Hudspeth County Underground Water Conservation District No. 1

Management Plan – Adopted November 13, 2007

This Management Plan was prepared in accordance to the requirements of Chapter 36 of the Texas Water Code and Texas Administrative Code Title 31 Section 356.5 (31 TAC §356.5 attached as Appendix A) and was made available for public comment prior to adoption by the Board of Directors of the Hudspeth County Underground Water Conservation District No. 1 (the District).

1. District Management of Groundwater Supply

The District will manage the production of groundwater from the Bone Spring-Victorio Peak aquifer within the District in a sustainable manner. The District will identify and engage in such practices, that, if implemented, would result in more efficient use of groundwater. The District will monitor the TWDB and USGS groundwater level monitoring wells located within the District in order to gain additional information regarding changing storage conditions of groundwater supplies within the District. The District will work cooperatively with investigations of the groundwater by the TWDB and the USGS, and will make the results of such investigations available to the public, once received by the District.

2. Management Goals, Objectives, and Performance Standards

2.1. Efficient Use of Groundwater

Management Objective: Each year the District will provide information to the general public about the status of the groundwater in the District.

Performance Standard: The District's annual newsletter that will be mailed to each of the existing validation and operational permit holders will include information on the status of groundwater in the District.

2.2. Controlling and Preventing Waste of Groundwater

Management Objective: The District will inform District water users on the efficient use of water and methods to prevent waste.

Performance Standard: The District's annual newsletter that will be mailed to all validation and operational permit holders will include an article on irrigation water management.

2.3. Controlling and Preventing Subsidence

There is no known subsidence (as defined within Chapter 36 of the Texas Water Code) within the District caused by groundwater withdrawals, and this management item is not applicable to the District's Management Plan.

2.4. Conjunctive Surface Water Management Issues

There are no known conjunctive surface water management issues within the District, and this management item is not applicable to the District's Management Plan.

2.5. Natural Resource Issues

Management Objective: The amount of groundwater withdrawals permitted by the District shall consider the long-term sustainable amount of recharge to the portion of the aquifer within the District and the groundwater elevation measured in the District's monitoring well(s) in accordance with the District's rules, and shall protect the historical and existing uses of groundwater withdrawn from the portion of the Bone Spring-Victorio Peak aquifer located within the District.

Performance Standard: The District shall report annually to the Board on the amount of groundwater being withdrawn through non-exempt wells located within the District, measured through the District's flow metering program, for the quantification of existing and historical use of groundwater within the District's boundaries, and for the issuing of validation and operational permits for all nonexempt wells in operation.

2.6. Drought Conditions

Management Objective: The annual amount of groundwater permitted by the District for withdrawal from the portion of the Bone Spring-Victorio Peak aquifer located within the District may be curtailed during periods of extreme drought in the recharge zone of the aquifer or because of other conditions that cause significant declines in groundwater surface elevations. Such curtailment may be triggered by the District's Board based on the groundwater elevation measured in the District's monitoring well(s).

Performance Standard: The District's annual report will include a report on the District's monitoring well groundwater elevation at least one measurement per year and report on whether the permitted withdrawals were curtailed at any time during the year because of drought conditions.

2.7. Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, and Brush Control

Management Objective: The District shall promote the efficient application of irrigation water to field crops.

Performance Standard: The District shall assist in organizing the field demonstration of irrigation water conservation technology during one day every other year.

Management Objective: The District shall coordinate each year with Hudspeth County on the maintenance of the three existing recharge and flood control facilities located in the district.

Performance Standard: The District Manager shall report to the District's board of directors annually regarding the activities of County of Hudspeth regarding the maintenance of the recharge and flood control facilities, and such report shall be reflected in the minutes of such board meeting.

Management Objective: The District shall promote Rainwater Harvesting, Precipitation Enhancement, and Brush Control.

Performance Standard: The District shall include articles on Rainwater Harvesting, Precipitation Enhancement, and Brush Control in its annual newsletter mailed to all of its validation and operational permit holders.

2.8. Managed Available Groundwater and Desired Future Conditions

Management Objective: The District shall adopt a Managed Available Groundwater and Desired Future Conditions value is accordance with the requirements of Chapter 36 of the Texas Water Code and Texas Administrative Code Title 31 Section 356.

Performance Standard: This Management Goal is not applicable at the time this management plan was prepared because the member districts of Groundwater Management Area 4 had not determined the desired future conditions, and therefore, the Managed Available Groundwater could not be calculated.

The District shall participate with other members of Groundwater Management Area 4 and shall work with the Texas Water Development Board and others in determining the amount of Managed Available Groundwater and Desired Future Conditions within the District prior to September 1, 2010.

3. Methodology the District Will Use to Track Progress on an Annual Basis in Achieving Management Goals.

The District shall prepare an annual report summarizing District activities to be approved by the Board of Directors during the first quarter of each year. A newsletter will be mailed to all validation and operational permit holders, and the newsletter will contain a summary of the annual report and various conservation information.

4. Actions, Procedures, Performance, and Avoidance

The District will implement and utilize the provisions of this plan as guidelines for determining the direction of District activities. Operations of the District, all agreements entered into by the District, and any additional planning activities in which the District may participate will be consistent with this plan and with the District's rules.

5. Estimates of Desired Future Conditions, Supply, Demand, Recharge and Other Information

5.1. Desired Future Conditions

The desired future condition for the groundwater management area has not yet been established in accordance with Chapter 36.108 of the Texas Water Code. The District is actively participating in the joint planning process and the development of a desired future condition for the aquifer within the District and the groundwater management area.

Chapter 36.108 Texas Water Code instructs the District to meet annually with other groundwater conservation district in Groundwater Management Area 4 to conduct joint planning and to review the management plans and accomplishments for the management area.

As of the date of the adoption of this plan, the desired future condition of the aquifers in Groundwater Management Area 4 has not been established in accordance with Chapter 36.108 of the Texas Water Code. The districts may establish different desired future conditions for each aquifer, or each geographic area overlying an aquifer in whole or in part or subdivision of an aquifer within the boundaries of the management area. Other districts included in the groundwater management area include:

- Brewster County Groundwater Conservation District
- Culberson County Groundwater Conservation District
- Jeff Davis County Underground Water Conservation District

- Presidio County Underground Water Conservation District

No later than September 1, 2010, and every five years after, the member Districts must consider groundwater availability models and other data or information for the management area and must establish desired future conditions for the relevant aquifers within the management area.

5.2. Managed Available Groundwater

At the time this management plan was prepared, the member districts of Groundwater Management Area 4 had not determined the desired future conditions, and therefore, the Managed Available Groundwater could not be calculated. This plan will be revised to reflect Groundwater Management Area 4 determinations when such determinations are final.

5.3. Long-Term Average Amount of Useable Groundwater

The best available information suggests that 63,000 acre-feet per year is the long-term average amount of groundwater available for consumptive use or transfer from the District from the Bone Spring-Victorio Peak aquifer (Ashworth, 1994, 2002), (Mace, 2001).

5.4. Amount of Groundwater being Used

Appendix B contains a report by Blair (2003) to the Far West Texas Regional Water Planning Group and the Texas Department regarding the amount of irrigated land and groundwater use in Hudspeth County. Irrigation water use makes up over 99% of the water use in Hudspeth County and in the District. Blair (2003) compared the USDA-NRCS and TWDB estimates of irrigation water use based on farmer interviews, satellite and aerial photographs, USDA-FSA records, and surface water delivery records for crops irrigated in Hudspeth County Conservation and Reclamation District No. 1 (Ft. Hancock). This report shows that the amount of irrigated land and water use estimated by the USDA-NRCS and TWDB for 2000 to be greater than actually occurred. Much of the error was a result of over-estimation of the amount of alfalfa grown in Hudspeth County. Table 1 below shows the estimated groundwater use for the District in 2000 (99,367 acre-feet).

Table 1 – 2000 Groundwater Use for Irrigation in HCUWCD and Diablo Farms

	HCUWCD			Diablo Farms			Total	
Crop	acres	ac-in/ac	ac-ft	acres	ac-in/ac	ac-ft	acres	ac-ft
Cotton	0	0	0	0	0	0	0	0
Silage	1,000	36	3,000	0	0	0	1,000	3,000
Corn	600	36	1,800	0	0	0	600	1,800
Grain	2,000	36	6,000	0	0	0	2,000	6,000
Alfalfa	16,000	60	80,000	830	60	4,150	16,830	84,150
Chile	2,000	40	6,667	0	0	0	2,000	6,667
Pasture	800	24	1,600	0	0	0	800	1,600
Vineyard	150	24	300	0	0	0	150	300
Totals	22,550	53	99,367	830	60	4,150	23,380	103,517

The District requires by rule that all groundwater pumped under validation or operation permits must be metered. The District has issued approximately 55 Validation Permits which, identify approximately 260 irrigation wells for which groundwater can be pumped. Approximately 120 of the irrigation wells identified in the Validation Permits are not equipped with a pump and thus are not required to have flow meters. Of the remaining 140 irrigation wells that are equipped with a pump, meter reading reports have been received by the District for 132 wells. The District is pursuing administrative action to obtain the meter readings for the 8 wells for which no report was submitted to the District.

The values of the amount of groundwater pumped for 28 of 132 wells is under review by the District and additional information is being requested from the owners of these wells.

The reported amount of groundwater production for 2006 from 104 wells (132 less 28) is equal to approximately 56,000 acre-feet. The total production of groundwater is estimated to be 75,000 acre-feet (56,000 x 140 / 104). Domestic, Livestock, and Municipal use is estimated to be less than 500 acre-feet.

The total amount of acreage that was irrigated in 2006 in Hudspeth County was not reported by USDA, but based on interviews with local farmers and analysis of satellite imagery (USGS Landsat7 Image for June 4, 2006) the District estimates that approximately 15,396 acres of land was irrigated within the District in 2006. The large majority of the irrigated land was used for production of alfalfa hay. For 2006, the average water use per acre of irrigated land was 4.9 acre-feet per acre (75,000 / 15,396) and the average water use per acre of land recognized in validation permits (approximately 34,000 acres) was 2.2 acre-feet per acre.

5.5. Amount of Recharge from Precipitation

Appendix C contains a copy of the TWDB GTA Aquifer Assessment Report 07-02. The results of the report state that:

> The annual amount of recharge from precipitation is estimated at 0.007 inches/year, which equates to 337 acre-feet of water over the 571,300-acre area of the district (Figure 1 [in Appendix C]).

5.6. Volume of Water that Discharges from the Aquifer to Springs and Surface Water

Historically, water from the Bone Springs-Victorio Peak Aquifer discharged to the Alkali Lakes in the Crow Flat portions of the Salt Basin. The exact date that such discharge stopped is not known but was assumed to have occurred prior to 1970. Currently there is no known spring flow from the aquifer.

Appendix C contains a copy of the TWDB GTA Aquifer Assessment Report 07-02. The results of the report state that:

> An estimate of the annual volume of water that discharges naturally from the Bone Spring-Victorio Peak aquifer is essentially 0 acre-feet per year (see discussion [in Appendix C]).

5.7. Volume of Flow Into and Out of the District

There is only one aquifer in the district and it is in a closed basin. The estimate of the annual volume of flow into and out of each aquifer, by definition, is zero. Appendix C contains a copy of the TWDB GTA Aquifer Assessment Report 07-02. The results of the report state that:

> An estimate of the annual volume of water that discharges due to pumping for irrigation from the Bone Spring-Victorio Peak aquifer is about 100,000 acre-feet per year (Blair, 2003). Some 35,000 acre-feet of that groundwater returns annually to the aquifer during irrigation (Logan, 1984).
>
> We estimate a groundwater inflow of about 65,000 acre-feet per year.

5.8. Projected Surface Water Supply

As required by 31 TAC §356.5(a) and obtained from the 2006 Far West Texas Regional Water Plan Table 3.1 as adopted in the 2007 State Water Plan, the projected surface water supplies available in the District for years 2010 through 2060 is zero. There are three recharge and flood control dams located within the District that do capture storm runoff, but during the drought-of-record the estimated amount of runoff is zero.

5.9. Projected Total Demand for Water

The 2006 Far West Texas Regional Water Plan (Regional Plan) incorporates by reference portions of the 2001 Far West Texas Regional Water Plan. Table 5 in the 2001 Plan lists the projected water supply from the Texas portion of the Bone Spring-Victorio aquifer for the year 2010 as 140,077 acre-feet. The Texas portion of Bone Spring-Victorio Peak aquifer extends outside of the District's boundaries and a negligible portion of the projected water supply may be from wells located outside the boundaries of the District. Section 3.7.3.4 of the Regional Plan states the 140,077 acre-feet of groundwater withdrawals from the Bone Spring-Victorio Peak aquifer could only be maintained "for one season" during times of drought without risking the encroachment of highly saline groundwater from the Salt Flats. Furthermore, the Regional Plan reports the following:

> The Bone Spring-Victorio Peak aquifer should remain viable in the future if total withdrawals do not exceed approximately 100,000 acre-feet per year (see Section 1.1.6.3, Agricultural Use of Groundwater, Executive Summary in the Regional Plan); and the amount of water available on an annual basis in the Dell Valley region is related to rates of water level decline and water quality, and that annual withdrawal of 90,000 to 100,000 acre-feet could be maintained without lowering the water table so much it will induce the flow of saline water from Salt Flats (see Section 3.7.3.4, Availability in the Regional Plan).

The Regional Plan in developing its recommended water supply strategies stated the following for Strategy # 71-6B:

> Because there is limited storage potential in the Dell Valley aquifer system, total maximum groundwater production needs to be equivalent with recharge in order to maintain a balance. If total groundwater production exceeds the available recharge, water will be drawn from aquifer storage and water level declines will occur.

The three areas that make up over 99% of the irrigated area of Hudspeth County are the Hudspeth County Underground Water Conservation District (HCUWCD), the Hudspeth County Conservation and Reclamation District (HCCRD), and private land farmed in the Salt Lake area of Hudspeth County (Diablo Farms and others). Table 2 below, from Blair (2003), shows the estimated amount of irrigated land and the water use for these three areas.

Table 2: Estimated Water Use for Irrigation in Hudspeth County, Texas for the Year 2000.

Location	Approximate Irrigable Acreage	Average Irrigated Acres	Estiamted Water Use
HCUWCD (Dell Valley)	38,161	22,550	99,367
HCCRD (El Paso Valley)	18,250	15,404	82,967
Other (Diablo Farms)	5,000	830	4,150
Total	**61,411**	**38,784**	**186,484**

As required by 31 TAC §356.5(a), the projected water demands from the Far West Texas Regional Water Plan that are incorporated into the 2007 State Water Plan are listed in Table 3 and 4. Since the District does not cover all of Hudspeth County, county-wide data are not representative data for the District. The data, with the exception to data for irrigation, in Table 4 have been proportionally adjusted based upon District area coverage relative to the total county area and are more representative of the projected District water demands. The area within the District is approximately 19.62 percent or 0.1962 of the total area of Hudspeth County.

Table 3. Projected Water Demands for Hudspeth County. All values are in acre-feet per year.

Water User Group	County	River Basin	2000	2010	2020	2030	2040	2050	2060
Sierra Blanca	Hudspeth	Rio Grande	110	125	136	142	142	142	142
County Other	Hudspeth	Rio Grande	264	302	328	341	341	341	341
Manufacturing	Hudspeth	Rio Grande	2	2	2	2	2	2	2
Irrigation	Hudspeth	Rio Grande	186,494	182,627	178,840	175,132	171,501	167,945	164,463
Livestock	Hudspeth	Rio Grande	613	613	613	613	613	613	613
Mining	Hudspeth	Rio Grande	1	1	1	1	1	1	1
Total Projected Water Demands			**187,484**	**183,670**	**179,920**	**176,231**	**172,600**	**169,044**	**165,562**

Table 4. Adjusted Water Demands Data (HCUWCD). All values are in acre-feet per year.

Water User Group	County	River Basin	2000	2010	2020	2030	2040	2050	2060
County Other	Hudspeth	Rio Grande	52	59	64	67	67	67	67
Manufacturing	Hudspeth	Rio Grande	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Irrigation	Hudspeth	Rio Grande	99,367	97,307	95,289	93,313	91,378	89,484	87,629
Livestock	Hudspeth	Rio Grande	120	120	120	120	120	120	120
Mining	Hudspeth	Rio Grande	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Projected Water Demands			**99,540**	**97,486**	**95,473**	**93,501**	**91,566**	**89,671**	**87,816**

6. Consideration of Water Supply Needs and Water Management Strategies

As required by 31 TAC §356.5(a) and obtained from the 2006 Far West Texas Regional Water Plan information as adopted in the 2007 State Water Plan, consideration of water supply needs and water management strategies for the District include the following strategies:

- Volumetric Measurement of Water Use
- On-Farm Irrigation Audits
- Land Leveling
- Replacement of Irrigation Ditches with Pipelines
- Low Pressure Center Pivot Irrigation Systems

The large majority of irrigated land in the District is planted with alfalfa for hay production. Hay production requires repetitive field operations of irrigation, cutting or windrowing, raking, and bailing. The harvest operations are dependent on the alfalfa leaf area being relatively dry and the moisture of the cut hay must be optimal for bailing (not too dry and not too wet). This sequence of irrigation, cutting, raking, and bailing is typically repeated 5 to 8 times per year. Because the scheduling of these harvest operations take priority over crop water requirements, irrigation scheduling is seldom used in alfalfa hay production, and thus is not a useful conservation strategy for the District. Similarly, because alfalfa is a multi-year crop (3 to 6 years) between replanting, conservation tillage is of limited value for alfalfa production.

The majority of the irrigated land within the District is irrigated using low pressure center pivots. Currently, only high value crops in the District, such as grapes, are irrigated using

drip irrigation. Several farms in the far south west area of New Mexico and eastern area of Arizona are using subsurface drip irrigation for alfalfa production. The irrigation water quality at these locations typically much higher (less salt) than the quality of the groundwater in the District. Nonetheless, some potential exists within the District for increasing the amount of drip irrigation.

7. How Annual Amount of Recharge May Be Increased

The annual recharge to the aquifer increases with the quantity of annual precipitation that occurs over the recharge zone of the Bone Spring-Victorio Peak aquifer (primarily in the Sacramento mountain range in southern New Mexico). Precipitation and recharge might be increased through weather modification over the recharge zone. No plans are contemplated by the District to attempt to increase the rainfall over the recharge zone.

8. Time Period for this Plan

This plan becomes effective upon certification by the Texas Water Development Board and approval by the District's Board of Directors and remains in effect until August 13, 2012. The District's Board of Directors shall readopt the plan with or without revisions at least once every five years.

9. Certified Copy of District Resolution Adopting Plan

A certified copy of the District Resolution adopting this Management Plan is attached as Appendix D.

10. Evidence of Notice and Hearing Regarding Plan

A hearing notice was published in the Hudspeth County Herald, in a newspaper of general circulation in Hudspeth County, Texas, on the 26th day of July 2007 and a copy of such notice is attached as Appendix E.

11. Evidence of Coordination with Surface Water Entity

There are no surface water entities (as defined in 31 TAC §356.2) or identified in the 2007 State Water Plan that are located within the District's boundaries.

12. Sharing with Regional Water Planning Group

Below is a copy of the transmittal letter for the copy of the plan that was sent by certified mail to the Chair of the Far West Regional Water Planning Group requesting the group's comments regarding this Management Plan.

13. References

Ashworth, John, (1995), Ground-water resources of the Bone Spring-Victorio Peak Aquifer in the Dell Valley Area, Texas, Texas Water Development Board Report No. 344, Austin, Texas, 43 pg.

Mace, Robert, et al (2001), Aquifers of West Texas, Texas Water Development Board Report No. 356, Austin, Texas, pg.135-152.

Ashworth, John, (2002a), January 21, 2002 E-mail to A.W. Blair regarding the recharge of the Bone Spring-Victorio Peak Aquifer. (available from HCUWCD No. 1)

Blair, A.W., (2002b), January 28, 2002 Memorandum to HCUWCD No. 1 Board of Directors regarding consumptive irrigation requirements and groundwater withdrawal in the District. (available from HCUWCD No. 1)

Blair, A.W., (2003), April 28, 2003 as revised on May 5, 2003. Report to the Far West Texas Regional Water Planning Group and the Texas Water Development Board. "Determination of Acres of Irrigated Land and Irrigation Water Use for the Year 2000 in Hudspeth County Texas.

Far West Texas Regional Water Plan, 2006, Rio Grande Council of Governments, http://www.riocog.org/EnvSvcs/FWTWPG/publishe.htm

Far West Texas Regional Water Plan, 2001, Rio Grande Council of Governments, http://www.twdb.state.tx.us/rwp/e/PDFs/

Mayer, J.R., (1995), The role of fractures in regional groundwater flow: Field evidence and model results from the basin-and-range of Texas and New Mexico, M.S. Thesis from University of Texas, Austin.

Logan, H.H., (1984), A groundwater recharge project associated with a flood protection plan in Hudspeth County, Texas, Master Thesis – Texas Christian University, 110 pg. (as cited in Ashworth, 1995).

Davis, M.E. and Leggat, E.R., (1965), Reconnaissance investigation of the groundwater resources of the upper Rio Grande Basin, Texas, Texas Water Commission Bulletin 6502, 99 pg (as cited in Ashworth, 1995).

Appendix A – Title 31 Section 356.5 of the Texas Administrative Code

(a) The management plan shall contain the following elements. If the management plan does not contain one or more of the listed elements, it must explain how the required element is either inappropriate or not cost-effective:

(1) management goals:

(A) providing the most efficient use of groundwater;

(B) controlling and preventing waste of groundwater, which may include the waste of groundwater through contamination induced by abandoned oil and gas wells, abandoned water wells, leaking pipelines, and other sources;

(C) controlling and preventing subsidence;

(D) addressing conjunctive surface water management issues;

(E) addressing natural resource issues which impact the use and availability of groundwater, and which are impacted by the use of groundwater;

(F) addressing drought conditions;

(G) addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective; and

(H) addressing, in a quantitative manner, the desired future conditions of the groundwater resources selected pursuant to §36.108, Water Code, provided such desired future conditions have been identified at the time the management plan is submitted to the board for approval;

(2) management objectives that the district will use to achieve the management goals in paragraph (1) of this subsection. Management objectives are specific, quantifiable, and time-based statements of desired future accomplishments or outcomes, each linked to a management goal, which set the individual priority for district strategies. Each desired future accomplishment or outcome must be the result of actions that can be taken by district staff or assigns;

(3) performance standards for each management objective. Performance standards are indicators or measures used to evaluate the effectiveness and efficiency of district activities by quantifying the results of actions. Evaluation of the effectiveness of district activities measures the accomplishments of the district. Evaluation of the efficiency of district activities measures how well resources are used to produce an output, such as the amount of resources devoted per unit of accomplishment;

(4) actions, procedures, performance, and avoidance, all specified in as much detail as practicable, necessary to effectuate the management plan, including specifications and the Internet address for all proposed rules;

(5) estimates of:

(A) managed available groundwater in the district, based on the desired future condition selected pursuant to §36.108, Water Code, provided that the desired future conditions have been identified at the time the management plan is submitted to the board for approval;

(B) the amount of groundwater being used within the district on an annual basis;

(C) the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;

(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;

(E) the annual volume of flow into and out of the district within each aquifer and between aquifers in the district, if a groundwater availability model is available;

(F) the projected surface water supply in the district according to the most recently adopted state water plan; and

(G) the projected total demand for water in the district, according to the most recently adopted state water plan;

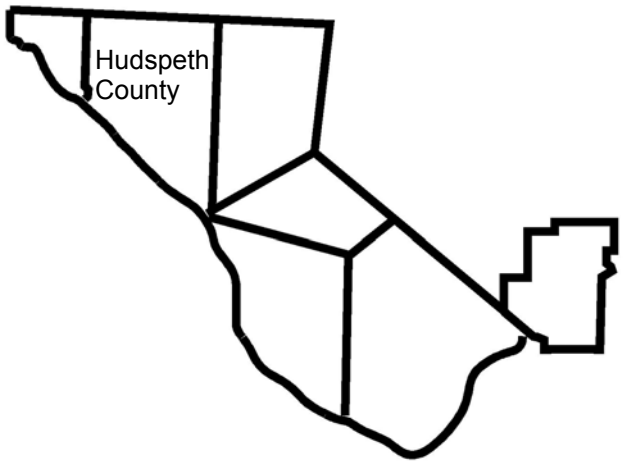
(6) details of how the district will manage groundwater supplies in the district, including a methodology by which a district will track its progress on an annual basis in achieving its management goals; and

(7) consideration of water supply needs and water management strategies included in the adopted state water plan.

(b) The management goals, performance standards and management objectives required in subsection (a)(1), (2), and (3) of this section and the actions, procedures, performance and avoidance specified in subsection (a)(4) of this section are to be established by each district based on specific needs of that district and any parameters established by joint groundwater planning under §36.108, Water Code, when completed. Each district shall use the best information available to it, including an existing groundwater management plan of the district, to make the estimates required in subsection (a) of this section and to develop the plan required by these rules, except that 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 to the executive administrator for review and comment before being used in the management plan when developing the estimates required in subsection (a)(5) of this section.

Appendix B – Blair 2003 Report Regarding Irrigated Land in Hudspeth County

Determination of Acres of Irrigated Land and Irrigation Water Use for the Year 2000 in Hudspeth County, Texas



Submitted to the: Far West Texas Regional Water Planning Group

and the Texas Water Development Board

by the

Hudspeth County Underground Water Conservation District No. 1

Dell City, Texas

and

Hudspeth County Conservation and Reclamation District No. 1

Ft. Hancock, Texas

April 28, 2003

REVISED May 5, 2003

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APPENDICES

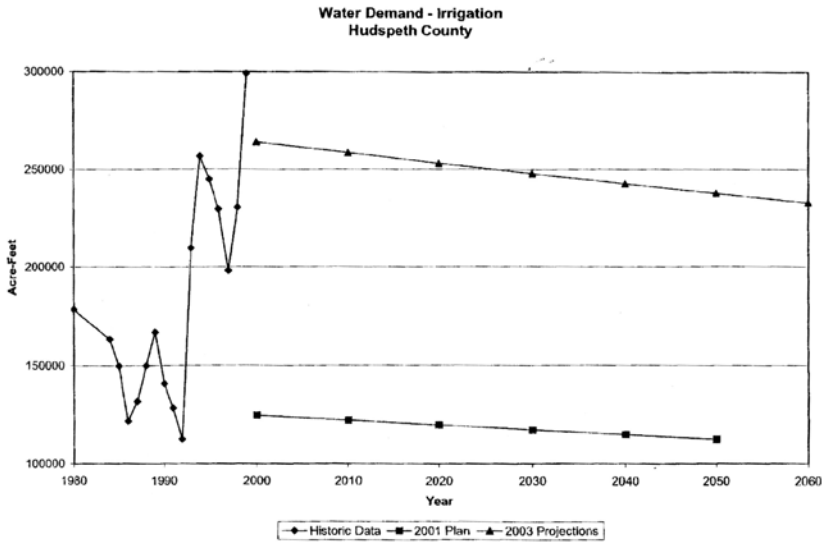
1. Introduction

This report was prepared at the request of the Hudspeth County Underground Water Conservation District No. 1 (HCUWCD) and Hudspeth County Conservation and Reclamation District No. 1 (HCCRD), together the "Districts", and was prepared in accordance with generally recognized engineering and scientific principles, practice, and methods. Specifically, this report was prepared in accordance with requirements of Section 4.2.4b Irrigation Water Demands of Exhibit B of the Texas Water Development Board Regional Planning Guidelines (Appendix A of this Report).

The author of the report, A.W. Blair, is professionally qualified in the subject matter of this report and has been designated by both District's Boards as their District Engineer. This report was prepared under the authority of each District and is submitted to the TWDB and the Far West Texas Water Planning Group as a work product of each District under their respective authorities as political subdivisions of the State of Texas as authorized under Chapter 59, Article 16 of the Texas Constitution.

Figure 1 shows the quantity of irrigation water demand during the year 2000 proposed by the TWDB for use by the Far West Texas Regional Water Planning Group. The accuracy of the numbers shown in Figure 1 is questioned by myself and staff of both Districts. The irrigation water demand shown in Figure 1 is approximately 50% greater than the quantity of water used for irrigation in Hudspeth County for the year 2000. This report was prepared using the best available data to estimate the quantities of irrigated land and irrigation water demands using direct metering of irrigation water withdrawn from aquifers or surface irrigation water delivered to farms and includes an estimate of surface conveyance losses within HCCRD.

Figure 1 – Draft "Water Demand – Irrigation Hudspeth County" from Far West Texas Regional Water Planning Group



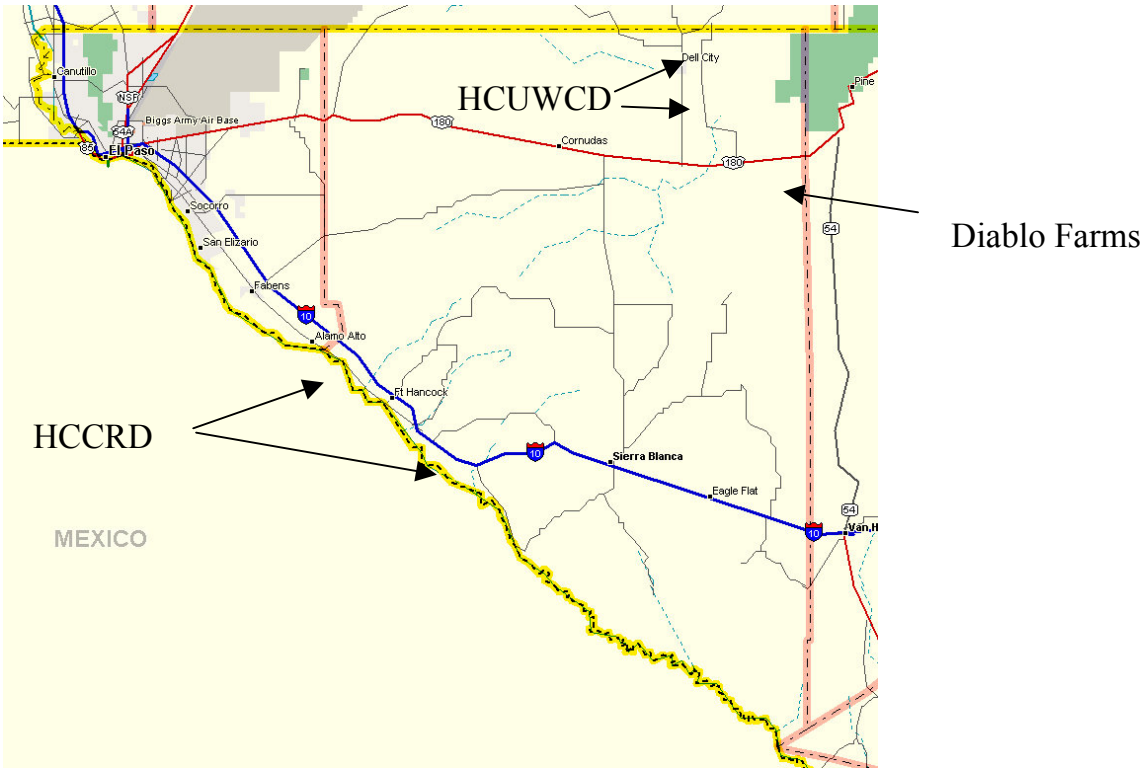
2. Irrigated Areas of Hudspeth County

In the 4,571 square miles that make up Hudspeth County, there are three geographic areas which have irrigable land that was irrigated in the year 2000:

1) a portion of the 18,250 acres of irrigable land within Hudspeth County Conservation and Reclamation District No. 1;

2) a portion of the 38,161 acres of farm land within the Hudspeth County Underground Water Conservation District No.1; and

3) a portion of the approximately 5,000 acres of Diablo Farms located near the Hudspeth/Culberson County lines in northern Hudspeth County.



Map 1 – Irrigated Areas of Hudspeth County

A small amount (less than 1,000 acres) of land outside of HCCRD and south of Ft. Quitman on the Rio Grande can be irrigated using water pumped directly from the Rio Grande. During 2000 no water was pumped for such lands. Map 1 shows the location of irrigated land within Hudspeth County.

3. NRCS 2000 Irrigation Survey

Below is a copy of the original Irrigation Survey for Hudspeth County obtained from NRCS. The two most significant errors in this survey are the quantity of acres of cotton (14,353 acres) estimated to have been irrigated using surface water and the total acres of alfalfa (35,000 acres) estimated to have been irrigated using groundwater. The original survey was modified to show a reduced number of acres of alfalfa, but an increased water use. Section 10 of this report list the best estimate of the acreage of land irrigated in Hudspeth County.

2000 IRRIGATION SURVEY

I	II	III	IV	V	VI	VII	VIII
ITEM	IRRIGATED CROP	IRRIGATED CROPS & TOTAL SEASON WATER APPLIED					
		SURFACE WATER		GROUND WATER		MIXED SW & GW	
		ACRES	IN	ACRES	IN	ACRES	IN
1	Cotton	14353	35				
2	Grain Sorghum						
3	Corn						
4	Rice						
5	Wheat						
6	Other Grain						
7	Forage Crops & Ensilage			7515	40		
8	Peanuts						
9	Soybeans						
10	Other Oil Crops						
11	Citrus						
12	Pecans						
13	Vineyard			80	30		
14	Other Orchard						
15	Alfalfa			35000	60		
16	Other Permanent Hay, Pasture						
17	Sugar Beets						
18	Irish Potatoes						
19	Vegetables (Shallow)						
20	Vegetables (Deep)			6532	40		
21	Sugarcane						
22	All Other Crops						
23	Total Crop Acres Irrigated	14353	X	49127	X	0	X
24	Acres Irrigated (From County Map)	14353	X	49127	X	0	X

Jerry Walker of NRSC State Office provided the follow comments regarding the NRSC 2000 Irrigation Survey for 2000.

After concerns were expressed last May about data NRCS provided on the Hudspeth County, 2000 Irrigation Survey, Don Ford, NRCS Zone Engineer, San Angelo, TX checked data previously submitted and found several items that required correction and/or adjustment. Please note the attached corrected 2000 Irrigation Survey data sheet. The corrected/adjusted information was provided to Mark Michon, TWDB, on July 19, 2002. Ford prepared this update based on interviews with irrigators, field office NRCS employees, and FSA staff. Ford was unable to contact the Districts for their input. Ford was informed by the FSA, County Executive Director, that a number of irrigators in the Dell City Area do not report their irrigated acres to FSA, and are not included in FSA records.

Updated NRCS 2000 Irrigation Inventory for Hudspeth County

County: HUDSPETH

2000 IRRIGATION INVENTORY

I	II	III	IV	V	VI	VII	VIII
ITEM	IRRIGATED CROP	IRRIGATED CROPS & TOTAL SEASON WATER APPLIED					
		SURFACE WATER		GROUND WATER		MIXED SUPPLY	
		ACRES	IN	ACRES	IN	ACRES	IN
1	Cotton	14353	40				
2	Grain Sorghum						
3	Corn						
4	Rice						
5	Wheat						
6	Other Grain						
7	Forage Crops & Ensillage	1000	48	6389	48		
8	Peanuts						
9	Soybeans						
10	Other Oil Crops						
11	Citrus						
12	Pecans						
13	Vineyard			80	36		
14	Other Orchard						
15	Alfalfa	1400	48	25965	66		
16	Other Permanent Hay, Pasture						
17	Sugar Beets						
18	Irish Potatoes						
19	Vegetables (Shallow)						
20	Vegetables (Deep)	500	48	4679	50		
21	Sugarcane						
22	All Other Crops						
23	Total Crop Acres Irrigated	17253	XXXXXXXX	37113	XXXXXXXX	0	XXXXXXXX
24	Acres Irrigated (From County Map)	17253	XXXXXXXX	37113	XXXXXXXX	0	XXXXXXXX

Page 1/2

4. TWDB 2000 Irrigation Survey of Hudspeth County

The table shown below contains TWDB's 2000 On-farm Irrigation Water Use Estimate for HUDSPETH County, Texas. This table was obtained from http://www.twdb.state.tx.us/assistance/conservation/ASPApps/Survey.asp. The TWDB survey is identical with the corrected NRCS report.

Crop	Acres	Ac-ft
cotton	14353	47843
grain sorghum	0	0
corn	0	0
rice	0	0
wheat	0	0
other grain	0	0
forage crops	7389	29556
peanuts	0	0
soybeans	0	0
other oil crops	0	0
citrus	0	0
pecans	0	0
vineyard	80	240
other orchard	0	0
alfalfa	27365	148408
hay-pasture	0	0
sugar beets	0	0
irish potatoes	0	0
vegetables (shallow)	0	0
vegetables (deep)	5179	21496
sugarcane	0	0
all other crops	0	0
Total	**54366**	**247543**

5. USDA – Agricultural Statistics Service Data Base Report for 2000

The USDA National Agricultural Statistics Service reported 10,000 acres of cotton and 1,400 acres of corn cropped in Hudspeth County for the year 2000. This data is available at http://www.nass.usda.gov. No cotton was grown in HCUWCD or Diablo Farms during the year 2000, so it is likely that the USDA reported numbers are for land within HCCRD.

USDA – Agricultural Statistics Service Data Base Report for 2000

Commodity	Practice	Year	State	County	District	Planted	Harvested	Yield	Yield Unit	Production	Production Unit
Corn For Grain	Total For Crop	2000	TX	Hudspeth	60	1400	300	106.7	BU	32000	BU
Cotton Amer. Pima	Irrigated	2000	TX	Hudspeth	60	2800	2800	1200	LBS	7000	BAL
Cotton Amer. Pima	Total For Crop	2000	TX	Hudspeth	60	2800	2800	1200	LBS	7000	BAL
Cotton Upland	Irrigated	2000	TX	Hudspeth	60	8600	7600	1036	LBS	16400	BAL
Cotton Upland	Total For Crop	2000	TX	Hudspeth	60	8600	7600	1036	LBS	16400	BAL

6. Methods Used for Determining Irrigated Acreage, Irrigation Water Use, and Irrigation Water Demand

A. NRCS and TWDB Estimates of Irrigation Water Demand

In determining the Irrigation Water Demand for Hudspeth County, the NRCS and TWDB Irrigation Surveys rely on estimates of the quantity of water needed to be applied to a specific crop (text book values or mathematical estimates) multiplied by the approximate number of acres irrigated as obtained from undocumented sources. NRCS provided estimated amount of water applied on the average, countywide, to each irrigated crop during the 2000 year. The total inches provided by NRCS were the estimated amount pumped and distributed to the crop (in the case of ground water), or the amount transmitted to the fields from the turnouts (surface water).

B. TWDB Regional Water Planning Guidelines

The Exhibit B of the TWDB Regional Water Planning Guidelines, states in part:

> "...irrigation water applications that are metered are the best method of determining actual use."

The methods used by the NRCS and TWDB to determine the quantity of irrigated water demand did not reflect any flow measurement records. This report uses the water used records and flow measurement records, FSA aerial photography, and LANDSAT thermal

images, and USGS DOQQ aerial photography to determine the acres of land irrigated and the quantity of water withdrawn

C. 2000 Irrigated Acreage in Hudspeth County

The amount of irrigated farm land in Hudspeth County was determined from HCCRD records, various sources of aerial and remote photography, interviews with farmers and District staff, and USDA FSA reports.

HCCRD maintains detailed records of the quantity of water delivered to irrigated lands within the District. Each delivery of surface irrigation water by the District to a farm is recorded and the duration of flow and the quantity of flow is measured. The District maintains a turn flow measurement data base of over 2,000 flow measurements. This data base is used to determine an average turn-out flow rate for each turn-out. The flow measurements are made using USGS/USBR stream gauging procedures (point velocity measurements). The quantity of water delivered to each type of crop is not recorded. HCCRD maintains approximately 18,250 acres of water rights land of which 17,975 acres are currently eligible for irrigation water. On average, less than 15,000 acres are irrigated in any give year. During 2000, Blair (2002b), the District irrigated 13,404 acres during the primary irrigation season (March through September) and approximately 2,000 acres during the winter irrigation season (October through February).

HCUWCD has recently undertaken a hydrographic survey to determine the number of existing and historic irrigated acres within the district. The survey has obtained numerous aerial photographs for the USDA FSA, reports of irrigated acres, interviews with farmers, and other data sources. The FSA reported that there are 38,161 acres of farm land within HCUWCD. Blair (2002a) estimated from aerial photographs, crop reports, and tax records that a maximum of 26,600 acres were irrigated in 2000. This report determined that 22,550 acres of land were irrigated within HCUWCD in 2000.

The quantity of irrigated land within Hudspeth County farmed by Diablo Farms during 2000 was estimated using rectified aerial photographs taken in 1999 and unrectified photographs taken in 2002.

D. Surface Irrigation Water Demand

HCCRD is the only water improvement district within Hudspeth County that delivers surface irrigation water to farm land.

A small amount (less than 1,000 acres) of land south outside of HCCRD and south of Ft. Quitman on the Rio Grande can be irrigated from pumping directly from the Rio Grande. During 2000 no water was pumped for such lands. Map 1 below shows the location of irrigated land within Hudspeth County.

E. Groundwater Irrigation Demand

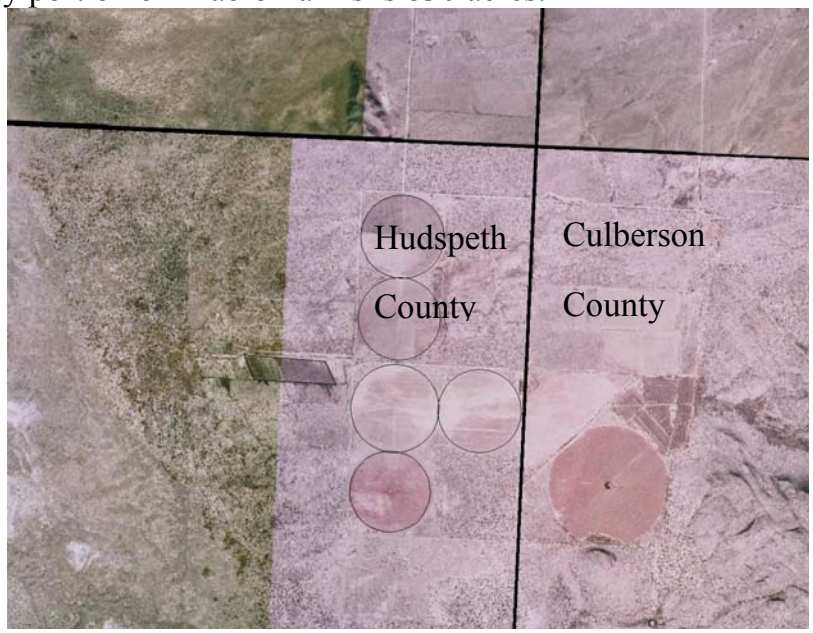
Land irrigated within HCUWCD and the Diablo Farms are the only locations of farm land within Hudspeth County that are irrigated with groundwater. During 2000, all of CL Machinery's wells within HCUWCD were metered. CL Machinery owns approximately 25% of the total quantity of irrigated land within HCUWCD. CL Machinery reported an average water use per acre of 4.0 acre-feet per acre per year in 2000.

F. Surface Water Conveyance Losses

The conveyance and operational loss of irrigation water from the Hudspeth Main Canal flowing past the Hudspeth/El Paso County line was estimated to be approximately 35% for normal water use years. Section 4.2.4b of Exhibit B of the TWDB guidelines estimates that losses range from 10 to 55% of gross quantity of surface water diverted into a typical irrigation conveyance system. Percentage loss in general is a poor "metric" for estimating conveyance losses, because losses are dependent on the duration of the cropping season, the length and type of canals and laterals, the amount of demand, and the quantity of water that can be conveyed in the system at any given time. Exact determination of HCCRD conveyance losses is beyond the scope and resources available for completion of this report.

7. Irrigated Land Within Diablo Farms, Hudspeth County

In 1999, a total of 625 acres in the five center pivots (show below) were irrigated and approximately 80 acres of land was flood irrigated. One additional 125 acre pivot may have been installed and irrigated in 2000. The estimate of the total land irrigated in 2000 in the Hudspeth County portion of Diablo Farms is 830 acres.



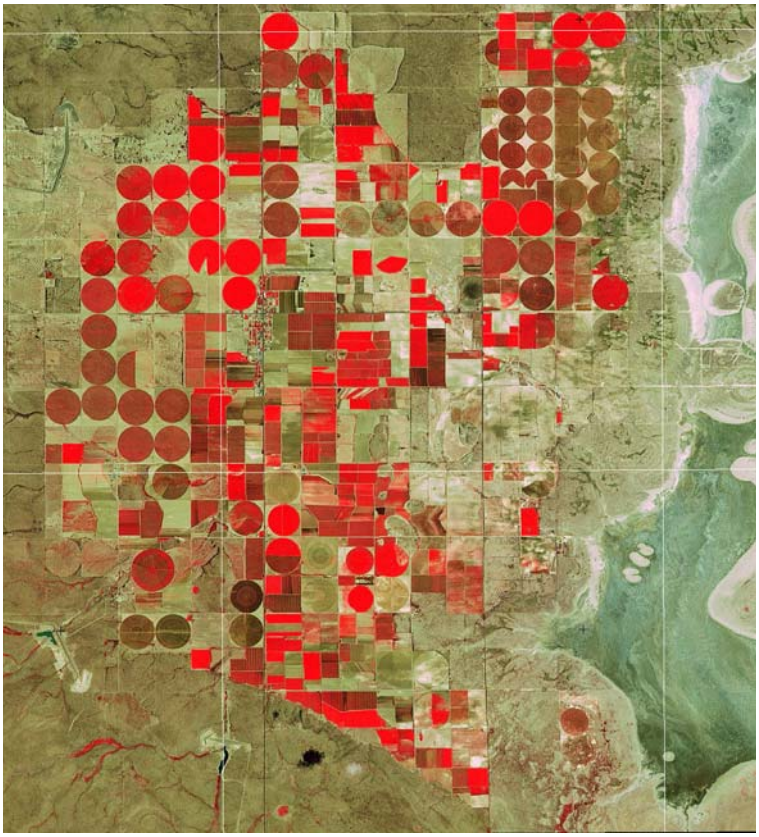
Photograph 1 - 1999 DOQ Aerial Photograph of Diablo Farms, Hudspeth Co, Texas

8. Irrigated Land and Irrigation Water Use Within HCUWCD

Table 1 below lists the amount of irrigated land within HCUWCD and the portion of Diablo Farms within Hudspeth County for the year 2000. The numbers in Table 1 were obtained from digitization of the irrigated areas shown in Photograph 2, below, from FSA reports, and from interviews with farmers.

Table 1 – HCUWCD and Diablo Farms Irrigated Land and Irrigation Water Use for 2000

	HCUWCD			Diablo Farms			Total	
Crop	acres	ac-in/ac	ac-ft	acres	ac-in/ac	ac-ft	acres	ac-ft
Cotton	0	0	0	0	0	0	0	0
Silage	1,000	36	3,000	0	0	0	1,000	3,000
Corn	600	36	1,800	0	0	0	600	1,800
Grain	2,000	36	6,000	0	0	0	2,000	6,000
Alfalfa	16,000	60	80,000	830	60	4,150	16,830	84,150
Chile	2,000	40	6,667	0	0	0	2,000	6,667
Pasture	800	24	1,600	0	0	0	800	1,600
Vineyard	150	24	300	0	0	0	150	300
Totals	22,550	53	99,367	830	60	4,150	23,380	103,517



Photograph 2 - 2000 LANDSAT Infrared Images of Irrigated Land Within HCUWCD

9. Irrigated Land and Irrigation Water Use Within HCCRD

Table 2 below lists the values reported by Blair (2002b) for the acres of irrigated land by crop type within HCCRD for the year 2000, and the total quantity of irrigation water use as measured by HCCRD staff during 2000. The HCCRD conveyance loss was estimated to be 35% of the quantity of irrigation water flowing past the El Paso/Hudspeth County line in the Hudspeth Main Canal during the primary irrigation season in 2000.

Table 2 – HCCRD Irrigated Land and Irrigation Water Use for 2000

	HCCRD acres	ac-in/ac	On Farm Metered ac-ft	Conveyance Loss ac-ft	Total ac-ft
Cotton	10,159				
Silage	1,126				
Corn	0				
Grain	0				
Alfalfa	1,444				
Chile	675				
Pasture	0				
Vineyard	0				
Total	13,404	46	50,935	27,427	78,362
Winter	2,000	18	3000	1,615	4,615
Total	15,404		53,935	29,042	82,977

10. 2000 Irrigated Land and Irrigation Water Use Within Hudspeth County, Texas

Table 3 below lists a summary of the acres of irrigated land within Hudspeth County as determined by the NRCS, the TWDB, and this report. Both the NRCS and the TWDB estimates of irrigated land are significantly greater than values in this report. The values in this report were based on direct measurements of the quantity of irrigated land using aerial photographs, LANDSAT images, FSA reports, district records, and interviews with farmers. The estimates of irrigation water use reported herein were determined from direct measurements (flow measurement) of all of the surface irrigated land and direct measurement (flow measurement) of approximately 25% of the groundwater withdrawn for irrigated agriculture in 2000 and estimates of the water demand based on irrigated crop type.

The differences between the quantity of irrigated land and water use reported in this report and those report by NRCS and adopted by the TWDB is currently being investigated. It is possible that the information NRCS relied upon from the FSA also included land that was for FSA considered planted but that no irrigation water was applied. A request has been made to the NRCS that they provide the documents that were used to make their estimates.

In accordance with Section 4.2.4.b of Exhibit B of the TWDB Guidelines for Regional Water Plants, the total irrigation water use in Hudspeth County, Texas during 2000 was determined to equal 186,494 acre-feet for which 38,784 acres of land where irrigated.

Table 3 - 2000 Irrigated Land and Irrigation Water Use Within Hudspeth County, Texas

	NRCS			TWDB			HCCRD/HCUWCD	
	acres	ac-in/ac	ac-ft	acres	ac-in/ac	ac-ft	acres	ac-ft
Cotton	14,353	35	41,863	14,353	40	47,843	10,159	
Corn	0		0	0		0	600	
Silage	0		0	0		0	2,126	
Grass Pasture	0		0	0		0	800	
Grain (Wheat/Oats)	0		0	0		0	2,000	
Forage	7,515	40	25,050	7,389	48	29,556	NA	
Alfalfa	35,000	60	175,000	27,365	65	148,408	18,274	
Vegetables (Chile)	6,532	40	21,773	5,179	50	21,496	2,675	
Winter							2,000	
Vineyard	80	30	200	80	36	240	150	
Totals	63,480	50	263,886	54,366	55	247,543	38,784	186,494

11. References

Blair, A.W., (2002a), January 28, 2002 Memorandum to HCUWCD No. 1 Board of Directors regarding consumptive irrigation requirements and groundwater withdrawal in the District. (available from HCUWCD No. 1)

Blair, A.W., (2002b), July 17, 2002, Water Conservation Plan for Hudspeth County Conservation and Reclamation District No. 1

Far West Texas Regional Water Plan, posted January 12, 2001 on the Texas Water Development Board's internet site at http://www.twdb.state.tx.us/rwp/e/

Hudspeth County Conservation and Reclamation District No. 1, 2002 Water Use Data Base Records.

Hudspeth County Appraisal District, 2002 Preliminary Tax Roll for HCUWCD No. 1.

Texas Water Development Board (2001), Surveys of Irrigation in Texas, Report 347

United States Farm Services Agency, Aerial Photograph Service, Salt Lake, Utah.

United States National Agricultural Statistical Service, 2000 Crop Land in Hudspeth County, Texas

United States Census Bureau (2002), State and County Quick Facts, Hudspeth County, Texas

Appendix A

Section 4.2.4.b of Exhibit B of TWDB's Regional Water Planning Guidelines

4.2.4.b Irrigation Water Demands

A comprehensive irrigation survey was performed in 2000 that provided up to date crop and irrigation data for consideration in making changes to the 2002 State Water Plan water demand projections. These estimates for acreage under irrigation and individual crop needs, supplied by the Natural Resource Conservation Service (NRCS), data developed in the previous two State Water Plans (1997 and 2002), and new data based on Potential Evaporation (PET), will be used for verification of baseline values and for trends.

The process of estimating irrigation demand in the Irrigation Survey is straightforward. The acreage planted for each crop under irrigation is estimated for each county. The crop water applications for each crop are estimated by NRCS and multiplied by the acreage to give total irrigation used.

Research is ongoing at TWDB to develop PET-based crop water demands, reduced by the amount of beneficial rainfall received, to be used for comparison to NRCS estimates of irrigation applications. That amount (irrigation needed) is multiplied by the irrigated acreage planted as reported by the Texas Agricultural Statistics Service (TASS).

The results are total irrigation water demands by crop for each county. These individual crop irrigation water demands are added and the county totals and regional totals are calculated. The final step is to add back in water amounts that are lost in the process of transportation to the field for crops using surface water.

Projection Methodology and Key Planning Assumptions

The 1997 State Water Plan irrigation demand projections were reviewed and revised by the Planning Groups as provided for by Senate Bill 1 and the TWDB rules for making revisions. The 2002 State Water Plan is based on the approved revisions to the 1997 State Water Plan numbers. The 2002 Plan projects a reduction of irrigation water demand of 14 percent over the period from 2000 to 2050.

Crop acreage data developed from comparing the 2000 Irrigation Survey and the 2002 State Water Plan will be used to represent cropping patterns for the 50-year planning period, unless limited by processes known to exist or anticipated to develop during this time frame. Examples such as water non-availability due to aquifer overdraft thereby reducing cropping, or farmland conversion to municipal land use are two processes that could alter cropping patterns. The rates of change for irrigation water use as projected in the 2002 State Water Plan will be largely retained. The crop water demands contained in the 2002 State Water Plan were approved by each Planning Group and reflect increased on-farm efficiencies and anticipated cropland losses.

The 2007 State Water Plan will use the 2002 State Water Plan projections as a baseline. The 2000 Irrigation Survey (completed after the 2002 projections were approved) will be used to detect changing trends in the most recent years. PET-based estimates, where available and appropriate, may also considered during the development of demand projections.

Adjustments to the 2002 State Water Plan projections will be made based on several factors. One factor is recent increases or decreases in the amount of acreage under irrigation (if the change in irrigated acreage is reasonably expected to be maintained). Another factor is increases or decreases in canal losses (for surface water diversion losses) for those counties reporting canal losses in the past

Surface Water Conveyance Losses

In 2000, 6.51 million acres of cropland were irrigated using 9.77 million acre-feet of water. Of these 6.51 million acres, 6.375 million were single cropped and 135,000 acres were double cropped. In addition to the 9.77 million acre-feet of water used on-farm, an additional amount of water was not used on-farm but should be considered in calculating irrigation needs. This "lost" water can be calculated as a percentage of surface water used on-farm. In 1995 the diversion losses were 622,043 acre-feet, representing about 19 percent of the 3.15 million acre-feet of surface water diverted or 25 percent of the 2.38 million acre-feet of surface water used on-farm. Using a similar percentage the diversion losses for 2000 can be estimated as 415,456 acre-feet (25 percent of 1,661,864). A comparison of surface water diversions (from TNRCC records) and total on-farm crop needs as determined in the 2000 Survey of Irrigation conducted for the TWDB by the NRCS can be used as a control for actual diversion losses.

Conveyance loss, also referred to as diversion loss, is the amount of water lost during the delivery of surface water from the point of diversion on the river or stream to the point of use on the farm. Surface water is typically conveyed by an open canal system, which exposes the water supply to possible loss from seepage, breaks, evaporation, and uptake by riparian vegetation. Surface water irrigation comprises about 31 percent of the total agricultural irrigation water use in Texas and occurs primarily along the upper and middle Texas Gulf Coast, along the Rio Grande, and in some areas of the Texas Hill Country. For areas of the state using surface water for irrigation, the water use estimates in 1990 and projections from 2000 to 2050 include conveyance losses. For areas of the state using groundwater for irrigation, water use estimates and projections do not include conveyance losses because groundwater is generally pumped on or near the point of use.

Although surface water irrigation represents a relatively small portion of irrigated agriculture, the loss of water through conveyance can be considerable. Estimates of loss can range between ten and 55 percent of the total amount of water diverted. Some surface water supply entities have tried to reduce water losses by making improvements to their conveyance systems. Such improvements can include repairing weaknesses in the canals, controlling vegetation, and lining the canals. These improvements can be expensive, and not all entities have the necessary capital for investment.

Because funding for capital improvement varies between entities or was uncertain in the future, the 1997 State Water Plan used the scenario that assumed that no improvements requiring capital investment would be made. It did assume conveyance loss would decline slightly as management practices improve. The 2002 State Water Plan and 2006 Regional Water Plan projections will make a similar assumption - that no significant capital improvements to canals will be made and no reduction of canal losses will be built in to the projections. Additional information relating to recent canal improvements, and planned expenditures for improvements will be gathered from communications with river authorities, water districts, and irrigation companies. A survey of all irrigation districts reporting canal losses can be made inquiring as to their expected level of diversion loss. For all counties with surface water irrigation demands, Planning Groups will be provided with information on the assumed conveyance loss separately from on-farm demand.

Limitations of the Analysis

The limitations to the methodology are the accuracy to which crop patterns may be estimated and the accuracy to which irrigation water use can be estimated for each crop. A pilot study using remote sensing in conjunction with on the ground surveys is underway in 5 counties. The remote sensing data should be more accurate as far as crop acreage is concerned.

Increased reliance on PET data may produce better estimates of irrigation need. However, irrigation water applications that are metered are the best method of determining actual use. Better use of electronic data sharing between the agencies producing the data and the TWDB would increase the reliability of the data, by reducing the chance of transcription errors. Therefore, the limiting factors for crop acreage and water use are the data collection methods.

Appendix C – TWDB GTA Aquifer Assessment 07-02

GTA Aquifer Assessment 07-02

by Peter George and Rima Petrossian, P.G.
Texas Water Development Board
Groundwater Technical Assistance Section
(512) 475-2136
June 7, 2007

REQUESTOR:

Rima Petrossian of the Texas Water Development Board on behalf of Hudspeth County Underground Water Conservation District No. 1.

DESCRIPTION OF REQUEST:

To provide estimates for the Bone Spring-Victorio Peak Aquifer for the district management plan. These estimates are the annual amount of recharge from precipitation and aquifer inflow and the annual volume of water that leaves the aquifer, both from natural discharge and from pumping.

RESULTS:

The annual amount of recharge from precipitation is estimated at .007 inches/year, which equates to 337 acre-feet of water over the 571,300-acre area of the district (Figure 1).

An estimate of the annual volume of water that discharges naturally from the Bone Spring-Victorio Peak aquifer is essentially 0 acre-feet per year (see discussion).

An estimate of the annual volume of water that discharges due to pumping for irrigation from the Bone Spring-Victorio Peak aquifer is about 100,000 acre-feet per year (Blair, 2003). Some 35,000 acre-feet of that groundwater returns annually to the aquifer during irrigation (Logan, 1984).

We estimate a groundwater inflow of about 65,000 acre-feet per year.

DISCUSSION:

The value .007 inches/year (.018 cm per year), is an estimate of recharge for the Diablo Plateau/Otero Mesa area based largely on soil chloride profiles (Kreitler et al., 1987; Mayer, 1998). This number was multiplied by 571,300 acres (area of the Hudspeth County Groundwater Conservation District) to arrive at the annual volume of distributed recharge (337 acre-feet) rounded to two significant figures.

This value of recharge is only for the Bone Spring-Victorio Peak Aquifer in the District and does not include return flows from irrigation.

The annual volume of water that discharged naturally from the Bone Spring-Victorio Peak Aquifer, prior to irrigation, has been estimated at about 100,000 acre-feet per year (Ashworth, 1995). Since the late 1940s, pumping has been the main means of discharge for the aquifer. A present water-level map of the Dell City area suggests little natural discharge relative to artificial discharge from pumping (George et al., 2005).

According to Texas Water Development Board estimates, the total annual amount of groundwater pumped from the Bone Spring-Victorio Peak Aquifer between the years of 1980 and 2003 ranged from as low of 38,000 acre-ft to as high as about 229,000 acre-ft. A recent study suggests that groundwater use for irrigation in Hudspeth County Underground Water Conservation District No. 1 is not as great as suggested by most of these estimates. Blair (2003), based on lower numbers for irrigated acreage, estimated irrigation water use in 2000 at about 103,000 acre-ft for the district. Return flow from irrigation has been estimated at 35 percent (Logan, 1984). Assuming annual pumpage of 100,000 acre-feet means about 35,000 acre feet is reintroduced to the aquifer beneath irrigated areas.

The large amount of groundwater that is pumped from the aquifer and the corresponding small volume of recharge from precipitation require a large volume of water to enter the Dell City area each year. Based on work in New Mexico to the north, we suggest that as much as 65,000 acre-feet of groundwater enters the area along a fracture zone that extends between Dell City and the Sacramento Mountains to the northwest (Mayer, 1995; Mayer and Sharp, 1998).

STIPULATIONS:

The values presented here for annual recharge and discharge are estimates. The pumpage volume is probably the most accurate, that is the 100,000 acre-feet per year value. The amount of recharge, both from precipitation and natural inflow, is not based on extensive research in the local area. There is also an uncertainty as to how much water is flowing out of the area in the subsurface. Groundwater from the Diablo Plateau may be discharging by interbasin flow beneath the salt flats through Permian carbonates and eventually discharge to the Balmorhea area or the Cenozoic Pecos Alluvium aquifer in Pecos County (Nielson and Sharp, 1985; Kreitler and others, 1990). Kreitler and others (1990) suggest that groundwater flow is forced beneath low permeability evaporites and Quaternary sediments in the Salt Basin to Permian strata.

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Ashworth, J.B., 1995, Ground-water resources of the Bone Spring-Victorio Peak aquifer in the Dell Valley Area, Texas: Texas Water Development Board Report 344, 42 p.

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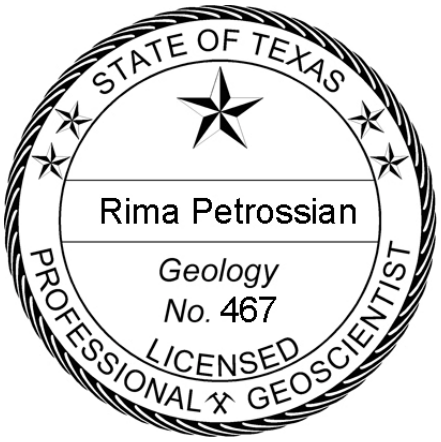

The seal appearing on this document was authorized by Rima Petrossian, P.G. on June 21, 2007.

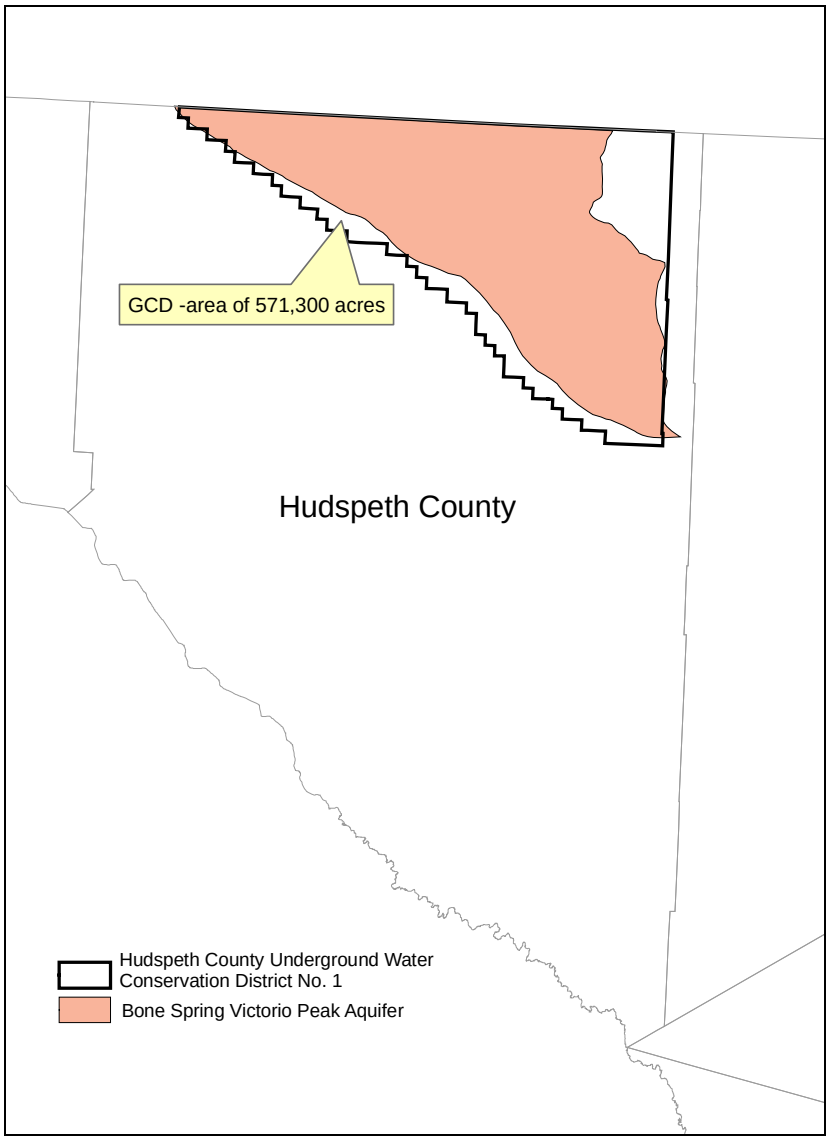

Figure 1. Location and extent of the Hudspeth County Underground Water Conservation District No. 1.

Appendix D – Copy of Resolution Adopting Management Plan

Resolution of the

Hudspeth County Underground Water Conservation District No. 1

(the District)

Whereas, the District in accordance with Chapter 36 of the Texas Water Code has provided public notice of hearing regarding amendment and adoption of the District's Groundwater Management Plan;

Whereas, the District has held three public meetings soliciting public comments regarding the proposed draft amended management plan and a quorum of the board was present for all hearings;

Whereas, copies of all written comments regarding the proposed management plan have been provided to each of the District's Board Members;

Therefore, on the November 13, 2007, the Board of Directors adopted the proposed management plan, as amended, and shall send a copy of the plan to the Texas Water Development Board for certification, to the Chair of the Far West Texas Water Planning Group, and to the general managers of each of the groundwater districts within Groundwater Management Area 4 of Texas.

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Talley Davis, President

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Attest: Phyllis Gentry, Secretary

Appendix E – Notice of Hearing