discovered or reported during the year that needed proper closure.

2.2ab Record the number of wells that were properly closed each year.

Management Objective

2.3A Each year the District will expend 20 staff hours in identifying, investigating, and seeking to prevent and control waste of groundwater by halting wasteful practices which allow groundwater to escape into any river, creek, natural watercourse, depression, lake, reservoir, drain, sewer, street, highway, road, or ditch, or onto land other than that of the well owner, unless such discharge is authorized.

Performance Standards

2.3aa Record the number of staff hours the District expended to identify and investigate seeking to control waste for the year.

Methodology

Annually, the district manager will prepare and present a report to the Board of Directors on District performances in regards to achieving Management Objective 2.2A and Management Objective 2.3A. The report will include the number of instances each activity was engaged in during the year, referenced to the expenditure of staff time and budget so that the effectiveness and efficiency of each activity may be evaluated. The report will be maintained on file at the District office.

Goal 3.0 Implement Management Maneuvers to address conservation of Groundwater by March 1, 2009.

Management Objective

3.1A Measure the monitor wells designated in the water level monitoring program to determine the change in the water level of the Ogallala aquifer on an annual basis.

Performance Standards

3.1aa Develop a network of 100 or more water level measurement wells.
3.1ab Mark 90% of the measurement wells on USGS 7 ½ minute topo maps to assure adequate coverage with emphasis on water usage in each quadrant.
3.1ac Measure 75% of the measurement wells annually.
3.1ad Insure greater accuracy by measuring the wells within 45 days of the same date as the previous years measurement date.
3.1ae Enter the results of each measurement from the field water level data book into the computer data base within 20 days of completing the measuring procedure.
3.1af Prepare and e-mail a water level report to TWDB within 60 days after completing the measuring process.
3.1ag Publish in the local newspaper 1 summary report of the annual water level monitoring program within 4 months of completing the program.
3.1ah Post on the Mesa UWCD website the updated water level report for the current year within 90 days of completing the measurement program

Methodology

A. Prepare a report reflecting the results of the annual water level monitoring program.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Management Objective

3.2A The District will annually operate the water level monitoring program at an average cost to the District of less than $50 per well.

Performance Standards

3.2aa Record the miles driven to measure the water level measurement wells.
3.2ab Record the hours spent measuring the wells.
3.2ac Record the hours used to transfer the data from the field data book to the computer water level program.
3.2ad Record the hours used to prepare and e-mail the levels report to TWDB.
3.2ae Record the hours used to prepare the newspaper summary report.
3.2af Record the cost of publishing the newspaper report.
3.2ag Record the hours used to prepare the annual water level monitoring report.
3.2ah Record the hours used to prepare the letters and charts which will be mailed to the well owners/operators.

3.2ai Record the postage expense for the mail-out.
3.2aj Record any other expenses occurred in the water level measuring program such as equipment, supplies, repairs, or other associated costs.

Methodology

A. Prepare an annual report reflecting the average cost per well to administer the water level monitoring program.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Management Objective

3.3A At the time the annual water level measurements indicate the two (2) year average of the water level decline in three (3) adjacent monitor wells (excluding the first {1st} year change in a new monitor well) is greater than -5 feet, the Board shall consider the establishment of an Extreme Decline Study Area (EDSA) which is a resolution by the Board to officially name (designate) and draw (delineate) on a map, a square, nine-section area for the purpose of collecting extensive hydrological information on an annual basis from all available and appropriate wells for monitoring in that sector.

Performance Standards

3.3aa Annually, the District will review and study data obtained from the Annual Water Level Monitoring Reports (AWLMR). If evidence of extreme decline exists, comparable to other monitor wells, the Board will consider within 6 months of the new calendar year the need for establishing an EDSA.
3.3ab The District will provide written individual notification to 75% of the known landowners, well owners/operators and water right holds within the EDSA, at least 60 days before the date of public hearing.
3.3ac A summary of available data from the AWLMR will be included in the notification letter mailed to the party at least 60 days before the public hearing.
3.3ad The Board will call for one or more public hearings to consider the establishment of an EDSA more than 60 days and less than 90 days after the notice has been given.
3.3ae The District will present data from the AWLMR at the hearing.
3.3af The Board will receive testimony from landowners, well owners/operators and water right holders within the proposed area.
3.3ag The Board will receive testimony from the public.
3.3ah The Board will evaluate the proceedings and consider the possibilities to establish an EDSA or continue the efforts of the standard AWLMR.

Methodology

A. The Board will evaluate the proceedings and make a resolution to establish an EDSA.
B. And/or the Board will evaluate the proceedings and determine an EDSA is not necessary at this time.

Management Objective

3.4A. Within one year after an EDSA has been established, the district will implement a data collection system to better understand the groundwater condition within the boundaries of the established EDSA.

Performance Standards

3.4aa The District will measure 75% of available and appropriate monitor wells to determine the water level of the identified measurement wells in the EDSA.
3.4ab The District will measure the wells within 30 days of the same date last year to assure greater accuracy.
3.4ac The District will compare subsequent changes in water level on an annual basis and the historical changes for monitor wells with historical data that may be in the EDSA.
3.4ad The District will evaluate and consider climate and environmental events which have occurred during the year.
3.4ae The District will consider changes in water use practices.
3.4af The District will consider any new available information on the use of new technology and/or procedures that may be influencing water level changes.
3.4ag The District will consider any other relevant information that may be contributing to the extreme water declines of the aquifer within the EDSA.

Methodology

A. Prepare an EDSA report for the Board to review and study within the first two board meetings after the annual study is completed.
B. Annually, the Board will make one or more of the following decisions:
    1. Continue monitoring and evaluating data of the area.
    2. Determine the designation of the EDSA is not necessary at this time.
    3. Determine from evidence gathered in the study area that possible over mining of the aquifer is occurring within the EDSA
    4. Begin the process of designating and delineating a Production Use Measurement Area.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Management Objective

3.5A Operate the EDSA activities at an annual average cost less than $200 per well.

Performance Standards

3.5aa Develop a District expense report to reflect EDSA expenses.
3.5ab Record the miles driven in the EDSA measurement program.
3.5ac Record the time needed to measure the EDSA monitor wells.
3.5ad Record other expenses incurred in the measuring activities.

Methodology

A. Prepare an annual report reflecting average cost per well to operate EDSA activities.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Management Objective

3.6A Within one year after the EDSA has indicated possible over production and apparent extreme decline damage to the aquifer, the board will establish a Production Use Measurement Area (PUMA) which is the formal resolution by the Board to officially name (designate) and draw (delineate) on a map, no more than four (4) contiguous ”sections” located within the EDSA whereby, all well/well systems will require an operating permit and a measuring devise will be installed to accurately measure the use of water.

Performance Standards

3.6aa The District will review and study data obtained from the Annual Water Level Monitoring Reports (AWLMR). If evidence is found of possible and probable excessive mining of the aquifer, compared to other monitor wells in the EDSA, the Board will consider the need for a PUMA.
3.6ab The District will provide notification to 75% of known landowners, well owners/operators and water right holds within the PUMA, at least 60 days before the date of public hearing.
3.6ac A summary of available data from the EDSA will be included in the notification.
3.6ad The Board will call a public hearing to consider the creation of a PUMA.
3.6ae The Board will present data from the EDSA at the hearing.
3.6af The Board will receive testimony from landowners, well owners/operators and water right holders within the proposed PUMA.
3.6ag The Board will receive testimony from landowners, well owners/operators and water right holders within the EDSA.
3.6ah The Board will receive testimony from the public.
3.6ai The Board will evaluate the proceedings and consider a resolution to establish a PUMA.

Methodology

A. The Board will evaluate the proceedings and make a resolution to establish a PUMA.
B. The Board will evaluate the proceedings and determine a PUMA is unnecessary at this time and continue the EDSA.

Management Objective

3.7A Implement an annual operating permit system and a water measurement program for all water users located within the PUMA.

Performance Standards

3.7aa the District will notify all known landowners, well owner/operator and water right holders of their placement into the PUMA and the requirements for which they are responsible.
3.7ab The District will require all well/well systems operators to file a completed operating permit application prior to operating a well/well system within a PUMA.
3.7ac The District will provide and install a water measuring device to accurately measure the water used in each operating permit.
3.7ad The District will calculate and print on the permit application the maximum allowable production for each operating permit.
3.7ae The District will read and record meter readings at least every other month during the growing season and notify the permit holder the year to date usage.
3.7af The District will compare meter readings usage results with the operating permit terms and notify the permit holder.
3.7ag The District will prepare renewal operating permits at the end of the existing operating period for all permit holders operating below the permit limitations.

Methodology

A. Prepare an annual report reflecting PUMA activities.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Management Objective

3.8A The District will annually operate the PUMA program at an average cost to the District of less than $1000 per well.

Performance Standards

3.8aa Develop a District expense report to reflect PUMA expenses.
3.8ab Amortize the cost of the water meters over 3 years.
3.8ac Amortize the installation cost for installing the water meters over a 3 year allocation period.
3.8ad Record maintenance expense for the water meters.
3.8ae Record the mileage required for reading the meters.
3.8af Record the time required to read the meters.
3.8ag Record the time required by office staff to record the readings into computer program.
3.8ah Record the time required by office personnel to prepare the reports.
3.8ai Record the time required by office personnel to prepare renewal permit applications.

Methodology

A. Prepare an annual report reflecting average annual cost per well to operate the PUMA activities.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Goal 4.0 Implement management maneuvers to address drought conditions by March 1, 2009

Management Objective

4.1A The District will annually operate a rainfall observation program.

Performance Standards

4.1aa Establish more than 4 rainfall measurement sites in the district.
4.1ab Record the rainfall events for each site in which the rainfall event measures .25 inches or more.
4.1ac During the growing season (May 1-September 1), calculate the number of days since rainfall of equal to or greater than .50 inch has occurred within a consecutive 2 day period; meaning a rain of less than .50 cannot end a drought.
4.1ad In each Sunday edition of the Lamesa Press Reporter, after the 60th day since the last rainfall of equal to or greater than .50 inch has occurred in a consecutive 2 day period, publish a report indicating the total number of days the district is experiencing drought conditions since the last rainfall event.
4.1ae In the drought report published in the Sunday newspaper, print a conservation statement.

Methodology

A Prepare an annual report in which the district manager will develop a report concerning the drought conditions as expressed in Goal 4. The report will contain a copy on the newspaper reports concerning the rainfall and drought conditions within the district. The report will be maintained in the district office.
B. Present the annual report to the Board.
C. After the first annual report, the District will provide a yearly comparison report as the procedure for tracking progress on an annual basis.

Goal 5.0 Addressing in a quantitative manner the desired future conditions of the groundwater resources which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District

Management Objective

5.1A District will calculate the average annual drawdown using the results of annual

water level measurements taken each January.

Performance Standards

5.1aa Present the average drawdown results to the Board of Directors by the March meeting

5.1ab Publish the drawdown map in an edition of the Lamesa Press Reporter each year as soon as possible after the annual water level measurements have been completed.

Management Objective

5.2a The District Staff will calculate the cumulative average annual drawdown beginning with 2012 year. The staff will calculate the remaining allowable drawdown (based on the DFC) for the remaining years of the 2012-2017 period.

Performance Standards

5.2aa Present the cumulative average annual drawdown results to the District Board of Directors by the March meeting.

Management Objective

5.3a The District Staff will monitor the water budget calculated in the Southern Ogallala GAM which is estimated to meet the adopted DFC. The water Budget will be compared to the annual estimated water use calculated by the staff. The estimated remainder of water usage within the selected 5 year time period will be presented each year.

Methodology

A. Estimate annual water usage within the district will be presented to the Board of Directors by the March Meeting.
B. Calculate the estimated remaining water usage that is allowable to meet the DFC for the period 2012-2017 and present these figures to the Board of Directors by the March meeting.
C. The Board of Directors will evaluate the allowable to meet the DFC. The Board will discuss and consider possible steps to reduce the allowable usage in order to meet the DFC.
D. The Board of Directors will evaluate and discuss possible changes to the DFC or possible changes to the rules of Mesa UWCD.

Management Goals Determined Not-Applicable

Goals Not-Applicable to Mesa UWCD

1.0 Controlling and preventing subsidence.

The rigid geologic framework of the region precludes subsidence from occurring. *The management goal for controlling and preventing subsidence within the District is therefore not applicable to the operations of the District.*

2.0 Addressing conjunctive surface water management issues within the District.

There are no surface water impoundments in the District, except for livestock consumption, which could possibly require conjunctive management. At the present time, Mesa UWCD has no jurisdiction over any surface water projects. Likewise, no agency which regulates surface water has the authority to manage groundwater within the territory of this District. *Therefore, the management goal for addressing conjunctive surface water management issues within the District is not applicable to the operations of the District.*

3.0 Addressing natural resource issues which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

The District has no documented occurrences of endangered or threatened species dependent upon groundwater. Other issues related to resources-air, water, soil, etc. supplied by nature that are useful to life are likewise not documented. The natural resources of the oil and gas industry are regulated by the Railroad Commission of Texas, and are exempt by Chapter 36.117(e), unless the spacing requirements of the District can be met when space is available. *Therefore, the management goal for addressing natural resource issues which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District is not applicable to the operations of the District.*

4.0 Addressing recharge enhancement projects which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

The District is unaware of any recharge enhancement projects that are in existence in the area. Because of the lack of consistent rainfall in the District there are virtually no projects which would be cost effective to pursue in an effort to enhance rainfall. *Therefore, the management goal for addressing recharge enhancement projects which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District is not applicable to the operations of the District.*

5.0 Addressing rainwater harvesting projects which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

The District is aware of only 1 rainfall harvesting project within the District. This project was instigated over 50 ago when the rural farm house was constructed. The District performs water

quality tests for the one project. This project has a reservoir underneath the house for storing rainwater. The District performs a bacteria test annually on the stored rainwater. Because there is only 1 project in the entire 576,000 acres of the District, this is ample proof that the rainwater harvesting projects are not viable in this arid part of the State that is so sparsely populated. *Therefore, the management goal for addressing rainwater harvesting projects which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District is not applicable to the operations of the District.*

6.0 Addressing a precipitation enhancement project which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

On several occasions the District has entertained the idea of precipitation enhancement for Dawson County. There are other precipitation enhancement programs around the area. The county due west of the District and the county to the northwest of the District are both in a precipitation enhancement programs. In addition, the East ½ of Dawson County was in the precipitation enhancement program of Upper Colorado River Municipal Water District and now that precipitation enhancement program has been dropped. It is the belief of the citizens that a precipitation enhancement program is not effective in enhancing rainfall in Dawson County and therefore, not cost-effective. *Therefore, the management goal for addressing precipitation enhancement projects which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District is not applicable to the operations of the District.*

7.0 Addressing a brush control project which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

The District is basically an agricultural county with row crops. The total amount of rangeland over the Ogallala Aquifer is only a very small amount. The large number of acres in rangeland where brush control could be effective is outside the Ogallala Aquifer and in an area which has little or no groundwater. There are areas of Salt Cedar around phyla lakes. There are provisions through the EQUIP program for cost share for the removal of Salt Cedar. The District has 3 monitor wells in a particular area where a rather large Salt Cedar removal project has taken place. Contrary to prior beliefs, the changes in water levels have not been significantly affected by the project. *Therefore, the management goal for addressing brush control projects which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District is not applicable to the operations of the District.*

8.0 Addressing in a quantitative manner the desired future conditions of the groundwater resources which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District.

District Management Plan IV makes this item applicable

The following includes historical changes in Groundwater Management.

Mesa UWCD Board President Richard Leonard is the voting representative on the Groundwater

Management Area #2 planning process. The District is actively participating in the planning for the establishment of a Desired Future Condition. At this time, Groundwater Management Area # 2 has not established the Desired Future Conditions (DFC) of the Ogallala Aquifer. Therefore, the Modeled Available Groundwater (MAG) has not been determined by the Texas Water Development Board. At the time the DFC has been established and the MAG has been determined, the District will develop Management Plan IV. *Therefore, the management goal for addressing DFC and MAG which impact the use and availability of groundwater and which are impacted by the use of groundwater in the District is not applicable to the operations of the District at the time of District Management Plan III.*

The following is a new overview in District Management Plan IV

Mesa UWCD District Management Plan IV is prepared to manage groundwater in a manner that will address the Modeled Available Groundwater as a result of establishing a Desired Future Condition of the Ogallala Aquifer in Dawson County.

The District adopted Desired Future Conditions for relevant aquifers in August 2010. The relevant aquifers are the Ogallala and Edwards-Trinity (High Plains) Aquifers. The Board decided the Dockum Aquifer is not a relative aquifer for Mesa UWCD at this time.

During the joint planning process, this District and five (5) other GCD's located along the Southern Boundaries of GMA #2 adopted DFC's for the Ogallala and Edwards Trinity (High Plains) based on an allowable amount of drawdown. The allowable drawdown is based on the average change in water levels during the 10-year period 1998-2007. For Mesa UWCD, that number is -1.58 ft/year. Based on the 50 year planning horizon, the Southern Ogallala GAM predicts the cumulative drawdown to be -74 feet for the District. However, for the purpose of Management Plan IV, the District proposes to evaluate the cumulative drawdown in 5 year increments, which will measure our attainment of the DFC in shorter increments, and allow the District to make changes accordingly.

It is the belief of the Board of Directors that no additional rule changes are needed at this time in order to meet the adopted DFC. Our proposal may be altered if, at the end of the 5 year period or anytime the Board feels necessary, our cumulative annual drawdown differs significantly from what is calculated to keep the District on track for DFC attainment.

Definitions and Concepts

"Board" means the Board of Directors of Mesa UWCD.

"District" is Mesa Underground Water Conservation District and those given the responsibility for the execution and performance of District functions and activities.

"Drilling Permit" means a permit for a water well issued or to be issued by the District allowing a water well to be drilled.

"Groundwater" means water located beneath the earth's surface within the District but does not include water produced with oil in the production of oil and gas.

“Landowner” means the person to whom bears ownership of the land surface area and water rights there under, unless previously sold.

“Operating Permit” means a permit issued within a *Production Use Measurement Area* by the District for a water well, allowing only a specified amount of groundwater to be withdrawn from a water well/well system for a designated period of time.

“Person” includes corporation, individual, organization, government or Governmental subdivision or agency, business trust, trust, partnership, association, or any other legal entity.

“Rule” means the rules of Mesa UWCD adopted May 1, 1997 to achieve the provisions of the District Act.

“Section” means the number section of a survey or block as shown in “Dawson County Farm Plats,” 1996 Edition, (Smith Publishing Co.).

“Well” means any facility, devise, or method used to withdraw groundwater from the groundwater supply within the District.

“Water Rights Holder” means the person other than the landowner who has ownership of the water rights beneath the land surface.

“Well owner” or “Well operator” means the person who owns the land upon which a well is located or is to be located or the person who operates a well or a water distribution system supplied by a well.

“Well system” means a well or group of wells tied to the same distribution system.

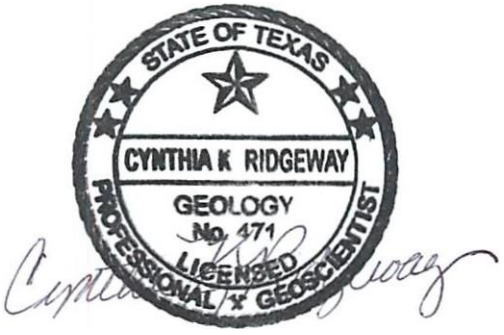
Appendices

Appendix I	GAM Run 10-030 MAG
Appendix II	Estimated Historical Water Use And 2012 State Water Plan Datasets
Appendix III	GAM Run 12-008: Mesa Underground Water Conservation District Management Plan

GAM Run 10-030 MAG

by Mr. Wade Oliver

Texas Water Development Board Groundwater Availability Modeling Section (512) 463-3132
June 22, 2011



Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on June 22, 2011.

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EXECUTIVE SUMMARY:

The estimated total pumping from the Ogallala Aquifer that achieves the desired future conditions adopted by the members of Groundwater Management Area 2 declines from approximately 2,367,000 acre-feet per year to 1,307,000 acre-feet per year between 2010 and 2060. This is summarized by county, regional water planning area, and river basin as shown in Table 2. The corresponding total pumping from the Edwards-Trinity (High Plains) Aquifer declines from approximately 96,000 acre-feet per year to 23,000 acre-feet per year over the same time period (Table 3). The estimated managed available groundwater, the amount available for permitting, for the groundwater conservation districts within Groundwater Management Area 2 for the Ogallala and Edwards-Trinity (High Plains) aquifers declines from approximately 2,368,000 acre-feet per year to 1,266,000 acre-feet per year between 2010 and 2060 (Table 9). The pumping estimates were extracted from Groundwater Availability Modeling Task 10-023, Scenario 3, which Groundwater Management Area 2 used as the basis for developing their desired future conditions.

REQUESTOR:

Mr. Jason Coleman of South Plains Underground Water Conservation District on behalf of Groundwater Management Area 2

DESCRIPTION OF REQUEST:

In a letter dated August 10, 2010 and received August 13, 2010, Mr. Jason Coleman provided the Texas Water Development Board (TWDB) with the desired future conditions of the Ogallala and Edwards-Trinity (High Plains) aquifers adopted by the members of Groundwater Management Area 2. Below are the desired future conditions for the Ogallala and Edwards-Trinity (High Plains) aquifers in the northern portion of the management area as described in Resolution No. and adopted August 5, 2010:

> [T]he *members of* [Groundwater Management Area] *#2 adopt the desired future condition of 50 percent of the saturated thickness remaining after 50 years for the Northern Portion of* [Groundwater Management Area] *#2, based on GAM Run 10-023, Scenario 3…*

As described in Resolution No. 2010-01, the northern portion of Groundwater Management Area 2 consists of Bailey, Briscoe, Castro, Cochran, Crosby, Deaf Smith, Floyd, Hale, Hockley, Lamb, Lubbock, Lynn, Parmer, and Swisher counties.

For the southern portion of Groundwater Management Area 2, desired future conditions for the Ogallala and Edwards-Trinity (High Plains) aquifers were stated as average water-level declines (drawdowns) over the same time period. The average drawdowns specified as desired future conditions for the southern portion of Groundwater Management Area 2 are: Andrews–6 feet, Bordon–3 feet, Dawson–74 feet, Gaines–70 feet, Garza–40 feet, Howard–1 foot, Martin–8 feet, Terry–42 feet, and Yoakum–18 feet.

In response to receiving the adopted desired future conditions, the Texas Water Development Board has estimated the managed available groundwater for each of the groundwater conservation districts within Groundwater Management Area 2 for the Ogallala and Edwards-Trinity (High Plains) aquifers.

Although not explicitly stated in the adopted desired future conditions statement, drawdown estimates for the Edwards-Trinity (High Plains) Aquifer associated with Scenario 3 of GAM Task 10-023 are shown in Table 1 below.

Table 1. Average drawdown in feet in the Edwards-Trinity (High Plains) Aquifer by county in Scenario 3 of GAM Task 10-023.

County	Average drawdown (feet)					
	2010	2020	2030	2040	2050	2060
Bailey	0	1	2	4	4	5
Borden	0	1	1	2	3	4
Cochran	-1	0	3	6	9	11
Dawson	3	21	37	50	60	67
Floyd	3	16	29	41	52	61
Gaines	6	28	42	53	61	67
Garza	2	10	18	26	33	40
Hale	1	8	15	22	29	36
Hockley	1	7	13	19	24	28
Lamb	0	1	1	2	3	3
Lubbock	1	8	14	20	25	29
Lynn	0	7	14	21	27	32
Terry	2	14	25	32	37	40
Yoakum	1	6	10	13	15	17

For purposes of developing total pumping and managed available groundwater numbers, it was assumed that by referencing Scenario 3 of GAM Task 10-023, the groundwater conservation districts in Groundwater Management Area 2 intended to fully incorporate the drawdown and pumping estimates of the Edwards-Trinity (High Plains) Aquifer. Thus, this analysis included those pumping numbers.

METHODS:

Groundwater Management Area 2, located in the Texas Panhandle, contains a portion of the Ogallala Aquifer and the entire Edwards-Trinity (High Plains) Aquifer. The location of Groundwater Management Area 2, the Ogallala and Edwards-Trinity (High Plains) aquifers, and the groundwater availability model cells that represent the aquifers are shown in Figure 1.

The Texas Water Development Board previously completed several predictive groundwater availability model simulations of the Ogallala and Edwards-Trinity (High Plains) aquifers to assist the members of Groundwater Management Area 2 in developing desired future conditions.

As stated in Resolution No. 2010-01 and the narrative of the methods used for developing desired future conditions provided by Groundwater Management Area 2, the simulation on which the desired future conditions above are based is Scenario 3 of GAM Task 10-023 (Oliver, 2010). The estimated pumping for Groundwater Management Area 2 presented here, taken directly from the above scenario, has been divided by county, regional water planning area, river basin, and groundwater conservation district. These areas are shown in Figure 2.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer are described below:

- The results presented in this report are based on "Scenario 3" in GAM Task 10-023 (Oliver, 2010). See GAM Task 10-023 for a full description of the methods, assumptions, and results for the groundwater availability model run.

- Version 2.01 of the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer (Blandford and others, 2008) was used for this analysis. This model is an expansion on and update to the previously developed groundwater availability model for the southern portion of the Ogallala Aquifer described in Blandford and others (2003). See Blandford and others (2008) and Blandford and others (2003) for assumptions and limitations of the groundwater availability model.

- The model includes four layers representing the southern portion of the Ogallala and Edwards-Trinity (High Plains) aquifers. The units comprising the Edwards-Trinity (High Plains) Aquifer (primarily Edwards, Comanche Peak, and Antlers Sand formations) are separated from the overlying Ogallala Aquifer by a layer of Cretaceous shale, where present.

- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the Ogallala Aquifer in 2000 is 33 feet. The mean absolute error for the Edwards-Trinity (High Plains) Aquifer in 1997 is 25 feet (Blandford and others, 2008).

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the August 3, 2010 version of the file that associates the model grid to political and natural boundaries for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer. Note that some minor corrections were made to the file to better reflect the relationship of model cells to political boundaries.

- The recharge used for the model run represents average recharge as described in Blandford and others (2003).

Determining Managed Available Groundwater

As defined in Chapter 36 of the Texas Water Code, "managed available groundwater" is the amount of water that may be permitted. The pumping output from groundwater availability models, however, represents the total amount of pumping from the aquifer. The total pumping includes uses of water both subject to permitting and exempt from permitting. Examples of exempt uses include domestic, livestock, and oil and gas exploration. Each district may also exempt additional uses as defined by its rules or enabling legislation.

Since exempt uses are not available for permitting, it is necessary to account for them when determining managed available groundwater. To do this, the Texas Water Development Board developed a standardized method for estimating exempt use for domestic and livestock purposes based on projected changes in population and the distribution of domestic and livestock wells in the area. Because other exempt uses can vary significantly from district to district, and there is much higher uncertainty associated with estimating use due to oil and gas exploration, estimates of exempt pumping outside domestic and livestock uses have not been included. The districts were also encouraged to evaluate the estimates of exempt pumping and, if desired, provide updated estimates. Once established, the estimates of exempt pumping were subtracted from the total pumping output from the groundwater availability model to yield the estimated managed available groundwater for permitting purposes.

RESULTS:

The estimated total pumping from the Ogallala Aquifer in Groundwater Management Area 2 that achieves the above desired future conditions declines from approximately 2,367,000 acre-feet per year in 2010 to 1,307,000 acre-feet per year in 2060. This pumping has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 2). The corresponding estimated total pumping from the Edwards-Trinity (High Plains) Aquifer declines from approximately 96,000 acre-feet per year to 23,000 acre-feet per year over the same time period (Table 3).

The total pumping estimates for the combined Ogallala and Edwards-Trinity (High Plains) aquifers are also summarized by county, regional water planning area, river basin, and groundwater conservation district as shown in tables 4, 5, 6, and 7, respectively. In Table 7, the total pumping both excluding and including areas outside of a groundwater conservation district is shown. Table 8 contains the estimates of exempt pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers by groundwater conservation district. The managed available groundwater, the difference between the total pumping in the districts (Table 7, excluding areas outside of a district) and the estimated exempt use (Table 8) is shown in Table 9. The total managed available groundwater for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 declines from approximately 2,368,000 acre-feet per year to 1,266,000 acre-feet per year between 2010 and 2060.

LIMITATIONS:

Managed available groundwater numbers included in this report are the result of subtracting the estimated future exempt use from the estimated total pumping that would achieve the desired

future condition adopted by the groundwater conservation districts in the groundwater management area. These numbers, therefore, are the result of (1) running the groundwater model to estimate the total pumping required to achieve the desired future condition and (2) estimating the future exempt use in the area.

The groundwater model used in developing estimates of total pumping is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future condition. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to develop estimates of total pumping is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition.

In addition, certain assumptions have been made regarding future precipitation, recharge, and streamflow in developing these total pumping estimates. Those assumptions also need to be considered and compared to actual future data when evaluating compliance with the desired future condition.

In the case of TWDB's estimates of future exempt use, key assumptions were made as to the pattern of population growth relative to the need for domestic wells or supplied water, per capita use from domestic wells, and livestock uses of water. In the case of district estimates of future exempt use, including exempt use associated with the exploration of oil and gas, the assumptions are specific to that district. In either case, these assumptions need to be considered when reviewing future data related to exempt use.

Given these limitations, users of this information are cautioned that the total pumping numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. 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 these managed available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

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Blandford, T.N., Kuchanur, M., Standen, A., Ruggiero, R., Calhoun, K.C., Kirby, P., and Shah, G., 2008, Groundwater availability model of the Edwards-Trinity (High Plains) Aquifer in Texas and New Mexico: Final report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 176 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.

Oliver, W., 2010, GAM Task 10-023: Texas Water Development Board, GAM Task 10-023 Report, 27 p.

Texas Water Development Board, 2007, Water for Texas – 2007—Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Table 2. Estimated total annual pumping for the Ogallala Aquifer in Groundwater Management Area 2. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Region	Basin	Year					
			2010	2020	2030	2040	2050	2060
Andrews	F	Colorado	17,584	15,085	13,678	12,014	10,016	7,377
		Rio Grande	54	50	41	41	41	41
Bailey	O	Brazos	62,538	41,283	34,907	30,064	24,021	21,429
Borden	F	Brazos	292	292	292	292	292	292
		Colorado	107	107	107	107	107	107
Briscoe	O	Red	33,622	26,457	19,722	14,220	13,037	11,933
Castro	O	Brazos	90,367	90,367	90,367	90,367	88,630	84,458
		Red	37,055	36,936	36,141	35,449	34,650	33,540
Cochran	O	Brazos	16,324	7,707	6,556	4,770	4,410	4,179
		Colorado	32,021	28,501	27,085	25,926	23,674	21,192
Crosby	O	Brazos	133,239	133,058	133,058	133,058	133,058	133,058
		Red	1,624	1,624	1,624	1,624	1,624	1,624
Dawson	O	Brazos	5,350	5,350	5,350	5,138	4,075	1,099
		Colorado	196,260	192,758	180,531	156,477	131,379	92,681
Deaf Smith	O	Red	129,167	118,166	106,868	97,057	80,382	65,931
Floyd	O	Brazos	95,488	93,749	92,041	90,930	86,458	84,300
		Red	59,482	55,617	53,320	47,453	43,351	40,061
Gaines	O	Colorado	350,369	240,110	175,175	130,951	97,498	71,544
Garza	O	Brazos	19,203	19,073	18,942	18,812	18,032	17,121
Hale	O	Brazos	130,097	129,291	127,492	125,488	119,612	111,734
		Red	525	525	525	525	525	525
Hockley	O	Brazos	87,712	84,378	80,285	76,847	69,445	60,771
		Colorado	8,256	8,004	8,004	7,571	7,324	7,009
Howard	F	Colorado	3,075	3,075	2,731	2,731	2,731	2,703
Lamb	O	Brazos	147,368	137,304	125,466	111,509	95,696	85,190
Lubbock	O	Brazos	124,519	120,044	115,348	108,699	100,762	91,073
Lynn	O	Brazos	98,003	97,740	96,954	94,600	86,945	78,543
		Colorado	6,020	6,020	6,020	6,020	6,020	5,925
Martin	F	Colorado	13,570	13,570	13,570	13,140	12,299	12,277
Parmer	O	Brazos	50,258	45,572	39,624	35,624	29,978	27,692
		Red	18,436	17,493	16,960	16,525	15,642	13,289
Swisher	O	Brazos	28,248	28,248	26,603	19,889	14,084	8,304
		Red	82,677	79,158	74,399	64,929	59,764	55,994
Terry	O	Brazos	13,342	13,342	13,342	9,793	5,348	4,092
		Colorado	192,317	182,880	121,267	77,305	48,557	29,555
Yoakum	O	Colorado	82,297	59,745	43,575	33,882	26,717	20,040
Total			**2,366,866**	**2,132,679**	**1,907,970**	**1,699,827**	**1,496,184**	**1,306,683**

Table 3. Estimated total annual pumping for the Edwards-Trinity (High Plains) Aquifer in Groundwater Management Area 2. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Region	Basin	Year					
			2010	2020	2030	2040	2050	2060
Bailey	O	Brazos	279	279	279	279	279	279
Borden	F	Brazos	65	65	65	65	65	65
		Colorado	41	41	41	41	41	41
Cochran	O	Brazos	137	137	137	137	137	137
		Colorado	127	127	127	127	127	127
Dawson	O	Brazos	0	0	0	0	0	0
		Colorado	1,103	1,103	1,103	1,103	1,103	1,103
Floyd	O	Brazos	521	521	521	518	505	499
		Red	695	695	695	695	695	683
Gaines	O	Colorado	85,058	46,202	30,316	22,997	16,523	12,904
Garza	O	Brazos	18	18	18	18	18	18
		Colorado	0	0	0	0	0	0
Hale	O	Brazos	3,523	3,523	3,523	3,523	3,523	3,419
Hockley	O	Brazos	96	96	96	96	96	96
		Colorado	0	0	0	0	0	0
Lamb	O	Brazos	164	164	164	164	164	164
Lubbock	O	Brazos	690	690	690	690	690	690
Lynn	O	Brazos	221	221	221	221	221	221
		Colorado	9	9	9	9	9	9
Terry	O	Brazos	23	23	23	23	23	23
		Colorado	959	959	922	922	922	922
Yoakum	O	Colorado	2,532	1,893	1,757	1,642	1,642	1,524
Total			**96,261**	**56,766**	**40,707**	**33,270**	**26,783**	**22,924**

Table 4. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by county in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Andrews	17,638	15,135	13,719	12,055	10,057	7,418
Bailey	62,817	41,562	35,186	30,343	24,300	21,708
Borden	505	505	505	505	505	505
Briscoe	33,622	26,457	19,722	14,220	13,037	11,933
Castro	127,422	127,303	126,508	125,816	123,280	117,998
Cochran	48,609	36,472	33,905	30,960	28,348	25,635
Crosby	134,863	134,682	134,682	134,682	134,682	134,682
Dawson	202,713	199,211	186,984	162,718	136,557	94,883
Deaf Smith	129,167	118,166	106,868	97,057	80,382	65,931
Floyd	156,186	150,582	146,577	139,596	131,009	125,543
Gaines	435,427	286,312	205,491	153,948	114,021	84,448
Garza	19,221	19,091	18,960	18,830	18,050	17,139
Hale	134,145	133,339	131,540	129,536	123,660	115,678
Hockley	96,064	92,478	88,385	84,514	76,865	67,876
Howard	3,075	3,075	2,731	2,731	2,731	2,703
Lamb	147,532	137,468	125,630	111,673	95,860	85,354
Lubbock	125,209	120,734	116,038	109,389	101,452	91,763
Lynn	104,253	103,990	103,204	100,850	93,195	84,698
Martin	13,570	13,570	13,570	13,140	12,299	12,277
Parmer	68,694	63,065	56,584	52,149	45,620	40,981
Swisher	110,925	107,406	101,002	84,818	73,848	64,298
Terry	206,641	197,204	135,554	88,043	54,850	34,592
Yoakum	84,829	61,638	45,332	35,524	28,359	21,564
Total	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 5. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by regional water planning area in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
F	34,788	32,285	30,525	28,431	25,592	22,903
O	2,428,339	2,157,160	1,918,152	1,704,666	1,497,375	1,306,704
Total	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 6. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by river basin in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year.

Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	1,108,085	1,052,535	1,012,364	961,614	886,567	818,946
Colorado	991,705	800,189	626,018	492,965	386,689	287,040
Red	363,283	336,671	310,254	278,477	249,670	223,580
Rio Grande	54	50	41	41	41	41
Total	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 7. Estimated total annual pumping for the Ogallala and Edwards-Trinity (High Plains) aquifers summarized by groundwater conservation district (GCD) in Groundwater Management Area 2 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Garza County UWCD	19,221	19,091	18,960	18,830	18,050	17,139
High Plains UWCD No. 1	1,421,975	1,343,554	1,282,656	1,208,126	1,109,582	1,019,597
Llano Estacado UWCD	435,427	286,312	205,491	153,948	114,021	84,448
Mesa UWCD	202,713	199,211	186,984	162,718	136,557	94,883
Permian Basin UWCD	16,403	16,403	16,099	15,669	14,828	14,795
Sandy Land UWCD	84,829	61,638	45,332	35,524	28,359	21,564
South Plains UWCD	207,257	197,820	136,170	88,659	55,466	35,208
Total (excluding non-district areas)	**2,387,825**	**2,124,029**	**1,891,692**	**1,683,474**	**1,476,863**	**1,287,634**
No District	75,302	65,416	56,985	49,623	46,104	41,973
Total (including non-district areas)	**2,463,127**	**2,189,445**	**1,948,677**	**1,733,097**	**1,522,967**	**1,329,607**

Table 8. Estimates of annual exempt use for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 by groundwater conservation district (GCD) for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Source	Year					
		2010	2020	2030	2040	2050	2060
Garza County UWCD	TA	68	71	69	67	64	59
High Plains UWCD No. 1	D	15,482	16,253	16,712	16,925	17,087	17,043
Llano Estacado UWCD	D	2,242	2,332	2,397	2,443	2,435	2,420
Mesa UWCD	TA	542	558	573	582	566	545
Permian Basin UWCD	TA	575	596	605	608	605	599
Sandy Land UWCD	TA	366	402	424	448	436	422
South Plains UWCD	TA	502	537	569	601	603	599
Total		**19,777**	**20,749**	**21,349**	**21,674**	**21,796**	**21,687**

TA = Estimated exempt use calculated by TWDB and accepted by the district

D = Estimated exempt use calculated by the district

Table 9. Estimates of managed available groundwater for the Ogallala and Edwards-Trinity (High Plains) aquifers in Groundwater Management Area 2 by groundwater conservation district (GCD) for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Garza County UWCD	19,153	19,020	18,891	18,763	17,986	17,080
High Plains UWCD No. 1	1,406,493	1,327,301	1,265,944	1,191,201	1,092,495	1,002,554
Llano Estacado UWCD	433,185	283,980	203,094	151,505	111,586	82,028
Mesa UWCD	202,171	198,653	186,411	162,136	135,991	94,338
Permian Basin UWCD	15,828	15,807	15,494	15,061	14,223	14,196
Sandy Land UWCD	84,463	61,236	44,908	35,076	27,923	21,142
South Plains UWCD	206,755	197,283	135,601	88,058	54,863	34,609
Total	**2,368,048**	**2,103,280**	**1,870,343**	**1,661,800**	**1,455,067**	**1,265,947**

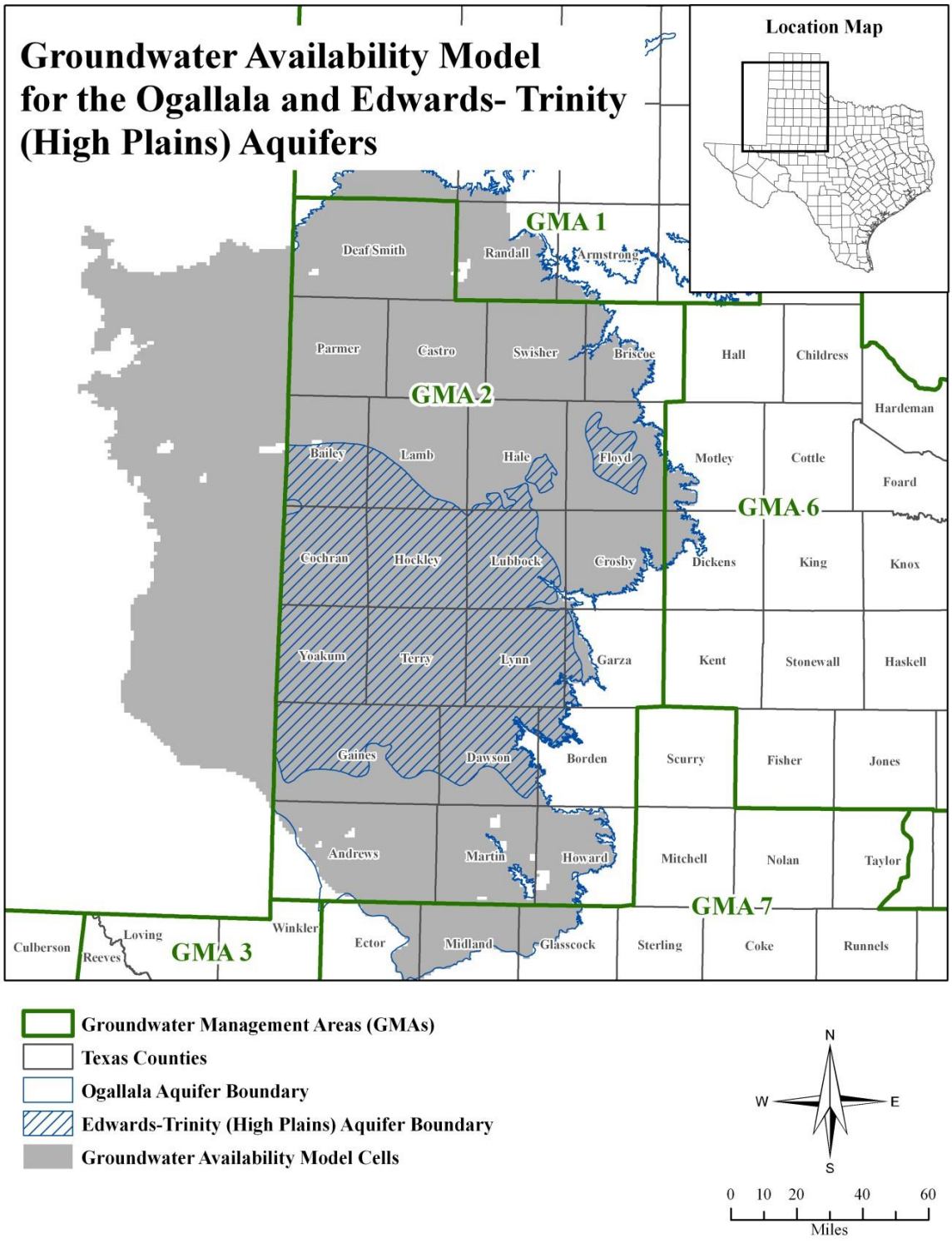

Figure 1. Map showing the areas covered by the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer.

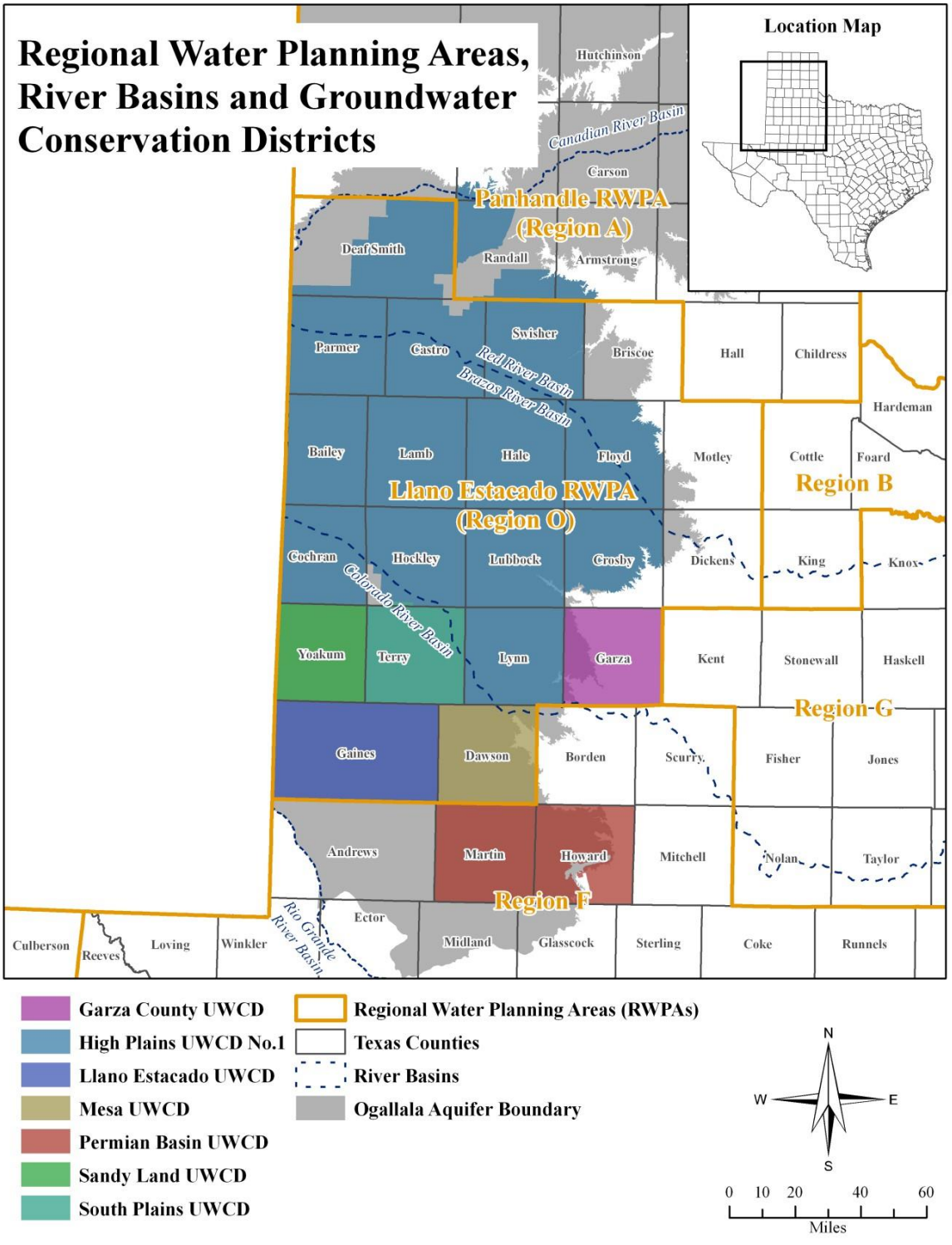

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 2. UWCD refers to Underground Water Conservation District.

Estimated Historical Water Use And 2012 State Water Plan Datasets:

Mesa Underground Water Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Resources Division
Groundwater Technical Assistance Section
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(512) 463-7317
December 3, 2013

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.state.tx.us/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in part 1 are:

1. Estimated Historical Water Use (checklist Item 2)
   from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist Item 6)
3. Projected Water Demands (checklist Item 7)
4. Projected Water Supply Needs (checklist Item 8)
5. Projected Water Management Strategies (checklist Item 9)
   reports 2-5 are from the 2012 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 updated Historical Water Use and 2012 State Water Planning data available as of 12/3/2013. Although it does not happen frequently, neither of these datasets are static and are subject to change pending the availability of more accurate data (Historical Water Use data) or an amendment to the 2012 State Water Plan (2012 State Water Planning data). District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The Historical Water Use dataset can be verified at this web address:
http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2012 State Water Planning dataset can be verified by contacting Sabrina Anderson (Sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317) or Rima Petrossian (rima.petrossian@twdb.texas.gov or 512-936-2420).

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

Groundwater and surface water historical use estimates are currently unavailable for calendar years 2005, 2011 and 2012. TWDB staff anticipates the calculation and posting of these estimates at a later date.

DAWSON COUNTY

All values are in acre-feet/year

Year	Source	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total
1974	GW	686	0	0	31,245	1,831	200	33,962
	SW	2,070	93	0	0	0	54	2,217
1980	GW	526	91	0	58,083	860	85	59,645
	SW	2,155	12	0	0	0	13	2,180
1984	GW	676	91	0	21,361	860	98	23,086
	SW	1,702	12	0	0	0	24	1,738
1985	GW	630	125	0	29,216	837	86	30,894
	SW	1,810	12	0	0	0	21	1,843
1986	GW	585	112	0	13,225	787	100	14,809
	SW	2,028	12	0	0	0	24	2,064
1987	GW	553	37	0	13,300	732	74	14,696
	SW	1,472	0	0	0	0	18	1,490
1988	GW	859	26	0	20,042	701	81	21,709
	SW	2,342	0	0	0	0	20	2,362
1989	GW	733	20	0	43,684	654	80	45,171
	SW	1,798	0	0	0	0	19	1,817
1990	GW	844	44	0	39,097	654	79	40,718
	SW	1,441	0	0	0	0	19	1,460
1991	GW	586	23	0	46,688	450	82	47,829
	SW	1,512	0	0	0	0	20	1,532
1992	GW	490	23	0	38,533	450	136	39,632
	SW	1,595	0	0	0	0	34	1,629
1993	GW	785	30	0	65,543	450	136	66,944
	SW	1,707	0	0	0	0	34	1,741
1994	GW	717	36	0	49,863	450	95	51,161
	SW	1,851	0	0	0	0	23	1,874
1995	GW	619	27	0	65,460	781	120	67,007
	SW	1,859	0	0	0	0	31	1,890
1996	GW	994	38	0	142,813	781	134	144,760
	SW	1,578	32	0	0	0	34	1,644
1997	GW	1,068	30	0	145,040	781	190	147,109

Year	Source	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total
1997	SW	1,803	41	0	0	0	47	1,891
1998	GW	1,111	24	0	129,654	781	138	131,708
	SW	1,637	0	0	0	0	35	1,672
1999	GW	1,087	14	0	104,999	781	113	106,994
	SW	2,723	0	0	0	0	29	2,752
2000	GW	1,441	32	0	146,039	781	100	148,393
	SW	2,288	69	0	0	0	24	2,381
2001	GW	1,244	30	0	141,495	781	94	143,644
	SW	2,180	40	0	0	0	29	2,249
2002	GW	1,223	14	0	133,731	781	91	135,840
	SW	2,142	18	0	0	0	27	2,187
2003	GW	1,050	14	0	125,572	781	73	127,490
	SW	1,827	20	0	1,094	0	22	2,963
2004	GW	1,166	13	0	101,796	781	71	103,827
	SW	1,335	17	0	1,008	0	21	2,381
2006	GW	1,734	45	0	126,144	0	98	128,021
	SW	1,590	0	0	855	0	11	2,456
2007	GW	1,537	46	0	67,736	0	98	69,417
	SW	1,848	0	0	0	0	11	1,859
2008	GW	2,172	28	0	135,659	0	174	138,033
	SW	1,551	0	0	0	0	19	1,570
2009	GW	1,913	0	0	130,073	218	159	132,363
	SW	1,734	0	0	0	46	18	1,798
2010	GW	795	0	0	78,974	188	197	80,154
	SW	1,685	0	0	600	39	22	2,346

Projected Surface Water Supplies
TWDB 2012 State Water Plan Data

DAWSON COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	Source Name	2010	2020	2030	2040	2050	2060
O	LAMESA	COLORADO	MEREDITH LAKE/RESERVOIR	843	1,062	1,062	1,062	978	978
O	LIVESTOCK	BRAZOS	LIVESTOCK LOCAL SUPPLY	1	2	1	2	2	2
O	LIVESTOCK	COLORADO	LIVESTOCK LOCAL SUPPLY	154	156	161	164	168	172
O	O'DONNELL	BRAZOS	MEREDITH LAKE/RESERVOIR	11	14	14	14	14	14
	Sum of Projected Surface Water Supplies (acre-feet/year)			**1,009**	**1,234**	**1,238**	**1,242**	**1,162**	**1,166**

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.

DAWSON COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	O'DONNELL	BRAZOS	17	17	17	17	17	16
O	IRRIGATION	BRAZOS	1,378	1,300	1,227	1,158	1,093	1,031
O	LIVESTOCK	BRAZOS	1	2	1	2	2	2
O	COUNTY-OTHER	BRAZOS	18	18	19	18	18	17
O	LAMESA	COLORADO	2,540	2,573	2,602	2,603	2,529	2,433
O	COUNTY-OTHER	COLORADO	610	612	616	607	587	565
O	MANUFACTURING	COLORADO	119	129	137	144	150	162
O	MINING	COLORADO	1,624	779	455	195	0	0
O	IRRIGATION	COLORADO	136,425	128,736	121,478	114,628	108,167	102,071
O	LIVESTOCK	COLORADO	154	156	161	164	168	172
	Sum of Projected Water Demands (acre-feet/year)		**142,886**	**134,322**	**126,713**	**119,536**	**112,731**	**106,469**

Projected Water Supply Needs
TWDB 2012 State Water Plan Data

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

DAWSON COUNTY

All values are in acre-feet/year

RWPG	WUG	WUG Basin	2010	2020	2030	2040	2050	2060
O	COUNTY-OTHER	BRAZOS	0	0	0	0	0	0
O	COUNTY-OTHER	COLORADO	0	0	0	0	0	0
O	IRRIGATION	BRAZOS	-955	-945	-898	-859	-792	-730
O	IRRIGATION	COLORADO	-94,673	-93,712	-89,026	-85,119	-78,437	-72,338
O	LAMESA	COLORADO	553	463	383	336	169	228
O	LIVESTOCK	BRAZOS	0	0	0	0	0	0
O	LIVESTOCK	COLORADO	0	0	0	0	0	0
O	MANUFACTURING	COLORADO	0	0	0	0	0	0
O	MINING	COLORADO	0	0	0	0	0	0
O	O'DONNELL	BRAZOS	17	17	17	17	16	17
	Sum of Projected Water Supply Needs (acre-feet/year)		**-95,628**	**-94,657**	**-89,924**	**-85,978**	**-79,229**	**-73,068**

Projected Water Management Strategies
TWDB 2012 State Water Plan Data

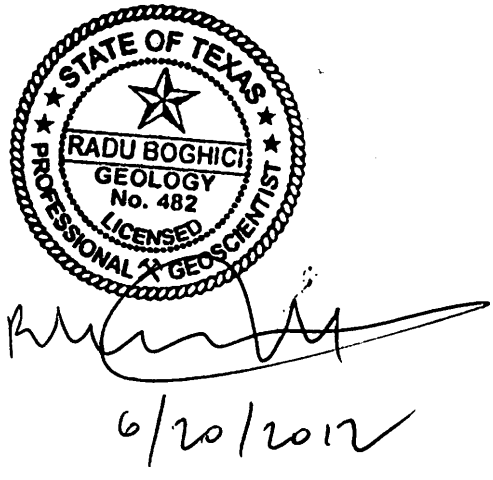
DAWSON COUNTY

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

Water Management Strategy	Source Name (Origin)	2010	2020	2030	2040	2050	2060
IRRIGATION, BRAZOS (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION (DAWSON)	61	55	49	44	40	36
IRRIGATION, COLORADO (O)							
IRRIGATION WATER CONSERVATION	CONSERVATION (DAWSON)	6,019	5,417	4,876	4,388	3,949	3,554
LAMESA, COLORADO (O)							
MUNICIPAL WATER CONSERVATION	CONSERVATION (DAWSON)	212	400	501	471	448	431
Sum of Projected Water Management Strategies (acre-feet/year)		6,292	5,872	5,426	4,903	4,437	4,021

GAM RUN 12-008: MESA UNDERGROUND WATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Radu Boghici, P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5808
June 20, 2012



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GAM RUN 12-008: MESA UNDERGROUND WATER CONSERVATION DISTRICT MANAGEMENT PLAN

by Radu Boghici, P.G.
Texas Water Development Board
Groundwater Resources Division
Groundwater Availability Modeling Section
(512) 463-5808
June 20, 2012

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 (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.

The purpose of this report is to provide Part 2 of a two-part package of information from the Texas Water Development Board to Mesa Underground Water Conservation District management plan to fulfill the requirements noted above. The groundwater management plan for Mesa Underground Water Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before February 13, 2014.

This report discusses the method, assumptions, and results from model runs using the groundwater availability model for the southern portion of the Ogallala Aquifer, which includes the Edwards-Trinity (High Plains) Aquifer. Tables 1 and 2 summarize the groundwater availability model data required by the statute, and Figure 1 shows the area of the model from which the values in the tables were extracted. This model run replaces the results of GAM Run 08-46. GAM Run 12-008 meets current standards set after the release of GAM Run 08-46 and includes model results from the updated model for the southern portion of the Ogallala Aquifer, which now includes the Edwards-Trinity (High Plains) Aquifer. If after review of the figure, Mesa Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the Texas Water Development Board immediately.

METHODS:

The groundwater availability model for the southern portion of the Ogallala Aquifer, which includes the Edwards-Trinity (High Plains) Aquifer, was run for this analysis. Water budgets for each year of 1980 through 2000 were extracted and the average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net inter-aquifer flow (lower) for the portions of the aquifers located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer

- Version 2.01 of the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer was used for this analysis. This model is an expansion on and update to the previously developed groundwater availability model for the southern portion of the Ogallala Aquifer described in Blandford and others (2003). See Blandford and others (2008) and Blandford and others (2003) for assumptions and limitations of the model.
- The model includes four layers representing the southern portion of the Ogallala and Edwards-Trinity (High Plains) aquifers. The units comprising the Edwards-Trinity (High Plains) Aquifer (primarily Edwards, Comanche Peak, and Antlers Sand formations) are separated from the overlying Ogallala Aquifer by a layer of Cretaceous shale, where present. Water

budgets for the district have been determined for the Ogallala Aquifer (Layer 1), as well as the Edwards-Trinity (High Plains) Aquifer (Layer 2 through Layer 4, collectively).

- The mean absolute error (a measure of the difference between simulated and actual water levels during the transient model calibration) for the Ogallala Aquifer in 2000 is 33 feet. The mean absolute error for the Edwards-Trinity (High Plains) Aquifer in 1997 is 25 feet (Blandford and others, 2008). This represents 1.8 and 3.0 percent of the hydraulic head drop across the model area for each aquifer, respectively.

- Irrigation return flow was accounted for in the groundwater availability model by a direct reduction in agricultural pumping as described in Blandford and others (2003).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the district and averaged over the duration of the calibration and verification portion of the model runs in the district, as shown in Tables 1 and 2. The components of the modified budget shown in Tables 1 and 2 include:

- Precipitation recharge—The areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.

- Surface water outflow—The total water discharging from the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).

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

- Flow between aquifers—The net vertical flow between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

The information needed for the District's management plan is summarized in Tables 1 and 2. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located (Figure 1).

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

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Ogallala Aquifer	62,265
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Ogallala Aquifer	3,141
Estimated annual volume of flow into the district within each aquifer in the district	Ogallala Aquifer	5,906
Estimated annual volume of flow out of the district within each aquifer in the district	Ogallala Aquifer	6,570
Estimated net annual volume of flow between each aquifer in the district	From the Ogallala Aquifer into the Edwards-Trinity (High Plains) Aquifer and adjacent underlying areas	1,127

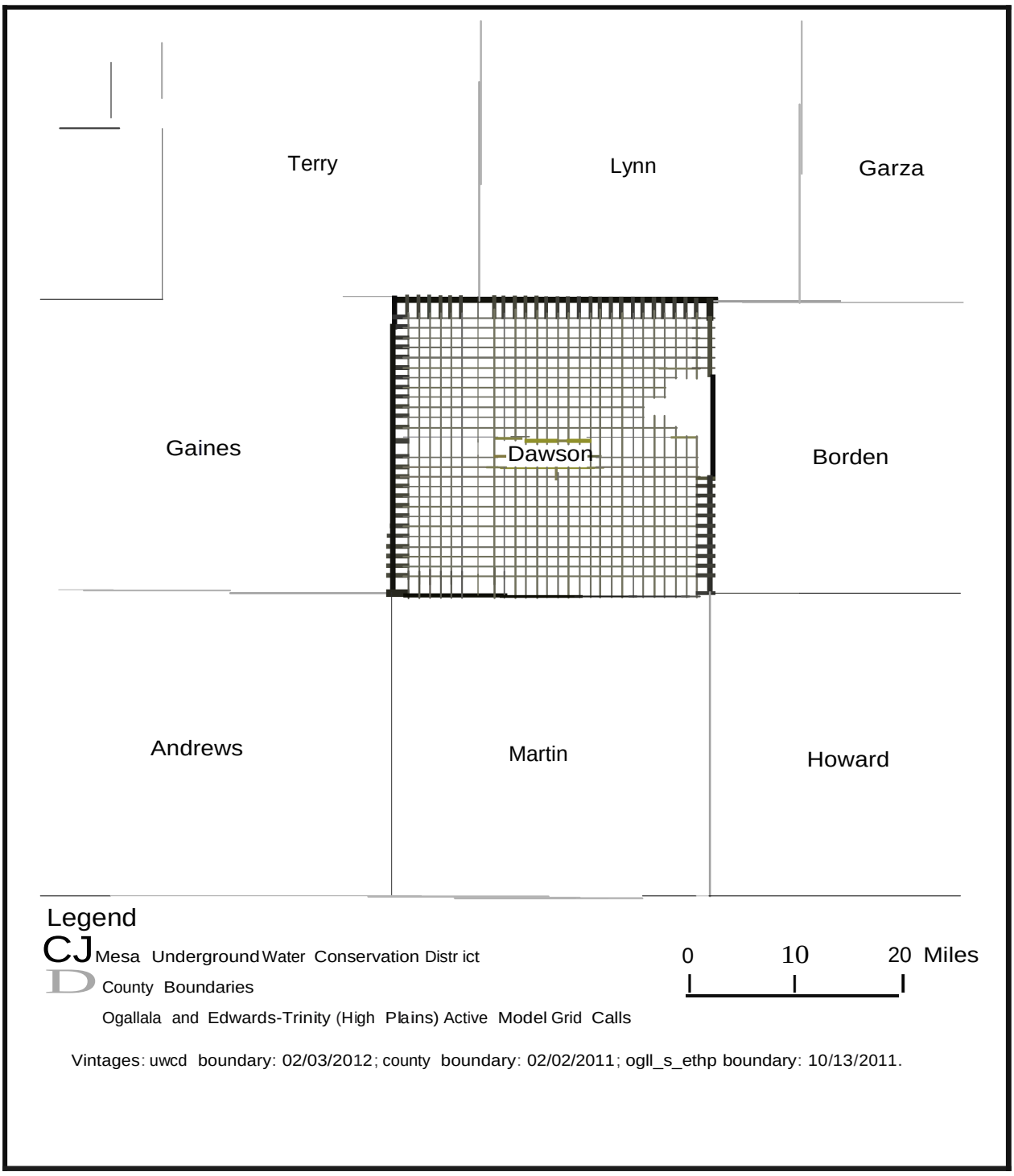

FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SOUTHERN PORTION OF THE OGALLALA AQUIFER FROM WHICH THE INFORMATION IN TABLES 1 AND 2 WAS EXTRACTED (THE AQUIFER EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2: SUMMARIZED INFORMATION FOR THE EDWARDS-TRINITY (HIGH PLAINS) AQUIFER THAT IS NEEDED FOR MESA UNDERGROUND WATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT. THESE FLOWS MAY INCLUDE FRESH AND BRACKISH WATERS.

Management Plan requirement	*Aquifer or confining unit*	*Results*
Estimated annual amount of recharge from precipitation to the district	Edwards-Trinity (High Plains) Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards-Trinity (High Plains) Aquifer	351
Estimated annual volume of flow into the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	715
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards-Trinity (High Plains) Aquifer	307
Estimated net annual volume of flow between each aquifer in the district	From the Ogallala Aquifer and overlying units and into the Edwards-Trinity (High Plains) Aquifer	1,284

LIMITATIONS

The groundwater model(s) used in completing this analysis is the best available scientific tool that can be used to meet the stated objective(s). To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need

to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

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