Groundwater Management Plan

2010 - 2015

Adopted by Board Resolution and Order No. 10-10-645
on October 12, 2010

Approved by the Texas Water Development Board
on January 5, 2011

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1.0 BACKGROUND INFORMATION

1.1 Groundwater Management Plan History

In 1997, the 75th Texas Legislature enacted Senate Bill 1 (SB 1), providing a major overhaul of many long-standing state water laws and policies. Among its many provisions, SB 1 amended Chapter 36 of the Texas Water Code to require all underground water conservation districts to develop a groundwater management plan (GMP) within their jurisdiction. All GMPs were required to address the efficient use of groundwater, methods of controlling and preventing waste of groundwater, conjunctive surface water issues, natural resource issues that affect the use and availability of groundwater, and methods of controlling and preventing subsidence. The initial groundwater management plans were to be submitted to the Texas Water Development Board (TWDB) for review and approval by September 1998 and be approved by the TWDB every five years on the anniversary of its approval. The Edwards Aquifer Authority (Authority or EAA) adopted its initial GMP on August 11, 1998. The TWDB Executive Administrator subsequently approved the Authority's initial GMP as administratively complete on September 17, 1998.

In 2001, the 77th Texas Legislature enacted Senate Bill 2, significantly amending SB 1. Some of the amendments, affecting groundwater management planning, included new planning requirements for addressing drought conditions and conservation. Additionally, districts were required to use best available data in developing their GMPs, and were required to submit their GMP to the Chair of any Regional Water Planning Group (RWPG) in which any part of the district is located. The district was required to request that the RWPG review the GMP and specify any area(s) that conflicted with the approved Regional Water Plan.

In 2005, the 79th Texas Legislature enacted HB 1763 which added additional items to the list of issues to address. The new items were: recharge enhancement, rainwater harvesting, precipitation enhancement and brush control. New information requirements were added to include an estimate of the managed available groundwater (if available), the amount of groundwater used within each district, the amount of recharge from precipitation, projected surface water supply, total water demand within the district, and consideration of water management strategies that were included in the adopted state water plan.

1.2 Edwards Aquifer Authority Mission Statement, Vision and Strategic Goals

A mission statement represents a brief overview of an organization's purpose, the identification of its clients, and a statement of broad outcomes. It galvanizes the organizational culture and forms the organization's philosophy and direction.

Edwards Aquifer Authority Mission Statement:

The Edwards Aquifer Authority manages, enhances, and protects the Edwards Aquifer system.

A vision is an articulation of the organizational culture, structure, and direction. It represents an organization's targeted destination and includes the ability of members to perceive changes in the organization. As a result, the vision is a comprehensive description of how the organization will look in the future.

Edwards Aquifer Authority Vision:

The Edwards Aquifer Authority is the premier water management agency in the United States and the authority on the Edwards Aquifer. The Authority responds to its enabling legislation through a creative, science-based aquifer management program, effective rule-making and enforcement, and an efficient administrative structure. The agency fosters region-wide understanding and cooperation among stakeholders, decision-makers, and citizens for the benefit and sustainability of biological and other natural resources, as well as the people who depend upon the aquifer. As a result of its successes, the Authority sets the standard for regional water management agencies.

The Authority has seven major strategic goals that will become the focus of the agency from 2010 through 2012. These are arranged into three thematic areas: water quantity; water quality; and support. Each strategic goal is listed as follows:

WATER QUANTITY

Goal A. Sustain Federally Protected Aquifer Dependent Species

Goal B. Manage Groundwater Withdrawals

Goal C. Develop Recharge Program for Improved Aquifer Management and Environmental Restoration

WATER QUALITY

Goal D. Implement and Expand Initiatives to Protect Water Quality

SUPPORT

Goal E. Identify, Prioritize, and Implement Authority's Research and Technology Program

Goal F. Nurture and Develop Edwards Aquifer Authority Staff

Goal G. Raise Public Awareness of the Authority

The Authority began operations on June 28, 1996, as a "conservation and reclamation district" to manage the southern portion of the Edwards Aquifer (Aquifer) as specified in the Authority's enabling legislation (the Edwards Aquifer Authority Act or the Act). The Act establishes the purposes and responsibilities of the Authority, specifies management functions and goals, and provides operational guidelines. The Texas Legislature directed the Authority to:

- protect the water quality of the Aquifer;
- protect the water quality of the surface streams to which the Aquifer provides streamflow;
- achieve water conservation;
- maximize the beneficial use of water available for withdrawal from the Aquifer;
- recognize the extent of the hydro-geologic connection and interaction between surface water and groundwater;
- protect aquatic and wildlife habitat;
- protect species that are designated as threatened or endangered under state or federal law;
- provide for instream uses, bays and estuaries;
- protect domestic and municipal water supplies;
- protect the operation of existing industries;
- protect the economic development of the State;
- prevent the waste of water from the Aquifer; and
- increase recharge of water to the Aquifer.

In addition to its specific powers, the Authority is also granted, among other powers, the rule making and enforcement powers of other Texas groundwater districts created under Chapter 36 of the Texas Water Code. The Act gives the EAA the authority to conduct research on topics relevant to regional water resources management. This authority includes the ability to conduct or contract for research on such topics as water quality, water resources management, the augmentation of springflow, and the development of additional water supplies.

It should be noted that the Authority's powers only apply to the use and management of the Edwards Aquifer within the Authority's boundaries. The Authority has no regulatory powers over portions of the Edwards Aquifer outside of its boundaries, over other groundwater, or over any surface water resources. The Authority's jurisdiction is limited to the Edwards Aquifer within an area that includes all of Bexar, Medina, Uvalde, and parts of Atascosa, Comal, Caldwell, Hays, and Guadalupe counties. Although the Authority's regulatory jurisdiction is contained within these counties, the use and management of the Edwards Aquifer affects a much larger area. In addition to being the primary water source for 1.7 million users within the Authority's boundaries, the Edwards Aquifer also supplies a significant portion of the flow in the Guadalupe River Basin downstream of Comal and San Marcos Springs. Consequently, the area of interest for water resources planning purposes includes the drainage area of the Edwards Aquifer and downstream areas in the Nueces, San Antonio and Guadalupe River Basins. This planning area encompasses all of the counties and cities represented on the South Central Texas Water Advisory Committee (SCTWAC).

1.3 Description of the District

As stated, the Edwards Aquifer is the primary water supply source for 1.7 million people that live within the Authority's boundaries. In terms of the socioeconomic characteristics of the planning

area, the region can be divided into three sub-regions (the Western Sub-Region, the San Antonio Sub-Region, and the Eastern Sub-Region), each of which relies directly on the Aquifer to support different economies and interests. The delineations of these sub-regions are neither exact nor static. For example, urbanization is spreading from metropolitan San Antonio into surrounding areas, blurring the distinctions between the economies of the regions.

Western Sub-Region

The **Western Sub-Region** is made up of Medina and Uvalde Counties, and includes a portion of Atascosa County. In 2000, Medina and Uvalde counties together had approximately 67,000 residents. The economies of these counties are driven largely by farming, ranching, and related agricultural activities, of which irrigated farming is a significant component. From the years 1994 to 1997, Medina and Uvalde counties generated an average annual income of approximately $68 million from crops alone. Of this value, roughly 90 percent was derived from crops that were grown in irrigated fields. Total irrigated acreage is estimated to be 41,600 and 49,800 acres (1994 statistics) for Medina and Uvalde counties respectively. Major crops include cotton, corn, milo, wheat, and vegetables.

San Antonio Sub-Region

The **San Antonio Sub-Region**, herein defined as Bexar County, encompasses the majority of the San Antonio metropolitan area. In 2000, the population of Bexar County was 1.39 million people. The economy in the San Antonio region is diverse, and is supported by strong trade and service sectors, tourism, and the presence of large military bases. Other significant components of the San Antonio economy include medical research, biotechnology, and higher education. In 1994, total sales from San Antonio's major industries were estimated at over $29 billion. Total non-farm employment in the area was estimated at 644,100 people in 1996, up nearly 15% from 1992. The presence of five local military bases served as an anchor to the region and contributed roughly $4 billion to the local economy. Currently, however, the amount of local military bases has been reduced to four.

Because of its high degree of urbanization, water use in the San Antonio metropolitan area is predominantly municipal and industrial.

In addition to the urban economy of San Antonio, the western portion of Bexar County relies on agricultural activity. From 1994 to 1997, approximately $48 million was generated by revenue from crops. In 1994, the TWDB estimated that there were approximately 15,700 acres of irrigated cropland in Bexar County.

Eastern Sub-Region

The **Eastern Sub-Region** consists of portions of Comal, Hays, Guadalupe, and Caldwell counties. In 2000, the population of this sub-region was approximately 175,000, which represented approximately 11 percent of the population within the Authority's jurisdictional boundaries. Unique to the eastern region is the significance of Comal and San Marcos springs to the local economy. Specifically, the springs are important attractions in the area's water-oriented tourism industry. In addition to their economic value, Comal and San Marcos springs are also the exclusive home to several endangered and threatened plant and animal species, and provide an

important source of freshwater for downstream users of the Guadalupe River, as well as freshwater inflows to coastal bays and estuaries.

1.4 Downstream Area

The **Downstream Area** refers to the cities and counties with SCTWAC representation. Each of these communities shares a common bond with the Edwards Aquifer in that they are dependent, to some degree, on surface water flows into or out from the Edwards Aquifer. Surface water uses by these communities vary widely and include municipal and industrial uses, irrigation, and recreation. Instream flows and freshwater inflows to coastal bays and estuaries, some of which are derived from Edwards Aquifer springflows, are also an important environmental water use in areas downstream of the Edwards Aquifer.

1.5 Physical Characteristics

The Edwards Aquifer influences or is influenced by various physical characteristics of the area. These characteristics affect both the inputs to and outputs from the Edwards Aquifer.

Topography of the Edwards Aquifer Area

The topography of the area contributes to the rainfall runoff events that are critical to the recharge of the Edwards Aquifer. The topography of the land within the Edwards Aquifer Area varies significantly from the higher elevations in the drainage area of the Edwards Plateau to the lower and flatter Gulf Coastal Plain that overlies the artesian part of the Aquifer. The altitude of the area ranges from about 3,000 feet above mean sea level (msl) in the extreme western part of the plateau area to a little more than 500 feet msl in the extreme eastern part. Local relief on the Edwards Plateau is as much as 300 feet msl. Elevation ranges from 2,371 feet msl in Rocksprings, in the drainage area, to 512 feet msl in San Antonio, on the recharge and artesian portions of the Aquifer. From west to east, the elevation ranges from 1,020 feet msl in Brackettville to 581 msl in San Marcos.

The Balcones Escarpment defines the southern and eastern edges of the Edwards Plateau. Here, the land surface is deeply dissected by streams that flow across and down the escarpment. Throughout most of the plateau, the streams descend only a few feet per mile, but at the escarpment, stream slopes increase to as much as 15 feet per mile. The streams descend several hundred feet through ravine-like valleys to the Gulf Coastal Plain. The relief may vary as much as 150 feet from the streambed to the ridges above the valleys.

Except during floods, the streams flowing from the western part of the plateau lose most of their water through recharge to the Edwards Aquifer, and are generally dry when they reach the Gulf Coastal Plain. In the eastern part of the area, major streams maintain flow for a larger percentage of time after crossing the recharge zone. The Gulf Coastal Plain is a gently rolling landscape, with altitudes near the escarpment that vary from about 1,100 feet msl in the western part of the area to about 600 feet msl in the eastern part. Local relief is about 50 feet.

Climate of the Edwards Aquifer Area

The planning area lies within two Texas climatic divisions: the Edwards Plateau division and the South Central division. The climate of the region is classified as humid subtropical with summers that are typically hot and humid and winters that are usually mild and dry. Precipitation varies across the region from an average of approximately 22 inches per year in the western portion to approximately 36 inches per year in the eastern portion (see Table 1). May, June, and September are the months with the greatest average precipitation. December, March, and January have the lowest average precipitation. Only November, December, January, and February have an average temperature of less than 60ºF.

Precipitation in the Edwards Aquifer Region has been collected by the USGS since 1934 and is highly variable from year to year (see Table 1). At Brackettville, in the western part of the area, average annual precipitation is 21.84 inches but ranges from a low of 7.58 inches to a high of 45.37 inches. Annual precipitation at San Marcos, in the eastern part of the area, has ranged from 13.42 inches to 58.51 inches, with an average of 35.56 inches. Average precipitation at San Antonio is 30.53 inches per year.

Table 1: Precipitation in the Edwards Aquifer Area as of 2007 (in inches per year)

	Brackettville	**Uvalde**	**Sabinal**	**Hondo**	**San Antonio**	**Boerne**	**New Braunfels**	**San Marcos**
Years of Record	70	74	71	74	74	73	74	74
Low (in/yr)	7.58 (1956)	9.29 (1956)	11.29 (1956)	11.92 (1954)	13.70 (1954)	10.29 (1954)	10.12 (1954)	13.42 (1954)
High (in/yr)	45.37 (1958)	46.04 (1976)	48.21 (1935)	58.73 (1935)	52.28 (1973)	64.17 (1992)	61.60 (1946)	58.51 (1998)
Average (in/yr)	21.84	24.06	25.25	29.60	30.53	34.76	34.23	35.56

Temperature variation is greater from the Edwards Plateau toward the Gulf Coastal Plain than it is from Brackettville to San Marcos. The area within the Edwards Plateau has an average annual temperature of about 65°F. The Gulf Coastal Plain area has an average annual temperature of about 69°F. The relatively high annual temperatures that occur throughout the entire region contribute to high evapotranspiration rates.

2.0 REVISIONS TO THE AUTHORITY GROUNDWATER MANAGEMENT PLAN

As directed under SB 1, the Authority will review and re-adopt the GMP, with or without revisions, at least once every five years. The last revision of the GMP occurred in 2004; Additionally, the Authority will continue to participate in the regional water planning process to ensure the GMP remains consistent with the approved regional water plan for the South Central Texas Regional Water Planning Group (Region L). The Authority's jurisdiction lies entirely within the South Central Texas study area; therefore, the Authority will only submit the GMP to Region L for review.

3.0 PLANNING DATA AND REQUESTED INFORMATION

3.1 Hydrological Estimates

The Edwards Aquifer Area was once part of a warm, shallow sea. Offshore barrier reefs extended from present day Mexico across Texas. These reefs would be similar to the present-day Great Barrier Reef off the northeastern coast of Australia. The reefs separated the deep, ancient Gulf of Mexico from the shallow lagoon seas that covered the area. The carbonate remains of marine plants and animals settled and accumulated on the sea bottom. The seas advanced and receded in a cyclic manner from 130 to 100 million years ago. During this time period, the carbonate material accumulated and later consolidated into the Edwards Limestone. Uplift of the area above sea level resulted in erosion that removed 100 feet or more of the deposits that were exposed to weathering. Younger sediments later covered the Edwards Limestone as the seas, once again, moved inland. Subsidence of the Gulf of Mexico and uplift of the Edwards Plateau produced the Balcones Escarpment and fault zone. The Edwards Limestone once again became exposed to weathering action. The faulting, solution, and erosion caused voids to develop within the limestone, creating the Edwards Aquifer in its present form.

The Edwards Aquifer is approximately 180 miles long (east to west) and has a width varying from 5 to 40 miles (north to south). The total surface area overlying the Aquifer is approximately 3,600 square miles. The Edwards Aquifer, San Antonio Area, is bounded to the east by a groundwater divide in Kyle, Texas, and in the west by another groundwater divide in Brackettville, Texas. To the north, the Edwards Aquifer begins where formations outcrop into the recharge zone within the Edwards Plateau. The southern extent of the Edwards Aquifer is marked by the "bad water line." This boundary, which is also referred to as the saline-water line or fresh-water/saline-water interface, marks the interface where total dissolved-solids concentrations reach 1,000 milligrams per liter.

From a regional perspective, the flow in the Edwards Aquifer appears to be simple. Precipitation on the drainage area is transported by streams to the Balcones Fault Zone, where it recharges into the Aquifer. The water, after entering the Aquifer, moves downdip in a southerly direction toward the coast. Before the water reaches the "bad water line," or downdip portion of the freshwater portion of the Aquifer, its direction is deflected eastward and then northeastward toward the major springs at New Braunfels and San Marcos. In reality, both the direction and rate of movement of water in the Aquifer are affected by the extremely complicated physical characteristics of the Edwards Limestone. Solution openings vary in size and a complicated series of steep-angle faults interrupt the movement of water. Igneous intrusions in the limestone also block the water flow, causing local deviations in the general flow direction in the Knippa Area of Uvalde County.

The Edwards Limestone is the major geologic component of the Aquifer. It occurs in three major and distinct parts. The first part is on the Edwards Plateau. Here, the limestone is exposed at the land surface and receives direct recharge from precipitation. Some water is stored in this porous limestone after cessation of a precipitation event, while some runs off as storm water into streams that flow across the Edwards Plateau. After storms, these streams often flow for extended periods as water stored in the porous limestone is slowly released to sustain the base flows of the streams. As the streams flow from the Edwards Plateau, they cross the Balcones Escarpment. Near the escarpment, many of these streams have completely eroded the Edwards Limestone down to the Glen Rose Formation.

The second part of the Edwards Limestone lies below the escarpment along the Balcones Fault Zone. This area is known as the recharge zone, or the unconfined portion of the Edwards Aquifer. The recharge zone of the Aquifer covers approximately 1,500 square miles. Groundwater flow is generally toward the southeast. As streams cross the fault zone, much of the flow percolates through the streambed into the Aquifer. During low-flow periods, virtually all stream flow is recharged into the Aquifer. During higher flows, when stream flow exceeds the maximum recharge rate, much of the water flows past the recharge zone to the Gulf Coastal Plain.

The third part of the Edwards Limestone lies beneath the Gulf Coastal Plain. A confining layer with low permeability, known as the Del Rio Clay Formation, overlies this portion of the Edwards Limestone, while another confining strata known as the Glen Rose Formation lies underneath. The confined part of the Edwards Limestone covers 2,100 square miles and is artesian (i.e., under pressure). This part of the Edwards Aquifer, with its many pore spaces, complex networks of solution openings, and artesian conditions has a great capacity for storing and moving water beneath the Gulf Coastal Plain.

The Edwards Aquifer is a highly permeable, carbonate aquifer that is capable of producing large quantities of high-quality water. The Aquifer's productivity is largely attributable to the occurrence and development of numerous faults, fractures, conduits, and caves that provide storage and facilitate the transmission of water throughout the Aquifer. Conduits or solution channels in the Edwards Limestone range in size from the diameter of a small child's finger to several feet in diameter. This variability in conduit size and location makes it difficult to quantify the amount of water in the Edwards Aquifer. Methodologies used to determine the amount of water in karst aquifer systems are unique, and the standard methodologies used for other formations are not applicable.

Capacity of the Edwards Aquifer to store water is determined largely by the percentage of voids within the rock matrix, while the capacity to transmit water is determined by the characteristics of fractures and solution-channel systems. The calculation of the estimated amount of water in the Aquifer is based on the estimated average thickness of the Aquifer, the confined and unconfined area of the Aquifer, and the percent porosity of the Aquifer.

The volume of water in storage in the confined freshwater zone of the Aquifer is estimated to be 19.5 million acre-feet. From Maclay, R.W. and T. A. Small (1984), Carbonate Geology and Hydrogeology of the Edwards Aquifer in the San Antonio, Area, Texas, Report 296, U.S. Geological Survey Open-File Report 83-537, p. 54.

The total volume of circulating freshwater in the Edwards Aquifer is about 45 million acre-ft, with 38 million acre-ft in the confined part and 7 million acre-ft in the unconfined part. From Maclay, R.W. (1995), Geology and Hydrology of the Edwards Aquifer in the San Antonio Area, Texas, U.S. Geological Survey Water-Resources Investigations Report 95-4186.

The volume of water in the confined portion of the Aquifer, inside the study area, is 157 million acre-feet, whereas the average volume of water in the unconfined part of the Aquifer is 16 million acre-feet. From Hovorka, S.D., A. R. Dutton, S.C. Ruppel, and J.S. Yeh (1996), Edwards Aquifer Ground-Water Resources: Geologic Controls on Porosity Development in Platform Carbonates, South Texas, Report of Investigations No. 238, University of Texas at Austin.

However, the amount of water in the Aquifer does not equal the amount of water that can be recovered from the Aquifer. There are many factors that determine how much water is available for recovery from the Edwards Aquifer. First, there are physical factors, such as depth and pressure that limit how much groundwater can be recovered and withdrawn. Second, there are considerations such as economics, well depth and location, and impact of other wells. Third, there are the minimum springflow requirements established pursuant to the Endangered Species Act (ESA) and withdrawal limits established by the Authority's enabling legislation.

3.2 Managed Available Groundwater

The 79th Legislative Session passed HB 1763, which required the State's 16 Groundwater Management Areas (GMAs) to develop definitive management schemes for all aquifers for which significant use is contemplated in the future. Managed available groundwater (MAG) is defined in Chapter 36 of the Texas Water Code as "… the amount of water that may be permitted by a district for beneficial use in accordance with the desired future condition of the aquifer as determined under Section 36.108." The Authority is a member of Groundwater Management Area 10 (GMA 10), which includes eight groundwater conservation districts (GCDs) – the Authority, Kinney County GCD, Uvalde County Underground Water Conservation District, Medina County GCD, Guadalupe County GCD, Hays Trinity GCD, Plum Creek Conservation District, and Barton Springs Edwards Aquifer Conservation District.

HB 1763 requires each GMA to develop a desired future condition (DFC) by September 1, 2010. The Texas Administrative Code defines a DFC as "the desired, quantified condition of groundwater resources … in the future … as defined by … a groundwater management area as part of the joint planning process." While the DFC is an important element for aquifer management, it represents only the first step in the development of the MAG, which is the ultimate goal of Section 36.108. Both the DFC and MAG for the Edwards Aquifer (San Antonio Segment within the Authority's boundary) were adopted by legislative act on May 28, 2007.

Normally, the DFC is developed by a GMA, and the MAG is developed by the Texas Water Development Board (TWDB) in light of the DFCs provided by a GMA. However, the EAA was created to resolve special and unique Aquifer management issues, and accordingly, the Act incorporates specific directions on both the DFC and the MAG for the portion of the Aquifer that is within the EAA's jurisdictional boundaries (see TWDB letter attached as Appendix A).

The DFCs are set out in Sections 1.14(a), (f), (h) and 1.26 of the Act and include one of the most unique drought management schemes in the country, referred to as the Critical Period Management Plan (CPMP), which requires reductions from permitted amounts when levels of the Aquifer drop below certain designated levels or when flows drop below certain amounts at Comal or San Marcos Springs. Due to the karst nature of the Aquifer, which causes Aquifer levels to rise and fall in accordance with precipitation, recharge, and groundwater withdrawals from wells, the Authority developed the CPMP. When the Authority's permit limits were modified in 2007, a CPMP was also placed in the Act as specified below:

Figure 1 (Critical Period Stages):

CRITICAL PERIOD MANAGEMENT PLAN REDUCTION STAGES FOR THE SAN ANTONIO POOL[1]				
COMAL SPRINGS FLOW CFS	SAN MARCOS SPRINGS FLOW CFS	INDEX WELL J-17 LEVEL MSL	*CRITICAL PERIOD STAGE	WITHDRAWAL REDUCTION
<225	<96	<660	I	20%
<200	<80	<650	II	30%
<150	N/A	<640	III	35%
<100	N/A	<630	IV	40%

- A change to a critical period stage with higher withdrawal reduction percentages is triggered if the 10-day average of daily springflows at the Comal Springs or the San Marcos Springs or the 10-day average of daily Aquifer levels at the J-17 Index Well drops below the lowest number of any of the trigger levels indicated in Table 1. A change to a critical period stage with lower withdrawal reduction percentages is triggered only when the 10-day average of daily springflows at the Comal Springs and the San Marcos Springs and the 10-day average of daily Aquifer levels at the J-17 Index Well are all above the same stage trigger level.

CRITICAL PERIOD MANAGEMENT PLAN REDUCTION STAGES FOR THE UVALDE POOL[2]		
INDEX WELL J-27 LEVEL MSL	CRITICAL PERIOD STAGE	WITHDRAWAL REDUCTION
N/A	I	N/A
<850	II	5%
<845	III	20%
<842	IV	35%

1 – the San Antonio pool is the part of the Aquifer underlying the boundaries of the Authority, other than Uvalde County.
2 – the Uvalde pool is the part of the Aquifer underlying the boundaries of Uvalde County

As for the MAG, direction came through amendments to the Act during the 80th Legislative Session. Section 1.14(c) of the Act now stipulates that "…for the period beginning January 1, 2008, the amount of permitted withdrawals from the aquifer may not exceed or be less than 572,000 acre-feet of water for each calendar year, which is the sum of all regular permits issued or for which an application was filed and issuance was pending action by the authority as of January 1, 2005." This stipulation mandates both the maximum and minimum amount of permitted withdrawals that may be made from the Aquifer for each calendar year. It should be noted, however, that the amount mandated in Section 1.14(c) does not cover exempt withdrawals or withdrawals made by federal facilities.

In addition, because the MAG for the Edwards Aquifer within the Authority's jurisdictional boundaries is mandated through legislative action to be 572,000 acre-feet, GAM Run 08-67 has not been used to help establish DFCs or in the calculation of the MAG. However, estimates for precipitation recharge, the amount of groundwater that discharges to surface water bodies, the flow into the Authority's jurisdictional boundaries within each aquifer, the flow out of the Authority's jurisdictional boundaries within each aquifer, and the flow between aquifers within the Authority's jurisdictional boundaries that are included in the GAM 08-67 report are attached as Appendix B.

3.3 Annual Groundwater Use

Annual groundwater usage data has been collected for withdrawals from the Edwards Aquifer since the 1950's. The USGS collected and reported the information until the late 1990's, when the Authority assumed that responsibility. All permitted wells must have water meters and submit annual water use reports to the Authority. The Authority had a comprehensive well metering

program in place by 1999. Therefore, water use reported after 1999 is the most accurate. Also, in 1995 the USGS changed the manner in which domestic/livestock usage was calculated and reported, resulting in significantly lower estimates for this category of water use. Table 2 below is the reported data by use for wells and springs from 1955 – 2007, which are in the Authority's Hydrologic Data Report for 2007:

Table 2: Annual Estimated Edwards Aquifer Groundwater Discharge by Use, 1955–2007 (measured in thousands of acre-feet).

Year	Irrigation	Municipal	Domestic/ Stock	Industrial/ Commercial	Springs
1955	85.2	120.5	30.1	25.1	127.8
1956	127.2	138.3	28.9	22.4	69.8
1957	68.8	116.1	29.8	22.6	219.2
1958	47.2	113.7	33.4	25.1	398.2
1959	60.0	118.9	31.5	24.2	384.5
1960	54.9	121.1	29.1	23.3	428.3
1961	52.1	124.5	29.6	22.2	455.3
1962	72.7	143.7	28.8	22.8	321.1
1963	75.4	151.8	27.8	21.8	239.6
1964	72.6	140.2	26.3	21.7	213.8
1965	68.0	138.8	27.0	22.3	322.8
1966	68.2	141.8	23.3	22.6	315.3
1967	119.4	171.0	25.1	25.8	216.1
1968	59.3	146.9	25.5	20.0	408.3
1969	95.2	162.0	29.2	21.1	351.2
1970	110.1	167.5	29.3	22.5	397.7
1971	159.4	196.2	28.6	22.6	272.7
1972	128.8	190.5	30.8	21.1	375.8
1973	82.2	177.1	32.3	18.8	527.6
1974	140.4	174.6	33.5	15.1	483.3
1975	96.4	182.5	33.6	15.3	540.4
1976	118.2	182.1	34.6	14.7	503.9
1977	124.2	205.3	38.1	13.0	580.3
1978	165.8	214.2	40.3	11.5	375.5
1979	126.8	208.9	40.7	15.2	523.0
1980	177.9	256.2	43.3	13.7	328.3
1981	101.8	231.8	40.9	12.6	407.3
1982	130.0	268.6	39.5	15.0	333.3
1983	115.9	249.2	38.8	14.7	301.5
1984	191.2	287.2	36.2	15.2	178.3
1985	203.1	263.7	39.2	16.5	334.0
1986	104.2	266.3	42.0	16.8	388.0
1987	40.9	260.9	43.5	18.7	557.9
1988	193.1	286.2	41.9	18.8	369.7
1989	196.2	285.2	38.2	22.9	224.1
1990	172.9	254.9	37.9	23.7	240.6

Year	Irrigation	Municipal	Domestic/ Stock	Industrial/ Commercial	Springs
1992	27.1	236.5	34.8	29.0	802.8
1993	69.3	252.0	49.9	36.1	589.4
1994	104.5	247.0	33.9	39.3	390.2
1995	95.6	255.0	11.6	37.3	361.3
1996	181.3	261.3	12.3	38.8	212.0
1997	77.4	253.0	12.3	34.4	383.9
1998	131.9	266.5	13.4	41.7b	464.1
1999	113.6	273.3	13.4	42.4	456.1
2000	106.3	261.3	13.4	33.8	337.5
2001	79.0	245.9	13.4	29.4	529.4
2002	97.1	228.4	13.6**	32.3	609.9
2003	79.6	237.2	13.7**	31.7	621.5
2004	55.4	220.3	13.8**	28.1	622.9
2005	85.3	255.1	13.8**	34.3	647.1
2006	149.1	259.1	13.8**	34.5	312.0
2007	37.9	234.0	13.8**	11.2	620.6
For period of record 1955-2007					
Mean	97.1	228.4	29.8	22.6	383.9
Median	105.4	209.1	29.0	24.6	396.8
For period of record 1998–2007 (last ten years):					
Mean	91.2	250.5	13.7	33.1	569.7
Median	93.5	257.9	13.6	31.9	522.1

Data source: United States Geological Survey unpublished report and Edwards Aquifer Authority files (2008). ** Revision based on number of new wells permitted annually. Differences in totals may occur as a result of rounding

As indicated above, the Authority requires all permitted wells to have meters and is required to pay for all costs related to the installation of meters on irrigation wells. Table 3 is the reported usage by use and county from permitted wells for 1999 – 2007 (Data source: Edwards Aquifer Authority files 2008):

Table 3:
Reported Usage By Use and County from Permitted Wells for 1999-2007
(measured in acre-feet)

County	Year	Total	Municipal	Industrial/Commercial	Irrigation
	1999	68,009	7,106	2,046	58,857
	2000	66,683	7,137	1,636	57,910
	2001	48,871	4,790	921	43,160
	2002	59,840	4,361	624	54,855
Uvalde	2003	49,276	4,023	488	44,765
	2004	38,416	3,834	218	34,364
	2005	51,616	4,248	940	46,428
	2006	84,633	5,250	307	79,076
	2007	28,983	3,725	173	25,085
	1999	48,085	7,727	1,354	39,004
	2000	44,162	6,564	839	36,759
Medina	2001	33,608	6,433	768	26,407

County	Year	Total	Municipal	Industrial/Commercial	Irrigation
Medina	2002	39,659	5,497	1,050	33,112
	2003	33,866	5,922	727	27,217
	2004	21,617	5,738	731	15,148
	2005	36,318	5,957	1,295	29,066
	2006	63,882	7,089	1,421	55,372
	2007	16,073	4,927	731	10,415
Bexar	1999	276,322	241,437	25,464	9,421
	2000	264,735	233,983	21,849	8,903
	2001	254,791	227,370	20,192	7,229
	2002	233,614	205,897	20,084	7,633
	2003	235,821	209,972	19,692	6,157
	2004	218,919	195,462	18,608	4,849
	2005	258,904	227,544	23,418	7,942
	2006	265,128	228,757	24,654	11,716
	2007	213,791	209,857	2,869	1,065
Comal	1999	22,882	10,511	12,242	129
	2000	15,384	7,733	7,514	137
	2001	13,880	7,289	6,556	44
	2002	16,681	8,093	8,533	55
	2003	13,815	4,174	9,549	92
	2004	11,120	3,658	7,421	41
	2005	12,860	5,275	7,528	57
	2006	12,340	5,362	6,925	53
	2007	10,494	4,204	6,263	27
Hays	1999	11,985	10,320	1,646	19
	2000	6,378	4,874	1,477	57
	2001	6,626	4,899	1,650	77
	2002	5,391	3,479	1,851	61
	2003	6,481	5,324	1,050	107
	2004	4,864	3,900	910	54
	2005	5,368	4,320	928	120
	2006	6,186	4,932	1,123	123
	2007	4,600	3,411	1,052	137
Guadalupe	1999	181	0	181	0
	2000	188	0	188	0
	2001	220	0	220	0
	2002	221	35	186	0
	2003	222	40	182	0
	2004	222	38	184	0
	2005	218	0	218	0
	2006	48	0	42	0
	2007	151	0	151	0
Atascosa	1999	1,726	0	0	1,726
	2000	1,204	0	0	1,204
	2001	1,171	0	0	1,171
	2002	729	0	0	729
	2003	677	0	0	677
	2004	337	0	0	337
	2005	1,120	0	0	1,120
	2006	2,125	0	0	2,125
	2007	537	0	0	537

3.4 Annual Recharge from Precipitation

The USGS has been providing estimates of annual recharge since 1934. Annual recharge for the period of record (1934-2007) ranges from a low of only 43,700 acre-feet at the height of the drought of record in 1956 to 2,486,000 acre-feet in 1992. Annual recharge statistics are as follows:

Recharge for 1934-2007
Mean 731,200 acre-feet
Median 585,700 acre-feet

Recharge for 10-year period 1998 – 2007
Mean 1,084,600 acre-feet
Median 916,700 acre-feet

Information from the GAM 08-67 report from the Texas Water Development Board regarding the estimated annual amount of recharge from precipitation to the Edwards and associated limestones is contained in the GAM 08-67 report in Appendix B. However, for planning purposes, the Authority prefers to use its own estimates and has submitted its information to the Executive Administrator of the Texas Water Development Board for review and comment.

Recharge directly affects water levels in the Aquifer. Water levels rise during years of higher-than-normal recharge, and generally decline during periods of lower-than-normal recharge. Since recharge is a direct result of precipitation, water levels in the Aquifer are greatly affected by rainfall. Due to the high transmissivity in the Aquifer, water levels rise rapidly in response to rainfall events.

The Authority currently operates four recharge dams on the Edwards Aquifer Recharge Zone. The Parker structure was built in 1974, followed by the Verde structure in 1978, the San Geronimo structure in 1979, and the Seco structure in 1982. These four projects have recharged approximately 180,000 acre-feet through 2007. The estimated average annual recharge for each structure ranges from 785 acre-feet to 3,723 acre-feet.

Table 4: Estimated Annual Enhanced Recharge from the Authority's Edwards Aquifer Recharge Projects Through 2007 (acre-feet)

Year	Parker	Verde	San Geronimo	Seco	Total
Total (# yrs)	27,861 (34)	23,545 (30)	31,539 (29)	96,787 (26)	179,732
Average(# yrs)	819 (34)	785 (30)	1,088 (29)	3,723 (26)	5,286
Median(# yrs)	242 (34)	250 (30)	334 (29)	508 (26)	1,151

3.5 Annual Discharge to Springs and Surface Water Bodies

The Edwards Aquifer discharges through two major springs, (Comal and San Marcos) and four minor springs (Leona, San Pedro, San Antonio and Hueco). Springflow for the period 1934 – 2007 has varied from a low of 69,800 acre-feet in 1956 to a high of 802,800 acre-feet in 1992.

Spring discharge from the Edwards Aquifer in 2007 was estimated to be approximately 621,000 acre-feet. The average total spring discharge for the period 1934 – 2007 is 385,200 acre-feet.

Table 5:
Springflow Discharge for 2007 (acre-feet)

Leona Springs	**30,290**
San Pedro Springs	**9,676**
San Antonio Springs	**69,920**
Comal Springs	**262,610**
Hueco Springs	**58,033**
San Marcos Springs	**190,510**
Total	**621,039**

Information from the GAM 08-67 report from the Texas Water Development Board regarding the estimated annual volume of water that discharges from the Edwards Aquifer and associated limestones to springs and any surface water body including lakes, streams, and rivers is contained in the GAM 08-67 report in Appendix B. However, for planning purposes, the Authority prefers to use its own estimates and has submitted its information to the Executive Administrator of the Texas Water Development Board for review and comment.

3.6 Flow Into and Out of the Edwards Aquifer

Information from the GAM 08-67 report from the Texas Water Development Board regarding the estimated annual volume of flow into and out of the Edwards Aquifer and associated limestones is contained in the GAM 08-67 report in Appendix B.

3.7 Annual Interformational Inflow and Outflows

Regarding interformational inflow and outflow for the Aquifer, some recharge occurs as interformational flow from adjacent aquifers such as the Trinity Aquifer. Estimates of the contribution from adjacent hydraulically connected aquifers are highly variable and range from 5,000 acre-feet to 60,000 acre-feet per year.

The official Groundwater Availability Model for the Aquifer is the USGS MODFLOW software. Regarding the model, for planning purposes, the interformational flow is assigned as a constant head that is implemented with injection well cells with a constant annual inflow of 40,299 acre-feet.

Information from the GAM 08-67 report from the Texas Water Development Board regarding the estimated annual volume of flow into and out of the Edwards Aquifer and associated limestones is contained in the GAM 08-67 report in Appendix B. However, for planning purposes, the

Authority prefers to use its own estimates and has submitted its information to the Executive Administrator of the Texas Water Development Board for review and comment.

3.8 Population Projections

Two sources of information were used for current population and population projections for the EAA's jurisdictional area. One source is a pro-rated population analysis for the Authority's jurisdictional area for the 1998 Groundwater Management Plan. The second source is the January 2006 South Central Texas Regional Water Planning Area Regional Water Plan. The latter projections were developed by the TWDB for the 2007 State Water Plan.

Population within the planning area has grown significantly and this trend is expected to continue through the 2060 planning horizon. The Authority's jurisdictional area was reported to be more than 1.36 million in 1990, and the 2000 population was reported to be approximately 1.7 million. Table 6 is an approximate population estimate for the counties, or portions of counties, within the Authority's jurisdiction for the period 1990 – 2060 using the proportions determined for each county in the 1998 Groundwater Management Plan. The proportions were calculated as follows: Atascosa – 5%; Bexar – 100%; Caldwell – 75%; Comal – 60%; Guadalupe – 60%; Hays – 55%; Medina – 100%; and Uvalde – 100% of the Region L population projections. All calculations were rounded from the nearest one-tenth.

TABLE 6: POPULATION

	Census		Projections					
	1990	2000	2010	2020	2030	2040	2050	2060
Region L Projections								
Atascosa	30,533	38,628	45,504	52,945	59,598	64,844	69,320	72,578
Bexar	1,185,394	1,392,931	1,631,935	1,857,745	2,059,112	2,222,887	2,369,950	2,500,731
Caldwell	26,392	32,194	45,958	59,722	71,459	83,250	95,103	106,575
Comal	51,832	78,021	108,219	146,868	190,873	233,964	278,626	326,655
Guadalupe	64,873	89,023	114,878	146,511	180,725	214,912	252,857	293,736
Hays	52,491	72,499	120,199	172,674	213,908	255,183	304,337	342,746
Medina	27,312	39,304	46,675	54,815	62,416	68,987	75,370	81,104
Uvalde	23,340	25,926	28,616	31,443	33,802	35,650	36,876	37,810
Total	1,462,167	1,768,526	2,141,984	2,522,723	2,871,893	3,179,677	3,482,439	3,761,935
Authority Projections								
Atascosa	1,527	1,931	2,275	2,647	2,980	3,242	3,466	3,629
Bexar	1,185,394	1,392,931	1,631,935	1,857,745	2,059,112	2,222,887	2,369,950	2,500,731
Caldwell	19,794	24,146	34,469	44,792	53,594	62,438	71,327	79,931
Comal	31,099	46,813	64,931	88,121	114,524	140,378	167,176	195,993
Guadalupe	38,924	53,414	68,927	87,907	108,435	128,947	151,714	176,242
Hays	28,870	39,874	66,109	94,971	117,649	140,351	167,385	188,510
Medina	27,312	39,304	46,675	54,815	62,416	68,987	75,370	81,104
Uvalde	23,340	25,926	28,616	31,443	33,802	35,650	36,876	37,810
Total	1,356,260	1,624,339	1,943,937	2,262,441	2,552,512	2,802,880	3,043,264	3,263,950

Table 6 above illustrates that the vast majority of the jurisdictional area's population is in Bexar County. Relative population proportions remained similar for Atascosa, Caldwell, Medina, and Uvalde counties. Population projections beyond the year 2000 show significant increases in Bexar County, as well as the three surrounding counties. This population increase is expected to continue as the region's economic development continues to increase.

3.9 Demand in the District

For planning purposes, the water demand projections for the South Central Texas Regional Water Planning Area have been separated into the following designated uses: municipal, industrial, steam and electric power generation, irrigation, mining, and livestock.

According to the Authority's Hydrologic Data Report for 2007, there was a total of 296,900 acre-feet of water pumped from the Aquifer, approximately 79 percent of which was withdrawn for municipal purposes and approximately 12 percent of which was withdrawn for irrigation use. However, the 10-year median for 1998-2007 discharge and withdrawal from the Aquifer within the jurisdictional area was 958,200 acre ft per year. Of this amount, approximately 59 percent was from springflow discharges and 41 percent was from withdrawals for various other uses.

Projected Water Demand within the Planning Area

Water demand projections for the Authority's jurisdictional area have also been revised consistent with the approved revisions to the projections for Region L. While the Authority only issues groundwater withdrawal permits for municipal, industrial or irrigation use, for planning purposes that are consistent with Region L, the water demand projections in this document are separated into the following use categories: municipal, industrial, steam and electric power generation, irrigation, mining, and livestock. Excluding spring discharges, municipal uses accounted for approximately 60 percent of total water demand for the planning area in 2000. Projections for each of these water demand categories, as well as for domestic water demands, a subcategory of municipal, are presented in the tables below. Please note that the data in tables 7-13 are apportioned versions of the whole county 2007 State Water Plan estimates. Each water demand estimate was apportioned by the Authority for Atascosa, Caldwell, Comal, Guadalupe, and Hays Counties based on population percentages (See Table 6). Whole county estimates are included in Appendix C.

Municipal Water Demand

As demonstrated previously, there has been a steady increase in the population of the jurisdictional area; this trend is projected to continue through the planning period. Consequently, municipal water demands are projected to increase steadily from approximately 314,000 acre-feet/year in 2010 to more than 488,000 acre-feet/year by 2060 (see Table 7).

Table 7: Municipal Water Demand Projections for the Edwards Aquifer Authority

Edwards Aquifer Area County	Municipal Water Demand Projections (ac-ft/yr)					
	2010	2020	2030	2040	2050	2060
Atascosa*	347	385	417	440	464	483
Bexar	262,106	290,071	316,423	336,033	355,245	374,536
Caldwell*	4,730	5,924	6,917	7,916	8,945	9,996
Comal*	11,263	14,852	18,959	22,982	27,191	31,811
Guadalupe*	10,268	12,700	15,357	17,944	20,988	24,320
Hays*	9,503	13,425	16,480	19,478	23,167	26,111
Medina	7,576	8,660	9,656	10,509	11,395	12,234
Uvalde	8,066	8,394	8,652	8,846	8,964	9,099
Total	**313,859**	**354,411**	**392,861**	**424,148**	**456,359**	**488,590**

* Denotes demand from the portion of a county that is within the Edwards Aquifer Authority boundaries.

Domestic Water Demand

The Act states, "A well that produces 25,000 gallons of water a day or less for domestic or livestock use is exempt from metering requirements. Exempt wells must register with the authority or with an underground water conservation district in which that well is located." Typically, a domestic well serves a single residence. Because of their exempt status, there is a lack of water use data on these wells. The TWDB has traditionally accounted for domestic water use within the "county-other" municipal category, which is based on census population data. The municipal water demand data, discussed in the above section, includes this domestic user group.

Tremendous growth is occurring in the rural areas outside the confines of municipalities. Many rural residents depend on water wells that produce less than 25,000 gallons per day. These types of wells are currently exempt from the Authority requirement of obtaining a withdrawal permit. Therefore, there are few, if any, records for the amount of water used from these exempt wells. The fact that this water use segment appears to be growing necessitates an accounting of this water use in the final water balance.

All domestic water demand projections make up less than 1 percent of the total water demand for the planning area, and while this may seem to be an insignificant contribution, it is of concern to the Authority. Domestic use and its growth is part of the water balance and must be considered and addressed in regional water supply planning.

Industrial Water Demand

Industrial water demand accounts for approximately 6 percent of total water demand in the planning area. Table 8 indicates that most industrial water demand is located within Bexar and Comal counties.

Table 8: Industrial Water Demand Projections for the Edwards Aquifer Authority

Edwards Aquifer Area County	Industrial Water Demand Projections (ac-ft/yr)					
	2010	2020	2030	2040	2050	2060
Atascosa*	0	0	0	0	0	0
Bexar	25,951	29,497	32,775	36,068	38,965	42,112
Caldwell*	11	14	16	18	20	22
Comal*	4,637	5,138	5,588	6,027	6,403	6,932
Guadalupe*	1,583	1,774	1,949	2,118	2,263	2,458
Hays*	117	137	157	177	195	212
Medina	67	75	82	89	95	103
Uvalde	432	455	473	490	505	538
Total	**32,798**	**37,090**	**41,040**	**44,987**	**48,446**	**52,377**

* Denotes demand from the portion of a county that is within the Edwards Aquifer Authority boundaries.

Steam-Electric Water Demand

The steam-electric power generation water demand category includes production facilities that supply private and public customers. At present, steam-electric water demand accounts for approximately 5 percent of total water demand in the jurisdictional area and nearly all of this demand is located within Bexar County. As shown in Table 9, steam electric water demand is projected to remain relatively constant in Bexar County but the planning area as a whole will see an increase because of the addition of new power generation facilities in Guadalupe and Hays counties.

Table 9: Steam Electric Water Demand Projections for the Edwards Aquifer Authority

Edwards Aquifer Area County	Steam Electric Water Demand Projections (ac-ft/yr)					
	2010	2020	2030	2040	2050	2060
Atascosa*	294	298	348	409	484	576
Bexar	17,309	17,275	20,196	23,757	28,098	33,390
Caldwell*	0	0	0	0	0	0
Comal*	0	0	0	0	0	0
Guadalupe*	6,039	8,644	10,106	11,888	14,061	16,709
Hays*	2,932	4,197	4,907	5,772	6,827	8,113
Medina	0	0	0	0	0	0
Uvalde	0	0	0	0	0	0
Total	**26,574**	**30,414**	**35,557**	**41,826**	**49,470**	**58,788**

* Denotes demand from the portion of a county that is within the Edwards Aquifer Authority boundaries.

Irrigation Water Demand

Irrigation water demand represented more than half of the total water demand in the jurisdictional area during 1990. However, rainfall during that time period was well below normal during the irrigation season (April-July), which resulted in higher-than-normal water demand. Median irrigation use for the 10-year period from 1998-2007 was 91,200 ac-ft/yr, which is 24 percent of all groundwater pumped in the Authority for this period.

Approximately 85 percent of total irrigation demand in the jurisdictional area occurs in Medina and Uvalde counties, as shown in Table 10. From 2010 to 2060, irrigation water demand is projected to decrease substantially. This decrease is largely attributed to transfers from irrigation use to municipal use, the expected adoption of more efficient irrigation practices, and to declines in agricultural prices.

According to the current water supply plan for Region L, irrigation demands are the only category of demand that will not be fully met in the future. Alternatives to provide additional water supply for irrigation are generally cost-prohibitive.

Table 10: Irrigation Water Demand Projections for the Edwards Aquifer Authority

Edwards Aquifer Area County	Irrigation Water Demand Projections (ac-ft/yr)					
	2010	2020	2030	2040	2050	2060
Atascosa*	2,044	1,975	1,909	1,846	1,784	1,725
Bexar	15,273	14,628	14,010	13,417	12,850	12,306
Caldwell*	783	696	618	550	488	434
Comal*	122	112	101	91	81	71
Guadalupe*	642	573	508	445	426	423
Hays*	194	193	191	189	188	186
Medina	54,450	52,179	50,005	47,922	45,927	44,015
Uvalde	55,791	53,609	51,513	49,498	47,563	45,703
Total	**129,299**	**123,965**	**118,855**	**113,958**	**109,307**	**104,863**

* Denotes demand from the portion of a county that is within the Edwards Aquifer Authority boundaries.

Mining Water Demand

Water use in mining operations currently represents only about 1 percent of the total water demand in the jurisdictional area. Most mining operations in the area are quarries, which excavate stone, gravel, sand, and clay for use in the local construction industry and elsewhere in the state. Thus, water demand associated with the mining industry is driven largely by regional economic conditions. As shown in Table 11, by the year 2060 mining water demand is projected to increase and will represent approximately 1.5 percent of the area's total water demand.

Table 11: Mining Water Demand Projections for the Edwards Aquifer Authority

Edwards Aquifer Area County	Mining Water Demand Projections (ac-ft/yr)					
	2010	2020	2030	2040	2050	2060
Atascosa*	65	69	70	72	74	75
Bexar	3,582	3,934	4,150	4,363	4,576	4,766
Caldwell*	11	11	12	13	14	14
Comal*	1,607	1,738	1,817	1,895	1,972	2,041
Guadalupe*	184	193	198	203	208	212
Hays*	78	83	86	89	89	90
Medina	130	135	137	139	141	143
Uvalde	313	345	364	383	401	418
Total	**5,970**	**6,508**	**6,834**	**7,157**	**7,475**	**7,759**

* Denotes demand from the portion of a county that is within the Edwards Aquifer Authority boundaries.

Livestock Water Demand

Livestock production in the jurisdictional area includes beef and dairy cattle, goats, horses, and poultry. At present, it is estimated that livestock watering accounts for 1 percent of the area's total water demand. Water use by livestock is projected to remain constant through the planning period, as shown in Table 12.

Table 12: Livestock Water Demand Projections for the Edwards Aquifer Authority

Edwards Aquifer Area County	Livestock Water Demand Projections (ac-ft/yr)					
	2010	2020	2030	2040	2050	2060
Atascosa*	87	87	87	87	87	87
Bexar	1,319	1,319	1,319	1,319	1,319	1,319
Caldwell*	689	689	689	689	689	689
Comal*	179	179	179	179	179	179
Guadalupe*	634	634	634	634	634	634
Hays*	154	154	154	154	154	154
Medina	1,298	1,298	1,298	1,298	1,298	1,298
Uvalde	1,284	1,284	1,284	1,284	1,284	1,284
Total	**5,644**	**5,644**	**5,644**	**5,644**	**5,644**	**5,644**

* Denotes demand from the portion of a county that is within the Edwards Aquifer Authority boundaries.

Projections of Total Water Demand

Overall water demand within the jurisdictional area is projected to increase. As indicated, water demand in Atascosa, Medina, and Uvalde counties are projected to decrease significantly due to projected declines in irrigation water demand. Dramatic increases are projected elsewhere in the area as a result of continued population growth and growth in non-agricultural economic activity.

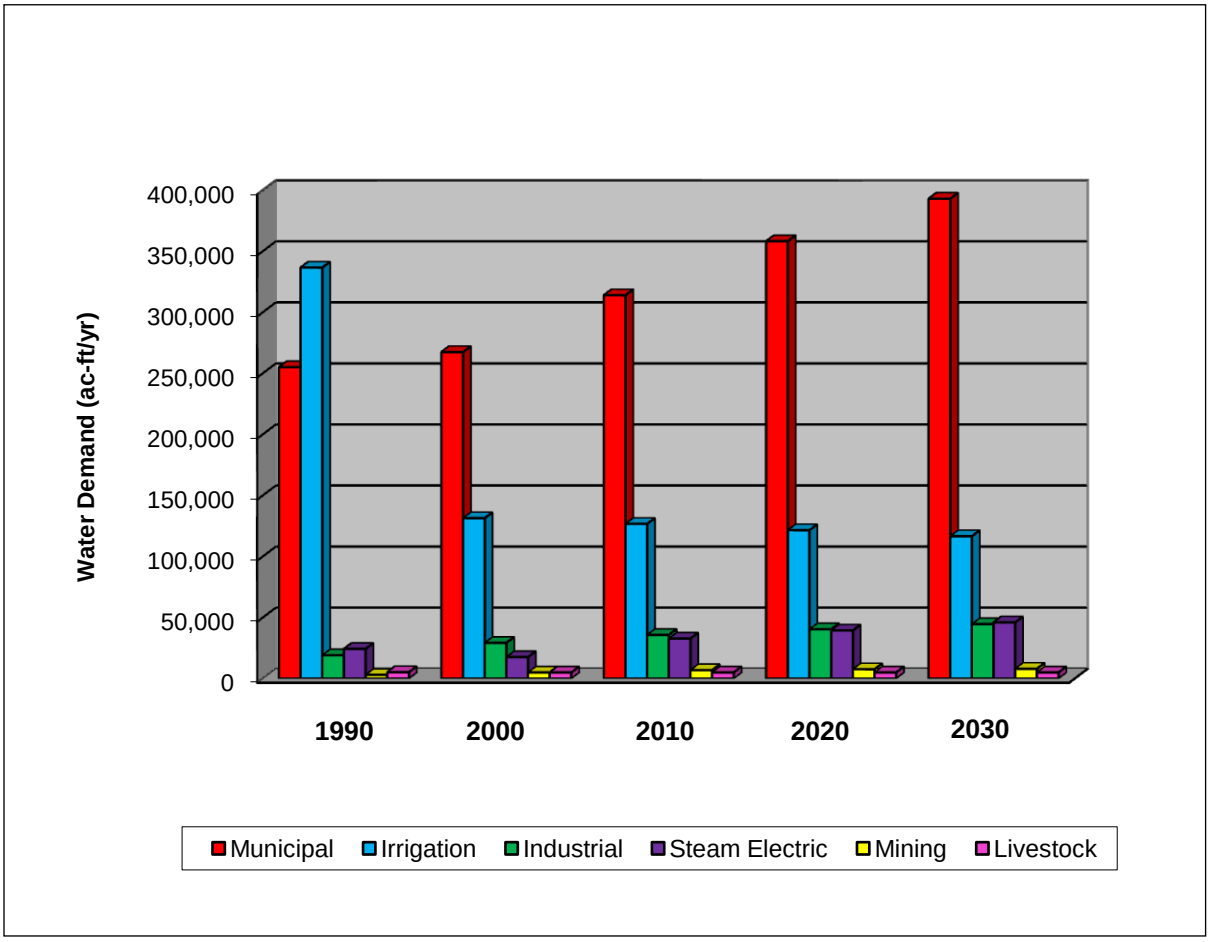
Table 13: Total Projected Water Demand for the Planning Area

Edwards Aquifer Area County	Total Projected Water Demand (ac-ft/yr)**					
	2010	2020	2030	2040	2050	2060
Atascosa*	2,837	2,814	2,831	2,854	2,893	2,946
Bexar	325,540	356,724	388,873	414,957	441,053	468,429
Caldwell*	6,224	7,334	8,252	9,186	10,156	11,155
Comal*	17,808	22,019	26,644	31,174	35,826	41,034
Guadalupe*	19,350	24,518	28,752	33,232	38,580	44,756
Hays*	12,978	18,189	21,975	25,859	30,620	34,866
Medina	63,521	62,347	61,178	59,957	58,856	57,793
Uvalde	65,886	64,087	62,286	60,501	58,717	57,042
Total	**514,144**	**558,032**	**600,791**	**637,720**	**676,701**	**718,021**

* Denotes portion of a county within the Edwards Aquifer Authority boundaries. Total water demand projections for whole counties are contained in Appendix C.

Figure 2 shows the contributions of each water use category to the total water demand of the jurisdictional area through 2030. As indicated, municipal water demand now surpasses irrigation water demand. The ranking for the other water use categories will remain more or less constant with the industrial category having the third highest use, followed by steam electric power generation, mining, and livestock.

Figure 2: Water Demand and Projections Distribution for the Edwards Aquifer Authority (1990-2030)



3.10 AVAILABLE WATER SUPPLY IN THE DISTRICT

The Texas State Bureau of Economic Geology estimates there is 173 million acre-feet of water in the Edwards Aquifer. The amount of recoverable water from the Aquifer, however, is not known at this time. Although the Aquifer stores, and is capable of yielding large amounts of water, only a relatively small quantity can be withdrawn annually without reducing springflow. This amount of water can be estimated by conducting a water balance of Aquifer recharge and discharge. For the period of record, from 1934 to 2007, average annual recharge to the Edwards Aquifer was 731,200 acre-feet and annual discharge by wells and springs was 693,500 acre-feet (data source: United States Geological Survey and EAA unpublished data 2008).

At issue are the Aquifer-supported springflows at Comal and San Marcos springs. The upper reaches of Comal Springs cease to flow when the Aquifer level at the Bexar County index well, J-17, reaches 623 feet mean sea level (msl). Springflows at Comal and San Marcos springs, provide habitat for several threatened and endangered species. A federal court mandated sufficient protection be provided for the endangered species in 1993, prompting the Texas legislature to create the Authority.

As revealed by the water balance information discussed above, availability of Edwards Aquifer water can vary greatly. While periods of greater than normal rainfall yield large volumes of water for springflow and pumping, drought years yield relatively little. It is these two extremes, along with the necessity to maintain springflow and instream flows, which make effective management of the Edwards Aquifer crucial.

Other Non-Edwards Groundwater and Surface Water Supplies

In addition to the Edwards Aquifer, other groundwater resources are utilized to a small extent in all of the eight counties within the planning area. These supplies include groundwater from the Carrizo-Wilcox, Trinity, and Edwards-Trinity (Plateau) Aquifers. The Authority does not regulate these other aquifers. It is difficult to determine the amount of groundwater use from other non-Edwards Aquifer sources within the planning area's boundaries because statistics for groundwater resources are based on reported entire county pumpage.

The projected surface water supplies for each county within the Authority's jurisdictional boundaries are listed in Tables 14 – 21 below. The amounts of supply are from the 2007 State Water Plan, Volume 3, Regional Water Planning Group Database and have *not* been apportioned in the same manner as the projected water demands listed in Tables 7-13. Any apportionment of projected water demands was based on the percentage of population that resided within the portion of each county that lay within the Authority's boundaries. Projected surface water supplies, however, were not apportioned because of the difficulty of determining how much of each supply was actually used within the portion of a county that lay within the Authority's boundaries. In addition, most of the water user groups (with the exception of the Bexar Met Water District and the City of Bulverde – as noted in Tables 14 and 17) have some portion of their respective service areas within the Authority's boundaries. A separate complicating factor is that some water user groups rely on both surface water and groundwater supplies, and (with the exception of Edwards groundwater which may only be used within the Authority's boundaries) it is too difficult to determine how much of each supply is used within a specific portion of a service area.

Projected Surface Water Supplies

TABLE 14
ATASCOSA COUNTY SURFACE WATER*
in acre-feet

Nueces River Combined Run of River Irrigation						
Year	2010	2020	2030	2040	2050	2060
Irrigation	1	1	1	1	1	1
Total	1	1	1	1	1	1
Livestock Local Supply						
Year	2010	2020	2030	2040	2050	2060
Livestock	914	897	879	861	846	838
Livestock	53	53	52	52	51	50
Total	967	950	931	913	897	888

*It should be noted that Bexar Met Water District's use of 186 acre-feet of water (for each projection year) from **San Antonio Run of River** has not been included because Bexar Met Water District's service area is not within the portion of Atascosa County that lies within the Authority's jurisdictional boundaries.

TABLE 15 BEXAR COUNTY SURFACE WATER in acre-feet						
Canyon Lake						
Year	2010	2020	2030	2040	2050	2060
East Central WSC	1,170	251	251	251	251	251
Fairoaks Ranch	900	962	1,036	1,036	1,036	1,036
Green Valley SUD	214	214	214	257	257	257
San Antonio	4,000	-	-	-	-	-
San Antonio	7,500	5,500	4,000	-	-	-
County Other	-	50	50	-	-	-
Total	13,784	6,977	5,551	1,544	1,544	1,544
San Antonio Run of River						
Year	2010	2020	2030	2040	2050	2060
Bexar Met Water District	233	233	233	233	233	233
Bexar Met Water District	574	495	427	370	319	270
Manufacturing	3	3	3	3	3	3
San Antonio	212	212	212	212	212	212
San Antonio	2,921	2,921	2,921	2,921	2,921	2,921
San Antonio	100	100	100	100	100	100
Somerset	405	484	552	609	660	709
Total	4,448	4,448	4,448	4,448	4,448	4,448
San Antonio Combined Run of River Irrigation						
Year	2010	2020	2030	2040	2050	2060
Irrigation	2,223	2,223	2,223	2,223	2,223	2,223
Total	2,223	2,223	2,223	2,223	2,223	2,223
Livestock Local Supply						
Livestock	12	12	12	12	12	12
Livestock	648	648	648	648	648	648
Total	660	660	660	660	660	660
Calaveras Lake						
Year	2010	2020	2030	2040	2050	2060
Steam Electric Power	36,900	36,900	36,900	36,900	36,900	36,900
Total	36,900	36,900	36,900	36,900	36,900	36,900
Victor Braunig Lake/Reservoir						
Year	2010	2020	2030	2040	2050	2060
Steam Electric Power	12,000	12,000	12,000	12,000	12,000	12,000
Total	12,000	12,000	12,000	12,000	12,000	12,000

TABLE 16 CALDWELL COUNTY SURFACE WATER in acre-feet						
Guadalupe Run of River						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County Line WSC	8	8	8	8	8	8
County Line WSC	59	59	59	59	59	59
Luling	193	193	193	193	193	193
Martindale	158	158	158	158	158	158
Martindale WSC	140	140	140	140	140	140
Maxwell WSC	6	6	6	6	6	6
Maxwell WSC	20	20	20	20	20	20
Maxwell WSC	139	139	139	139	139	139
County Other	500	500	500	500	500	500
Total	1,223	1,223	1,223	1,223	1,223	1,223
Guadalupe Combined Run of River Irrigation						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Irrigation	331	331	331	331	331	331
Total	331	331	331	331	331	331
Canyon Lake						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County Line WSC	328	328	328	328	328	328
Gonzales County WSC	21	21	21	21	21	21
Maxwell WSC	477	477	477	477	477	477
Martindale WSC	39	39	39	39	39	39
Total	865	865	865	865	865	865
Livestock Local Supply						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Livestock	78	78	78	78	78	78
Livestock	381	381	381	381	381	381
Total	459	459	459	459	459	459

TABLE 17 COMAL COUNTY SURFACE WATER in acre-feet						
Canyon Lake*						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Canyon Lake WSC	4,000	4,000	4,000	4,000	4,000	4,000
Crystal Clear WSC	253	253	253	253	253	253
Fairoaks Ranch	48	65	70	70	70	70
Green Valley SUD	150	151	151	181	181	181
New Braunfels	5,634	5,634	5,634	5,634	5,634	5,634
County-Other	155	572	1,071	1,071	1,071	1,071
County-Other	45	400	400	400	400	400
Irrigation	269	269	269	269	269	269
Manufacturing	9	9	9	9	9	9
Total	10,563	11,353	11,857	11,887	11,887	11,887
Guadalupe River Run of River						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Crystal Clear WSC	10	10	10	10	10	10
New Braunfels	1,639	1,639	1,639	1,639	1,639	1,639
County-Other	7	7	7	7	7	7
Manufacturing	3,559	3,559	3,559	3,559	3,559	3,559
Total	5,215	5,215	5,215	5,215	5,215	5,215
Guadalupe Combined Run of River Irrigation						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Irrigation	106	106	106	106	106	106
Total	106	106	106	106	106	106
Livestock Local Supply						
Year	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Livestock	128	128	128	128	128	128
Livestock	21	21	21	21	21	21
Total	149	149	149	149	149	149
*It should be noted that Bulverde City's use of 400 acre-feet of water (for each projection year) from **Canyon Lake** has not been included because Bulverde City is not within the Authority's jurisdictional boundaries.						

TABLE 18 GUADALUPE COUNTY SURFACE WATER in acre-feet						
Canyon Lake						
Year	2010	2020	2030	2040	2050	2060
Cibolo	800	2,800	2,800	2,800	2,800	2,800
Crystal Clear WSC	1,480	1,480	1,480	1,480	1,480	1,480
East Central Valley WSC	123	26	26	26	26	26
Green Valley SUD	1,161	4,141	3,930	3,975	3,736	4,125
Green Valley SUD	474	695	906	1,188	1,427	1,038
Marion	100	100	100	100	100	100
Martindale WSC	11	11	11	11	11	11
New Braunfels	186	186	186	186	186	186
Seguin	2,000	2,000	2,000	2,000	2,000	2,000
Springs Hill WSC	3,549	3,549	3,549	3,549	3,549	3,549
Springs Hill WSC	626	626	626	626	626	626
County-Other	10	10	10	10	10	10
Irrigation	390	390	390	390	390	390
Manufacturing	985	985	985	985	985	985
Steam Electric Power	6,840	5,720	5,720	5,720	5,720	5,720
Total	18,735	22,719	22,719	23,046	23,046	23,046
Guadalupe River Run of River						
Year	2010	2020	2030	2040	2050	2060
Crystal Clear WSC	59	59	59	59	59	59
Martindale WSC	98	98	98	98	98	98
New Braunfels	54	54	54	54	54	54
Seguin	7,000	7,000	7,000	7,000	7,000	7,000
County-Other	61	61	61	61	61	61
County-Other	73	73	73	73	73	73
Total	7,345	7,345	7,345	7,345	7,345	7,345
Guadalupe River Combined Run of River Manufacturing						
Year	2010	2020	2030	2040	2050	2060
Manufacturing	57	57	57	57	57	57
Total	57	57	57	57	57	57
Guadalupe River Combined Run of River Irrigation						
Year	2010	2020	2030	2040	2050	2060
Irrigation	1,167	1,167	1,167	1,167	1,167	1,167
Total	1,167	1,167	1,167	1,167	1,167	1,167
Livestock Local Supply						
Year	2010	2020	2030	2040	2050	2060
Livestock	397	397	397	397	397	397
Livestock	132	132	132	132	132	132
Total	529	529	529	529	529	529

TABLE 19 HAYS COUNTY SURFACE WATER in acre-feet						
Canyon Lake						
Year	2010	2020	2030	2040	2050	2060
County Line WSC	724	724	724	724	724	724
Crystal Clear WSC	509	509	509	509	509	509
Kyle	589	589	589	589	589	589
Maxwell WSC	167	167	167	167	167	167
San Marcos	5,000	5,000	5,000	5,000	5,000	5,000
Steam Electric Power	2,464	2,464	2,464	2,464	2,464	2,464
Total	9,453	9,453	9,453	9,453	9,453	9,453
Guadalupe River Run of River						
Year	2010	2020	2030	2040	2050	2060
County Line WSC	19	19	19	19	19	19
County Line WSC	129	129	129	129	129	129
Crystal Clear WSC	20	20	20	20	20	20
Maxwell WSC	2	2	2	2	2	2
Maxwell WSC	7	7	7	7	7	7
Maxwell WSC	49	49	49	49	49	49
San Marcos	513	513	513	513	513	513
Total	739	739	739	739	739	739
Guadalupe River Combined Run of River Manufacturing						
Year	2010	2020	2030	2040	2050	2060
Manufacturing	571	571	571	571	571	571
Total	571	571	571	571	571	571
Guadalupe River Combined Run of River Irrigation						
Year	2010	2020	2030	2040	2050	2060
Irrigation	344	344	344	344	344	344
Total	344	344	344	344	344	344
Livestock Local Supply						
Year	2010	2020	2030	2040	2050	2060
Livestock	140	140	140	140	140	140
Total	140	140	140	140	140	140

TABLE 20 MEDINA COUNTY SURFACE WATER in acre-feet						
San Antonio Combined Run of River Irrigation						
Year	2010	2020	2030	2040	2050	2060
Irrigation	1	1	1	1	1	1
Total	1	1	1	1	1	1
Livestock Local Supply						
Year	2010	2020	2030	2040	2050	2060
Livestock	558	588	588	588	588	588
Livestock	91	91	91	91	91	91
Total	649	649	649	649	649	649

TABLE 21 UVALDE COUNTY SURFACE WATER in acre-feet						
Nueces River Combined Run of River Irrigation						
Year	2010	2020	2030	2040	2050	2060
Irrigation	1,231	1,231	1,231	1,231	1,231	1,231
Total	1,231	1,231	1,231	1,231	1,231	1,231
Livestock Local Supply						
Year	2010	2020	2030	2040	2050	2060
Livestock	642	642	642	642	642	642
Total	642	642	642	642	642	642

It should be noted that Medina Lake, located in the northeast corner of Medina County and owned by Bexar-Medina-Atascosa Water Control Irrigation District WCID #1, has a permit of 66,750 acre-feet per year for irrigation, municipal, domestic, and livestock purposes. This lake and the associated river beds are also a source of recharge to the Edwards Aquifer. Medina Lake is not, however, included by Region L in the current available water supplies. Medina Lake and the associated downstream Diversion Lake dry up during drought of record conditions. There is no firm yield associated with this surface water resource, and thus, it was excluded from the Authority's available water supplies during drought of record conditions as well.

Reclaimed water is a fairly new resource being utilized in the planning area and the state. Currently, San Antonio Water System (SAWS) and the City of San Marcos are each in the process of developing and implementing an innovative operation system that utilizes reclaimed water.

3.11 Projected Water Supply Needs

Table 22 represents the projected water supply needs from the 2007 State Water Plan, Volume 3, Regional Water Planning Group Database. The needs considered for each county included within the Authority's jurisdictional boundaries are represented below in parentheses. For simplicity

purposes, each county's entire projected water supply needs, rather than apportioned projections, are included in the table.

Table 22
Projected Water Needs by Water User Group
(In Acre-Feet)

Water User Group (Basin)	2010	2020	2030	2040	2050	2060
Atascosa County						
Benton City WSC (San Antonio)	10	(12)	(31)	(46)	(59)	(69)
Benton City WSC (Nueces)	121	(132)	(354)	(522)	(675)	(786)
Bexar Met Water District	(319)	(435)	(529)	(594)	(657)	(709)
Charlotte	708	715	726	741	755	759
Jourdanton	828	805	789	786	785	773
Lytle	(169)	(180)	(190)	(196)	(205)	(213)
McCoy WSC	(493)	(796)	(1,045)	(1,239)	(1,417)	(1,549)
Pleasanton	651	645	646	669	682	672
Poteet	142	155	177	197	212	216
County-Other (San Antonio)	4	8	13	17	20	21
County-Other (Nueces)	81	198	297	381	442	481
Municipal Total	**1,564**	**971**	**499**	**194**	**(117)**	**(404)**
Manufacturing	1	1	1	2	2	2
Steam-Electric Power	961	1,045	194	(874)	(2,212)	(3,952)
Mining	7	38	73	110	136	151
Irrigation (San Antonio)	(76)	(40)	(6)	28	59	90
Irrigation (Nueces)	(1,885)	(982)	(105)	718	1,432	1,784
Livestock (San Antonio)	0	0	0	0	0	0
Livestock (Nueces)	0	0	0	0	0	0
County Total	**(992)**	**62**	**157**	**(16)**	**(583)**	**(1925)**

Table 22 Projected Water Needs by Water User Group (In Acre-Feet)						
Water User Group (Basin)	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Bexar County						
Alamo Heights	(515)	(578)	(580)	(576)	(590)	(614)
Atascosa Rural WSC	(561)	(732)	(884)	(1,011)	(1,121)	(1,233)
Balcones Heights	0	0	0	0	0	0
Bexar Met Water District	(6,242)	(6,456)	(6,821)	(6,890)	(7,089)	(7,348)
Castle Hills	(96)	(83)	(69)	(56)	(47)	(47)
China Grove	0	0	0	0	0	0
Converse	225	(199)	(597)	(912)	(1,179)	(1,432)
East Central WSC	1170	4	(214)	(398)	(557)	(713)
Elmendorf	0	0	0	0	0	0
Fair Oaks Ranch	6	64	135	131	98	93
Green Valley SUD	(154)	(342)	(514)	(592)	(721)	(835)
Helotes	0	0	0	0	0	0
Hill Country Village	(730)	(727)	(723)	(720)	(718)	(718)
Hollywood Park	(1,969)	(2,044)	(2,113)	(2,166)	(2,220)	(2,271)
Kirby	(299)	(298)	(301)	(295)	(307)	(328)
Lackland AFB (CDP)	(857)	(833)	(809)	(785)	(769)	(769)
Leon Valley	58	75	86	98	103	94
Leon Valley (SAWS)	0	0	0	0	0	0
Live Oak	863	851	831	815	776	724
Lytle	(4)	(6)	(7)	(9)	(10)	(11)
Olmos Park	0	0	0	0	0	0
San Antonio (SAWS)	(53,166)	(78,094)	(101,583)	(122,024)	(138,024)	(153,980)
San Antonio (BMWD)	(10,455)	(17,272)	(19,958)	(21,988)	(23,951)	(25,908)
San Antonio (Others)	(184)	(217)	(248)	(271)	(294)	(316)
Schertz	89	(10)	(95)	(164)	(230)	(288)
Selma	(697)	(1,093)	(1,475)	(1,426)	(1,370)	(1,321)
Shavano Park	(499)	(515)	(527)	(536)	(548)	(560)
Somerset	0	0	0	0	0	0
St. Hedwig	0	0	0	0	0	0
Terrell Hills	0	0	0	0	0	0
Universal City	(141)	(449)	(708)	(658)	(634)	(634)
Water Ser Inc (Apex Water Ser)	(544)	(671)	(783)	(876)	(956)	(1,035)
Windcrest	0	0	0	0	0	0
County-Other (SAWS)	0	0	0	0	0	0
County-Other (Other)	7,496	7,652	6,583	6,240	5,967	5,707
County-Other (Nueces Basin)	1	2	(108)	(106)	(105)	(106)
Municipal Total	**(67,205)**	**(101,965)**	**(131,482)**	**(155,175)**	**(174,496)**	**(193,849)**
Manufacturing	(3,258)	(6,804)	(10,082)	(13,375)	(16,272)	(19,419)
Steam-Electric Power	31,591	31,625	28,704	25,143	20,802	15,510
Mining (Nueces Basin)	(23)	(22)	(74)	(75)	(77)	(78)
Mining (San Antonio Basin)	0	0	(879)	(971)	(1,065)	(1,151)
Irrigation (San Antonio Basin)	7,037	7,596	7,976	8,488	8,979	9,451
Irrigation (Nueces Basin)	(184)	(150)	(529)	(489)	(452)	(417)
Livestock (San Antonio Basin)	0	0	(81)	(84)	(88)	(92)
Livestock (Nueces Basin)	0	0	0	0	0	0
County Total	**35,163**	**32,245**	**25,035**	**18,637**	**11,827**	**3,804**

Table 22 Projected Water Needs by Water User Group (In Acre-Feet)						
Water User Group (Basin)	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Caldwell County						
Aqua WSC	(49)	(121)	(178)	(240)	(300)	(362)
County Line WSC	205	101	4	(92)	(191)	(286)
Creedmoor-Maha WSC (Colorado)	227	186	150	113	76	38
Creedmoor-Maha WSC (Guadalupe)	165	136	109	82	56	28
Goforth	(29)	(114)	(187)	(262)	(340)	(416)
Gonzales County WSC	2	(14)	(29)	(43)	(57)	(71)
Lockhart	(341)	(984)	(1,519)	(2,070)	(2,615)	(3,175)
Luling	(168)	(311)	(400)	(485)	(587)	(695)
Martindale	33	24	19	15	8	0
Martindale WSC	37	26	21	17	9	0
Maxwell WSC	268	93	(73)	(225)	(395)	(560)
Mustang Ridge (Colorado)	(17)	(55)	(89)	(123)	(157)	(191)
Mustang Ridge (Guadalupe)	(2)	(7)	(10)	(14)	(18)	(22)
Niederwald	(12)	(29)	(47)	(64)	(81)	(97)
Polonia WSC (Colorado)	82	16	(41)	(100)	(157)	(217)
Polonia WSC (Guadalupe)	187	35	(96)	(231)	(363)	(502)
County-Other (Colorado)	6	7	7	7	8	8
County-Other (Guadalupe)	493	510	538	564	585	602
Municipal Total	**1,087**	**(501)**	**(1,821)**	**(3,151)**	**(4,519)**	**(5,918)**
Manufacturing	15	12	9	6	3	1
Mining (Colorado)	1	0	1	1	1	1
Mining (Guadalupe)	0	0	0	0	0	0
Irrigation (Colorado)	0	0	0	0	0	0
Irrigation (Guadalupe)	20	56	88	117	143	166
Livestock (Colorado)	0	0	0	0	0	0
Livestock (Guadalupe)	0	0	0	0	0	0
County Total	**35**	**68**	**97**	**123**	**146**	**168**

Table 22 Projected Water Needs by Water User Group (In Acre-Feet)						
Water User Group (Basin)	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Comal County						
Bexar Met Water District (Guadalupe)	(33)	(53)	(75)	(95)	(117)	(141)
Bexar Met Water District (San Antonio)	(386)	(652)	(941)	(1,206)	(1,502)	(1,825)
Bulverde City (Guadalupe)	(5)	(10)	(17)	(23)	(30)	(37)
Bulverde City (San Antonio)	(648)	(1,332)	(2,111)	(2,887)	(3,693)	(4,558)
Canyon Lake WSC	1,072	(769)	(2,838)	(4,898)	(7,034)	(9,331)
Crystal Clear WSC	82	(3)	(104)	(194)	(297)	(409)
Fairoaks Ranch	3	20	25	25	23	22
Garden Ridge (Guadalupe)	(170)	(252)	(346)	(440)	(537)	(644)
Garden Ridge (San Antonio)	(115)	(171)	(234)	(298)	(364)	(436)
Green Valley SUD	(22)	(100)	(195)	(249)	(347)	(452)
New Braunfels	1,333	(1,135)	(4,015)	(6,866)	(9,793)	(13,041)
Shertz (Guadalupe)	22	(14)	(53)	(92)	(133)	(177)
Shertz (San Antonio)	5	0	(7)	(12)	(19)	(26)
Selma	(57)	(109)	(173)	(202)	(228)	(254)
Water Services Inc	(294)	(388)	(495)	(601)	(709)	(831)
County-Other (Guadalupe)	(1,699)	(1,492)	(1,211)	(1,405)	(1,770)	(2,071)
County-Other (San Antonio)	(53)	275	248	211	166	118
Municipal Total	**(965)**	**(6,185)**	**(12,542)**	**(19,232)**	**(26,384)**	**(34,093)**
Manufacturing (Guadalupe)	1,526	692	(59)	(789)	(1,416)	(2,297)
Manufacturing (San Antonio)	368	368	368	367	367	367
Mining	(1,905)	(2,094)	(2,210)	(2,324)	(2,590)	(2,694)
Irrigation (Guadalupe)	865	880	895	909	924	938
Irrigation (San Antonio)	14	17	19	22	24	26
Livestock (Guadalupe)	(91)	(93)	(93)	(95)	(101)	(102)
Livestock (San Antonio)	(18)	(18)	(18)	(18)	(19)	(19)
County Total	**759**	**(248)**	**(1,098)**	**(1,928)**	**(2,811)**	**(3,781)**

Table 22 Projected Water Needs by Water User Group (In Acre-Feet)						
Water User Group (Basin)	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Guadalupe County						
Cibolo	(66)	1,610	1,254	902	502	70
Crystal Clear WSC	565	193	(231)	(617)	(1,096)	(1,612)
East Central WSC	135	4	(34)	(71)	(108)	(150)
Green Valley SUD (Guadalupe)	(39)	2,496	1,770	1,357	532	290
Green Valley SUD (San Antonio)	(16)	23	23	118	118	(529)
Marion	17	2	(13)	(28)	(48)	(70)
Martindale WSC	62	45	25	(2)	(19)	(41)
New Braunfels	(91)	(327)	(584)	(840)	(1,123)	(1,434)
Santa Clara (Guadalupe)	(14)	(40)	(68)	(95)	(126)	(159)
Santa Clara (San Antonio)	(62)	(165)	(280)	(390)	(516)	(651)
Schertz	2,171	879	(480)	(1,854)	(3,431)	(5,130)
Seguin	9,402	8,702	7,966	7,217	6,351	5,373
Selma	(3)	(30)	(57)	(75)	(96)	(120)
Springs Hill WSC (Guadalupe)	2,513	2,235	1,916	1,606	1,247	841
Springs Hill WSC (San Antonio)	443	391	333	275	209	134
Water Services Inc	(29)	(36)	(44)	(52)	(60)	(70)
County-Other (Guadalupe)	249	297	347	400	437	474
County-Other (San Antonio)	(48)	(37)	(25)	(15)	(7)	0
Municipal Total	**15,189**	**16,242**	**11,818**	**7,836**	**2,766**	**(2,784)**
Manufacturing (Guadalupe)	1,457	1,138	847	566	325	0
Manufacturing (San Antonio)	2	2	1	1	1	0
Steam-Electric Power	(3,225)	(7,567)	(10,004)	(12,974)	(16,595)	(21,008)
Mining (Guadalupe)	0	0	0	0	0	0
Mining (San Antonio)	0	0	0	0	0	0
Irrigation (Guadalupe)	728	817	901	982	1,007	1,011
Irrigation (San Antonio)	0	0	0	0	0	0
Livestock (Guadalupe)	0	0	0	0	0	0
Livestock (San Antonio)	0	0	0	0	0	0
County Total	**(1,038)**	**(5,610)**	**(8,255)**	**(11,425)**	**(15,262)**	**(19,997)**

Table 22 Projected Water Needs by Water User Group (In Acre-Feet)						
Water User Group (Basin)	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Hays County						
Buda	(638)	(1,514)	(1,989)	(2,474)	(3,052)	(3,526)
Cimarron Park Water Company	(41)	(127)	(220)	(314)	(427)	(520)
County Line WSC	(44)	(1,096)	(1,416)	(1,490)	(1,709)	(2,079)
Creedmore-Maha WSC	21	19	16	14	11	8
Crystal Clear WSC	161	7	(160)	(313)	(519)	(681)
Dripping Springs	(520)	(1,296)	(1,737)	(2,185)	(3,300)	(3,736)
Dripping Springs WSC	(108)	(261)	(420)	(577)	(773)	(926)
Goforth WSC	(50)	(418)	(782)	(1,153)	(1,623)	(1,992)
Hill Country WSC	0	0	0	0	0	0
Kyle	(1,388)	(2,588)	(2,865)	(3,025)	(3,522)	(3,851)
Maxwell WSC	113	70	21	(24)	(84)	(132)
Mountain City (Colorado)	14	16	16	17	17	17
Mountain City (Guadalupe)	88	62	35	9	(24)	(50)
Niederwald	(23)	(66)	(113)	(157)	(213)	(257)
Plum Creek Water Company	123	(73)	(274)	(479)	(738)	(941)
San Marcos	526	(2,634)	(5,807)	(9,260)	(12,995)	(15,875)
Wimberley WSC	(177)	(400)	(628)	(847)	(1,248)	(1,479)
Woodcreek	(118)	(187)	(257)	(325)	(436)	(506)
Woodcreek Utilities Inc	(475)	(872)	(1,292)	(1,702)	(2,255)	(2,651)
County-Other (Colorado)	(759)	(2,072)	(3,416)	(4,784)	(8,400)	(9,738)
County-Other (Guadalupe)	(1,033)	(1,233)	(1,444)	(1,667)	(1,978)	(2,201)
Municipal Total	**(4,328)**	**(14,663)**	**(22,732)**	**(30,736)**	**(43,268)**	**(51,116)**
Manufacturing (Colorado)	231	113	(6)	(126)	(234)	(333)
Manufacturing (Guadalupe)	2,111	2,074	2,038	2,001	1,968	1,937
Steam-Electric Power	1,069	(1,231)	(2,522)	(4,095)	(6,013)	(8,351)
Mining (Colorado)	9	15	19	21	19	19
Mining (Guadalupe)	(82)	(88)	(92)	(94)	(106)	(107)
Irrigation (Colorado)	963	963	963	963	962	962
Irrigation (Guadalupe)	491	494	497	500	503	506
Livestock (Colorado)	626	626	626	626	621	621
Livestock (Guadalupe)	(82)	(82)	(82)	(82)	(82)	(82)
County Total	**5,336**	**2,884**	**1,441**	**(286)**	**(2,362)**	**(4,828)**

Table 22 Projected Water Needs by Water User Group (In Acre-Feet)						
Water User Group (Basin)	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Medina County						
Benton City WSC	188	98	13	(59)	(135)	(203)
Bexar Met Water District	(15)	(24)	(32)	(38)	(45)	(51)
Castroville	(274)	(337)	(396)	(448)	(502)	(555)
Devine	63	50	44	38	22	4
East Medina SUD (Nueces)	126	15	(89)	(173)	(262)	(351)
East Medina SUD (San Antonio)	6	0	(6)	(11)	(16)	(21)
Hondo	(804)	(1,021)	(1,225)	(1,394)	(1,568)	(1,737)
La Coste	(96)	(113)	(130)	(142)	(156)	(172)
Lytle	(23)	(21)	(20)	(19)	(19)	(19)
Natalia	(198)	(242)	(283)	(318)	(353)	(387)
Yancey WSC	(577)	(758)	(925)	(1,073)	(1,214)	(1,348)
County-Other (Nueces)	(180)	(507)	(799)	(1,058)	(1,326)	(1,567)
County-Other (San Antonio)	113	105	97	91	84	78
Municipal Total	**(1,671)**	**(2,755)**	**(3,751)**	**(4,604)**	**(5,490)**	**(6,329)**
Manufacturing	479	471	464	457	451	443
Mining (Nueces)	0	0	0	0	0	0
Mining (San Antonio)	0	0	0	0	0	0
Irrigation (Nueces)	(4,651)	(2,888)	(1,201)	417	1,965	3,450
Irrigation (San Antonio)	4,621	5,001	5,364	5,711	6,045	6,364
Livestock (Nueces)	0	0	0	0	0	0
Livestock (San Antonio)	0	0	0	0	0	0
County Total	**449**	**2,584**	**4,627**	**6,585**	**8,461**	**10,257**
Uvalde County						
Sabinal	(139)	(135)	(130)	(125)	(121)	(121)
Uvalde	(3,793)	(3,830)	(3,850)	(3,854)	(3,856)	(3,884)
County-Other	960	665	422	227	107	0
Municipal Total	**(2,972)**	**(3,300)**	**(3,558)**	**(3,752)**	**(3,870)**	**(4,005)**
Manufacturing	728	705	687	670	655	622
Mining	0	0	0	0	0	0
Irrigation	24,256	26,438	28,534	30,549	32,484	34,344
Livestock	0	0	0	0	0	0
County Total	**24,984**	**27,143**	**29,221**	**31,219**	**33,139**	**34,966**

3.12 Projected Water Management Strategies

To meet long-term water supply needs within Region L, the 2007 State Water Plan contains projected water management strategies. These strategies are not broken out by county or water user group, but rather are compiled for the entire jurisdictional area of the Authority. The specific strategies are listed below.

Table 23
Water Management Strategies

RECOMMENDED WATER MANAGEMENT STRATEGIES FOR REGION L IN THE 2007 STATE WATER PLAN
Brackish Groundwater Desalination (Wilcox Aquifer)
LCRA/SAWS Water Project
Edwards Aquifer Recharge – Type 2 Projects
CRWA Dunlap Project – Includes Temporary Overdrafts
Municipal Water Conservation
Irrigation Water Conservation
Industrial, Steam-Electric Power Generation, and Mining Conservation
Edwards Transfers
Local Groundwater (Corrizo-Wilcox Aquifer) – Included Temporary Overdrafts
Local Groundwater (Trinity Aquifer)
Local Groundwater (Barton Springs Edwards Aquifer)
Regional Carrizo for Bexar County Supply – Includes Temporary Overdrafts
Regional Carrizo for SSLGC Project Expansion – Includes Temporary Overdrafts
Wells Ranch Project – Includes Temporary Overdrafts
Hays/Caldwell Carrizo Project – Includes Temporary Overdrafts
SAWS Recycled Water Program – Phased Expansion
CRWA Siesta Project
Recycled Water Programs
Canyon Reservoir – Downstream Diversions
Wimberley and Woodcreek Water Supply from Canyon Reservoir
Surface Water Rights
LGWSP Capacity for GBRA Needs

4.0 GROUNDWATER MANAGEMENT PLAN

The Authority's basic management goals are derived from its Strategic Plan, which is available online at http://www.edwardsaquifer.org/display_document_cat.php?cID=6. More specifically, Section 36.1071 of the Texas Water Code and associated TWDB Administrative Rules require the Authority's Groundwater Management Plan to address the following management goals, as applicable:

1. Providing the most efficient use of groundwater;
2. Controlling and preventing waste of groundwater;
3. Controlling and preventing subsidence;
4. Addressing conjunctive surface water management issues;
5. Addressing natural resource issues that impact the use and availability of groundwater, and that are affected by the use of groundwater;
6. Addressing drought conditions;
7. Addressing:
    A) Conservation;
    B) Recharge Enhancement;
    C) Rainwater Harvesting;
    D) Precipitation Enhancement; and
    E) Brush Control; and
8. Addressing, in a quantitative manner, desired future conditions.

5.0 GOALS, MANAGEMENT OBJECTIVES, AND PERFORMANCE STANDARDS

5.1 Implement management strategies that will provide for the most efficient use of groundwater.

5.1(A) Management Objective:

- Implement efficient transfer program that allows water rights to transfer between permitted users.

Performance Standard:

- Process transfers within 60 days of declaration of administrative completeness by the Authority.

5.1(B) Management Objective:

- Require water meters on all permitted wells.

Performance Standard:

- Make field inspections on 75 percent of all permitted wells, at least annually.

- Report amount of permitted wells inspected in the annual report to the Board of Directors.

5.1(C) Management Objective:

- Enhance reporting of annual withdrawals by documenting annual water use by federal facilities within the Authority's jurisdiction.

Performance Standard:

- Make a good faith effort to negotiate agreements with federal facilities and begin receiving annual use reports concerning their Aquifer pumping.

5.1(D) Management Objective:

- Receive annual water use reports for all permitted wells (See also Management Objective 5.7(B)).

Performance Standard:

- Require water use reports to be submitted by March 1 of each year and follow up with appropriate enforcement actions.

- Report 100 percent of the permitted water use received, reviewed and approved by the Authority annually in the Edwards Aquifer Authority Hydrologic Data Report.

5.1(E) Management Objective:

- Require a groundwater conservation plan (GCP) for all municipal and industrial users permitted for three acre-feet or more and all irrigation users that are not operating at specified operating efficiencies (See also Management Objective 5.7(A)).

Performance Standard:

- Present a status report of the Authority's GCP to the Legislature by January 1 of each odd-numbered year.

5.2 Implement management strategies that will control and prevent waste.

5.2(A) Management Objective:

- Continue and expand the Authority's well registration program.

Performance Standard:

- Complete focused efforts in Hays and Comal counties and begin efforts in Bexar County by the end of the five-year period.

5.2(B) Management Objective:

- Continue to register wells throughout the region as they come to the Authority's attention.

Performance Standard:

- Register 100 percent of unregistered wells discovered through the well registration program annually.

- Report the number of unregistered wells that were discovered and subsequently registered in the annual report to the Board of Directors.

5.2(C) Management Objective:

- Continue the Authority's abandoned well closure program.

Performance Standard:

- Initiate appropriate enforcement actions to address noncompliance.

- Report the number of abandoned wells closed during the year in the annual report to the Board of Directors.

5.2(D) Management Objective:

- Identify and address unauthorized withdrawals discovered under the well registration and abandoned well closure programs.

Performance Standard:

- Initiate appropriate enforcement actions to address noncompliance.

- Report the number of unauthorized withdrawals discovered and the number of unauthorized withdrawals addressed in the annual report to the Board of Directors.

5.3 Implement management strategies that will control and prevent subsidence

This goal is not applicable to the Authority.

5.4 Implement management strategies that address conjunctive surface water management issues.

5.4(A) Management Objective:

- Participate in the South Central Texas Regional Water Planning Group (Region L) water planning activities by attending at least one meeting annually.

Performance Standard:

- Consider Interlocal Agreement annually, committing financial and staff support for planning efforts.

5.4(B) Management Objective:

- Participate in the Cibolo Creek Watershed feasibility study with the Corps of Engineers, Guadalupe-Blanco River Authority, San Antonio River Authority, and the San Antonio Water System (See also Management Objective 5.8(B)).

Performance Standard:

- Conclude Phase 3 of the study by 2011.

5.4(C) Management Objective:

- Participate in the Nueces Basin feasibility study with the Corps of Engineers, Nueces River Authority, San Antonio River Authority, San Antonio Water System, and the City of Corpus Christi (See also Management Objective 5.8(C)).

Performance Standard:

- Present an annual status report to the Edwards Aquifer Authority Board.

5.5 Address natural resource issues that impact the use and availability of groundwater and which are affected by the use of groundwater.

Management Objective:

- Continue to participate in the Edwards Aquifer Recovery Implementation Program (EARIP) for Aquifer-dependent, federally protected species.

Performance Standard:

- Provide a status report to key legislators each January; and
- Participate in the EARIP and successfully negotiate an appropriate program document by December 31, 2012.

5.6 Implement management strategies that will address drought conditions.

5.6(A) Management Objective

- Collect daily information at Comal Springs, San Marcos Springs, and at the J-17 and J-27 Index Wells and compare that information to the drought triggers that lead to implementation of the critical period management plan. The drought triggers are described in Figure 1 of this document and in Section 1.26 of the Edwards Aquifer Authority Act.

Performance Standard

- Provide a report on Aquifer Conditions to the Board of Directors at each board meeting.

5.6(B) Management Objective

- Implement critical period management plan to mitigate the consequences of drought.

Performance Standard

- Notify 100 percent of affected permit holders of mandatory reductions and reporting requirements within two days of declaring Critical Period Stage I and each subsequent stage.

- Enforce all aspects of the Authority's Critical Period Rules on 100 percent of permits greater than three acre-feet during stages of Critical Period.

- Identify and notify 100 percent of monthly non-reporters within ten business days after the reporting deadline.

5.7 Implement management strategies that address conservation.

5.7(A) Management Objective:

- Require a groundwater conservation plan (GCP) for all municipal and industrial users permitted for three acre-feet or more and all irrigation users that are not operating at specified operating efficiencies (See also Management Objective 5.1(E)).

Performance Standard:

- Present a status report of the Authority's GCP to the Legislature by January 1 of each odd-numbered year.

5.7(B) Management Objective:

- Receive annual use reports for all permitted wells (See also Management Objective 5.1 (D)).

Performance Standard:

- Require water use reports to be submitted by March 1 of each year and follow up with appropriate enforcement actions.

5.7(C) Management Objective:

- Support water conservation practices of groundwater withdrawal permit holders to maximize the efficiency of water use throughout the region.

Performance Standard:

- Issue water conservation grants to five groundwater permit holders annually.

5.7(D) Management Objective:

- Use aquifer management fees to encourage groundwater conservation.

Performance Standard:

- Issue rebates of aquifer management fees originally paid for groundwater authorized but not pumped by municipal and industrial permit holders within 120 days after the submittal of annual use reports.

5.8 Implement management strategies that address recharge enhancement.

5.8(A) Management Objective:

- Maintain the Authority's four recharge enhancement structures.

Performance Standard:

- Report at least one recharge estimate to the Texas Commission on Environmental Quality annually.

5.8(B) Management Objective:

- Participate in the Cibolo Creek Watershed feasibility study with the Corps of Engineers, Guadalupe-Blanco River Authority, San Antonio River Authority, and the San Antonio Water System (See also Management Objective 5.4(B)).

Performance Standard:

- Conclude Phase 3 of the study by 2011.

5.8(C) Management Objective:

- Participate in the Nueces Basin feasibility study with the Corps of Engineers, Nueces River Authority, San Antonio River Authority, San Antonio Water System, and the City of Corpus Christi (See also Management Objective 5.4(C)).

Performance Standard:

- Present an annual status report to the Edwards Aquifer Authority Board.

5.9 Implement management strategies that address rainwater harvesting.

5.9(A) Management Objective:

- Support rainwater harvesting efforts by providing information to the public through brochures and the Authority's educational program.

Performance Standard:

- Distribute informational brochures to 100% of permit holders.

- Maintain brochures that are available to the public at the Authority office and have brochures available at 100% of educational booths.

5.9(B) Management Objective:

- Support rainwater harvesting efforts by providing some funding for three rainwater harvesting demonstration projects over the next five years.

Performance Standard:

- A status report on the projects will be included in the annual report to the Board of Directors.

5.10 Implement management strategies that address precipitation enhancement.

5.10(A) Management Objective:

- Participate in cost-effective Precipitation Enhancement Programs.

Performance Standard:

- Make annual determination regarding Precipitation Enhancement Program based on seasonal effectiveness report submitted by the South Texas Weather Modification Association and the Southwest Texas Rain Enhancement Association.

- A report of the annual Precipitation Enhance Program determination will be included in the annual report to the Board of Directors.

5.11 Implement management strategies that address brush control.

5.11(A) Management Objective:

- Participate in programs that will establish reasonable and cost-effective brush control.

Performance Standard:

- For as long as practicable under the terms of the agreement, continue with the Memorandum of Understanding with the United States Department of Agriculture Natural Resources Conservation Service to implement best management practices on private lands within the Edwards Aquifer Recharge and Contributing Zones in Bexar, Comal, Hays, Medina, and Uvalde Counties to treat Ashe Juniper.

- Provide funding to qualifying landowners for cost share of brush management.

- The amount of funding provided to qualifying landowners will be included in the annual report to the Board of Directors.

5.12 Address, in a quantitative manner, desired future conditions.

This goal is not applicable to the Authority. For a discussion of the desired future conditions of the Edwards Aquifer, within the Authority's jurisdictional boundaries, please refer to Section 3.2 of this Groundwater Management Plan. The DFC and MAG for the Edwards Aquifer (San Antonio Segment within the Authority's boundary) were adopted by legislative act on May 28, 2007. In addition, the Authority is a member of GMA 10 and has actively participated in the adoption of DFCs for the Leona Gravel Aquifer (Medina County) on May 17, 2010, and both the Edwards Aquifer (Northern Subdivision) and Saline Edwards Aquifer (Northern Subdivision) on June 14, 2010. However, the Authority does not have jurisdiction over these aquifers; therefore, the adopted DFCs are not applicable to the Authority's goals and management objectives.

6.0 ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The Authority will implement the provisions of this plan and will utilize such provisions as a guidepost for determining the direction or priority for Authority activities.

Pursuant to its enabling legislation, the Authority has adopted rules relating to the permitting of wells and the production of groundwater, which are currently being adhered to and enforced. The Edwards Aquifer Authority Rules can be found at:

http://www.edwardsaquifer.org/files/Final_Rules.pdf.

The Authority has always and will continue to strive to treat all citizens with equality when enforcing current rules and when developing, enacting and enforcing any future rules.

The Authority will seek the cooperation and coordination of appropriate state, regional or local management entities in the implementation of the plan and the management of groundwater supplies within the Authority's jurisdictional boundaries.

7.0 METHODOLOGY FOR TRACKING AUTHORITY PROGRESS IN ACHIEVING MANAGEMENT GOALS

The General Manager of the Authority will prepare and present an annual report to the Board of Directors on the Authority's performance in achieving management goals and objectives. The presentation of the report will occur during the first monthly board meeting of each year, beginning January 2011. The report will include the number of instances in which each of the activities specified in the Management Objectives section of this plan was engaged in during the previous year. The frequency of an activity will be referenced to the appropriate performance standard for each management objective describing the activity. The Authority will maintain the report on file for public inspection at the Authority's office upon adoption by the board. This methodology applies to all management goals contained in this plan.