Policy Overview of the Barton Springs Edwards Aquifer Conservation District

Barton Springs Edwards Aquifer CONSERVATION DISTRICT

Quick Facts

Created: **1987 by Texas Legislature**
Size: **417 square miles**
Counties: **parts of Travis, Hays, and Caldwell**
Aquifers: **Edwards, Trinity, Austin Chalk, Alluvium**
Endangered Species: **Barton Springs and Austin Blind Salamanders**
Annual permitted volume: **8,867 acre feet**

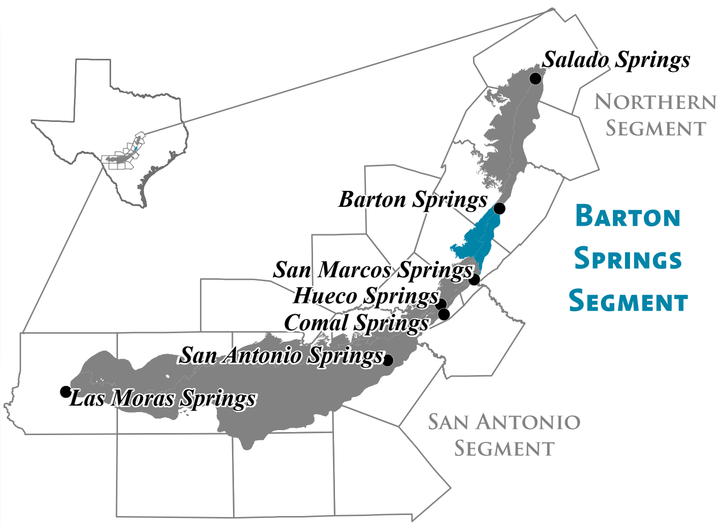


Figure 1: The Edwards Aquifer, source for some of the largest springs in Texas, is divided into three segments based on groundwater flow paths. Barton Springs is the lowest discharge point in the entire aquifer.

Mission

To conserve, protect, recharge, and prevent waste of groundwater and preserve all aquifers in the District.

Goal

To equitably and effectively manage and protect groundwater resources for all groundwater users within the District. We serve the groundwater community by monitoring groundwater levels and water quality, managing the shared groundwater resource, coordinating water conservation efforts during drought, and researching aquifer dynamics.

Groundwater Resources

The area covers the unconfined (recharge) zone, the confined zone, and the saline zone of the Barton Springs segment of the Edwards Aquifer and the underlying Trinity Aquifer.

Boundaries

- ***West:*** Edge of the Edwards Aquifer outcrop
- ***North:*** Colorado River
- **East:** Service area limits of what are now the Creedmoor-Maha and Goforth Water Supply Corporations.
- ***South:*** The southern boundary of Hays County

Permit Types and Volumes

Currently, the District is only issuing Limited Production Permits, Conditional Edwards and Historical Trinity permits. All permitted wells are subject to drought restrictions.

Permit	Pumpage (acre-feet)
Historic Edwards	7,239
Conditional Edwards	1,071
Limited Production Permit (LPP) Edwards	132
Historic Trinity	419
total	**8,867**

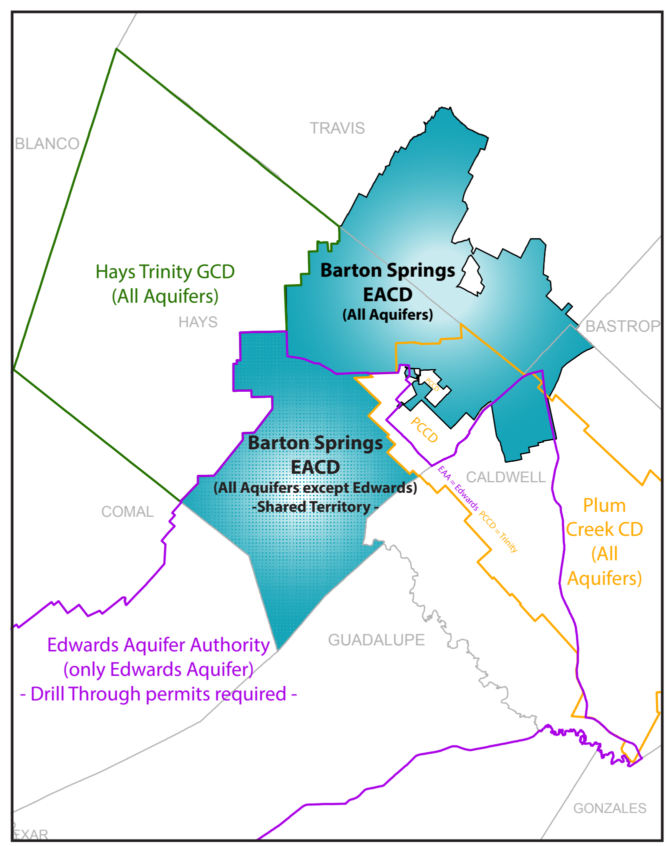


Figure 2: BSEACD Exclusive and Shared Territories and adjacent or overlapping groundwater conservation districts.

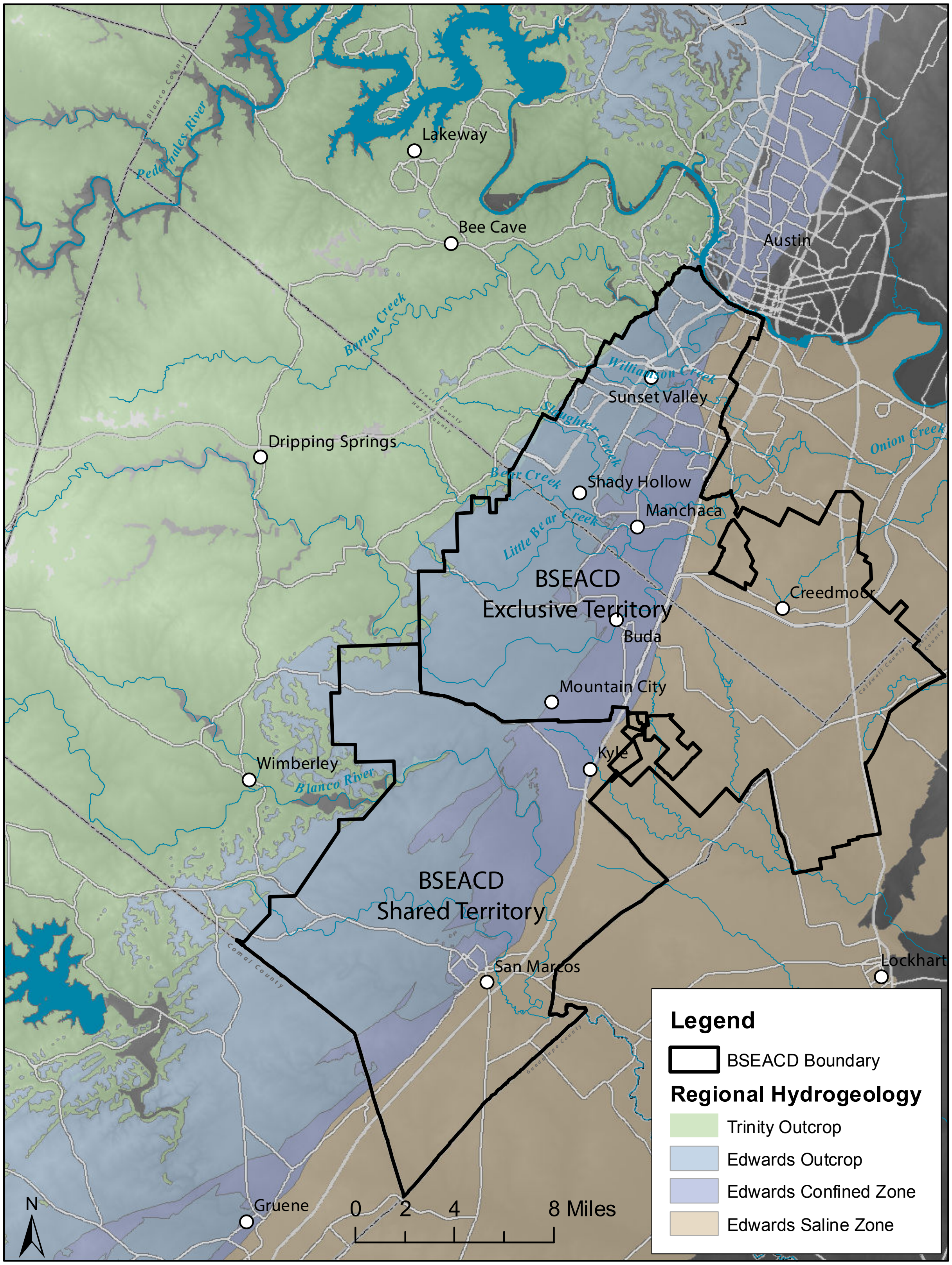


Figure 3: Map showing the Exclusive and Shared territories of the BSEACD and regional hydrogeology.

BSEACD

Table of Contents

Table of Contents

**Barton Springs
Edwards Aquifer
Conservation District**
1124 Regal Row
Austin, Texas 78748
(512) 282-8441
www.bseacd.org

AD – Acronyms Defined

CFS – Cubic Feet per Second
A rate of flow commonly used to describe springflow.

DFC – Desired Future Conditions
Physical aquifer conditions that are to be achieved (or maintained) over a 50-year planning period.

GAM – Groundwater Availability Model
Computer model used to simulate an aquifer system, including its inputs (recharge), flow, and outputs (discharges at wells and springs); can be used to calculate groundwater available for use that is consistent with a desired future condition.

GCD – Groundwater Conservation District
Local governmental agency responsible for preserving, conserving, protecting, and preventing waste of groundwater resources, through management activities including scientific studies, educational outreach, and regulatory programs.

GMA – Groundwater Management Area
One of sixteen regions in the state, based on major aquifer boundaries, that are used by the GCDs within that defined area for joint regional groundwater planning of shared aquifers, including the definition of DFCs for those aquifers (planning process established by House Bill 1763, 2005).

MAG – Modeled Available Groundwater
Estimate by the TWDB of the amount of groundwater available for use that is consistent with the DFC, and, along with estimates of exempt use, establishes a ceiling on permitted use of an aquifer within a GMA and are inputs into the regional water planning process.

RWPA – Regional Water Planning Area
Areas based on the major river basins in the state and that are used to develop regional water plans for the area, including forecasting future water demands, analyzing available water supplies, and developing needed water management strategies over a 50 year planning period (established by Senate Bill 1, 1997).

RWPG – Regional Water Planning Group
Prescribed group of individuals, representing a variety of interests that conducts the regional water planning for an RWPA, and that is charged with producing a plan (the Regional Water Plan) every five years that is incorporated into the State Water Plan.

TWDB – Texas Water Development Board
State agency responsible for developing and implementing the State Water Plan, including the funding of required infrastructure.

District Overview
Director Profiles

BSEACD

www.bseacd.org/about-us/board/

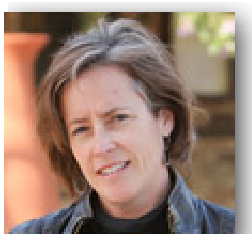
Since 1904, the legal framework for administering groundwater rights in Texas has been the common law "Rule of Capture." Under this law an owner of land may drill a well and withdraw groundwater without limitation as to amount, place, or purpose of use without incurring any liability for impacts to adjacent wells. For many decades, the Rule of Capture was considered the sole groundwater doctrine in the state, and the only change made in this law during that time was to ensure that the withdrawals were not wasteful, malicious, or caused subsidence.

Although the Rule of Capture remains in effect, in the 1950s the Texas Legislature began authorizing the establishment of local groundwater conservation districts, or GCDs. GCDs are designated by statute as the state's preferred method of groundwater management and are specifically authorized to modify the Rule of Capture within their boundaries, as part of a comprehensive, groundwater management plan approved by the Texas Water Development Board. Under the specific authorities provided by Texas Water Code, Chapter 36, and their enabling legislation, GCDs may adopt rules consistent with their management plans to manage groundwater production in order to conserve, preserve, and protect groundwater or groundwater recharge, and to prevent waste of the groundwater resource or groundwater reservoirs in their jurisdiction.

Upon a petition in the mid-1980s by most of the municipalities dependent on the Edwards Aquifer in Travis and Hays Counties as a water supply, the 70th Texas Legislature passed Senate Bill 988 in 1987 and created the Barton Springs/Edwards Aquifer Conservation District as a GCD with authority to manage the groundwater resources in its jurisdictional area. The District's original jurisdictional area encompassed approximately 255 square miles and was generally defined to include all the area within the Barton Springs segment of the Edwards Aquifer with an extended utility service area to the east.

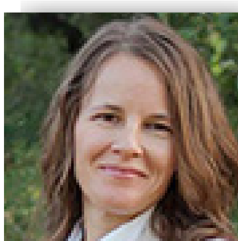
In 2015, the 84th Texas Legislature passed House Bill 3405 to expand the District's jurisdictional area to include the portion of Hays County located within the boundaries of the Edwards Aquifer Authority excluding the overlapping area in the Plum Creek Conservation District. This area, designated as "Shared Territory," excludes the Edwards Aquifer and includes all other aquifers, including the underlying Trinity. The District's jurisdictional area now encompasses approximately 420 square miles and includes both urban and rural areas in southern Travis County, central and eastern Hays County, and portions of northwestern Caldwell County.

The District is governed by a five-member Board of Directors that ensures the District's work is consistent with the mission, the District management plan and rules, and local priorities. Directors are elected in the November general elections of even-numbered years by the registered voters in five single-member precincts (see Director Precinct map). The Board sets policies and adopts rules and bylaws that guide District operations and direct permitting and enforcement decisions. Board meetings are generally held on the 2nd and 4th Thursdays each month and are open to the public.



Precinct 1
Mary Stone
Director
Term: 2/2008 - 11/2020
mstone@bseacd.org

Mary Stone has been a resident of Hays County for 20 years. She is a mother of two busy teenagers, a registered nurse, and a professional photographer. She is a community activist and has served as a board member of both the Hays Education Foundation and the Hays Youth Soccer Association.



Precinct 2
Blayne Stansberry
President
Term: 2/2014 - 11/2018
bstansberry@bseacd.org

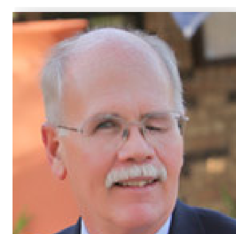
Blayne Stansberry is a civil engineer and works to protect creeks from erosion, improve stormwater runoff quality, and design water distribution systems. She grew up playing in Bear Creek and depending on water from the Edwards Aquifer. She feels stewardship, conservation, and water quality protection are fundimental.

Precinct 3
Blake Dorsett
Secretary
Term: 11/2012 - 11/2020
bdorsett@bseacd.org

Blake Dorsett is a licensed groundwater treatment plant and water distribution system operator specializing in underground water line installation and maintenance. He has served as Fire Chief of the Chisholm Trail Volunteer Fire Dept. and remains an active senior firefighter.

Precinct 4
Robert Larsen, PhD
Director
Term: 5/2003 - 11/2020
rlarsen@bseacd.org

Dr. Bob Larsen is a Texas State University professor who specializes in solid waste planning and management, land use planning, and transportation issues. He serves as a member of the TCEQ Pollution Prevention Advisory Committee and the Director of the Texas State Government Partnership Program.



Precinct 5
Craig Smith
Vice President
Term: 5/1998 - 11/ 2018
csmith@bseacd.org

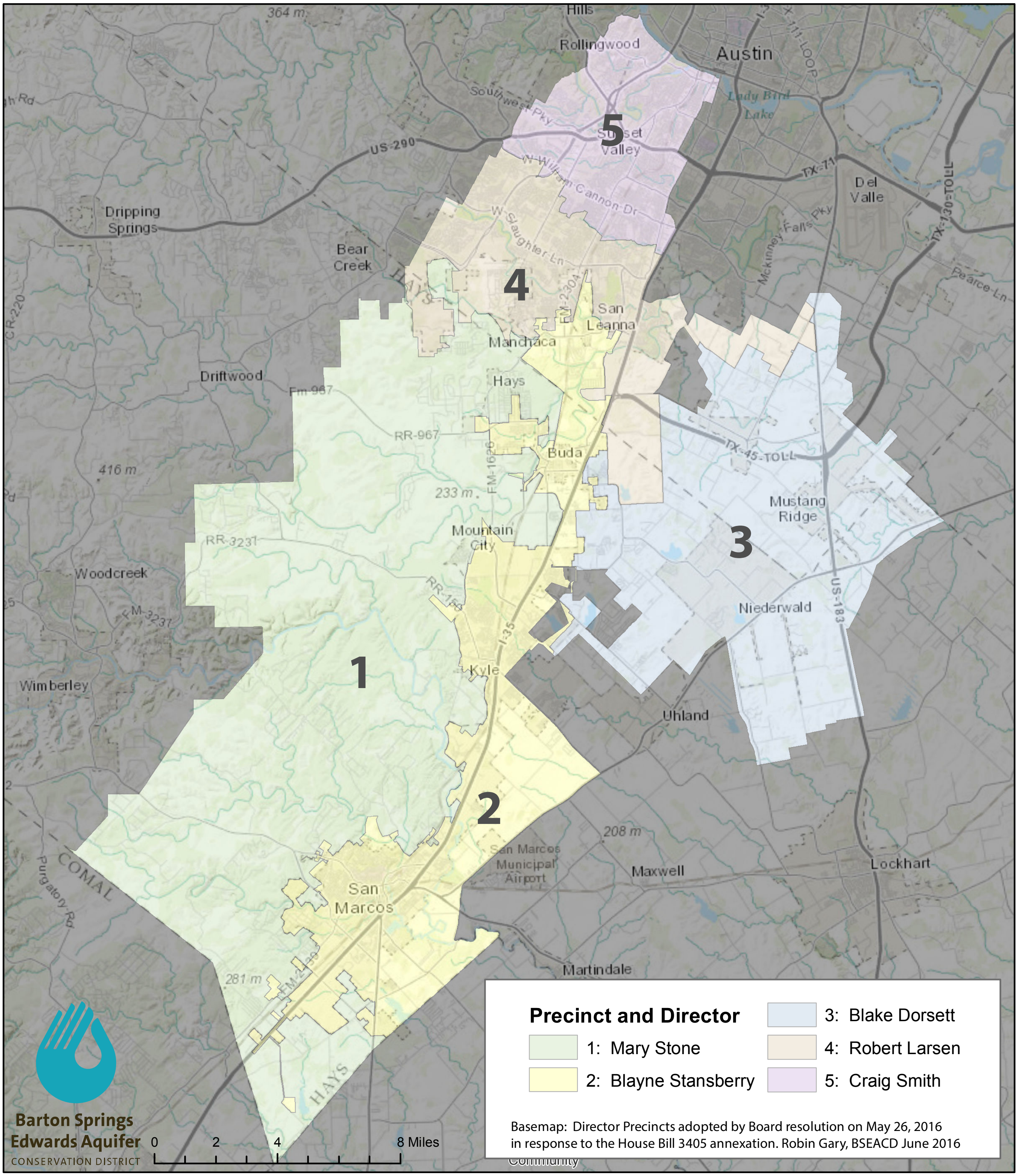
Craig Smith is an Assistant Travis County Attorney and a year-round, daily Barton Springs pool swimmer (100 miles in 2013), a board member of Save Barton Creek Association and the Hill Country Conservancy.

BSEACD

Director Precincts Map

www.bseacd.org/publications/maps/

Director Precincts



State & Regional Water Planning

BSEACD

Joint regional groundwater planning process is the process that enabled the coordinated management of aquifers that are shared by multiple Groundwater Conservation Districts (GCDs). It was the product of House Bill 1763 (HB1763) passed in 2005. The joint regional groundwater planning process established groundwater availability estimates for the regions aquifers and is integral to the regional and state water planning process.

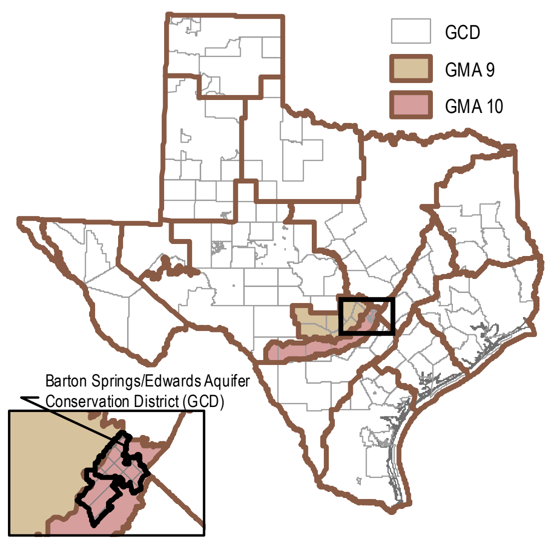
The State's water planning process was the product of Senate Bill 1 (SB1, the so-called "omnibus" water bill) that was passed in 1997. SB1 implemented a "bottom-up" approach to state water planning, meaning that a plan is developed first on a regional basis then passed up to the State level to be incorporated into the larger State Water Plan. SB1 established 16 regional water planning areas that were largely delineated by the major river basins in the state (Figure 5) and regional water planning groups for each. Each group consists of representatives from different interest groups, including industry, agriculture, local government, river authorities, water districts, Groundwater Manager Areas (GMAs), and environmental representatives, among others.

The purpose of the regional water planning group is to develop a regional water plan that identifies available water supplies and forecasts future water demands over the next 50 years. The plan evaluates the known water supplies versus the projected increases in demand to determine any unmet water needs and identifies specific water management strategies that are needed to address those unmet needs. The preferred strategies serve as a basis for local, regional, and state water projects that by inclusion in the plan become eligible for low-interest loan-financing through the State Water Implementation Fund for Texas (SWIFT) program administered by the Texas Water Development Board (TWDB).

Prior to 2005, the regional water planning groups were solely responsible for determining the existing and projected availability of groundwater supplies. Although the planning groups typically coordinated with the GCDs in making these estimates, the ultimate decision that had important ramifications to groundwater management efforts by GCDs was in the hands of the appointed members of the regional water planning group—not the entities responsible for managing groundwater supplies.

HB 1763, passed in 2005, changed this relationship by initiating the joint regional groundwater planning process in which the GCDs that manage areas with shared aquifers (GMAs) collaborate to determine the Desired Future Conditions (DFCs) for the aquifers that the member GCDs are responsible for managing. These DFCs reflect a GMA policy decision that specifies what aquifer conditions should be achieved or maintained while providing for future demands. The TWDB then makes a best-science estimate of how much groundwater is available under those conditions. These GMA-derived availability estimates, referred to as Modeled Available Groundwater (MAG) are then provided to the regional water planning groups to be incorporated into the regional water plans as the volume of available groundwater for planning purposes.

Groundwater Conservation Districts (GCD) and Groundwater Management Areas (GMA)



Regional Water Planning Areas (RWPA)

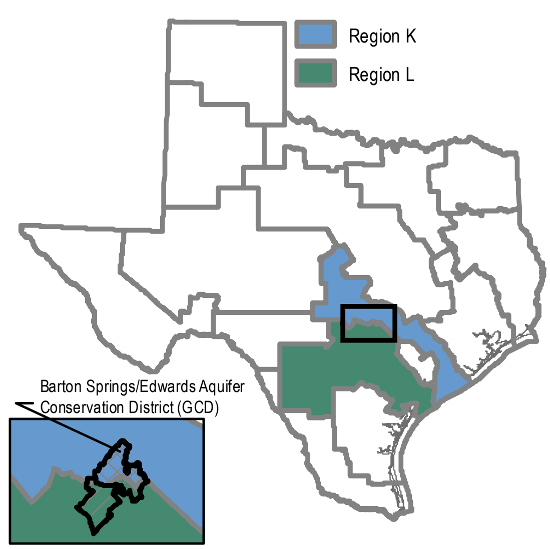


Figure 5: Groundwater Conservation Districts, Groundwater Management Areas, and Regional Water Planning Areas

BSEACD

Available Groundwater

The District actively participates in a collaborative planning process established with the passage of HB 1763 in 2005 to determine the Desired Future Conditions (DFCs) for all the aquifers that the member Districts are responsible for managing. DFCs are physical aquifer conditions that are to be achieved (or maintained) over a 50-year planning period. The DFCs serve as the regulatory goal and the focus of the District's groundwater management activities. The Texas Water Development Board (TWDB) uses various models and aquifer assessment tools (the "science" side) to estimate the total amount of groundwater production and aquifer can afford while preserving those DFCs. The resulting groundwater production estimate, referred to as Modeled Available Groundwater (MAG), is provided by the TWDB for each relevant aquifer and is used to inform a GCD's permitting decisions (Table 1). The exempt-use estimates and MAGs are also used by the regional water planning groups as the basis for determining groundwater availability in the regional and state water plans (Figure 6).

Table 1: Modeled Available Groundwater Amounts by Aquifer

Aquifer	MAG (acre-ft/yr)	MAG (cfs)	TWDB Report Citation
Edwards (Freshwater)			
Average Conditions	11,528	16	Hutchison and Oliver, 2011
Drought Conditions	3,756	5.2	
Edwards (Saline)	523	N/A	Bradley, 2011
Trinity Aquifer (undifferentiated)	1,288	N/A	Thorkildsen and Backhouse, 2011

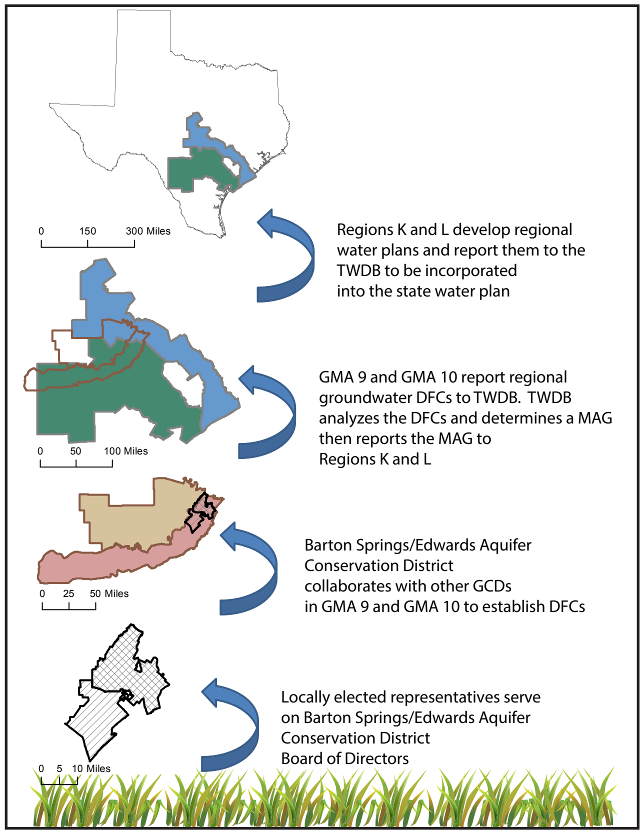


Figure 6: Flowchart of water planning process.

The District actively participates in two Groundwater Management Areas (GMAs) – GMA 9 and GMA 10. The member GCDS of the GMAs meet throughout the year and review the DFCs and the individual GCD management plans at least once each year and must re-adopt or revise the DFCs at least every five years.

One of the major aquifers in our District is the Barton Springs segment of the Edwards Aquifer. GMA 10 is the joint planning entity delineated to principally encompass for the Edwards Aquifer. GMA 10 has chosen to establish different DFCs for three of the Edwards Aquifer's groundwater subdivisions: the Northern (Barton Springs segment), Central, and Western subdivisions. The Northern subdivision has DFCs for "Extreme Drought" that sets a lower limit and "All Conditions" that sets an upper limit. Both DFCs are expressed as discharge rates at the Barton Springs complex which serves as a barometer of aquifer conditions. The Extreme Drought or lower limit DFC drives the District's drought management program to assure adequate water supply for well users and adequate flow for endangered species at the springs; the DFC states: "During extreme droughts, including a recurrence of the 1950s drought of record, monthly average springflow at Barton Springs shall not be less than 6.5 cfs." Since adoption, this DFC has become an integral component of the District's draft Habitat Conservation Plan and its application for an Incidental Take Permit for the endangered salamanders the depend on springflows at the Barton Springs complex. The All Conditions or upper limit DFC, which helps avoid an unacceptable amount of acceleration into declared drought stages and their mandatory curtailments, states: "The seven-year average springflow of Barton Springs shall not be less than 49.7 cfs during average recharge conditions."

GMA 10 also established a DFC for the Saline Edwards in the Northern Subdivision, to facilitate the development of this aquifer as a new water supply for Central Texas while protecting the adjacent freshwater resource. The Saline Edwards DFC states: "No more than 75 feet of regional average potentiometric surface drawdown due to pumping when compared to pre-development conditions."

The Trinity Aquifer is the other major aquifer that the District is responsible for managing. Parts of the Trinity Aquifer within the District are within both GMA 9 and 10. GMA 9 has adopted the following DFC for the Trinity Aquifer: "Groundwater withdrawals from the (Undifferentiated) Trinity Aquifer (including both exempt and non-exempt uses) shall produce no more than a regional-average 30 feet of drawdown under average recharge conditions." It should be recognized that this does not imply that all parts of GMA 9 will have groundwater created by 30 feet of drawdown available to them. Similarly, GMA 10 has a (Undifferentiated) Trinity Aquifer DFC stating that regional average well drawdown, during average recharge conditions, should not exceed 25 feet.

Groundwater Resources

BSEACD

www.bseacd.org/aquifer-science/about-the-aquifers/

The Edwards and Trinity Aquifers within the District are heterogeneous. Water quality can vary substantially depending on location, screened rock interval, and well depth. That said, groundwater within the District often requires little treatment, but well owners are encouraged to regularly test water quality to ensure it is safe to use.

Edwards Aquifer

Recharge refers to water replenishing the aquifer. The recharge zone is where the exceptionally porous Edwards limestone is exposed at the surface providing direct access to the groundwater system. Recharge occurs mainly along the six major streams [see District Map, p. 2] that cross the recharge zone, but also in upland areas of the recharge zone. In creek beds and in upland areas, there are very thin soils to help remove contaminants before they enter the groundwater system. So the benefit is that water can replenish the water supply, but the drawback is that the quality of that water is directly linked to land use and surface water quality. Conservation easements, building restrictions, impervious cover limitations, high stormwater treatment standards, and most importantly, residents' land stewardship have been effective at protecting the quality of water recharging the aquifer, so far. With increasing development, the quality of the water in the freshwater Edwards is at greater and greater risk of contamination.

Water levels in the freshwater Edwards Aquifer vary according to the amount of water stored in the aquifer, which is dependent upon climatic conditions. In addition, the location (Western Edwards--unconfined or Eastern Edwards--confined zones) within the aquifer can also influence the water levels and how much they may vary over time. Barton Springs and some wells respond very quickly to recharge events reflecting their influenced by conduit (fast) permeability. Most water wells show a combined influence of matrix (slow) and conduit flow. Wells in the freshwater Edwards are subject to significant drought restrictions.

The saline zone of the Edwards is located in the eastern section of the District. Generally, water is more stagnant, and therefore, has a high concentration of total dissolved solids--making it brackish. Water must be treated, but there are few wells, relatively large available volume of water, and few drought restrictions for water pumped from the saline zone. This area is the focus of many water availability and treatment studies at the local and state level. Any permitted wells in this zone must not significantly influence the fresh/saline water boundary.

Trinity Aquifer

The Trinity Aquifer underlies much of the Edwards Aquifer within the District. Water quality in the Trinity Aquifer varies significantly by rock layer. While water quality in the Upper Trinity (in communication with the lower Edwards) is generally good, the lower portions of the Trinity aquifer can have high salinity, high total dissolved solids, and/or high sulfates.

Recharge to the Middle and Lower Trinity Aquifer happens to the west in the Hill Country where Glen Rose limestone is exposed at the surface. In the District, water levels in the Trinity Aquifers respond more slowly to rainfall than the Edwards, indicating a slower recharge rate and lower permeability (ability to transmit water).

In the western portion of the District, the Edwards has been substantially eroded away and is either thin or absent, so the Trinity is the only reliable option for groundwater. In the central portion of the District, the Lower and Middle Trinity Aquifers can be viable alternative water supplies, because they are hydrologically independent of the Edwards Aquifer, do not source as many wells as the Edwards, and consequently are not subject to as strict permitting regulations and drought compliance. The tradeoff: Trinity wells are much deeper and can have less desirable water quality.

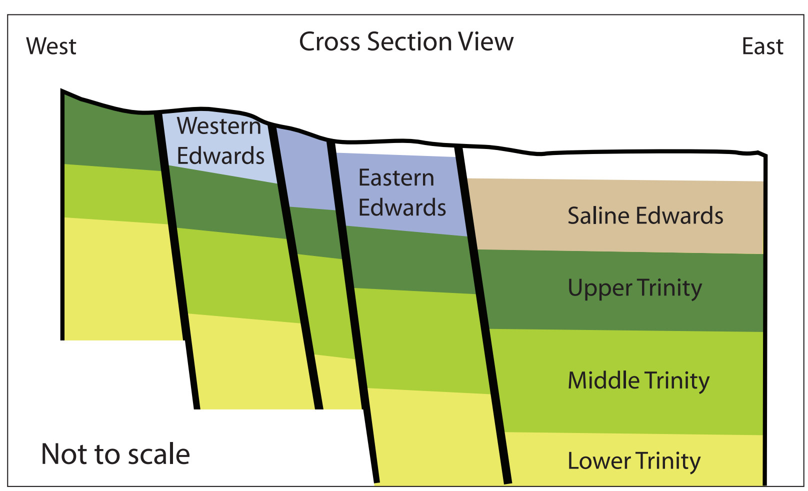


Figure 7: Cross section view of aquifers present in the District.

All wells within the District are required to be registered by the District and comply with District well construction standards. Beyond that, permitting requirements are based on whether a well is exempt, nonexempt, and other characteristics (Fig 8).

	Permit Type	Currently Available	Water Use	Max. Drought Curtailment	Meter Readings	General Summary
	Exempt	Yes	Domestic or Livestock	-	-	Lot larger than 10 acres and pump smaller than 1 hp or 7 gpm
General Permit by Rule	Limited Production Edwards	Yes	Domestic only	50%	Annual	Outside water serviceprovider area
	Limited Production Trinity	Yes	Domestic only	30%	Annual	Outside water serviceprovider area
	Monitor	Yes	Monitor aquifer conditions	-	-	Temp. permit and limited production
	Test	Yes	Evaluate aquifer characteristics	-	-	Temp. permit and limited production
Individual Production Permit	Historical Edwards	**No**	Various	50%	Monthly	Permits issued before Sept. 2004
	Conditional Edwards	Yes	Various	100%	Monthly	Classes A, B, C, and D Alt. water supply required
	Historic Trinity	Yes	Various	40%	Monthly	Below Edwards, quality varies, fewer wells
	Saline Edwards	Yes	Various	-	Monthly	Water requires treatment, must be 3 miles away from Fresh/Saline Water Boundary

Figure 8: Chart showing an overview of District permit types.

Exempt Wells

Exempt wells are generally defined as low capacity wells used solely for large lot residential or livestock needs. Exempt wells are exempt from permitting, but they have requirements to be registered, meet well construction standards, and production is restricted by limitations on pump capacity. A well may maintain its exempt status provided the well's use stays the same, pump is appropriately sized, and the lot is not subdivided such that it no longer meets the size criteria.

Nonexempt Wells

Nonexempt wells require a permit to authorize any groundwater withdrawals from the aquifers managed by the District. Permitting for Nonexempt Wells is determined by the well use type and the well's corresponding management zone (MZ, Fig. 9).

In 2004, the District's sustainable yield study results indicated an increase in groundwater production from the Edwards Aquifer during drought conditions may cause many wells to "go dry" and may cause detrimentally low spring flow. As of September 9, 2004, rules require that all new authorizations for pumpage from the Freshwater Eastern and Western Edwards MZs are issued as Conditional Production Permits. Conditional permits may be Class A, B, C, or D; each with distinct, more rigorous drought curtailments and allocation limits. Class A permits are for new nonexempt domestic use Limited Production Permits (LPP), Class B permits have been fully subscribed, Class C permits only allow pumping during No Drought conditions, and Class D permits are reserved for groundwater production associated with aquifer storage and recovery projects.

For all nonexempt wells, staff tracks pumpage data through meter readings from permitted wells and monitors usage for compliance with the District Rules and Bylaws, production permits, and approved User Drought Contingency Plans (UDCPs).

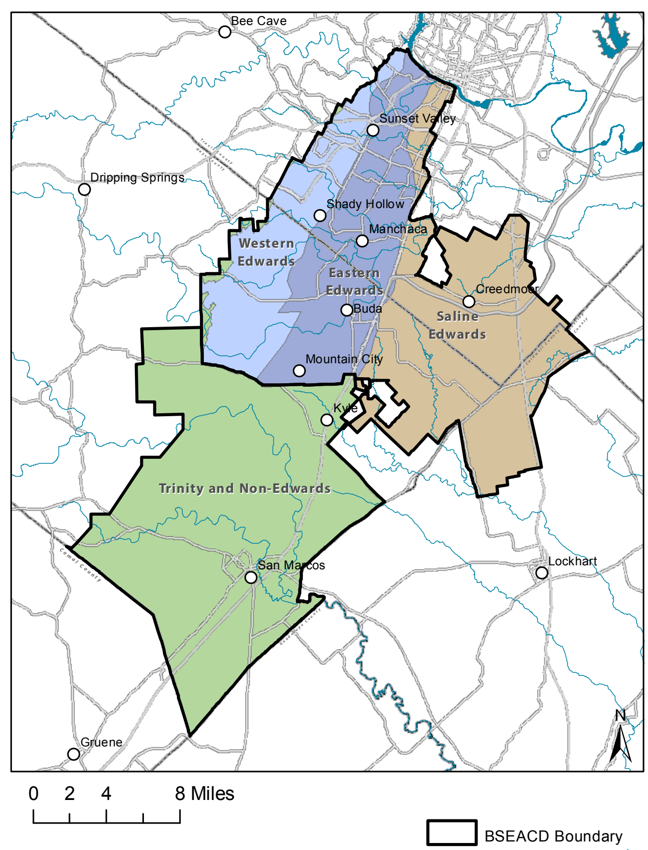


Figure 9: Map showing District management zones.

Recharge to Local Water Sources

BSEACD

'Recharge' is the term used to describe replenishing a water source. Water recharging an aquifer or a lake after a significant rainfall implies that there is an increase in water stored in the aquifer or lake. In Central Texas, people rely on both groundwater (stored in an aquifer) and surface water (stored in lakes) as their source of water. Recharge to aquifers and lakes are limited in different ways. The majority of homeowners in Central Texas get their water from groundwater through an individual well or water utility with public supply wells or from surface water through Lower Colorado River Authority (LCRA) or the City of Austin.

Since 2005 the District has declared drought 5 times for a total of XX months. In these dry times, every drop counts. Understanding how rainfall recharges our water sources can help shed light on drought restrictions. The number of end users, available volume, drainage area, and recharge limitations are the most substantial differences between local groundwater and surface-water supplies (Fig. 10).

	Highland Lakes (surface water)	Barton Springs segment of the Edwards Aquifer (groundwater)
End Users	**1,000,000+ people**	**60,000 people**
Available volume	**1,500,000 acre-feet per year**	**6,600 acre-feet per year**
Drainage Area	**38,800 square miles** 31,828 square miles above Buchanan 6,972 square miles between Travis and Buchanan	**385 square miles** 287 square miles in the Contributing Zone 98 square miles in the Recharge Zone
Recharge Challenges	**Soil must be saturated to allow runoff to fill tributaries and lakes.**	**Soil must be saturated to allow runoff to produce stream flow. Once creeks flow across the recharge zone, water enters the aquifer through caves and fractures in the creek bottoms.**

Figure 10: Chart comparing statistics for area surface water and groundwater resources.

The majority of surface water in the area comes from the Highland Lakes (main storage reservoirs: Lake Buchanan and Lake Travis) managed by the LCRA. The LCRA can distribute up to 1.5 million acre-feet per year from Lake Buchanan and Lake Travis. The Highland Lakes supply drinking water for over a million people, as well as water for industry, energy, and recreation; for irrigating rice and other crops; and for preserving a healthy ecosystem along the lower river and in Matagorda Bay. Inflows from surface runoff and tributaries recharge the system of lakes. The drainage area, or area contributing runoff and stream flow, to Lake Buchanan and Lake Travis is approximately 38,800 square miles. The large drainage area increases the possibility of recharge during a rain event, because rain falling anywhere in the drainage basin will recharge the lakes—provided there is enough rain to saturate the soil and produce runoff.

The majority of groundwater in the area comes from the Barton Springs segment of the Edwards Aquifer and is managed by the Barton Springs/Edwards Aquifer Conservation District. The Edwards Aquifer of Central Texas is subdivided into the Northern, Barton Springs, and San Antonio segments. The Barton Springs segment is bounded on the south by a groundwater divide near Kyle and to the north by the Colorado River. Approximately 60,000 people depend upon water from the Barton Springs segment of the Edwards Aquifer as their primary source of water, and the Barton Springs complex is the only known habitat for the endangered Barton Springs salamander.

The Barton Springs segment has a drainage area of approximately 385 square miles—287 square miles in the Contributing Zone and 98 square miles in the Recharge Zone itself. While there are nearly 300 miles of drainage area, there are only 98 square miles where water can actually enter the aquifer through the caves and fractures in the creek beds within the Recharge Zone. Because water must enter through these discrete openings, recharge to the aquifer is more limited than recharge to a surface water reservoir. Rain has to fall in the right location long enough to allow surface runoff to fill the creeks that cross the Recharge Zone.

BSEACD

Droughts and Floods

Drought dominates discussion in many circles of Texas life with its broad impacts on the health and wealth of our society. Central Texas' climate is highly variable—often characterized as a series of droughts punctuated by floods. Climate is the long-term variation of temperature and rain (among other variables) for a given region. In contrast, weather is the short-term variation of temperature and rain (among other variables) for a region. Floods seem to break a drought in Texas—all too often in a catastrophic way. The highest mean annual flow along the Colorado River occurred in 1935, as well as the record peak. Fortunately, since 1941 the Highland Lake system has effectively limited peak (flood) flows and helped extend flows during droughts (such as the 1950s).

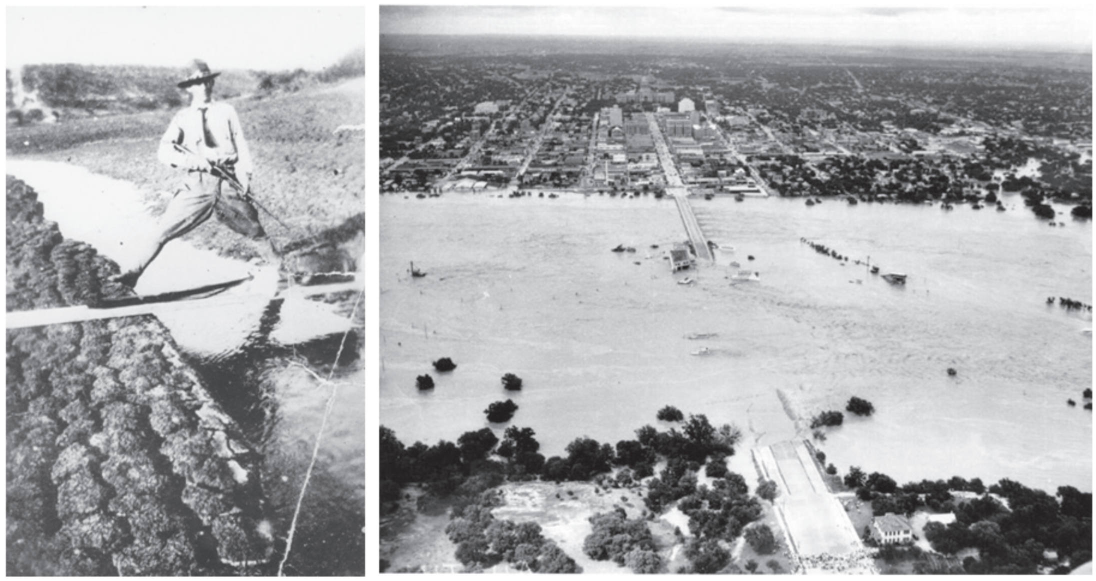


Figure 11: Left) The Colorado River near the now Tom Miller Dam during the 1917 drought. Right) The Colorado River near Congress Ave during the 1935 flood. Photos from Austin Historical Society.

In Figure 11-A, a young man straddles the Colorado River during the drought of 1917, just upstream of where the Tom Miller Dam is today. There were no dams functioning at that time, so the diminished flows seen in the photo represent actual river flows. We can assume that without the dams, August 2013 low flows would be lower than shown in the picture. The 1935 flood inundated much of central Austin along the river near Congress Avenue. The devastating floods of 1935 were again repeated in 1936, and then again in 1938.

The photographs of these two extreme drought and flood events illustrate the variability in our climate over the past 100 years or so. Climate scientists tell us that a changing climate, driven by increasing temperatures, is predicted to exacerbate these types of extreme events--both droughts and floods.

The good news is that we know enough to take actions to help mitigate and adapt for future droughts and flood events, we know they will happen regardless of climate change--that's our norm. However, climate scientists warn that we must also reduce greenhouse gases so that we don't add fuel to the fire. Discussion of the compounding issues of climate variability, population growth, and climate change will help us find solutions to these problems, and allow Central Texas to thrive in a changing climate. Historic photographs can help start the discussion.

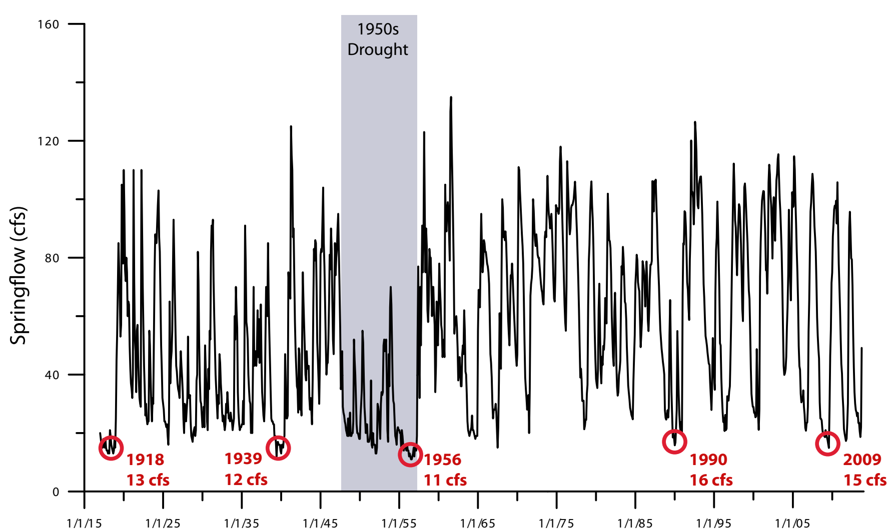


Figure 12: Hydrograph of average springflow at Barton Springs from 1915 to present.

BSEACD

Barton Springs Edwards Aquifer Conservation District

1124 Regal Row
Austin, Texas 78748
(512) 282-8441
www.bseacd.org

Mission

To conserve, protect, recharge, and prevent waste of groundwater and preserve all aquifers in the District.

Goal

To equitably and effectively manage and protect groundwater resources for all groundwater users within its boundary. We serve the groundwater community by monitoring groundwater levels and water quality, managing the shared groundwater resource, coordinating water conservation efforts during drought, and researching aquifer dynamics.