NATURAL RESOURCES

At the request of the TCEQ, an evaluation of selected natural resources in the study area was conducted by the Texas Parks and Wildlife Department (TPWD) in 2004. Most information presented in this section was obtained from TPWD's 2004 report prepared by El-Hage (2004). The remaining information has been obtained from the Region E Regional Water Plan (FWTRWPG, 2001), Brune (1981), and the Handbook of Texas Online (2005b) .

Designated Natural Areas

The Guadalupe Mountains National Park (Figure 1) is located in Hudspeth and Culberson counties in Texas and extends into New Mexico. Other natural areas include the Sierra Diablo Wildlife Management Area (only a small area of the 11,625 acres lies within Hudspeth County) and the Sierra Blanca and Eagle mountains (Figure 1). None of these areas include water-based recreation facilities other than bird-watching.

Springs

In his 1981 publication "Springs of Texas", Volume 1, Gunnar Brune divided springs into seven classes: very large; large; moderately large; medium; small; very small; and seeps. Brune indicated there were no springs in Hudspeth County that fell with the range of the moderately large to very large classes. Eight of the springs in the study area are seeps, two have very small flows, four have small flows, and two have medium flows (Mesquite and Indian Hot Springs)(Brune,1981). The Indian Hot Springs, a cluster of seven geothermal springs with high dissolved solids, are on the Rio Grande twenty-five miles south of Sierra Blanca in southern Hudspeth County. This area is at the southern extension of the Hueco Bolson along the Caballo Fault. Temperatures of the springs range from 27° C (81° F) to 47° C (117° F). Currently, rock and wood "bathhouses" or rock "tubs" have been constructed around the springs. Indian Hot Springs is now privately owned, and it was listed on the National Register of Historic Places in 1991 (Handbook of Texas Online, 2005b).

Brune (1981) also identified the location of a number of former springs. Human activities, mainly overgrazing and well pumping, have led to the decline and failure of many of these springs. These springs have also ceased to flow due to diminished recharge capacity associated with drought.

Rio Grande

The Rio Grande originates in the San Juan Mountains in southwestern Colorado flowing southward passing through the cities of Albuquerque and Las Cruces in New Mexico turning southeasterly at the City of El Paso in Texas. The river forms the international boundary between the Mexican states of Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, and the state of Texas. The total length of the river is approximately 1,896 miles with 1,248 miles making up the international boundary between Texas and Mexico. From El Paso to Fort Quitman, flow in the river consists of treated municipal wastewater from El paso, untreated municipal wastewater from Juarez, and irrigation return flow (FWTRWPG, 2001). The flow below the El Paso-Hudspeth county-line, consists primarily of return flow and occasional flood water run-off from adjacent areas. The channel losses in the stretch of the river from below Fort Quitman, in Hudspeth County, to the confluence with the Rio Conchos in Mexico, upstream of the City of Presidio, in Brewster County, often results in the river being dry. The Rio Conchos is the only significant tributary between Elephant Butte Reservoir in New Mexico and the City of Presidio (FWTRWPG, 2001).

In 1998, the stretch of the Rio Grande from El Paso to Laredo was designated as an American Heritage River (AHR) under Executive Order 13061. The Rio Grande was among the original ten rivers to receive this federal designation during the first phase of the AHR initiative. The goals of the initiative include economic revitalization, natural resource and environmental protection, and historic and cultural preservation (El-Hage, 2004).

Water-Dependent Fauna and Stream Segments with Significant Natural Resources

El-Hage (2004) reported that the development of agriculture and the population growth along the Rio Grande has resulted in a marked decrease in the Rio Grande water quality and quantity. This degradation of the river has had an adverse effect on the range and distribution of many fish species. There are approximately 15 fish species, five toad and one frog species, and three species of turtles that are primarily aquatic. Water-dependent mammals in the region include most bats, raccoons, nutria, beaver, muskrats, and probably others. There are 505 bird species occurring within the Trans-Pecos ecoregion of Texas.

Five species of fish that were once present in this region are now either extinct or extirpated from this area. The Rio Grande Shiner (extirpated from the area) is believed to have been a common fish in this area prior to the man-induced reduction in water quantity. Other rare species occur or potentially occur in Hudspeth County in association with aquatic habits. Examples include the common black hawk (federally- and state-listed threatened), southwestern willow flycatcher, yellow-billed cuckoo, Pecos River muskrat, Yuma myotis bat, Big Bend Slider, and the Chihuahuan mud. In addition to the common black hawk, there are five other species of birds either federally- or state-listed as endangered or threatened in the area. There are two species of mammals in Hudspeth County either federally- or state-listed as endangered or threatened, and four species of reptiles state-listed as threatened (El-Hage, 2004).

According to state law, a Regional Water Planning Group may recommend legislative designation of river or stream segments within the region as ecologically unique. The qualities influencing the potential for listing a stream segment as ecologically unique include, but are not limited to: 1) biological function; 2) hydrological function; 3) location with respect to conservation areas; 4) water quality; and, 5) the presence of state or federally listed threatened or endangered species and the critical habitat for such species.

In reviewing the provisions of Senate Bill 1, the Region E Water Planning Group concluded the consequences of designating a stream segment as ecologically unique is unclear. Due to the regulatory protection of these sites by other agencies and laws and also because the subsequent ramifications of designation are unknown, representatives of the Region E Water Planning Area have chosen to not submit a list of potential ecologically unique river or stream segments in the region until the state legislature clarifies the actions associated with designation (FWTRWPG, 2001). However, the Region Water Planning group states there are eighteen endangered species of mussels in the Rio Grande and the Pecos River.

Agriculture and Farmland

Currently, ranching is the major agronomic enterprise in Hudspeth County. According to the United States Department Agriculture, the cattle and calves inventory for Hudspeth County, in 2002, was 22,291 head dropping from 32,811 in 1997. In 2002, the sheep and lambs inventory was 1,006 (USDA, 2005). There are two irrigated farming valleys within the county, the Dell Valley around the area of Dell City and the Rio Grande Valley in the area around Fort Hancock. The major crops grown in these areas are

cotton, alfalfa, and vegetables (TCE, 2005). In the early 1980s, Hudspeth County ranked second in the state in production of American pima cotton and ninth in the production of hay and cantaloupes; other principal crops included sorghum, tomatoes, watermelons, peaches, and pecans (Handbook of Texas Online, 2005a).

Hudspeth County irrigation water demand is the second highest, behind El Paso County, in the Far West Texas Region. Most of the irrigation from groundwater occurs within the Dell City area. Along the Rio Grande, all irrigation water is diverted from the river, except during years when flow in the river is significantly below normal (FWTRWPG, 2001). In 2000, there was a total of 54,366 acres irrigated with 247,542 acre-feet of water. Of that acreage, 17,253 acres was irrigated with 59,443 acre-feet of surface water and 37,113 acres with 188,099 acre-feet of groundwater (TWDB, 2001). However, the TWDB Water Uses Section estimated irrigation use, in 2000, to be 222,023 acre-feet from groundwater and 41,863 acre-feet from surface water (George and others, 2005). In addition to these estimations, a study by Blair (2003) estimated that 103,000 acre-feet of groundwater was used for irrigation.

Water-Related Threats to Natural Resources

Stresses on the different ecosystems come not just from the number of people, but also from their location, and in the nature and scale of their activities. The population for Hudspeth County is not expected to increase much over the 25-year study period. However, the population of El Paso County is expected to exceed 1.4 million by 2060. In the future, it is El Paso that may impose an ever increasing demand and pressure on water resources in the study area (El-Hage, 2004).

Within the Hudspeth County study area, there are currently 48 species federally-listed, being considered for federal-listing, or state-listed as endangered, threatened, or rare. Listed species do not share the same probability of occurrence in the area. Some are migrants or wintering residents only, while others are year-round residents. Though native plant and wildlife resources have adapted to withstand aridity of the region, the availability of water can be a critical element in the health of the ecosystem (El-Hage, 2004).

STATE-OWNED LANDS

The state owns approximately 1,241 square miles or over 27 percent of Hudspeth County. This section describes the state-owned Permanent University Fund and Permanent School Fund lands. The development of water resources on these state-owned lands could radically change the future water availability to the citizens of the study area. The amount of pumpage, the exact location of where pumpage will occur, and the potential effect of pumping from state-owned lands is unknown at this time.

Permanent University Fund Lands

University Lands - West Texas Operations, under the direction of the Office of Business Affairs, is responsible for managing the Permanent University Fund (PUF) lands and the Trust Minerals. The PUF lands were created on January 26, 1839, when approximately 220,000 acres of land were set aside from the public domain by the Republic of Texas for the establishment and endowment of a university. The State of Texas Constitution of 1876 called for the creation of the University of Texas and appropriated one million acres of land for the establishment of a Permanent University Fund. An additional one million acres were added to the PUF in 1883. These lands constitute the bulk of what is commonly referred to as University Lands. Now totaling approximately 2.1 million acres, most of this land is located in the West Texas counties of Andrews, Crane, Crockett, Culberson, Dawson, Ector, El Paso, Gaines, Hudspeth, Irion, Loving, Martin, Pecos, Reagan, Schleicher, Terrell, Upton, Ward and Winkler (University of Texas System, 2005).

The University of Texas Land System currently owns and manages a contiguous 493,405 acre tract (approximately 771 square miles) in the northern part of Hudspeth County (Figure 10). Grazing and hunting are the primary uses for these lands. A very small portion (a total 111 acres) are used commercially for microwave and radio tower sites and pipeline pump stations. Nineteen pipelines cross these lands transporting oil and gas, refined and unrefined. No surface water exists and groundwater use is in minor quantities normally associated with ranching and domestic activities. There are currently no plans to irrigate or add additional industry that would increase groundwater use.

All of the acreage has been leased for oil and gas exploration at one time or another. Currently, 457,675 acres are leased. Eleven wells have been drilled previously in search of petroleum. These well did not produce and were abandoned. At present, there are two well permits on file. Both are over one year old, and it is unlikely they will be drilled. When oil and gas exploration wells are being drilled, minor amounts of water are necessary for drilling operations. Since no oil or gas has ever been produced from these lands, there is little chance oil or gas operations will require appreciable amounts of groundwater in the next 25 years.

Several groundwater exploration permits have been issued in the past and all have expired. None of the wells have had the capacity or reserves to be capable of municipal usage. There have never been any water contracts issued on this portion of University Lands. The Texas Water Development Board (TWDB) has thirteen wells listed in its database identified as being on this tract of University Lands. An additional six wells have been drilled for water, but are not included in the TWDB database.

Permanent School Fund Lands

The Republic of Texas Congress established the General Land Office (GLO) in 1836. The GLO was originally responsible for managing the public domain by collecting and keeping records, providing maps and surveys and issuing land titles. The GLO's duties have changed, but its core mission is still the

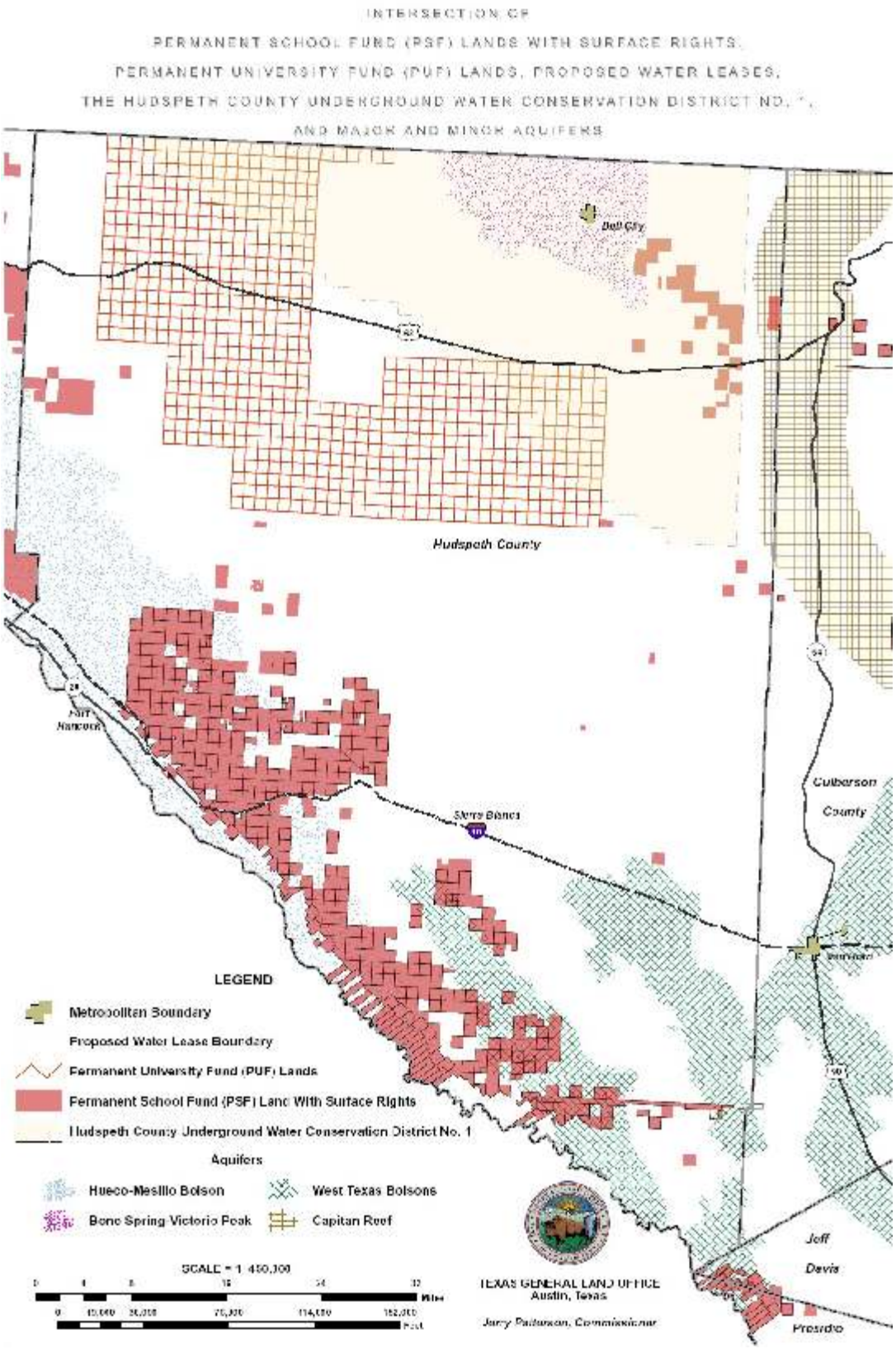

Figure 10. Map showing state lands managed by the General Land Office (Public School Fund Lands and University Lands - West Texas Operations (Public University Fund Lands).

management of state lands and mineral-right properties totaling 20.3 million acres. These properties Include beaches, bays, estuaries and other "submerged" lands out to 10.3 miles in the Gulf of Mexico, institutional acreage, grazing lands in West Texas, timberlands in East Texas, and commercial sites in urban areas throughout the state.

The GLO now leases drilling rights for oil and gas production on state lands, producing revenue and royalties which are funneled into the state's Permanent School Fund (PSF). The dividends and interest from PSF investments go into the Available School Fund, and from there money is distributed to school districts on a per-pupil basis, helping to offset local property taxes. The GLO has deposited more than $6.8 billion into the Available School Fund since the PSF was established in 1854, mostly from oil and gas leases and real estate trades and sales (GLO, 2005a).

The GLO has begun to explore the potential benefits of developing water resources on state-owned lands. The purpose of developing water resources is to provide another reliable source of revenue for the PSF. The School Land Board of the GLO has adopted in a public hearing the following guiding principles for consideration of water development projects.

- Each project shall generate a rate of return to the PSF consistent with the goals and strategies of the School Land Board, as well as all laws governing the fund.
- Each project will take into account the public good, water conservation efforts, and economic growth.
- Each project will adhere to applicable local, state, and federal laws and groundwater conservation district rules.
- Each project will focus on developing and marketing water that can be treated and transported in an economical manner from replenishable resources (GLO, 2005b).

Currently, in Hudspeth County, the GLO oversees approximately 470 square miles of PSF lands with surface rights. The GLO is considering an aggregate area of approximately 390 of the 470 square miles to lease for water development (Figure 10). The proposed water lease area in Hudspeth County is located primarily over the Hueco Bolson and the Red Light Draw part of the West Texas Bolsons aquifer. The proposed lease area also covers a small portion of the Eagle Flat part of the West Texas Bolsons aquifer. There is also proposed lease area located over the Green River Valley part of the West Texas Bolsons aquifer in Jeff Davis, and Presidio counties. Since the Green River Valley also occurs in the study area, pumpage could also potentially affect water-levels in the Hudspeth County portion of the Green River Valley.

WATER USE, DEMAND, SUPPLY, AND AVAILABILITY

Evaluations of population, historic water usage, water demand projections, potential water exportation, current water supplies, and total water availability are provided in this section. The evaluated data come predominantly from the 2002 State Water Plan (TWDB, 2002) and the 2001 Far West Texas Regional Water Plan (FWTRWPG, 2001). If not discussed here, the methodologies for development of the evaluated data may be referenced in the state and regional water plans.

Population Projections

Current and projected population estimates, presented in Table 1, were obtained from the 2002 State Water Plan (TWDB, 2001). Overall, between 2000 and 2030, the population in the study area is expected to increase by 651 inhabitants, or 19.5 percent. The current population density for Hudspeth County is very low (< 1 person/square mile) (El-Hage, 2004). Dell City is the only incorporated city in Hudspeth County. From 2010 to 2030, the population of Dell City is expected to grow by 53 inhabitants. The community of Sierra Blanca, the County Seat of Hudspeth County, is expected to grow by 12 inhabitants. This stands in stark contrast to El Paso County which is projected to have a population growth from 2010 to 2030 of 332,723 inhabitants, increasing from 921,780 to 1,254,503 (36.1 percent).

Table 1.Current and Projected Population Estimates for Hudspeth County

	2000	2010	2020	2030	2040
Dell City	728	781	809	827	834
Sierra Blanca	610	653	672	665	650
County-Other	1,944	2,197	2,403	2,503	2,570
County Total	3,282	3,631	3,884	3,995	4,054

Source: 2002 State Water Plan
County-Other refers to rural population

Historical Water Use

Historical water usage in the study area is presented in Table 2. Total water use in the study area for all purposes (municipal and non-municipal) from 1993 to 2002 averaged 242,797 acre-feet. The lowest amount of total water used, from 1984 to 2002, was 113,147 acre-feet in 1992. From 1984 through 1991, the highest amount of total water use was 167,443 acre-feet in 1989 with an average of 144,691 acre-feet. After 1992, total water use dropped only once below 200,000 acre-feet (in 1998 with a total water use of 198,710 acre-feet) and exceeded 300,000 acre-feet once (in 1999 with a total water use of 300,051 acre-feet). Total water use declined from 1999 to 2002 by 70,039 acre-feet. From 1993 to 2002, municipal demand accounted for a low of 280 acre-feet, or 0.13 percent of total water used (in 1993), to 445 acre-feet, or 0.17 percent of total water used (in 2001), with groundwater the sole source for supplies. Water for non-municipal purposes was also obtained primarily from groundwater sources (over 84 percent in 2002). From 1993 to 2002, the amount of groundwater water used for municipal purposes in the study area increased from 280 to 417 acre-feet. From 1993 to 2002, the amount of groundwater water used for non-municipal purposes in the study area increased from 120,031 to 193,647 acre-feet. The amount of surface water used for non-municipal purposes decreased by 53,650 acre-feet, or by almost 60 percent.

Table 2. Estimated water use from 1974 to 2002, Hudspeth County, in acre-feet per year.											
Water User Group	**1974**	**1977**	**1980**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**
GW Municipal: County-other	252	3,025	897	840	288	278	338	254	305	326	289
SW Municipal: County-other	0	27	0	0	0	0	0	0	0	0	0
GW Manufacturing	31	27	1	5	3	5	2	2	2	2	3
SW Manufacturing	0	0	0	0	0	0	0	0	0	0	0
GW Power	0	0	0	0	0	0	0	0	0	0	0
SW Power	0	0	0	0	0	0	0	0	0	0	0
GW Irrigation	137,735	123,500	140,000	105,898	97,102	45,273	48,993	55,800	97,749	50,863	52,593
SW Irrigation	35,006	24,000	38,500	57,372	52,610	76,303	82,573	94,046	69,031	89,759	75,624
GW Mining	852	0	0	26	26	0	0	0	0	0	0
SW Mining	0	0	0	0	0	0	0	0	0	0	0
GW Livestock	473	474	751	589	338	197	311	345	339	335	344
SW Livestock	0	24	20	31	17	10	16	18	17	17	18
Total (acre-feet per year):	**174,349**	**151,077**	**180,169**	**164,761**	**150,384**	**122,066**	**132,233**	**150,465**	**167,443**	**141,302**	**128,871**
Water User Group	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
GW Municipal: County-other	322	280	346	400	408	366	342	385	376	445	417
SW Municipal: County-other	0	0	0	0	0	0	0	0	0	0	0
GW Manufacturing	4	10	10	0	10	3	2	0	2	3	1
SW Manufacturing	0	0	0	0	0	0	0	0	0	0	0
GW Power	0	0	0	0	0	0	0	0	0	0	0
SW Power	0	0	0	0	0	0	0	0	0	0	0
GW Irrigation	40,655	119,638	175,776	139,790	130,981	131,625	153,132	232,640	222,023	217,152	192,718
SW Irrigation	71,744	89,988	80,873	105,146	98,520	66,366	77,209	66,366	41,863	40,944	36,338
GW Mining	0	0	0	2	2	2	1	1	1	4	1
SW Mining	0	0	0	0	0	0	0	0	0	0	0
GW Livestock	401	383	518	388	341	331	579	626	583	554	510
SW Livestock	21	20	27	20	18	17	30	33	31	29	27
Total (acre-feet per year):	**113,147**	**210,319**	**257,550**	**245,746**	**230,280**	**198,710**	**231,295**	**300,051**	**264,879**	**259,131**	**230,012**
Source: TWDB Water Uses Section; GW-Groundwater SW-Surface Water; County other refers to rural domestic use											

Groundwater: In 2002, the total amount of groundwater used in the study area for both municipal and non-municipal purposes was 193,647 acre-feet (84.2 percent of total water use). The Irrigation water use category (WUC) is the primary WUC in the county. The Irrigation WUC used 99.5 percent of the total groundwater used in the study area. The next largest WUC of groundwater in 2002 was the Livestock WUC at 0.26 percent followed by the Municipal WUC with 0.22 percent. The Mining and Manufacturing WUCs were the smallest users in 2002 accounting for only one acre-foot each of total groundwater used. Groundwater withdrawal from the Hueco Bolson aquifer has declined significantly since 1992 from more than 2,400 acre-feet per year to less than 200 acre-feet per year in 2000. While groundwater withdrawal from the Capitan Reef Complex aquifer has increased from less than 50 acre-feet per year in 1992 to more than 3,500 acre-feet per year in 2000 (Table 3).

Surface Water: The total amount of surface water used in the study area in 2002 was 36,365 acre-feet (or 15.8 percent of total water use). The Irrigation WUC used 99.9 percent of the total surface water used in the study area. The only other WUC using surface water is Livestock accounting for less than 0.01 percent. From 1984 to 2002, the greatest amount of surface water used was in 1995 with 105,146 acre-feet (George and others, 2005).

A recent study suggests that water use for irrigation in Hudspeth County is not as great as indicated by TWDB-published (Table 2) estimates. A study by Blair (2003) was conducted to revise projected irrigation demands for the county. Blair (2003) used detailed local data to estimate use rather than the broader information used by the Natural Resources Conservation Service (NRCS), who conducted irrigation surveys for the TWDB at the time. The estimates for surface water irrigation calculated by Blair (2003) were similar to those by the NRCS; however, there was a significant difference in the estimates for groundwater irrigation. Local records indicated that there were 23,380 acres in irrigation whereas NRCS had estimated 40,013 acres. Blair (2003) estimated groundwater use in the year 2000 at about 103,000 acre-feet, while the NRCS estimated water at about 200,000 acre-feet. Much of this difference is due to Blair (2003) using a significantly lower estimate of alfalfa acreage. The TWDB approximations of historical groundwater use for irrigation may have been overestimated.

Projected Water Demand

Projected water demands in the study area are presented in Table 4, which lists water demands by area (city) and user category (municipal, manufacturing, livestock, or irrigation). Water demand are projected as part of the regional water planning process and provide information on the amount of water that cities and counties will need for municipal, manufacturing, mining, power generation, livestock, and irrigation purposes. TWDB bases the estimates on population growth and past use. Specifics of the methodology used to determine these projections are described in detail in the 2002 State Water Plan (TWDB, 2002).

Under projected conditions from the 2002 State Water Plan, the total annual water demand for the study area is expected to decrease by slightly more than six percent between the years 2000 and 2030. In 2030, the water demand is projected to be about 117,714 acre-feet per year, a decrease of 7,589 acre-feet per year from 2000. Most of this decrease in water demand, over the study period, is projected to occur in the Irrigation water use category. In the study area, Irrigation water demand is expected to decrease from 124,521 to 116,935 acre-feet per year (6.1 percent), over the 2000-2030 period. Municipal water demand is expected to decrease by five acre-feet per year, over the 2000-2030 period. Manufacturing water demand is expected to increase from two to four acre-feet per year, and the Livestock demand is expected to remain constant at 422 acre-feet per year, over the 2000-2030 period. However, the TWDB has approved new water demand projections for Hudspeth County submitted by the Far West Texas Regional

Table 3. Estimated historical groundwater pumping from 1980 to 2000, reported at 2 year increments, for the aquifers in Hudspeth County, in acre-feet per year.

Hueco Bolson aquifer

Water use category	**1980**	**1984**	**1986**	**1988**	**1990**	**1992**	**1994**	**1996**	**1998**	**2000**
Municipal	79	70	103	93	138	147	159	196	201	90
Manufacturing	0	0	0	0	0	0	0	0	0	0
Power	0	0	0	0	0	0	0	0	0	0
Mining	0	0	0	0	0	0	0	0	0	0
Irrigation	1,500	5,800	2,480	3,057	2,787	2,228	0	0	0	0
Livestock	113	88	29	52	50	58	75	49	84	84
Total:	**1,692**	**5,958**	**2,612**	**3,202**	**2,975**	**2,433**	**234**	**245**	**285**	**174**

West Texas Bolsons aquifer

Water use category	**1980**	**1984**	**1986**	**1988**	**1990**	**1992**	**1994**	**1996**	**1998**	**2000**
Municipal	2	1	1	1	1	1	1	1	1	1
Manufacturing	1	1	0	1	1	0	0	0	0	0
Power	0	0	0	0	0	0	0	0	0	0
Mining	0	8	0	0	0	0	0	2	0	0
Irrigation	3,500	0	0	0	0	0	0	0	0	0
Livestock	68	53	18	31	30	35	45	30	51	51
Total:	**3,571**	**63**	**19**	**33**	**32**	**36**	**46**	**33**	**52**	**52**

Bone Spring–Victorio Peak aquifer

Water use category	**1980**	**1984**	**1986**	**1988**	**1990**	**1992**	**1994**	**1996**	**1998**	**2000**
Municipal	653	637	38	35	40	38	41	50	43	41
Manufacturing	0	0	0	0	0	0	0	0	0	0
Power	0	0	0	0	0	0	0	0	0	0
Mining	0	0	0	0	0	0	0	0	0	0
Irrigation	132,200	100,000	42,755	52,697	48,034	38,394	172,979	128,897	150,696	218,491
Livestock	38	30	10	17	17	20	26	17	30	29
Total:	**132,891**	**100,667**	**42,803**	**52,749**	**48,091**	**38,452**	**173,046**	**128,964**	**150,769**	**218,561**

Table 3. Continued.

Capitan Reef Complex aquifer

Water use Category	**1980**	**1984**	**1986**	**1988**	**1990**	**1992**	**1994**	**1996**	**1998**	**2000**
Municipal	2	1	1	1	1	1	1	1	1	1
Manufacturing	1	0	0	0	0	0	0	0	0	0
Power	0	0	0	0	0	0	0	0	0	0
Mining	0	18	0	0	0	0	0	0	0	0
Irrigation	2,800	98	37	46	42	33	2,797	2,084	2,436	3,532
Livestock	11	9	3	5	5	6	8	5	9	8
Total:	**2,814**	**126**	**41**	**52**	**48**	**40**	**2,806**	**2,090**	**2,446**	**3,541**

Other-aquifers

Water use category	**1980**	**1984**	**1986**	**1988**	**1990**	**1992**	**1994**	**1996**	**1998**	**2000**
Municipal	191	32	43	39	54	44	41	51	42	30
Manufacturing	0	0	0	0	0	0	0	0	0	0
Power	0	0	0	0	0	0	0	0	0	0
Mining	0	0	0	0	0	0	0	0	0	0
Irrigation	0	0	0	0	0	0	0	0	0	0
Livestock	521	409	137	240	232	282	365	240	406	411
Total:	**712**	**441**	**180**	**279**	**286**	**326**	**406**	**291**	**448**	**441**

Total of all aquifers:	**141,680**	**107,255**	**45,655**	**56,315**	**51,432**	**41,287**	**176,538**	**131,623**	**154,000**	**222,769**

Source: TWDB Water Uses Section; irrigation and livestock data from NRCS (U.S. Department of Agriculture) and Texas Agriculture Statistics 2002 (Texas Department of Agriculture); "county other" refers to rural domestic use; recent estimates of water use may be overestimated (Blair, 2003, estimated irrigation use in 2000 from the Bone Spring Victorio Peak and the Capitan Reef Complex aquifers to total 103,000 acre-feet; see discussion in Historical Water Use section).

Table 4. Water demand projections for 2000 to 2050, reported at 10 year increments, Hudspeth County, Texas						
Water User Group	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Municipal: County-Other	207	214	215	216	214	213
Municipal: Sierra Blanca	113	114	111	107	103	100
Municipal: Dell City	38	36	33	30	26	25
Manufacturing	2	3	4	4	5	6
Livestock	422	422	422	422	422	422
Irrigation	124,521	121,939	119,411	116,935	114,510	112,136
Total (acre-feet per year):	**125,303**	**122,728**	**120,196**	**117,714**	**115,280**	**112,902**
Source: Table 2, 2002 State Water Plan						

Water Planning Group for inclusion in the 2006 Far West Texas Regional Water Plan and the 2007 State Water Plan.

Projected water demands in the study area for the 2006 Far West Texas Regional Water Plan are presented in Table 5, which lists water demands by area (city) and use category (municipal, manufacturing, mining, livestock, irrigation, or steam electric power). Under these projections, the total annual water demand for the study area is still expected to decrease by slightly more than six percent between the years 2000 and 2030. However, now the demand is expected to be much greater than in the 2002 State Water Plan (TWDB, 2002). The major differences in the new water demand projections is in the Irrigation water use category. In 2000, the new projected demand for irrigation is 61,973 acre-feet greater than the 2002 State Water Plan (TWDB, 2002) projections. In 2030, the new projected demand for irrigation is 58,197 acre-feet greater than the 2002 State Water Plan (TWDB, 2002) projections. The new, total projected water demand for Hudspeth County is expected to decrease by 11,301 acre-feet per year from 187,484 in 2000 to a projected water demand in 2030 of 176,183; the Irrigation water use category water demand decreasing by 11,362 acre-feet over the study period. Under the new data, Municipal water demand is expected to increase by 61 acre-feet per year or 16.3 percent. Livestock, Manufacturing, and Mining demand is expected to remain constant at 613, 2, and 1 acre-feet per year, respectively.

The projected water demand numbers in the 2001 Far West Texas Regional Water Plan were based on historical demands from around 1990. The water demand projections for the 2006 Far West Texas Regional Water Plan are based on more recent and higher historical pumping rates and take into consideration the work by Blair (2003) as discussed in the Historical Water Use section of this report.

Table 5. TWDB Board-Approved water demand projections for the years 2000 to 2060, reported at 10 year increments, Hudspeth County, Texas. For inclusion in the 2006 Regional Water Plan (Region E).

Water User Group	2000	2010	2020	2030	2040	2050	2060
Municipal: County-Other	264	287	297	301	288	284	284
Municipal: Sierra Blanca	110	123	130	134	132	131	131
Manufacturing	2	2	2	2	2	2	2
Mining	1	1	1	1	1	1	1
Steam Electric	0	0	0	0	0	0	0
Livestock	613	613	613	613	613	613	613
Irrigation	186,494	182,627	178,840	175,132	171,501	167,945	164,463
Total (acre-feet per-year):	**187,484**	**183,653**	**179,883**	**176,183**	**172,537**	**168,976**	**165,494**

Source: TWDB Water Uses Section

Water Supply

Projected water supply data, by county and category for the study area, are presented in Table 6. The values in the table assume drought-of-record conditions. Groundwater supply projections represent the volume of groundwater that a specific user or group of users may reasonably expect to pump from an aquifer based on limitations imposed by factors such as depth to water, existing infrastructure, cost of pumping, and water quality (FWTRWPG, 2001). The study area is projected to have a water supply of 150,529 acre-feet per year in 2000 remaining constant through 2050. Under drought-of-record conditions, water supply comes exclusively from groundwater. The major groundwater supply source in Hudspeth County is the Bone Spring-Victorio Peak aquifer which provides water for the City of Dell City and for livestock, irrigation, and County-Other (rural domestic) in the area around Dell City. The community of Sierra Blanca receives water from the City of Van Horn in Culberson County which produces water from one of the West Texas Bolsons. The rest of the county (County-Other) receives its water from the Hueco Bolson and "Other" aquifers. The largest water use category is Irrigation. Aside from the Dell City area, Irrigation water supplies come from the Capitan Reef Complex and "Other" aquifers. Surface water from the Rio Grande also supplies irrigation in normal precipitation years. Water supplies for manufacturing and mining come from "Other" aquifers. Livestock supplies come from the Hueco Bolson, West Texas Bolsons, Capitan Reef Complex, and "Other" aquifers (George, 2005).

A comparison of water supply (Table 6) and water demand (Table 4) projections from the 2001 Far West Texas Regional Water Plan and the 2002 State Water Plan by category is presented in Table 7. Overall, the county has a water surplus of 25,129 acre-feet in 2000, increasing to 32,718 in 2030. However, Table 6 indicates there is a deficit of 46,988 acre-feet for the Rio Grande Valley irrigation surface water use category in 2000, decreasing to 43,726 acre-feet by 2030. The Rio Grande is not expected to produce any water in times of drought, and groundwater from the Rio Grande Alluvium aquifer is limited due to

Table 6. Water supply projections for 2000 to 2050, reported at 10 year increments, Hudspeth County, Texas									
Water Users Group	**Source Type**	**Source County**	**Source Name**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Dell City	Groundwater	Hudspeth	Bone Spring-Victorio Peak aquifer	50	50	50	50	50	50
Sierra Blanca	Groundwater	Culberson	West Texas Bolsons aquifer	351	351	351	351	351	351
County-other	Groundwater	Hudspeth	Bone Spring-Victorio Peak aquifer	1	1	1	1	1	1
County-other	Groundwater	Hudspeth	Hueco-Mesilla Bolson aquifer	196	196	196	196	196	196
County-other	Groundwater	Hudspeth	Other aquifer	51	51	51	51	51	51
Irrigation	Surface water		Upper Rio Grande Combined Run-Of-River	0	0	0	0	0	0
Irrigation	Groundwater	Hudspeth	Bone Spring-Victorio Peak aquifer	140,000	140,000	140,000	140,000	140,000	140,000
Irrigation	Groundwater	Hudspeth	Capitan Reef Complex aquifer	2,797	2,797	2,797	2,797	2,797	2,797
Irrigation	Groundwater	Hudspeth	Other aquifer	6,556	6,556	6,556	6,556	6,556	6,556
Livestock	Groundwater	Hudspeth	Bone Spring-Victorio Peak aquifer	26	26	26	26	26	26
Livestock	Groundwater	Hudspeth	Capitan Reef Complex aquifer	8	8	8	8	8	8
Livestock	Groundwater	Hudspeth	Hueco-Mesilla Bolson aquifer	75	75	75	75	75	75
Livestock	Groundwater	Hudspeth	Other aquifer	365	365	365	365	365	365
Livestock	Groundwater	Hudspeth	West Texas Bolsons aquifer	45	45	45	45	45	45
Manufacturing	Groundwater	Hudspeth	Other aquifer	6	6	6	6	6	6
Mining	Groundwater	Hudspeth	Other aquifer	2	2	2	2	2	2
			Total (acre-feet per year):	**150,529**	**150,529**	**150,529**	**150,529**	**150,529**	**150,529**

Note: Table assumes drought-of-record conditions
Source: Table 5, 2002 State Water Plan

Table 7. Comparison of water supply and water demand projections for 2000 to 2050, reported at 10 year increments, Hudspeth County, Texas.

Water User Group	2000	2010	2020	2030	2040	2050
Municipal: Dell City	12	14	17	20	24	25
Municipal: Sierra Blanca	238	237	240	244	248	251
Municipal: County-Other	41	34	33	32	34	35
Manufacturing	4	3	2	2	1	0
Mining	2	2	2	2	2	2
Irrigation (Dell Valley)	71,820	73,292	74,733	76,144	77,526	78,879
Irrigation (River)	-46,988	-45,878	-44,791	-43,726	-42,683	-41,662
Livestock	97	97	97	97	97	97
Surplus (acre-feet per year):	**25,129**	**27,704**	**30,236**	**32,718**	**35,152**	**37,530**

Source: 2002 State Water Plan

poor quality. During drought-of-record conditions, irrigated agriculture in the Hudspeth County Conservation and Reclamation District will be severely impacted (FWTRWPG, 2001). All other WUCs in Hudspeth County show a surplus, most noticeably the Irrigation WUC in the Dell Valley area with a surplus of 71,820 acre-feet increasing to 76,144 acre-feet in 2030.

Water Availability

Projected water availability data, by water source for the study area, are presented in Table 8. The values in this table assume drought-of-record conditions when surface water is not available. The 2001 Far West Texas Regional Water Plan defined groundwater availability for the Capitan Reef Complex, Hueco Bolson, Rio Grande Alluvium, and West Texas Bolsons aquifers as the "drainable volume" of water. This volume is considered the total recoverable volume of groundwater, in acre-feet, from aquifer storage. Groundwater availability for the Bone Spring-Victorio Peak aquifer was defined as a temporary increase of pumping during times of drought from a sustainable annual production (in acre-feet per year) that minimizes the risk of saline water intrusion from the Salt Flats (FWTRWPG, 2001).

The 2001 Far West Texas Regional Water Plan shows groundwater availability for Hudspeth County remaining constant through 2050 (Table 8). Annual production during times of drought of 141,000 acre-feet per year for the Bone Spring-Victorio Peak aquifer and a total recoverable storage volume for all other study-area aquifers of 1,847,500 acre-feet are estimated. At this time, there is not enough data to generate an estimate for groundwater availability for the Diablo Plateau aquifer. Based on recoverable storage, the three largest sources of groundwater are the Red Light Draw of the West Texas Bolsons at 35.6 percent, Rio Grande Alluvium at 31.5 percent, and the Eagle Flat of the West Texas Bolsons at 20.6 of the groundwater available (George and others, 2005).

Table 8. Water availability projections for 2000 to 2050, reported at 10 year increments, Hudspeth County, Texas							
Water Supply Source	**Type of Water Supply**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
West Texas Bolsons, Red Light Draw	Groundwater	708,000	708,000	708,000	708,000	708,000	708,000
Rio Grande Alluvium	Groundwater	626,000	626,000	626,000	626,000	626,000	626,000
West Texas Bolsons, Eagle Flat	Groundwater	409,000	409,000	409,000	409,000	409,000	409,000
Bone Spring - Victorio Peak	Groundwater	141,000	141,000	141,000	141,000	141,000	141,000
West Texas Bolsons, Green River Valley	Groundwater	89,000	89,000	89,000	89,000	89,000	89,000
Other Aquifers	Groundwater	10,000	10,000	10,000	10,000	10,000	10,000
Capitan Reef Complex	Groundwater	5,000	5,000	5,000	5,000	5,000	5,000
Hueco Bolson	Groundwater	500	500	500	500	500	500
Upper Rio Grande	Surface Water	0	0	0	0	0	0
	Total (acre-feet):	**1,988,500**	**1,988,500**	**1,988,500**	**1,988,500**	**1,988,500**	**1,988,500**

Source: Table 4, 2002 State Water Plan

The Hudspeth County UWCD No. 1 includes an estimate of annual groundwater availability (indicated as the total amount of usable groundwater) for the Bone Spring-Victorio Peak aquifer in its certified groundwater management plan. The Hudspeth County UWCD No. 1 estimates that the amount of groundwater available for consumptive use or transfer from the District for the Bone Spring-Victorio Peak to be 63,000 acre-feet per year. The Hudspeth County UWCD No. 1 management plan states that according to the best available data 63,000 acre-feet per year is the long-term average amount of recharge from lateral inflow and approximately 27,000 acre-feet per year of recharge results from irrigation return flow (Hudspeth County UWCD No. 1, 2002).

The Rio Grande has historically provided a significant amount of water for irrigation in southwestern Hudspeth County. The stretch of the river from Fort Quitman (southwest of Sierra Blanca in Hudspeth County) to Presidio (southern Presidio County) is, however, often a dry riverbed. The amount of water that flows into Hudspeth County from upriver depends on the climate in Colorado and northern New Mexico and releases from dams located in Texas and New Mexico. According to the 2001 Far West Texas Regional Water Plan, there is no surface water available for use, and therefore no surface water supply, during a repeat of the drought-of-record.

STAKEHOLDER PARTICIPATION

On June 16, 2004, staff of the TCEQ mailed out notices to area stakeholders regarding the Hudspeth County PGMA Study. The notice informed area stakeholders that they were being availed a 45-day comment period to provide any information to be added to the study report. Only one stakeholder responded, the University of Texas System, University Lands - West Texas Operations (University Lands).

University Lands Comments

University Lands electronically sent digital data for the boundaries of their property located in Hudspeth County. University Lands also sent a report describing the terrain and the water use on their property. University Lands owns almost 500,000 acres in the northern part of Hudspeth County with the primary use being grazing and hunting. The land is also used by radio and microwave towers and pipeline pump stations, pipelines cross these lands carrying both oil and gas, refined and unrefined. Oil and/or gas exploration wells have been drilled on University Lands; however, no oil or gas has ever been produced from these lands.

The report states that no surface water exists on these lands and groundwater use is in minor quantities normally associated with ranching and domestic activities. There are no plans to irrigate or add additional industry that would increase groundwater use. When the oil/gas wells were being drilled minor amounts of water were used during drilling operations. However, there is little chance that oil and gas operations will require appreciable amounts of groundwater in the next 25 years. The report states that several groundwater exploration permits have been issued in the past and all have expired, none has identified the capacity or reserves to be capable of municipal usage. There are thirteen water wells in the TWDB database on University Lands. In addition to these there are six more water wells not in the database. The report states that data for these wells can be provided upon request. In the conclusions, the report states that it is the desire of University Lands that these lands be excluded from any Priority Groundwater Management Area or study.

Stakeholder Interviews

From September 29 to October 1, 2004, the author traveled to the study area to conduct interviews with area stakeholders. While in the area, the author met with the General Manager of the Hudspeth County UWCD No. 1, based in Dell City, the Hudspeth County Judge and County Attorney, in Sierra Blanca, and the General Manager of the Fort Hancock Water Conservation and Improvement District, in Fort Hancock.

According to the Hudspeth County Underground Water Conservation District (UWCD) No. 1 sustainability was considered the greatest water issue for the District. The Hudspeth County UWCD No. 1 has placed meters on all high volume wells (irrigation) and set a production limit of 4 acre-feet per acre per year. Wells are permitted (validation permits) based on historical usage. The Hudspeth County UWCD No. 1 set the historical period as 1992 to 2002 and purchased imagery over this time period as evidence for irrigation during this time period. The Hudspeth County UWCD No. 1 also has a program to give users “operating permits.” These permits allow users to operate their wells only if water-levels rise above an elevation of 3,580 feet. The Hudspeth County UWCD No. 1 also has rules to limit production if levels drop too far.

The rules set up by the Hudspeth County UWCD No. 1 state that only 2.8 acre-feet per acre per year can be exported out of the District. The Hudspeth County UWCD No. 1 made the assumption that 30% (1.2 acre-feet per acre per year) of irrigated water recharges the aquifer, and thus made rules that limited the amount of groundwater exportation by 30%. The General Manager indicated that the City of El Paso had purchased land over the Capitan Reef Complex aquifer east of the District in both Hudspeth and Culberson counties and were wanting to produce 11,000 to 15,000 acre-feet per year from these properties.

The question was posed to the General Manager if a PGMA is designated for the rest of Hudspeth County would the District want to add the PGMA and become one large district. The General Manager indicated that he would be against such addition due to the hydrogeologic differences between the Hudspeth County UWCD No. 1 and the rest of the county. The management plan for the Hudspeth County UWCD No. 1 is specifically geared to the needs of the District and managing groundwater resources of the Bone Spring-Victorio Peak aquifer.

The Hudspeth County Judge considered the biggest water issue for the Community of Sierra Blanca to be availability and access to alternative water sources. Currently, Sierra Blanca receives its water from the City of Van Horn. The Judge stated that a prison is being built in the area and people working there needed local housing, but there is not enough water to hook up to new houses. Sierra Blanca has not been able to get additional water supplies from Van Horn. The Judge also stated that water management is needed to live in the desert and that exporting water out of a desert should not be allowed.

The Hudspeth County Attorney, a life-long resident of the region, has recently made headlines as being the first person to donate water (1,236 acre-feet) to the Texas Water Trust. The County Attorney believes the biggest water issues for the county are: whether the three communities of the county (Dell City, Sierra Blanca, and Fort Hancock) will have enough water; and, whether some outside entity (a water marketer or El Paso) would come in and export water out of the county.

The County Attorney stated he believed the "rule of capture" was wrong for this area. He also related stories of irrigation districts pumping to the point of drying up springs (Comanche Springs). He thought that a groundwater conservation district (GCD) would be a good idea for the area, and thought that other residents would agree.

The General Manager of the Fort Hancock Water Control and Improvement District (WCID) thought the biggest water issue for Fort Hancock was water quality and water quantity. The community's current well is high in total dissolved solids (TDS). The General Manager thought that the TDS level was approximately 1,400 mg/L (state rules set the maximum secondary constituent levels for public water systems for TDS at 1,000 mg/L). The present well, in addition to having poor water quality, does not produce enough water for the WCID. The WCID plans on drilling a new well and building a reverse osmosis plant to treat the water for both wells. This project is going to cost 1.7 million dollars. The project will be paid for by a $300,000 loan and an unused $600,000 grant. The rest will be paid by raising water rates. The General Manager said the average monthly water bill will be $90. The bidding process for the project should start in the spring of 2005.

The County Judge and the County Attorney believed a GCD managing area groundwater resources would be a good idea; however, the General Manager of the Fort Hancock WCID was unfamiliar with GCDs. The General Manager of the Hudspeth County UWCD No. 1 thought the rest of the county would benefit

from groundwater management, but that due to differing groundwater management issues between the District and the rest of the county, the Hudspeth County UWCD No. 1 should not join the rest of the county into a single district.

Texas Department of Agriculture

On June 30, 2004, staff of the TCEQ, in accordance with Texas Water Code, §35.007(e), requested that the Texas Department of Agriculture (TDA) provide any information it deemed pertinent and needed to be considered in the PGMA report. A letter was received by the TCEQ on August 19, 2004, from The Honorable Susan Combs, Commissioner of the Texas Department of Agriculture. Commissioner Combs states in her letter that area water resources are becoming more valuable especially in light of the City of El Paso looking to fulfill its water needs from Hudspeth County and the General Land Office's interest in leasing state-owned land for private water production and marketing. Commissioner Combs encouraged the TCEQ to recommend the designation of a Hudspeth County PGMA.

AREA WATER CONCERNS AND IDENTIFIED MANAGEMENT STRATEGIES

This section summarizes data and information to evaluate whether the study area is experiencing, or is expected to experience, critical groundwater problems within the next 25 years. Discussions in this section regard groundwater quality conditions which may limit usability and groundwater export and other water supply concerns. This discussion relies primarily upon George and others (2005) and the Far West Texas Regional Water Plan (FWTRWPG, 2001).

After evaluating water supplies and availability, and present use and future demand, each regional water planning group is required to identify water use categories (WUCs) which have, or will have, unmet water needs. The regional water planning groups are then required to develop strategies to address the unmet needs in the future. The Far West Texas Regional Water Planning Group has identified strategies for the Irrigation and County-Other WUCs in Hudspeth County and the use of Hudspeth County resources to supplement future needs in El Paso County. These strategies generally include adding new water supply wells or expanding the use of existing wells, desalination of groundwater for public consumption, transferring groundwater supplies to the City of El Paso, and other conservation and maintenance practices.

Groundwater Quality Conditions

The water in the Diablo Plateau aquifer is slightly saline with total dissolved solids (TDS) values ranging from 1,000 to 3,000 mg/L. In the Dell Valley area, the Bone Spring-Victorio Peak aquifer produces water that is moderately saline with TDS concentrations ranging from 3,000 to 10,000 mg/L. The Bone Spring-Victorio Peak currently supplies the municipal demand for the City of Dell City, although, due to the high TDS values, groundwater has to be desalinated (George and others, 2005). Water quality in the Dell Valley area is strongly influenced by groundwater flow from New Mexico (Mayer, 1995; Mayer and Sharp, 1998). A large plume of relatively fresh water enters this area from the north lowering TDS concentrations and increasing the potential for dissolution.

The water quality in the Capitan Reef Complex aquifer is generally poor. The TDS values average around 3,000 mg/L (Brown, 1997). Some wells completed in the Capitan Reef Complex in Hudspeth County are slightly saline (1,000 to 3,000 mg/L) (George and others, 2005). In general, fresher water is located near areas of recharge where reef rock is exposed (Ashworth and Hopkins, 1995). There are several wells in Culberson and Hudspeth counties located close to recharge areas that produce groundwater good enough to enough to serve domestic purposes (Brown, 1997).

The Hueco Bolson aquifer in Hudspeth County generally displays a northeast to southwest increase in TDS values from 1,000 to 3,000 mg/L near the Diablo Plateau to 3,000 to 10,000 mg/L along the Rio Grande. From the plateau to the river, chloride increases from less than 250 to over 2,000 mg/L, sulfate increases from 250-750 to 750-2,000 mg/L, and magnesium increases from less than 25 to greater than 150 mg/L. Nitrate concentrations are generally low, although some values fall within the 44 to 100 mg/L range along the Rio Grande (George and others, 2005). Water contained in the Rio Grande alluvium typically has high concentrations of TDS, as much as 2,000 mg/L or more. Because of the high TDS, the water is not used as a source of drinking water (FWTRWPG, 2001). However, a well supplying water from the Hueco Bolson aquifer to the community of Fort Hancock contains elevated TDS levels, around 1,400 mg/L. State rules set the maximum contaminant level (MCL) for TDS in drinking water at 1,000 mg/L. The Fort Hancock WCID is planning building a reverse osmosis plant to treat the water.

The El Paso Water Utilities estimates recoverable fresh water in storage in the Hueco Bolson, as of the year 2000, was approximately 3 million acre-feet. In addition to the fresh water, the El Paso Water Utilities estimates 2.5 million acre-feet of slightly saline (1,000 to 2,000 mg/L, as defined by the El Paso Water Utilities) water is available for desalination (FWTRWPG, 2001). Groundwater models predict, with current trends, that El Paso will pump the last of its fresh water by 2025, and that Ciudad Juárez will pump the last of its fresh water by 2005 (Sheng and others, 2001). The area overlying the Hueco Bolson in El Paso County was designated as a PGMA by the TCEQ in 1998.

Southeast Hudspeth County generally has fresh water with TDS values of less than 1,000 mg/L. Exceptions occur east and southeast of Sierra Blanca and along the Rio Grande where values range from 1,000 to 10,000 mg/L. Apart from these areas, the majority of wells have chloride levels less than the state MCL secondary standard of 300 mg/L. Sulfate levels are higher and more variable but are generally less than 300 mg/L (the state MCL standard for sulfate is 300 mg/L). Nitrate concentrations are generally less than 10 mg/L, although there are a number of wells in the 10 to 44.27 mg/L range (44.27 mg/L is the EPA's MCL value for nitrate). These wells are found southeast of Sierra Blanca and northwest of the Carrizo Mountains in Eagle Flat, along the Green River Valley, and at the south end of Red Light Draw. Fluoride levels are primarily less than 3 mg/L (the state MCL is 2 mg/L). There are a group of wells southeast of Sierra Blanca that have fluoride levels of more than 4 mg/L (George and others, 2005).

Water Export

There are currently three potential groundwater export projects being contemplated in the county: the export of groundwater from the Bone Spring-Victorio Peak aquifer in the Dell City area to the City of El Paso; the export of groundwater from the Capitan Reef Complex aquifer to the City of El Paso; and, the possible export of groundwater from the Hueco Bolson and West Texas Bolsons aquifers in southern Hudspeth County to users yet to be determined.

The 2001 Far West Texas Regional Water Plan includes a water management strategy to export water from the Bone Spring-Victorio Peak aquifer in the Dell Valley area to the City of El Paso (FWTRWPG, 2001). Current net agricultural water production (groundwater pumping minus irrigation return flow) is approximately equal to the sustainable yield of the Dell Valley groundwater system. This strategy, with the potential of being implemented within the next ten years, calls for the export of as much as 30,000 acre-feet per year in 2030 and 45,000 acre-feet per year in 2050. The strategy suggests that any water produced for export will need to be balanced with a commensurate net reduction in irrigation. The reduction is needed to maintain the sustainability of pumping from the aquifer and to prevent the migration of poorer quality water from the Salt Basin into the production area (FWTRWPG, 2001).

In 2003, El Paso Water Utilities purchased properties that overlie the Capitan Reef Complex aquifer in Hudspeth County. One property is entirely in Hudspeth County while two other properties straddle the Hudspeth-Culberson county line. Planning by El Paso Water Utilities includes the transfer of 25,000 acre-feet per year of groundwater from either the Capitan Reef Complex aquifer or the Dell City area within the next 10 to 15 years. Since these properties were not purchased until after the 2001 Far West Texas Regional Water Plan and the 2002 State Water Plan were completed, this project is not currently listed as a water management strategy, but will be added to the next version of these plans. Current plans by El Paso Water Utilities call for producing 25,000 acre-feet per year from the Capitan Reef Complex aquifer and producing 50,000 acre-feet per year from the Bone Spring-Victorio Peak aquifer (George and

others, 2005). Export from the Dell Valley area will need to be balanced with a commensurate reduction in net groundwater production for irrigation.

The State of Texas owns land in Hudspeth County managed by the General Land Office (GLO) (Figure 10). The GLO is considering leasing groundwater rights in southern Hudspeth County to a private interest. Most of the State's land being considered for groundwater leasing overlies the Hueco Bolson and the West Texas Bolsons aquifers (George and others, 2005). At a meeting of the Far West Texas Regional Water Planning Group on February 24, 2005, representatives of Rio Nuevo Ltd. (RN) gave a presentation about their plan to potentially export groundwater from GLO-managed land. According to the minutes of this meeting, RN is an applicant to the GLO for a license to explore and produce groundwater from state-owned land in Culberson, Hudspeth, Presidio, and Jeff Davis counties. The meeting minutes noted that the license is expected to be finalized in the spring of 2005. The license requirements include that RN submit an Exploration Plan to evaluate and model the existing data and to identify the specifics for field investigations. The data collection and modeling phase will be followed with an Exploration Program. At the meeting, a representative for RN noted that a go/no–go decision would be made two years from this spring. During questioning of the RN representatives by the Regional Water Planning Group, it was revealed that no entity had been secured as a buyer for any water produce by RN (FWTRWPG, 2005). At this time, there is insufficient information about how much and when this water might be produced, or to whom it would be sold to be included as a water management strategy in the regional and state water plans.

In addition to these export projects, there are out-of-state groundwater development projects proposed with potential to impact groundwater resources in Hudspeth County. The New Mexico Interstate Stream Commission has filed applications to pump 90,000 acre-feet per year of groundwater from the New Mexico portion of the Bone Spring/Salt Basin aquifer (TCEQ personal communication, March, 2005). Much of the recharge to the Bone Spring-Victorio Peak aquifer comes from the Sacramento River and Otero Mesa in New Mexico (Scalapino, 1950; Ashworth, 1995) with groundwater flowing from the Sacramento Mountains southward to the Dell Valley area (Mayer, 1995). If this volume of pumpage in New Mexico were to occur, it could have a major effect on groundwater underflow into the study area and groundwater availability in the Dell Valley area. At this time, there is not enough information to accurately predict how this potential pumpage in New Mexico would impact groundwater resources in Texas.

Water Supply Concerns

Water-levels in the Bone Spring-Victorio Peak aquifer show long-term declines. Declines since the late 1940s range from 5 to 60 feet with an average of approximately 30 feet. The declines are likely due to irrigation pumping (George and others, 2005). However, the water-levels have become relatively stable since the 1970s (Ashworth and Hopkins, 1995). The Hudspeth County UWCD No. 1 has been created to manage the Bone Spring-Victorio Peak aquifer. In other rural areas of Hudspeth County, a number of private domestic wells have reportedly gone dry as a result of drought induced water-level declines (FWTRWPG, 2001). Sufficient water-level data is not available for some study area aquifers such as the Hueco Bolson, Green River Valley Bolson, and Capitan Reef Complex to produce reliable potentiometric surface maps or to determine long-term water-level trends.

Irrigation
Irrigation and Livestock are the predominant WUCs in Hudspeth County. Irrigation occurs in two separate areas within the county. Significant volumes of groundwater are withdrawn from the Bone Spring-Victorio Peak aquifer in the Dell Valley area in the northeastern part of the county for irrigation. Due to the large volume of water in storage in the aquifer, well production and irrigation activity are not immediately affected during initial drought periods. This groundwater supply is managed by the Hudspeth County UWCD No. 1.

The second area of irrigation occurs along the Rio Grande floodplain where water from the river is the source for the irrigation. During extended drought periods in the upper part of Rio Grande basin, surface water for irrigation may not exist. Due to the arid nature of the region, dryland farming is not an option and irrigating with high salinity water significantly reduces soil productivity. Strategies identified by the Regional Water Planning Group are to either irrigate with effluent from the City of El Paso for areas within the Hudspeth County Conservation and Reclamation District No. 1 or cease growing operations until river water becomes available.

Municipal
The Community of Sierra Blanca has drilled as many as five wells in an unsuccessful attempt to supply municipal needs. Sierra Blanca purchases water through Hudspeth County Water Control and Improvement District No.1 from the City of Van Horn in Culberson County. Production is from the Wild Horse Flat (part of the West Texas Bolsons aquifer) well field of Culberson County. Production from the Wild Horse Flat should be sufficient throughout the 25-year study period (FWTRWPG, 2001).

The City of Dell City relies on desalinated groundwater. Sufficient groundwater exists from the Bone Spring-Victorio Peak aquifer for municipal use; however, the desalination plant must be continuously maintained. Since the concentrate water produced by the desalination process is generally of better quality than groundwater being used for irrigation, disposal is of minor concern.

Communities located along the Rio Grande historically relied on groundwater provided by the Fort Hancock Water Control Improvement District and the Esperanza Fresh Water Service Company, Inc. Public supply wells in this area are currently failing to produce water of sufficient quantity and quality, and water suppliers are having to find alternative means to provide water to supply local communities. Water suppliers are currently working with the Hudspeth County Conservation and Reclamation District No. 1 to study the feasibility of desalination and surface water treatment. A number of private domestic wells in the rural areas of the county have gone dry as a result of drought. These well owners will need deepen wells to reach groundwater (FWTRWPG, 2001).

Tables 9 and 10 show recommended water management strategies and the amount of water supplies required for the strategies in the study area. These are the Far West Texas Regional Water Planning Group recommended management strategies to address identified problems and issues. Briefly, the strategies include:

- creation of approximately 20 new, low volume, individual domestic water wells to serve each new rural home and two new, moderate volume, public supply wells to serve increased demands primarily along the river corridor in the southern part of the county;
- expanding use of existing wells by increasing the pumping time to produce more water;

- conversion of rights to use up to 3,000 acre-feet of Rio Grande Project water to be stored in an Hudspeth County Conservation and Reclamation District No. 1 reservoir (this strategy includes the construction of a treatment plant plus a distribution pipeline from the treatment plant to the Fort Hancock area);
- construction of a reverse osmosis desalination facility near the current groundwater supply for Fort Hancock.;
- purchasing groundwater from the City of Van Horn and deliver through an existing pipeline to Sierra Blanca and onward through a new pipeline to southern Hudspeth County;
- developing well fields in the Red Light Draw or Green River Valley of the West Texas Bolsons aquifer and transport by pipeline to communities in southern Hudspeth County;
- capturing rainfall from roofs or in small surface impoundments, providing water that is usually lost to the rural homeowner;
- using aggressive water conservation technologies, improved water efficient crops, and reduction in the Federal farm program subsidies serve to reduce the amount of water used on agricultural crops;
- expanding use of existing wells in the lower valley to provide supplemental water to carry perennial crops such as alfalfa and irrigated pasture through a growing season;
- installing 40 additional irrigation wells in the lower valley if expanded use of existing wells in the Rio Grande Alluvium is insufficient to meet anticipated needs; and,
- expansion and renovation of the regulating reservoir system currently in use by Hudspeth County Conservation and Reclamation District No. 1.

Table 9. Recommended water management strategies, Hudspeth County.

No.	Water user group	County	Water management strategy	Source name
1	El Paso	El Paso	Groundwater transfer	Bone Spring–Victorio Peak aquifer
2	Steam electric power	El Paso	Additional wells	Other aquifer
3	County-other	Hudspeth	Additional wells	Hueco Bolson aquifer
4	County-other	Hudspeth	Desalination	Hueco Bolson aquifer (brackish)
5	County-other	Hudspeth	Distribution system maintenance	Conservation
6	County-other	Hudspeth	Expanded use of existing wells	Hueco–Mesilla Bolson aquifer
7	County-other	Hudspeth	Groundwater transfer	West Texas Bolson aquifer (1)
8	County-other	Hudspeth	Groundwater transfer	West Texas Bolson aquifer (2)
9	County-other	Hudspeth	Rainfall harvesting	Rainfall
10	County-other	Hudspeth	Conversion of rights to use water	Upper Rio Grande
11	Irrigation	Hudspeth	Additional wells	Rio Grande Alluvium
12	Irrigation	Hudspeth	Conservation technology	Conservation
13	Irrigation	Hudspeth	Expanded use of existing wells	Rio Grande Alluvium
14	Irrigation	Hudspeth	Reservoir storage expansion	Upper Rio Grande

Table 10. Amount of water required for recommended water management strategies, in acre-feet per year.

No.	Water management strategy	2000	2010	2020	2030	2040	2050
1	Bone Spring–Victorio Peak aquifer	NI	15,000	20,000	30,000	45,000	45,000
2	Other aquifer	NI	NI	4,000	4,000	4,000	4,000
3	Hueco Bolson aquifer	180	180	180	180	180	180
4	Hueco Bolson aquifer (brackish)	NI	216	216	216	216	216
5	Conservation	NA	NA	NA	NA	NA	NA
6	Hueco–Mesilla Bolson aquifer	27	27	27	27	27	27
7	West Texas Bolson aquifer (1)	NI	220	220	220	220	220
8	West Texas Bolson aquifer (2)	NI	220	220	220	220	220
9	Rainfall	NA	NA	NA	NA	NA	NA
10	Upper Rio Grande (3)	NI	0	0	0	0	0
11	Rio Grande Alluvium	0	5,892	5,892	5,892	5,892	5,892
12	Conservation	NA	NA	NA	NA	NA	NA
13	Rio Grande Alluvium	NI	618	618	618	618	618
14	Upper Rio Grande	NI	0	0	0	0	0
	Total:	**207**	**24,365**	**33,365**	**43,365**	**58,365**	**58,365**

Source: 2001 Far West Texas Regional Water Planning Group;
NI indicates strategy not implemented at this time;
NA indicates strategy has no specific volume estimate;
(1) Red Light Draw, Hudspeth County; (2) Wild Horse Michigan Flats, Culberson County; (3) supply source is not available during drought-of-record conditions.

Research and Data

Reliable information about groundwater resources is primarily obtained through the evaluation of subsurface hydrogeologic data, and generally, one of the most important sources for this kind information is water well data. Geology, hydrostratigraphy, structure, water-levels (groundwater flow), chemistry (groundwater quality), and hydraulic properties can all be obtained from well bores and aquifer testing. Recharge and natural discharge, pumpage, and current water use data are also necessary to make meaningful assessments. The ability to understand aquifer resources and dynamics is proportional to such data availability.

Data available for study area aquifers is highly variable; however, an abundance of water wells can indicate the quality and availability of known groundwater resources or indicate the present level of demand on the resource. Some study area aquifers have numerous wells and others have very few; some have been previously studied and provide good framework data, while other have been studied little. The TWDB has significant data for the Red Light Draw and Eagle Flat Bolson aquifers, limited data for the Hueco Bolson aquifer in Hudspeth County, and very little data for the Capitan Reef Complex, Green River Valley Bolson, and Diablo Plateau aquifers.

Regarding water availability and not including the Bone Spring-Victorio Peak aquifer, the Far West Texas Regional Water Plan estimates that the total recoverable volume of groundwater from Hudspeth County aquifers is 1,847,500 acre-feet (Table 8). The regional water plan also states that availability is likely to remain equivalent to the total recoverable storage. It is obvious that there are other factors that must be considered to accurately make such a prediction. Recharge, natural and man-induced discharge, and groundwater movement between aquifer systems must be understood. The existing estimates of recharge from the best available data for these aquifers are as follows:

- Red Light Draw – from 280 to 2,000 acre-feet per year,
- Eagle Flat – from 430 to 3,000 acre-feet per year,
- Green River Valley – from 120 to 1,000 acre-feet per year,
- Hueco Bolson – around 2,800 acre-feet per year, and
- Capitan Reef Complex – around 12,500 acre-feet per year.

The conclusion that availability is likely to remain equivalent to the total recoverable storage does not account for groundwater use in excess of annual effective recharge volumes. Aquifer pumpage, whether from existing users (Table 3) or from any potential new demands (see previous discussion on Water Export), over annual effective recharge amounts would cause groundwater mining conditions by removing water from aquifer storage. While such removal of groundwater from aquifer storage may be acceptable or even desirable, negative impacts such as water-level declines, salt water intrusion, and wells and springs going dry should be anticipated.

More groundwater research is needed in this study area to understand the nature and dynamics of the aquifers. More data are needed to understand how much usable water is truly available for annual use, and how much water can be removed from storage without causing detrimental harm to the natural resources and those whose livelihoods presently depend on the resources as they exist today. Significant well inventorying, aquifer-specific field work, and data development are necessary to more accurately quantify groundwater availability and quality for these study area aquifers. This level of research will be

necessary to characterize the resources and to make calculations to evaluate the possible effects of additional groundwater pumping on study area aquifer conditions. If adequate funding and resources are available, it is this level of detail and research that is necessary for regional water planners to make informed decisions about existing groundwater resources and about regional water plan management strategies to address needs that impact these resources.

EXISTING WATER PLANNING, REGULATORY, AND MANAGEMENT ENTITIES

In evaluating the need for groundwater management, it is important to examine the efficiency of existing institutions in managing, planning, and regulating groundwater use. If existing entities can effectively develop and implement groundwater management and protection strategies, new entities may neither be necessary nor desirable. However, if such entities do not exist, or if an existing entity does not implement its programs consistently, or does not have sufficient authority, then alternatives may need to be considered.

Several major groups of entities can be considered in the evaluation of groundwater management. These include government entities, authorities and planning groups, water suppliers and water users. Entities that may be involved with groundwater regulatory or management activities include local municipalities; counties; state and federal government; regional planning authorities and commissions; regional surface water and groundwater management authorities; regional, municipal, and private water suppliers; and major agricultural, industrial and commercial water users.

Federal and Interstate Programs

The U.S. Environmental Protection Agency (USEPA), U.S. Department of Agriculture (USDA), and U.S. Nuclear Regulatory Commission are federal agencies responsible for enforcing numerous federal laws for protecting groundwater quality. Generally, these agencies have delegated the administration of federal regulatory programs to individual states, or occasionally to local authorities. For example, the USEPA which has authority over the federal Resource Conservation and Recovery Act; the Comprehensive Environmental Response, Compensation and Liability Act; the Clean Water Act; the Safe Drinking Water Act; and the Federal Insecticide, Fungicide and Rodenticide Act has delegated administration of these programs in Texas to the TCEQ.

The USDA administers numerous programs at the local level to protect and conserve water resources. The USDA Farm Service Agency's Conservation Reserve Program (CRP) undertakes to reduce soil erosion and sedimentation in streams and lakes, improve water quality, establish wildlife habitats, and enhance wetland resources. The CRP encourages farmers to convert highly erodible cropland or other environmentally sensitive areas to vegetative cover such as native grasses. The USDA Natural Resource Conservation Service (NRCS) provides technical assistance to landowners, communities, and local governments in planning and implementing conservation programs. The USDA/NRCS's national Farm*A*Syst and Home*A*Syst programs promote voluntary assessments to prevent pollution. Step-by-step worksheets allow individuals to apply site-specific management practices to their property.

State Water Planning and Regulatory Programs

Water planning efforts at the state level are the responsibility of the TWDB which prepares a statewide water plan using plans developed by regional stakeholders and other state water agencies. State law requiring the TWDB to develop a statewide water plan was significantly modified by Senate Bill 1, Acts of the 75th Legislature, 1997, which established a TWDB-coordinated regional water planning process. The TWDB has established 16 regional water planning areas covering the entire state, and a region water planning group (RWPG) in each of these areas. Each regional water planning area, through its RWPG, is responsible for obtaining local input and developing a regional water plan. The study area is located within the Region E Water Planning Area. The Region E Regional Water Plan (LBG-Guyton Associates

et al, 2001) was adopted and submitted to the TWDB prior to January 5, 2001, and incorporated into the 2002 State Water Plan, adopted by the TWDB on December 12, 2001 (TWDB, 2002).

In addition to its water planning responsibilities, the TWDB collects and analyzes data for its planning functions, and administers water development funds under state and federal programs. Water development funds generally are available as low interest loans and some as grants to local and regional governments for water supply and wastewater planning, feasibility, and infrastructure development. However, TWDB financial assistance may be provided only to water supply projects that meet needs in a manner that is consistent with an approved regional water plan. In addition, the TCEQ cannot issue a water right for municipal purposes unless it is consistent with an approved regional water plan.

Other state agencies such as the TCEQ, the Railroad Commission of Texas, Texas Department of Health, Texas Department of Agriculture, Texas Department of Licencing and Regulation, and the Texas State Soil and Water Conservation Board have management or regulatory responsibilities for activities related to environmental protection (TGPC, 2001). The TCEQ is the state's primary environmental regulatory agency. Among its regulatory authorities are water rights permitting; creation and supervision of water districts; industrial, municipal and waste management; and water quality protection. State law, however, does not provide the TCEQ or any other state agency the authority to manage or control groundwater pumpage and use.

State agencies do not have authority to manage or regulate groundwater resources. The roles of state agencies in addressing the problems and concerns identified in the study area are limited to water quality protection primarily through the regulation of waste management, water resource planning and project funding, and facilitation of groundwater management activities through the creation and limited oversight of groundwater conservation districts. Exceptions are the University Lands - West Texas Operations and the GLO, as previously discussed. These state entities can control, generally based on economic viability, groundwater production on state-owned lands.

Regional Institutions

Regional planning and water supply authorities to be considered in evaluating groundwater management activity include some water districts, river authorities, and surface water management authorities. Other regional planning institutions include councils of governments and regional water planning groups.

The Texas State Soil and Water Conservation Board (TSSWCB) was established by the Texas Legislature to administer the Texas Soil Conservation Law. The TSSWCB offers a technical assistance program to the state's 216 soil and water conservation districts (SWCDs). The TSSWCB is the lead agency for the planning, management and abatement of agricultural and silvicultural nonpoint source pollution. The TSSWCB maintains regional offices in strategic locations in the state to help carry out the agency's water quality responsibilities. There are two SWCDs located in the study area, El Paso-Hudspeth SWCD #205 and High Point SWCD #230. Senate Bill 503, an Act of the 73rd Legislature, 1993, created the Water Quality Management Plan Program to provide agricultural and silvicultural (forestry) producers with an opportunity to comply with state water quality laws through traditional, voluntary, incentive-based programs. Landowners and operators may request the development of a site-specific water quality management plan through local SWCDs. Plans include appropriate land treatment practices, production practices, and management and technology measures to achieve a level of pollution

prevention or abatement consistent with state water quality standards (Texas State Soil and Water Conservation Board, 2003).

The study area is located within the Rio Grande Council of Governments (RGCOG). Created in 1967, the RGCOG serves 33 local governments, seven county governments, 12 municipalities, and 14 special districts. The RGCOG is governed by a board of directors that is comprised of 19 local officials from the area (Texas Association of Regional Councils, 2004). Councils of governments (COGs) are political subdivisions of the state and are basically planning and funding distribution agencies with no independent regulatory authority. Among numerous other responsibilities, COGs may make recommendations concerning recreational sites, public utilities, and water supplies. State law mandates that COGs have primary responsibility for the development of regional municipal solid waste plans Regional municipal solid waste plans must conform with the state plan and are adopted by TCEQ rule.

As previously discussed, the study area is located in the Far West Texas Region Water Planning Area, Region E, covering seven counties. The Far West Texas Regional Water Planning Group (FWTRWPG) consist of members representing the public, counties, municipalities, industry, agriculture, environmental groups, small business, electric generating utilities, river authorities, water districts, and water utilities. The FWTRWPG is required to develop a regional water plan, establish policies, make decisions, and consider interest groups in the development of the plans as required by Senate Bill 1 (75th Legislature, 1997). The development of a regional water plan includes studies, decisions, and recommendations on water supply needs. The purpose of the plan is to identify and recommend methods or strategies to conserve water supplies, meet future water supply needs, and respond to future droughts in the region.

Local Government and Water Purveyors

Counties and municipalities typically carry out public health programs such as disposal of municipal solid waste; production, distribution, and protection of public drinking water supplies; and treatment and discharge of municipal wastewater. Local water suppliers include municipalities, water supply corporations, water supply districts, and water conservation and irrigation districts. Wholesale and retail water suppliers are required to prepare and adopt drought contingency plans under TCEQ rules (Title 30, Texas Administrative Code, Chapter 288). These plans are to be implemented during times of water shortage or drought and usually address a variety of measures to reduce peak demands and to extend water supplies. The TCEQ public water system database lists seven public water supply systems in the study area, including: Cerro Alto Water System, Cornudas Restaurant, Dell City, Esperanza Water Service Company, Inc., Fort Hancock WCID, Hudspeth County WCID No. 1, and Villas Travel Plaza.

McNary and Fort Hancock rely on groundwater from the Hueco Bolson. The water is provided by one well owned by Fort Hancock Water Control and Improvement District (WCID) and 11 wells owned by the Esperanza Water Service Company (WSC) (Figure 11). The Fort Hancock WCID has plans to drill another well and to install a reverse osmosis treatment plant. The Esperanza WSC has installed a reverse osmosis plant to desalinate water (FWTRWPG, 2001).

Sierra Blanca, through the Hudspeth County WCID No. 1 (Figure 11), purchases water from the City of Van Horn in Culberson County. The City of Van Horn produces water from a well field located over the Wild Horse Flat of the West Texas Bolsons aquifer (FWTRWPG, 2001).

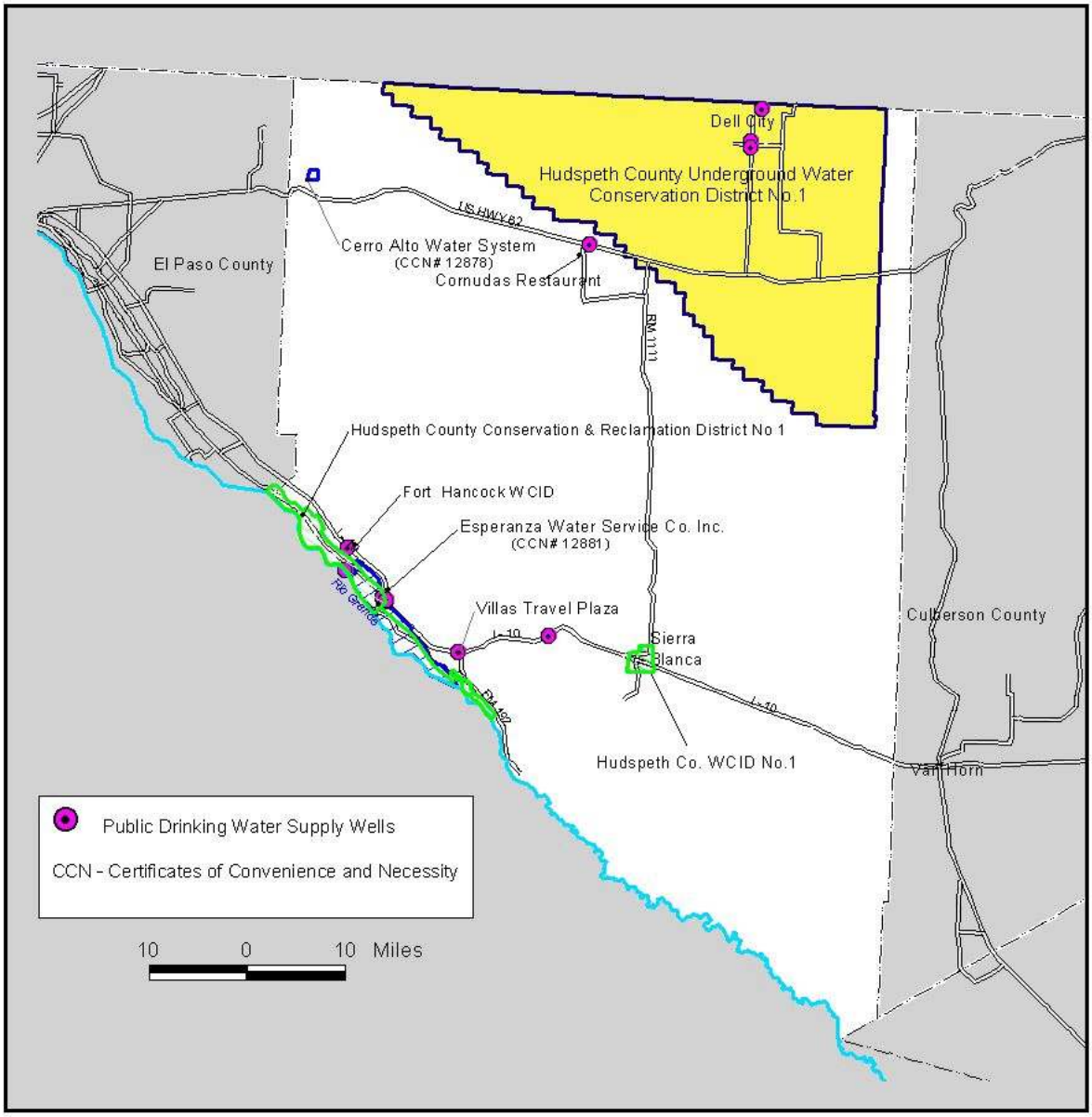

Figure 11. Location of Certificates of Convenience and Necessity and public water supply wells within the study area.

The Hudspeth County Conservation and Reclamation District No. 1 (HCCRD) includes approximately 18,300 acres of Rio Grande bottomlands from the El Paso-Hudspeth county line downstream to Fort Quitman (Figure 11). The HCCRD was created to provide adequate irrigation to those bottomlands. The HCCRD does not supply potable water. The HCCRD was organized in 1924 to consolidate water diversions from the Rio Grande. A board of directors governs the district with headquarters in Fort Hancock, Texas. The HCCRD developed an irrigation district plan in November, 1991 to conserve the waters of the Rio Grande to the maximum (George and others, 2005).

The Local Government Code, §§212.0101 and 232.0032 provide groundwater availability certification authority to all municipal and county platting authorities in the state. Under this statute, a municipal platting authority or county commissioners court may require a person submitting a plat for the subdivision of a tract of land for which the intended source of water supply is groundwater under that land to demonstrate that adequate groundwater is available for the proposed subdivision. If groundwater availability certification is required by the local platting authority under the Local Government Code, the plat applicant must evaluate groundwater resources and prepare the availability certification pursuant to TCEQ rules. The rules establish the appropriate form and content of a groundwater availability certification and have been adopted as Title 30, Texas Administrative Code, Chapter 230.

Municipalities have authorities for the protection of public health but are not directly authorized to manage or regulate groundwater withdrawals. Municipalities and other water suppliers can indirectly limit groundwater withdrawals by implementing and enforcing water conservation programs and securing and developing alternative supplies. Municipal and county groundwater availability authority under the Local Government Code can be an effective groundwater management tool and can address certain wells that would be outside of a groundwater conservation district's management jurisdiction. However, this management tool is limited because it only addresses areas that are being subdivided and does not allow for aquifer-wide or regional assessments.

Groundwater Conservation Districts

Groundwater conservation districts are charged to manage groundwater by providing for the conservation, preservation, protection, recharging, and prevention of waste of the groundwater resources within their jurisdictions. Groundwater conservation districts have required duties that must be performed, as well as a number of authorized powers that may be invoked. The required duties include:

- developing and adopting a comprehensive management plan and coordinating planning with regional planning groups, state agencies, and other groundwater conservation districts located within the same groundwater management area;
- adopting necessary rules to implement the management plan;
- requiring permits for drilling, equipping, or completing wells that produce more than 25,000 gallons per day;
- requiring records to be kept of the drilling, equipping, and completion of water wells, as well as on the production and use of groundwater; and,
- adopting rules for governance and to establish administrative and financial procedures, such as preparing and approving an annual budget, having an annual audit, holding regular board meetings, and submitting records to the appropriate state agency.

To manage groundwater resources, groundwater conservation districts are also authorized to adopt rules to: control the spacing of water wells and regulating the production of wells; carry out research projects and collect information regarding the use of groundwater; require abandoned wells permanently closed or capped; and, develop and maintain aquifer recharge projects.

The study area is located within both Groundwater Management Areas 4 and 5 as designated by the TWDB (Figure 12). Most of the study area is located within Groundwater Management Area 4 with Brewster, Culberson, Jeff Davis, and Presidio counties with the southwest corner area lying within Groundwater Management Area 5 along with El Paso County. Five groundwater conservation districts have been created and confirmed within Groundwater Management Area 4. The GCDs include: Brewster County GCD, located southeast of the study area; Culberson County GCD, located in the southwest corner of Culberson County east of the study area; Jeff Davis UWCD, located southeast of the study area; Presidio County UWCD, located southeast of the study area; and, Hudspeth County UWCD No. 1, located within the study area in the northeast corner of Hudspeth County.

Hudspeth County UWCD No. 1 was created in 1956 and is located in the Dell Valley irrigation area of northeast Hudspeth County, with the City of Dell City lying approximately in the center of the District. District activities primarily include the monitoring of water-levels in the aquifer, permitting of groundwater use, and advising local irrigators of pending problems (FWTRWPG, 2001; George and others, 2005). The Hudspeth County UWCD No. 1 revised its groundwater management plan in May 2002 (Hudspeth County UWCD No. 1, 2002). The Hudspeth County UWCD No. 1 issues two categories of production permits: “validation permits” issued to existing and historic users and “operating permits” issued to new users. Depending on the aquifer level, validation permit holders may pump between three and four acre-feet per acre per year, and operating permit holders may pump between zero and four acre-feet per acre per year.

In summary, five groundwater conservation districts have been established within Groundwater Management Area 4 to manage the Edwards-Trinity Plateau, Bone Spring-Victorio Peak, Igneous, West Texas Bolsons, Marathon, and Capitan Reef Complex aquifers and these districts have sufficient authority to conserve, preserve, and protect groundwater resources. One of the groundwater conservation districts, Hudspeth County UWCD No. 1, is located within the study area and overlies the Bone Spring-Victorio Peak aquifer. However, in the rest of the study area, there are no existing groundwater management authorities with the ability to effectively manage the Capitan Reef Complex, Hueco Bolson, or West Texas Bolsons aquifers.

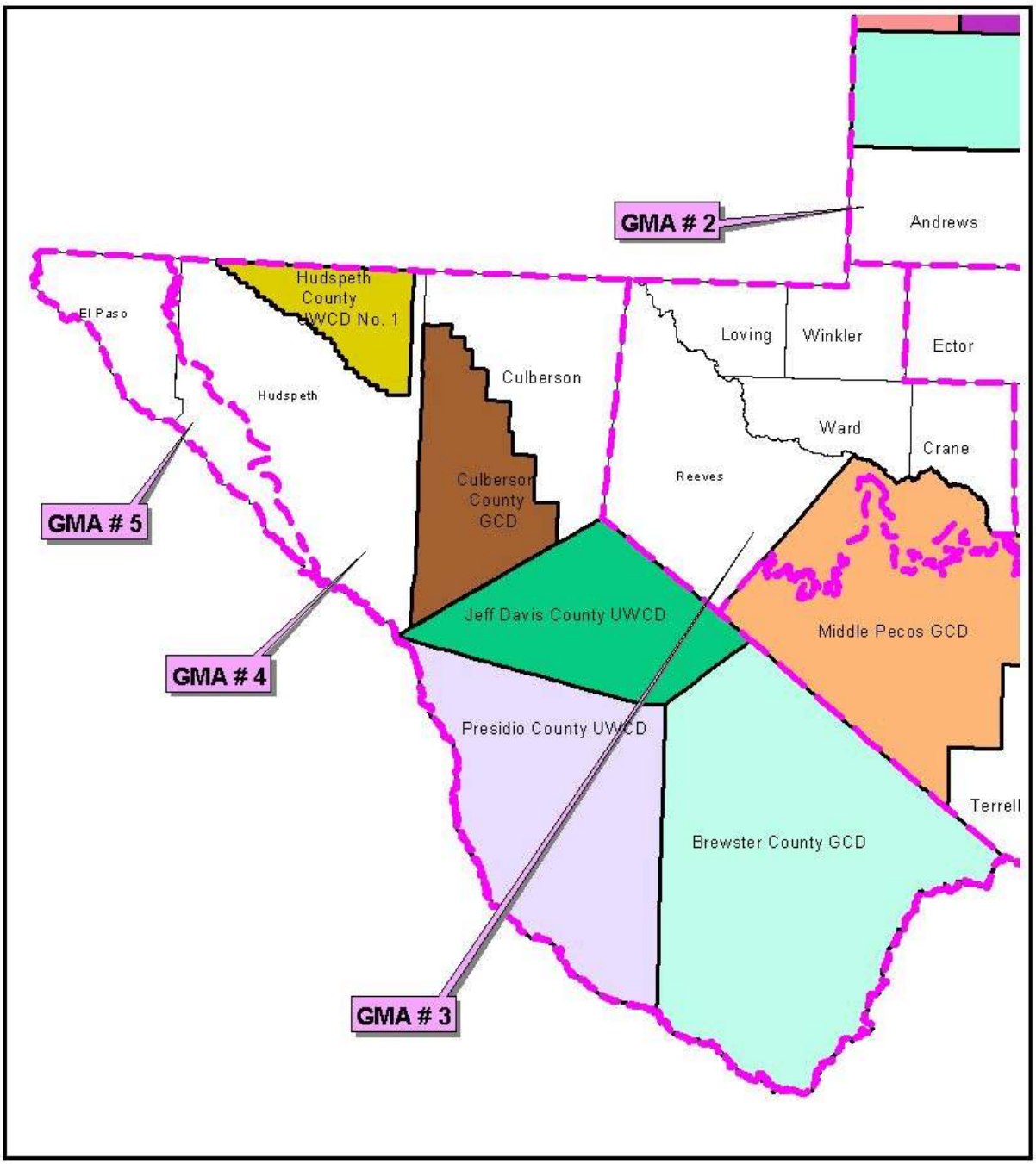

Figure 12. Groundwater conservation districts and groundwater management areas in far west Texas.

ADMINISTRATIVE FEASIBILITY OF GROUNDWATER MANAGEMENT

At present, the only groundwater conservation district existing in the study area is the Hudspeth County Underground Water Conservation District No. 1. The feasibility of managing groundwater resources within the study area, but outside of the Hudspeth County UWCD No. 1, is presented within this section. Groundwater management approaches which can be utilized by groundwater conservation districts are evaluated. Area-specific groundwater management strategies, economic and financial considerations, and available district-creation options are discussed below.

Groundwater Management Approaches

Various mechanisms are available for protecting groundwater resources in an area. They range from imposing restrictions on groundwater withdrawals to developing alternate supplies, to conjunctively using both surface water and groundwater. Some existing entities such as municipalities and water providers can effectively implement programs to secure alternative supplies or to treat water for public consumption. However, they are able to research and protect aquifer systems. Regulating groundwater withdrawal can prolong the life of an aquifer and increase land value by assuring a reliable supply of water for future use and economic development.

Local or regional groundwater conservation districts (GCDs) are the state's preferred method of managing groundwater resources, and are the only entities in Texas explicitly granted the power to regulate groundwater withdrawals. These districts are charged with managing groundwater by conserving, preserving, protecting, recharging, and preventing wastage of the groundwater resources within their jurisdiction. The approaches or techniques for managing groundwater through a groundwater conservation district include:

- water resource planning and education;
- groundwater resource assessment and research;
- monitoring of water-levels, water quality and land subsidence;
- well permitting and registration;
- limiting withdrawals through well spacing or setback requirements;
- well pumpage or use limitations; and,
- use of engineered structures or injection wells to enhance natural recharge or artificially recharge groundwater aquifers.

Through groundwater monitoring (both quantity and quality) and assessment functions, a GCD can quantify groundwater resources, study and investigate aquifer characteristics, and identify groundwater problems which need to be addressed. Planning functions outline appropriate management objectives and goals for the district to preserve and protect groundwater resources and GCD rules are adopted to achieve the management planning objectives and goals.

GCDs are required to establish water well permitting and registration programs and through these programs can quantify aquifer impacts from pumpage. An efficient water well inventory, permitting, and registration program allows a groundwater conservation district to establish an overall understanding of groundwater use and production within the district. Permits must be obtained from the district to drill, equip or complete wells, or to substantially alter the size of wells or well pumps. Certain types of water wells are exempted from GCD permitting. These exempted wells generally include wells incapable of

producing 25,000 gallons per day on tracts of land larger than 10 acres and wells supplying water for exploration, production, and other activities permitted by the Railroad Commission of Texas. Wells exempted from regulation by a district must, however, be completed and maintained in accordance with the district's rules regarding prevention of waste and pollution of the groundwater, and must be registered with the district before being installed.

GCDs may also adopt rules to regulate the spacing and production of water wells. Spacing regulations are generally adopted by a district to minimize drawdown of water-levels (both water table and artesian pressure), control subsidence, prevent waste, and prevent interference from other nearby wells. Spacing and production regulations are commonly based on minimum distances from other wells or property lines, a maximum number of wells in a specified area of land (e.g., ¼-section, ½-section, or full-section), or a maximum allowable production per a given unit of land (e.g., 5 gallons per minute per acre or 1 acre-foot of production per year per acre of land).

Groundwater conservation district management activities can include protecting water quality by regulating water well construction and ensuring proper well closure and actively identifying and closing abandoned wells. Districts may also administer activities such as weather modification or recharge enhancement projects to enhance natural recharge and increase groundwater supplies. Other important GCD management programs include water conservation, public education efforts, and providing conservation assistance through loan and grant programs.

The FWTRWPG is required to consider current water availability and use, existing water supply plans, and drought contingency plans during the development of their regional water plans. Regional water planning groups are charged to include potentially feasible water management strategies, including groundwater strategies, within their regional water plans. The regional water planning groups are designed to involve the stakeholders and the public in water issues both at a local and regional level. Such local participation should improve the development of management, conservation, and reclamation practices for those whose lives and livelihoods depend on protection their common water resources.

Identified Groundwater Management Strategies

The water supply problems identified in the study area include widespread high total dissolved solids (TDS) concentrations in groundwater, lack of firm alternative supplies for irrigation use in the Rio Grande Valley during drought-of-record conditions, and private domestic wells in the rural areas of the county going dry due to drought.

The available data indicates that water is of sufficient quality in the study area to meet intended and projected uses. Water suppliers either use or are planning to use desalination to treat groundwater to meet drinking water standards (maximum contaminant level of 1,000 mg/L). Surface and groundwater supplies are sufficient to meet the present needs during typical years and are projected to be sufficient to meet all future needs to 2030. The exception to this is the Irrigation water use category in the Rio Grande Valley during drought-of-record conditions. Another potential water supply problem for the study area is water exportation. However, it is unknown at this time how much and where this water exportation will take place, and therefore, the potential effect this exportation will have on the water resources of the study area cannot be determined at this time. The Far West Texas Regional Water Plan calls for deepening wells to reach groundwater for rural water users and constructing new wells for irrigation in the Rio Grande Valley in times of extreme drought.

The following management strategies are recommended for the area to address identified problems and issues:

- quantify groundwater availability and quality, understand aquifer characteristics, and identify groundwater problems which should be addressed (both quantity and quality) through aquifer- and area-specific research, monitoring, data collection, and assessment programs;
- quantify aquifer impacts from pumpage and establish an overall understanding of groundwater use through a comprehensive water well inventory, registration, and permitting program;
- evaluate and understand aquifers sufficiently to establish spacing regulations to minimize drawdown of water levels and to prevent interference from neighboring wells;
- establish educational programs, for school children and for the general public, to make them aware of actions which can be taken to conserve water resources;
- establish administrative programs and contacts to assist agriculture producers secure conservation grant or loan monies for conversion to more efficient irrigation systems;
- protect water quality by requiring water well construction to be protective of fresh-water zones and by administering a program to locate and plug abandoned water wells; and,
- actively participate in the regional water planning process, groundwater availability model refinements, and regional groundwater management and protection programs with other far west Texas groundwater conservation districts and entities.

Implementation of any or all of the above management programs would be a benefit to the study area by protecting groundwater resources. These programs could best be implemented by a GCD. A GCD could benefit the study area by implementing groundwater management strategies as authorized under Texas Water Code, Chapter 36 such as monitoring, assessment, planning, and permitting programs as well as water well spacing and water-quality protection rules.

Economic Considerations and Impacts

Obtaining alternative sources of water for an area is often cost prohibitive because either new or additional surface water rights must be acquired or infrastructure constructed to deliver surface water or groundwater from outside sources. The economic impacts of managing groundwater resources through a groundwater conservation district are both positive and negative. For example, managing an area's groundwater resources can increase the value of land in the area by extending the economic life of the aquifer(s), limiting the possible encroachment of salt-water, and reducing other water quality impacts. Indeed, one of the benefits of a GCD is the district's proactive approach through its assessment and monitoring, planning, permitting, and other conservation programs to equitably extend groundwater supplies for future use and economic development. GCDs also benefit the area by developing and implementing regulations for adequate well spacing, water well construction, pollution prevention through the plugging of abandoned wells, and also by providing public education outreach programs.

While a district may provide many benefits to those living within its boundaries, there is a cost for the groundwater management services and activities provided. To finance its operations, a GCD must generate revenue which is generally done either through property taxes collected from all residents within the district or from well production fees collected from major water users. Collection of tax to operate a district places an additional financial burden on all individuals within the district, and the collection of well production fees adds a financial burden to the users of water with permitted wells. The scale of cost for residents is dependent upon many factors including the size and total tax base of the

district or the quantity of water subject to production fees, and the scale and scope of the programs undertaken by the district. Additionally, because a GCD is a political subdivision, it is an additional layer of local government which may not be welcomed by all residents.

Financing Groundwater Management Activities

Groundwater conservation districts are required to operate from an annual budget with spending limited to budgeted items. Present budgets for GCDs in the Far West Texas Regional Water Planning Area range from about $11,600 to about $89,000 (TCEQ personal communication, December, 2004).

Under Texas Water Code, Chapter 36, a GCD may levy an *ad valorem* tax at a rate not to exceed 50 cents per $100 assessed valuation to pay for maintenance and operating expenses. In fact, most GCDs have lower *ad valorem* tax caps established either by their enabling legislation or by voters. Existing groundwater conservation districts currently have tax rates ranging from $0.004 to $0.213 per $100 assessed valuation (or, $4.00 to $213.00 annual tax paid on property valued at $100,000) (Texas Alliance of Groundwater Districts, 2003). Single-county districts generally tend to have higher tax rates than multi-county districts which typically have tax rates averaging around $0.01 per $100 assessed valuation.

The total appraised value for county taxation in Hudspeth County is $227,284,087 (Texas Association of Counties, 2004). The appraised value for county taxation for the area in Hudspeth County outside of the Hudspeth County Underground Water Conservation District No. 1 is $189,262,185. Assuming a GCD was created to cover all of the county, a tax rate of $0.01 (one cent) per $100 value would generate approximately $22,728 annually. If a GCD was formed for the area outside the Hudspeth County UWCD No. 1, and assessed a tax at the same rate ($0.01 per $100), approximately $18,926 revenue would be generated. A tax rate of $0.05 per $100 would generate approximately $94,631 in revenue.

GCDs may also generate revenue through the assessment and collection of well production fees on permitted wells. Unless otherwise addressed by a district's enabling legislation, the production fees are capped by state law at $1 per acre-foot/year for agricultural use, and $10 per acre-foot/year for other uses. Based on year 2000 supply data provided in Table 5, and assuming county-other, livestock, and mining uses would be exempt from potential regulation and fees, about 9,353 acre-feet of water was produced for irrigation and about six acre-feet of water was produced for other purposes (municipal and manufacturing) in the study area. (The water produced from the Bone Springs-Victorio Peak aquifer is managed by the Hudspeth County UWCD No. 1, and thus not included in these numbers.) Based on the creation of a GCD in Hudspeth County outside the boundaries of Hudspeth County UWCD No. 1 and utilizing the maximum statutory well production fee rates ($1 per acre-foot/year for agricultural use and $10 per acre-foot/year for other uses), about $9,413 of revenue could be generated through this method to finance district operation and maintenance.

To a lesser extent, GCDs may also generate revenue by assessing fees for administrative services such as processing permit or groundwater transport applications, performing water quality analysis, providing services outside of the district, and capping or plugging abandoned wells. These fees must not unreasonably exceed the cost of providing these services. GCDs can also impose export fees (see below) and apply for and receive grants, loans and donations from governmental agencies, individuals, companies or corporations for specific conservation projects or research.

In addition, GCDs can issue and sell tax bonds for capital improvements such as building dams, draining lakes and depressions, installing pumps and equipment, and providing facilities for the recharge of aquifers. Such tax bonds are subject to voter authorization, TCEQ review, and the State Attorney General's approval. The taxing rate is not capped for the repayment of bond indebtedness.

GCDs may impose an export fee on water transferred out of the district. Unless otherwise addressed by a district's enabling legislation, the export fee is based on the district's existing tax or production fee rates or is negotiated with the transporter. GCDs are allowed to charge a 50 percent export surcharge in addition to the production fee charged for in-district use. Conversely, a few groundwater conservation districts have been created without the authority to impose *ad valorem* taxes or water use fees. These districts have generally been funded by county government and are limited in the scope of programs they can implement by the amount of funding received.

Management Options

Water management planning can be carried out at various scales of oversight and authority. On a state-wide scale, no single entity has authority to manage all the groundwater resources of the state. However, state-level water planning responsibilities and GCD management plan oversight responsibilities are well defined. Assessment and planning by the regional water planning groups can identify areas with groundwater problems and appropriate management options for use by regional and local entities. However, the regional water planning groups do not have authority to manage groundwater or other water resources or to implement water conservation programs.

County and municipal authorities can require plat applicants to evaluate and demonstrate that site-specific groundwater resources are available and sufficient for new subdivisions. Cities, utilities, and water suppliers can implement programs to discourage water waste and seek alternative supplies. However, none of these local entities are directly authorized to manage groundwater pumpage or sufficiently authorized to research, monitor, and develop programs and rules to protect aquifer systems.

Several groundwater management options are available for the study area. In one scenario, citizens can opt not to take any action. If an area does not have any demonstrated or anticipated groundwater problems or issues, this may be an appropriate choice. If this is not the case, however, this choice would not offer any resource protection to landowners and would allow existing groundwater problems to persist or worsen.

A GCD created within the study area would have the necessary authority to accomplish groundwater management objectives identified in the preceding text. Such a district would have the best available regulatory authority to manage groundwater resources in the area. If true groundwater management is desired, the citizen must consider several methods for the creation of a groundwater conservation district. Most GCDs are created by special Acts of the Texas Legislature. In other general law procedures, statute allows landowners to petition the TCEQ for the creation of a GCD, or allows landowners to petition another district to be added into that district. Lastly, if an area is designated as a PGMA, landowners are provided a two-year period to accomplish one of the above district creation actions. If they do not, TCEQ is required to create a GCD or recommend the area be added to an existing GCD. (Methods of, and procedures for, GCD creation are discussed in significant detail in TCE, 2002a and 2002b.)

Historically, single-county GCDs have been the predominant choice of Texas citizens. However, multi-county GCDs covering larger portions of aquifers have become more prevalent over the past half-dozen years. Such districts can exercise management and planning authority on a local scale and can affect groundwater management on a regional scale. Generally, multiple single-county GCDs or a few multi-county GCDs are created within the same groundwater management area and each district operates under its own rules and regulations to manage the groundwater resource. However, because these GCDs share common groundwater resources, it is imperative their efforts to manage the resource be coordinated.

Under §36.108 of the Texas Water Code, GCDs within a common groundwater management area are required to share their certified groundwater management plans with the other districts present within the management area. These GCDs are encouraged, under §36.108, to conduct joint public meetings to review management plans and plan-accomplishments for the management area. The districts are further advised under §36.108 to consider the goals and effectiveness of each management plan and the impact each management plan will have on planning throughout the management area. Through these cooperative efforts, local GCDs can effectively provide coordinated regional management of a shared groundwater resource.

Study Area Only Groundwater Conservation District

Citizens could consider a district configured by the study area, which would include all of Hudspeth County minus the area contained in the Hudspeth County UWCD No. 1. The generation of revenue to finance meaningful groundwater management programs would be the limiting factor for the consideration of this GCD creation option. TCEQ staff estimate approximately $150,000 in revenue is needed to operate a district and sufficiently fund groundwater management programs. The area of Hudspeth County outside of the Hudspeth County UWCD No. 1 is capable of generating sufficient revenue to operate a GCD alone through an *ad valorem* tax of less than $0.08 per $100 valuation. A tax rate of $0.08 per $100 valuation would generate approximately $151,410.

TCEQ staff estimate that by utilizing the maximum statutory well production fee rates about $9,413 of revenue could be generated to finance district operation and maintenance. Therefore, a study area only GCD would not be able to generate sufficient revenue to operate a GCD through the assessment of well production fees.

The creation of a study area only GCD is feasible; nevertheless, citizens should understand that better economic, administrative, groundwater management options exist. This type of district would be able to adopt regulations and programs to manage the Hueco Bolson, the West Texas Bolsons, the Capitan Reef Complex, and the Diablo Plateau aquifers.

Addition of Study Area to Existing Groundwater Conservation District

Alternatively, the landowners in the study area could join an existing GCD through the petition and annexation procedures outlined in Texas Water Code, Chapter 36, Subchapter J. Under such circumstances, and assuming a petition to add territory is accepted by the receiving district, landowners in the study area would agree to assume the financial obligations of the district they would join and be provided equitable representation on the receiving district's board of directors. The advantage of joining an existing district include having established regulations, programs, and infrastructure in place, and an increased tax base which may be less burdensome on the taxpayers in the study area. Presently, the only GCDs that landowners in the study area could join are the Culberson County GCD, Jeff Davis County GCD, or Hudspeth County UWCD No. 1 (Figure 12).

The residents of southwest Culberson County confirmed creation of the Culberson County GCD by election on May 2, 1998. The Culberson County GCD generates revenue from property taxes at a rate of $0.07301 per $100 valuation and manages parts of the Capitan Reef Complex and West Texas Bolsons aquifers. Both the Capitan Reef Complex and West Texas Bolsons aquifers extend from Culberson County into Hudspeth County. Along with shared aquifers, Culberson County also has the highest budget of all GCDs in this region.

The residents of Jeff Davis County confirmed creation of the Jeff Davis County GCD by election on November 2, 1993. The Jeff Davis County GCD is funded by the County Commissioners Court plus the District generates revenue by assessing well production fees. The Jeff Davis County GCD manages parts of the Edwards-Trinity, West Texas Bolsons, and Igneous aquifers.

The residents of the Dell Valley area of northeast Hudspeth County confirmed creation of the Hudspeth County UWCD No. 1 by election on October 5, 1957. By an Act of the 78th Legislature, Regular Session, 2003 (HB 3442), the boundaries of the Hudspeth County UWCD No. 1 were changed by removing territory from the eastern part of the District, overlying the Capitan Reef Complex aquifer, and by adding territory to the south and west, overlying the Bone Spring-Victorio Peak aquifer. The Hudspeth County UWCD No. 1 generates revenue from property taxes at a rate of $0.213 per $100 valuation and manages groundwater resources in the Bone Spring-Victorio Peak aquifer. The rules of the Hudspeth County UWCD No. 1 are specifically tailored to the groundwater management issues of the Bone Spring-Victorio Peak aquifer and may not be a good fit for other aquifers in the county.

If any of these GCDs were agreeable to an inclusion-petition from landowners in the study area, the resultant GCD would have the benefit of 1) a larger revenue base, 2) a larger areal extent of area aquifers, and 3) being able to develop uniform management programs for the area aquifers. However, the enabling legislation for the Culberson County GCD, Jeff Davis County GCD, and Hudspeth County UWCD No. 1 would need to be amended to allow flexibility for board member representation.

The general manager of the Hudspeth County UWCD No. 1 has initially indicated that the district's Bone Spring-Victorio Peak management programs could not be applied to the other hydrologically different parts of the county and adding the rest of the county to the district would be problematic. The other two GCDs did not offer any comments for TCEQ consideration. However, they both manage some common aquifers with the study area. Because of GCD budget and specific aquifer management programs, adding specific parts of the study area to the Culberson County GCD may be the most feasible and practicable GCD creation option for the study area.

Under any of the groundwater conservation district creation scenarios outlined above, it will be imperative for a district to understand the water supply options and strategies that have been identified in the Far West Texas Regional Water Plans (FWTRWPG, 2001) and the groundwater data in the State Water Plan (TWDB, 2002). These data and water supply strategies will serve as guides for water planning in the region for the next 50 years. Further, a district should also intimately understand and recognize the drought contingency plans of the water suppliers in the area and the water demands of areas proposed for platting. Through monitoring programs, assessment, research, and cooperation, a district in the study area should be able to institute successful groundwater management programs for the Hueco Bolson, the Red Light Draw, the Eagle Flat, the Green River Valley, the Capitan Reef Complex, and the Diablo Plateau aquifers and provide better information and input about the groundwater resources for consideration in future updates to the regional and state water plans.

SUMMARY

Texas Water Code, Section 35.007, requires that a TCEQ Priority Groundwater Management Area (PGMA) report: 1) examine the reasons and supporting information for or against designating the study area as a PGMA; 2) recommend the delineation of boundaries if PGMA designation is proposed; 3) provide recommendations regarding groundwater conservation district creation in the study area; 4) recommend actions necessary to conserve natural resources within the study area; and, 5) evaluate information or studies submitted by the study area stakeholders.

The Texas Water Code requires the report to identify present critical groundwater problems, or those expected to occur within a 25-year planning horizon. Critical groundwater problems which warrant PGMA designation include shortages of surface water or groundwater, land subsidence resulting from groundwater withdrawal, and contamination of groundwater supplies. This report evaluates the authorities and management practices of existing groundwater management entities within the study area and makes recommendations on appropriate strategies necessary to conserve and protect groundwater resources in the area.

Water Use and Supply

The water supplies in the study area include groundwater and surface water from the Rio Grande. More water is used for irrigation in the study area than for any other purpose. Irrigation has consistently accounted for over 99 percent of the total amount of water used in Hudspeth County for many years. Of the amount of water used for irrigation purposes in 2000, 84 percent was supplied by groundwater sources, up from 57 percent in 1995 and 36 percent in 1990. However, information generated for Hudspeth County stakeholders estimated much less groundwater use for irrigation in 2000. Using this estimation, irrigation still accounted for more than 99 percent of total water used, but groundwater accounts for 71 percent of water used for irrigation. Municipal and County Other (primarily rural domestic) use accounted for less than 0.2 percent of the total water used in 2000; all of this water was groundwater. Livestock water use accounted for over 0.2 percent. Groundwater was used to supply water for mining and manufacturing purposes. In 2000, water supply for mining and manufacturing represented a combined 3 acre-feet per year, or 0.001 percent of total water use.

The total quantity of water available to the study area, under drought-of-record conditions, is estimated to be 150,529 acre-feet per year through 2030. In the study area, groundwater during drought-of-record conditions would supply all of the water usage. In 2000, groundwater supplied approximately 222,985 acre-feet in the study area, while surface water supplied 41,894 acre-feet. Using Blair's (2003) estimation, groundwater supplied approximately 103,962 acre-feet. Of this amount, irrigation use accounted for over 99 percent of this supply. The Bone Spring-Victorio Peak aquifer is the most prolific aquifer in the study area. The 2001 Far West Texas Regional Water Plan indicates that the Bone Spring-Victorio Peak aquifer is expected to be able to supply over 140,000 acre-feet per year through 2030. However, the Hudspeth County UWCD No. 1 estimates that the usable amount of groundwater (groundwater availability) from the Bone Spring-Victorio Peak aquifer to be 63,000 acre-feet per year, the average amount of recharge from lateral inflow, and state that this value is the long-term average amount of groundwater available for consumptive use. Water demand in the study area is expected to decline from 125,303 to 117,714 acre-feet per year in 2030.

Surface water in the study area consists of only the Rio Grande. The Rio Grande enters Texas from New Mexico and forms the boundary between the United States and Mexico eventually making its way to the Gulf of Mexico. The Hudspeth County Conservation and Reclamation District No. 1 obtains water from the Rio Grande to irrigate croplands. In 1990, 89,759 acre-feet of surface water was used for irrigation and 18 acre-feet for livestock. In 1995, that number increased to 105,146 acre-feet for irrigation and 20 acre-feet for livestock. In 2000, irrigation from surface water decreased to 41,863 acre-feet, but livestock use increased to 31 acre-feet. Irrigation supply in the Rio Grande Valley is linked directly and solely to flow and availability of surface water in the Rio Grande. During drought-of-record conditions, there is no water available from the Rio Grande.

Groundwater Supply Concerns

Under present water demands, there is enough water in Hudspeth County to meet all needs. However, there is a widespread problem with water salinity. Most aquifers in the county contain water that is at least slightly saline (more than 1,000 mg/L to 3,000 mg/L). The salinity of groundwater greatly limits its use without treatment. Historic pumpage has caused some springs to stop flowing and, in the Bone Spring-Victorio Peak aquifer, pumpage has caused an average water-level decline of 30 feet.

The only unmet need in the county is the Irrigation water use category (WUC) in the Rio Grande Valley. In a typical year, when water is present in the river, the Irrigation WUC obtains water for its needs from the Rio Grande. However, under drought-of-record conditions there is no water in the river. Under these conditions, there is an unmet need of over 40,000 acre-feet per year. The only options for the Rio Grande Valley Irrigation WUC during drought-of-record conditions are to obtain effluent from the City of El Paso, pump groundwater from the Rio Grande Alluvium, or suspend agricultural activities altogether. Due to the salinity of the water in the Rio Grande Alluvium, the use of water produced from this aquifer is greatly limited since elevated salinity can reduce soil productivity.

Another potential threat to groundwater supplies is exportation of water out of the county. According to the 2001 Far West Texas Regional Water Plan, a primary management strategy for the City of El Paso is to export groundwater from other local counties. One of these areas is over the Bone Spring-Victorio Peak aquifer in Hudspeth County. The strategy calls for the export of 30,000 acre-feet per year in 2030. In addition to the identified strategy for transferring water from the Bone Spring-Victorio Peak aquifer, land has been purchased over the Capitan Reef Complex aquifer on the Culberson-Hudspeth county line by the El Paso Water Utilities. Long-range planning (10 to 15 years) by the El Paso Water Utilities includes importing groundwater from either the Bone Spring-Victorio Peak or the Capitan Reef Complex aquifer (up to 25,000 acre-feet per year). Eventually, the El Paso Water Utilities plans on producing 25,000 acre-feet per year from the Capitan Reef Complex aquifer and 50,000 acre-feet per year from the Bone Spring-Victorio Peak aquifer.

The General Land Office (GLO), which manages state of Texas-owned lands in Hudspeth County, is considering leasing land for the production of groundwater from the Hueco Bolson and the West Texas Bolsons aquifers. There is a potential lessee for groundwater development on these lands, but no agreements exist at this time. It is unknown how much, when, or even if groundwater will be produced from these aquifers on Public School Fund Land.

There are also out-of-state groundwater development projects going on with potential to impact groundwater resources in Hudspeth County. The New Mexico Interstate Stream Commission has filed

applications to pump 90,000 acre-feet per year of groundwater from the New Mexico portion of the Bone Spring/Salt Basin aquifer. This volume of pumpage could have a major effect on groundwater underflow into the study area and groundwater availability in the Dell Valley area. At this time, there is not enough information to accurately predict how this potential pumpage in New Mexico would impact groundwater resources in Texas.

Projected Demand, Availability, and Strategies to Meet Needs

Overall, the total population of the study area increased by almost seven percent (187 people) between 1980 and 1990, and by almost another 15 percent (429 people) between 1990 and 2000. The regional and state water plans project that between the years 2000 and 2030, total population within the study area will increase by over 19 percent (from 3,344 inhabitants in 2000 to 3,995 inhabitants in 2030). However, the total projected water demand from the study area is expected to decrease over the 30-year period. The total projected demand for 2000 was 125,303 acre-feet and the total projected demand for 2030 is 117,714 acre-feet, a difference of 7,589 acre-feet, a decline of just over six percent over the 30-year time frame.

The Irrigation WUC places the highest demands (over 99 percent) on water resources of any WUC in Hudspeth County and will continue to do so over the 25-year study period. This demand is projected to decrease slightly by 2030. Demand for municipal and livestock supplies from 2000 to 2030 are projected to account for a fairly consistent 0.3 percent each of the total water demand in the study area. In 2000, manufacturing demand was only two acre-feet and expected to grow to four acre-feet in 2030 account for significantly less than one percent of the total water demand in the study area. There is no projected mining demand through 2030.

For the 2001 Far West Texas Regional Water Plan, the groundwater availability for all of the study area's aquifers, except for the Bone Spring-Victorio Peak, was defined as the drainable volume of water in the aquifer. For the Bone Spring-Victorio Peak aquifer, groundwater availability was defined on a temporary increase of pumping during times of drought from a sustainable annual production that minimizes the risk of saline water intrusion from the Salt Flats. The data indicate that the drainable volume of the Hueco Bolson, West Texas Bolsons, Capitan Reef Complex, Rio Grande Alluvium, and "Other" aquifers amounts to 1,847,500 acre-feet of groundwater. Production could be maintained for one season, in times of drought, for the Bone Spring-Victorio Peak at 141,000 acre-feet per year. Again, however, the Hudspeth County UWCD No. 1 estimated that, for long-term consumptive use, only 63,000 acre-feet per year is available from the Bone Spring-Victorio Peak aquifer. Under drought-of-record conditions, there is no surface water available.

The 2001 Far West Texas Regional Water Plan and 2002 State Water Plan indicate a county-wide surplus of water for meeting in-county demands. However, there are projected unmet needs in Hudspeth County. In southern Hudspeth County, the Rio Grande is not expected to produce water during a repeat of the drought-of-record and use of groundwater from the Rio Grande Alluvium aquifer is limited due to poor quality. The preferred strategy of the 2001 Far West Texas Regional Water Plan to provide more water for irrigation is to add wells or expand existing wells. However, due to the high salinity of wells along the Rio Grande, the Far West Texas Regional Water Planning Group proposed either obtaining effluent from the City of El Paso or agricultural growing operations until river water becomes available. Also, some rural domestic water wells have gone dry due to drought; the Far West Texas Regional Water Planning Group recommends deepening existing wells.

There are planned water exportation projects from the Bone Spring-Victorio Peak and the Capitan Reef Complex aquifers to meet water needs in El Paso County from Hudspeth County. Planning by El Paso Water Utilities includes the transfer of 25,000 acre-feet per year of groundwater from either the Capitan Reef Complex aquifer or the Dell City area within the next 10 to 15 years. There are also proposed plans for a private entity to export water from the Hueco Bolson and the West Texas Bolsons aquifers from Permanent School Fund Lands managed by the General Land Office. Currently, there are no projections for how much water, if any, will be exported or on what time frame export would occur.

Natural Resources Considerations

Brune (1981) identified eight springs and eight seeps in the study area. Brune also identified the location of a number of former springs. There are early records for a number of springs occurring in Hudspeth County, among them, Indian Hot Springs, Eagle Spring, Cottonwood Springs, Washburn Springs, Persimmon Springs, Cove Spring, and Crow Springs. Most of these springs ceased flowing in the 1950s, due to the lowering of the water table by agricultural practices. Overgrazing in the region has led to the destruction of luxuriant grasses and associated organic matter which aided recharge by retaining water until it could sink into underground formations. Thus, overgrazing has caused a reduction in recharge.

The development of agriculture and population growth along the Rio Grande has resulted in a marked decrease in the Rio Grande water quality and quantity. This degradation of the river has had an adverse effect on the range and distribution of many fish species. Five species of fish that were once present in this region are now either extinct or extirpated from this area.

There are currently 48 species federally-listed, being considered for federal-listing, or state-listed as endangered, threatened, or rare in the study area. Some of these species are migrants or wintering residents only, while others are year-round residents. Though native plant and wildlife resources have adapted to withstand aridity of the region, the availability of water can be a critical element in the health of the ecosystem.

Natural resources in the area also support ranching and agricultural production. There were 22,291 cattle and calves and 1,006 sheep and lambs in Hudspeth County in 2002. There are two irrigated farming valleys within the county, the Dell Valley in northern Hudspeth County centered in Dell City and the Rio Grande Valley in the southwest part of the county. In 2000, these farming valleys included an irrigated area of approximately 54,366 acres.

Public Participation Evaluation

A notice regarding this study was sent out to area stakeholders on June 16, 2004. The University of Texas Lands - West Texas Operations (University Lands) was the only respondent to the notice. The information supplied by University Lands indicated that no surface water existed on their 493,405 acres in northern Hudspeth County and that groundwater use is in minor quantities. The groundwater that is produced is normally used for domestic and ranching activities. The University Lands reports that there are no plans to irrigate or add more industry that would increase groundwater use. Currently, there are nineteen wells on University Lands. Several permits have been issued for groundwater exploration. All of these permits have expired without drilling a well capable of supporting municipal usage.

From September 29 to October 1, 2004, the author traveled to the study area to conduct interviews with representatives of the county leadership, Hudspeth County UWCD No. 1, and Fort Hancock WCID. Some of the biggest water issues facing the county according to these stakeholders included: availability of water resources; access to alternative resources; having enough water supply; exportation of groundwater out of the county; sustainability of groundwater production; and, poor water quality.

The Commissioner of Texas Department of Agriculture indicated that, due to the possibility of water exportation by the City of El Paso or some entity leasing water rights on land managed by the General Land Office, the TCEQ should create a PGMA in the study area to ensure groundwater resources in the county are managed.

CONCLUSIONS AND RECOMMENDATIONS

TCEQ staff have considered data and information provided by the TWDB, TPWD, stakeholders in the study area, the 2001 Far West Texas Regional Water Plan, and from independent research to support the following conclusions and recommendations regarding the Hudspeth County PGMA Study Area.

Study Area Designation Recommendation

The water supply problems identified in the study area include widespread high total dissolved solids (TDS) concentrations in groundwater and the lack of firm alternative supplies for irrigation use in the Rio Grande Valley during drought-of-record conditions.

The available data indicates that water is of sufficient quality in the study area to meet intended and projected uses. Surface and groundwater supplies are sufficient to meet the present needs during average precipitation years and are projected to be sufficient to meet all future needs to 2030. The exception to this is the Irrigation water use category in the Rio Grande Valley during drought-of-record conditions. Another potential water supply problem for the study area is water exportation. However, it is unknown at this time how much and from where water exportation will take place. The potential effect this exportation will have on the water resources of the study area cannot be determined at this time. The water supply and water quality issues identified in the report are not presently critical problems and are not anticipated to be critical problems during the next 25-year planning horizon. It is concluded and recommended that the Hudspeth County PGMA study area should not be designated as a priority groundwater management area at this time.

More data are needed to understand how much usable water is truly available for annual use, and how much water can be removed from storage without causing detrimental harm to the natural resources and those whose livelihoods presently depend on the resources as they exist today. Significant well inventorying, aquifer-specific field work, and data development are necessary to more accurately quantify groundwater availability and quality for the study area aquifers. This level of research will be necessary to characterize the resources and to make calculations to evaluate the possible effects of additional groundwater pumping on study area aquifer conditions.

New water demand projections have been adopted for the second round of the state water-planning cycle, and the second round of regional plans are due in 2006. The population of the county is not expected to change drastically within the next 25 years. However, the population in the City of El Paso in El Paso County is expected to increase dramatically. As the population of El Paso grows, it will put greater pressure on area resources including those resources in adjacent counties. A reevaluation of Hudspeth County for critical groundwater problems could be warranted in the future, if potential water exportation projects come to fruition.

Natural Resources Recommendations

The ecology of the Trans-Pecos today reflects a history of human disturbance including overgrazing, soil erosion, lowered water tables in some areas, declining native grasses, and altered river ecosystems. Some study area springs have stopped flowing due to overpumping. It is recommended care be taken in locating water wells so as not to interfere with spring flow.

The fauna and flora of Hudspeth County have adapted to the arid climate that exists there. Some of the species of this region, though, face an uncertain future. The future of these species depends on the quality and quantity of the scarce water resources both surface and ground. Mitigating the negative impacts of past and current land-use practices, such as overgrazing, agriculture, oil and gas extraction, and groundwater pumping, will improve the chances of natural resources recovery. Fundamental changes in natural resources management strategies and valuation are needed to protect the biological systems and natural resources in the study area.

Groundwater Conservation District

The Far West Texas Regional Water Planning Group has identified water supply strategies for the study area including the addition of new water supply wells, expanding the use of existing wells, desalination of groundwater, and other conservation and maintenance practices. In addition to the strategies for the study area, there are water supply strategies for the region that include exporting groundwater supplies out of the study area to the City of El Paso. Existing water suppliers in the study area currently are using or have plans to use desalination for area water supplies. Area water suppliers also have the ability to seek out alternative supplies to meet needs. However, the water purveyors are not authorized to manage groundwater resources on an aquifer-wide scale.

It is concluded that managing and protecting the groundwater resources within the study area could be accomplished through the establishment of a groundwater conservation district. A GCD could benefit the study area by implementing monitoring, assessment, education, planning, and permitting programs as well as water well spacing and water quality protection rules for the Hueco Bolson, West Texas Bolsons, and Capitan Reef Complex aquifers. Due to the potential for groundwater exportation out of the study area, a GCD could set water production limits to ensure long-term groundwater availability for future generations. The protection of groundwater supplies is of great importance because alternative sources are not readily available.

Because the data does not justify PGMA designation for the study area at this time, the local leadership, landowners, and citizens must determine if they desire to manage their groundwater resources. If Hudspeth County citizens do decide that they want manage their groundwater then, on their own initiative, they would need to consider the different methods available to create a groundwater conservation district. Most GCDs are created by special laws of the Texas Legislature. In other general law procedures, statute allows landowners to petition the TCEQ for the creation of a GCD, or allows landowners to petition another district to be added into that district. It is suggested that either creating a GCD in the remaining part of Hudspeth County, or adding the Capitan Reef Complex, the Hueco Bolson, and the Eagle Flat, Red Light Draw, and Green River Valley Bolson aquifer areas to the Culberson County GCD would be feasible and practicable GCD creation options.

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