

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

Presented to Little River Basin Master Gardeners



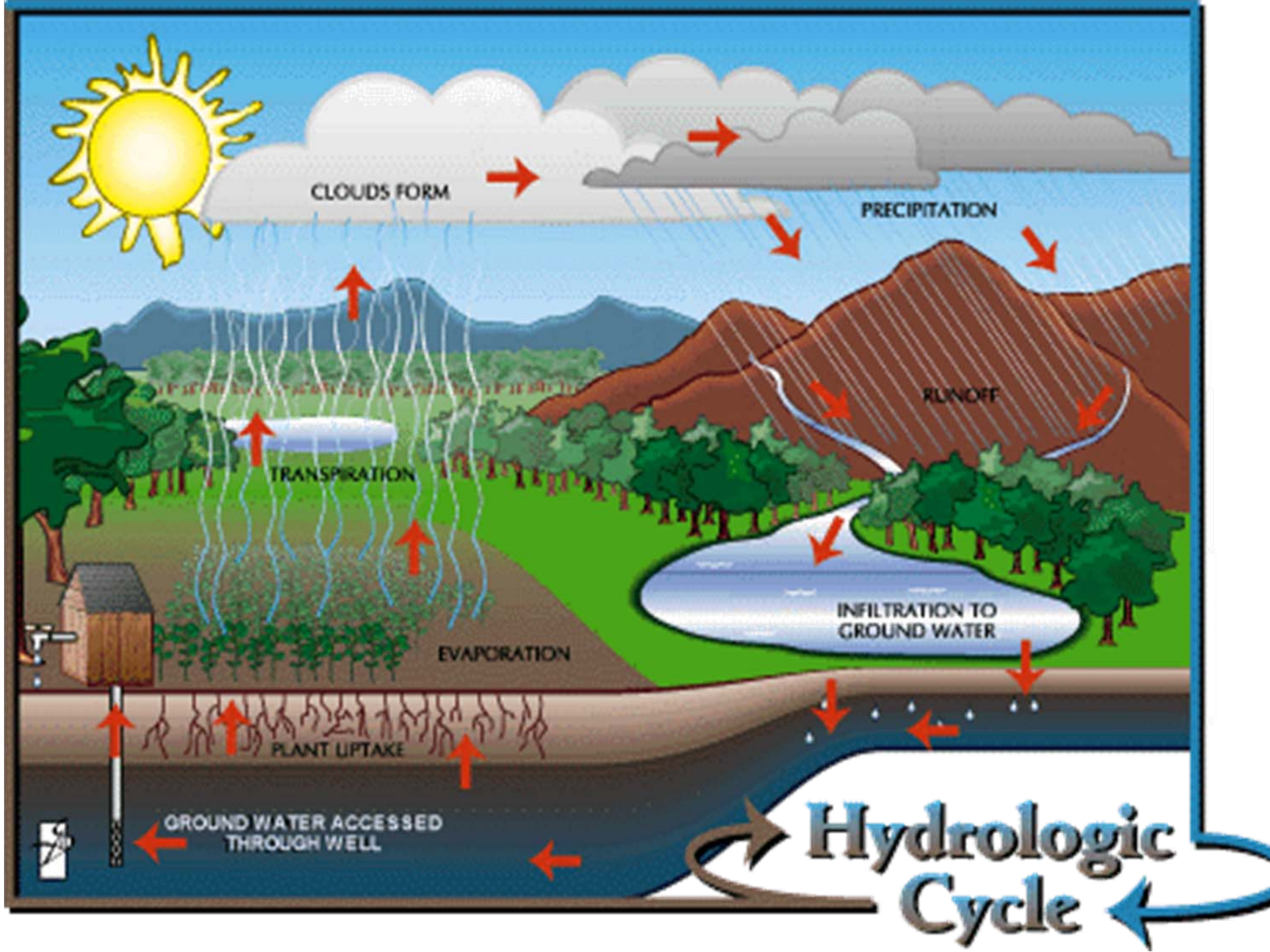
Gary Westbrook, General Manager
Post Oak Savannah GCD
August 17, 2011

Serving the citizens of Milam and Burleson Counties

Agenda

1. Texas Water Resources
2. Texas Water Management
3. GCDs- Powers and purposes
4. Why POSGCD in Burleson and Milam counties
5. Groundwater Resources and Management strategies within POSGCD

Texas Water Resources



CLOUDS FORM

PRECIPITATION

RUNOFF

TRANSPIRATION

EVAPORATION

INFILTRATION TO GROUND WATER

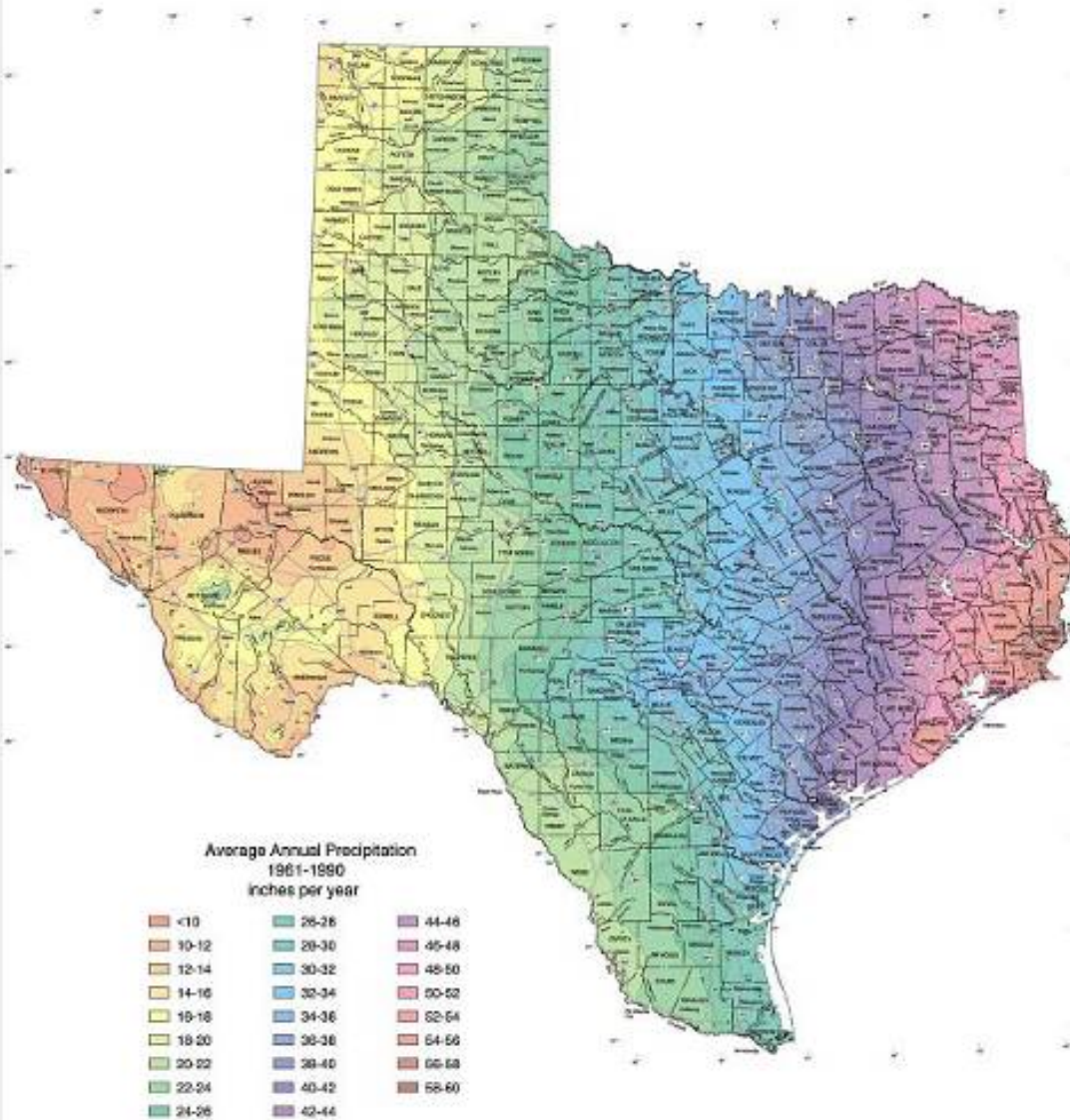
PLANT UPTAKE

GROUND WATER ACCESSED THROUGH WELL

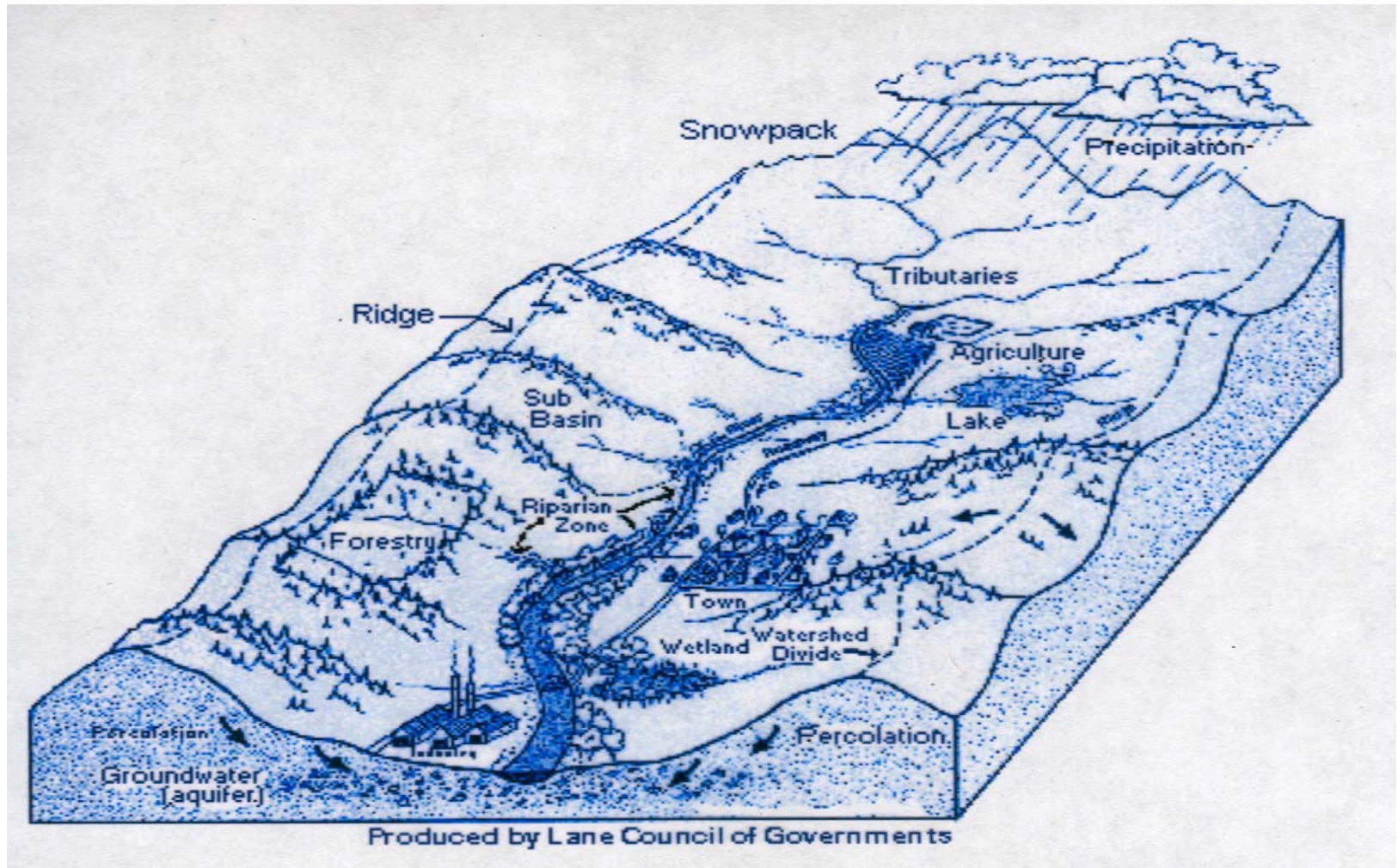
Hydrologic Cycle

TEXAS

ANNUAL PRECIPITATION

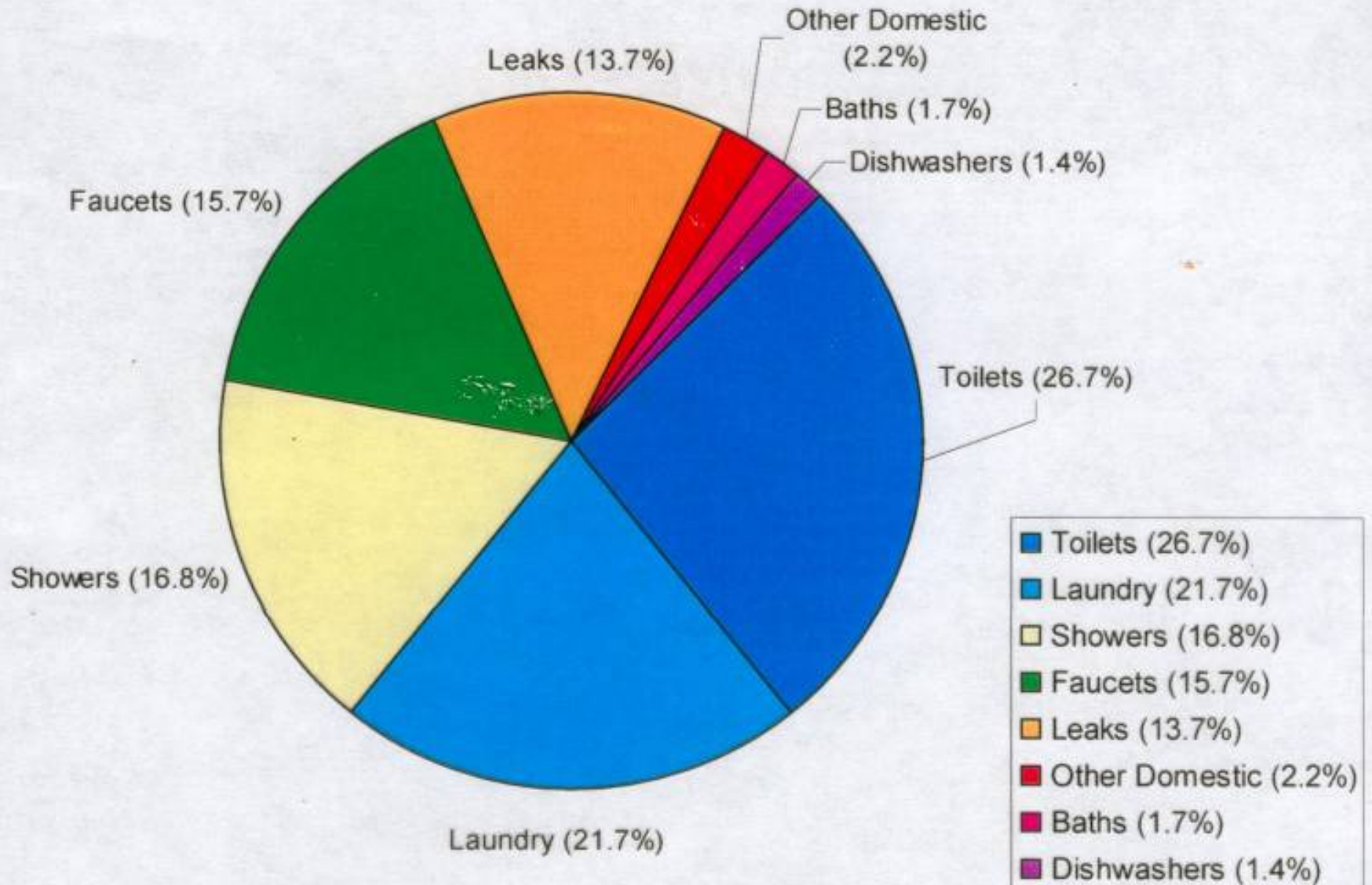


Watershed

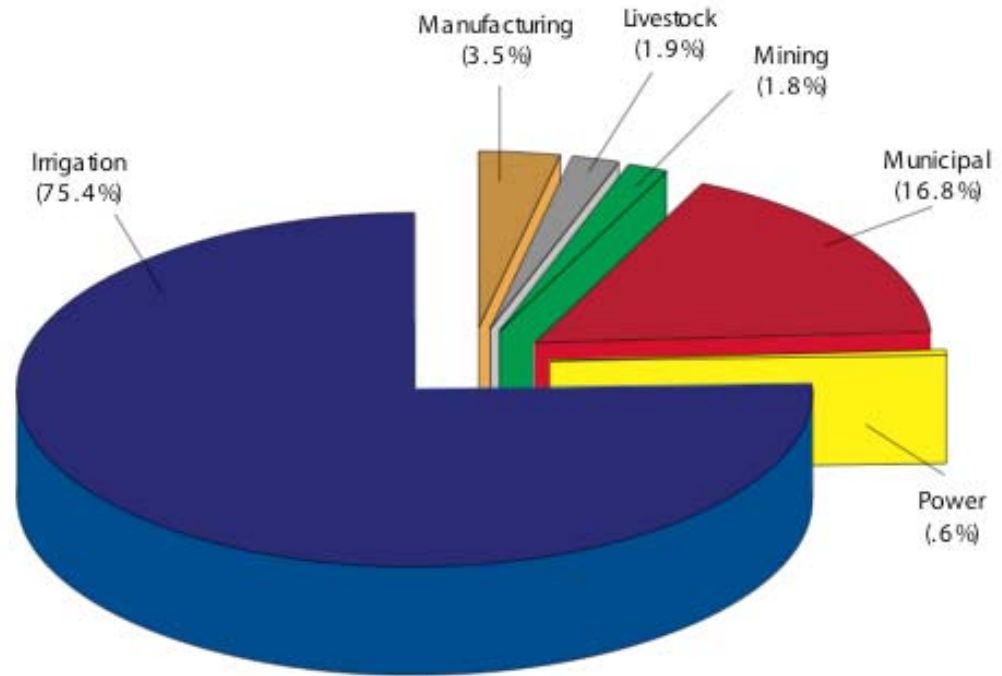


Many watersheds make a river basin.

Indoor Water Use (American Avg. 60 GPD)



Groundwater Use in Texas, 1992



Outdoor Water Use

(American Avg. 120 GPD)

Agriculture Irrigation

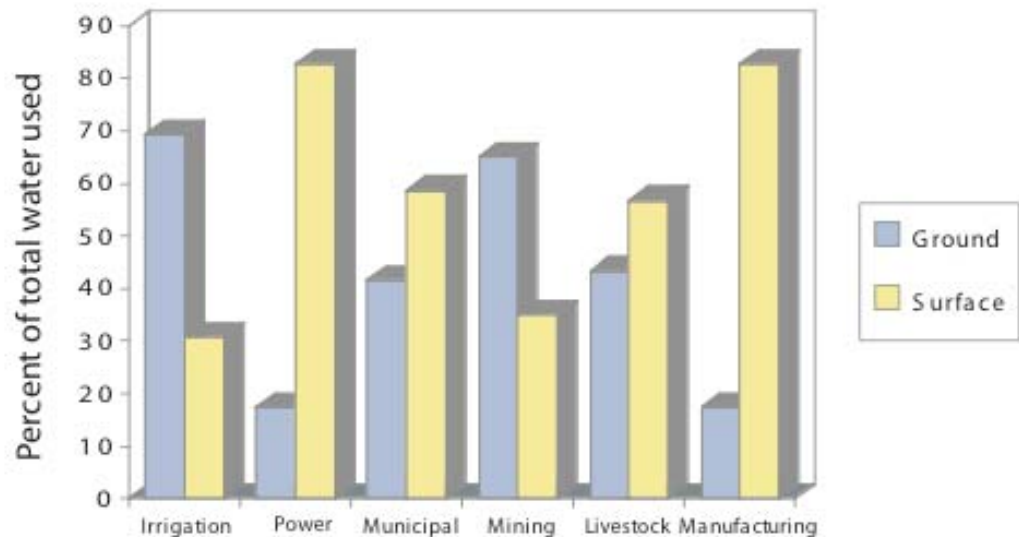
Coastal Bermuda hay

Pecans ~ Corn ~ Milo

Soybeans ~ Melons

Turf Grasses ~ Wheat

Cotton



How much water does it take?



6 gallons



120 gallons



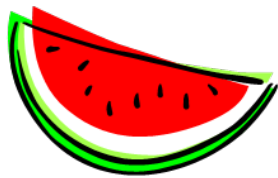
65 gallons



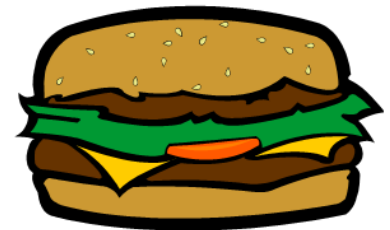
3 gallons



65,000 gallons!!!

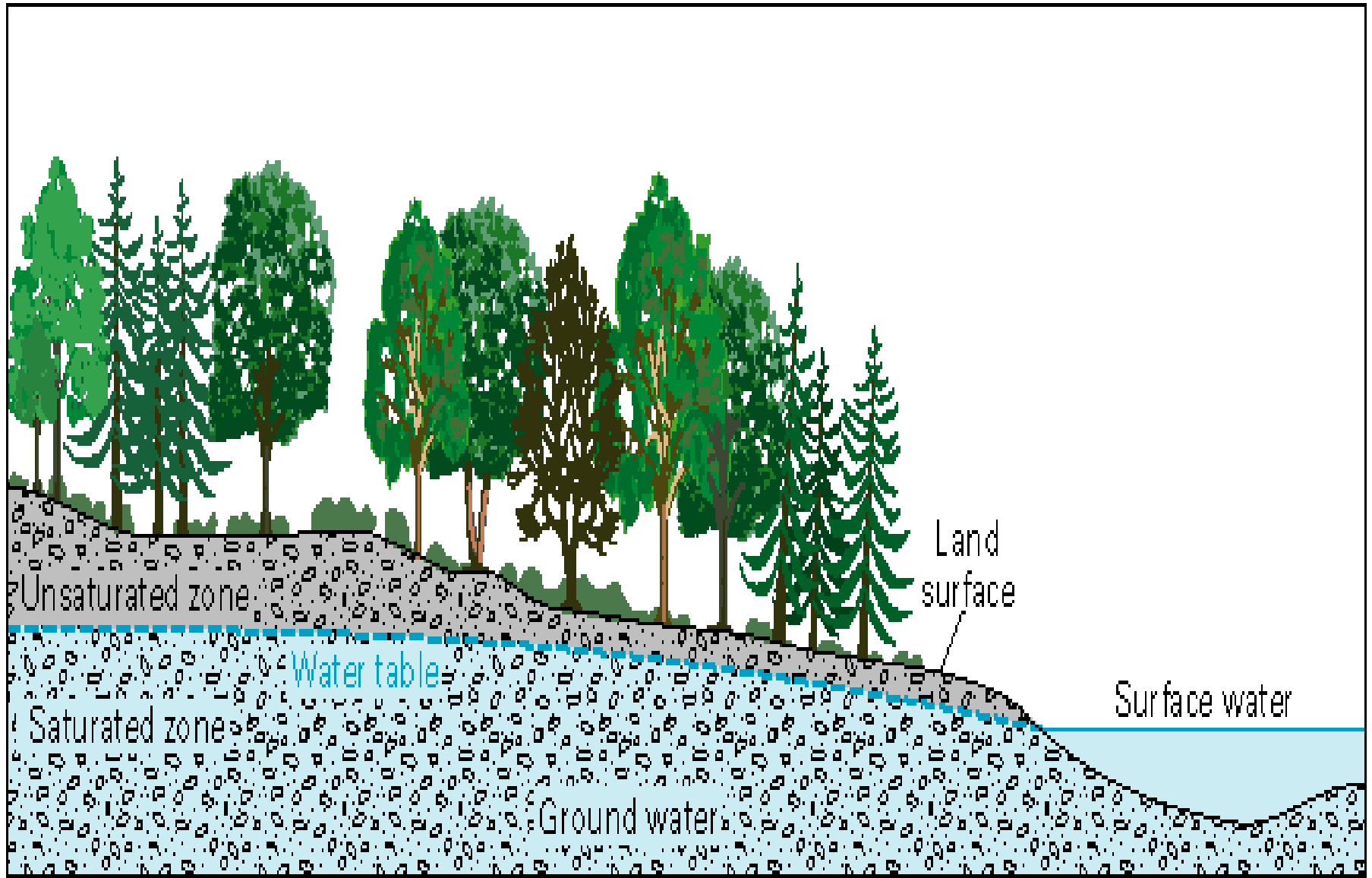


100 gallons



1,300gallons

Groundwater System



More than **half** of all Texans (54.9%)
depend on **groundwater** for their drinking water.
Where does your drinking water come from?

Why Groundwater?

- 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

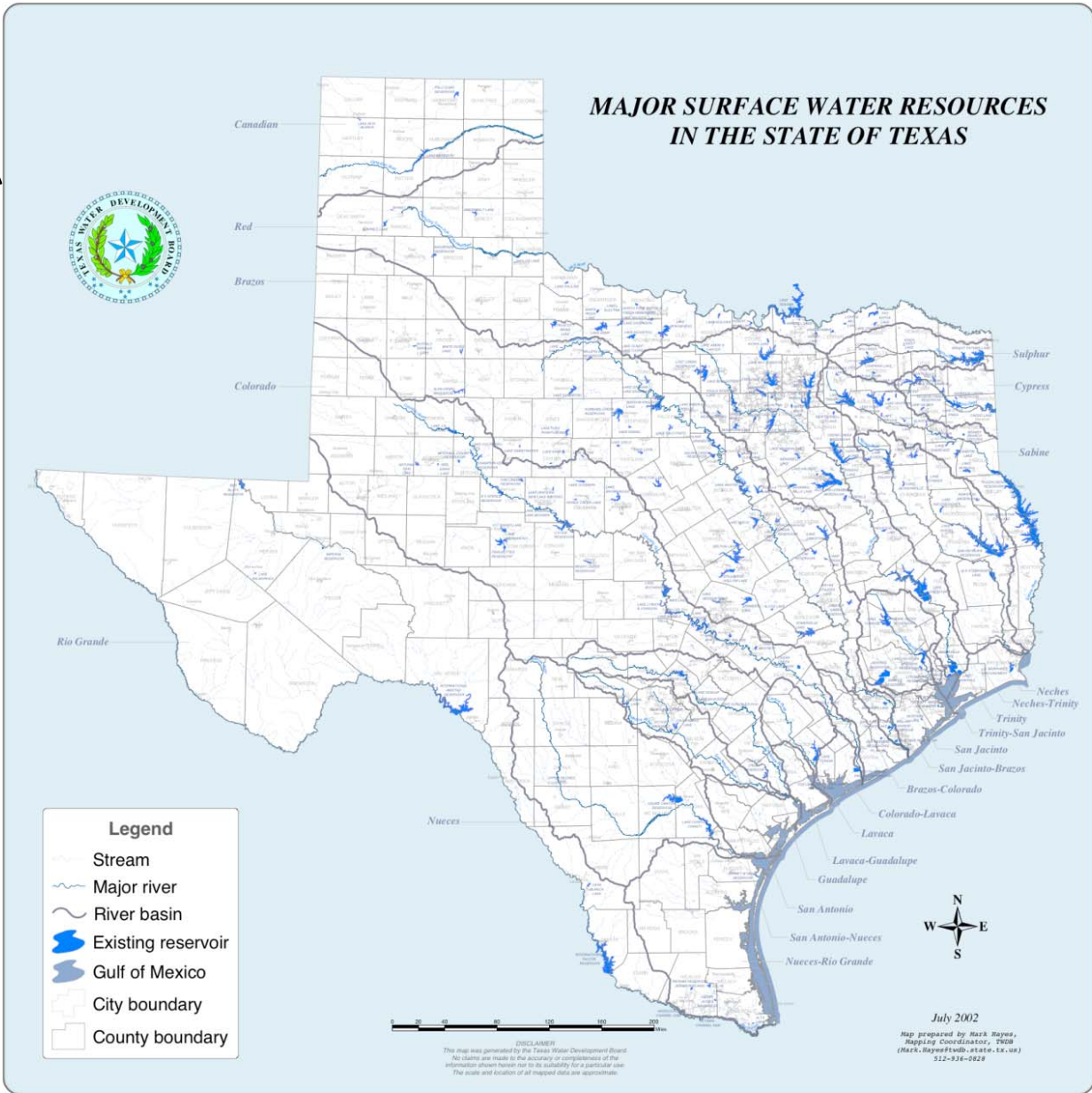
Texas Water Management

Planning- Texas: 2000 vs. 2060

	<u>2000</u>	<u>2060</u>
<u>Population</u>		
Texas	20 M	45.5 M
Region G	1.6 M	3.3 M
<u>GW Demands (A/F)</u>		
Texas	16.9 M	21.6 M
Municipal	4 M	8.2 M

SURFACE WATER

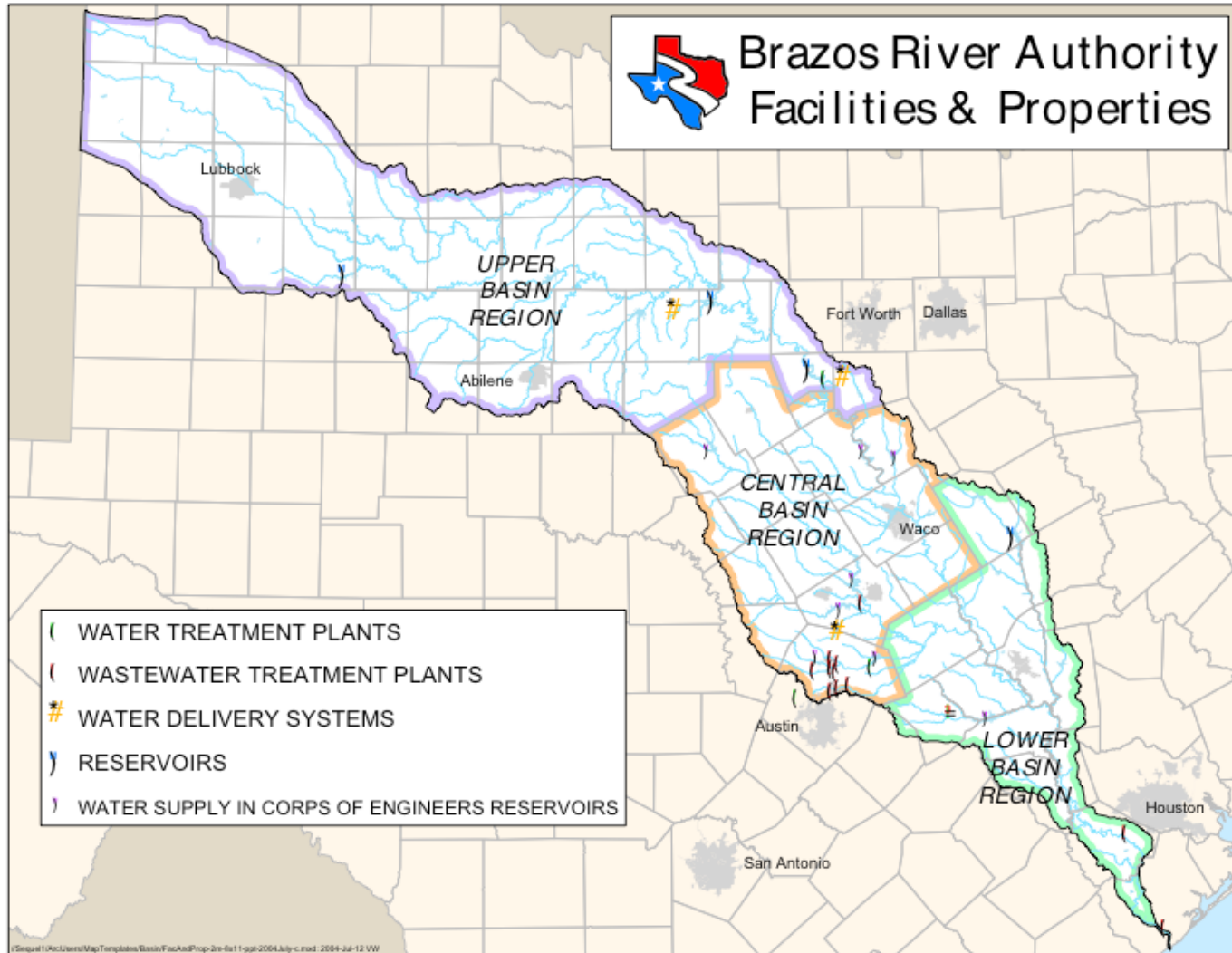
is regulated by
River
Authorities



Major River Basins In Texas



Brazos River Authority



Groundwater in Texas aquifers is regulated by Groundwater Conservation Districts

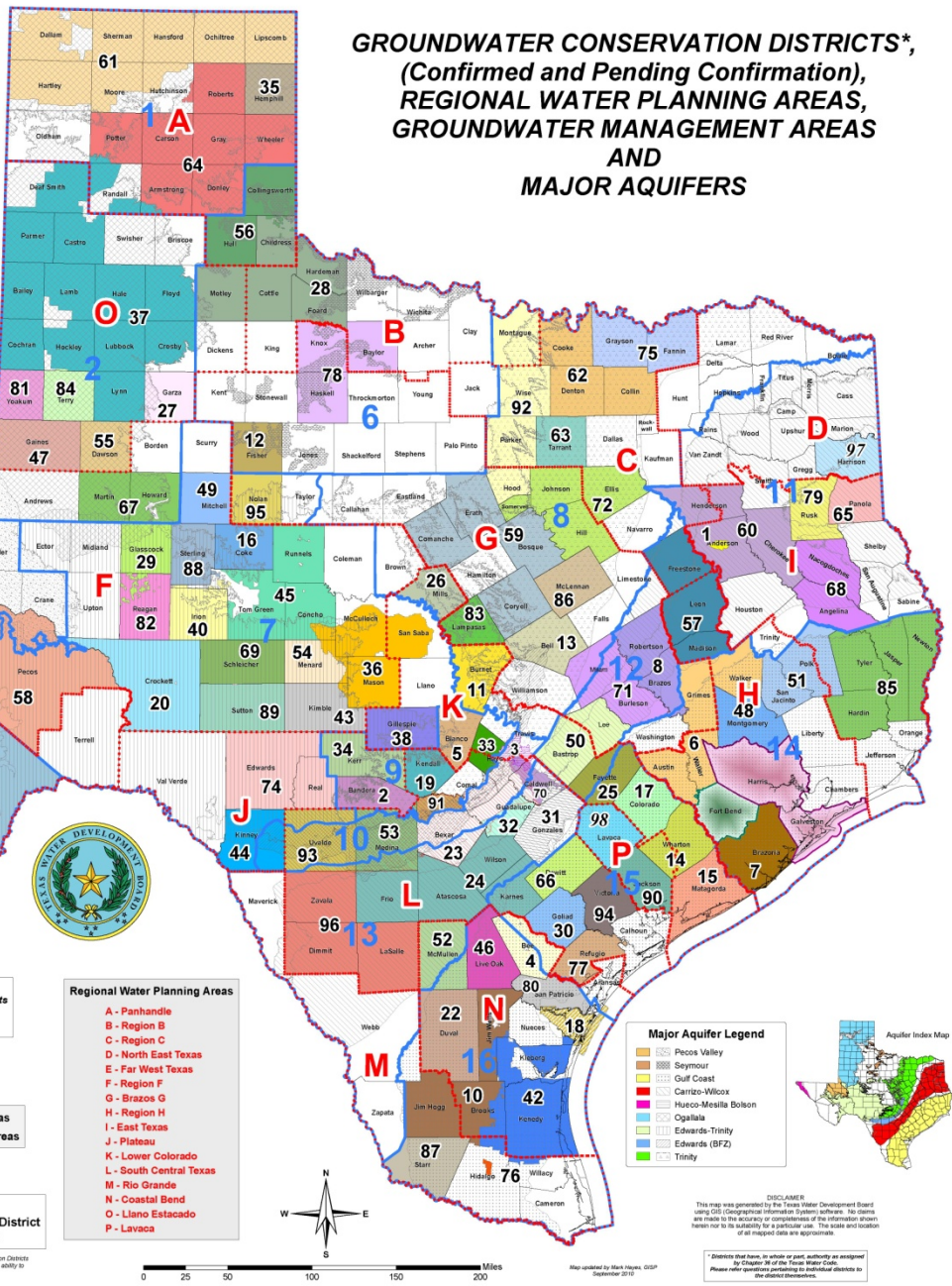
- Confirmed Groundwater Conservation Districts**
1. Anderson County UWCD
 2. Bandera County River Authority & Ground Water District
 3. Barton Springs/Edwards Aquifer CD
 4. Bee GCD
 5. Blanco-Pedernales GCD
 6. Bluebonnet GCD
 7. Brazoria County GCD
 8. Brazos Valley GCD
 9. Brewster County GCD
 10. Brush Country GCD
 11. Central Texas GCD
 12. Clear Fork GCD
 13. Clearwater UWCD
 14. Coastal Bend GCD
 15. Coastal Plains GCD
 16. Coke County UWCD
 17. Colorado County GCD
 18. Corpus Christi ASRCD
 19. Cow Creek GCD
 20. Crockett County GCD
 21. Cullbertson County GCD
 22. Duval County GCD
 23. Edwards Aquifer Authority
 24. Evergreen UWCD
 25. Fayette County GCD
 26. Fox Crossing Water District
 27. Garza County UWCD
 28. Gateway GCD
 29. Glasscock GCD
 30. Goliad County GCD
 31. Gonzales County UWCD
 32. Guadalupe County GCD
 33. Hays Trinity GCD
 34. Headwaters GCD
 35. Hemphill County UWCD
 36. Hickory UWCD No. 1
 37. High Plains UWCD No. 1
 38. Hill Country UWCD
 39. Hudspeth County UWCD No. 1
 40. Iron County WCD
 41. Jeff Davis County UWCD
 42. Kenedy County GCD
 43. Kinble County GCD
 44. Kinney County GCD
 45. Lipan-Kickapoo WCD

- Confirmed Groundwater Conservation Districts (continued)**
46. Live Oak UWCD
 47. Llano Estacado UWCD
 48. Lone Star GCD
 49. Lone Wolf GCD
 50. Lost Pines GCD
 51. Lower Trinity GCD
 52. McMullen GCD
 53. Medina County GCD
 54. Menard County UWCD
 55. Mesa UWCD
 56. Mesquite GCD
 57. Mid-East Texas GCD
 58. Middle Peases GCD
 59. Middle Trinity GCD
 60. Neches & Trinity Valleys GCD
 61. North Plains GCD
 62. North Texas GCD
 63. Northern Trinity GCD
 64. Panhandle GCD
 65. Panola County GCD
 66. Pecan Valley GCD
 67. Permian Basin UWCD
 68. Pineywoods GCD
 69. Platana UWC and Supply District
 70. Plum Creek CD
 71. Post Oak Savannah GCD
 72. Prairielands GCD
 73. Presidio County UWCD
 74. Real-Edwards C and R District
 75. Red River GCD
 76. Red Sands GCD
 77. Rolling GCD
 78. Rolling Plains GCD
 79. Rusk County GCD
 80. San Patricio County GCD
 81. Sandy Land UWCD
 82. Santa Rita UWCD
 83. Saratoga UWCD
 84. South Plains UWCD
 85. Southeast Texas GCD
 86. Southern Trinity GCD
 87. Starr County GCD
 88. Sterling County UWCD
 89. Sutton County UWCD
 90. Texasian GCD
 91. Trinity Glen Rose GCD
 92. Upper Trinity GCD
 93. Uvalde County UWCD
 94. Victoria County GCD
 95. Wes-Tex GCD
 96. Wintergreen GCD

- Pending Confirmation Groundwater Conservation Districts**
- 97. Harrison County GCD + &
 - 98. Lavaca County GCD + #
- Regional Water Planning Areas**
- Pending Election Results
 - Created by the 80th Legislature
 - Created by the 81st Legislature
- Groundwater Management Areas**

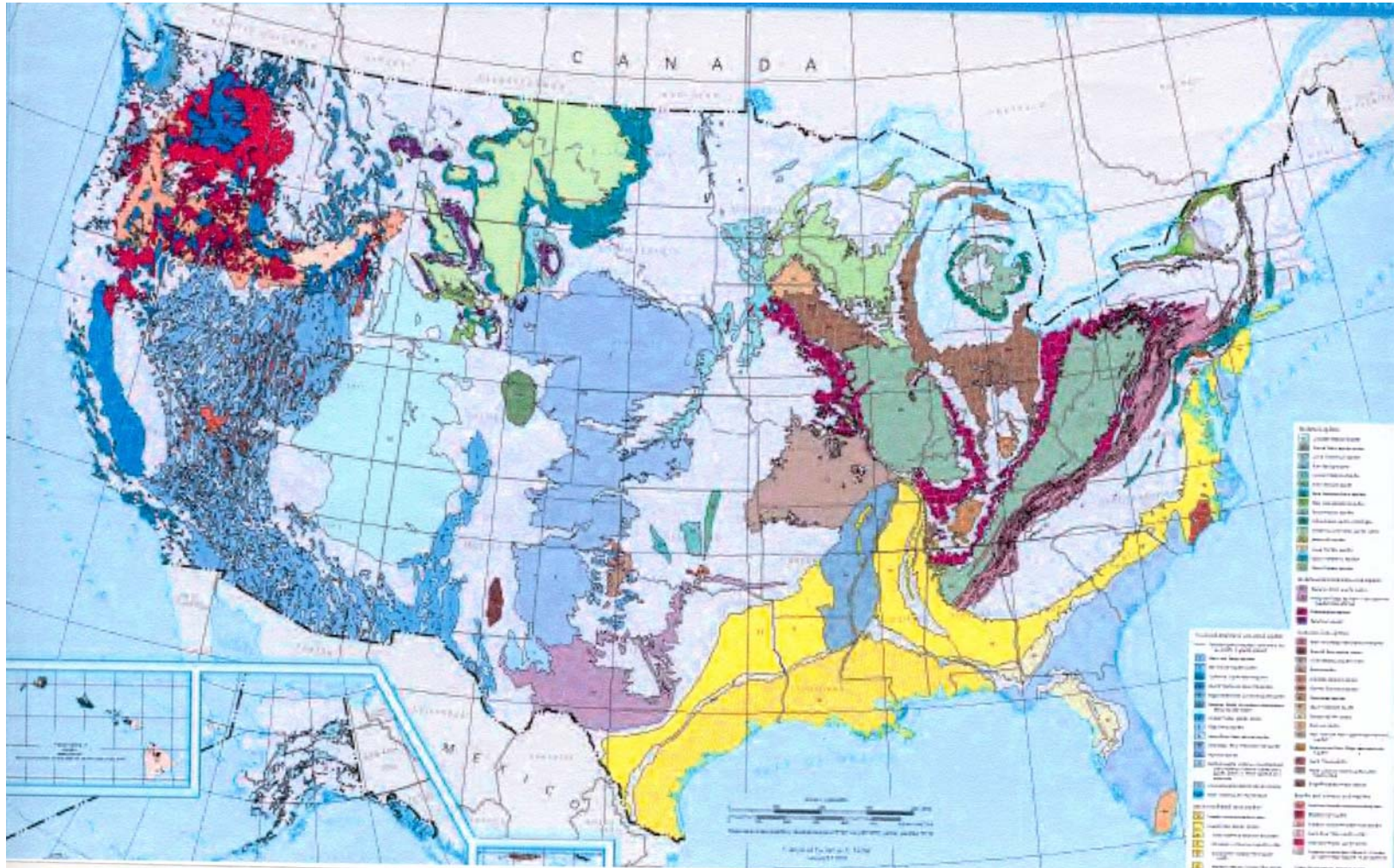
- Subsidence Districts**
- Harris-Galveston Subsidence District
 - Fort Bend Subsidence District

NOTE: These subsidence districts are not Groundwater Conservation Districts as defined under Chapter 36 of the Texas Water Code, but have the ability to regulate groundwater production to prevent land subsidence. (P.L. 86 Stat. 811 of the 79th Legislative Session)

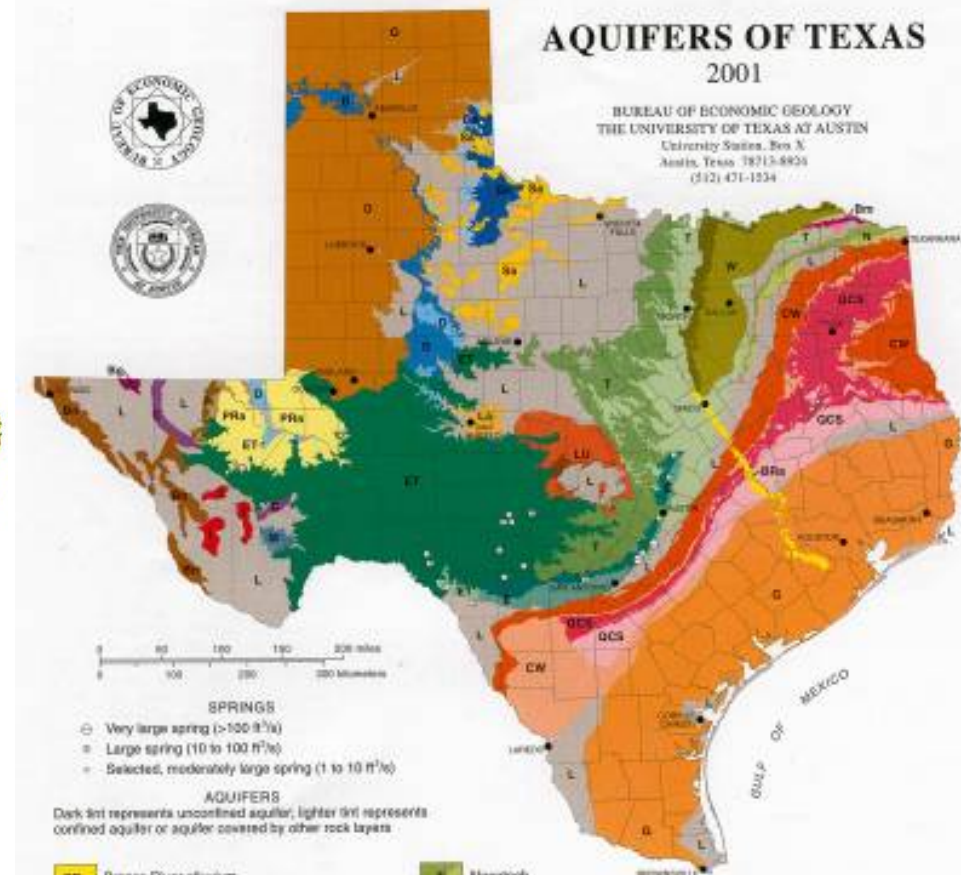
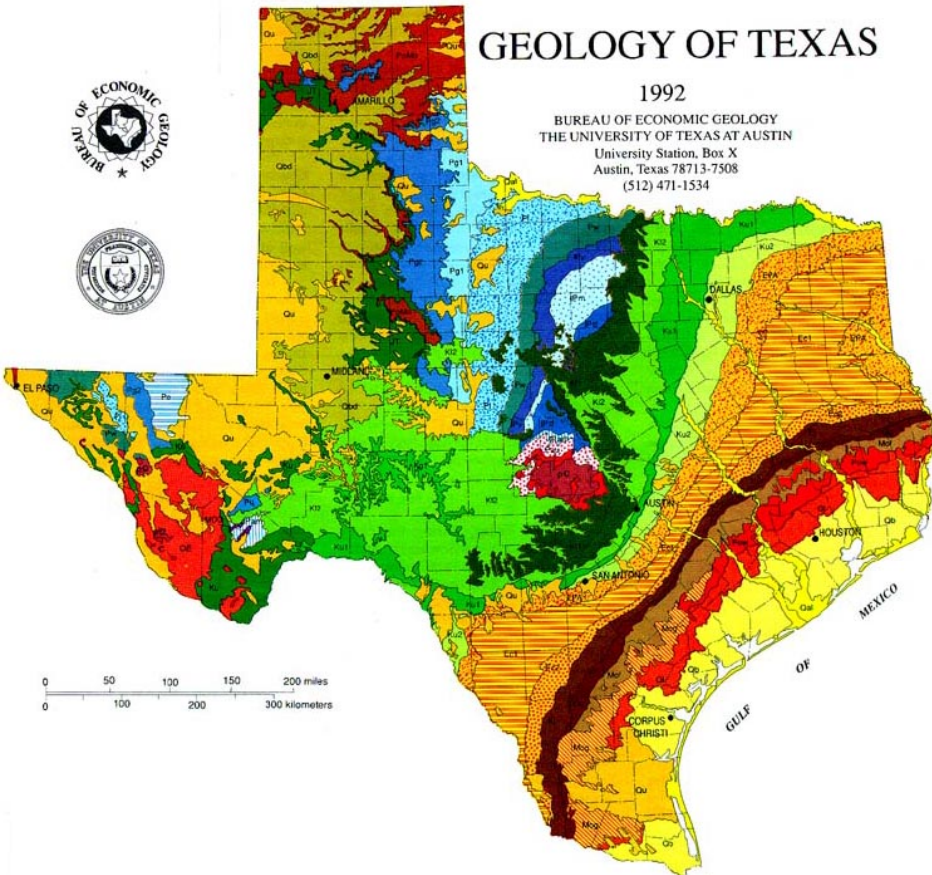


GROUNDWATER CONSERVATION DISTRICTS*, (Confirmed and Pending Confirmation), REGIONAL WATER PLANNING AREAS, GROUNDWATER MANAGEMENT AREAS AND MAJOR AQUIFERS

U.S. Aquifers



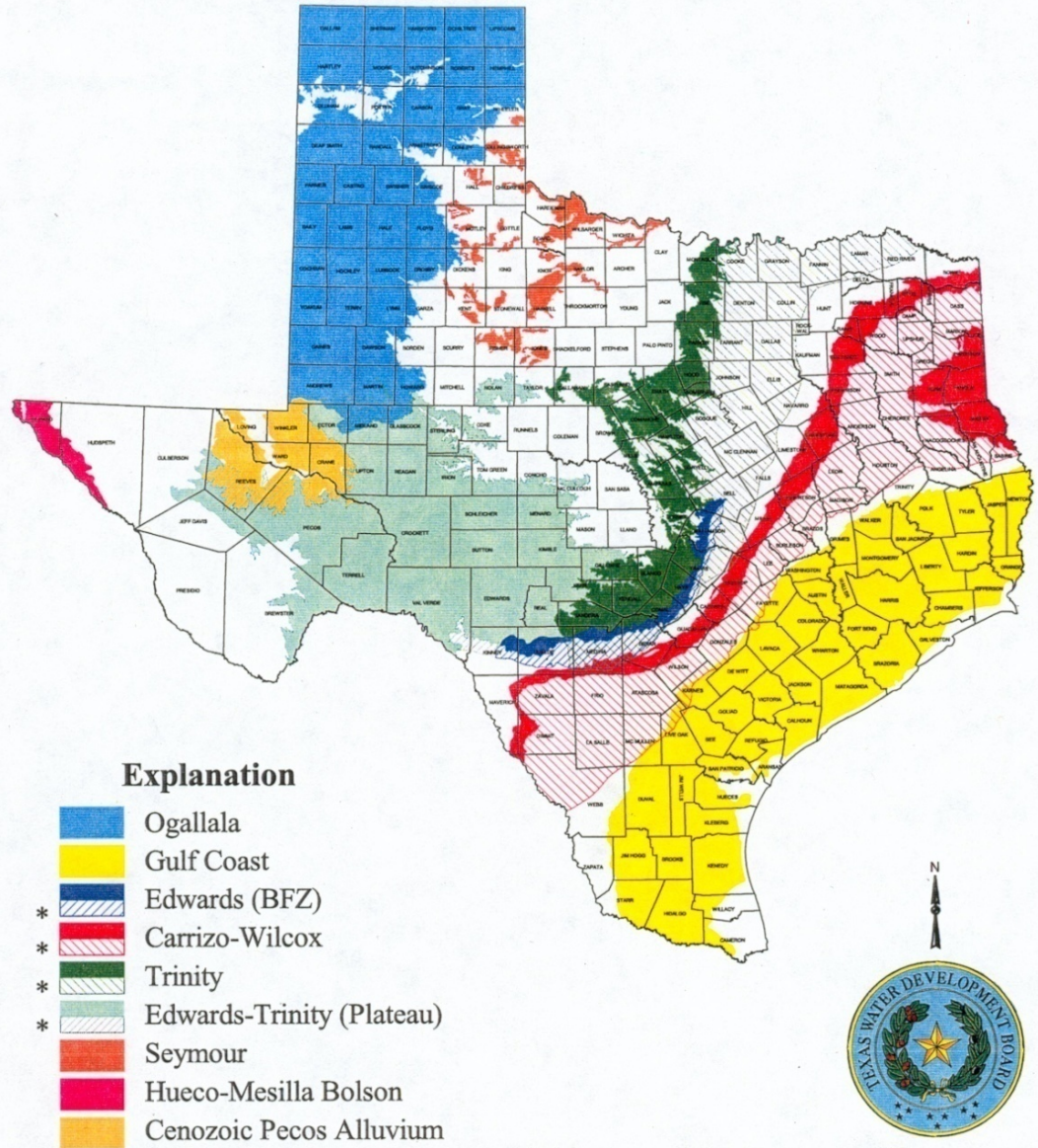
Geology / Aquifers



Major Aquifers of Texas

POSGCD

Carrizo-Wilcox



Minor Aquifers of Texas

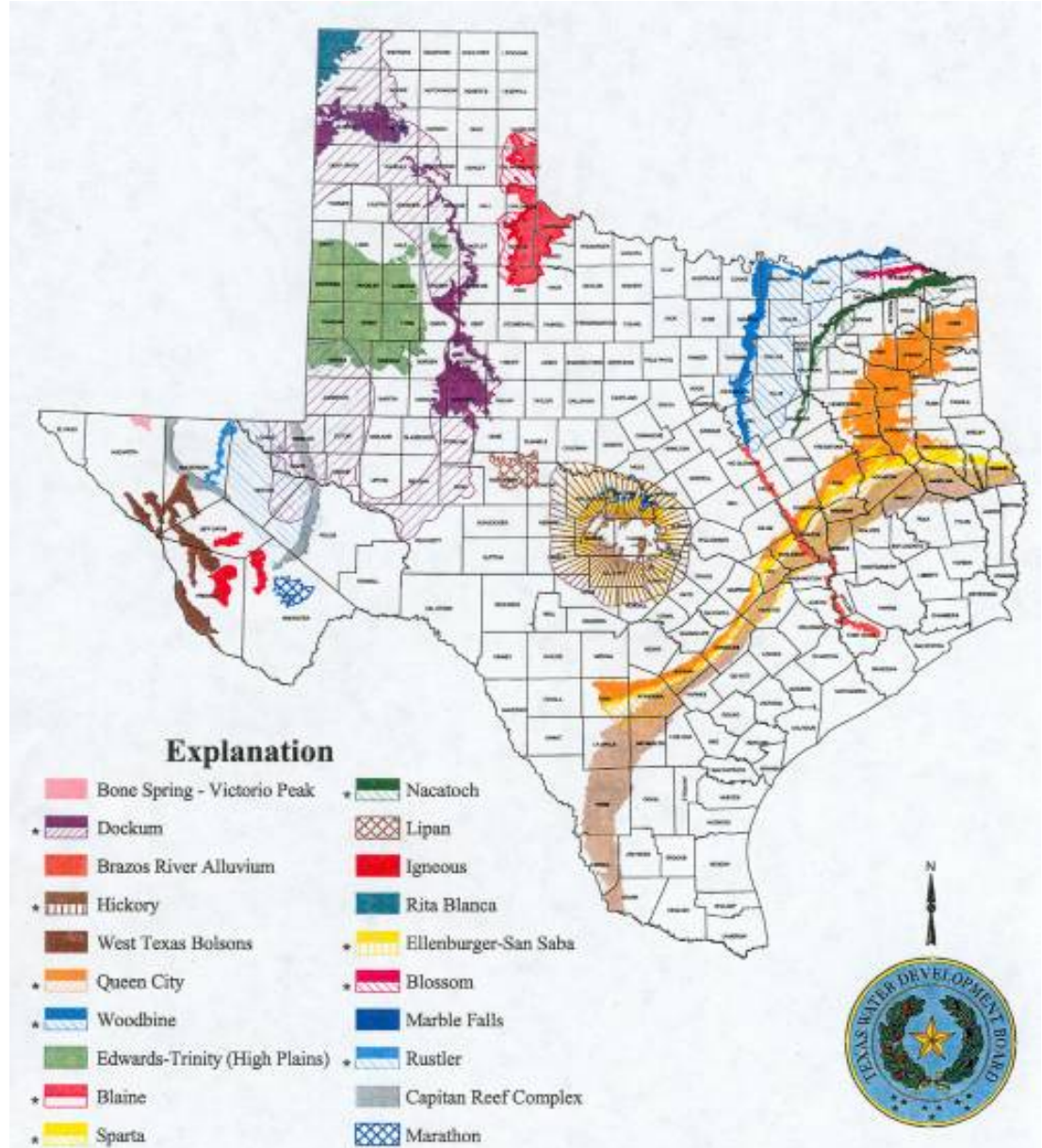
POSGCD

Queen City

Sparta

Yegua-Jackson

Brazos Alluvium



Groundwater Conservation Districts

Powers and purposes

Rule of Capture

- Old English Rule
- Landowners have the right to pump unlimited groundwater from the land they own, as long as not wasteful, without liability to neighbors

History of Groundwater Management in Texas

- 1904 – Rule of Capture
- 1949 – Groundwater Conservation Districts
 - Can alter, modify or discard Rule of Capture
 - Preferred method of groundwater management
- 2001 (SB 2) – Groundwater Management Areas
 - TWDB designates 16 GMAs
 - GCDs within GMA share GWMPs
 - Joint Planning within a GMA available if called for by one of the GCDs
- 2005 (HB1763) Requires GMA Joint Planning
 - GCDs within GMA must set DFCs for aquifers by 2/3 vote by 9-1-10
 - Each GCD gets one vote
 - Must complete process every 5 years, or as needed, annual reviews
 - TWDB evaluates DFCs using GAM to derive MAGs by GCD, RWPG, and River Basin for planning purposes

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**

OWNERSHIP OF GROUNDWATER

Section 36.002

The legislature recognizes that a landowner owns the groundwater below the surface of the landowner's land as real property.

Nothing in this code shall be construed as granting the authority to deprive or divest a landowner... of the groundwater ownership and rights described by this section.

This section does not:

- (1) prohibit a district from limiting or prohibiting the drilling of a well by a landowner for failure or inability to comply with minimum well spacing or tract size requirements adopted by the district;
- (2) affect the ability of a district to regulate groundwater production as authorized under Section 36.113, 36.116, or 36.122 or otherwise under this chapter or a special law governing a district; or
- (3) require that a rule adopted by a district allocate to each landowner a proportionate share of available groundwater for production from the aquifer based on the number of acres owned by the landowner

Old law- The ownership and rights of the owners of the land and their lessees and assigns in groundwater are hereby recognized, and nothing in this code shall be construed as depriving or divesting the owners or their lessees and assigns of the ownership or rights, **except as those rights may be limited or altered by rules promulgated by a district.**

ADMINISTRATION

Section 36.051

The governing body of a district is the board of directors . . .

***may be appointed or elected- please reference enabling legislation.

POSGCD Directors

(appointed by Commissioner's Courts)

Milam County

Carroll Glaser

Jay Tumlinson

Kerry Starnes

Jim Hodson

Dwayne Jekel

Interest

At Large

Agriculture

Municipal

Industrial

Rural Water

Burleson County

Nathan Ausley

Jay Wilder

Andy Hovarak

Lee Alford, III

Robert Ware

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....

PROTECTION OF HISTORIC OR EXISTING USE

Sec. 36.116

- In promulgating any rules limiting groundwater production, the district may preserve historic or existing use before the effective date of the rules to the maximum extent practicable consistent with the district's comprehensive management plan under Section 36.1071 and as provided by Section 36.113.

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"



NOTICE REQUIREMENTS

Section 36.101

- 20 days notice required for **rulemaking** hearings
- Posted at District Office, County Clerk's Office, one or more newspapers in counties of District
- Provide notice by mail, fax, or email to persons requesting notice (lasts one year)
- Make available copy of proposed rules on website and at office location during normal business hours

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
- 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.

RIGHT TO ENTER PROPERTY

Section 36.123

- District employees and agents are entitled to enter any public or private property within the boundaries of the district ... at any reasonable time for the purpose of inspecting and investigating conditions relating to the quality of water in the state or the compliance with any rule, regulation, permit, or other order of the district
- ... shall observe the establishment's rules and regulations concerning safety ... and notify any occupant or management of their presence and shall exhibit proper credentials

MISCELLANEOUS

- Section 36.107 - A district may carry out any research projects deemed necessary by the board
- Section 36.109 - A district may collect any information the board deems necessary
- Section 36.158 - A district may make or accept grants, gratuities, advances, or loans in any form to or from any source approved by the board, including any governmental entity, and may enter into contracts, agreements, and covenants in connection with grants, gratuities, advances, or loans that the board considers appropriate

AUTHORITY TO SET FEES

Section 36.205

- A district may set fees for administrative acts of the district, such as filing applications (Fee schedule)
- A district shall set and collect fees for all services provided outside the boundaries of the district
- A district may assess production fees based on the amount of water authorized by permit
- A district may assess the fees in lieu of, or in conjunction with, any taxes otherwise levied by the district
- A district may use revenues generated by the fees for any lawful purpose in accomplishing its purposes

DRILLERS' LOGS

Section 36.112

A district shall require that accurate drillers' logs be kept of water wells and that copies of drillers' logs and electric logs be filed with the district

RECORDS AND REPORTS

Section 36.111

- A district may require that records be kept and reports be made of the drilling, equipping, and completing of water wells and of the production and use of groundwater
- A district may adopt rules that require an owner or operator of a water well that is required to be registered with or permitted by the district, except for the owner or operator of a well that is exempt from permit requirements under Section 36.117(b)(1), to report groundwater withdrawals using reasonable and appropriate reporting methods and frequency.

EXEMPTIONS

Section 36.117

A district may exempt wells from the requirement of obtaining a drilling permit, an operating permit, or any other permit required by this chapter or the district's rules

A district may not require any permit issued by the district for:

- a well used solely for domestic use or for providing water for livestock or poultry on a tract of land larger than 10 acres that is either drilled, completed, or equipped so that it is incapable of producing more than 25,000 gallons of groundwater a day
- the drilling of a water well used solely to supply water for a **rig** that is actively engaged in drilling or exploration operations for an oil or gas well permitted by the Railroad Commission of Texas provided that the person holding the permit is responsible for drilling and operating the water well and the well is located on the same lease or field associated with the **drilling rig** (Does not include secondary exploration such as frac water)

EXEMPTIONS

Section 36.117

A district may not require any permit issued by the district for:

- the drilling of a water well authorized under a permit issued by the Railroad Commission of Texas under Chapter 134, Natural Resources Code, or for production from such a well to the extent the withdrawals are required for mining activities regardless of any subsequent use of the water
- A water well exempted under (36.117) shall be registered in accordance with rules promulgated by the district

PERMITS FOR WELLS

Section 36.113

A district **shall** require a permit for the drilling, equipping, operating, or completing of wells or for substantially altering the size of wells or well pumps, except as provided by Section 36.117 (Exemptions)

DRILLING OR ALTERING WELL

Section 36.115

No person, firm, or corporation may:

- drill or operate a well without first obtaining a permit from the district
- alter the size of a well or well pump such that it would bring that well under the jurisdiction of the district without first obtaining a permit from the district
- By definition “person” is all inclusive

REGULATION OF SPACING AND PRODUCTION

Section 36.116

A district by rule may:

- Regulate spacing of new wells from existing wells and property lines based on production capacity or other characteristics
- Regulate production of groundwater by setting production limits on wells based on acreage or tract size, acreage assigned to an authorized well site, acre feet per acre, or gallons per minute per well site acre, managed depletion, or any combination of these
- In promulgating any rules limiting groundwater production, the district may preserve historic or existing use... to the maximum extent practicable consistent with the district's comprehensive management plan

MANAGEMENT PLAN

Section 36.1071

- Must be adopted within 3 years of creation or confirmation
- Must be approved by Texas Water Development Board
- Must contain estimates of groundwater resources, availabilities, demands, and uses
- Must contain District management strategies including Desired Future Conditions
- Must be developed by using the District's best available data
- Must be compatible with other GCD Management Plans in same Groundwater Management Area
- The district shall adopt rules necessary to implement the management plan

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)



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

POSGCD created by 77th Legislature, HB1784, 2001

POSGCD Background and Reasons for creation (2001)

I. Resources + Location + Growth =

>35,000 acres water rights leased by 2000



II. Local Concerns

a. Existing Area Users (100% Burl. Co., 90% Milam Co.- use groundwater)

Municipal, Industrial, Agricultural

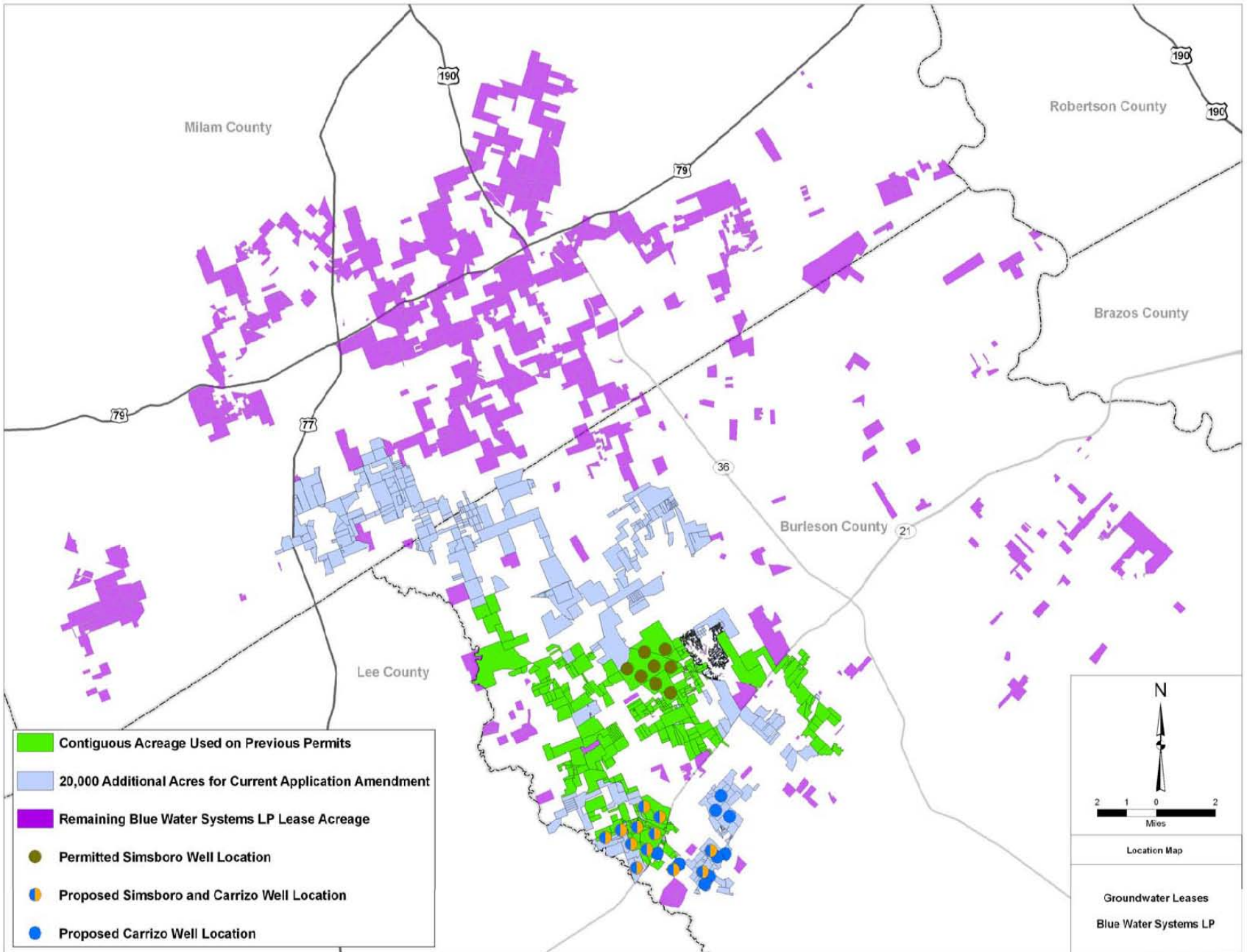
b. Future Growth

c. Reasonableness of Management Strategies

d. Insufficient Science

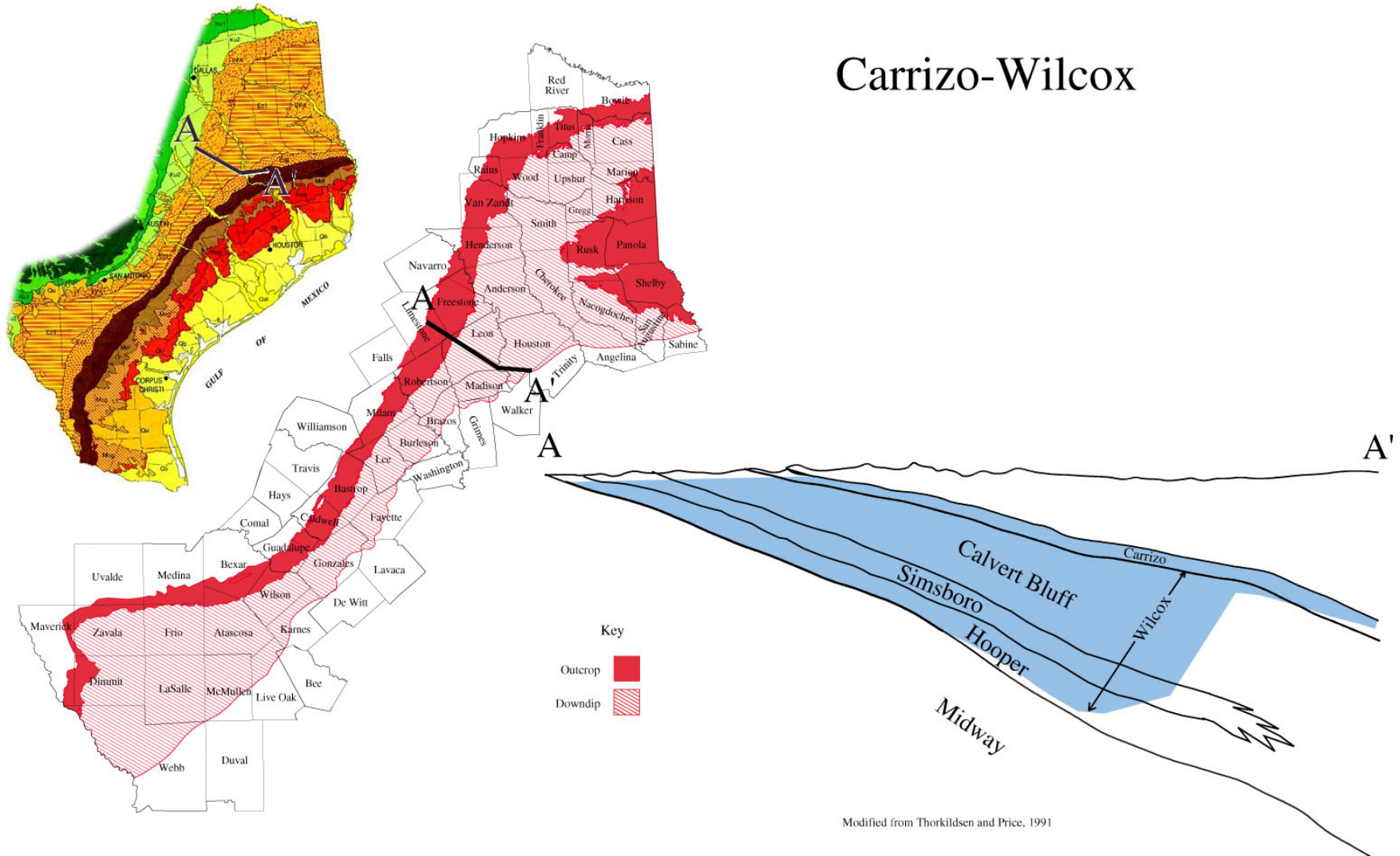
e. Unknown area future projects (in and out of District)

f. Property Rights



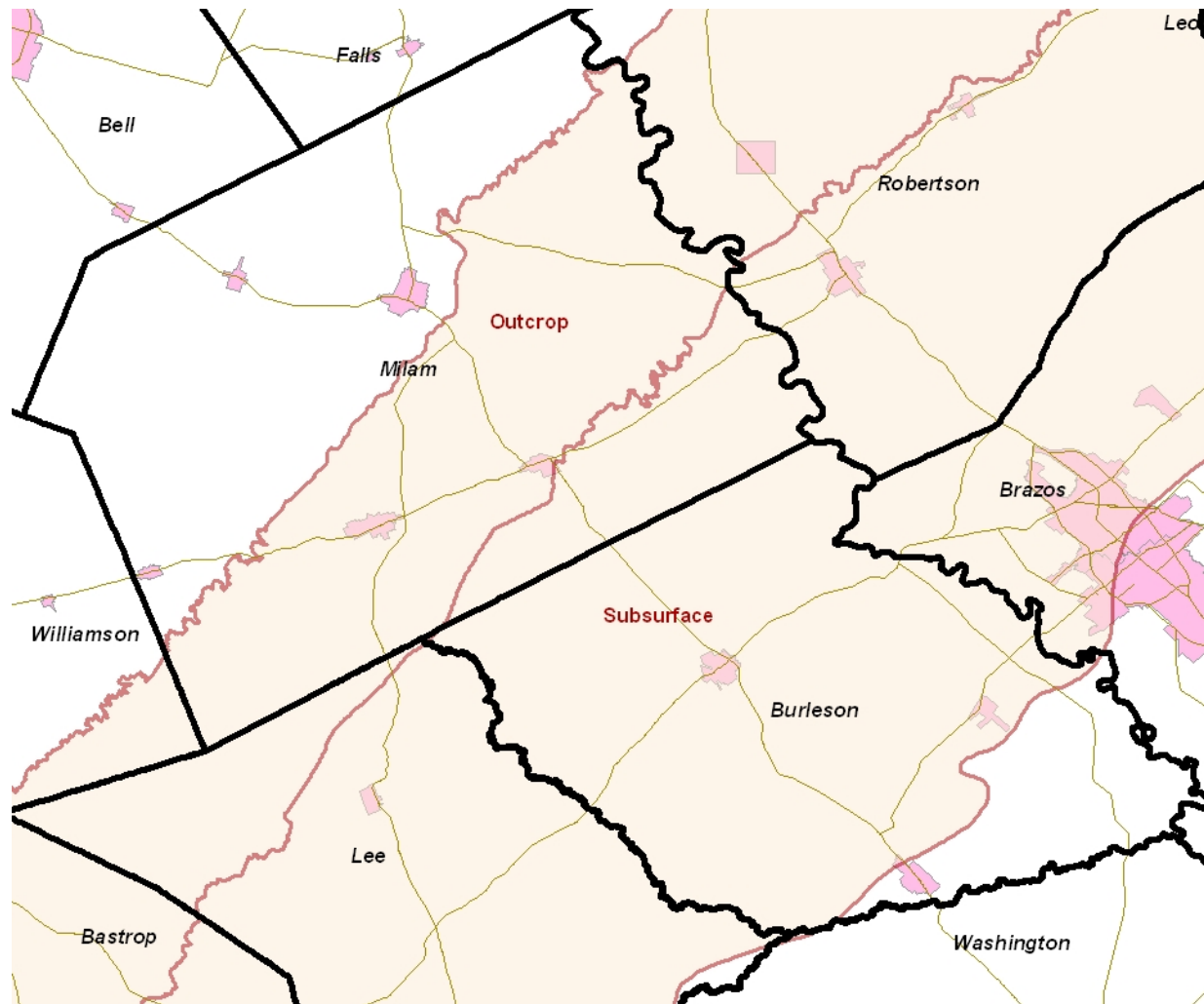
Groundwater resources and Management Strategies within POSGCD

Carrizo-Wilcox Aquifer

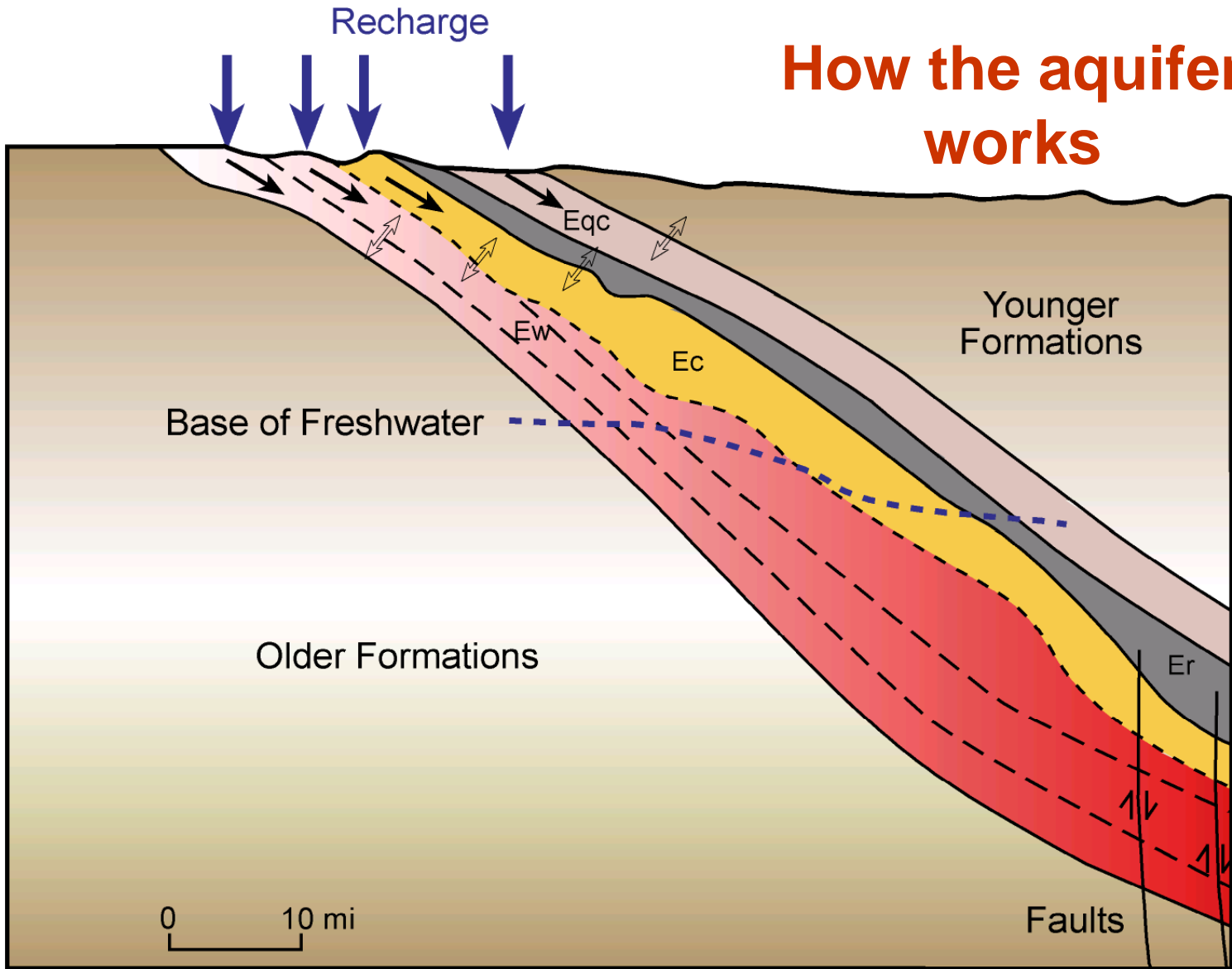


Modified from Thorkildsen and Price, 1991

Outcrop and Subsurface Extent of Carrizo-Wilcox Aquifer



How the aquifer works

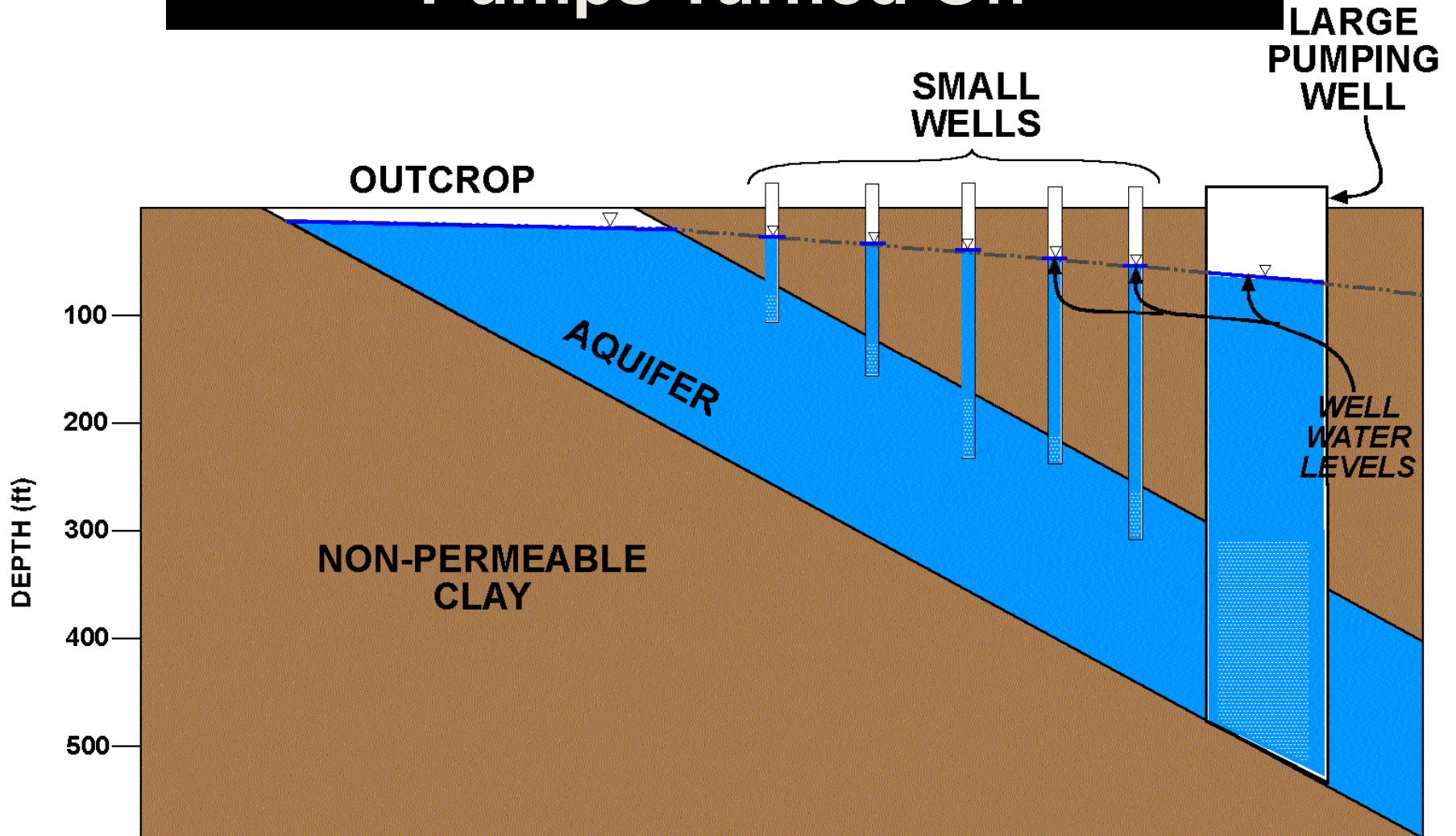


Ew = Wilcox; Ec = Carrizo; Er = Reklaw; Eqc = Queen City

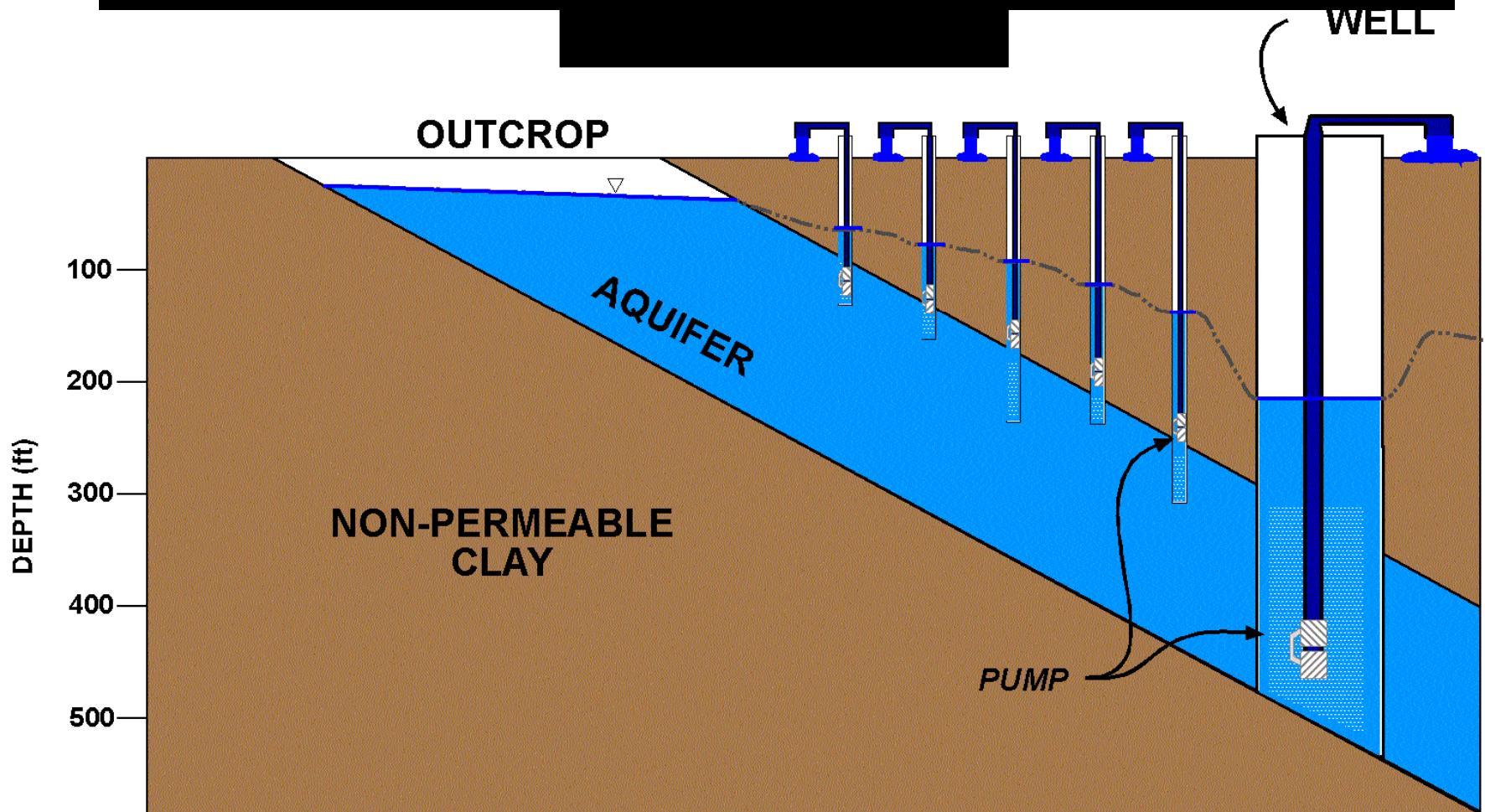
Carrizo-Wilcox Formations (layers)

- **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

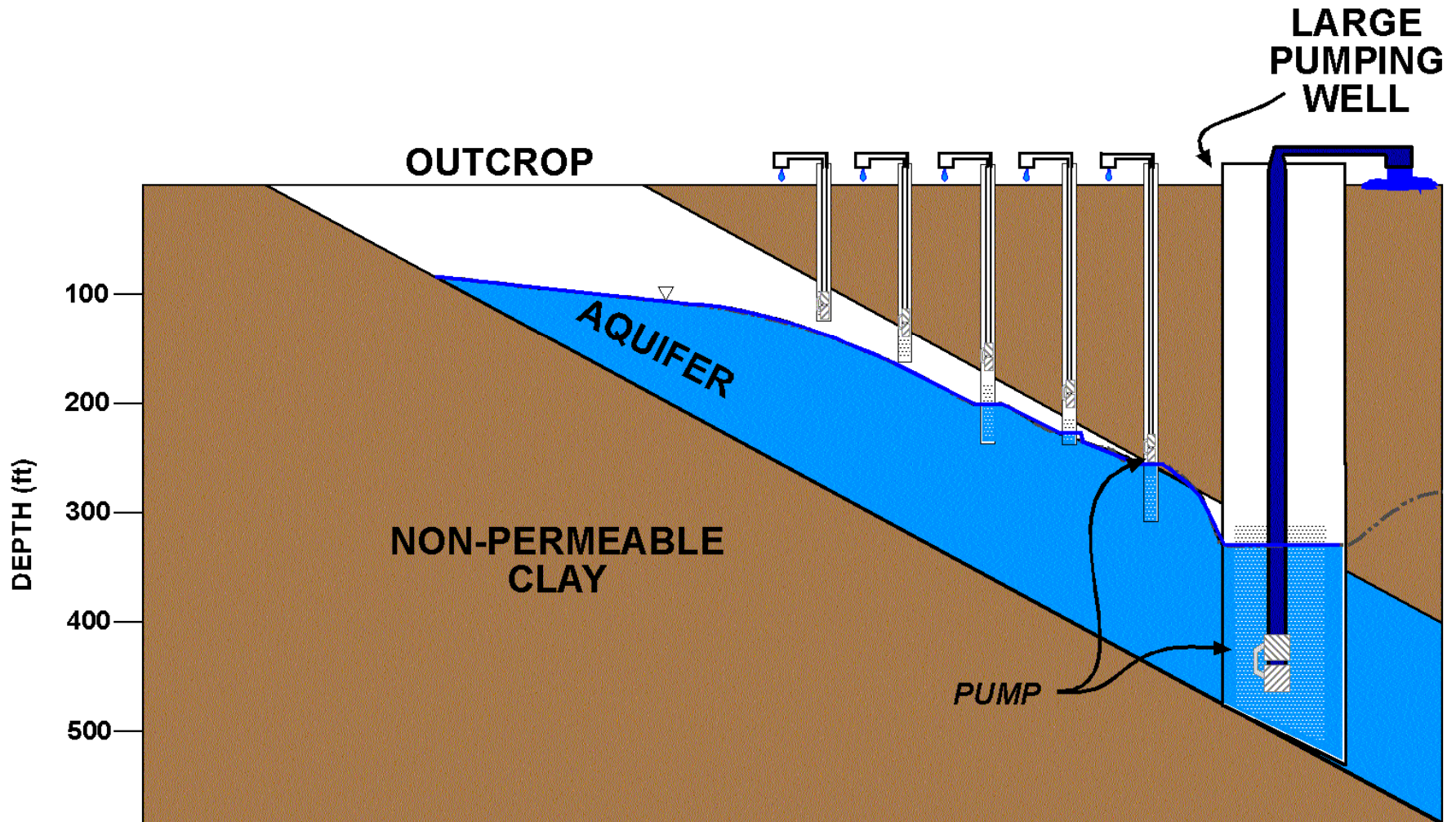
Cross Section of Aquifer Pumps Turned Off



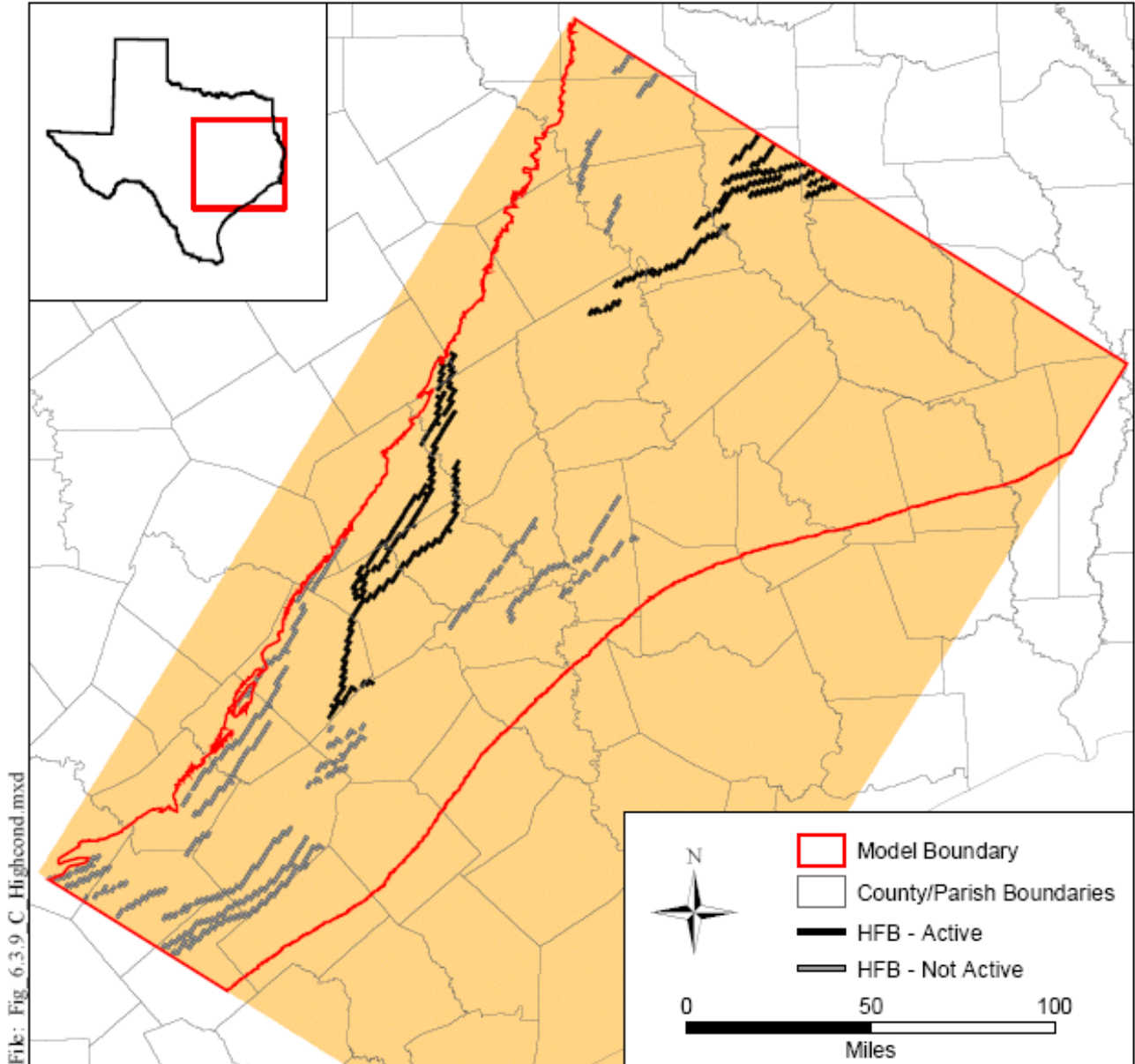
Normal Pumping – All wells have water



Continued Overpumping – Aquifer may take decades to recover



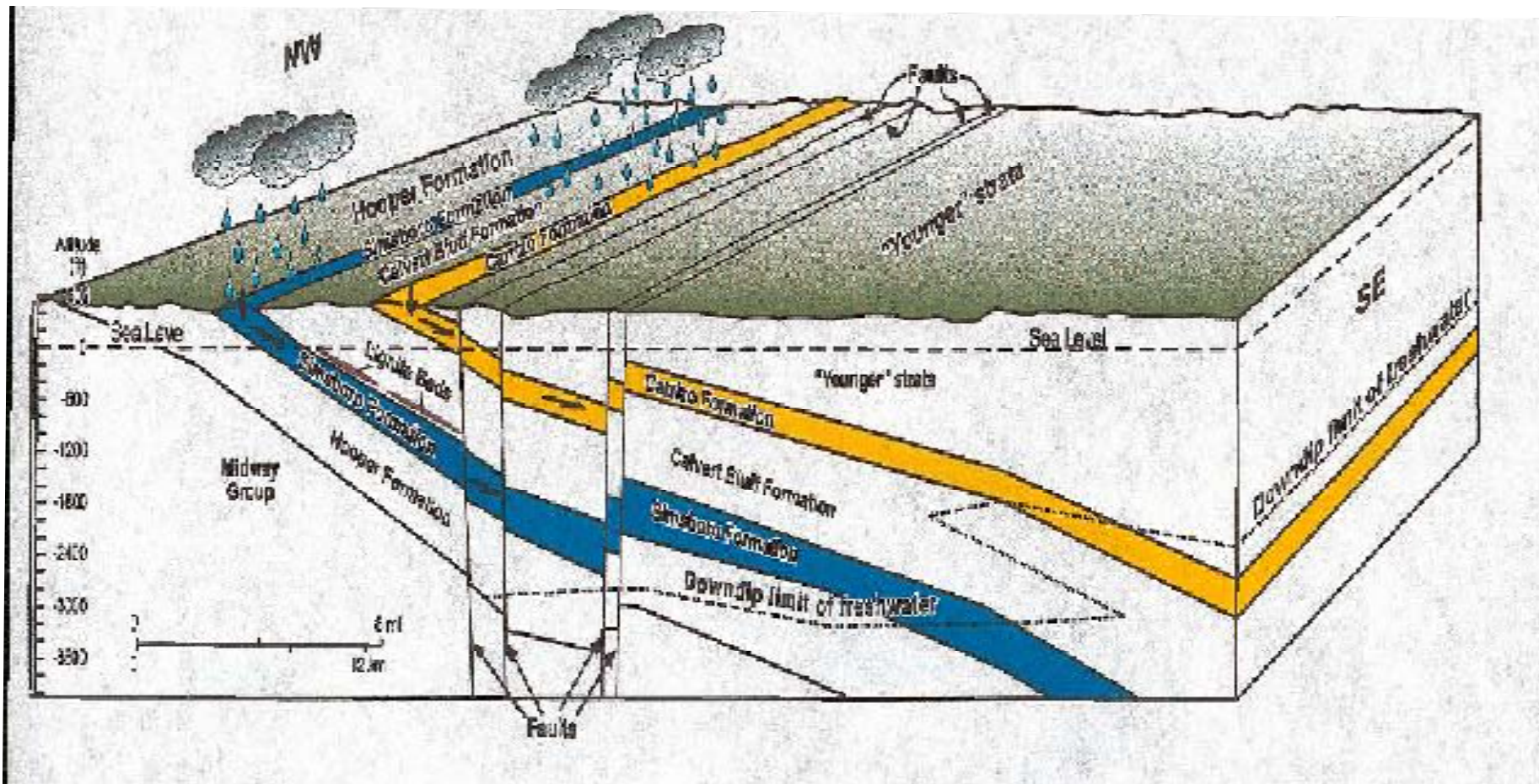
Representation of Faults in Central QSCW GAMs



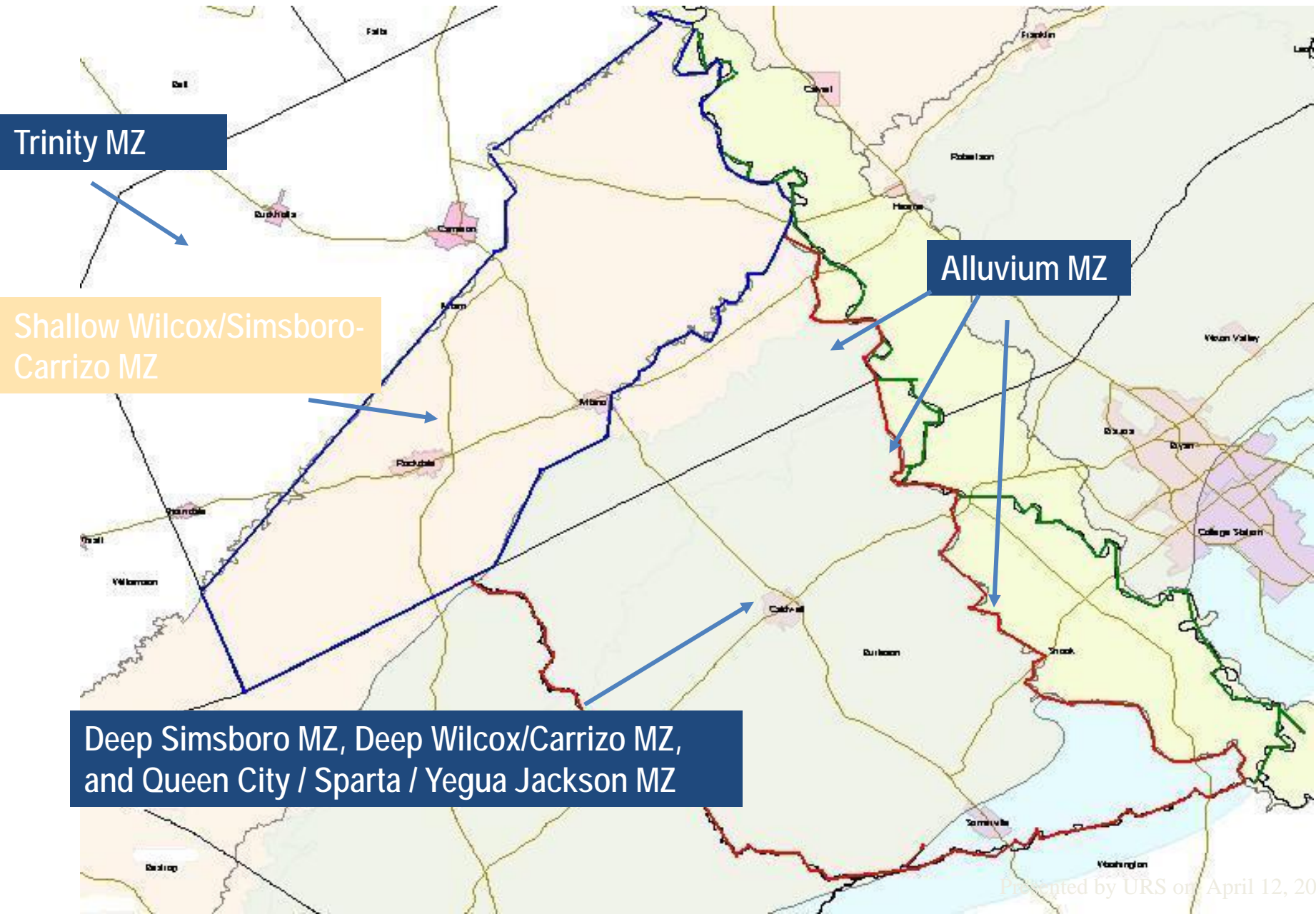
Draft – for discussion purposes only

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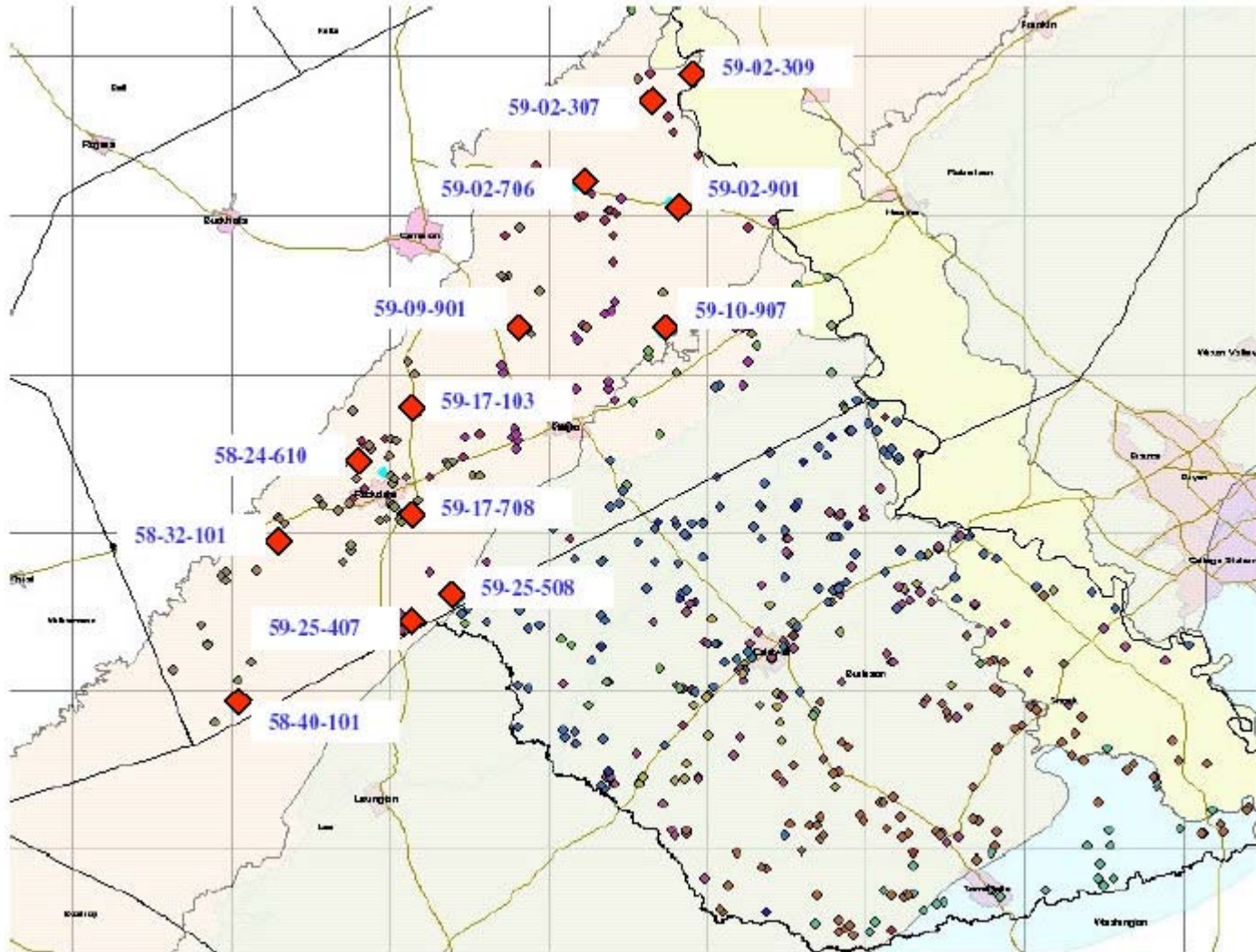
Geologic Cross Section Carrizo-Wilcox Aquifer Fault Zones



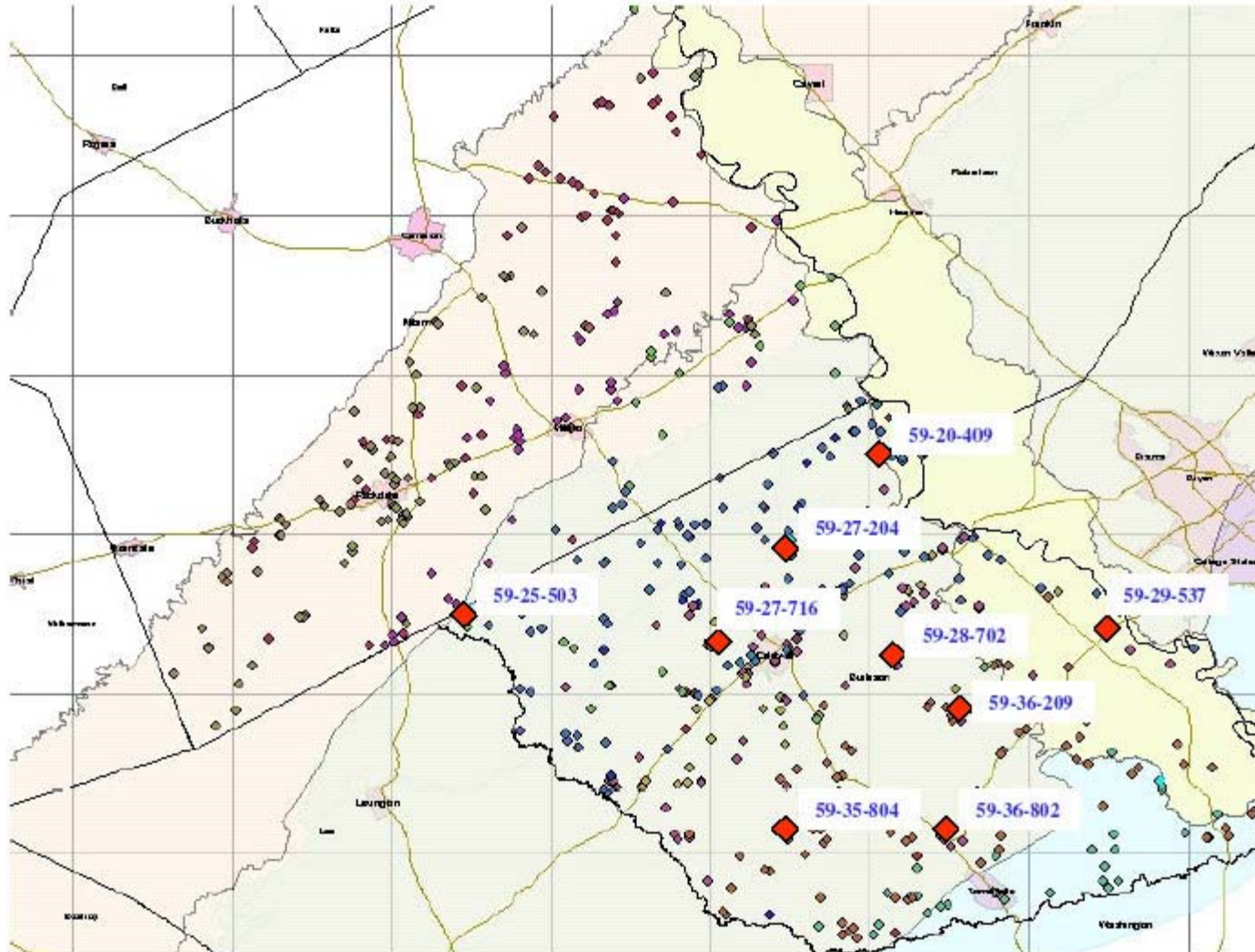
Management Zone Boundaries



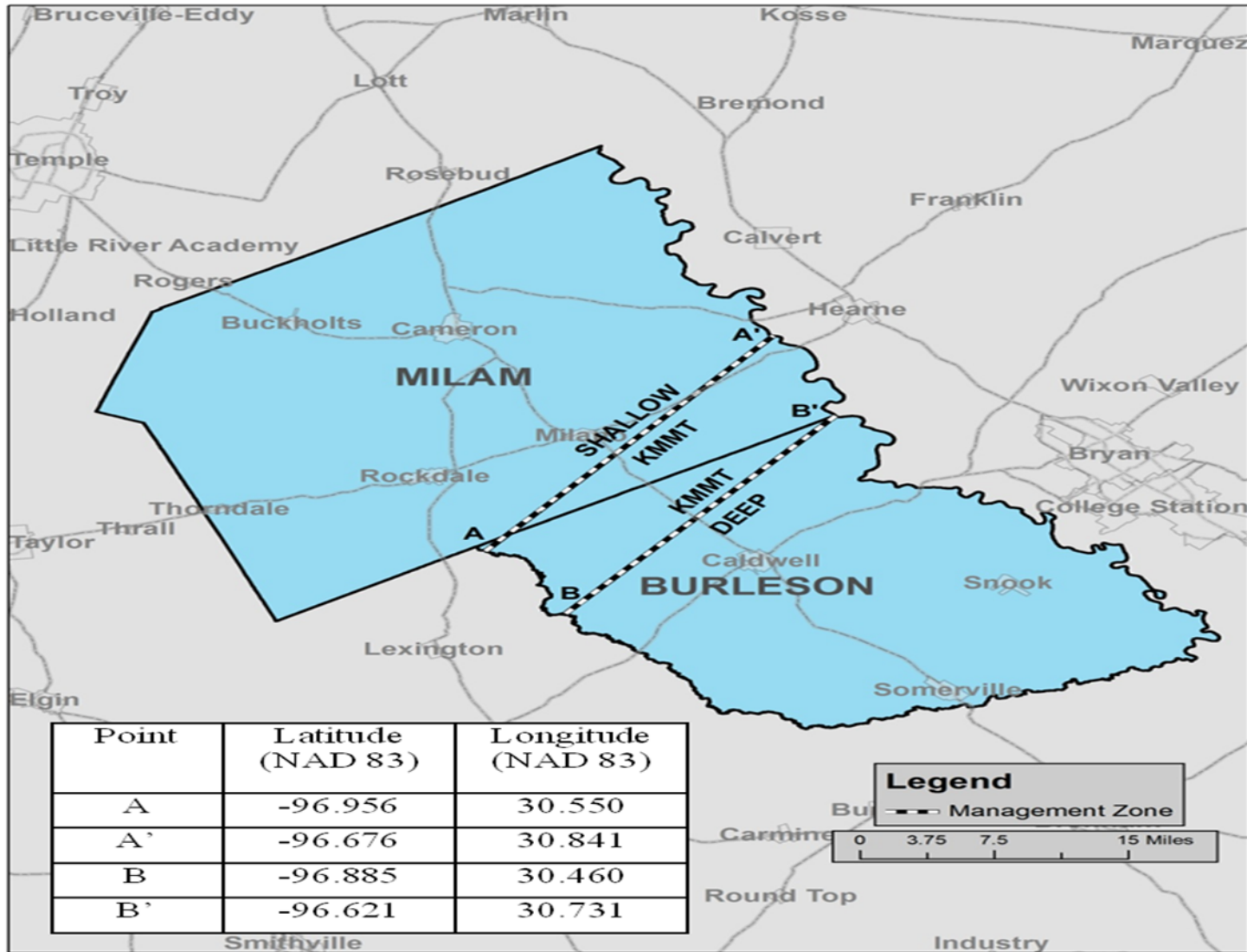
Shallow Carrizo-Wilcox Monitoring Wells



Deep Carrizo-Wilcox Monitoring Wells



POSGCD- New Management Zone Added: Karnes-Milano-Mexia-Talco (KMMT) Carrizo-Wilcox MZ for flexibility and safety



Measuring Water Depth

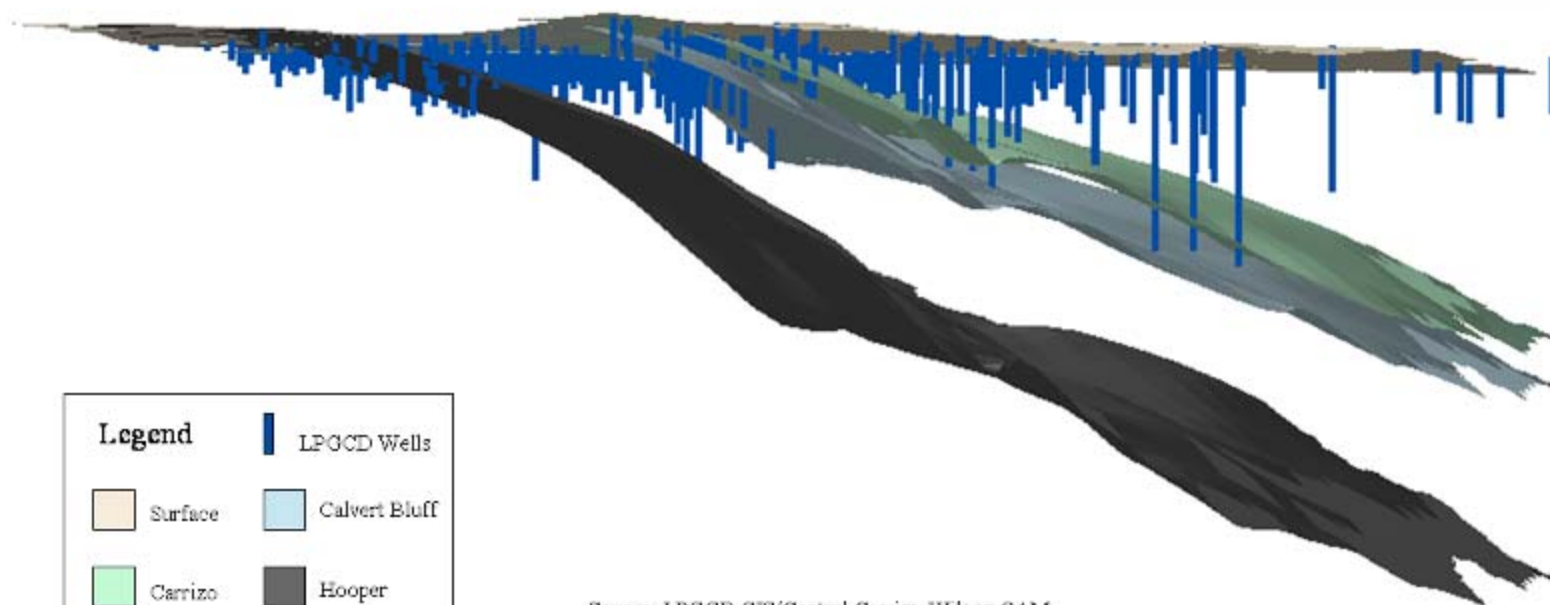
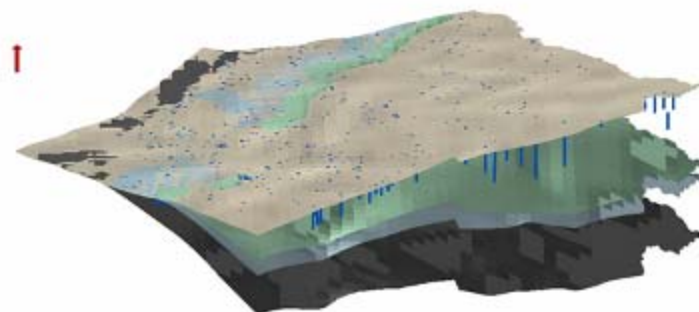








LPGCD Aquifers



Legend	
	Surface
	Calvert Bluff
	Carrizo
	Hooper
	LPGCD Wells

Source: LPGCD GIS/Central Carrizo-Wileox GAM

Current Info in District Well Database

<u>Formation</u>	<u># wells</u>
• Yegua/Jackson	2091
• Sparta	644
• Queen City	592
• Simsboro	397
• Carrizo	186
• Hooper	422
• Other	>3200
• Total	>7500

Relevant Factors for Consideration in Management of Groundwater Resources

- Chapter 36
- The purpose of the rules of the District;
- The equitable distribution of the resource;
- The economic hardship resulting from grant or denial of a permit, or the terms prescribed by the permit;
- The potential effect the permit may have on the aquifer, sustainability of the recharge on the aquifer as a whole, and groundwater users;
- The Desired Future Conditions and the estimated Managed Available Groundwater Values; and
- The Management Goals, Objectives, and Performance Standards

Summary of POSGCD Management Strategies

Management Zone	Estimated Groundwater Availability (ac-ft/yr)	Groundwater Drawdown Trigger Level
Trinity	300	N/A
Brazos/LR Alluviums	9400	N/A
Shallow Carrizo-Wilcox	33,750	50 feet
Deep Simsboro	60,000	300 feet
Deep Carrizo-Wilcox	30,750	190 feet
Queen City-Sparta-Yegua	14,500	N/A

History of Groundwater Management in Texas

- 1904 – Rule of Capture
- 1949 – Groundwater Conservation Districts
 - Can alter, modify or discard Rule of Capture
 - Preferred method of groundwater management
- **2001 (SB 2) – Groundwater Management Areas**
 - TWDB designates 16 GMAs
 - GCDs within GMA share GWMPs
 - Joint Planning within a GMA available if called for by one of the GCDs
- **2005 (HB1763) Requires GMA Joint Planning**
 - GCDs within GMA must set DFCs for aquifers by 2/3 vote by 9-1-10
 - Each GCD gets one vote
 - Must complete process every 5 years, or as needed, annual reviews
 - TWDB evaluates DFCs using GAM to derive MAGs by GCD, RWPG, and River Basin for planning purposes

Joint Planning and Acronyms

- Texas Water Development Board (TWDB)
 - Groundwater Conservation Districts (GCDs)
 - Groundwater Management Areas (GMAs)
 - Regional Water Planning Groups (RWPGs)
 - Groundwater Availability Models (GAMs)
 - Water Availability Models (WAMs)
 - Desired Future Conditions (DFCs)
 - Managed Available Groundwater (MAGs)
 - GCD Groundwater Management Plan (GWMP)
- ****GCD Management Plans and Rules within a GMA

The Joint Planning Process of Groundwater Management Areas

- Confirmed Groundwater Conservation Districts**
- Anderson County UWCD
 - Bandera County River Authority & Ground Water District
 - Barton Springs/Edwards Aquifer CD
 - Bee GCD
 - Blanco-Pedernales GCD
 - Bluebonnet GCD
 - Brazoria County GCD
 - Brazos Valley GCD
 - Brewster County GCD
 - Brush Country GCD
 - Central Texas GCD
 - Clear Fork GCD
 - Clearwater UWCD
 - Coastal Bend GCD
 - Coastal Plains GCD
 - Coke County UWCD
 - Colorado County GCD
 - Corpus Christi ASRCD
 - Cow Creek GCD
 - Crockett County GCD
 - Culberson County GCD
 - Duval County GCD
 - Edwards Aquifer Authority
 - Evergreen UWCD
 - Fayette County GCD
 - Fox Crossing Water District
 - Garza County UWCD
 - Gateway GCD
 - Glasscock GCD
 - Goliad County GCD
 - Gonzales County UWCD
 - Guadalupe County GCD
 - Hays Trinity GCD
 - Headwaters GCD
 - Hemphill County UWCD
 - Hickory UWCD No. 1
 - High Plains UWCD No.1
 - Hill Country UWCD
 - Hudspeth County UWCD No. 1
 - Iron County WCD
 - Jeff Davis County UWCD
 - Kenedy County GCD
 - Kimble County GCD
 - Kinney County GCD
 - Lipan-Kickapoo WCD

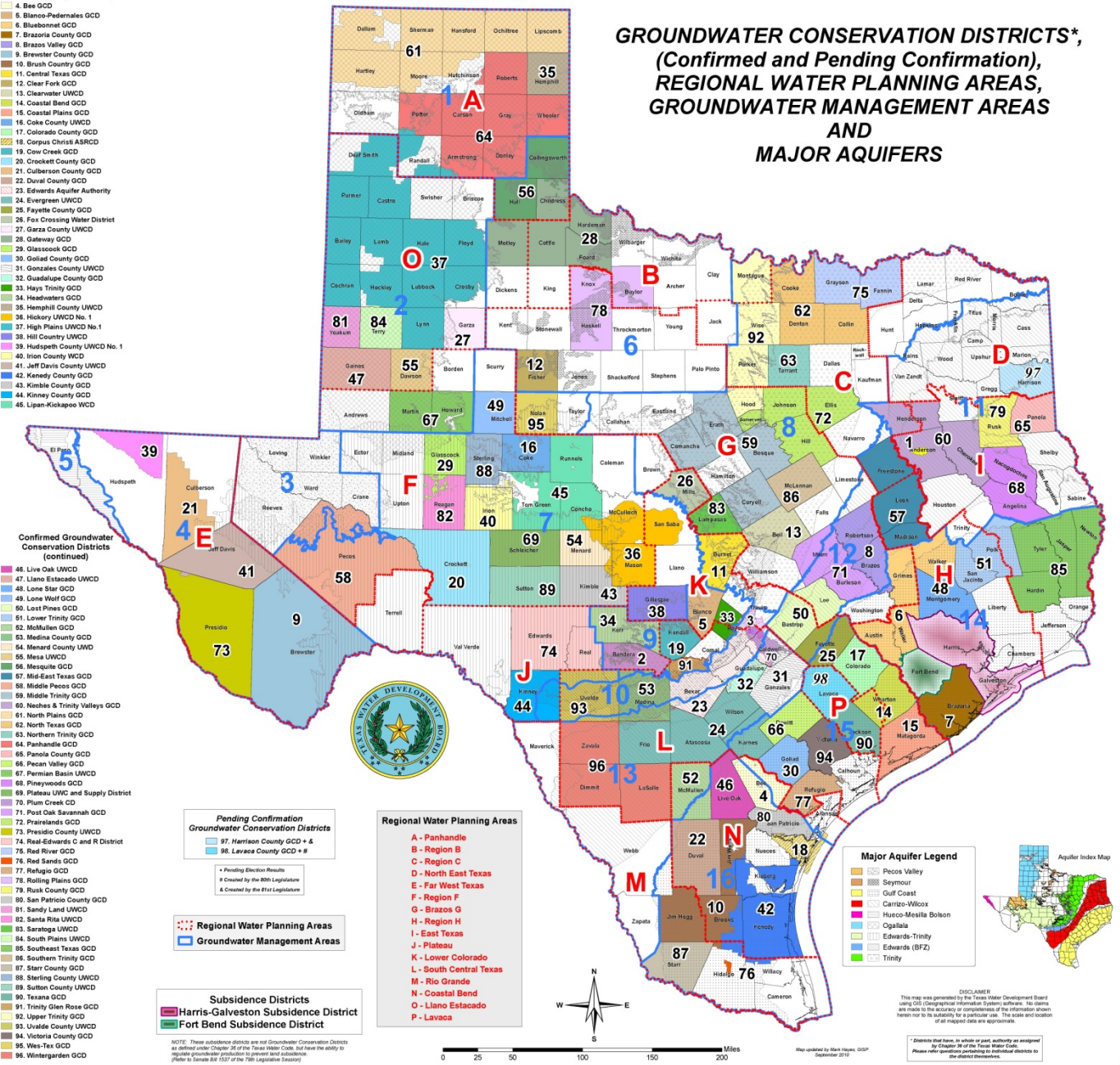
- Confirmed Groundwater Conservation Districts (continued)**
- Live Oak UWCD
 - Llano Estacado UWCD
 - Lone Star GCD
 - Lone Wolf GCD
 - Lost Pines GCD
 - Lower Trinity GCD
 - McMullen GCD
 - Medina County GCD
 - Menard County UWCD
 - Mesa UWCD
 - Mesquite GCD
 - Mid-East Texas GCD
 - Middle Pecos GCD
 - Middle Trinity GCD
 - Neches & Trinity Valleys GCD
 - North Plains GCD
 - North Texas GCD
 - Northern Trinity GCD
 - Panhandle GCD
 - Panola County GCD
 - Pecos Valley GCD
 - Permian Basin UWCD
 - Pineywoods GCD
 - Plains UWCD and Supply District
 - Plum Creek CD
 - Post Oak Savannah GCD
 - Prairielands GCD
 - Presidio County UWCD
 - Real-Edwards C and R District
 - Red River GCD
 - Red Sands GCD
 - Religio GCD
 - Rolling Plains GCD
 - Rusk County GCD
 - San Patricio County GCD
 - Sandy Land UWCD
 - Santa Rita UWCD
 - Saratoga UWCD
 - South Plains UWCD
 - Southeast Texas GCD
 - Southern Trinity GCD
 - Starr County GCD
 - Sterling County UWCD
 - Sutton County UWCD
 - Texas GCD
 - Trinity Glen Rose GCD
 - Upper Trinity GCD
 - Uvalde County UWCD
 - Victoria County GCD
 - Wes-Tex GCD
 - Wintergreen GCD

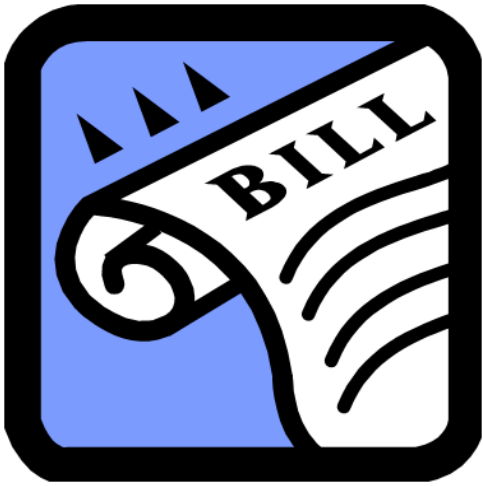
- Pending Confirmation Groundwater Conservation Districts**
- 97. Harrison County GCD + & 98. Lavaca County GCD + #
- Regional Water Planning Areas**
- Confirmed Groundwater Management Areas

- Subsidence Districts**
- Harris-Galveston Subsidence District
 - Fort Bend Subsidence District

NOTE: These subsidence districts are not Groundwater Conservation Districts as defined under Chapter 36 of the Texas Water Code, but have the ability to regulate groundwater resources to prevent land subsidence. (P.L. 86-560, 1979; P.L. 86-561, 1979; P.L. 86-562, 1979; P.L. 86-563, 1979; P.L. 86-564, 1979; P.L. 86-565, 1979; P.L. 86-566, 1979; P.L. 86-567, 1979; P.L. 86-568, 1979; P.L. 86-569, 1979; P.L. 86-570, 1979; P.L. 86-571, 1979; P.L. 86-572, 1979; P.L. 86-573, 1979; P.L. 86-574, 1979; P.L. 86-575, 1979; P.L. 86-576, 1979; P.L. 86-577, 1979; P.L. 86-578, 1979; P.L. 86-579, 1979; P.L. 86-580, 1979; P.L. 86-581, 1979; P.L. 86-582, 1979; P.L. 86-583, 1979; P.L. 86-584, 1979; P.L. 86-585, 1979; P.L. 86-586, 1979; P.L. 86-587, 1979; P.L. 86-588, 1979; P.L. 86-589, 1979; P.L. 86-590, 1979; P.L. 86-591, 1979; P.L. 86-592, 1979; P.L. 86-593, 1979; P.L. 86-594, 1979; P.L. 86-595, 1979; P.L. 86-596, 1979; P.L. 86-597, 1979; P.L. 86-598, 1979; P.L. 86-599, 1979; P.L. 86-600, 1979; P.L. 86-601, 1979; P.L. 86-602, 1979; P.L. 86-603, 1979; P.L. 86-604, 1979; P.L. 86-605, 1979; P.L. 86-606, 1979; P.L. 86-607, 1979; P.L. 86-608, 1979; P.L. 86-609, 1979; P.L. 86-610, 1979; P.L. 86-611, 1979; P.L. 86-612, 1979; 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GROUNDWATER CONSERVATION DISTRICTS*, (Confirmed and Pending Confirmation), REGIONAL WATER PLANNING AREAS, GROUNDWATER MANAGEMENT AREAS AND MAJOR AQUIFERS

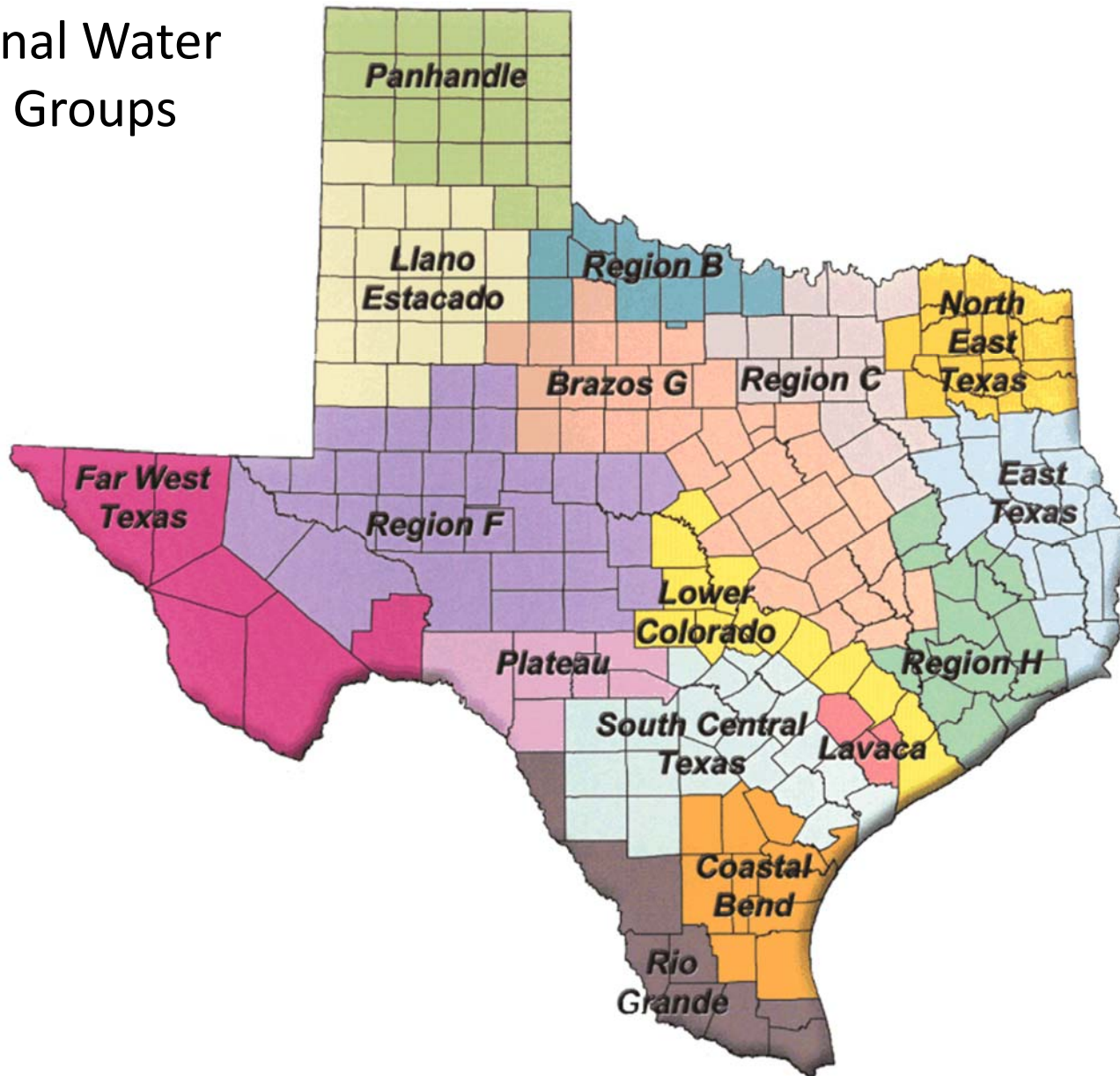




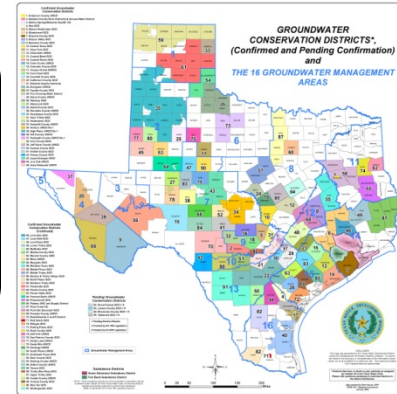
Texas State Water Planning

- State Water Planning through 16 RWPGs
- Water demands determined from water users
- Groundwater Supplies determined by GCDs in 16 GMAs by adopting DFCs
- DFCs determine GW Supply
- RWPGs use available GW and SW Supply numbers for planning

16 Regional Water Planning Groups



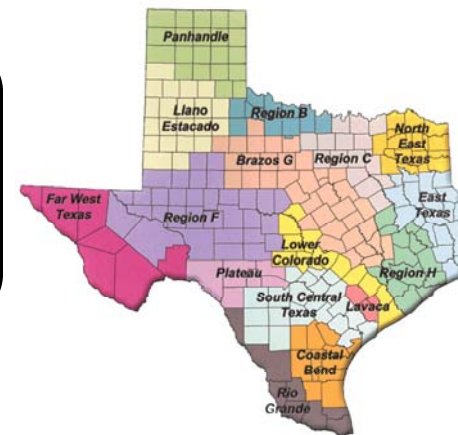
GCDs in GMAs
decide **Desired Future Conditions**
and deliver to TWDB



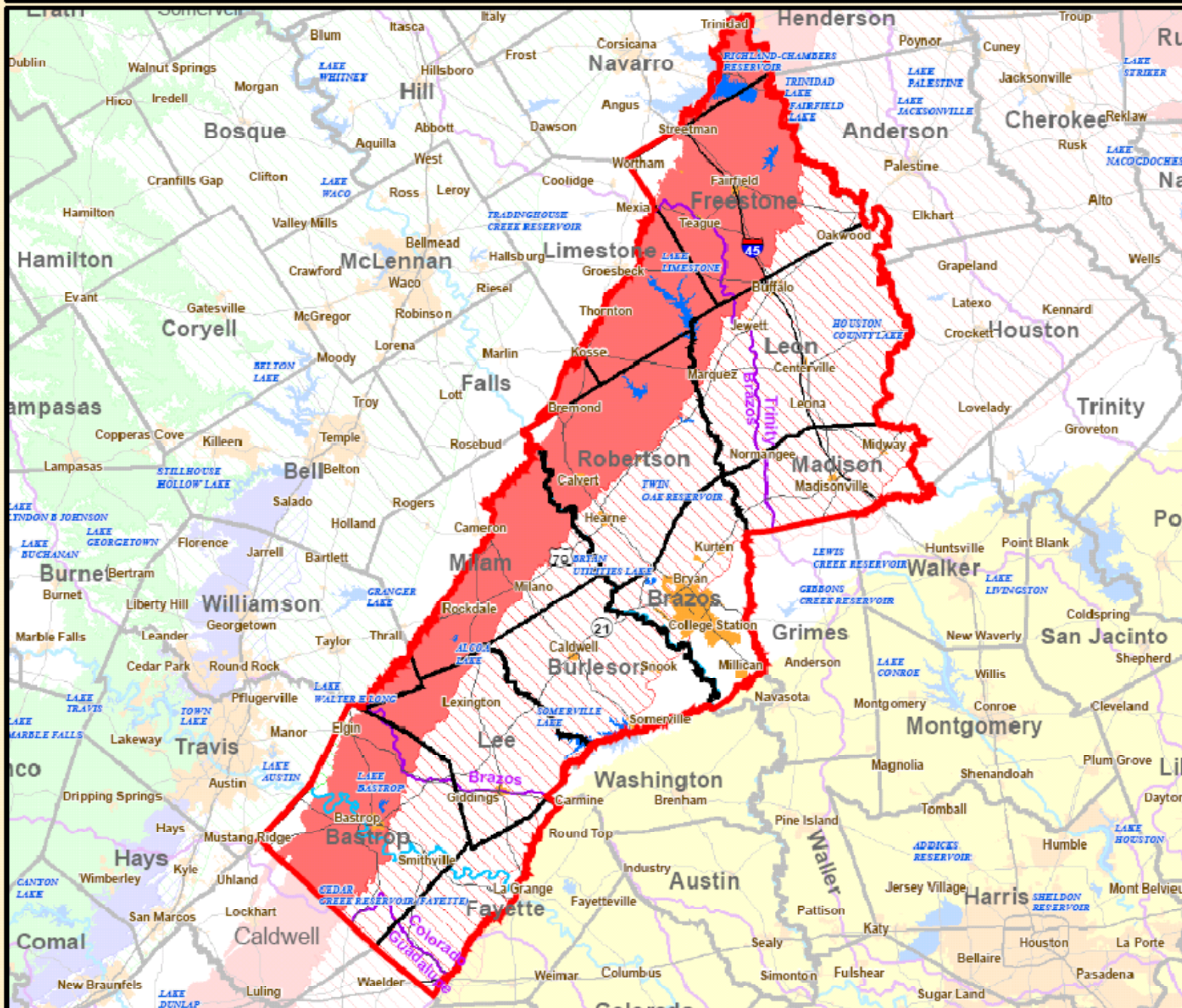
TWDB provides estimates
of **Managed Available Groundwater**
to districts and regions



GCDs and RWPGs include
Managed Available Groundwater
in plans



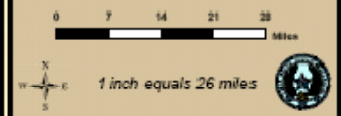
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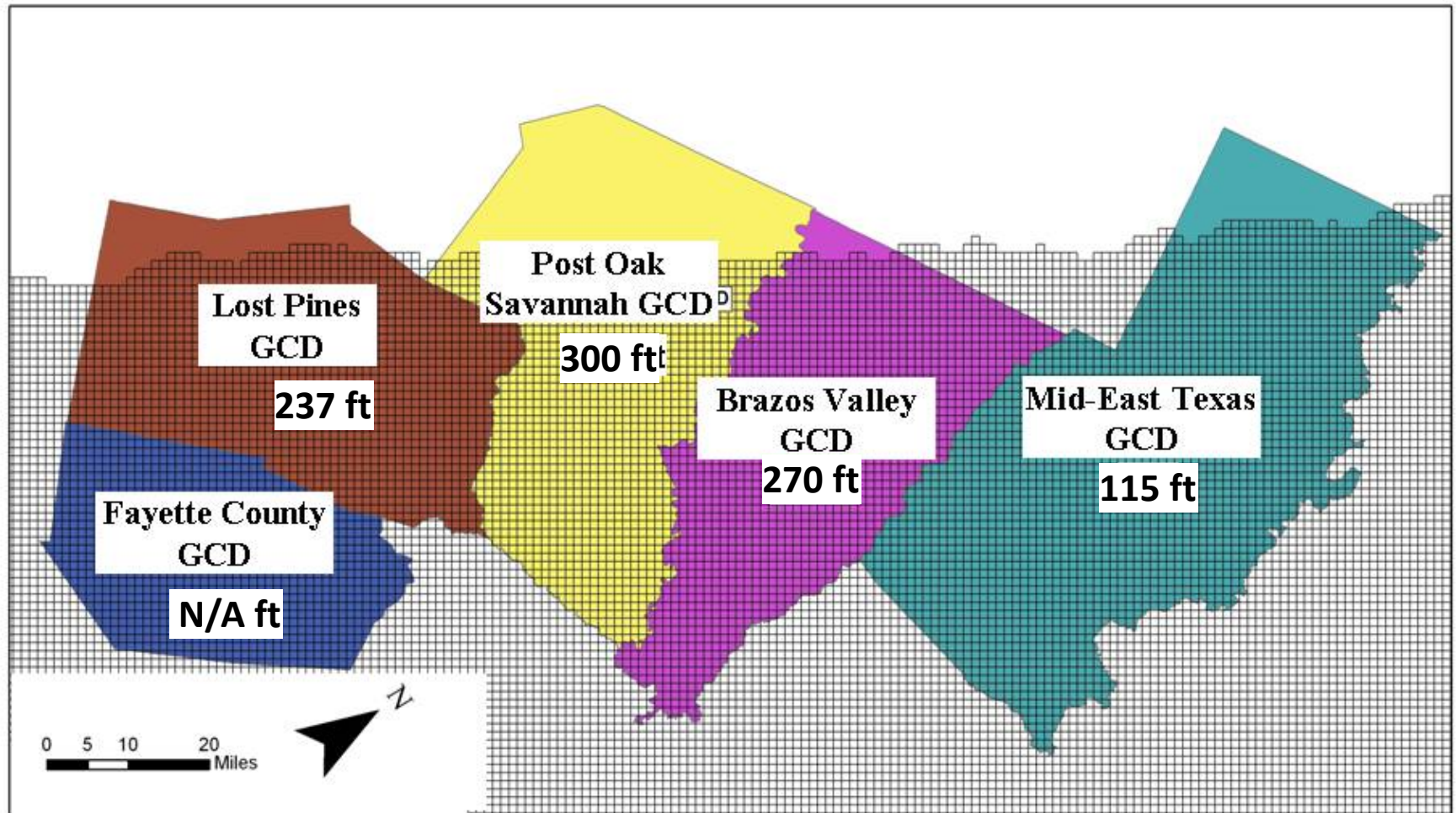
MAP LEGEND

- GMA #12
 - River
 - River Basin
 - Reservoir
 - Cities
 - Counties
- ### Major Aquifers
- Cenozoic Pecos Alluvium
 - Seymour
 - Gulf Coast
 - Carrizo - Wilcox (outcrop)
 - Carrizo - Wilcox (down dip)
 - Hueco - Mesilla Bolson
 - Ogallala
 - Edwards - Trinity Plateau (outcrop)
 - Edwards - Trinity Plateau (down dip)
 - Edwards BFZ (outcrop)
 - Edwards BFZ (down dip)
 - Trinity (outcrop)
 - Trinity (down dip)

DISCLAIMER
 No claims are made to the accuracy or completeness of the data nor to its suitability for a particular use. The scale and compilation of all information shown here is approximate.
 Map prepared by Mark Hayes
 Texas Water Development Board
 GIS Section
 12/21/2005



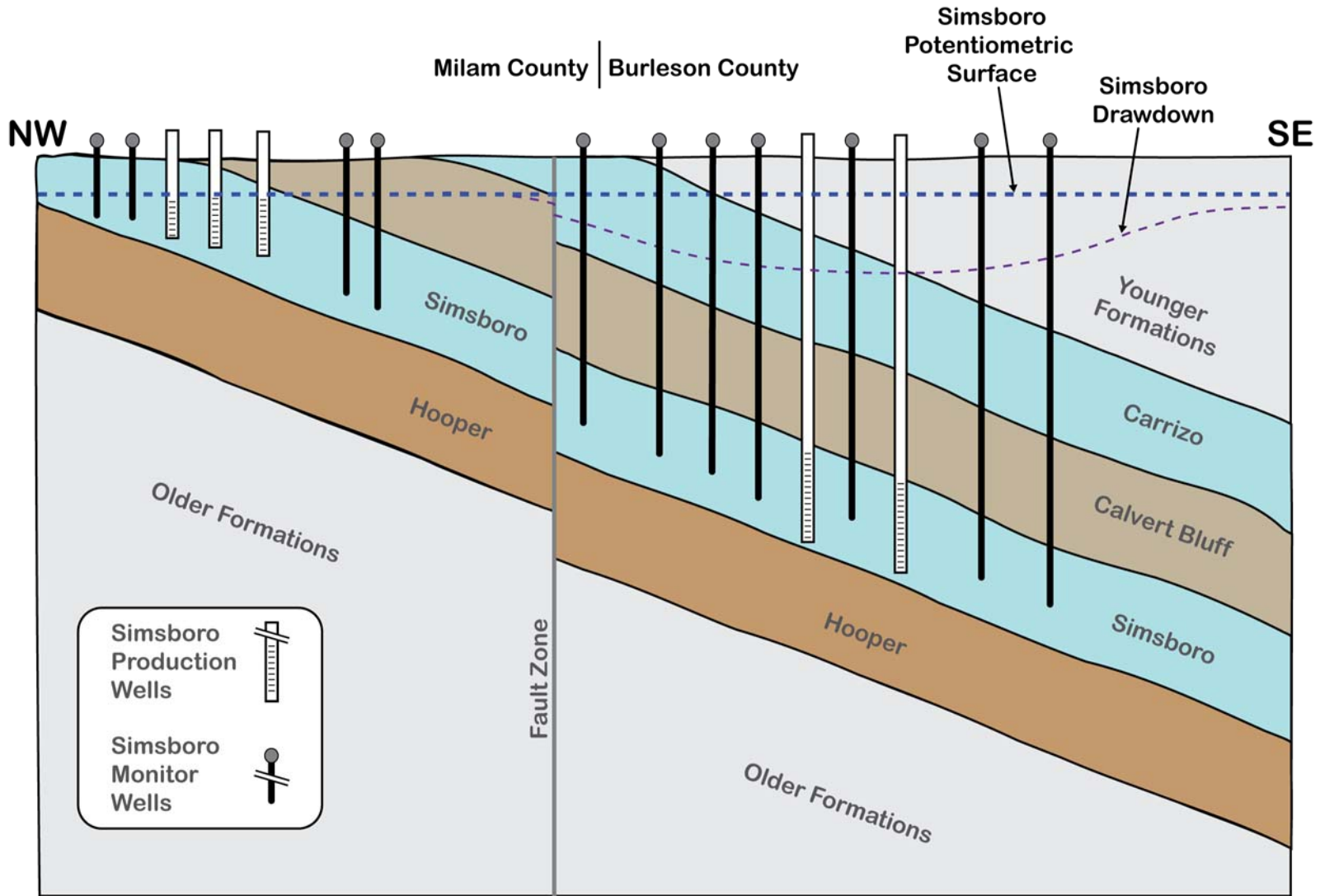
Adopted DFCs: Expressed in Average across District Simsboro (2010 to 2060)



Example DFC Calculations: Simsboro

Conditions			Desired Future Conditions - Drawdown
			Aquifer
DD in Unconfined Area	% Decline in artesian pressure	Max DD in Confined Area	Simsboro
10	0.25	450	312
15	0.25	450	313
20	0.25	450	313
25	0.25	450	314

Schematic Cross Section Simsboro Drawdown



Avg. Drawdown in
Shallow Simsboro Wells
is 15' x 326 sq. miles

Avg. Drawdown in
Deep Simsboro Wells
is 400' x 809 sq. miles

Rockdale Wells and Water Levels**

Well Name	Screen Depth	Pump Depth	Water Level	Well Buffer	Total Buffer
New Texas	370	273	128	145	242
Airport	443	235	134	101	309
Tracy	346	224	137	87	209
Runway	450	285	154	131	154
Praesel	225	225	N/A	N/A	N/A
Belton (m)	390	N/A	134	N/A	N/A

**Rockdale wells are located in the shallow portion of the Carrizo-Wilcox formations

Well Buffer = difference between Water Level and Pump Depth

Total Buffer= difference between Screen Depth and Water Level (if able to drop pumps)

(m) = monitor well only

Management utilizing DFCs

- **Adjusting based on Threshold Levels**

- Examples of Thresholds

- Percentage of DFC drawdown

- DFC is avg. 300 feet

- 1st Threshold is at 70% of DFC or 210 feet- notice and evaluations
- 2nd Threshold is at 80% of DFC or 240 feet- begin curtailment of permits
- 3rd Threshold is at 90% of DFC or 270 feet- continue curtailment of permits, considering other triggers

Predicted Drawdown Over Time

Zone/Aquifer		Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
Post Oak GCD	2020	19	28	89	96	196	108
	2040	24	37	109	128	254	147
	2060	27	42	122	154	306	184
Lost Pines GCD	2020	4	10	33	57	151	74
	2040	6	15	49	79	191	105
	2060	6	18	63	102	238	135
Brazos Valley GCD	2020	7	8	35	66	161	104
	2040	11	12	51	94	222	144
	2060	12	13	61	117	273	178
Mid-East Texas GCD	2020	-1	-2	34	40	68	56
	2040	-2	-3	46	57	93	78
	2060	-3	-5	55	70	115	97
Fayette County	2020	30	27	26	73	139	99
	2040	48	46	47	105	182	138
	2060	60	60	63	133	226	174

Note: Work in progress, all results are preliminary

Hydrogeology

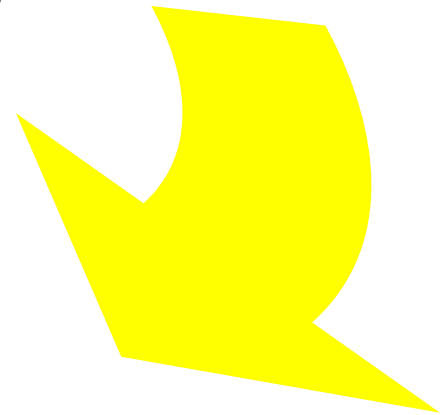


Legal
Framework

***GROUNDWATER
MANAGEMENT***



Institutional
Framework



Groundwater
Availability

=

DFC + MAG

(Policy) + (Science)

Confirmed Groundwater Conservation Districts

- 1. Anderson County UWCD
- 2. Bandera County River Authority & Ground Water District
- 3. Barton Springs/Edwards Aquifer CD
- 4. Bee GCD
- 5. Blanco-Pedernales GCD
- 6. Bluebonnet GCD
- 7. Brazoria County GCD
- 8. Brazos Valley GCD
- 9. Brewster County GCD
- 10. Central Texas GCD
- 11. Clear Fork GCD
- 12. Clearwater UWCD
- 13. Coastal Bend GCD
- 14. Coastal Plains GCD
- 15. Coke County UWCD
- 16. Colorado County GCD
- 17. Corpus Christi ASRCD
- 18. Cow Creek GCD
- 19. Crockett County GCD
- 20. Culberson County GCD
- 21. Duval County GCD
- 22. Edwards Aquifer Authority
- 23. Evergreen UWCD
- 24. Fayette County GCD
- 25. Fox Crossing Water District
- 26. Garza County UWCD
- 27. Gateway GCD
- 28. Glasscock GCD
- 29. Goliad County GCD
- 30. Gonzales County UWCD
- 31. Guadalupe County GCD
- 32. Hays Trinity GCD
- 33. Hayswater UWCD
- 34. Hemphill County UWCD
- 35. Hickory UWCD No. 1
- 36. High Plains UWCD No. 1
- 37. Hill Country UWCD
- 38. Hudspeth County UWCD No. 1
- 39. Irion County WCD
- 40. Jeff Davis County UWCD
- 41. Kenedy County GCD
- 42. Kimble County GCD
- 43. Kinney County GCD
- 44. Lipan-Kickapoo WCD
- 45. Live Oak UWCD
- 46. Llano Estacado UWCD
- 47. Lene Star GCD
- 48. Lone Wolf GCD
- 49. Lost Pines GCD
- 50. Lower Trinity GCD
- 51. McMullen GCD
- 52. Medina County GCD
- 53. Menard County UWCD
- 54. Mesa UWCD
- 55. Mesquite GCD
- 56. Mid-East Texas GCD
- 57. Middle Pecos GCD
- 58. Middle Trinity GCD
- 59. Neches & Trinity Valleys GCD
- 60. North Plains GCD
- 61. Northern Trinity GCD
- 62. Panhandle GCD
- 63. Panola County GCD
- 64. Pecan Valley GCD
- 65. Permian Basin UWCD
- 66. Pineywoods GCD
- 67. Plateau UWCD and Supply District
- 68. Plum Creek CD
- 69. Post Oak Savannah GCD
- 70. Prairielands GCD
- 71. Presidio County UWCD
- 72. Real-Edwards C and R District
- 73. Red River GCD
- 74. Red Sands GCD
- 75. Refugio GCD
- 76. Rolling Plains GCD
- 77. Rusk County GCD
- 78. San Patricio County GCD
- 79. Sandy Land UWCD
- 80. Santa Rita UWCD
- 81. Saratoga UWCD
- 82. South Plains UWCD
- 83. Southeast Texas GCD
- 84. Southern Trinity GCD
- 85. Star County GCD
- 86. Sterling County UWCD
- 87. Sutton County UWCD
- 88. Texana GCD
- 89. Trinity Glen Rose GCD
- 90. Upper Trinity GCD
- 91. Uvalde County UWCD
- 92. Victoria County GCD
- 93. Wes-Tex GCD
- 94. Wintergarden GCD

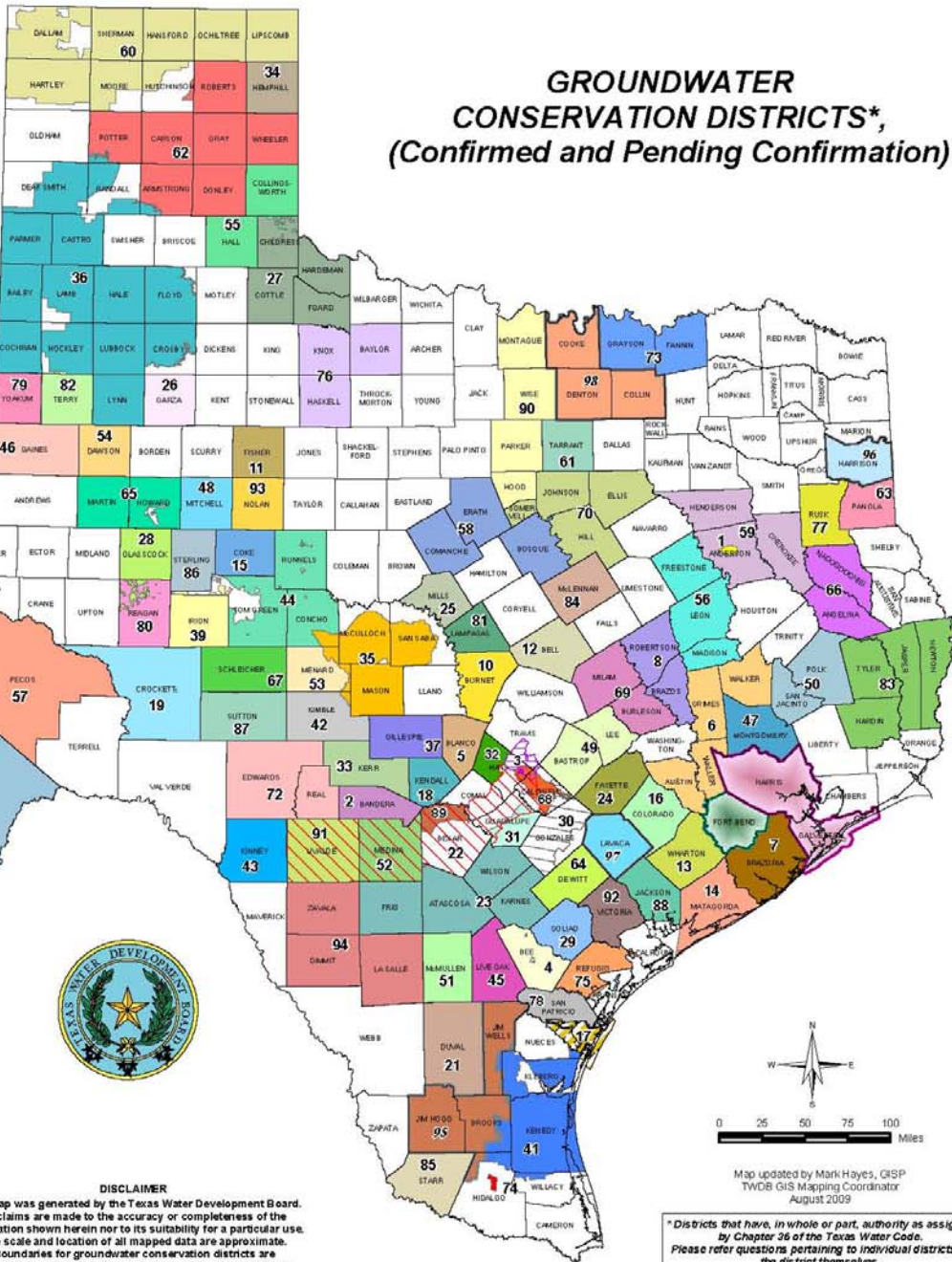
Pending Groundwater Conservation Districts

- 95. Brush Country GCD + &
 - 96. Harrison County GCD + &
 - 97. Lavaca County GCD + &
 - 98. North Texas GCD + &
- Pending Election Results**
 1 Created by the 90th Legislature
 4 Created by the 91st Legislature

Subsidence Districts

- Harris-Galveston Subsidence District
- Fort Bend Subsidence District

NOTE: These subsidence districts are not Groundwater Conservation Districts as defined under Chapter 36 of the Texas Water Code, but have the ability to regulate groundwater production to prevent land subsidence. (Refer to Senate Bill 1537 from the 79th Legislature Session)

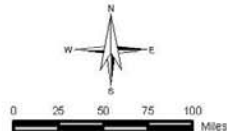


GROUNDWATER CONSERVATION DISTRICTS*, (Confirmed and Pending Confirmation)



DISCLAIMER

This map was generated by the Texas Water Development Board. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Boundaries for groundwater conservation districts are approximate and may not accurately depict legal descriptions.



Map updated by Mark Hayes, GISP
 TWDB GIS Mapping Coordinator
 August 2009

* Districts that have, in whole or part, authority as assigned by Chapter 36 of the Texas Water Code. Please refer questions pertaining to individual districts to the district themselves.

Questions?

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Serving the Citizens of Milam and Burleson Counties