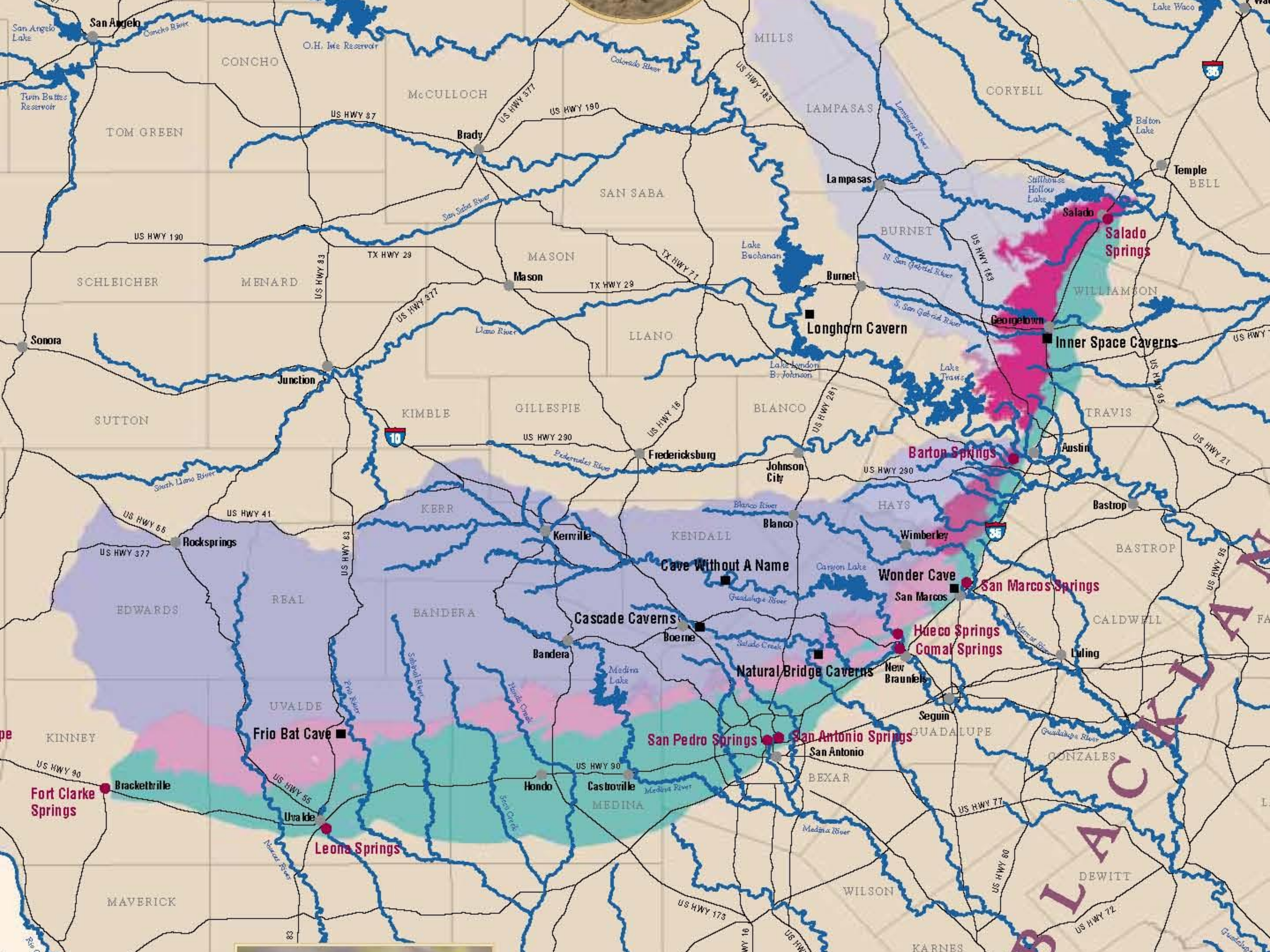
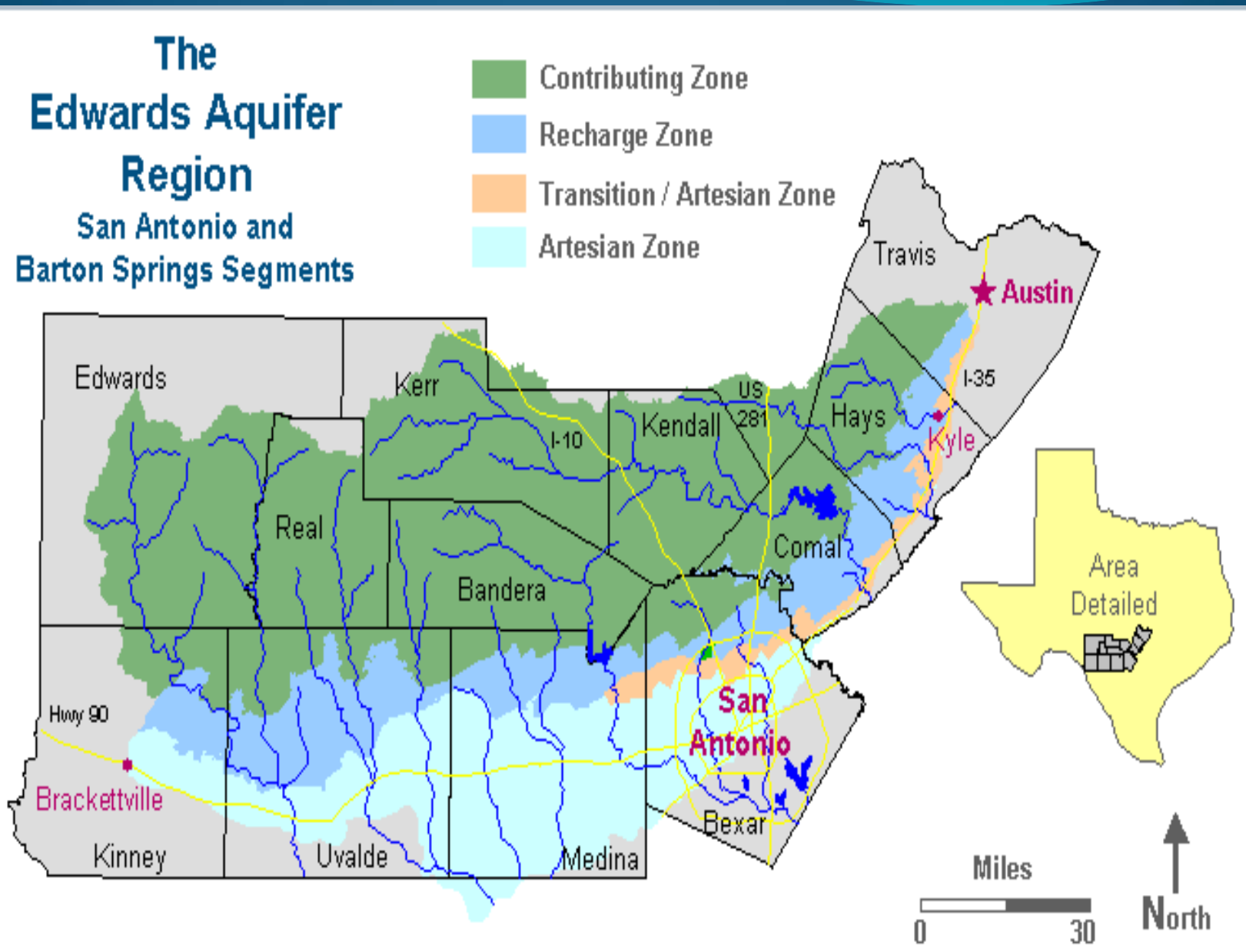
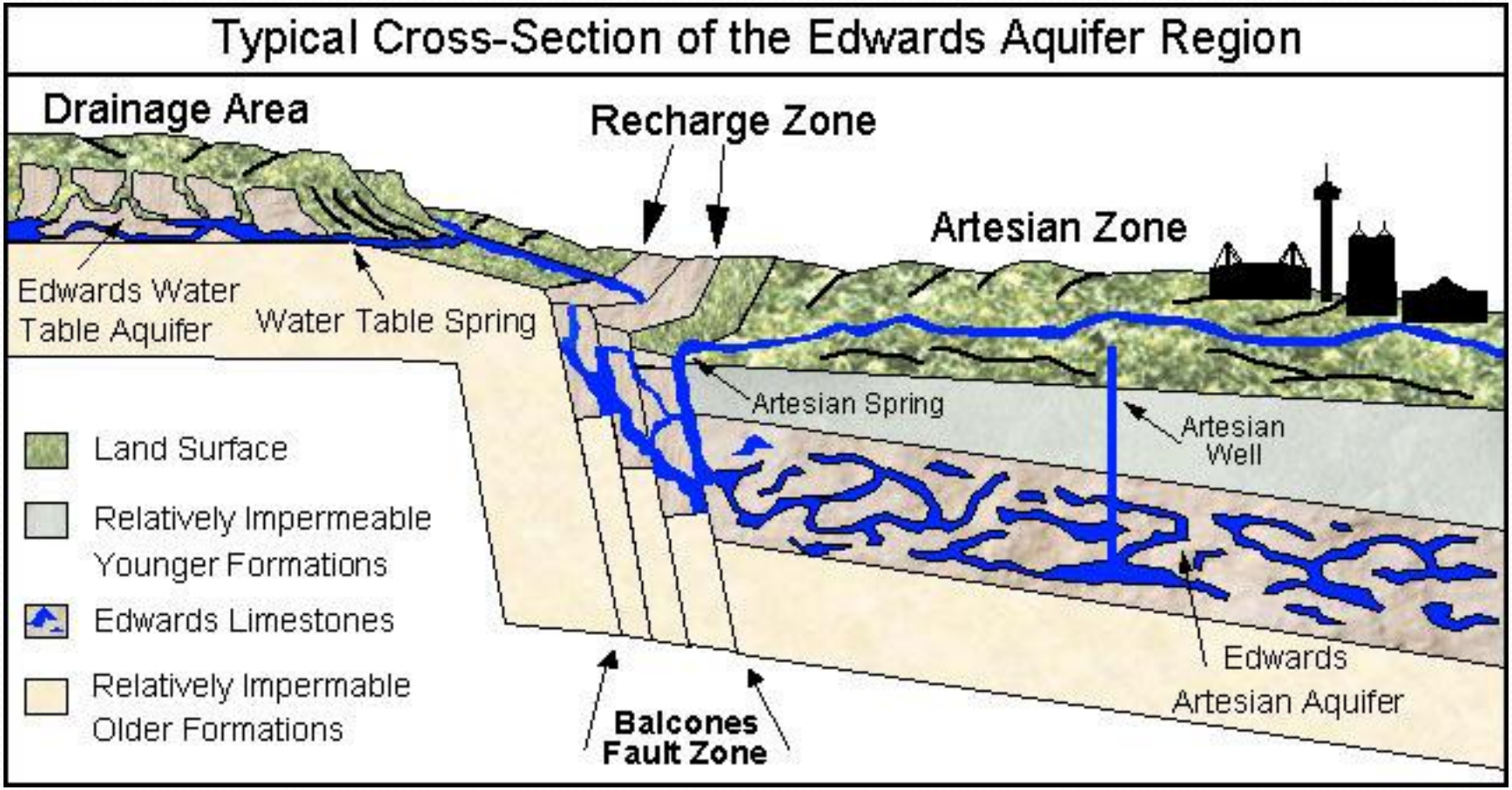
Geology

The Edwards Aquifer

GEAA Greater Edwards Aquifer Alliance

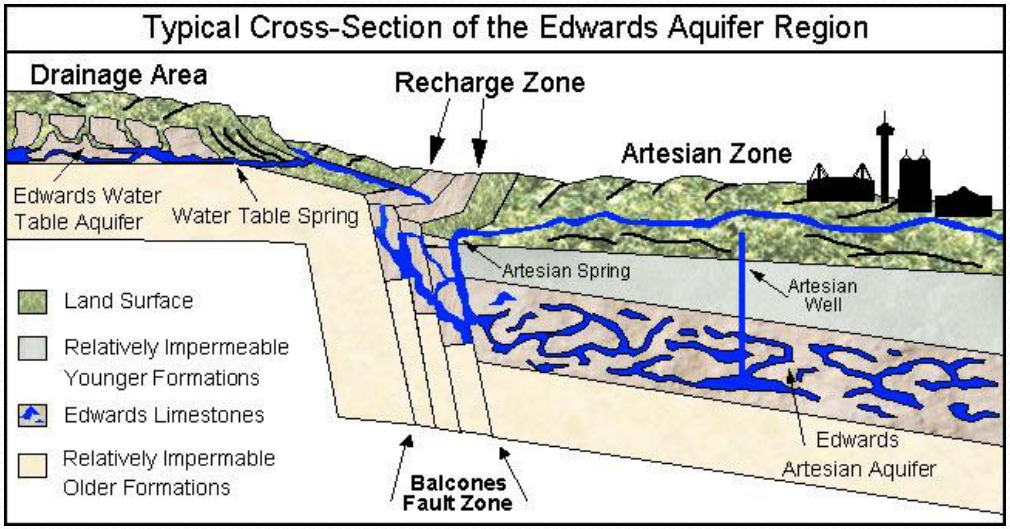

San Angelo
San Angelo Lake
Concho River
O.H. Ivie Reservoir
CONCHO
Twin Buttes Reservoir
McCULLOCH
Colorado River
MILLS
US HWY 183
LAMPASAS
CORYELL
Lake Waco
TOM GREEN
US HWY 87
Brady
US HWY 377
US HWY 190
Lampasas River
Belton Lake
Lampasas
Temple
BELL
SAN SABA
Stillhouse Hollow Lake
Salado
Salado Springs
San Saba River
US HWY 190
TX HWY 29
MASON
Lake Buchanan
BURNET
N. San Gabriel River
SCHLEICHER
MENARD
US HWY 83
Mason
TX HWY 71
TX HWY 29
Burnet
WILLIAMSON
US HWY 377
S. San Gabriel River
Georgetown
Longhorn Cavern
Llano River
LLANO
Inner Space Caverns
Sonora
Lake Lyndon B. Johnson
Lake Travis
Junction
KIMBLE
GILLESPIE
BLANCO
US HWY 281
US HWY 16
TRAVIS
SUTTON
US HWY 290
Austin
Barton Springs
Fredericksburg
Pedernales River
Johnson City
US HWY 290
South Llano River
US HWY 41
Blanco River
HAYS
Bastrop
US HWY 55
KERR
Blanco
Rocksprings
US HWY 377
Kerrville
KENDALL
Wimberley
BASTROP
US HWY 83
Cave Without A Name
Canyon Lake
Wonder Cave
San Marcos Springs
EDWARDS
REAL
BANDERA
Guadalupe River
San Marcos
Cascade Caverns
CALDWELL
Boerne
Hueco Springs
Bandera
Salado Creek
Comal Springs
Luling
Medina Lake
Natural Bridge Caverns
New Braunfels
UVALDE
Seguin
Frio Bat Cave
KINNEY
San Pedro Springs
San Antonio Springs
GUADALUPE
San Antonio
GONZALES
US HWY 90
US HWY 90
BEXAR
Brackettville
Fort Clarke Springs
US HWY 55
Hondo
Castroville
Medina River
MEDINA
US HWY 77
Uvalde
Leona Springs
Medina River
WILSON
DEWITT
MAVERICK
US HWY 173
US HWY 72
KARNES
BLACKLAND


The
Edwards Aquifer
Region
San Antonio and
Barton Springs Segments
Contributing Zone
Recharge Zone
Transition / Artesian Zone
Artesian Zone
Travis
Austin
Edwards
Kerr
I-10
Kendall
US
281
Hays
I-35
Kyle
Real
Bandera
Comal
Area
Detailed
Hwy 90
San
Antonio
Brackettville
Bexar
Kinney
Uvalde
Medina
Miles
0
30
North


Typical Cross-Section of the Edwards Aquifer Region
Drainage Area
Recharge Zone
Artesian Zone
Edwards Water Table Aquifer
Water Table Spring
Artesian Spring
Artesian Well
Land Surface
Relatively Impermeable Younger Formations
Edwards Limestones
Relatively Impermable Older Formations
Edwards Artesian Aquifer
Balcones Fault Zone

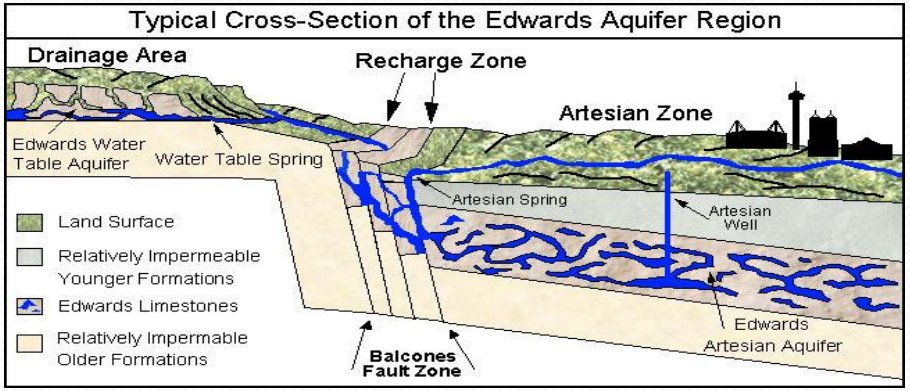
Contributing Zone

- Also known as drainage area or catchment area
- Covers area of about 5,400 square miles
- Land surface "catches" rainfall and water runs off into streams or infiltrates into the water table aquifer of the plateau



Recharge Zone

- A 1,250 square mile area
- Highly faulted and fractured
- Edwards limestone outcrops at the surface
- About 75% of recharge occurs when streams and rivers cross this permeable area and go underground
- About 25% of recharge occurs when precipitation falls directly on the outcrop



Helotes Creek in Recharge Zone

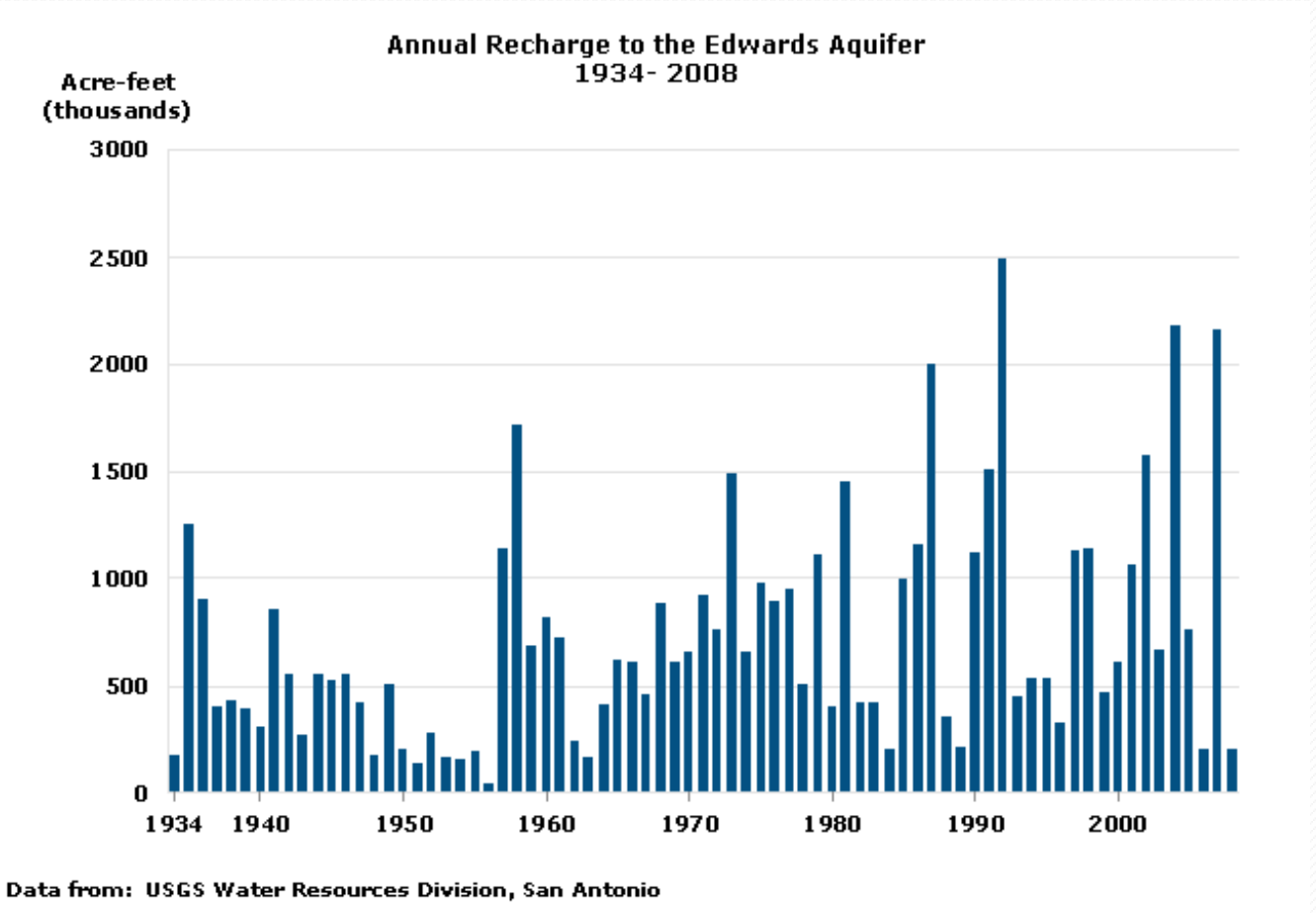
- Large plates of fractured limestone in the creek bottom, which allow recharge water to go into the Aquifer

Seco Creek Recharge Project

- Water is purposefully collected and diverted into the sinkhole to increase Aquifer recharge
- Sinkholes can quickly receive large volumes of recharge during rainstorms and transmit the recharge directly into the aquifer

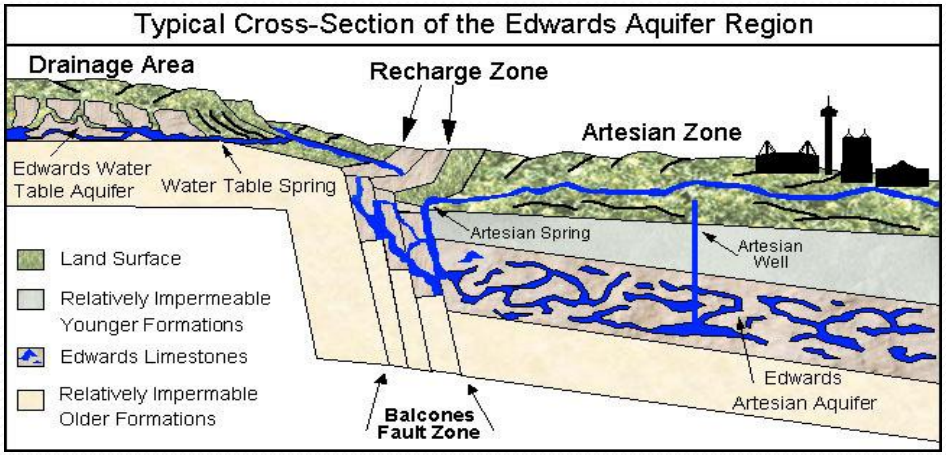
Recharge Zone Fracture

- Edwards limestone outcrop


Annual Recharge to the Edwards Aquifer
1934- 2008
Acre-feet
(thousands)
3000
2500
2000
1500
1000
500
0
1934
1940
1950
1960
1970
1980
1990
2000
Data from: USGS Water Resources Division, San Antonio

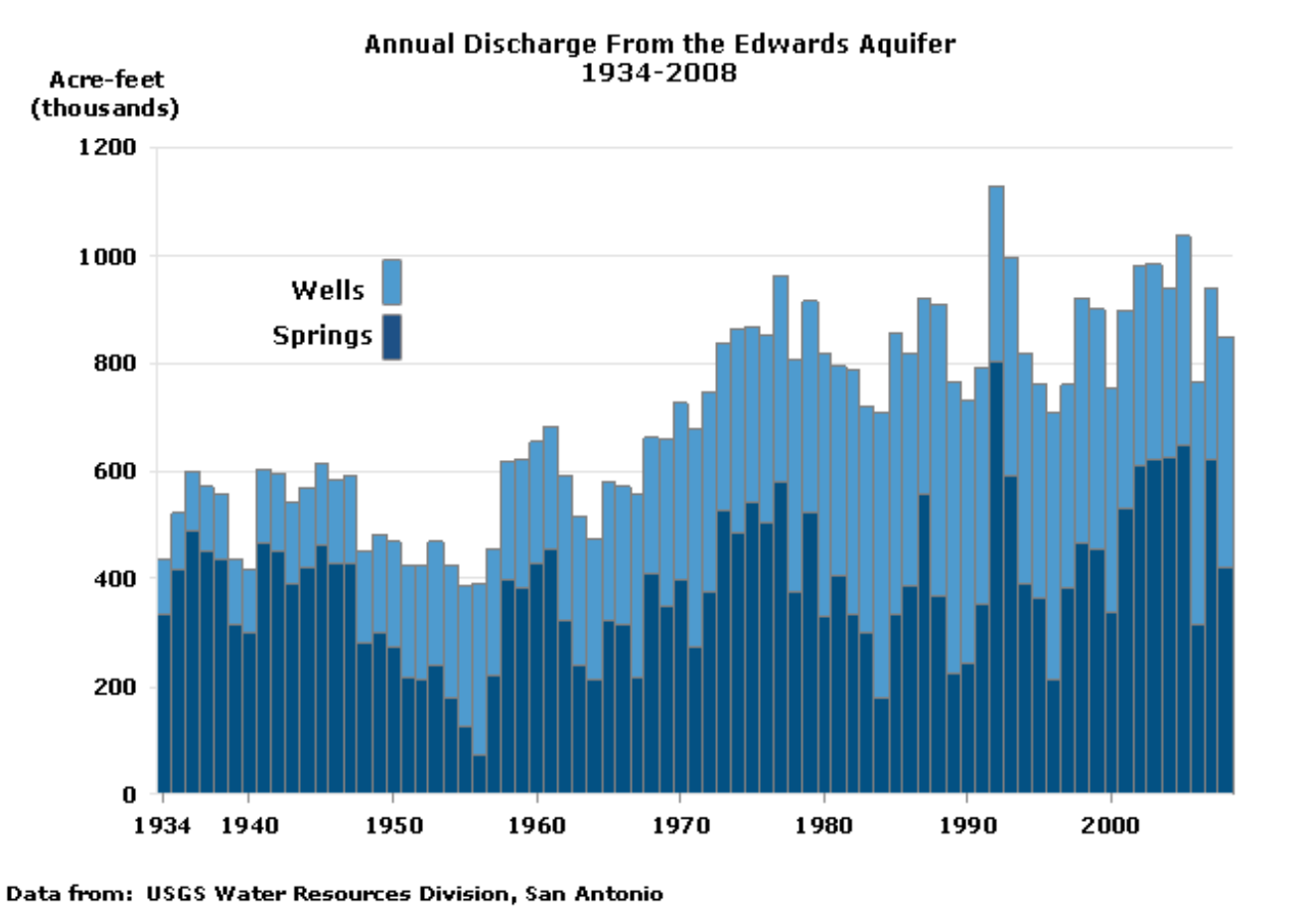
Artesian Zone

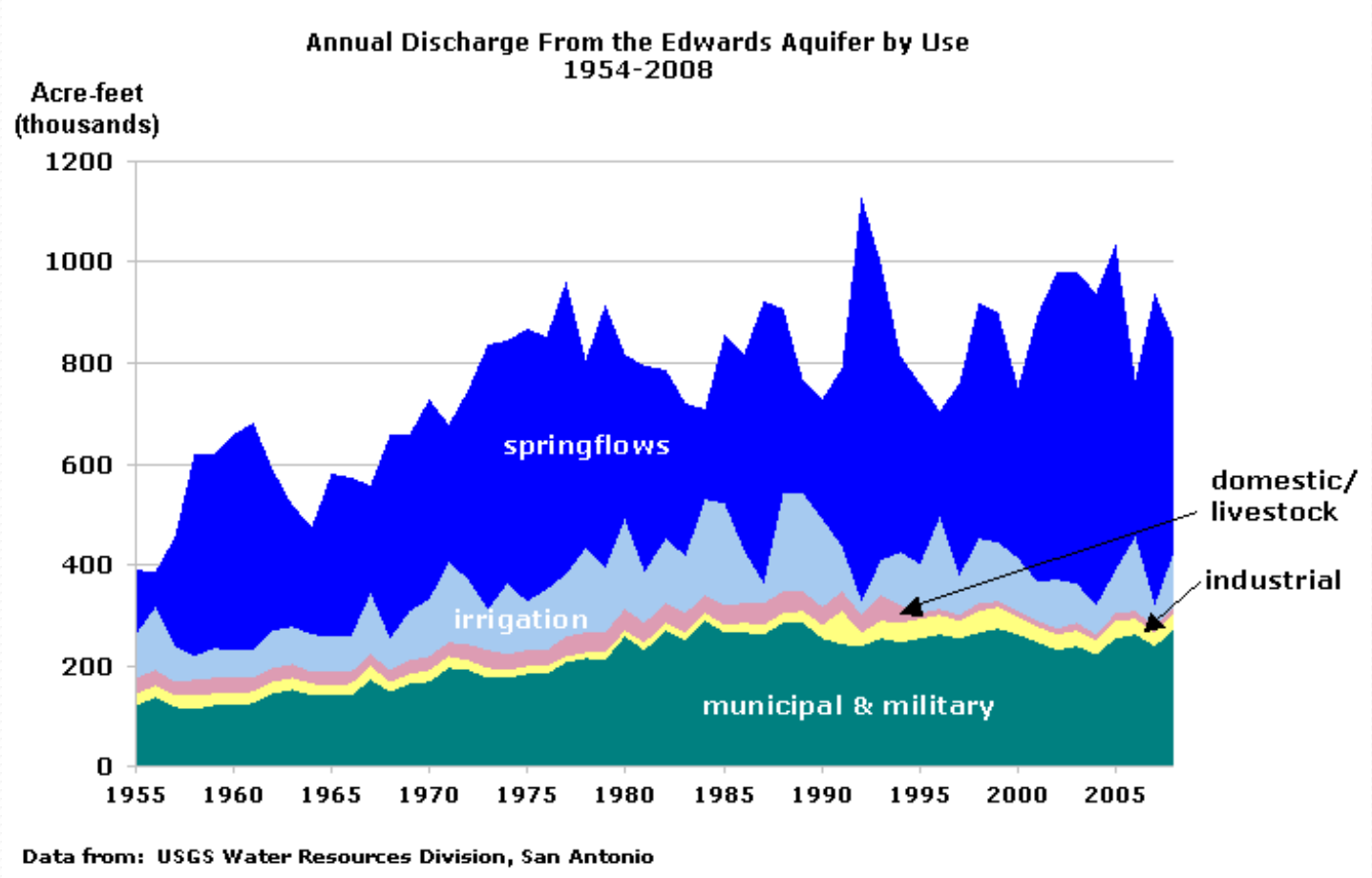
- Water is confined between two relatively impermeable formations - the Glen Rose formation below and the Del Rio clay on top
- Flowing Artesian wells and springs exist where hydraulic pressure is sufficient to force water up through wells and faults to the surface.



Artesian Wells in San Antonio

- San Antonio began to rely on artesian wells for its water supply in 1891
- The effect of releasing all this pressure through wells was that springflows began to decline immediately and significantly


Annual Discharge From the Edwards Aquifer
1934-2008
Acre-feet
(thousands)
1200
1000
800
600
400
200
0
Wells
Springs
1934
1940
1950
1960
1970
1980
1990
2000
Data from: USGS Water Resources Division, San Antonio


Annual Discharge From the Edwards Aquifer by Use
1954-2008
Acre-feet
(thousands)
1200
1000
800
600
400
200
0
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
springflows
irrigation
municipal & military
domestic/
livestock
industrial
Data from: USGS Water Resources Division, San Antonio

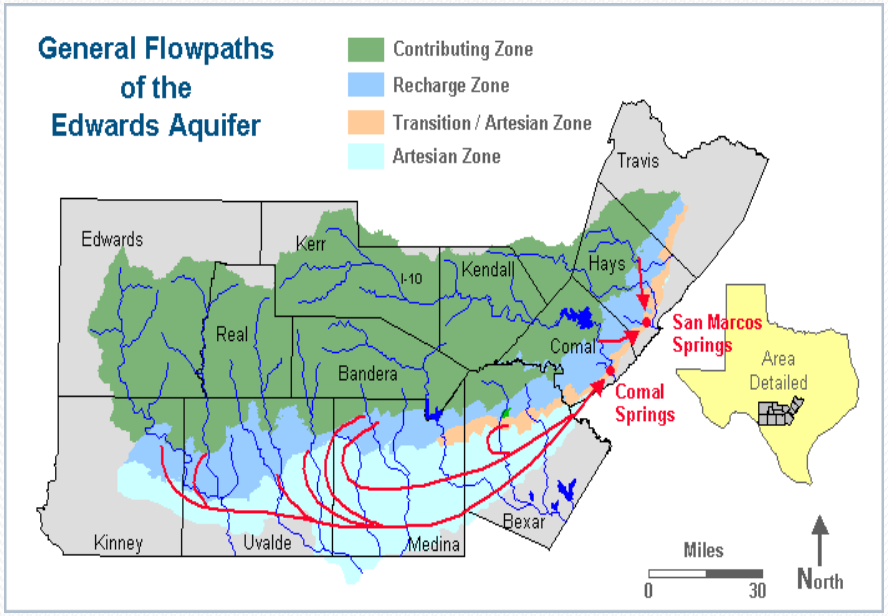
Aquifer Protection

- Edwards water does not require treatment before distribution besides chlorination
- However a recent hike in urbanization has caused local concern over the quality of water
- Many critics point to weak rules issued by multiple agencies since the Texas Water Development Board in 1970
- Another issue facing the progress of aquifer protection is the cultural attitude towards property rights in Texas
- With 1.7 million people depending on the Edwards as their primary sources of water this issue is as pressing as ever

Jurisdiction Regarding the Contributing Zone

- Neither of the two main protection agencies, the EAA and the TCEQ, have the authority to apply rules in the Contributing Zone

- The people living on the Edwards Plateau are not Edwards Aquifer water users which complicates the problem of protection

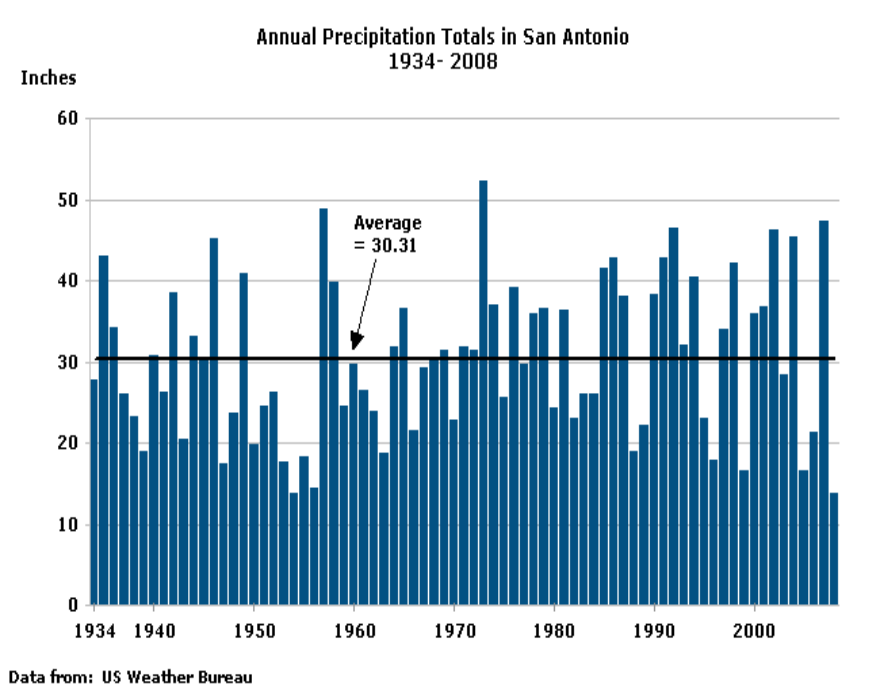


Expanding Central Texas

- The Hill Country is the most rapidly-expanding area in all of Texas
- The Edwards Aquifer Authority has recently enacted legislation to limit the developers ability to install impervious cover over the recharge zone
- Environmental officials are trying to avoid the wash of pollutants from streets, cars, and new industry into the aquifer

A Limited Resource

- With rainfall being the only source of recharge for the aquifer we are at the mercy of annual rainfall
- Low rainfall reduces pressure within the aquifer and at springs
- Many aquatic and karst dwelling species rely on the Edwards



Stakes

- What is the economic value of environmental services the Edwards is providing for free? How much are we willing to pay to protect the ability of the Edwards to provide treatment?
- To what extent can we limit development or regulate land use in order to protect Edwards water quality? Will compensation be required, and who will pay?
- What agency has the legal authority and responsibility to develop water quality regulations? How do we deal with competing jurisdictions and agency boundaries that are set up along political, not hydrogeologic lines?

Want to Know More?

- www.AquiferAlliance.org
- www.EdwardsAquifer.net

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