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GROUNDWATER MANAGEMENT IN EL PASO, TEXAS

by

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DISSERTATION

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ABSTRACT

Groundwater represents an important supply source for municipal and irrigation uses in Far West Texas. The City of El Paso receives about 50 percent of its municipal water supply from surface water and 50 percent from local groundwater. Groundwater pumping in El Paso is from the Hueco Bolson and the Mesilla Bolson. Historic groundwater pumping in the Texas portion of the Mesilla Bolson has not resulted in significant changes in groundwater levels or groundwater quality in existing wells.

Historic pumping in the Hueco Bolson has resulted in lowered groundwater levels and brackish groundwater intrusion. The groundwater level declines have resulted in the intrusion of brackish groundwater into areas that historically pumped fresh groundwater. A 1979 assessment concluded that El Paso would deplete fresh groundwater in the Hueco Bolson by 2030 if groundwater pumping continued to increase. Partly as a result of the 1979 assessment, El Paso reduced its groundwater pumping from the Hueco Bolson by increasing surface water diversions from the Rio Grande, increasing conservation efforts, and increasing reclaimed water use. As a result, groundwater levels in many parts of the Hueco Bolson have stabilized.

Brackish groundwater intrusion remains an issue, and is being addressed with a brackish groundwater desalination plant, currently under construction. The new wells and existing wells that will supply this desalination plant will also assist in the management of brackish groundwater intrusion by intercepting the brackish groundwater before it can flow towards existing fresh groundwater wells.

The 2006 Far West Texas Regional Water Plan contemplates a groundwater transfer project to meet increasing demands in El Paso County beginning about 2030, mostly from the Dell City area in Hudspeth County, Texas. Groundwater management in the Dell City area is

governed by a groundwater conservation district that has established limits on groundwater pumping based on existing and historic uses. Groundwater pumping for irrigation began in the Dell City area in 1948, and groundwater levels have been essentially stable for since the 1980s. Future planning for a groundwater transfer project will require a detailed understanding of the hydrogeology of the groundwater in the Dell City area.

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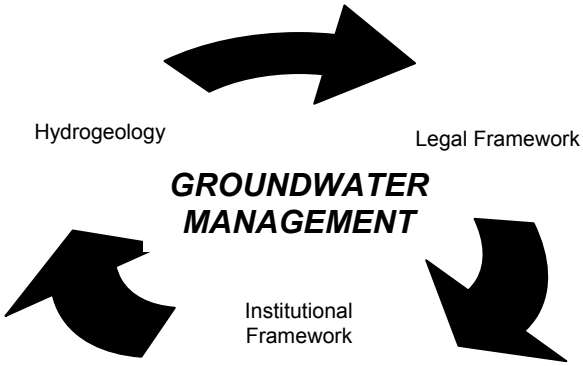
CHAPTER 1. INTRODUCTION

Desert landscapes and mountains characterize far west Texas. Surface water is generally scarce, except for the Rio Grande. Consequently, groundwater represents an important supply source for municipal, irrigation, manufacturing, mining and domestic uses. Managing groundwater resources is important to the present and future of the communities in the area.

Groundwater management combines elements of the hydrogeology of an area, and the legal and institutional framework of the state and region. This dissertation represents a study of the current state of groundwater management in El Paso, Texas, the largest city in west Texas along the border between Texas and Chihuahua (Figure 1). El Paso Water Utilities is the largest provider of water and wastewater services in El Paso County, and provides services within the City of El Paso and several unincorporated areas of El Paso County.



El Paso groundwater management is unique for a two major reasons. First, although the climate in the region is arid (annual rainfall averages 8 inches), water is supplied from both surface water from the Rio Grande and groundwater. Second, it is a city that is located in a state with a unique approach to groundwater regulation, and is within a binational (United States of America and Mexico) and tri-state (Texas, New Mexico and Chihuahua) region. The metropolitan area of El Paso, Texas and Ciudad Juarez, Chihuahua represents the largest international border community in the world.

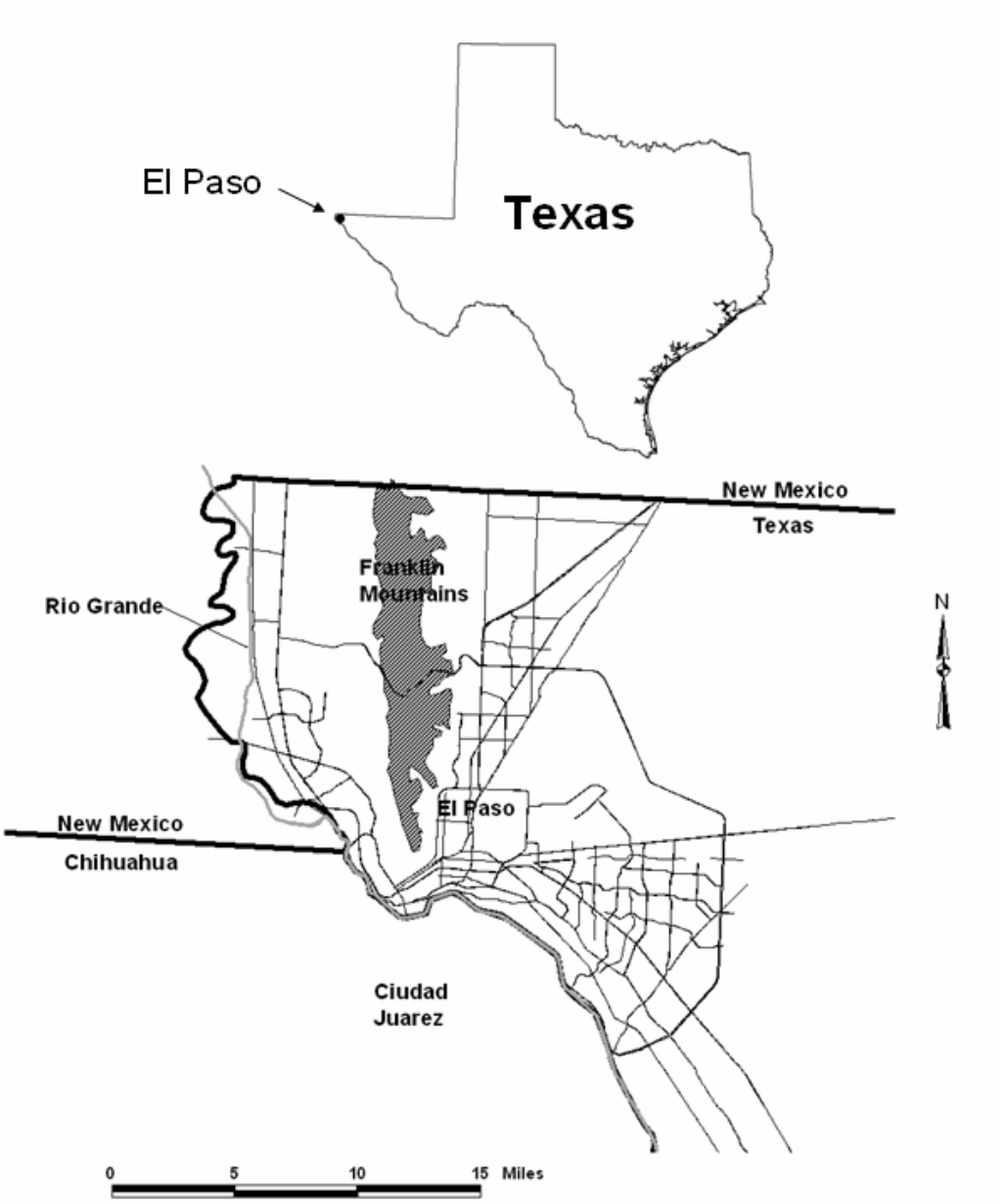


Figure 1. Location of El Paso, Texas

The hydrogeology of the area is influenced by the presence of the Rio Grande and the arid climate. The institutional and legal framework aspects are influenced by the unique groundwater regulation approach in Texas coupled with the binational and tri-state location of El Paso.

1.1 Past and Current EPWU Supplies

Since the beginning of the 20th century, El Paso Water Utilities (EPWU) has relied on both surface water and groundwater for municipal water supply. Surface water is supplied from the Rio Grande (Figure 2).

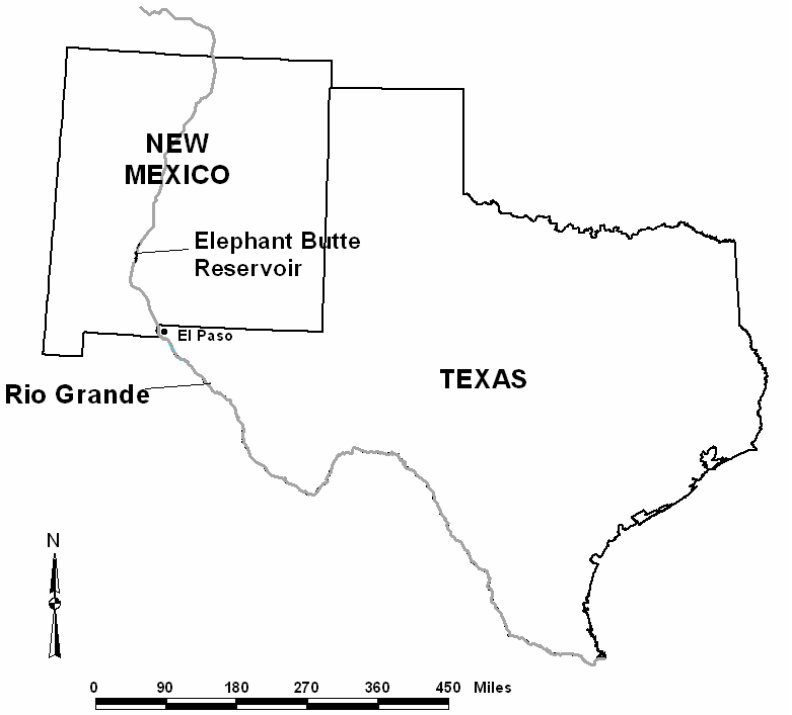


Figure 2. Rio Grande and Elephant Butte Reservoir

The Rio Grande flows that are diverted in the El Paso area are primarily derived from snowmelt runoff in southern Colorado and northern New Mexico. Historically, there are also occasional flood surges associated with storm systems in the summer monsoon season. Spring runoff is stored in Elephant Butte Reservoir in southern New Mexico before releases are made for irrigation and municipal use in southern New Mexico and the El Paso area. EPWU is a customer of the local irrigation district (El Paso County Water Improvement District No.1), and obtains water through ownership of water rights land, or leasing of water rights from agricultural water rights holders (Figure 3).

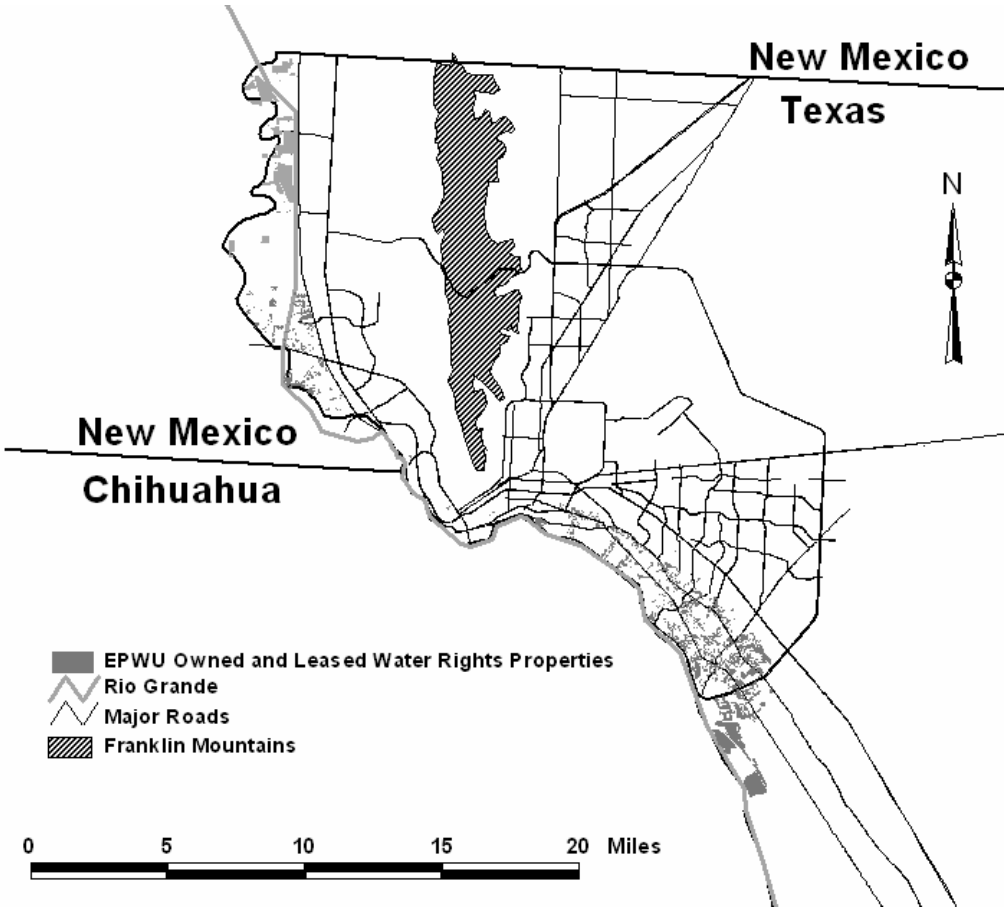


Figure 3. Location of EPWU Water Rights Properties (Owned and Leased)

Groundwater supplies are pumped from the Mesilla Bolson and the Hueco Bolson (Figure 4). The Los Muertos Bolson, adjacent to the Mesilla Bolson is also shown in Figure 4. These groundwater basins underlie portions of New Mexico, Texas and Chihuahua (Creel and others, 2006). Groundwater occurs in unconsolidated fluvial, alluvial, and lacustrine sediments. The Rio Grande plays an important role in the recharge and discharge of both groundwater basins.

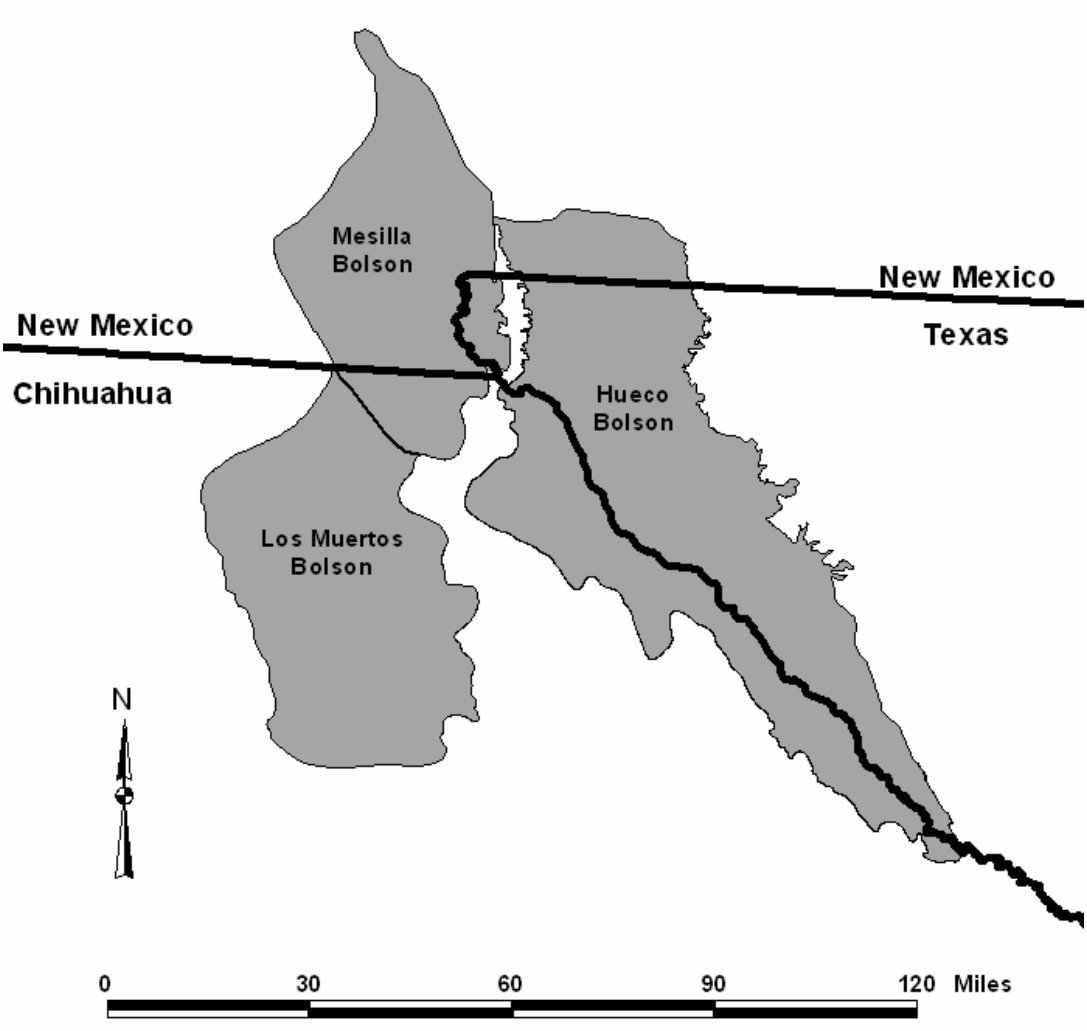


Figure 4. Location of Hueco Bolson, Mesilla Bolson and Los Muertos Bolson

The location of EPWU wells in the Hueco Bolson and Mesilla Bolson and the location of the two EPWU surface water treatment plants are shown on Figure 5. Annual production from each of these sources is summarized in Figure 6, and the data are summarized in Table 1.

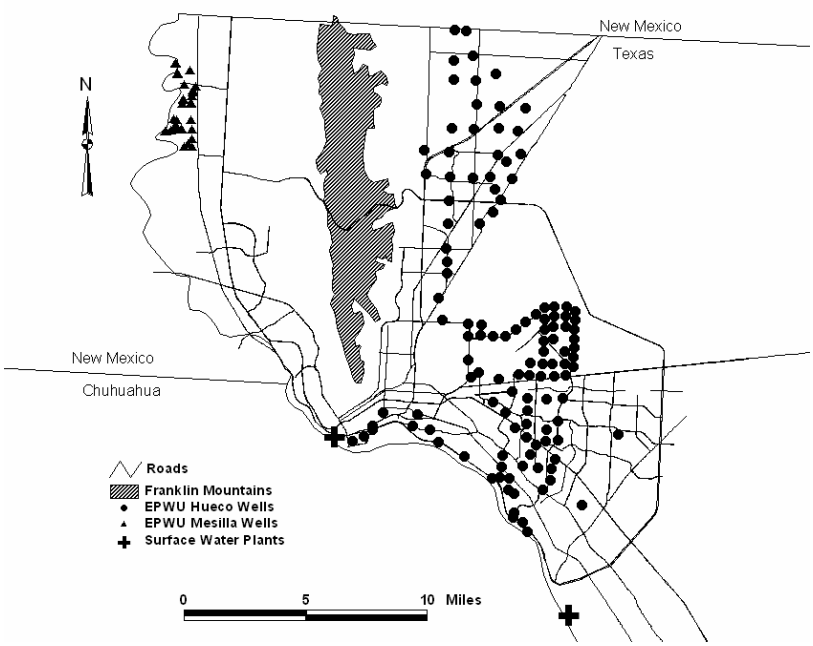


Figure 5. Location of EPWU Wells and Surface Water Plants

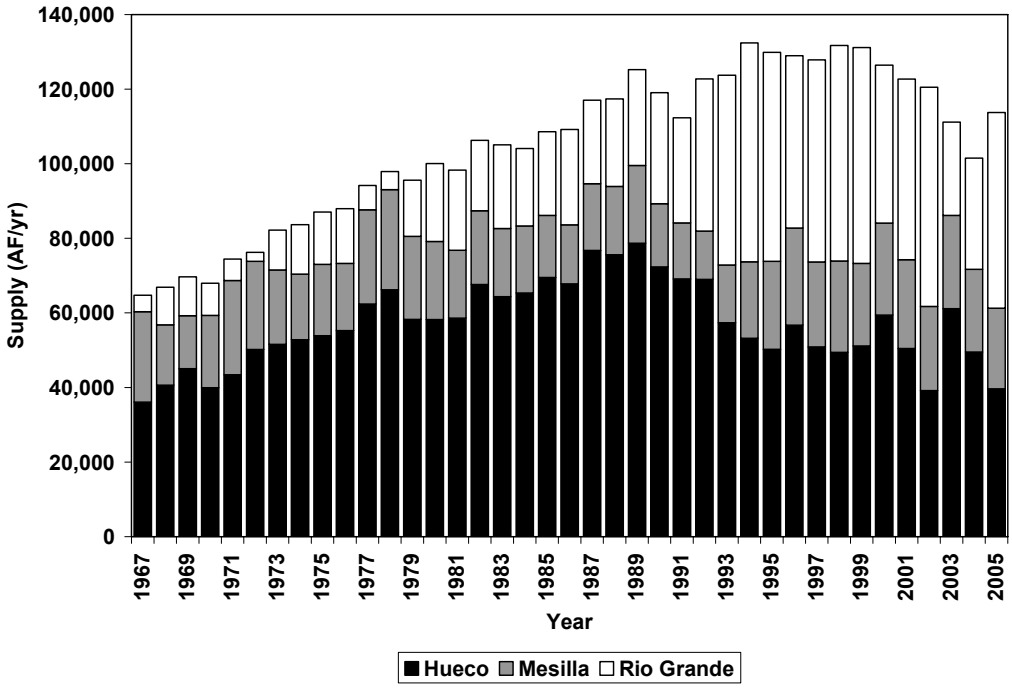


Figure 6. History of EPWU Supplies from Groundwater (Hueco Bolson and Mesilla Bolson) and Surface Water (Rio Grande)

Table 1. Summary of EPWU Supply - 1967 to 2005
All Values in AF/yr

Year	Hueco Pumping	Mesilla Pumping	Surface Water	Total Supply
1967	36,050	24,276	4,426	64,752
1968	40,649	16,147	10,111	66,907
1969	45,055	14,197	10,415	69,668
1970	39,951	19,370	8,631	67,951
1971	43,390	25,291	5,722	74,403
1972	50,190	23,626	2,426	76,243
1973	51,569	19,940	10,674	82,183
1974	52,798	17,596	13,281	83,675
1975	53,865	19,132	14,041	87,039
1976	55,236	18,011	14,680	87,927
1977	62,398	25,258	6,496	94,151
1978	66,212	26,821	4,840	97,873
1979	58,278	22,276	15,038	95,592
1980	58,213	20,917	20,929	100,059
1981	58,587	18,221	21,481	98,289
1982	67,612	19,743	18,922	106,277
1983	64,328	18,298	22,419	105,045
1984	65,309	17,979	20,769	104,058
1985	69,482	16,660	22,423	108,565
1986	67,776	15,822	25,588	109,186
1987	76,741	17,894	22,378	117,014
1988	75,572	18,338	23,448	117,359
1989	78,699	20,841	25,674	125,215
1990	72,332	16,920	29,812	119,064
1991	69,117	15,024	28,153	112,294
1992	68,965	12,956	40,810	122,731
1993	57,363	15,477	50,868	123,709
1994	53,187	20,526	58,667	132,380
1995	50,220	23,605	56,060	129,885
1996	56,711	26,019	46,219	128,948
1997	50,870	22,772	54,194	127,837
1998	49,398	24,509	57,794	131,700
1999	51,127	22,136	57,879	131,142
2000	59,410	24,682	42,329	126,421
2001	50,438	23,823	48,428	122,689
2002	39,151	22,591	58,743	120,485
2003	61,103	25,063	24,992	111,158
2004	49,480	22,221	29,794	101,495
2005	39,630	21,635	52,546	113,721

EPWU pumping in the Hueco Bolson peaked at about 80,000 acre-feet per year (AF/yr) in 1989. As a result of concerns regarding the long-term ability to continue this level of pumping (e.g. Muller and Price, 1979 and Boyle Engineering, 1991), EPWU implemented the following water management strategies: 1) adopted a rate structure that increases the cost of water for high use, 2) promoted water conservation through various incentive programs, 3) increased the use of Rio Grande Water, and 4) expanded the reuse of reclaimed water.

EPWU pumping in the Hueco Bolson in 2002 was below 40,000 AF/yr for the first time since 1967. Hueco pumping increased in 2003 and 2004 due to a drought and the associated reduction in surface water diversions. Pumping again dropped below 40,000 AF/yr in 2005 as a result of a return of nearly full river allocation conditions. The conjunctive use of surface water and groundwater (increasing groundwater pumping in times of surface water shortages) to meet overall demands is part of EPWU's overall water supply strategy.

The surface water plants have a combined capacity of 100 mgd. Under normal river flow conditions, the plants operate seven months during the year (i.e. during the irrigation season). EPWU is a customer of El Paso County Water Improvement District No.1, and receives water from the Rio Grande Project via its ownership of lands within the project area or through leases from water rights holders. Currently, El Paso has water rights of about 65,000 AF/yr from the Rio Grande Project (Far West Texas Regional Planning Group, hereinafter FWTRPG, 2006).

Despite population increases, total demand has been declining since the late 1990s due to conservation and pricing strategies. Current total demand is about 110,000 AF/yr. Per capita demand has been reduced from about 225 gallons per person per day in the 1970s to about 137 gallons per person per day in 2005 (Figure 7).

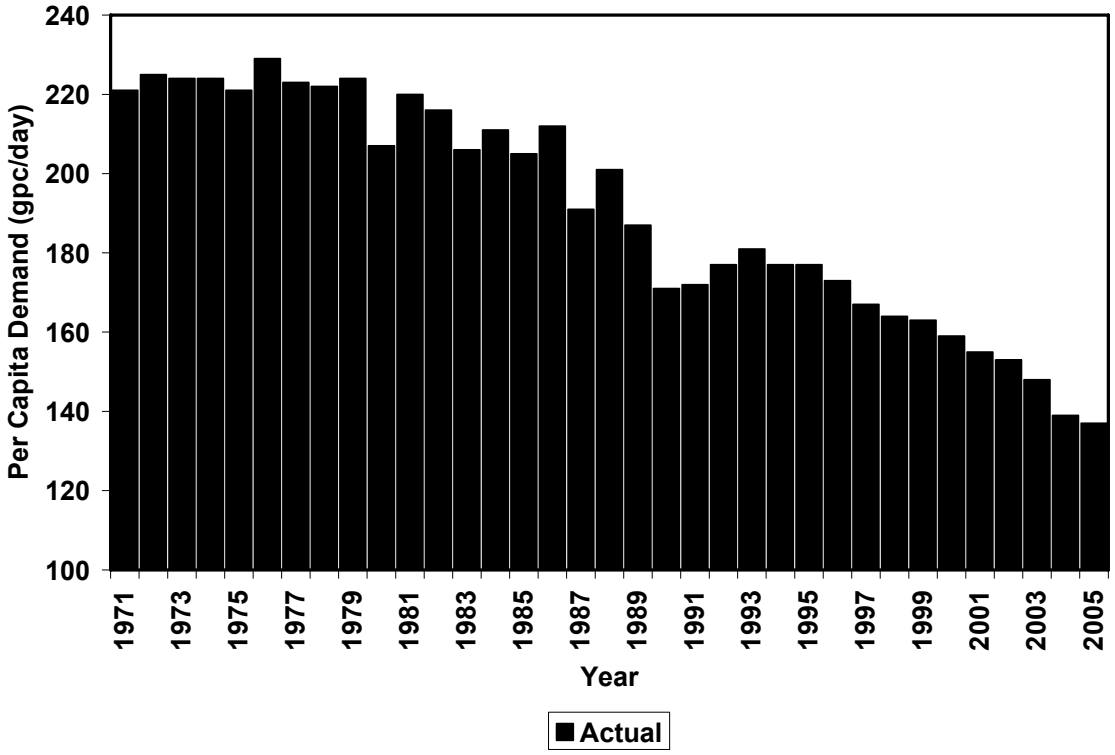


Figure 7. EPWU Per Capita Demand

1.2 Current and Future El Paso County Supplies

Currently, EPWU supplies about 90% of all municipal water in El Paso County (FWTRPG, 2006). The recently completed Regional Water Plan included a study of alternative means of supplying nonagricultural water to El Paso County through the year 2060 (FWTRPG, 2006 and Gooch and others, 2006).

Based on current capacities of wells and surface water plants, and the limitation that surface water is only available during the irrigation season, total available municipal supply in El Paso County is about 150,000 AF/yr (FWTRPG, 2006). This total includes about 5,000 AF/yr of reclaimed water supply that is available independent of drought conditions. Under full surface water allocation conditions, municipal surface water supply is about 60,000 AF/yr. Under these