



## **Considerations for the Future of the City of San Antonio’s Edwards Aquifer Protection Program**

### **Overview**

In 2000, the citizens of the City of San Antonio voted to approve Proposition 3 to utilize a 1/8 cent sales tax to collect \$45 million to purchase properties located on the environmentally sensitive recharge zone of the Edwards Aquifer. This was viewed as a means to protect the quality and quantity of water entering the Edwards Aquifer in Bexar County. The generated funds were used to acquire almost 6,500 acres of land. The sales tax was re-approved in 2005, 2010 and 2015 (under the guise of Proposition 1). The program was expanded to include acquisitions of recharge zone properties in other counties to the west of Bexar County, where the preponderance of recharge to the aquifer (and San Antonio’s water supply) occurs. To date, more than 150,000 acres of recharge zone and contributing zone lands have been protected through fee simple acquisitions, or through the purchase of conservation easements administered through the city-run Edwards Aquifer Protection Program (EAPP).

### **The Basis for the EAPP: A Susceptible Water Resource**

The Edwards Aquifer is one of the most productive in the United States, providing spring flow to two of the Southwest’s major spring systems – the Comal and San Marcos – and supporting the water needs of more than two million people across South Central Texas. The Edwards is a karst aquifer - a natural geologic system of porous limestone rock exposed at the land surface, through which water percolates to its subsurface destination, between confined layers of clay, above and below, to create a vast underground aquifer of water under artesian pressure.

The Edwards Aquifer System consists of three parts: the Contributing Zone, Recharge Zone, and Artesian Zone (see Figure 1). Surface water from the Contributing Zone flows southward from the Texas Hill Country via streams and rivers to and across the Recharge Zone where it enters the aquifer as recharge. Water may also enter the aquifer as direct rainfall on the Recharge Zone, or as subsurface interformational flow from the Trinity Aquifer.

The Contributing Zone makes up approximately 80 percent, and the Recharge Zone makes up approximately 20 percent of the land area that contributes water to the aquifer. The area of landmass (and subsequent catchment area) in the Contributing Zone is one reason water levels in the aquifer are capable of rebounding so quickly when heavy rainfall impacts the region.

The presence of sinkholes, sinking streams, and caves, allow rapid infiltration of surface water (recharge) into the aquifer. However, these same features also allow pollutants entrained in surface water to enter the aquifer with little to no filtration. Groundwater velocities in the recharge zone of the Edwards Aquifer have been measured at more than a mile per day. These high velocities also make it difficult to accurately monitor water quality in the aquifer.

The characteristics that make the aquifer so productive — specifically, the ability to take in large amounts of water from the surface and transport them deep underground — also make it vulnerable to pollution from surface impacts such as stormwater runoff and poorly maintained and deteriorated wells. The United States Environmental Protection Agency (US EPA) has identified karst aquifers as the aquifer type most vulnerable to contamination. The Edwards Aquifer was the first in the United States to be designated as a Sole Source Aquifer (RECON et al, 2012).

### **The Effects and Continued Potential of the EAPP: Shared Value in Protecting the Water Resource**

While much of the region within the recharge and contributing zones of the aquifer were historically undeveloped, trends in urbanization of these areas have increased the potential for non-point pollution to enter the aquifer. Rapid growth in the recharge and contributing zones in Bexar and surrounding counties is likely to increase the rate at which non-point pollution could enter the system. The current rate of growth in the greater San Antonio area is approximately two percent per year. The metropolitan population will double from 2.47 million (2017) to almost five million in 35 years, if the growth rate remains steady (*Texas Health and Human Services, 2018*). This projected population growth is also likely to result in additional withdrawals of water from the Trinity Aquifer, whose interconnectedness to the Edwards may pose yet-to-be realized and understood impacts.

While regulatory protective approaches that restrict development could be considered, the consideration of property right interests make an incentive-based public-private partnership approach, like that of the EAPP, more likely to achieve a successful outcome. For example, since 2000, of the approximately 500,000 acres of land located on the recharge zone in Uvalde, Medina, and Bexar counties combined, the EAPP has protected nearly 140,000 acres, or about 27 percent of this area of recharge zone. Additionally, just over 13,000 acres of contributing zone lands have been enrolled in the EAPP.

### **What's Left to Do? Protect the Edwards Aquifer Watersheds**

Many municipalities have created programs to protect their water supply systems and watersheds. The US EPA created a Source Water Protection Program to require public water supplies using groundwater to assess the area of recharge to their well fields and water intakes. They encouraged municipalities to create source water protection zones and to limit certain types of development around their well fields. Karst aquifers were noted to be difficult to assess because their areas of contribution are hard to define. The US EPA recommends a whole watershed approach more characteristic of surface water systems (*Schindel et al, 1996*).

Two of the most notable efforts to protect drinking water sources or watersheds include New York City and the Chesapeake Bay Compact. The New York City water supply provides water for nine million people from three separate surface water sources. It has protected more than 477,000 acres or 40 percent of its

watershed. Additionally, it has created watershed partners on 450 farms with pollution prevention plans, paid for the upgrade of waste water treatment plants, septic system repairs, stream management restoration programs, and emphasized land management and low impact recreation. It has an extensive data collection program and has committed \$2.7 billion to watershed protection since 1993. Ninety percent of New York City's water supply system does not require filtration because of its protection efforts.

The Chesapeake Bay Compact was created in 1983 to protect the largest most productive estuary in the US. The Chesapeake Bay receives runoff from 64,000 square miles with 18 million people in the basin. It stretches more than 524 miles, and has more than 8.8 million acres of land permanently protected from development (22 percent of the watershed). It protects land through conservation easements, land donations, parks and recreational land, and publicly owned lands. By 2025, it has a goal of acquiring an additional two million protected. As of 2016, the Compact has already protected one million acres toward that goal.

The Edwards Aquifer Protection Program is a valuable start in protecting the City of San Antonio's water supply. However, the EAPP has not reached the level of protection afforded other communities and resources such as New York City or the Chesapeake Bay. A continuation of the program creates an opportunity to protect the City's water resource in the future. If the program is discontinued, ongoing development will remove the opportunity to protect the aquifer through conservation easements or fee simple purchases. Furthermore, until recently, the Contributing Zone has been disregarded concerning its importance for maintaining Edwards Aquifer water quantity and quality.

### **The Cause for a Watershed Protection Approach: Protect and Enhance Water Quality from Catchment to Recharge**

There are more than two million acres in the Contributing Zone north of Bexar, Medina, and Uvalde counties, but less than one percent - 13,500 acres – are currently protected through conservation easement. This despite the fact that the Contributing Zone is the catchment area for the water recharging the aquifer primarily via surface streams and rivers. Of the vast acreage comprising the Contributing Zone, approximately 400,000 acres of land (see Figure 1), are located within five miles upgradient of and contiguous to the Recharge Zone. Because of the topographic and geologic relation to the Recharge Zone, these first five miles (identified as a water quality buffer zone within the EAA Act) are currently considered the most sensitive portions of the Contributing Zone relative to surface water impacts to the Edwards Aquifer. Accordingly, the Edwards Aquifer Authority (EAA) regulates hazardous materials storage within this five-mile buffer in addition to the Recharge Zone. Furthermore, EAA scientific investigations indicate this buffer area often contains springs that provide source water to streams flowing from the Trinity Aquifer into the Edwards Aquifer. Research staff have also noted that many areas in this zone exhibit a high degree of connectivity between these two aquifers.

In addition to karst features such as sinkholes, caves, etc. within the Recharge Zone and Contributing Zone, surface streams and rivers are arguably the most sensitive environmental features with respect to the potential impact to the quality of water that ultimately recharging the Edwards Aquifer. Subsequently, there are approximately 118,000 acres of land within 1,000 feet from a watercourse within the five-mile buffer area discussed above.

In conclusion:

- Since 2000, the City of San Antonio's EAPP has effectively protected approximately 140,000 acres (approximately 27%) of western portions of the Recharge Zone properties.
- The Contributing Zone is the catchment area for recharge that enters the Edwards Aquifer, of which an estimated one-percent, or just over 13,000 acres, has EAPP-related protections.
- Contributing Zone land in Bandera, Bexar, Edwards, Gillespie, Kendall, Kerr, Medina, Real, and Uvalde counties accounts for over two million acres.
- Contributing Zone land in the most immediate five-mile buffer area north of the western Recharge Zone (Uvalde, Medina, Bandera, and Bexar counties) totals over 400,000 acres, and is considered highly sensitive and impactful regarding Edwards Aquifer water quantity and quality in many locations.
- Within the five-mile buffer, there are approximately 118,000 acres of land within 1,000 feet of a watercourse.
- Combining all portions of the Recharge and Contributing zones as discussed herein, the total watershed geographically applicable to the EAPP is between 2.5 and 2.8 million acres. When viewed in this manner, the total protected area of the watershed as of the end of 2018 is about six percent, meaning that **about 94% of this area remains unprotected.**

In consideration of these facts and in comparing and contrasting the watershed protection for New York City (approximately 40%) and the Chesapeake Bay (about 21%, and growing) with that of the City of San Antonio's EAPP program (less than 6%), it appears prudent that an effort to continue to acquire sensitive areas within this watershed should remain a focus for the foreseeable future to help ensure the long-term protection of the City's primary water source, the Edwards Aquifer.

### **Potential steps forward**

With about 6% of the Edwards Aquifer watershed protected, there are a number of potential opportunities to further ensure high water quality and maintenance of historical recharge in the future. Following is a brief description of these options:

#### *Continue acquiring conservation easements further upgradient into the watershed.*

By renewing funding of the EAPP at the current level, the City could continue to preserve valuable land on the Recharge Zone as well as the Contributing Zone. A goal of preserving half of the acreage within the five-mile buffer (approximately 200,000 acres) would increase the percentage of total watershed protection to 15 percent (assuming the current Proposition 1 funding results in a total of 180,000 acres under easement by 2020).

#### *Prioritize acquiring conservation easements on properties adjacent to watercourses.*

An alternative to acquiring conservation easements generically across the five-mile buffer would be to focus efforts on portions of properties that are within 1,000 feet of a watercourse within that five-mile buffer. Protecting this approximately 118,000 acres (see Figure 2) would increase the percentage of total watershed protection to 12 percent. Using this approach and extending the distance from the

Recharge Zone to ten miles would add an additional 76,000 acres and would increase the percentage of total watershed protection to 15 percent.

*Further enhance water quality by incentivizing riparian restoration and maintenance on lands already under easement or as an alternative to easement.*

Another alternative to acquiring conservation easements would involve offering financial incentives to owners of property adjacent to watercourses five or ten miles upgradient from the Recharge Zone to restore riparian areas resulting in enhanced water quality in these areas. Reimbursing property owners for costs associated with implementing best management practices on properties generally with 1,000 feet of a watercourse could be a cost effective way of preserving water quality over the long-term. This program would protect the same 118,000 to 194,000 acres described in the previous option through public-private partnerships and multi-governmental collaboration. Costs associated with restoration and maintenance practices can vary, but generally should be in the \$1,000 per acre range or less.

The EAA looks forward to continued discussions on how the City could further secure and enhance its investment in protecting the Edwards Aquifer.

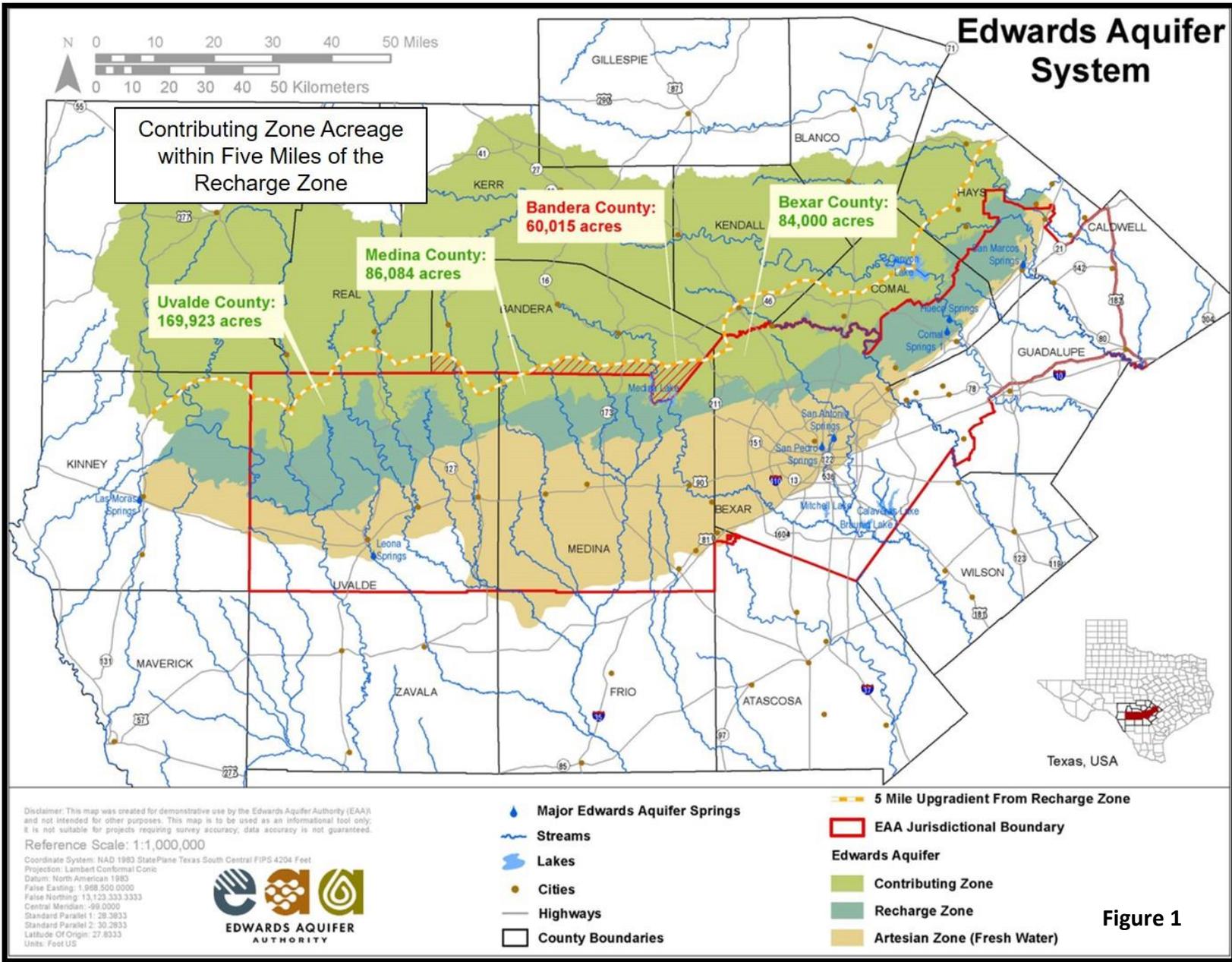
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## References

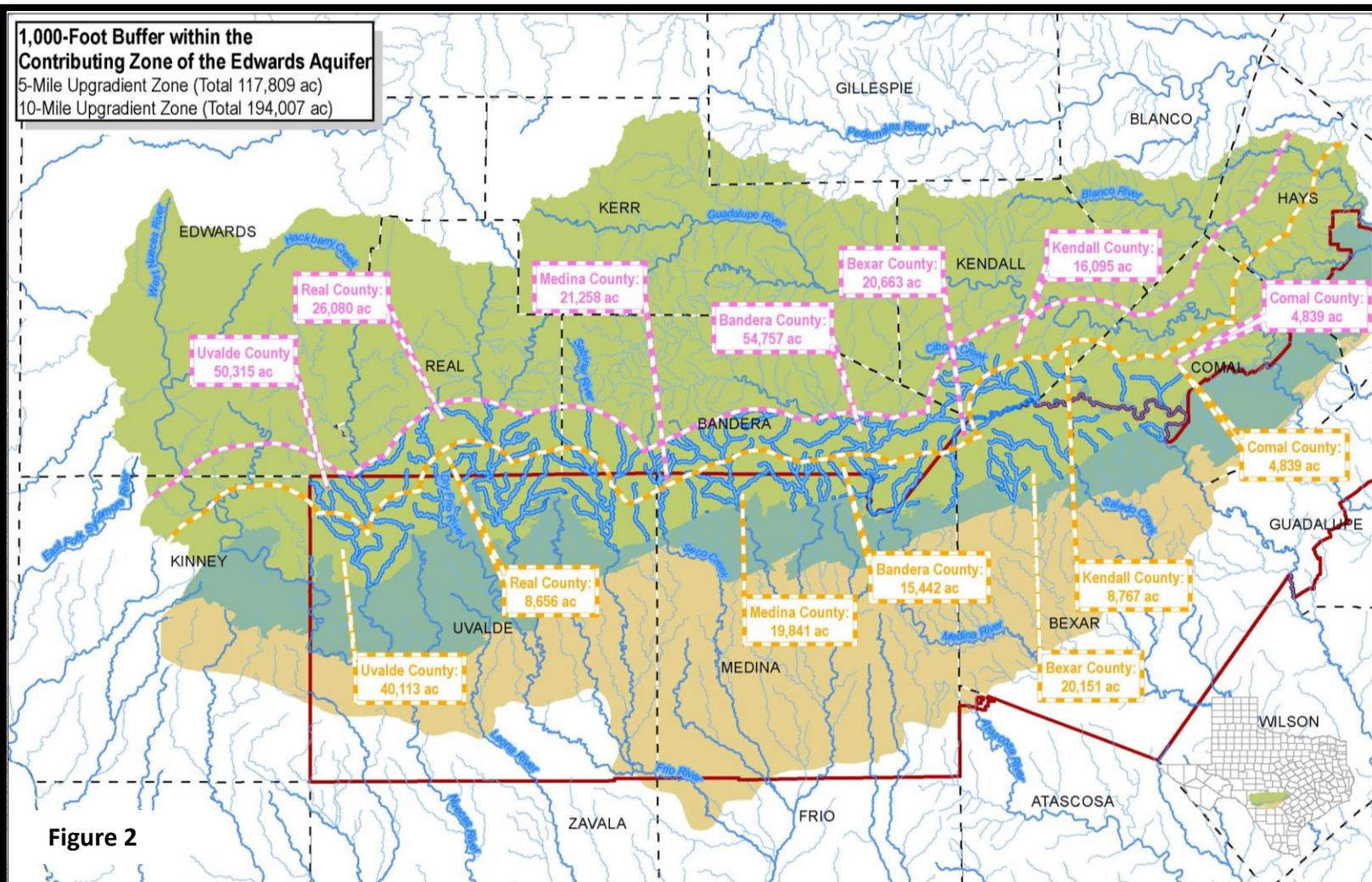
RECON Environmental, Inc.; Hicks & Company, Zara Environmental LLC, and Bio-West, 2012: Edwards Aquifer Recover Implementation Program – Habitat Conservation Plan. Prepared for Edwards Aquifer Recovery Implementation Program, November.

Texas Health and Human Services, 2018: Texas Department of State Health Services, Texas Population 2017 (Projections), <https://dshs.texas.gov/chs/popdat/ST2017.shtm>

Schindel, Quinlan, Davies, and Ray, 1996: Guidelines for Wellhead and Springhead Protection Area Delineation in Carbonate Rocks; prepared for Groundwater Protection Branch, U.S. Environmental Protection Agency, Region 4, Atlanta, George. October.



**1,000-Foot Buffer within the Contributing Zone of the Edwards Aquifer**  
 5-Mile Upgradient Zone (Total 117,809 ac)  
 10-Mile Upgradient Zone (Total 194,007 ac)



**Figure 2**

Disclaimer: This map was created for demonstrative use by the Edwards Aquifer Authority (EAA) and not intended for other purposes. This map is to be used as an informational tool only; it is not suitable for projects requiring survey accuracy; data accuracy is not guaranteed.

Reference Scale: 1:1,000,000

Coordinate System: NAD 1983 NSRS2007 Texas Centric Mapping System Albers  
 Projection: Albers  
 Datum: NAD 1983 NSRS2007  
 False Easting: 1,500,000.0000  
 False Northing: 6,000,000.0000  
 Central Meridian: -100.0000  
 Standard Parallel 1: 27.5000  
 Standard Parallel 2: 36.0000  
 Latitude Of Origin: 18.0000  
 Units: Meter



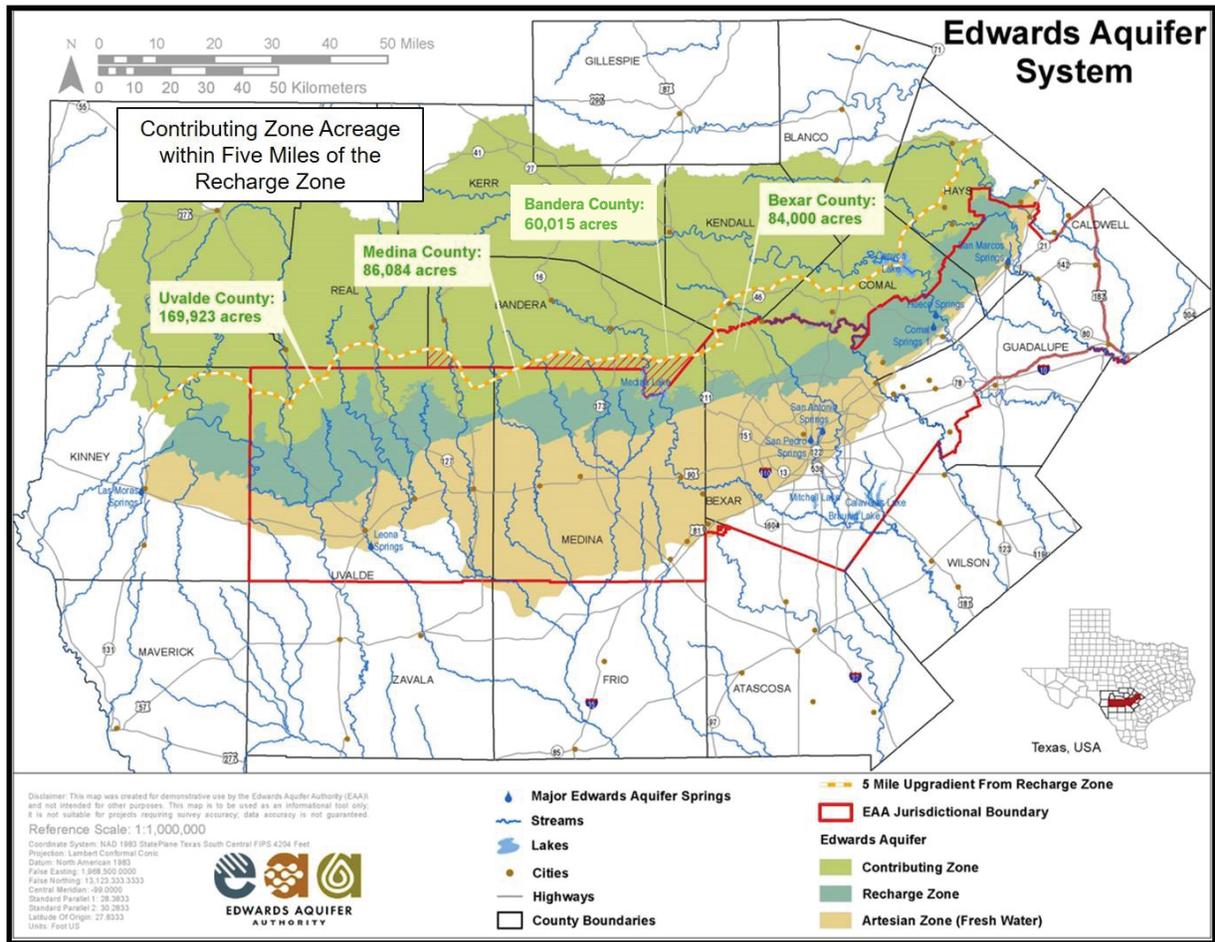
- Streams
- 1,000-Foot Buffer
- 5-Mile Upgradient from Recharge Zone
- 10-Mile Upgradient from Recharge Zone
- EAA Jurisdictional Boundary

- Edwards Aquifer Contributing Zone
- Recharge Zone
- Artesian Zone
- Counties

Analysis: Named NHD Flowlines and 1,000-foot buffers of those in 5- and 10-mile buffers of EAA recharge zone; acres calculated by TNRIS County in local Albers projection and truncated for labels.

# EDWARDS AQUIFER WATERSHED PROTECTION

Since 2000, the Edwards Aquifer Protection Program has protected over 150,000 acres of primarily recharge zone property, representing approximately **27%** of the western portion of the Recharge Zone properties. However, only **6%** of the total watershed has been protected.



**40%**



**NYC**

**22%**



**CBC**

**6%**



**SA**

## FOR COMPARISON:

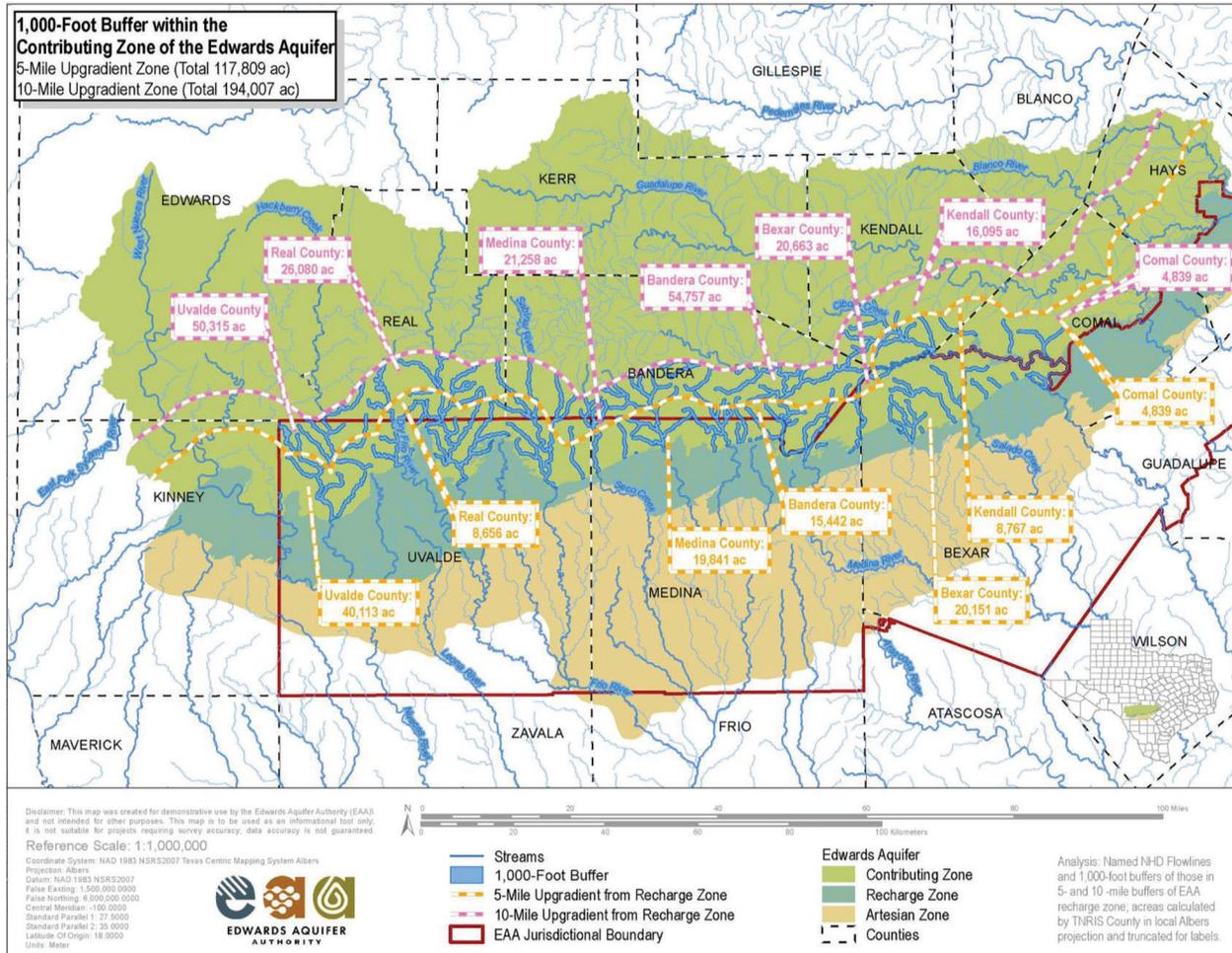
Since 1983, New York City has protected more than 477,000 acres or **40% of its total watershed** at a cost of **\$2.7 billion**.

Since 1993, the Chesapeake Bay Compact has protected 8.8 million acres or **22% of its total watershed** at a cost of **\$5.6 billion**.

Since 2000, San Antonio has protected over 150,000 acres or **6% of its total watershed** at a cost of **\$315 million**.

- **NYC**= New York City
- **CBC**= Chesapeake Bay Compact
- **SA**= San Antonio

# RENEWAL OF PROP 1 FUNDING WOULD ALLOW CONTINUED ACQUISITION OF PROPERTY ON RECHARGE ZONE AND CONTRIBUTING ZONE



A more flexible program that allows for **acquisition of strategic riparian properties** (conservation easements or fee simple) and **incentivized riparian restoration practices** would stretch tax dollars further while **greatly benefitting water quality** recharging the Edwards Aquifer.

## What Remains To Be Protected

- **400,000** acres of highly sensitive land within 5-mile buffer area within the Contributing Zone north of the western Recharge Zone in Uvalde, Medina, Real, Bandera, Bexar counties
- **194,000** acres of land in the 10-mile buffer area is within 1,000 feet of a water course
- **118,000** acres of land in the 5-mile buffer area is within 1,000 feet of a water course