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**The Edwards Aquifer, Texas:
Sorting out Competing Uses in an
Unregulated Resource**

Russell L. Masters

Edwards Underground Water District

**Uncovering The Hidden Resource:
Groundwater Law, Hydrology and Policy in the 1990s**

Natural Resources Law Center

**University of Colorado
School of Law**

June 15-17, 1992

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The Edwards Aquifer

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I. Geographic Location

Deep in South Central Texas where Mexican food and afternoon siestas are a way of life, people go about their everyday business almost oblivious to the presence of one of the most extraordinary natural resources in the world, the Edwards Aquifer.

The Edwards (Balcones/Fault Zone) Aquifer lies under San Antonio, Texas, the ninth largest City in the United States. The aquifer actually is 175 miles long, extending from Bracketville which is approximately 30 miles from Mexico, east, northeast under San Antonio to Kyle, Texas which is about 15 miles from Austin, the State Capital.

The aquifer and its catchment area in the San Antonio region covers 8,000 square miles and includes all or part of 13 south central Texas counties. The commonly-referred-to "Edwards Aquifer," in the San Antonio area, covers an expanse of about 3,600 square miles.

Much of the region which relies on the aquifer for its only source of water is agricultural or ranch land with some areas of dense population.

II. Description of the Aquifer

The Edwards (Balcones Fault Zone) Aquifer is a karst limestone aquifer composed of three distinct zones: the drainage zone, recharge zone, and the artesian (freshwater zone).

Drainage Zone

The drainage zone is the Southern portion of the Edwards Plateau. Here Edwards limestone is found on the surface and ranges from 350 to 500 feet in thickness. Rain falling on the exposed and weathered, fractured limestone in this area is absorbed by the limestone. This rainfall as it exits the base of the limestone layer at the northern edge of the Balcones Escarpment forms the headwaters of the streams and rivers that eventually intersect the highly faulted area in the streambed and the waters are lost to recharge.

Recharge Zone

The recharge zone is found at the southern edge of the Edwards Plateau where major faulting has taken place. As streams cross the fault zone, much of the flow percolates through the streambed into the aquifer. During below average rainfall conditions, virtually all streamflow is recharged to the aquifer. The average annual recharge to the aquifer for the period of record 1934 - 1990 is 636,000 acre feet. Over long periods of time, after much attenuation of suspended solids and other material by the honeycombed limestone, water arrives in the artesian, or freshwater zone in a state of such high quality as not to require any treatment.

Artesian Zone

The artesian, or confined zone of the Edwards Aquifer is that portion of the aquifer where most of the water is stored. The artesian zone is a complex network of pore spaces and solution openings, some of which are huge cavern systems. Water, after entering the aquifer moves downdip in a southerly direction toward the coast. Before the water reaches the "badwater" line, or southern limit of freshwater in the aquifer, the direction of flow is deflected in an east northeasterly direction toward the major spring openings at New Braunfels and San Marcos, Texas.

III. Uses of the Aquifer

The Edwards Aquifer is a very, very significant resource for the region of Texas it underlies, because it is currently the sole source of water for that region. In many ways, the Edwards Aquifer has shaped this part of south central Texas. The aquifer supplies thousands of acre feet of water each year to an irrigated agricultural industry encompassing approximately 100,000 acres, to a major metropolitan area and rural communities of 1.5 million people; and to the southwestern United States' largest springs which are habitat to four endangered and threatened species of flora and fauna.

Springs emanating from the aquifer, in the five counties which make up the region, form the headwaters of major streams and rivers which traverse the aquifer and make their way to the Texas Gulf coast, providing significant flows to thriving bays and estuaries.

The economy of the entire region is "handcuffed" to this phenomenal natural resource. It's abundant flowing water drew the Indians to this area of Texas. Its unpredictable nature, and the lack of long-term plans for water needs in the San Antonio area have caused business to locate elsewhere, where there are plans for future water needs.

Information for the time period 1976-1990 indicates that irrigation demands have averaged 142,000 acre feet per year with a low of 41,000 in 1987 and a high of 203,000 in 1985. During the same time period, municipal demands accounted for an average of 250,000 acre feet with a low of 182,000 in 1976 and a high of 287,000 in 1984. Industry and other uses averaged 55,000 and springflow averaged 343,000 acre feet. It is significant to point out that recharge for this fourteen year time period averaged 872,000 acre feet, 236,000 acre feet in excess of the long term 56 year average of 636,000 acre feet.

Uses range from irrigated grain and vegetables to food processing, uses in bottling processed beverages and pure Edwards water, some small amount of manufacturing and mining, recreation around the springs, water intensive theme parks, such as Sea World and Fiesta Texas (Opry-land), and a considerable residential and military use.

IV. Issues that Surround the Edwards Aquifer

The drought of the 1950s, changed how water was used and managed throughout the State of Texas and brought about the realization that the Edwards Aquifer not an infinite resource. During the 10 years of the drought, water level in the Edwards Aquifer plummeted from an annual long-term average elevation of 675 feet amsl (above mean sea level), to an all time record low of 612 ft. amsl in 1956.

The drought of the 1950's was broken by record recharge of 1,711,000 acre feet in 1958. But concerned citizens across south central Texas realized that without managing, conserving and protecting the Edwards Aquifer the region was at risk.

In the 1957 legislative session, legislation was introduced to create an underground water conservation district to **preserve, conserve, protect** and increase the recharge to the Edwards. That legislation failed in 1957 but finally was approved in the 1959 session, and the Edwards Underground Water District was formed.

From 1959

The Edwards Underground Water District initiated monitoring programs and began carrying out studies.

Growth and development skyrocketed throughout the region.

In 1965

Studies conducted in 1965 by the U.S. Army Corp. of Engineers indicated that the Edwards Aquifer could not meet the future water requirements of the area and recommended a safe-yield withdrawal of 400,000 acre feet.

In 1978

In 1978 the Bureau of Reclamation pointed out serious consequences associated with continued and unrestricted use of the Edwards Aquifer. The Texas Department of Water Resources developed the first study of the Edwards Aquifer using computer modeling in 1979. This effort reiterated the need for an annual "safe-yield" withdrawal of 450,000 acre feet.

Countless studies were done through the 1960's and 1970's, all illustrating, concluding, repeating, restating the need for management and development of supplemental water supplies. The studies however, were done by "outsiders". Local interests had not conducted their own study, and consequently were suspicious of those done by "outsiders."

The various planning groups and forums frequently mentioned that not enough information was available. A study of the problem and needs was necessary before a "plan" could be developed.

1983 Regional Effort

In 1983, The Edwards Underground Water District approached the City of San Antonio with the idea to undertake a joint study of the Edwards Aquifer. The study would look at the regional water resources and needs, and the study output would be input for a regional management plan. The Edwards Underground Water District and City of San Antonio signed a **Memorandum of Agreement** in November of 1983 and the effort was underway. First we needed to study the "problem" to ascertain what the "problem" was, and then we could set about attempting to develop a plan that would provide the solution.

Little did anyone know in November of 1983 that the proposed effort would ultimately lead to disagreements so great throughout the five-county Edwards region as to ultimately cause the partial break up of the Edwards Underground Water District and a total mistrust among the three divergent interest groups.

The study got underway however, with substantial time, effort, and expense devoted to carefully defining the scope of work, appointing advisory committees, selecting qualified consultants, conducting the study, and involving the public to the maximum extent possible. Credibility of the final product was a high priority. This was to be "the study to end all studies."

Completion of the Regional Water Resources Study

In 1986, when the Regional Water Resources Study was completed it was even more evident that a regional water management plan was needed. The Edwards Underground Water District and the City of San Antonio took the next step to form a committee to get the Regional Water Resources Study into the hands of the public throughout the region, so that a consensus could be reached on the fundamental policies and objectives necessary to develop a regional water management plan.

After six months of meetings and spirited, lively arguments to reach a consensus, it was concluded that the waters of the Edwards Aquifer, through a comprehensive water plan, should be allocated and that the plan must include conservation, reuse, and surface water development.

The Regional Water Resources Plan was ultimately completed and approved by both the Edwards Underground Water District and the City of San Antonio in July 1988. The document contained five components:

1. Aquifer Recharge
2. Groundwater Withdrawal
3. Conservation
4. Wastewater Reuse
5. Surfacewater Projects

After all the studies, the issue remained the same: the Edwards Aquifer could not sustain continued growth without severe consequences to the users and the resource.

V. Current Conflict

Major conflicts in the region began to emerge as a result of the completion of the Regional Water Resources Plan. The main issue was the groundwater withdrawal component of the plan which advocated allocation of the resource by certain uses. Irrigation farmers, although grandfathered and guaranteed a certain amount of water, took offense to the notion that their heretofore right of ownership to unlimited amounts of groundwater would be regulated and restricted. This attitude prevailed throughout the five counties. San Antonio did not want to be restricted, and like the irrigation farmers, wanted access to unlimited supplies. Everyone wanted what they always had access to, and no one really wanted to compromise. This mentality of "no restrictions" was counter to their belief that restrictions were detrimental, that they actually deprived them of certain rights. What they did not, and do not realize, is that restrictions or regulations would protect the rights and uses they had built up over the years. Those involved would realize the error of their uncompromising attitude in the summer of 1991.

The three diverging interests:

1. Agricultural
2. Municipal (San Antonio)
3. Springflow Protection - Eastern counties

Conflicts Among the Three Groups

1. The Farmers and San Antonio wanted to maintain "status quo".
2. San Antonio and agricultural interests at different times, looked at the springs as "just leaks from the aquifer".
3. Springflow protection could not see how other interests in the region could ignore the:
 - 1) significance of the endangered species
 - 2) local economy built around the springs.
4. The farmers and recreational users had problems with San Antonio not planning for its obvious growing water needs. They resented the increasing demands on the aquifer by San Antonio.
5. The farmers agreed at one point that, so long as San Antonio built a reservoir for future needs, the farmers would agree to some level of capping their demands on the aquifer. When San Antonio allowed voters to halt construction of the reservoir, the farmers lost all confidence in the City.
6. If San Antonio was going to be forced to develop or purchase alternate sources of water, the City wanted the other interests to help pay for the water.

The Regional Water Plan of 1988 and its ramifications led to the development of legislation which would put the regulatory and governance framework into place and allow the plan to be implemented. The thought of the Edwards Underground Water District having the authority to regulate the use of groundwater however, was too much for the irrigation farmers in the western counties of Medina and Uvalde. They began a process that ultimately allowed the electorate in the respective counties to vote their counties out of the District. This concern was aggravated by the actions in Bexar County that would ultimately provide Bexar County with six members elected to the Board, while the other four counties were limited to three. In addition, proposed legislative alternatives could not be agreed upon.

Agricultural interests feared that a 1979-1995 time period to recognize historic users would cause an artificial increase in irrigation pumping and that water right transfer provisions would destroy the economy of the rural counties.

Concerns of the agricultural interests prompted a revised legislative proposal in December of 1988, which recognized irrigation uses and capped the uses at 220,000 acre feet per year. The following month, January 1989, during the Edwards Underground Water District elections, Medina and Uvalde counties were successful at formally withdrawing from the

Edwards Underground Water District. An entity that had been in place for 30 years and provided protection, management, conservation, and had increased the recharge to the Edwards Aquifer for the benefit of 1.5 million people, was suddenly fragmented.