



By: Gary Westbrook
General Manager

Water Management in Texas and Management of Groundwater Resources within the Post Oak Savannah GCD



Serving the citizens of Milam and Burleson Counties

Master Naturalists

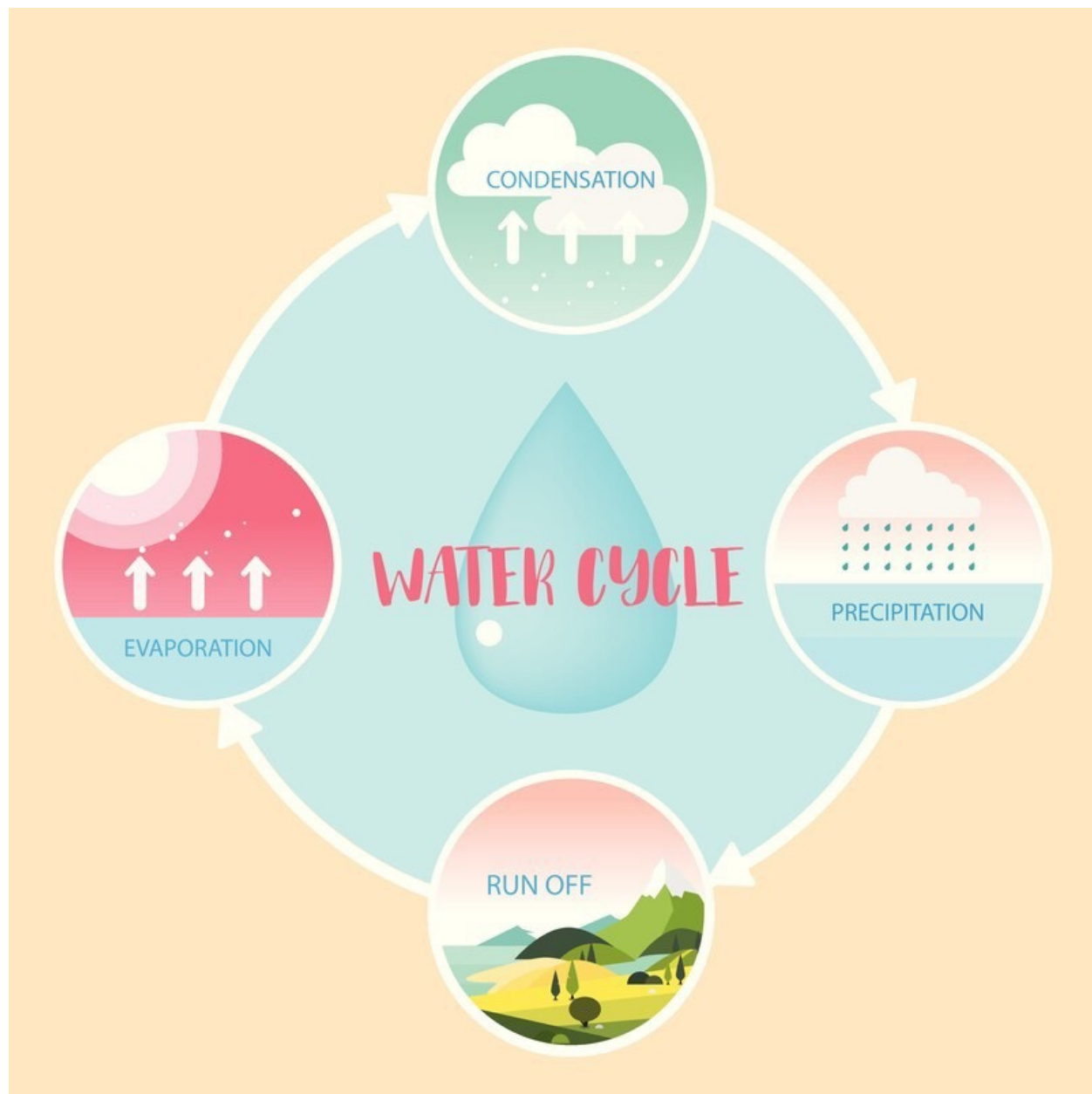
Agenda

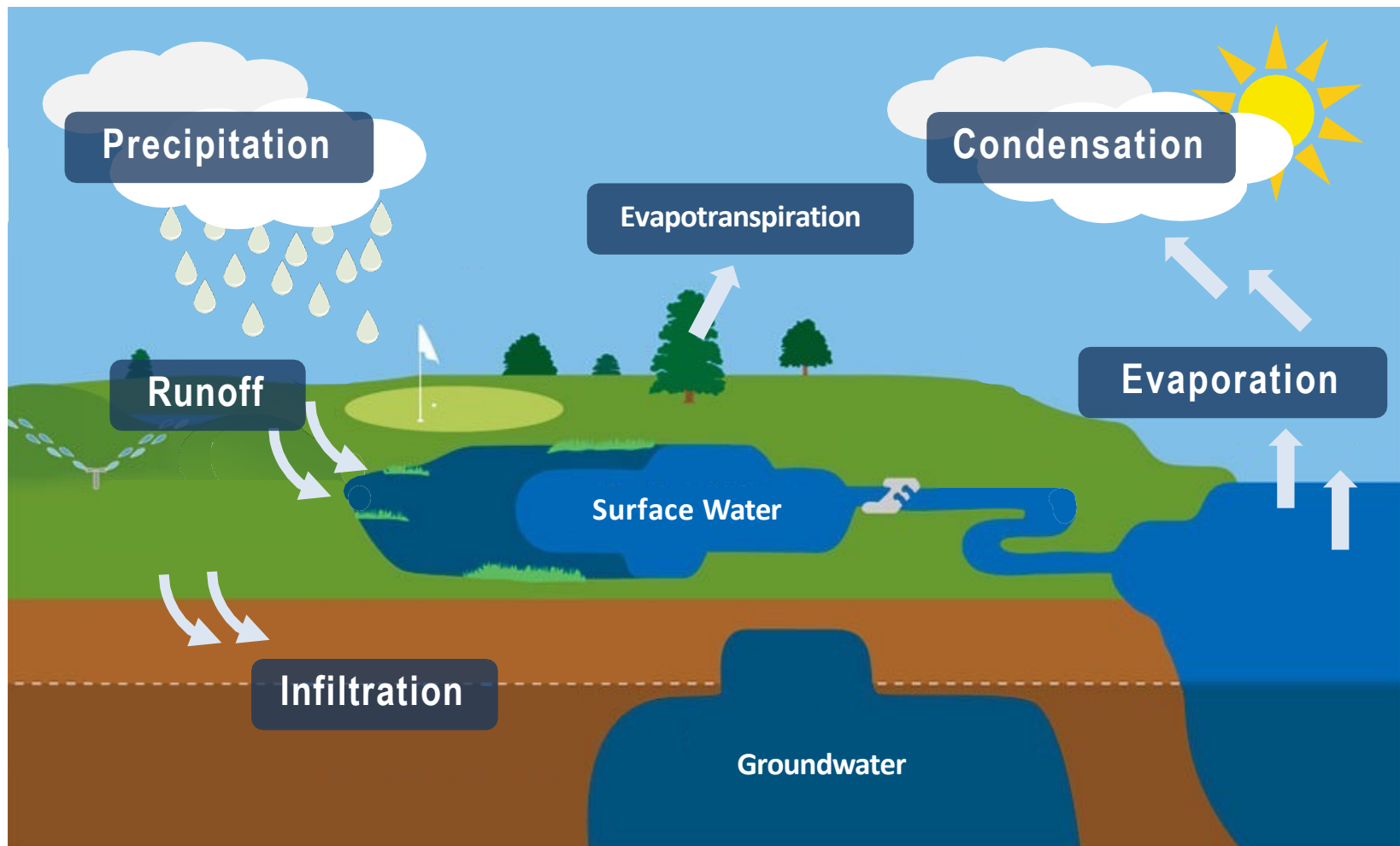
1. The Basics: The Water Cycle
2. Texas Water Resources and Management
3. GCDs Powers and purposes
4. About POSGCD
5. Groundwater Resources within POSGCD
6. GMA Joint Planning and State Water Planning
7. Management and conservation strategies of POSGCD
8. POSGCD Programs





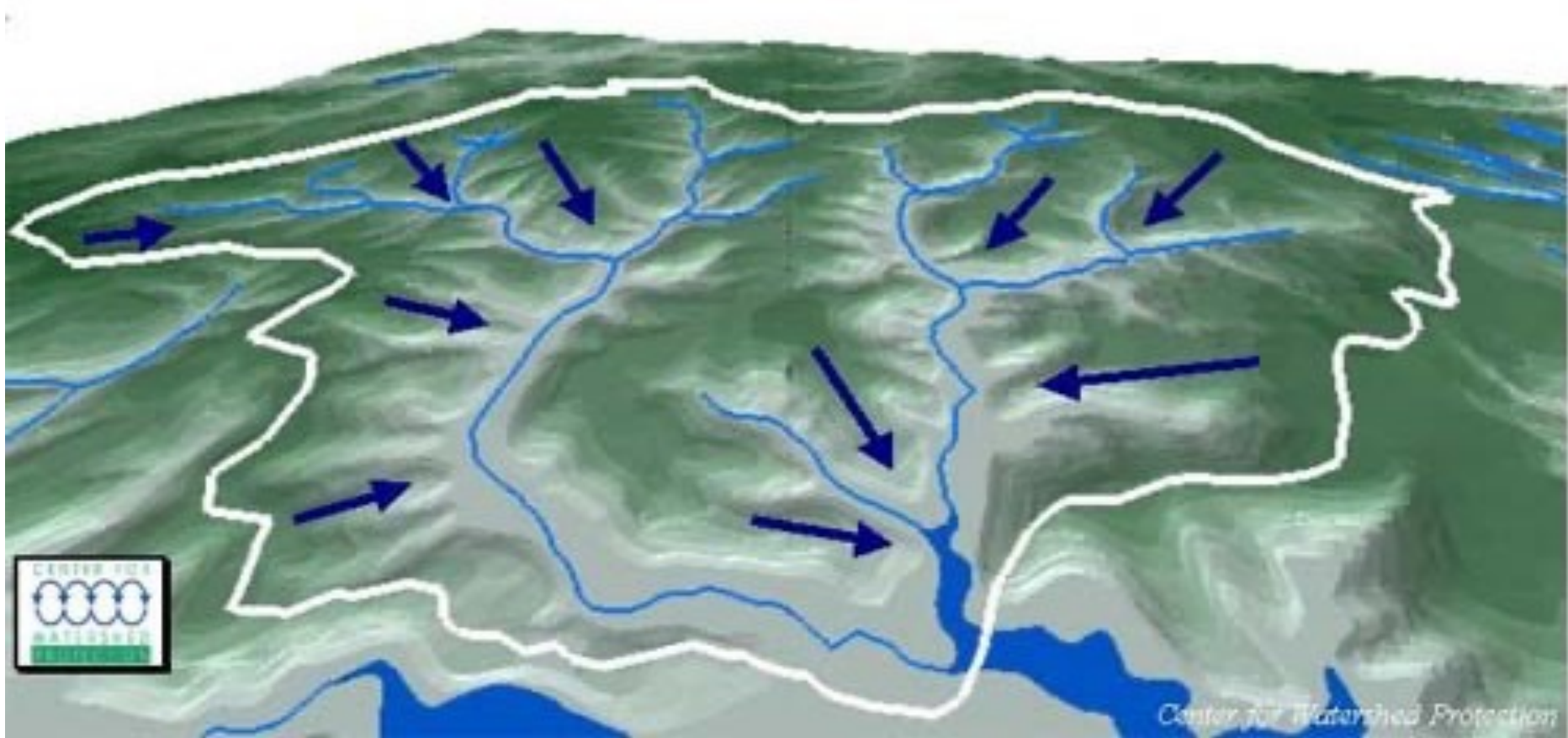
The Basics: The Water Cycle





What is a Watershed?

A **watershed** is an area or ridge of land that **separates waters** flowing to different rivers, basins or seas.



Many watersheds make a river basin.

Texas Water Resources



Ownership and Rights



Surface Water

OWNERSHIP

owned by the state of Texas and held in trust for public use.

RIGHTS

Governed by legal principle “Doctrine of Prior Appropriation.”

Regulated by Texas Commission on Environmental Quality (TCEQ)
River Authorities manage the delivery and infrastructure.

“First in time, first in right”



Groundwater

OWNERSHIP

groundwater rights are considered the property of the landowner above it.

RIGHTS

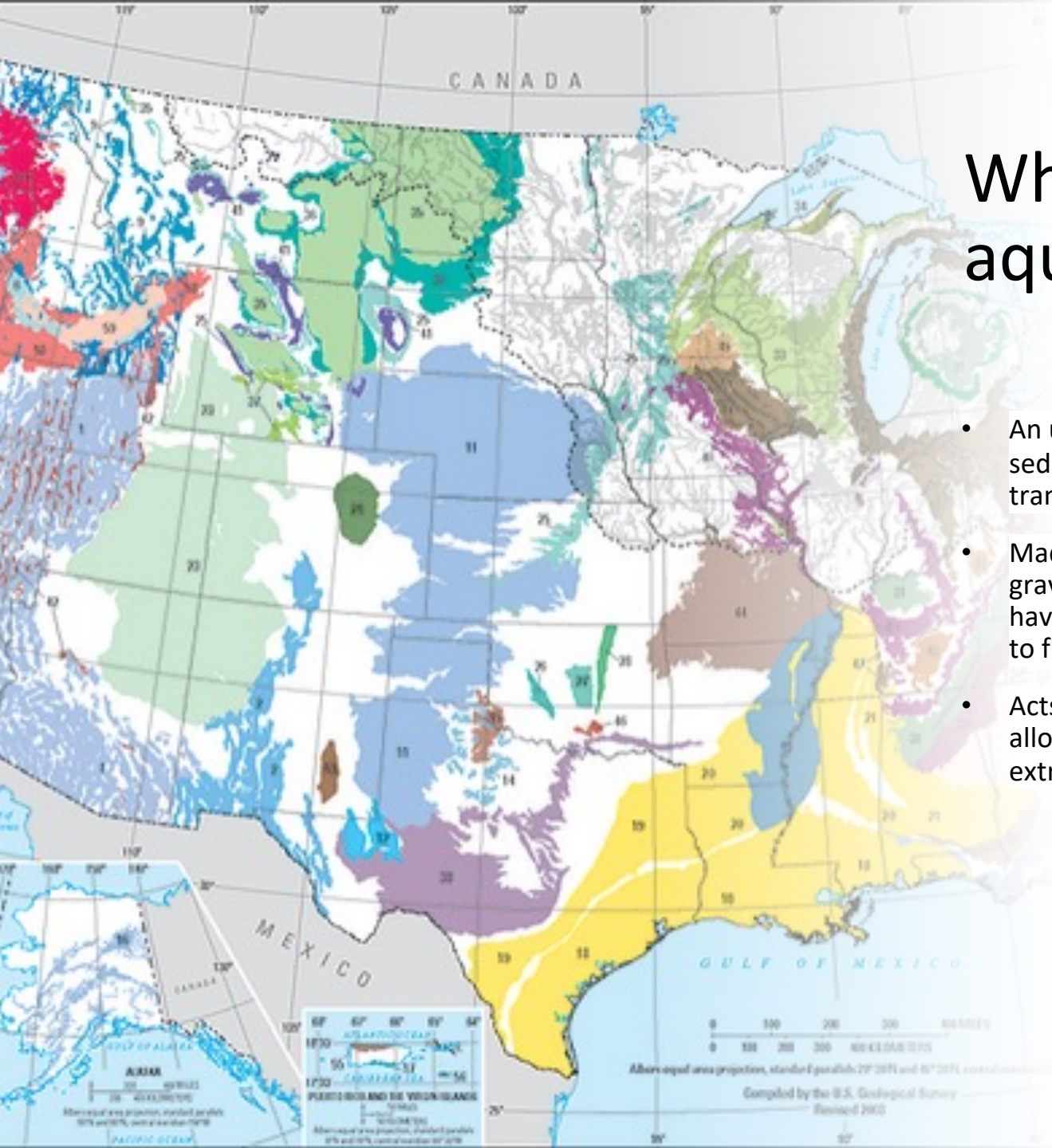
Governed by “Rule of Capture,” and owners can pump unlimited groundwater from their land, as long as it is not malicious or wasteful.

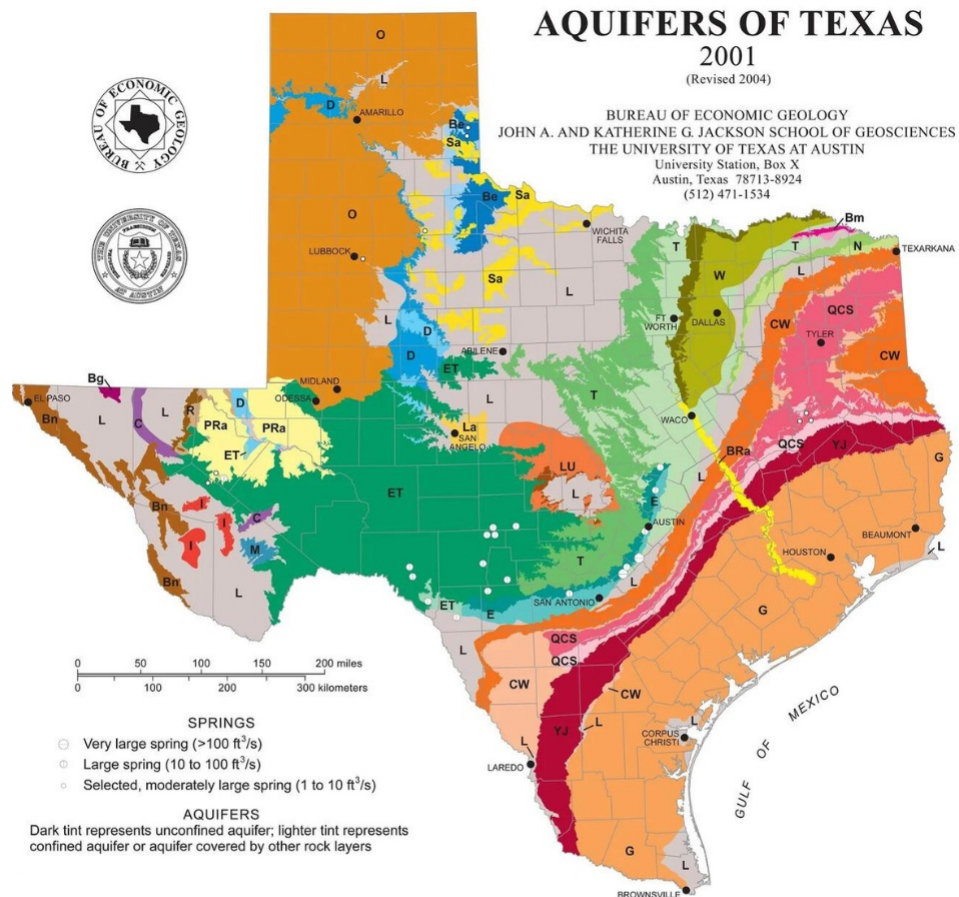
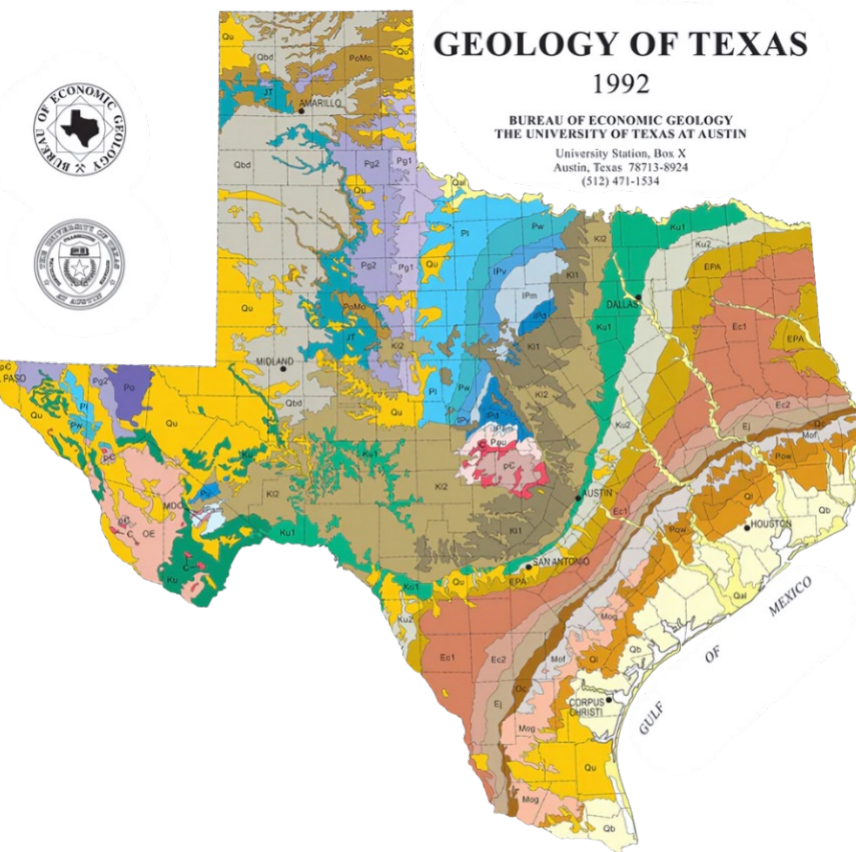
If one exists in their area, a Groundwater Conservation Districts (GCDs) can regulate the spacing of wells, the amount of water pumped, and other conservation measures to prevent aquifer depletion within their jurisdiction.

“Law of the biggest pump”

What is an aquifer?

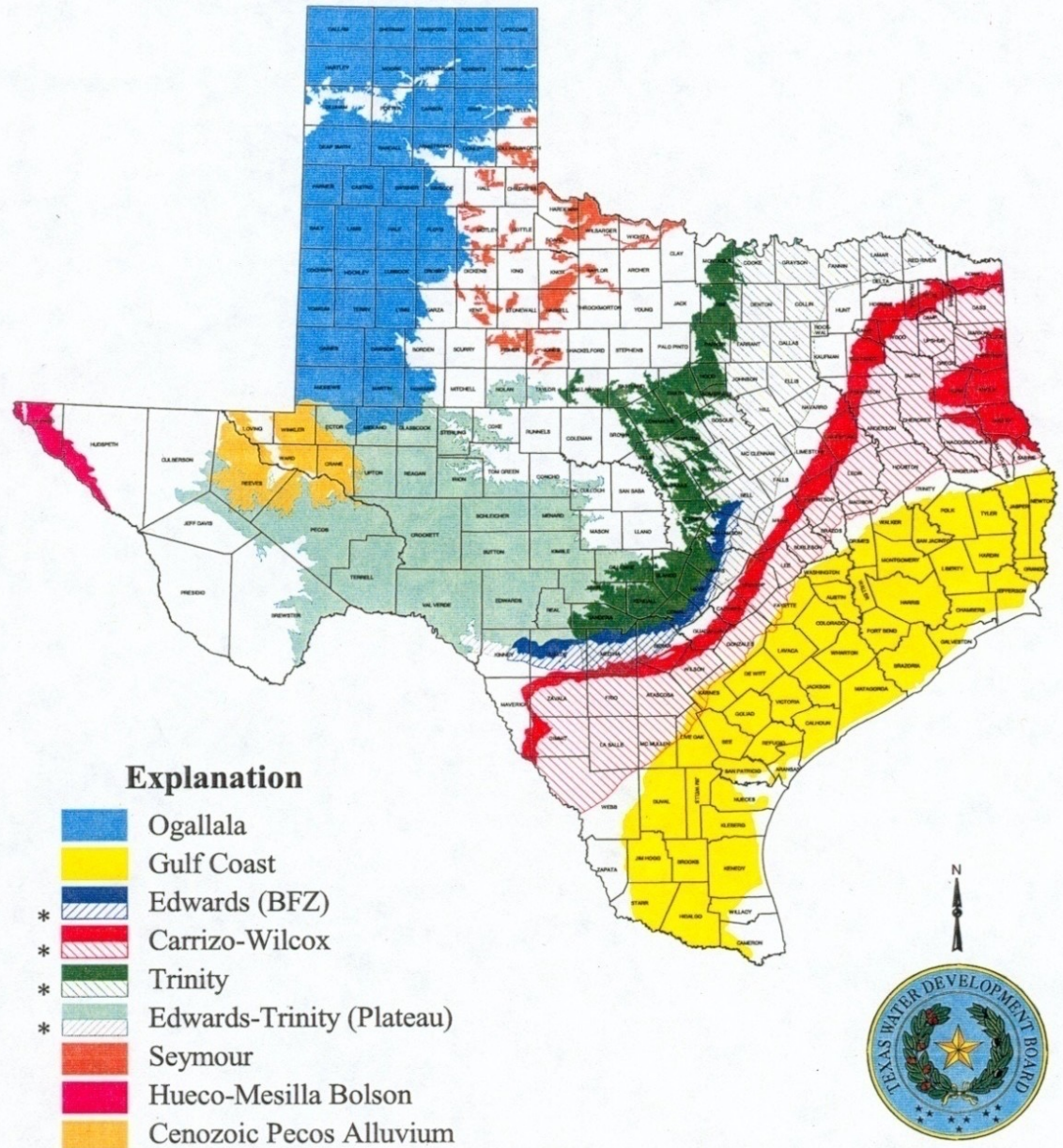
- An underground layer of rock or sediment that stores and transmits groundwater.
- Made up of materials like sand, gravel, or fractured rock that have spaces or pores for water to fill.
- Acts as a natural reservoir, allowing groundwater to be extracted through wells for use.



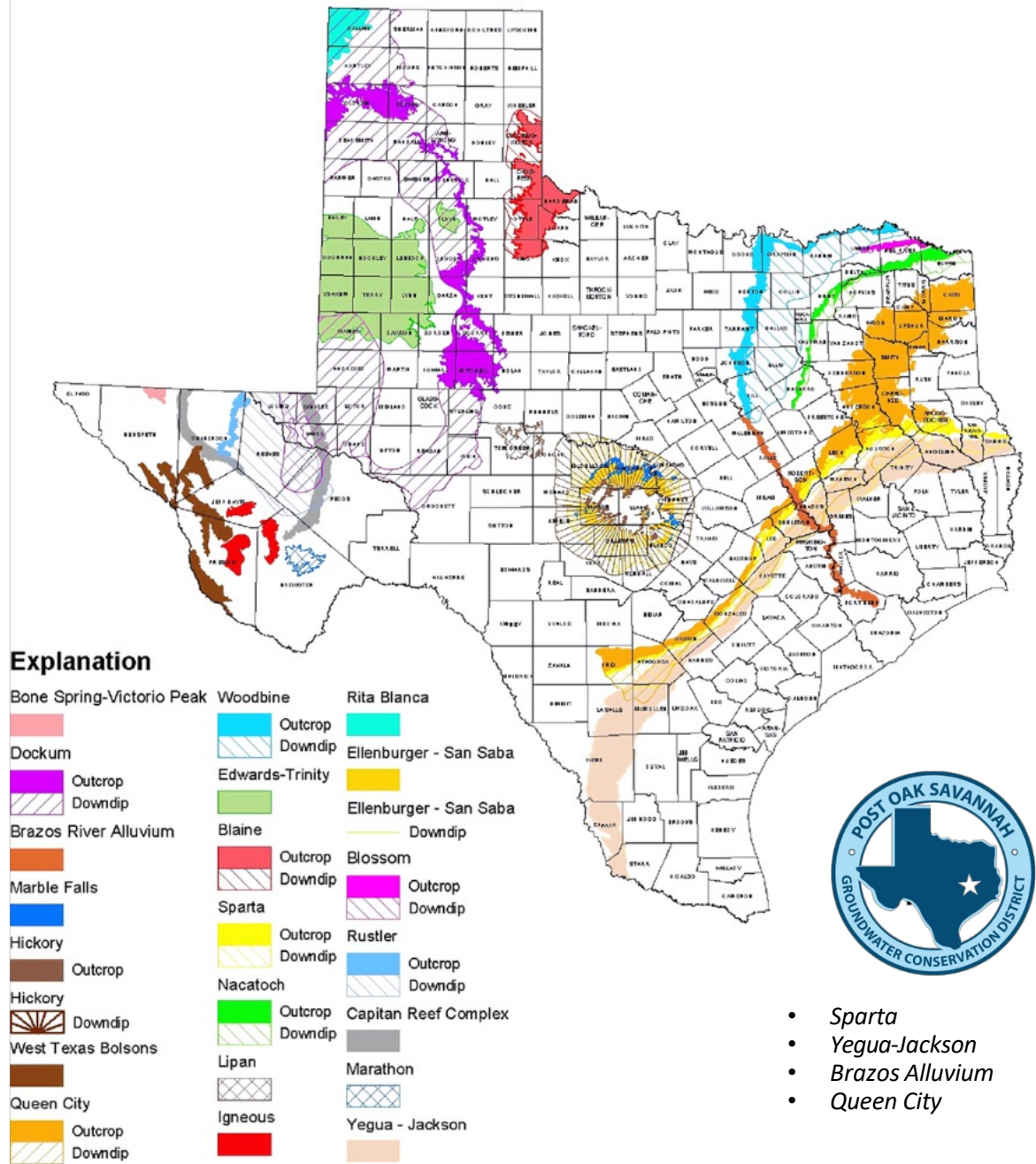


Geology and Aquifers

Major Aquifers of Texas



Minor Aquifers of Texas



Groundwater Conservation Districts

Purpose and Powers



Political Subdivisions

- GCDs are Political Subdivisions of State
(Specific authority and responsibilities in a defined geographic area)
- "Political subdivision" means a county, municipality, or other body politic or corporate of the state, including a **district or authority** created under Section 52, Article III, or Section 59, Article XVI, Texas Constitution, a state agency, or a nonprofit water supply corporation created under Chapter 67. (*Ch. 36.001*)
- Empowered by Chapter 36, Texas Water Code

Purpose

Chapter 36.0015

- **Provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater** (Also must provide for most efficient use of the groundwater resources)
- **Groundwater Conservation Districts are the state's preferred method of groundwater management through rules developed, adopted, and promulgated by a district**

The GCD Balancing Act



Rights of Landowners and
the highest practicable
level of groundwater
production

Conservation, preservation,
protection, recharging and
prevention of waste of
groundwater

Rulemaking Power

Sec. 36.101

A district may make and enforce rules, including rules limiting groundwater production **based on tract size or the spacing of wells**, to provide for conserving, preserving, protecting, and recharging of the groundwater or of a groundwater reservoir or its subdivisions in order to control subsidence, prevent degradation of water quality, or prevent waste of groundwater and to carry out the powers and duties provided by this chapter.

- During the rulemaking process, the board shall consider **all groundwater uses and needs** and shall develop rules which are fair and impartial.
- After notice and hearing, the board **shall** adopt and enforce rules to implement this chapter....



Source of the struggle for Property Rights: Historic or Existing users vs. Future users

Existing Users: “Protect my investment/livelihood”

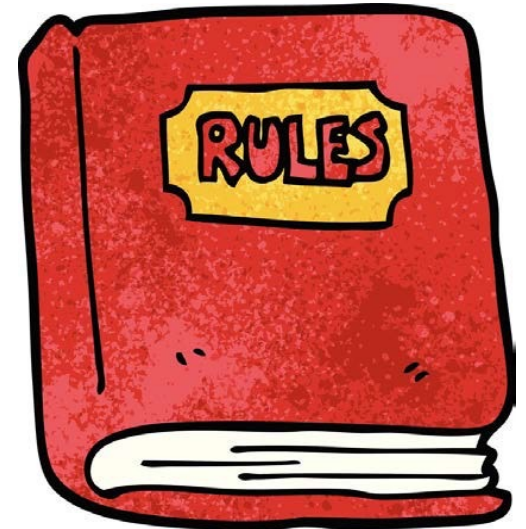
Future Users: “Protect my property rights”



Enforcement of Rules

Section 36.102

- A district may enforce this chapter and its rules by injunction, mandatory injunction, or other appropriate remedy in a court of competent jurisdiction (\$100K settlement)
- The board **by rule may set** reasonable civil penalties for breach of any rule of the district not to exceed \$10,000 per day per violation, and each day of a continuing violation constitutes a separate violation
- If the district prevails in any suit to enforce its rules, the district **may** seek and the court **shall** grant, in the same action, recovery for attorney's fees, costs for expert witnesses, and other costs incurred by the district before the court. Also applies to defense to suit)



Other

- GCDs may be created by:
 - TCEQ- Priority Groundwater Management Area
 - Legislation- Locally filed
- Confirmation Election
 - Temporary Directors prior
 - Permanent Directors after
- Revenues
 - Tax Based
 - Fee Based
 - Both
- Powers and Authorities from 2 sources
 - Chapter 36
 - Enabling or Special Legislation of District- takes precedent over Chapter 36
 - Add or amend powers (fee structure)
 - Remove Powers (eminent domain)

A photograph of a single-story building with a wide, covered entrance. The building has light-colored horizontal siding and a stone veneer base. Two flagpoles stand to the right of the entrance, flying the United States flag and the Texas state flag. The building is surrounded by trees and a paved area with yellow parking lines. The sky is overcast.

About Post Oak Savannah Groundwater Conservation District in Burleson and Milam Counties

Who is Post Oak Savannah GCD?

Legislation passed in 2001 and
Approved in Confirmation
Election by Citizens of Burleson
and Milam Counties in 2002



POSGCD Background

Legislation passed in 2001 and
Approved in Confirmation
Election by Citizens of Burleson
and Milam Counties in 2002

I. Resources + Location + Growth =

>35,000 acres water rights leased by 2000

II. Local Concerns

a. Existing Area Users (*100% Burleson Co. and 90% Milam Co. use groundwater*)

Municipal, Industrial, Agricultural

b. Future Growth

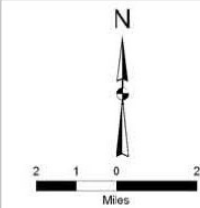
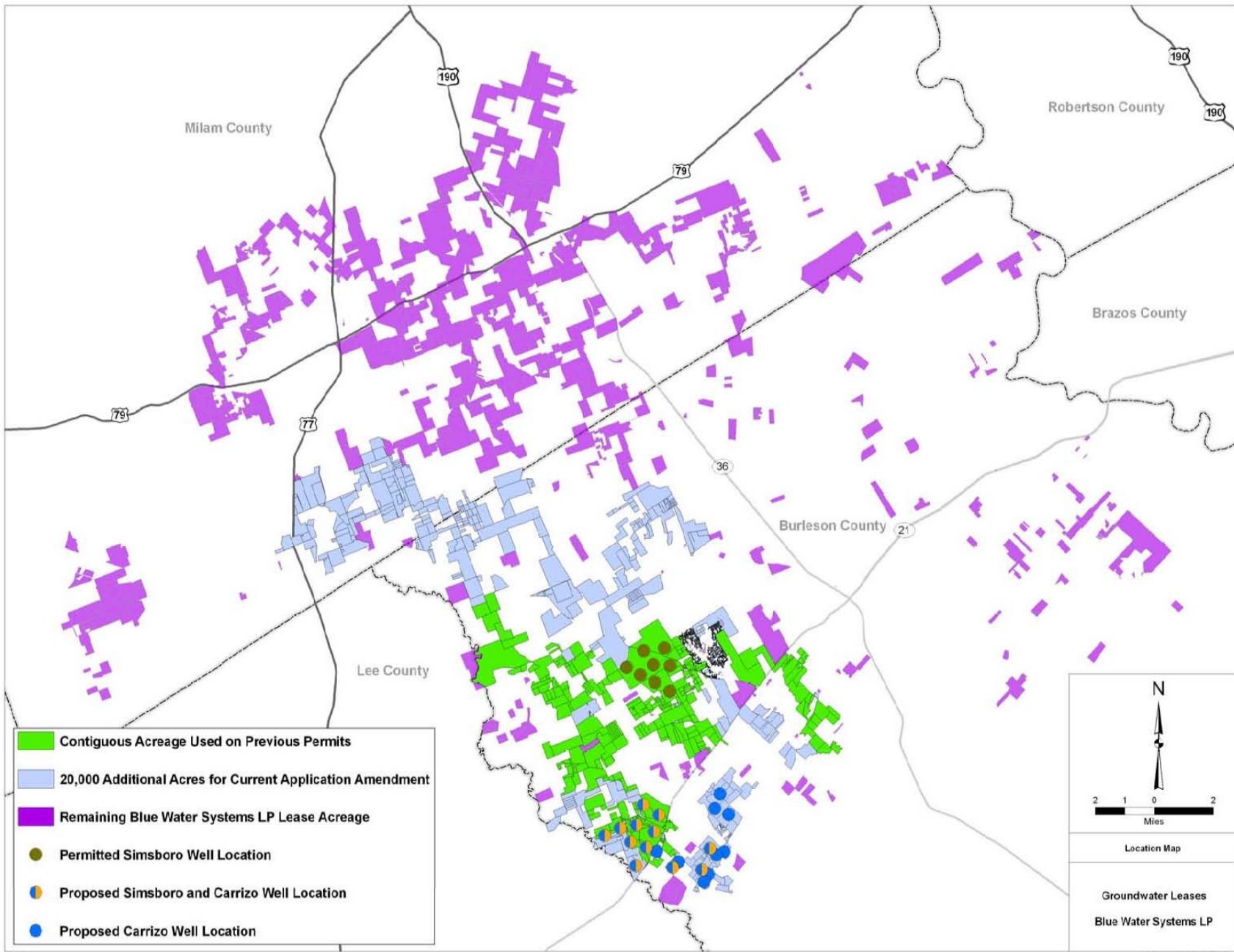
c. Reasonableness of Management Strategies

d. Insufficient Science

e. Unknown future projects in the region

f. Property Rights





Location Map

Groundwater Leases
Blue Water Systems LP

Management Strategies



District Management Strategies are found in the District Management plan at

<https://posgcd.org/wp-content/uploads/2024/02/Amended-Management-Plan-12-12-2023.pdf>

Some of these Strategies include:

- 1) Efficient Use of Groundwater
- 2) Groundwater Well Assistance Program
- 3) Desired Future Conditions and Protective Drawdown Limits



Monitoring Summary 2024

Aquifer/Aquitard	# of Monitoring Wells
Brazos River Alluvium	7
Calvert Bluff	79
Carrizo	138
Hooper	57
Queen City	45
Reklaw	1
Simsboro	69
Sparta	24
To Be Determined	5
Yegua-Jackson	20

Total 445

110 Monitoring Wells in 2016



POSGCD Programs

District Education Programs

Public Presentations

- Informative sessions on groundwater conservation and management

Educational Resources Articles, updates, meeting info and more available on our website: www.posgcd.org

Events, Classes, and Workshops

- Professional development classes for educators, local water utilities, and real estate agents
- Annual Groundwater Summit with updates on groundwater projects and legal frameworks

Stay Informed

- Quarterly newsletter
- Media outreach – articles on our website, social media, press releases for local newspapers, etc.





Educational Partnerships




**Texas Water
 Resources Institute**
make every drop count



TEXAS A&M
AGRI LIFE



Educational Resources & School Programs

- Provide educational materials and lesson plans to 4th and 5th grade classrooms for hands-on learning tailored to meet TEKS requirements
- 9+ classes cohosted with AgriLife Extension

Rainwater Harvesting Rebate



What it is

- Reimbursement for installing a rainwater harvesting system
- Reimbursement rate calculated at \$1.00 per gallon of the system's storage capacity
- Maximum of \$5,000 per household

2024 RAINWATER HARVESTING

Post Oak Savannah Groundwater Conservation District offers a Rainwater Harvesting Rebate Program in collaboration with AgriLife Extension Service. Through this partnership, the District offers free training to help incentivize residents to collect rainwater as a way to take some pumping pressure off the aquifers.



11 SYSTEMS INSTALLED

Total number of households that installed a system this year after completing educational training.



100,527 TOTAL GALLONS OF STORAGE

Gallons of storage. The rebate program is based on \$1 per gallon of tank capacity up to \$5,000 per household.



51 TOTAL NO. TANKS

51 rainwater storage tanks were installed by the 11 applicants. These systems will reduce erosion, divert and slow down flood water, promote groundwater recharge, and reduce pumping of the aquifers



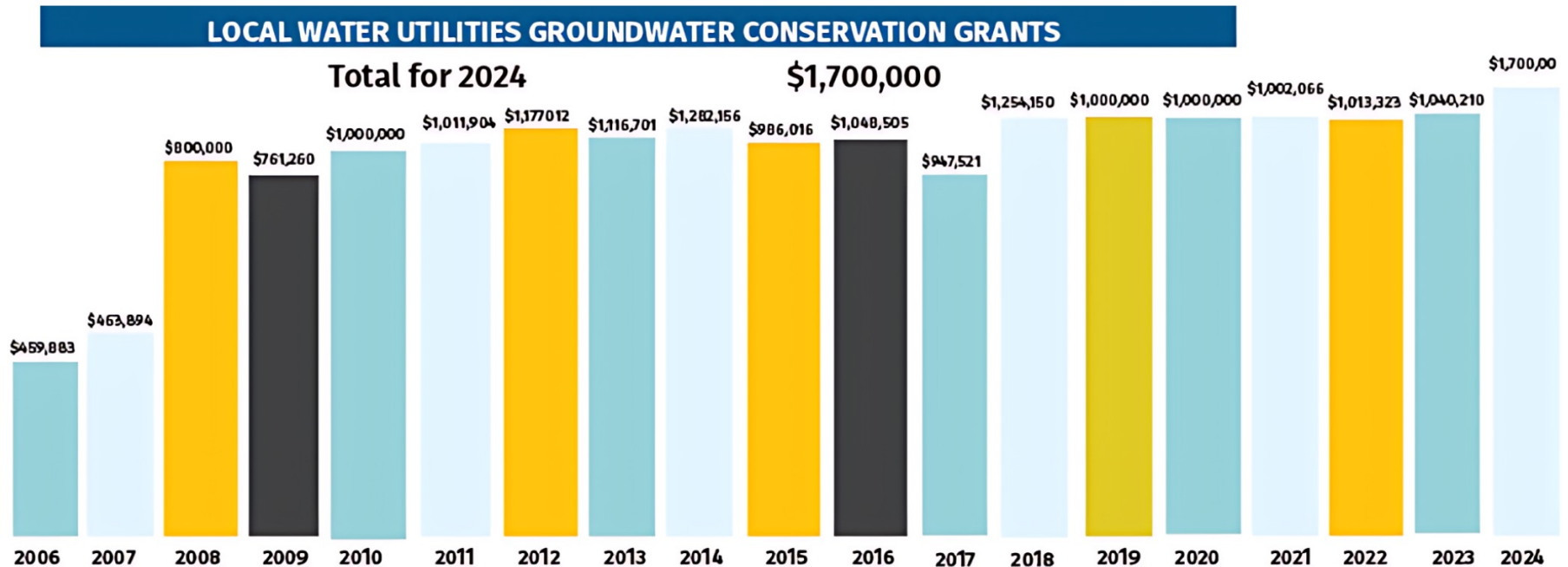
425,325 GALLONS COLLECTION

The total number of gallons of rainwater these collection systems can store.



District Groundwater Conservation Grants for Local Water Utilities

- Awarded 90 grants
- 23 different Local Water Utilities
- Approximately \$19 million



Groundwater Well Assistance Program (GWAP)

Purposes-Increase # of monitoring wells, Predict and correct issues with water supply

Not Including Science	2020	2021	2022	2023	2024	June
Wells Serviced	20	44	39	25	13	1
Total POSGCD Spent	\$76,161	\$233,954	\$448,481	\$338,667	\$178,008	4,318
Total Reimbursed to POSGCD From Vista Ridge & I-130 Projects	\$17,653	\$95,025	\$72,729	\$57,825	\$5,911	\$5,911

Total Expense-to-Date including Science and Well Service under GWAP is \$1,419,839

Total Science Expense for 2024: \$6,182

Wells Plugged for 2024: \$20,253



**GROUNDWATER
WELL ASSISTANCE PROGRAM**

**POST OAK SAVANNAH
GROUNDWATER CONSERVATION
DISTRICT**

POSGCD

Aquifer Conservancy Program (ACP)

- Empowers landowners to protect their groundwater rights and promote sustainable water use.
- By forming their own contiguous acreage, landowners can control water use and prevent large-scale projects from acquiring land for extensive water permits.
- District has authority to set pumping limits and allow 2 acre-feet per year per acre – limited by state regulations and the need to balance water rights among users, ensuring fair and sustainable management.

CONTRACT TERM	ANNUAL PAYMENT (PER ACRE)
5 years	\$5
10 years	\$8
20 years	\$10
30 years	\$15
50 years	\$25

Other District Programs and Services



4H2O Water Ambassadors Scholarship and Sponsorship Program: Covers the cost of students in District counties to participate in the program. Also, up to **\$5,000**, paid to the higher education institution of their choice upon graduation.

Interlocal Agreements with Counties: Each county within the district's jurisdiction receives an annual allocation of **\$125,000** to give each county environmental office.

Well Plugging Program: Covers the full cost of well plugging up to a maximum of **\$3,500** per well.

In-house Coliform Testing: Test water samples for E. coli and coliform bacteria free with a 24-hour turn around.

Well Inspections

Annual Well Water Sampling

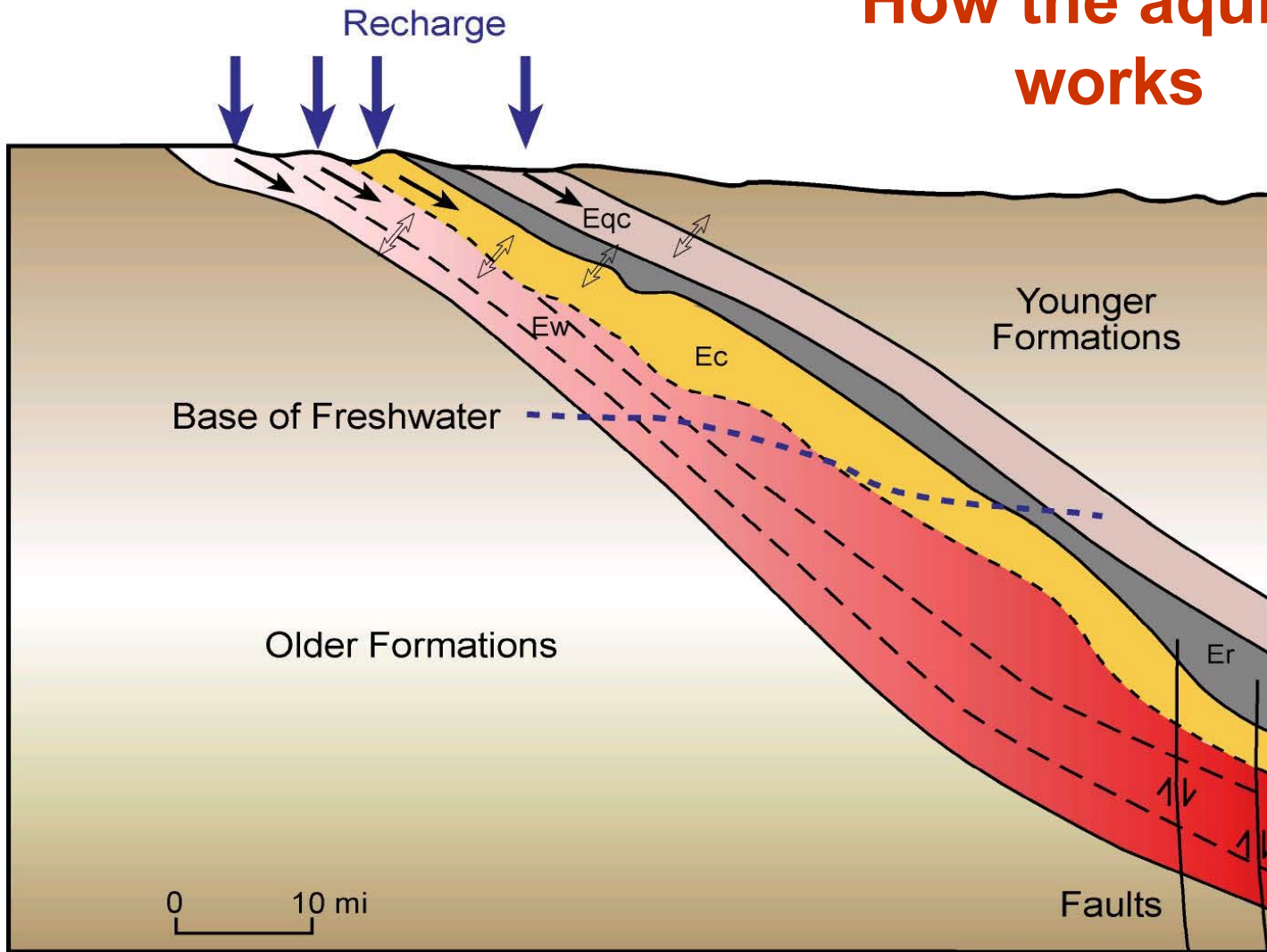


Fire Department Reimbursements

Local Aquifers and Groundwater Resources



How the aquifer works

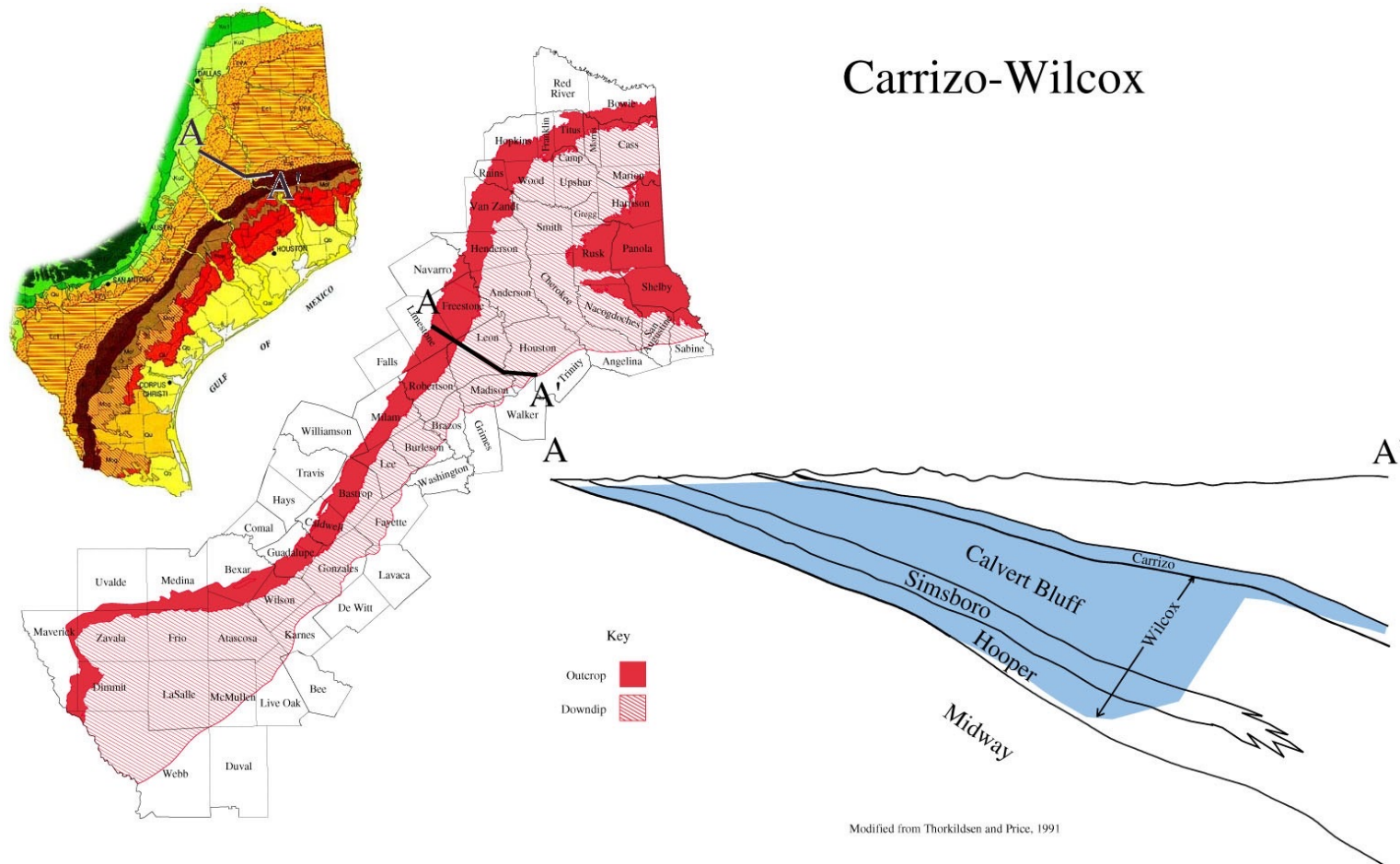


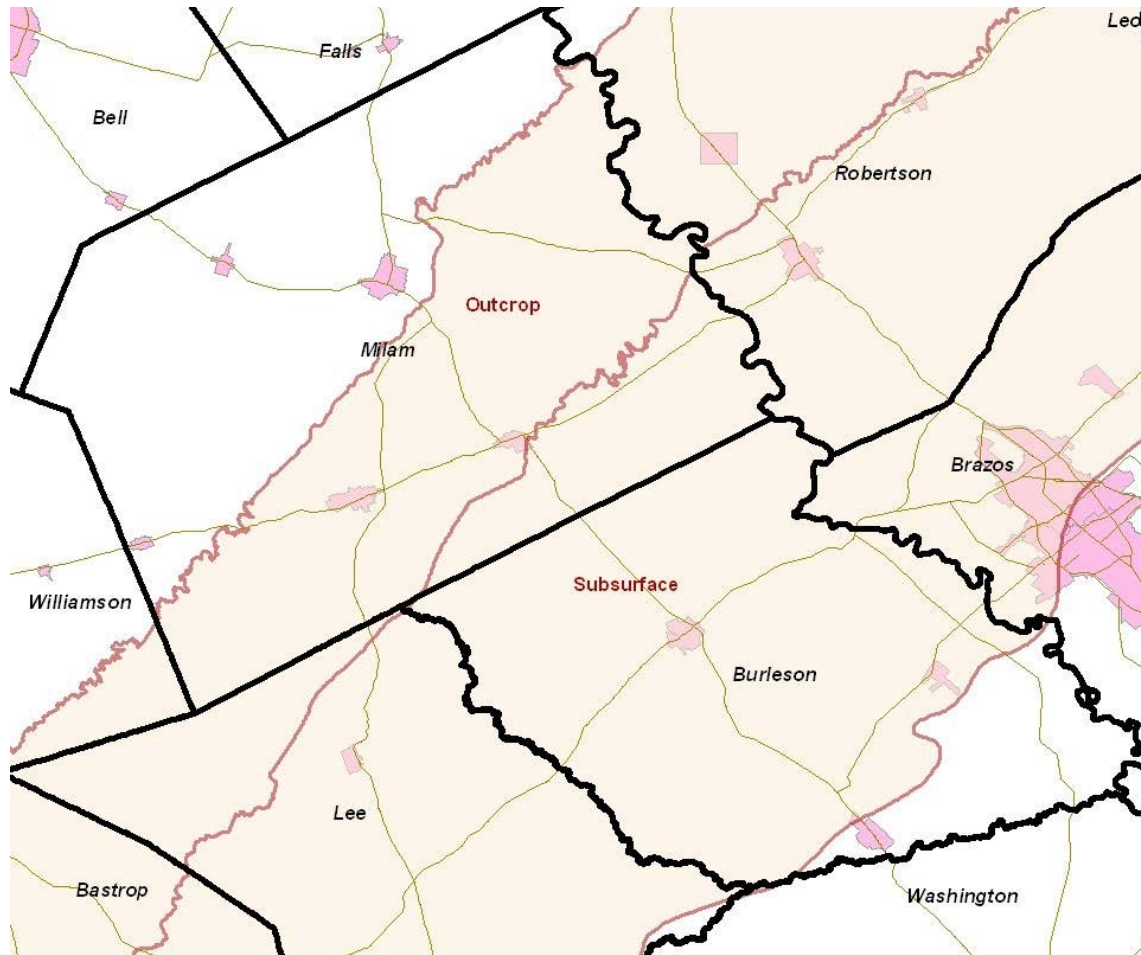
Ew = Wilcox Ec = Carrizo Er = Reklaw Eqc = Queen City

Layers of the Carrizo- Wilcox Formations

- **CARRIZO** = primarily sand
- **CALVERT BLUFF** = up to 1000 feet thick, mixture of sand & clays; layer of **lignite**
- **SIMSBORO** = 100 to 700 feet thick, sand
- **HOOPER** = oldest; mud, clay & silt

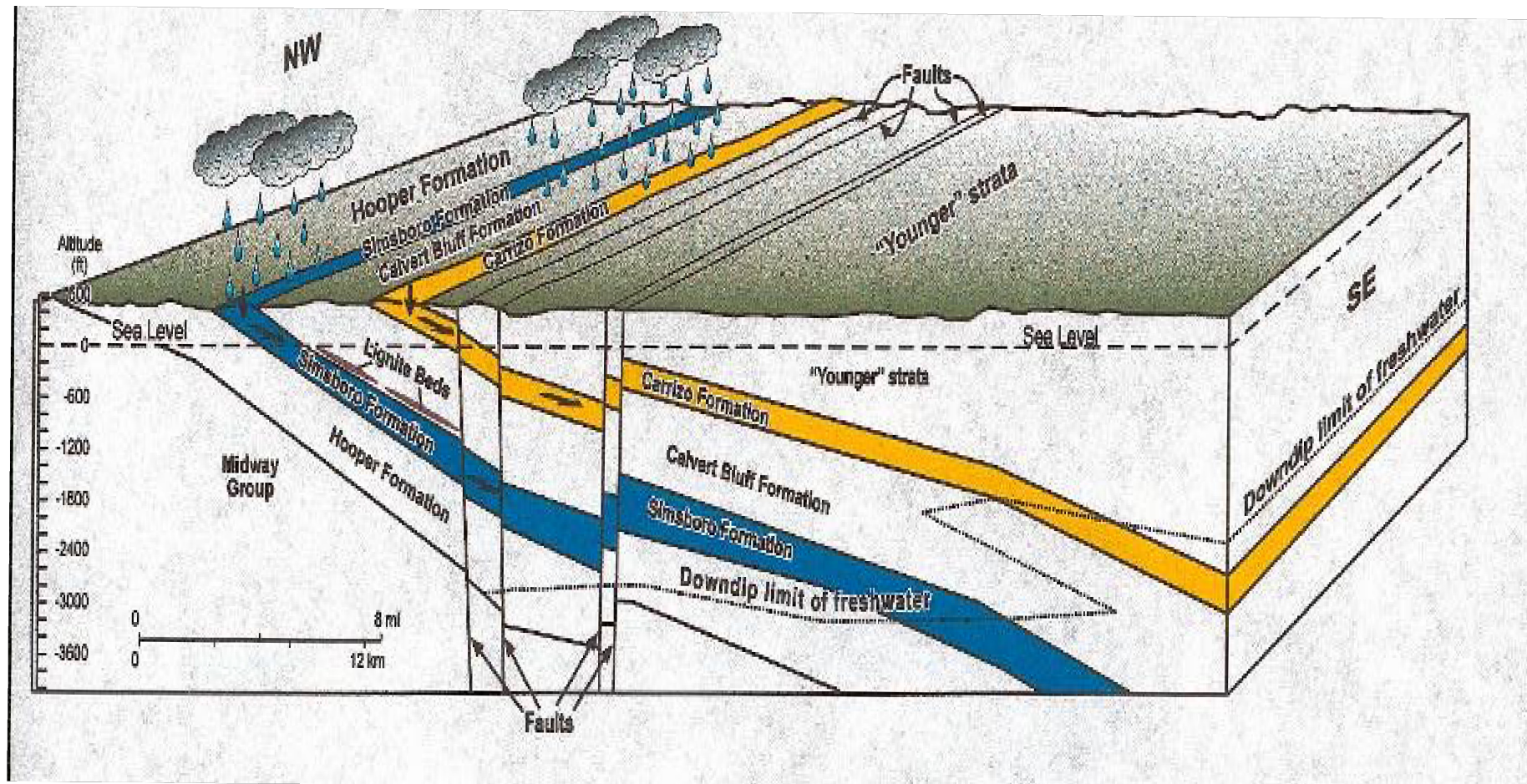
Carrizo-Wilcox Aquifer





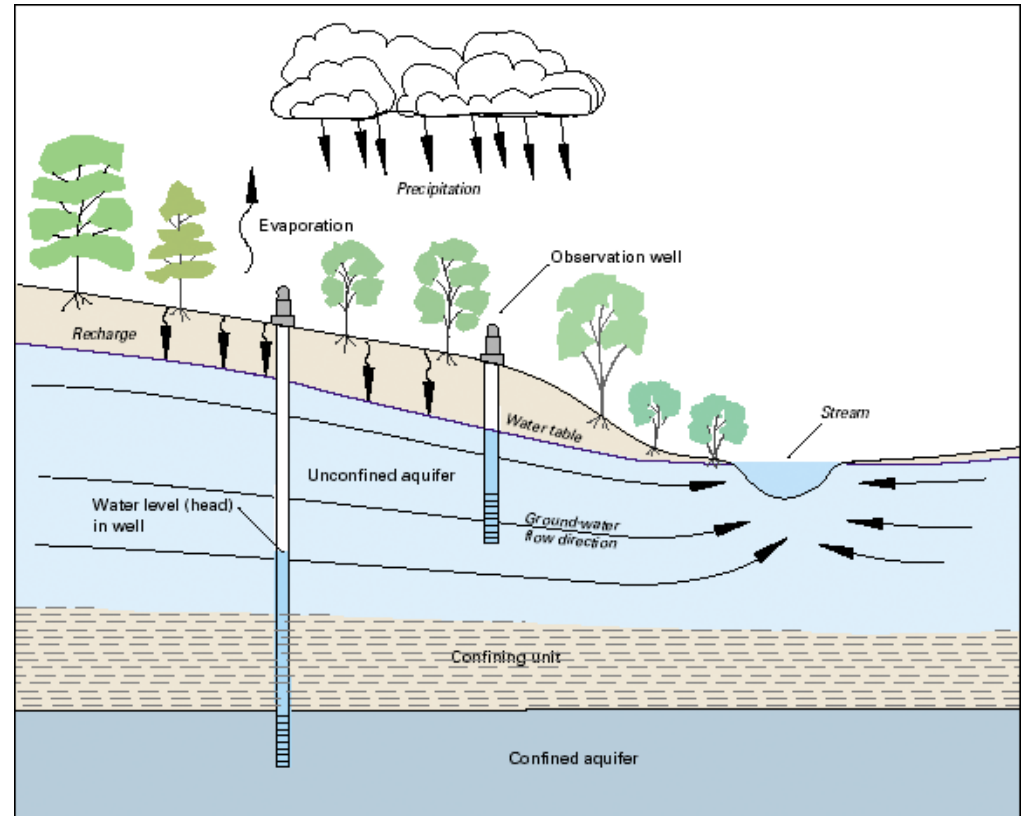
Outcrop and Subsurface Extent of Carrizo-Wilcox Aquifer

Geologic Cross Section Carrizo-Wilcox Aquifer Fault Zones



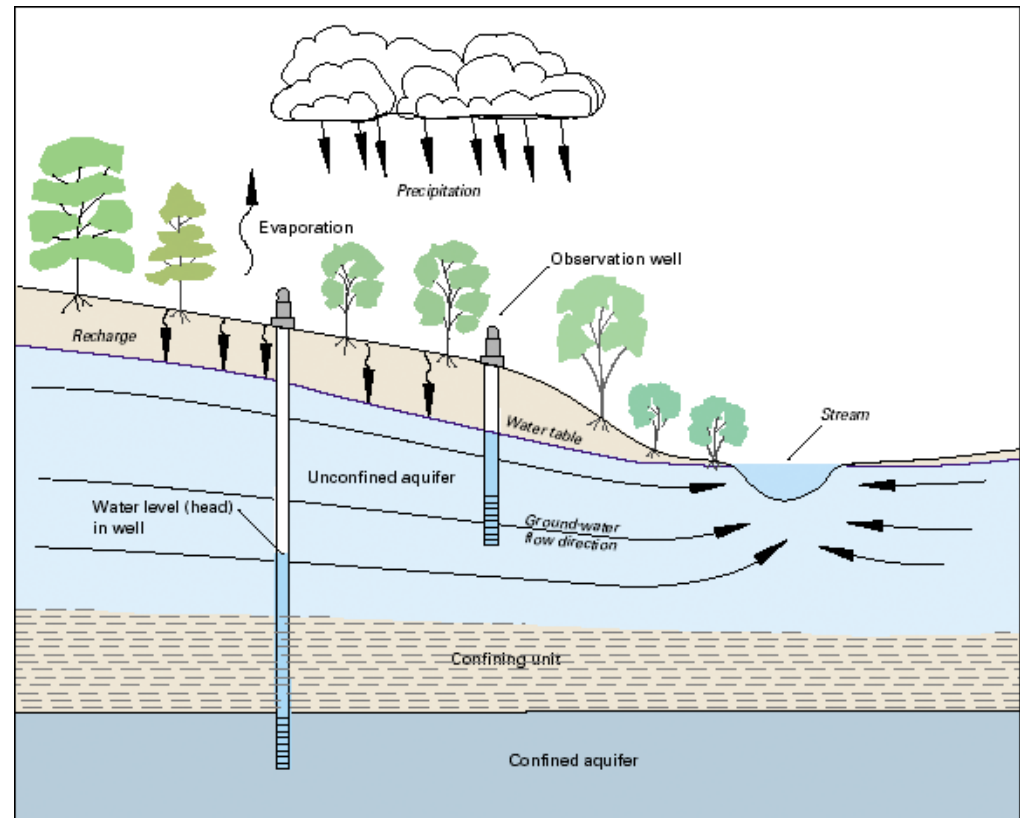
Unconfined Aquifers

- Where the water level in a well occurs below the top of an aquifer, typically at aquifer outcrops
- Recharges directly from surface water
- A decline in a well's water level represents **a reduction in the aquifer thickness** because water is **removed from the pore spaces between sands and clay**. (Young et. al., 2024)



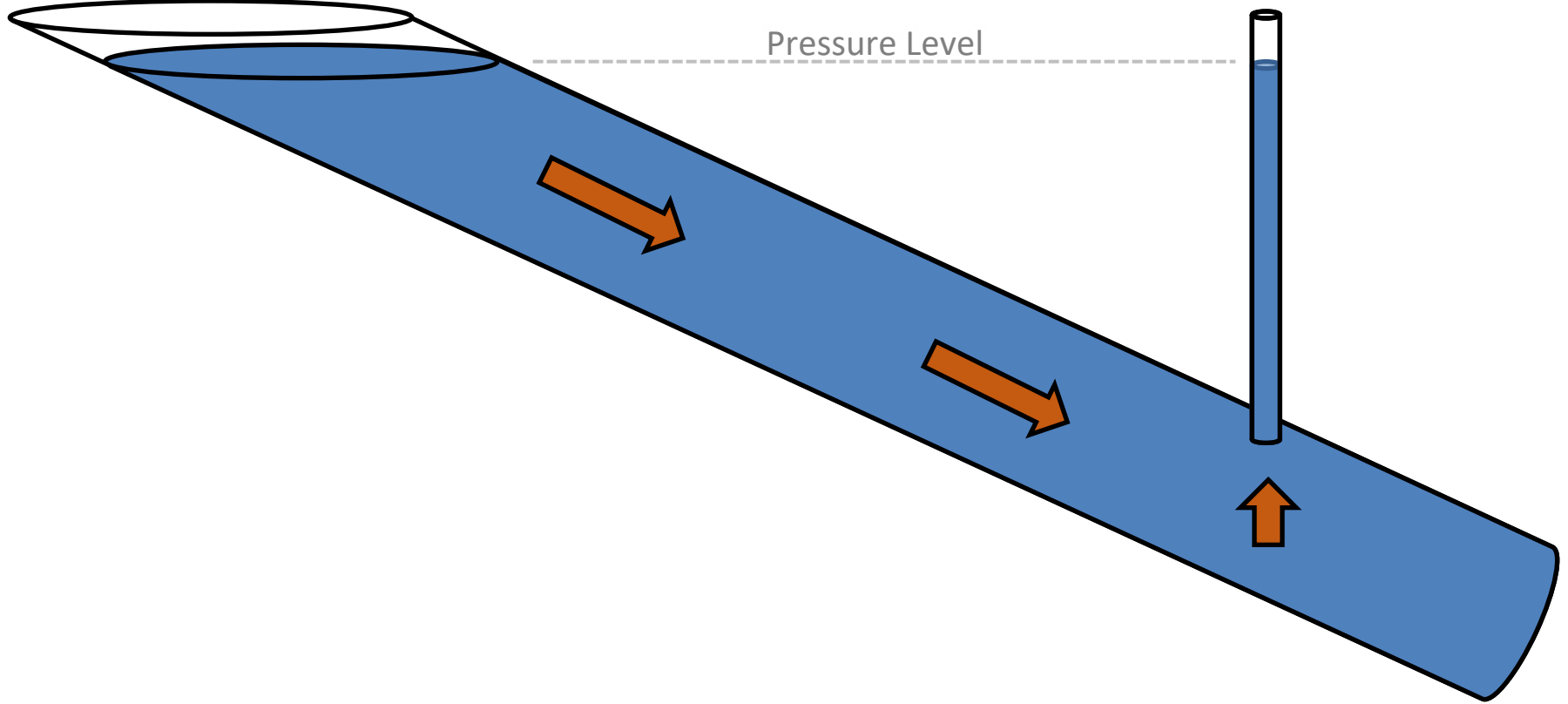
Confined Aquifers

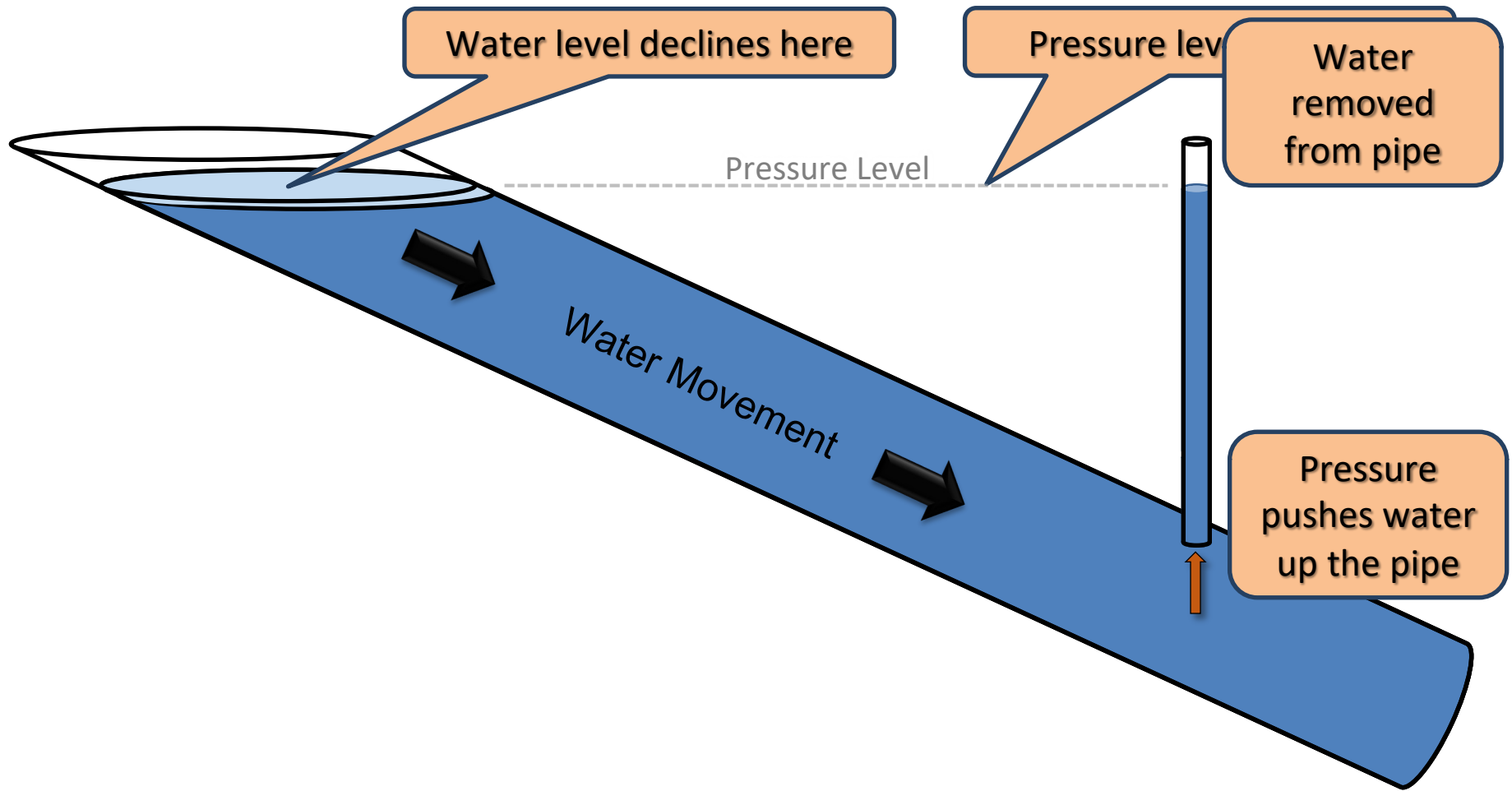
- Lies beneath a layer of impermeable rock or clay.
- Water is **under pressure due to the overlying impermeable layer.**
- Can produce water that rises above the aquifer level due to pressure.
- **A decline in a water well represents a change in hydraulic pressure of the groundwater in a saturated aquifer.**
(Young et. al., 2024)



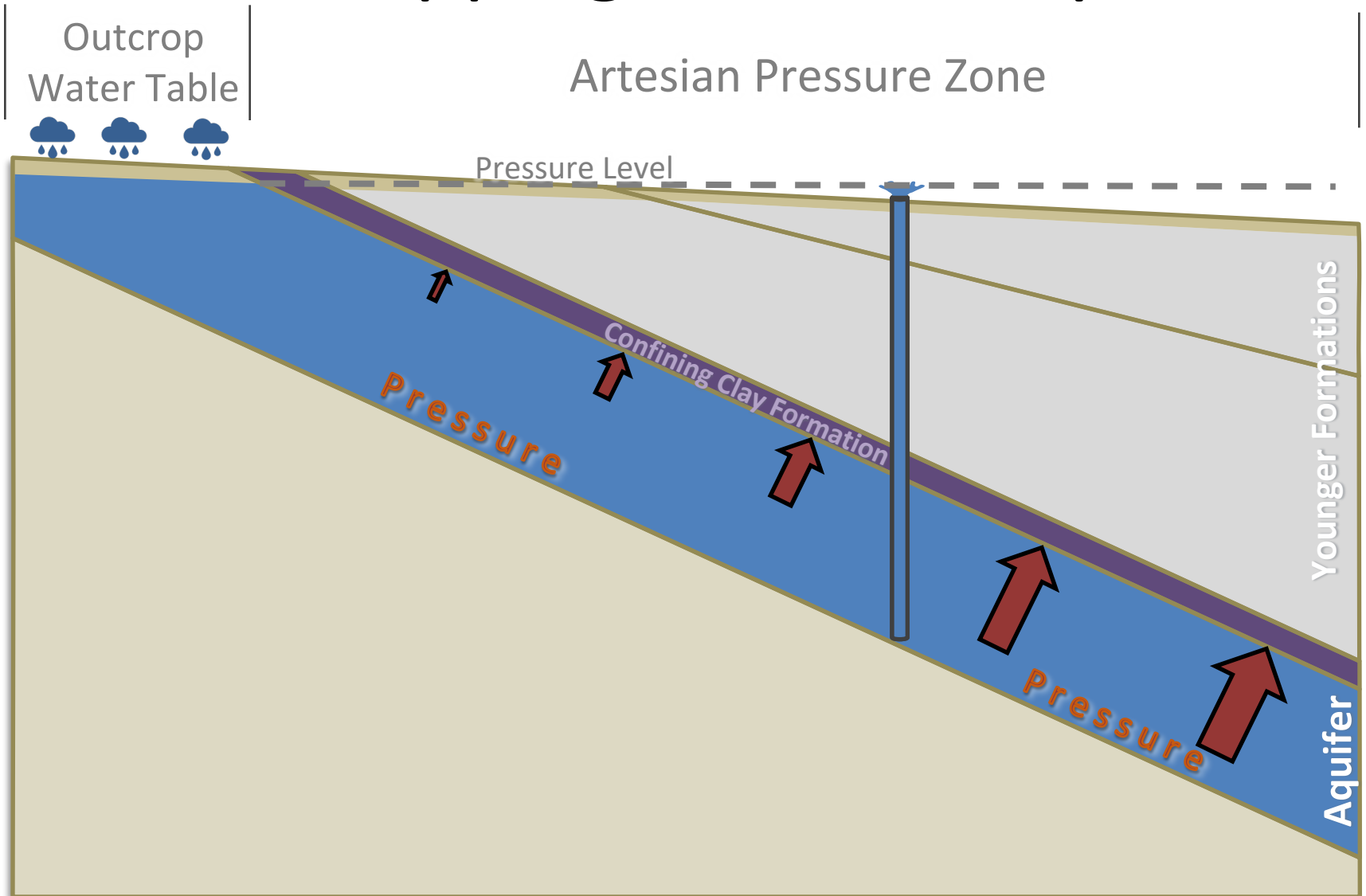
If enough drawdown occurs, a confined aquifer can become an unconfined aquifer

Pressure Example

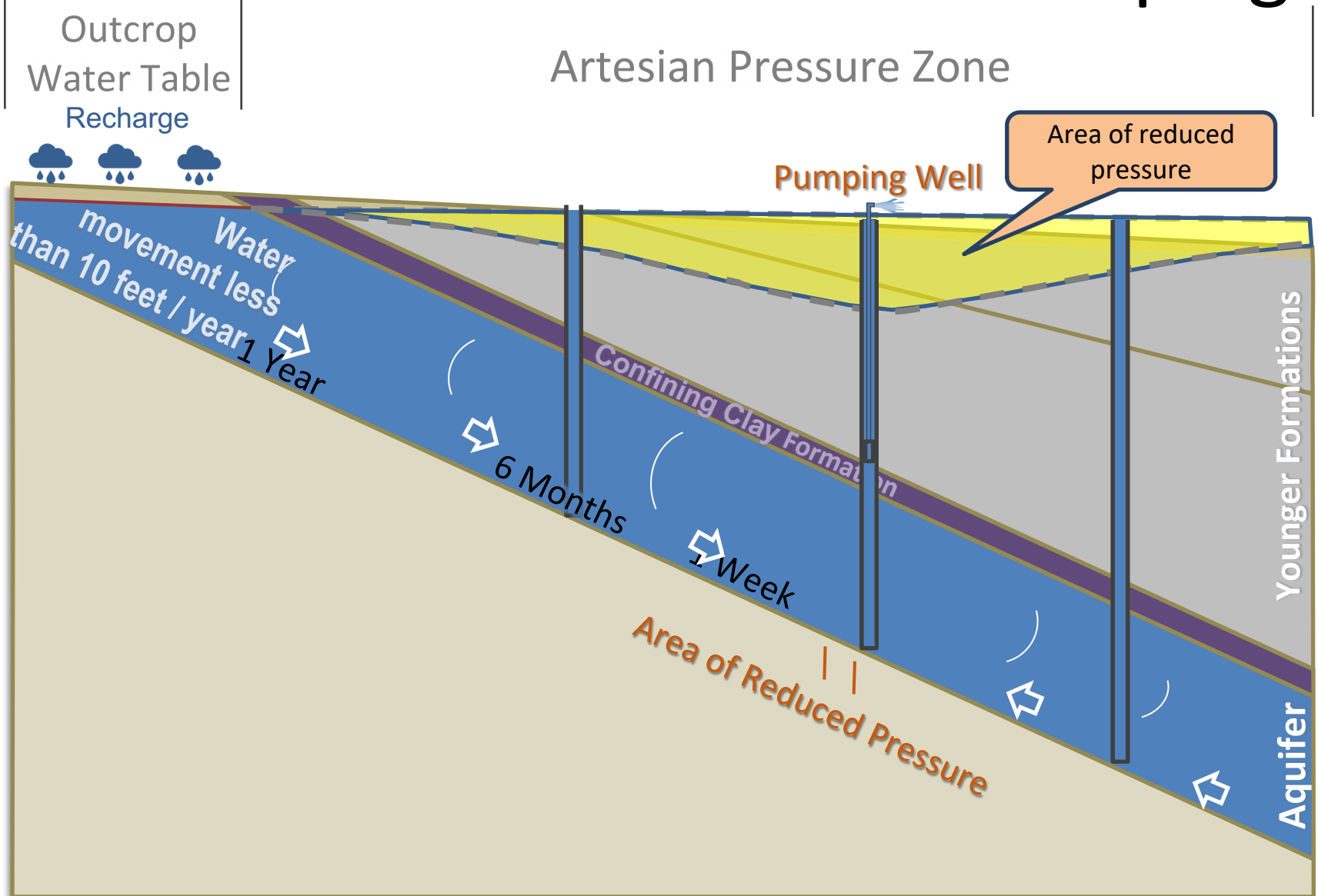




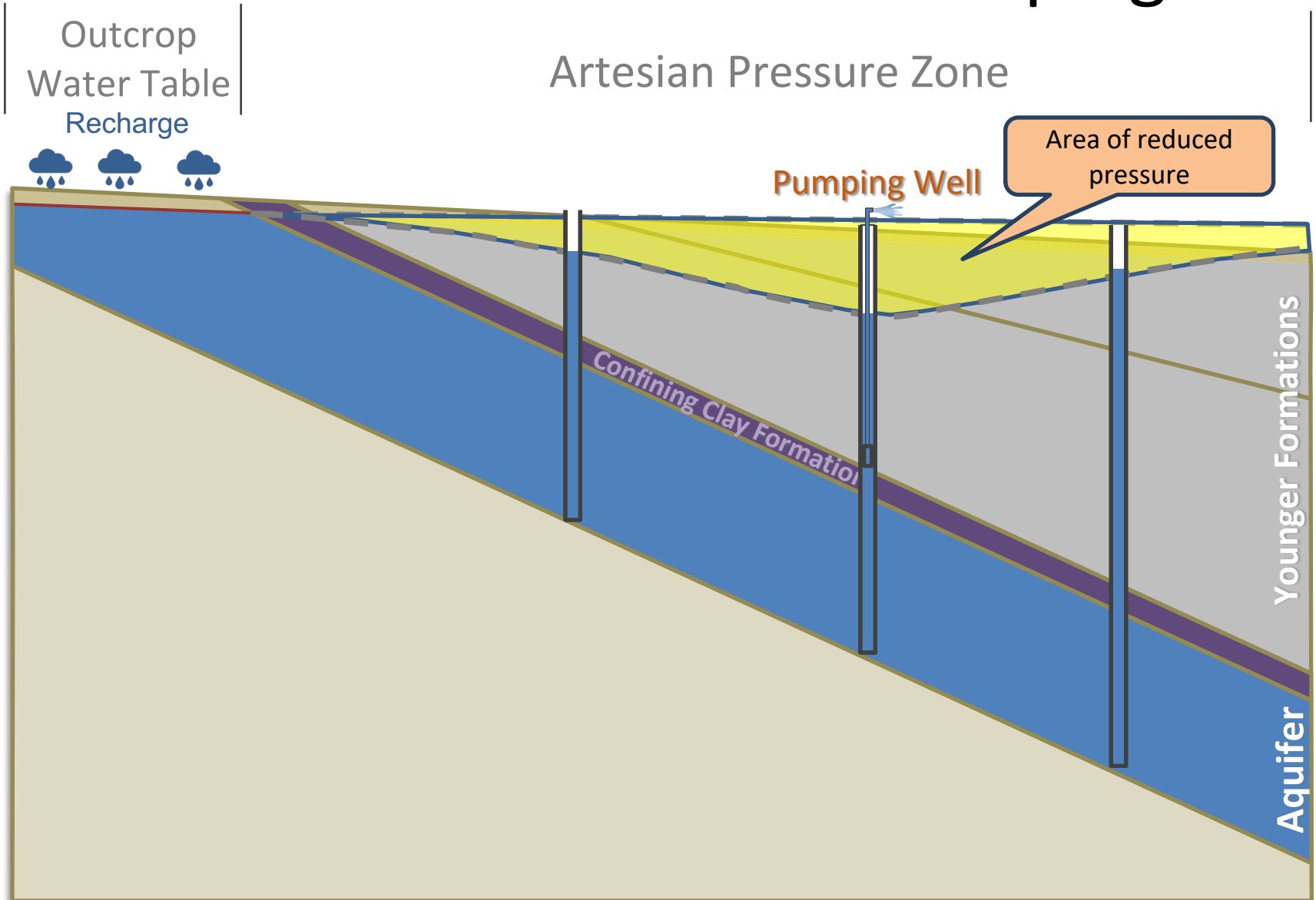
Idealized Dipping Artesian Aquifer



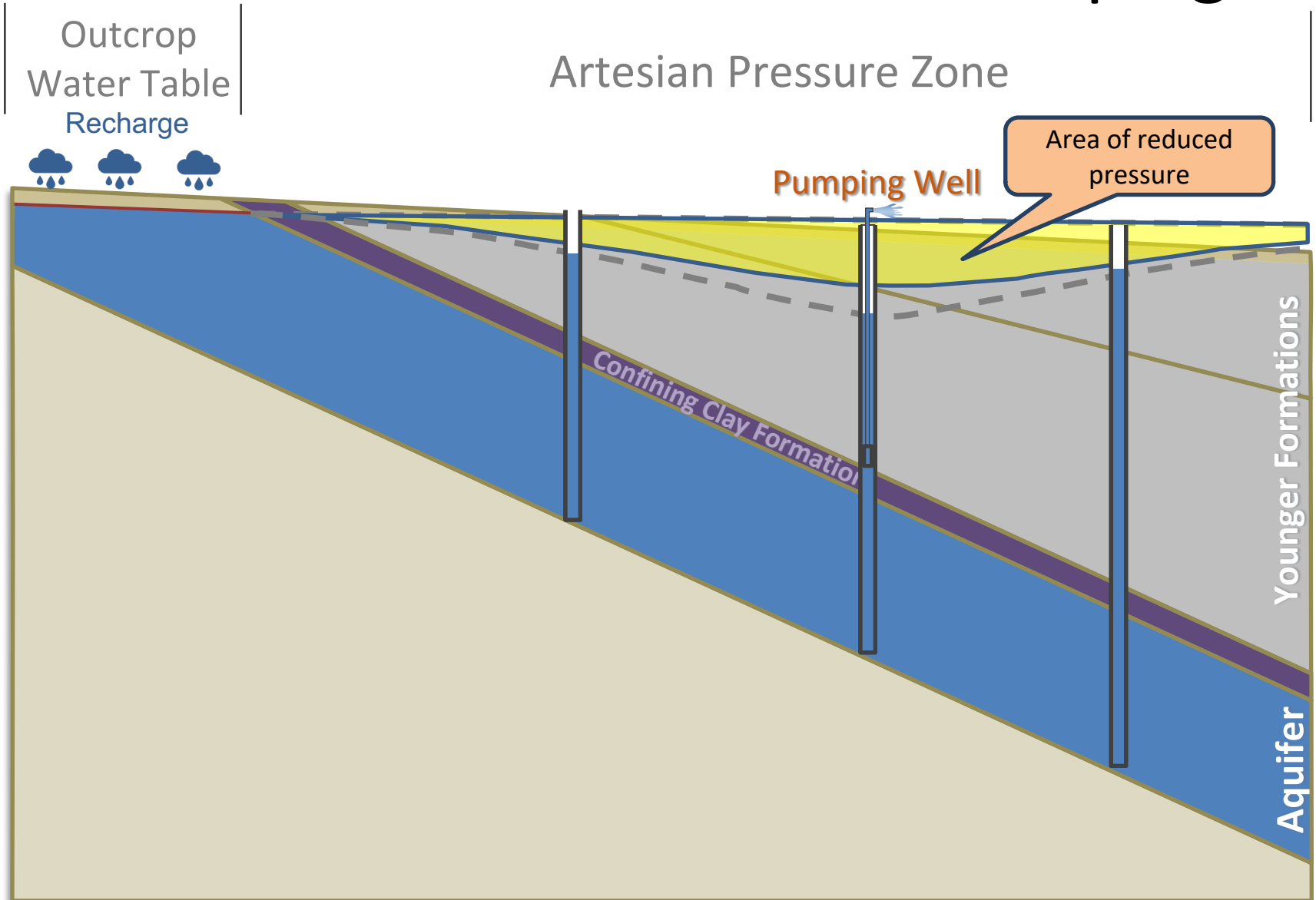
Pressure Reduction due to Pumping



Pressure Reduction due to Pumping

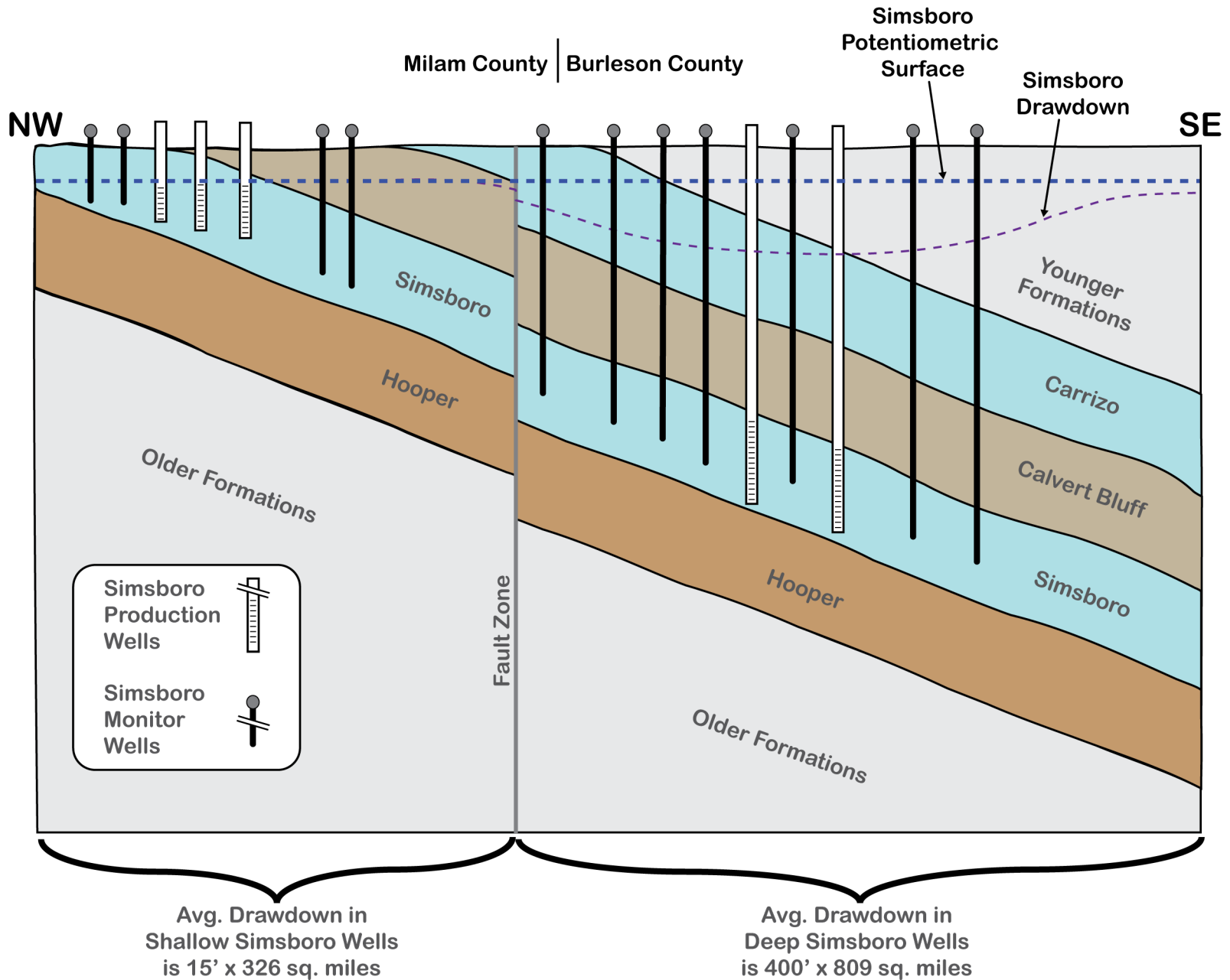


Pressure Rise with Decrease in Pumping

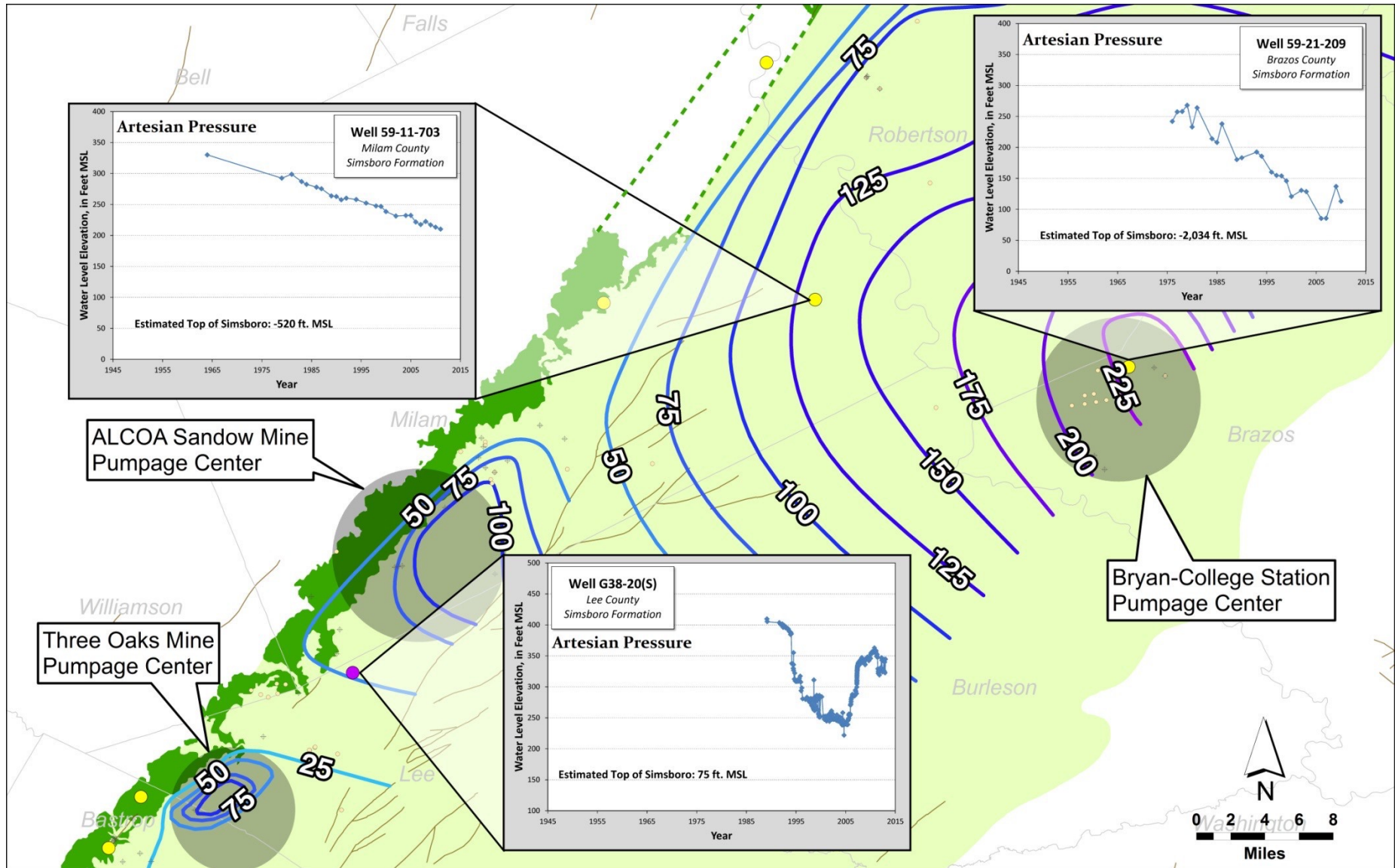


Schematic Cross Section

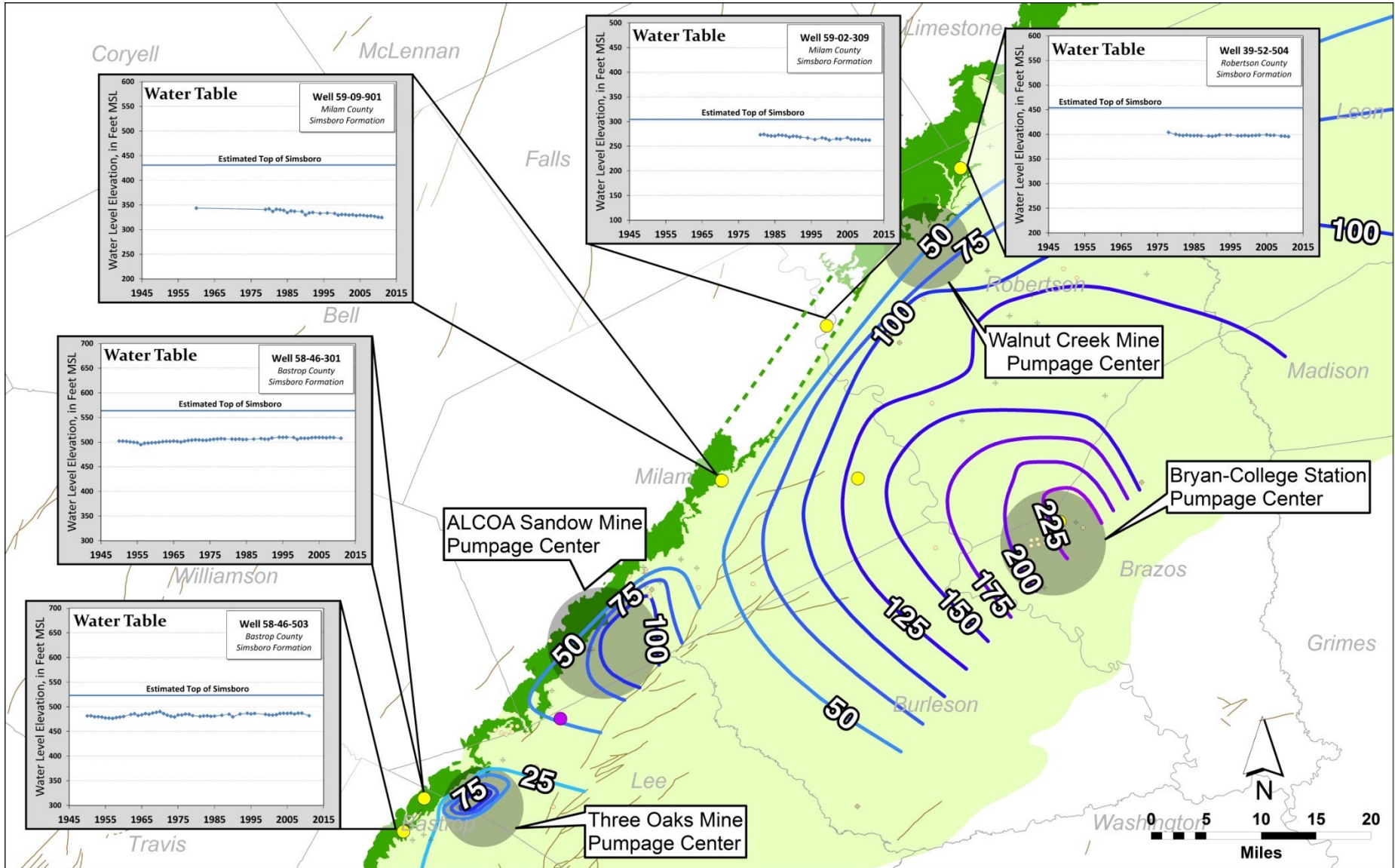
Simsboro Drawdown



Artesian Pressure Drawdown



Water Table Drawdown



GMA and Joint Planning for State Water Planning



Why Groundwater?

More than **half** of all Texans (54.9%) depend on **groundwater** for their drinking water.

- Comparatively inexpensive - drilling wells
- Costs much less than building water
- Treatment plants required to filter, purify, and disinfect surface water
- Natural filtration occurs as water percolates through layers of sand & gravel
- Groundwater is generally pure, clear and clean



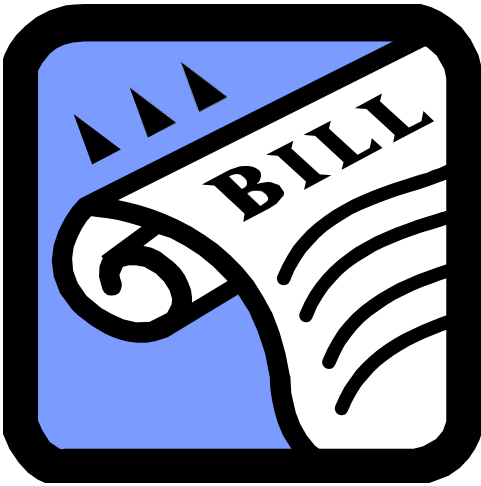
Planning- Texas Population: 2020 vs. 2070

<u>Population</u>	<u>2020</u>	<u>2070</u>
Texas	29.7 M	51.5 M
Region G	2.37 M	4.35 M

Demands (A/F)

Texas	17.6 M	19.2 M
Municipal	5.2M	8.5 M



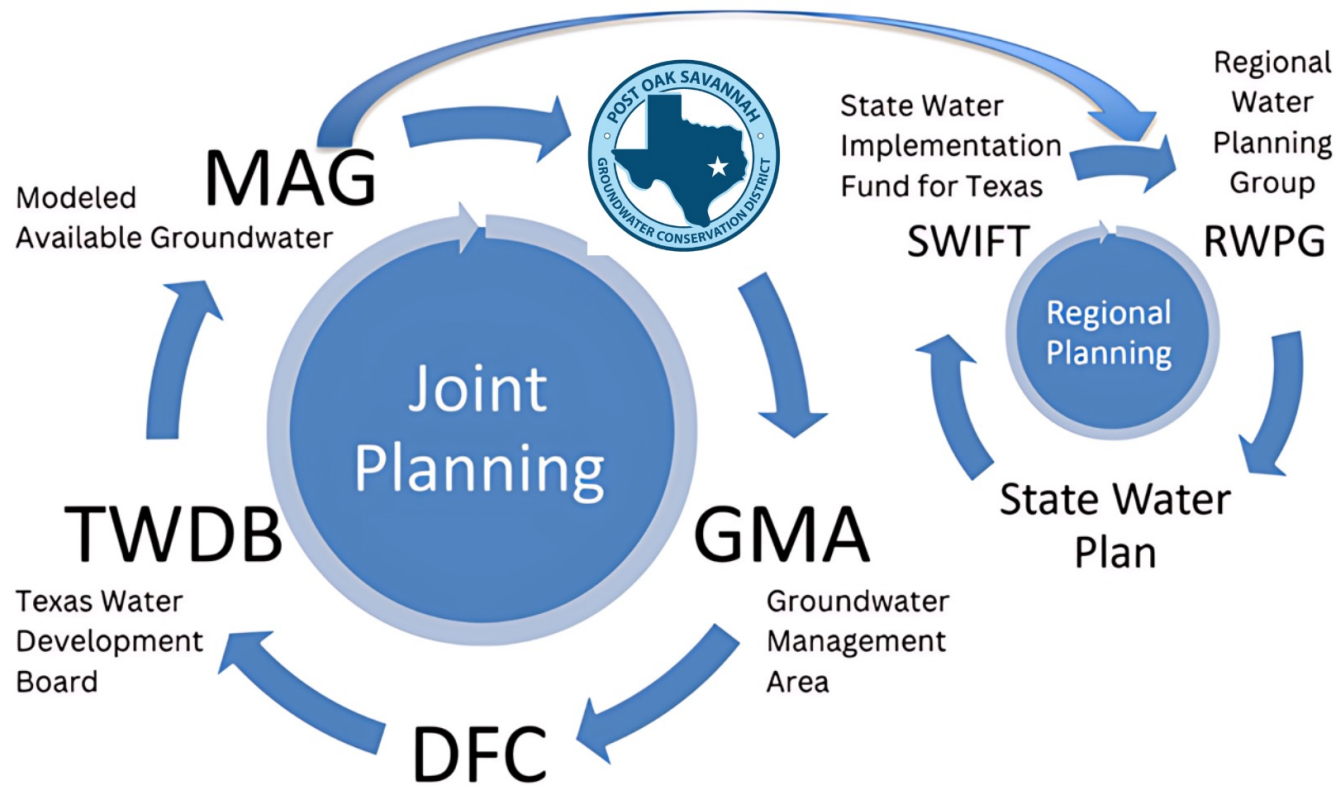


Texas State Water Planning

(think balance sheet)

- **16 Regional Water Planning Groups (RWPGs)** responsible for developing regional water plans
- Water users determine their own water demands and report them to the RWPGs
- **Groundwater Conservation Districts (GCDs)** operate within 16 **Groundwater Management Areas (GMAs)** and collaboratively adopt **Desired Future Conditions (DFCs)** to determine sustainable water use, or **Groundwater Supplies (GW)**
- **Surface Water Supplies (SW)** determined by State
- RWPGs use available GW and SW to supply data used to develop and recommend strategies to meet future water demands

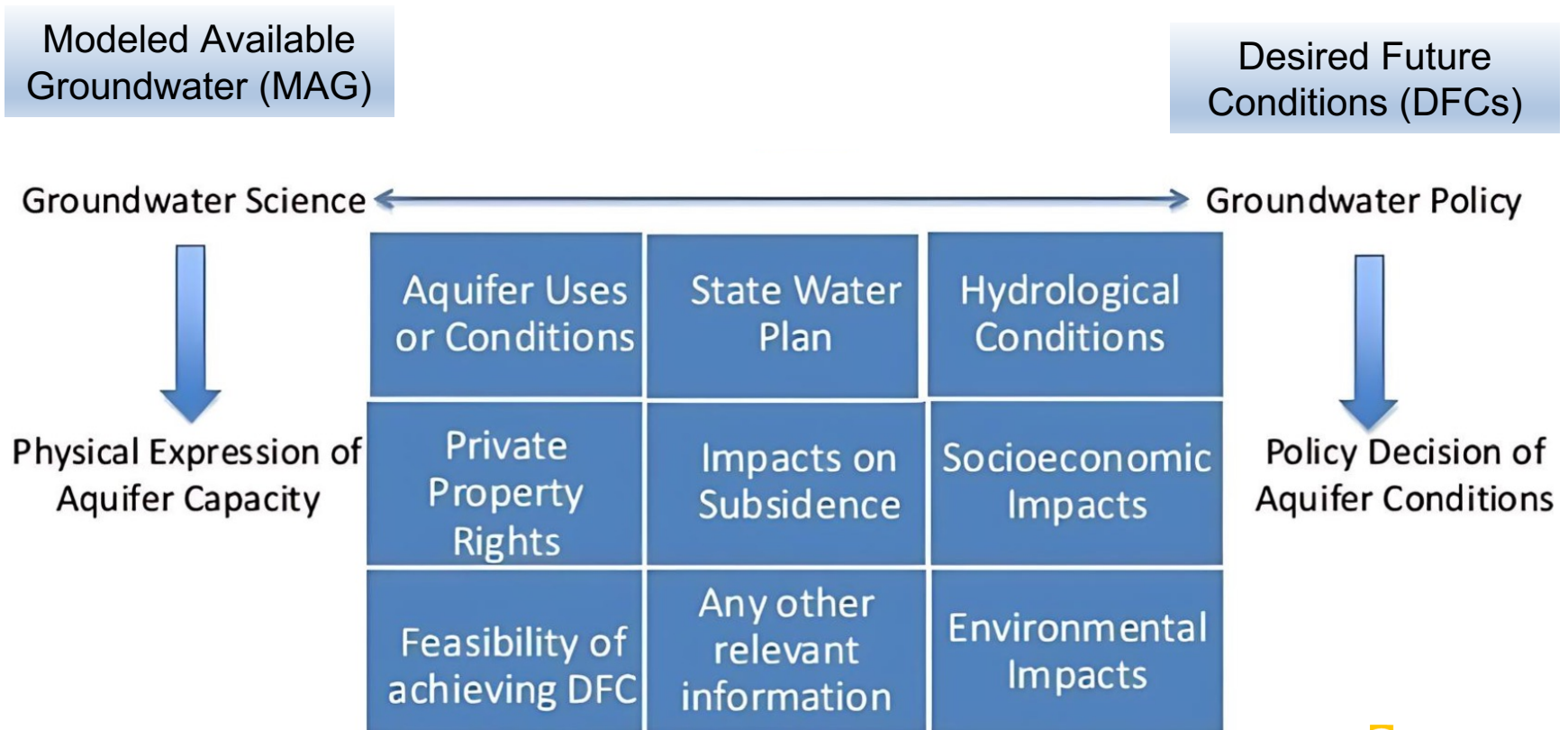
Separate and Different Processes: GCD Management vs. State Water Plan



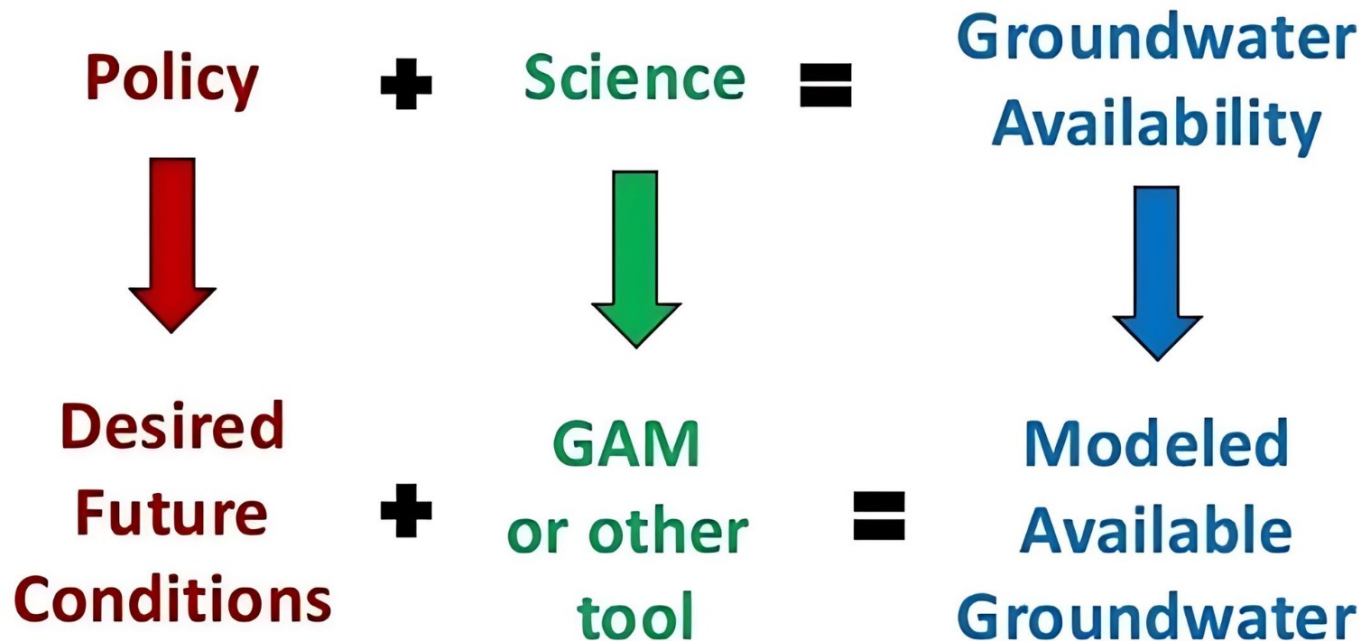
Desired Future Conditions

Credit for original graphic - TWDB

Science and Policy



What is Groundwater Availability?



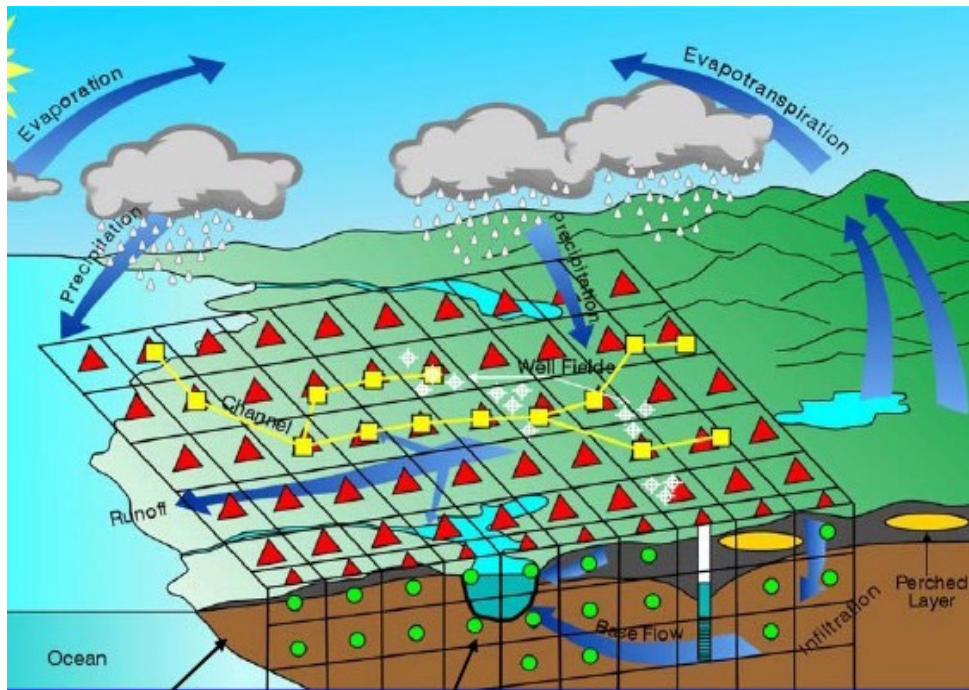
Goal: informed decision-making

Modeled Available Groundwater

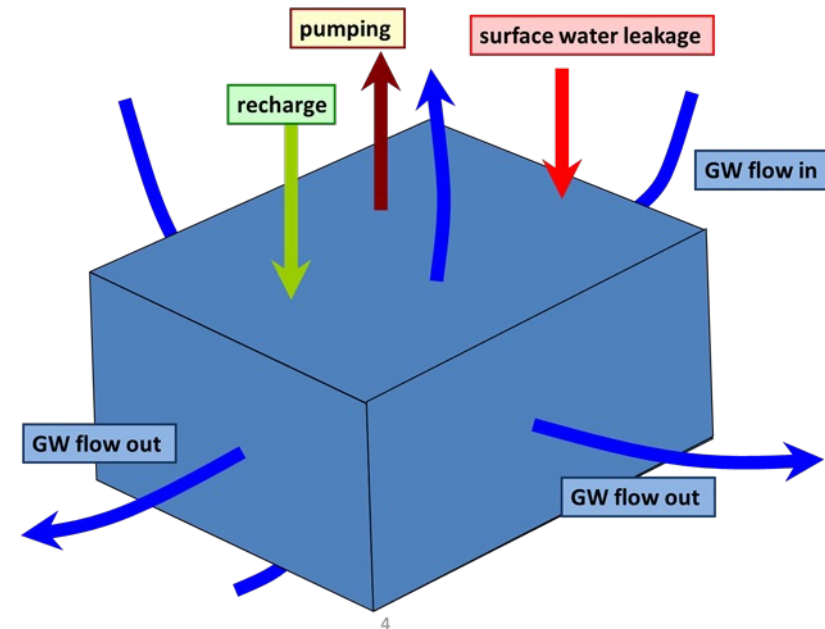
- **Modeled available groundwater** represents the **total** amount of groundwater, including both **permitted** and **exempt** uses, that can be produced from the aquifer in an average year, that achieves a “**desired future condition.**”
- It is expressed as a rate – generally in acre-feet per year.

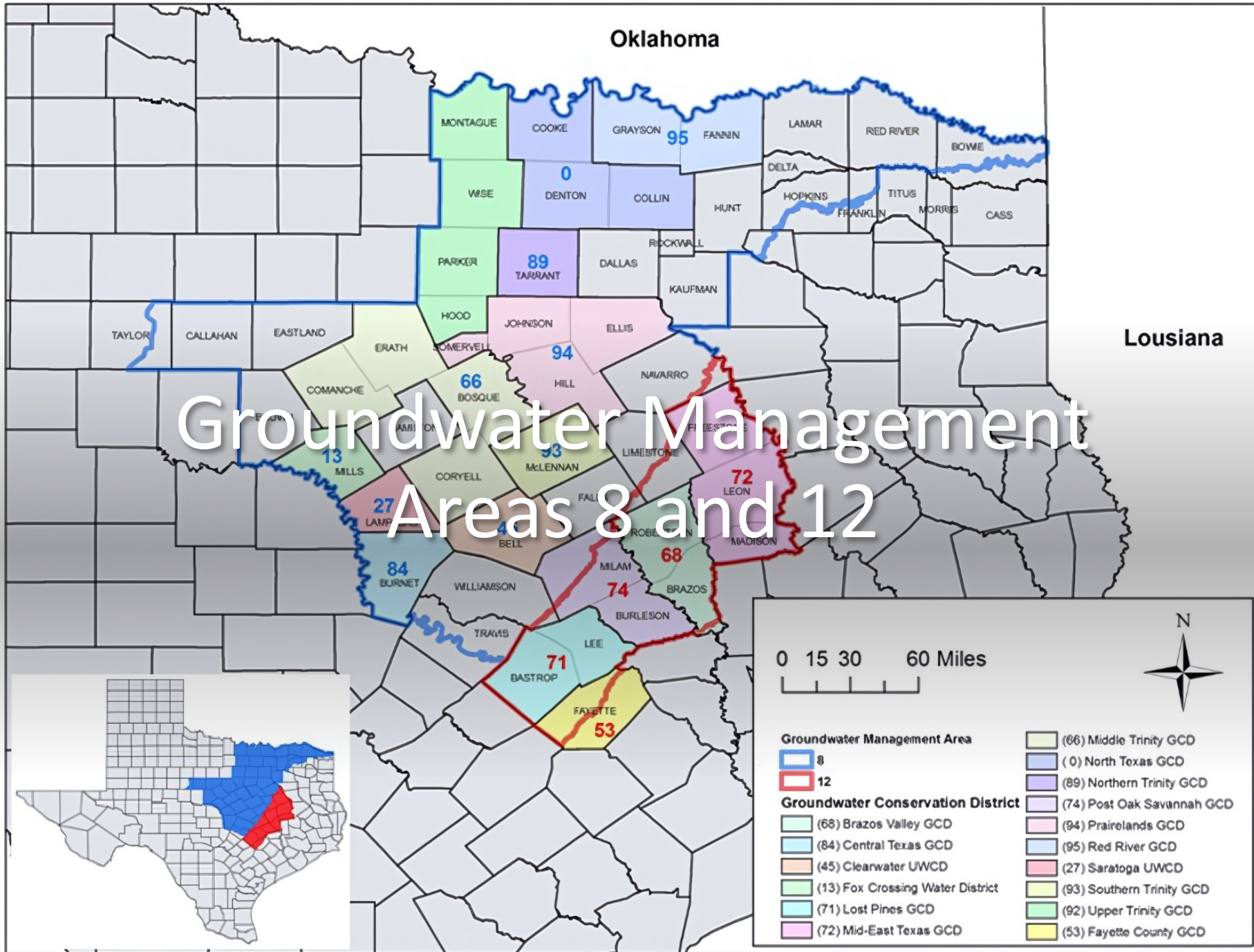
Description of Groundwater Model

- Integrates data and hydrology to predict groundwater flow
- Acts like a big Excel spreadsheet where grid cells physically represent “blocks” of aquifer material
- Water levels are predicted by solving for a water balance at each block using equations describing groundwater flow



Schematic from MODHMS MODFLOW Manual





16 Regional Water Planning Groups



**GCDs in GMAs
decide Desired Future Conditions
and deliver to TWDB**

**TWDB provides estimates
of Modeled Available Groundwater
to districts and regions**

**GCDs and RWPGs include
Managed Available Groundwater
in plans**

