

# Region K

## Water 101 Training Workshop Groundwater Presentation

Ronald G. Fieseler, P.G.

General Manager, Blanco-Pedernales Groundwater Conservation District

Jim Totten

General Manager, Lost Pines Groundwater Conservation District

“There ain’t no aquifers  
around here...but I got a  
dang good well.”

*Anonymous*

The background of the slide is a solid blue color. In the lower half, there are several faint, concentric white circles that resemble ripples on water, scattered across the bottom right and center areas.

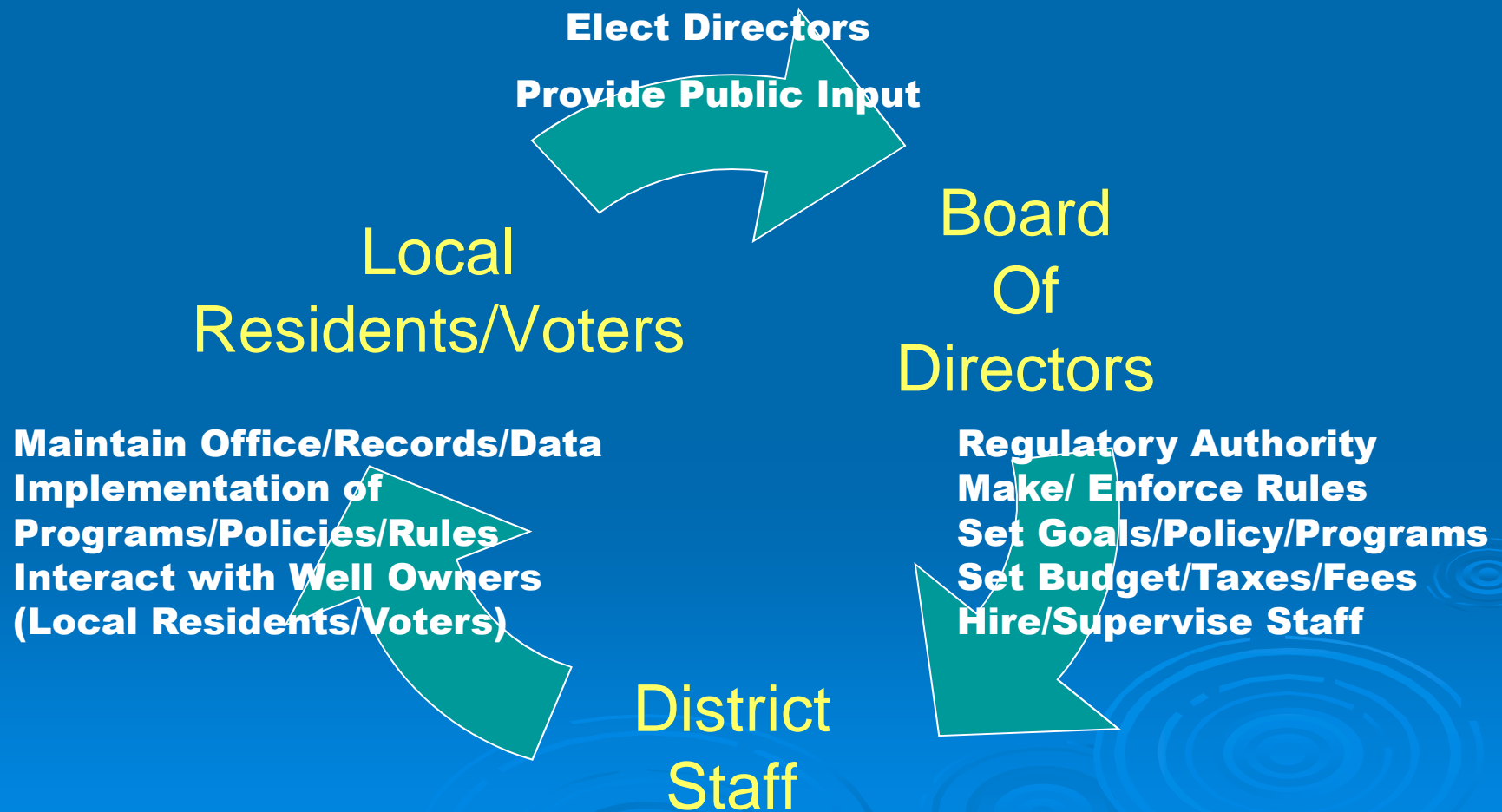
# Useful Terms:

- GCD – Groundwater Conservation District
- TWDB – Texas Water Development Board
- GMA – Groundwater Management Area
- RWPG – Regional Water Planning Group
- GAM - Groundwater Availability Model
- DFC – Desired Future Condition
- MAG – Modeled Available Groundwater

# Why Groundwater Districts

- Created by Texas legislature as the only method for local areas to regulate groundwater
- Groundwater districts are the only legal means to modify “Rule of Capture”
- Without a groundwater district you have no protection

# Groundwater Conservation District Organization



# Groundwater Conservation Districts

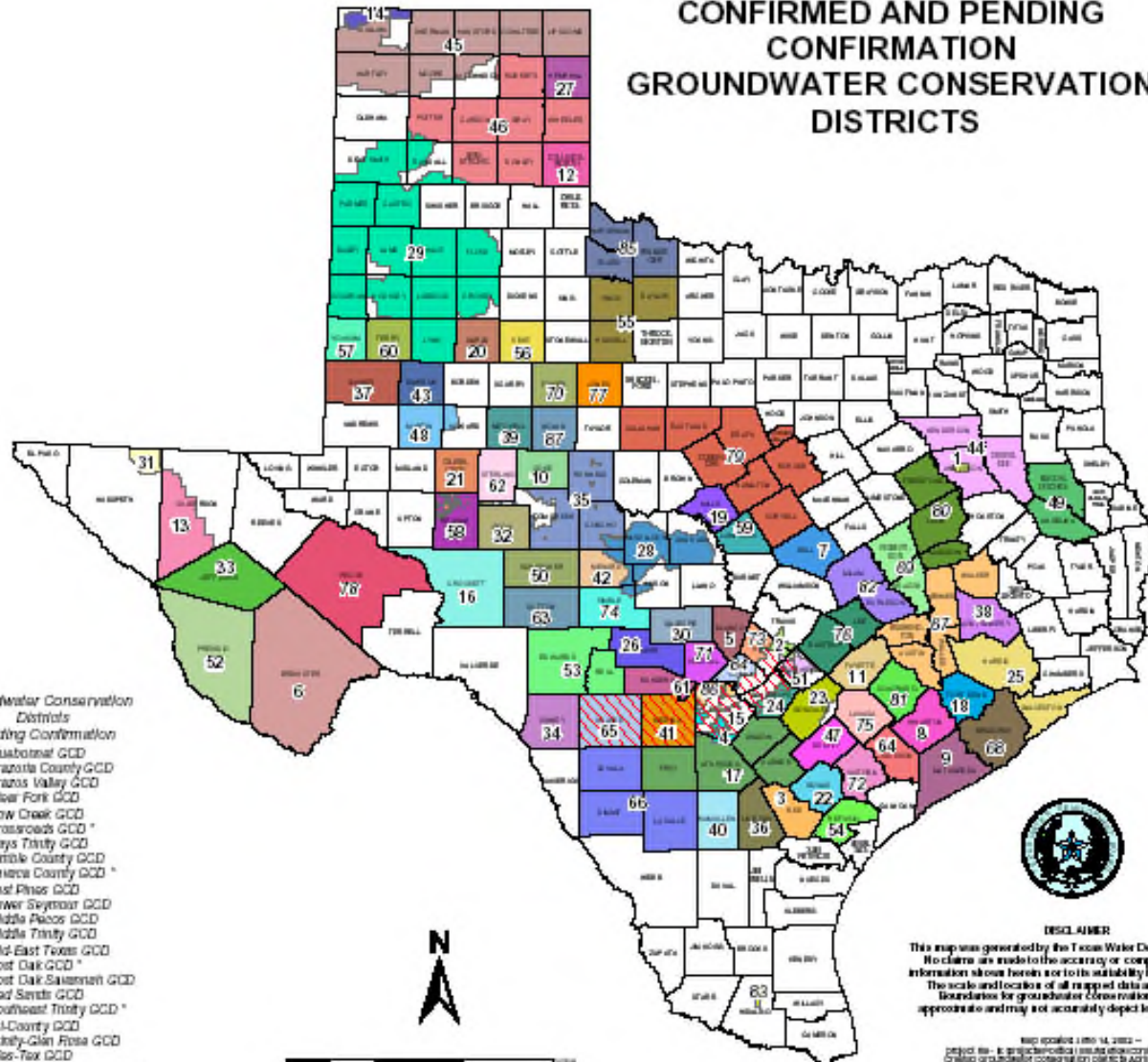
- ❑ Locally Controlled Groundwater Regulatory/Management Authorities, a “bottom up” management process
- ❑ Texas Water Code Chapter 36.0015: “Groundwater conservation districts created as provided by this chapter are the state's preferred method of groundwater management...”
- ❑ Approximately 100 GCDs. “One Size Does Not Fit All”  
Wide variety of local hydrogeological issues, demographics, climate, and political needs must be addressed by local GCDs
- ❑ Concerned about local Groundwater Quantity, Quality, Current & Future Demands, Aquifer Protection, and site - specific hydrogeological issues
- ❑ Should become an asset to the Local Property Owners

# CONFIRMED AND PENDING CONFIRMATION GROUNDWATER CONSERVATION DISTRICTS

- Confirmed Groundwater Conservation Districts**
- 1. Anderson County UWCD
  - 2. Barton Springs/Edwards Aquifer CD
  - 3. Bee GCD
  - 4. Bexar Metropolitan Water District
  - 5. Blanco-Pedernales GCD
  - 6. Brewster County GCD
  - 7. Clearwater UWCD
  - 8. Coastal Bend GCD
  - 9. Coastal Plains GCD
  - 10. Coke County UWCD
  - 11. Colorado Valley GCD
  - 12. Collingsworth County UWCD
  - 13. Culberson County GCD
  - 14. Dallam County UWCD No. 1
  - 15. Edwards Aquifer Authority
  - 16. Emerald UWCD
  - 17. Evergreen UWCD
  - 18. Fort Bend Subsidence District
  - 19. Fox Crossing Water District
  - 20. Garza County Underground And Fresh WCD
  - 21. Glasscock County UWCD
  - 22. Gold County GCD
  - 23. Gonzalez County UWCD
  - 24. Guadalupe County GCD
  - 25. Harris-Galveston Coastal Subsidence District
  - 26. Headwaters UWCD
  - 27. Hempfil County UWCD
  - 28. Hickory UWCD No. 1
  - 29. High Plains UWCD No.1
  - 30. Hill Country UWCD
  - 31. Huddspeth County UWCD No. 1
  - 32. Iron County WCD
  - 33. Jeff Davis County UWCD
  - 34. Kinney County GCD
  - 35. Upper-Rickapoo WCD
  - 36. Live Oak UWCD
  - 37. Llano Estacado UWCD
  - 38. Lone Star GCD
  - 39. Lone Wolf GCD
  - 40. McMillan GCD
  - 41. Medina County GCD
  - 42. Menard County UWCD
  - 43. Mesa UWCD
  - 44. Neches&Trinity Valleys GCD
  - 45. North Plains GCD
  - 46. Panhandle GCD
  - 47. Pecan Valley GCD
  - 48. Permian Basin UWCD
  - 49. Pinneywoods GCD
  - 50. Plateau UWCD And Supply District
  - 51. Plum Creek CD
  - 52. Presidio County UWCD
  - 53. Real-Edwards C and R District
  - 54. RioJugio GCD
  - 55. Rolling Plains GCD
  - 56. Salt Fork UWCD
  - 57. Sandy Land UWCD
  - 58. Santa Rita UWCD
  - 59. Saratoga UWCD
  - 60. South Plains UWCD
  - 61. Springhills Water Management District
  - 62. Sterling County UWCD
  - 63. Sutton County UWCD
  - 64. Texaco GCD
  - 65. Uvalde County UWCD
  - 66. Wintergarden GCD

- Groundwater Conservation Districts  
Pending Confirmation**
- 67. Bluebonnet GCD
  - 68. Brazoria County GCD
  - 69. Brazos Valley GCD
  - 70. Clear Fork GCD
  - 71. Cow Creek GCD
  - 72. Crossroads GCD \*
  - 73. Hays Trinity GCD
  - 74. Kirtile County GCD
  - 75. Lavaca County GCD \*
  - 76. Lost Pines GCD
  - 77. Lower Seymour GCD
  - 78. Middle Peas GCD
  - 79. Middle Trinity GCD
  - 80. Mid-East Texas GCD
  - 81. Post Oak GCD \*
  - 82. Post Oak Savannah GCD
  - 83. Red Sands GCD
  - 84. Southeast Trinity GCD \*
  - 85. Tri-County GCD
  - 86. Trinity-Glan Rose GCD
  - 87. Waco-Tex GCD

\* Districts Filled Initial Confirmation Election



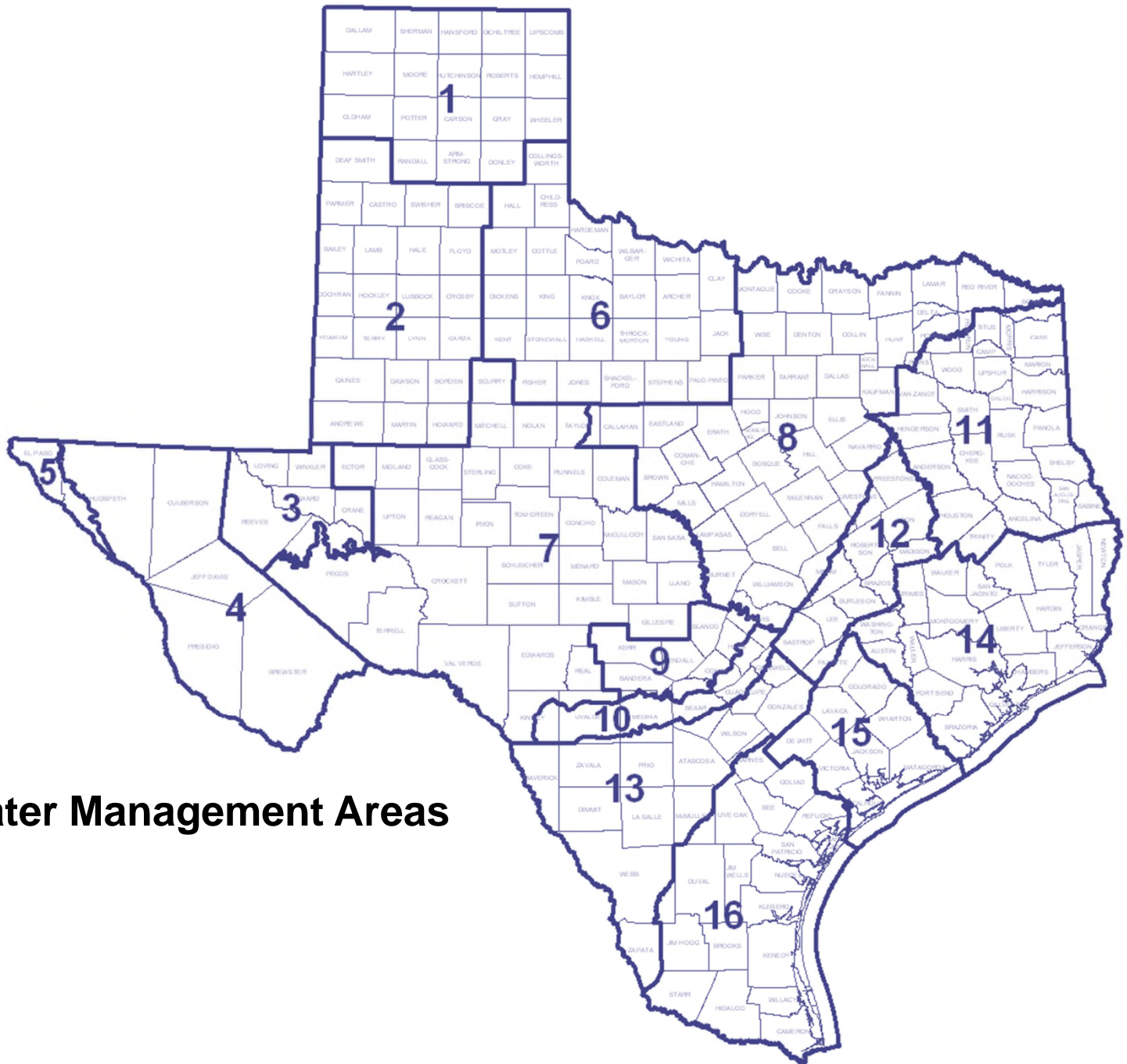
**DISCLAIMER**  
This map was generated by the Texas Water Development Board. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Boundaries for groundwater conservation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

Map updated 1/20/14, 2013 -  
Project 66 - Groundwater Conservation Districts and Water  
Quality Groundwater Conservation Districts April 2000 to 1/20/14

# Groundwater Management Areas

- ❑ TWDB designated 16 Groundwater Management Areas (GMAs) in December 2002
- ❑ House Bill 1763 (2005) Required GCDs within a GMA to conduct Joint Planning to determine the Desired Future Conditions of Aquifers both regionally and locally
- ❑ GMAs first required to set Desired Future Conditions of Aquifers by Sept. 2010
- ❑ GMAs must meet annually to review status of DFCs and must re-adopt or revise DFCs every five years (2<sup>nd</sup> Planning Cycle almost complete)





# 16 Groundwater Management Areas

# Case Study - GMA 9

Bandera County River Authority & GCD - Bandera County

Barton Springs/Edwards Aquifer Conservation District –  
Parts of Hays and Travis County

Blanco-Pedernales GCD - Blanco County

Edwards Aquifer Authority - in Bexar County (non-voting)

Comal Trinity GCD – Comal County

Cow Creek GCD - Kendall County

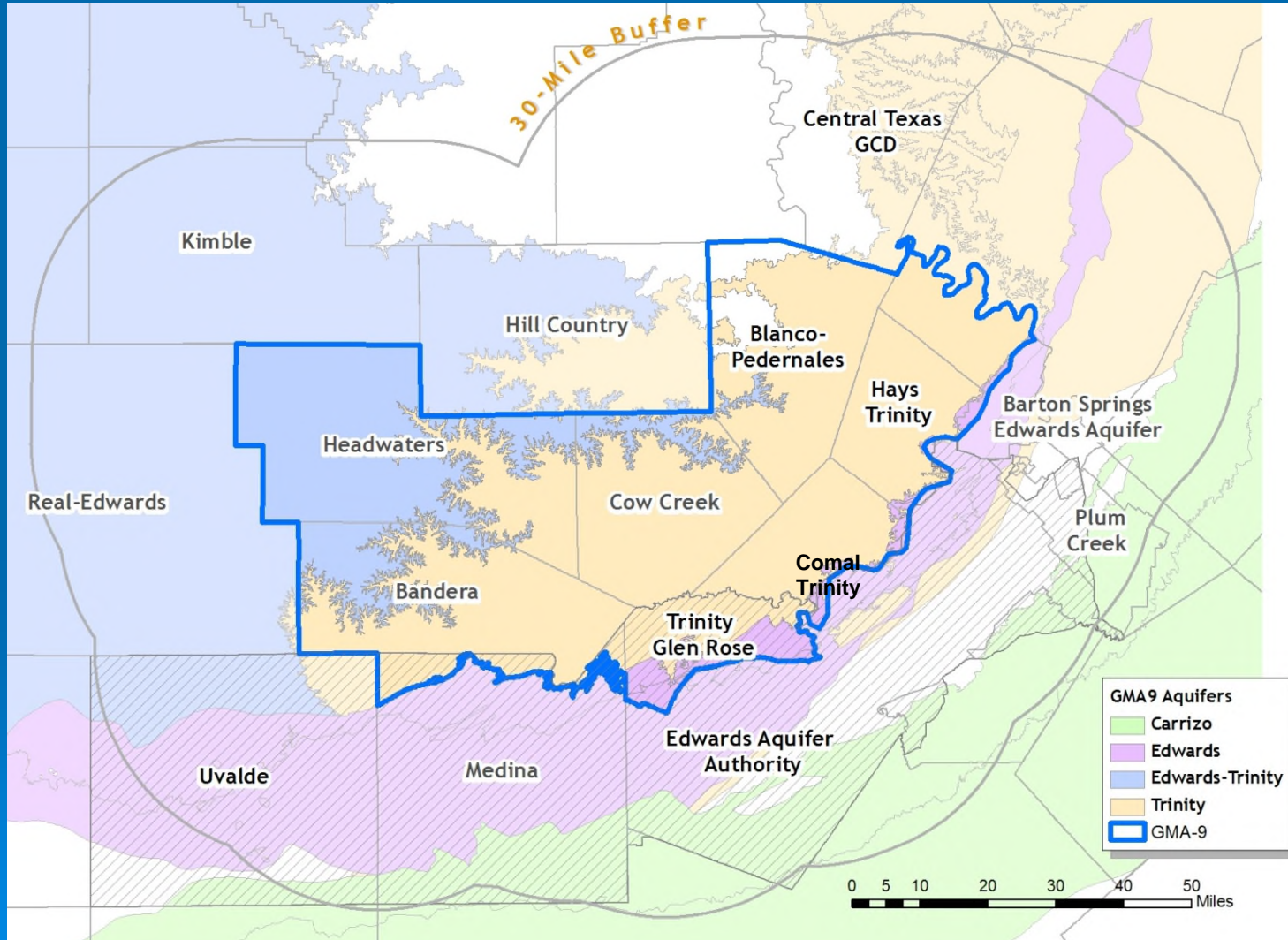
Hays Trinity GCD - Western Hays County

Headwaters GCD - Kerr County

Medina County GCD - Northern Medina County

Trinity Glen Rose GCD - Northern Bexar County

# GCDs and Major Aquifers in GMA 9



# GMA 9 Organization

- ❑ Interlocal Agreement between GCDs
- ❑ GMA 9 Committee consists of the Board President of each District or their designated representative
- ❑ GMA 9 Technical or Liaison Committees consists of General Managers, hydrologists, geologists, consultants, or other technically oriented individuals and serve as needed for specific projects
- ❑ Consultants are hired by GMA 9 for specific projects
- ❑ State of Texas does not provide funding for GMAs. GCDs use local funds to meet legislative mandates.

GMA 9 determines the  
Desired Future Conditions (DFCs)

which will followed by

the TWDB calculating the  
Modeled Available Groundwater (MAG)

(How do we do this ???)

The background of the slide features several concentric, light blue circular ripples that resemble water droplets hitting a surface, scattered across the lower half of the frame.

# Desired Future Condition (DFC)

“...a physical, quantifiable condition of an aquifer...”

This is a local political (GCD/GMA) decision, but it is one that must be based on sound scientific data in order to be considered “reasonable.”

# Examples of Desired Future Condition Statements

## Spring Flows

Spring flows are not lower than 10% of mean values for perpetuity

## Volume

Fifty percent of the water in the aquifer is remaining after 50 years

## Water Levels

On average, water levels are 100 feet lower than current levels in 50 years

## Water Quality

Total dissolved solids concentrations are not allowed to exceed 1,000 milligrams per liter in 50 years.



In Texas, anything can happen...



So we need to  
plan ahead for  
a variety of  
situations....



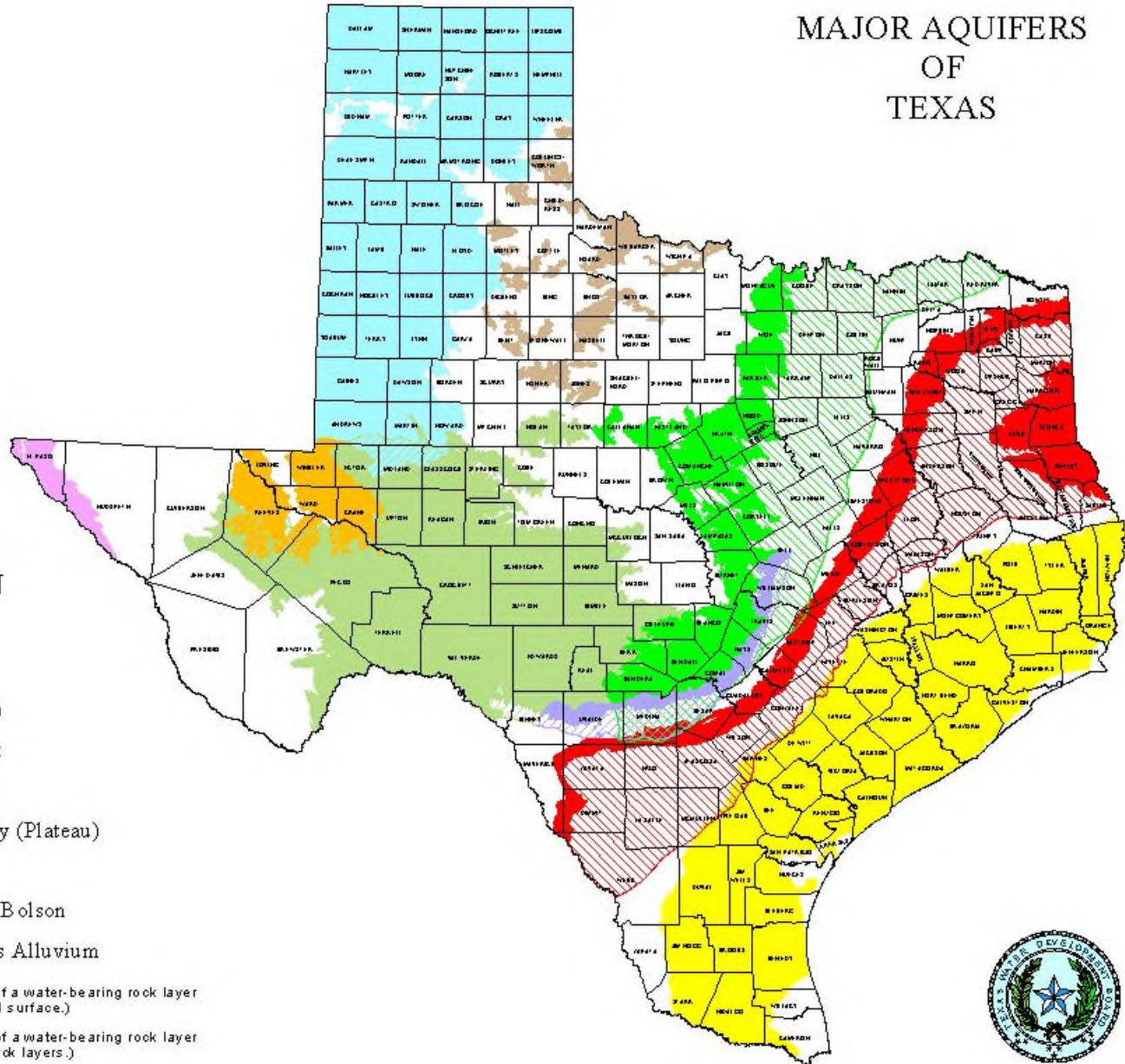
# Water, Water, Everywhere



# Except During a Drought!



# MAJOR AQUIFERS OF TEXAS



## EXPLANATION

- Ogallala
- Gulf Coast
- \* Edwards (BFZ)
- \* Carrizo-Wilcox
- \* Trinity
- \* Edwards-Trinity (Plateau)
- Seymour
- Hueco-Mesilla Bolson
- Cenozoic Pecos Alluvium

OUTCROP (That part of a water-bearing rock layer which appears at the land surface.)

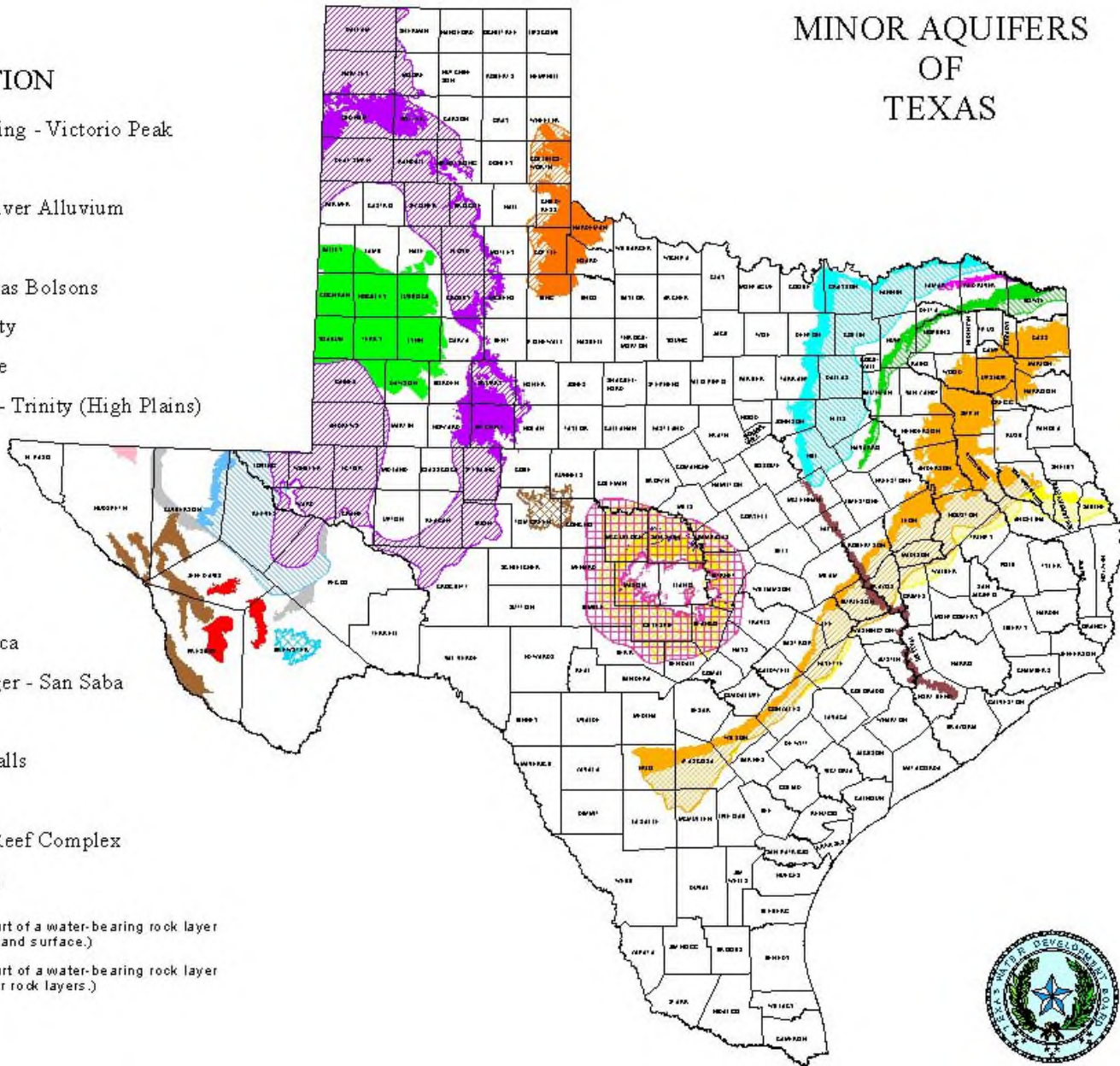
\* DOWNDIP (That part of a water-bearing rock layer which dips below other rock layers.)



# MINOR AQUIFERS OF TEXAS

## EXPLANATION

-  Bone Spring - Victorio Peak
-  Dockum
-  Brazos River Alluvium
-  Hickory
-  West Texas Bolsons
-  Queen City
-  Woodbine
-  Edwards - Trinity (High Plains)
-  Blaine
-  Sparta
-  Nacatoch
-  Lipan
-  Igneous
-  Rita Blanca
-  Ellenburger - San Saba
-  Blossom
-  Marble Falls
-  Rustler
-  Capitan Reef Complex
-  Marathon



OUTCROP (That part of a water-bearing rock layer which appears at the land surface.)

\* DOWNDIP (That part of a water-bearing rock layer which dips below other rock layers.)



# Driller's Well Logs



# Geophysical Well Logs



# Groundwater Monitoring



# Water Level Measurements





# Spring Discharge

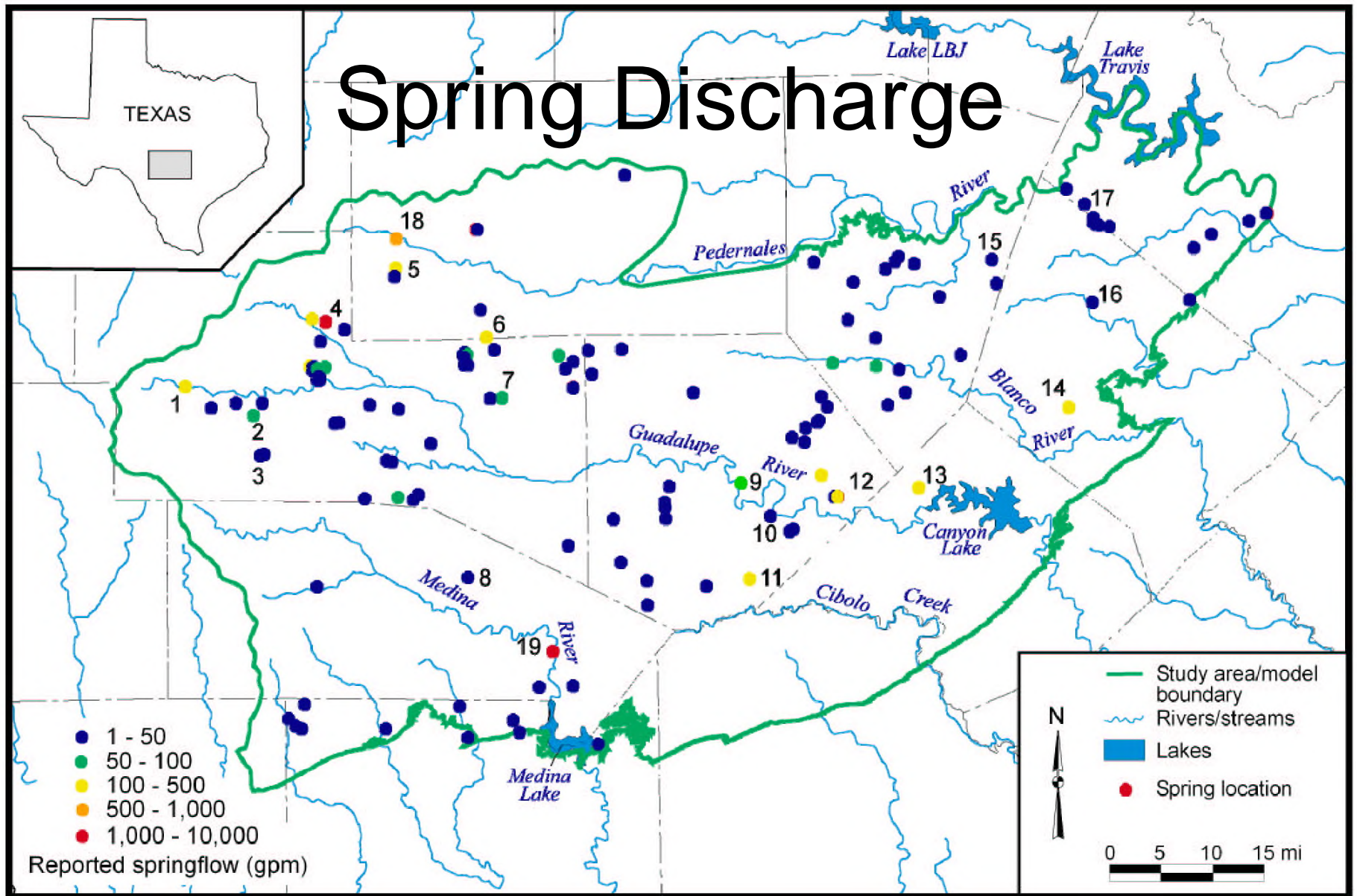
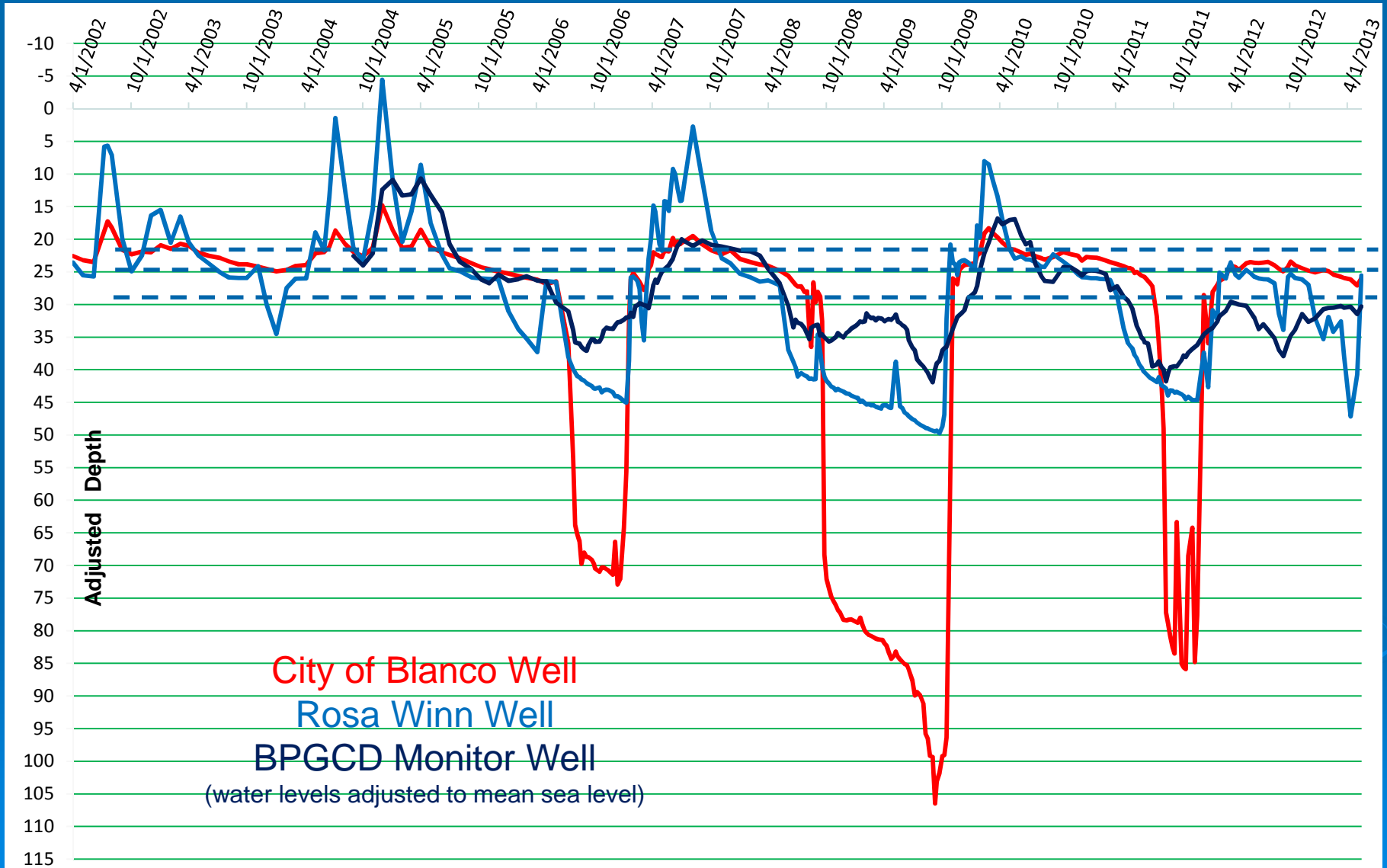


Figure 2. Map showing estimated spring discharges in the model area (from Mace and others, 2000). Springs simulated in the model are numerically labeled 1 to 19.

# Well Correlation

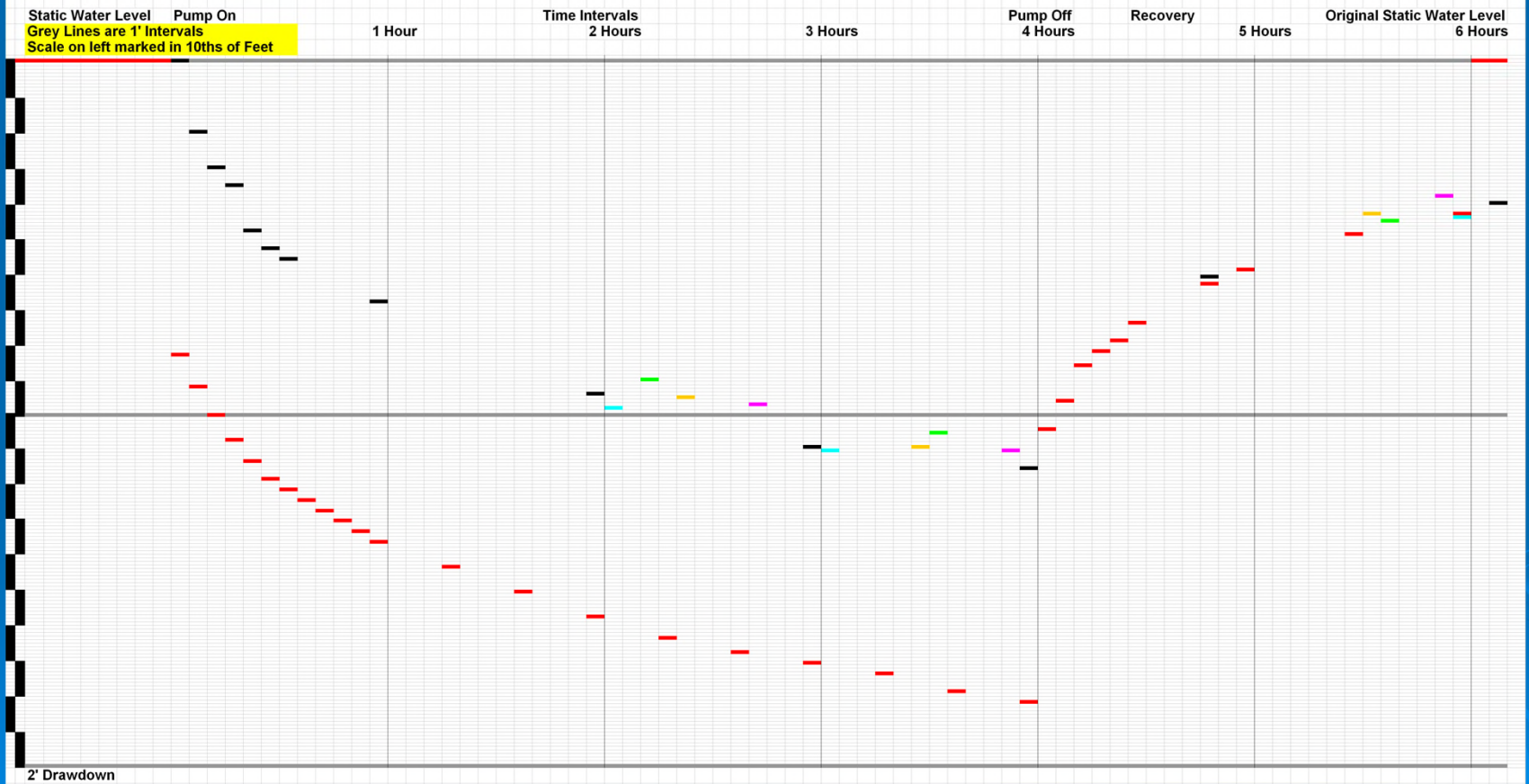


# Aquifer Testing



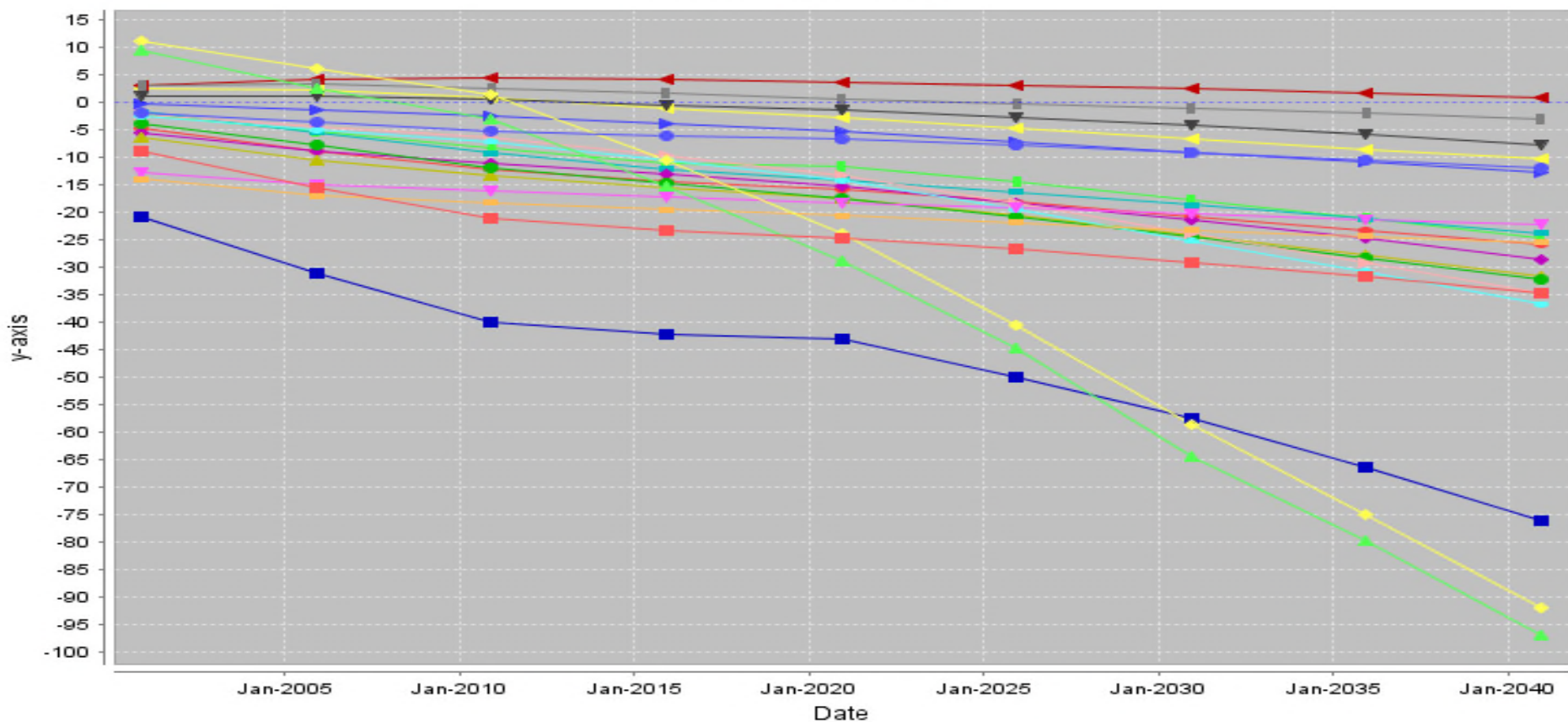
# Data Analysis

Rockin J Well # 1 Pump Test Drawdown Conducted on March 3, 2006 by BPGCD



# GMA 9 Drawdown Example

## DRAWDOWN AVG



- Bandera County AND LAYER3 (ron favorite)
- Bandera County AND LAYER3 (Hays x 1.0)
- Bexar County AND LAYER3 (ron favorite)
- Bexar County AND LAYER3 (Hays x 1.0)
- Blanco County AND LAYER3 (ron favorite)
- Blanco County AND LAYER3 (Hays x 1.0)
- Comal County AND LAYER3 (ron favorite)
- Comal County AND LAYER3 (Hays x 1.0)
- Gillespie County AND LAYER3 (ron favorite)
- Gillespie County AND LAYER3 (Hays x 1.0)
- Hays County AND LAYER3 (ron favorite)
- Hays County AND LAYER3 (Hays x 1.0)
- Kendall County AND LAYER3 (ron favorite)
- Kendall County AND LAYER3 (Hays x 1.0)
- Kerr County AND LAYER3 (ron favorite)
- Kerr County AND LAYER3 (Hays x 1.0)
- Medina County AND LAYER3 (ron favorite)
- Medina County AND LAYER3 (Hays x 1.0)
- Travis County AND LAYER3 (ron favorite)
- Travis County AND LAYER3 (Hays x 1.0)

# GMA 9 Stakeholder Process

## Primary Goals

Gather Stakeholder Information Through Interviews

Understand the Issues

GMA 9 Decision Support

# GMAAs will Approve DFCS

- ❑ GMA Committee Members will consult with their local GCD Board of Directors on the recommended DFCS
- ❑ A Public Hearing will be held to explain the proposed DFCS and receive public comment at each local GCD
- ❑ The GMA Committee will later meet to vote on the DFCS and submit them to the TWDB along with an Explanatory Report

# Don't like the DFC?

## You might petition the TWDB

- ❑ A person with a legally defined interest in the groundwater in the groundwater management area, a district in or adjacent to the groundwater management area, or a regional water planning group for a region in the groundwater management area may:
  - file a petition** with the TWDB appealing the approval of the desired future conditions of the groundwater resources
  - provide evidence that the districts did not establish a reasonable desired future condition** of the groundwater resources in the groundwater management area.
- ❑ If such petitions are filed timely and meet legal requirements, they may trigger a public hearing process, which may result in recommendations on DFC revisions.



# DFC to a MAG

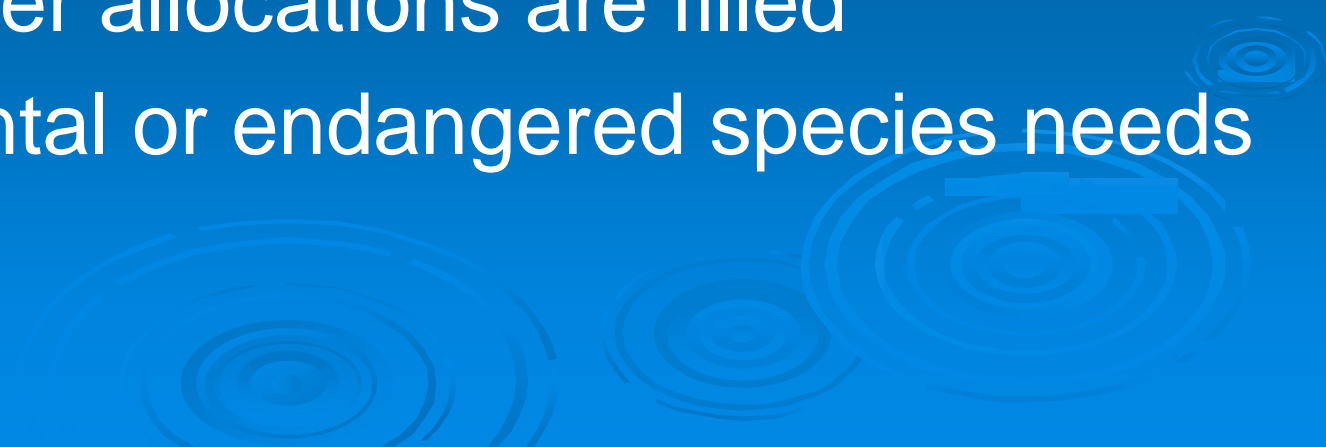
## GMA Coordination and Cooperation with TWDB



# TWDB will use the DFC to Calculate a MAG

- ❑ This will generally require the use of a Groundwater Availability Model (GAM).
- ❑ The Hill Country Trinity GAM will be the primary tool used in determining the MAG in the Trinity Aquifer for GMA 9 and its member GCDs.
- ❑ It uses model cells with assigned hydrological characteristics and assumptions to approximate field conditions.


# Current or Potential Problems

- ❑ Dry shallow wells and lowering water levels
  - ❑ Dry springs or reduced flow
  - ❑ Contaminated water supplies
  - ❑ Urban encroachment
  - ❑ Increasing demand on groundwater as surface water allocations are filled
  - ❑ Environmental or endangered species needs
- 


# Causes of Water Problems

- ❑ Population growth and demographic changes
- ❑ Limited water resources, both surface and groundwater
- ❑ Drought frequency and length of drought
- ❑ Legal interpretations on use and ownership of groundwater
- ❑ Limited authority of GCDs
- ❑ Groundwater Marketing – Water Rights

# Consequences of (Poor) Management or Lack Thereof

- ❑ More dry wells and lowering aquifer levels
  - ❑ Reduction or cessation of spring flow
  - ❑ Reductions in base flow to creeks and rivers
  - ❑ More water contamination
  - ❑ Litigation
  - ❑ Unlimited drilling of new wells
  - ❑ Unlimited pumping of groundwater
- 

# Possible Actions

- ❑ Cooperation
  - ❑ Responsible development
  - ❑ Market incentives
  - ❑ Public education
  - ❑ Alternative sources and conservation
  - ❑ Infrastructure investment
- 

# Barriers to GCD Action

- ❑ **Limited resources**

  - money**

  - data**

  - staff**

  - education**


- ❑ **Mistrust of government**

- ❑ **Costly alternatives**

- ❑ **Resistance to change and/or regulation**

- ❑ **Legal challenges**

# Ideal Outcomes

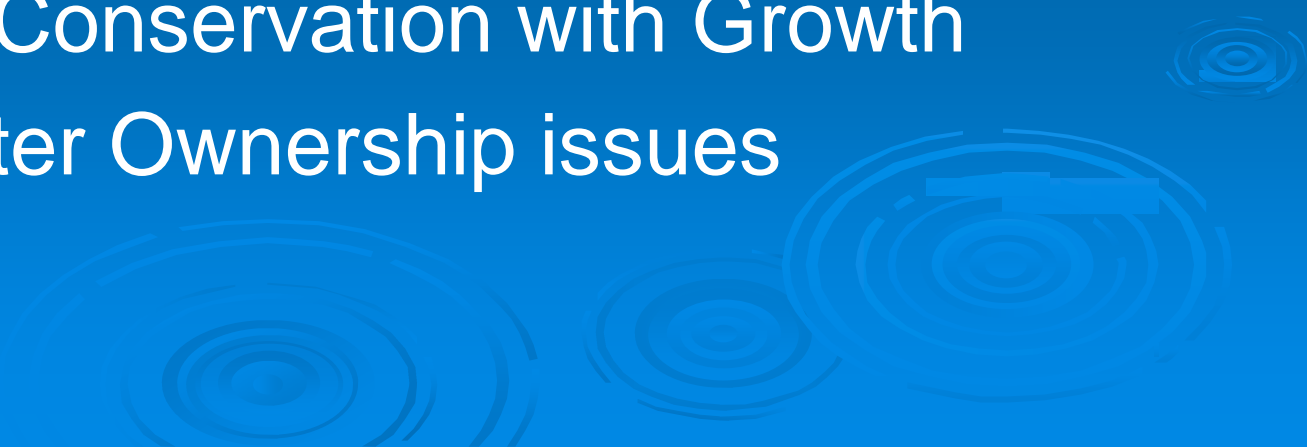
- ❑ Assured water availability for all users
  - ❑ Maintain spring flows
  - ❑ Maintenance of groundwater levels
  - ❑ No Lawsuits!
- 



# Areas of Consensus

- ❑ Increased communication and coordination between GCD's
- ❑ Development of a comprehensive plan representing all interests
- ❑ Continuous long term groundwater availability
- ❑ There will be growth - how do we manage it effectively?

# Areas of Contention

- ❑ What is Appropriate Data
  - ❑ Prioritization of Use
  - ❑ How much development, who controls it?
  - ❑ How do GCDs effectively restrict pumping?
  - ❑ Geological vs. Political Boundaries
  - ❑ Balancing Conservation with Growth
  - ❑ Groundwater Ownership issues
- 

# MAGs go to the Region Water Planning Groups

- ❑ Once the MAGs have been determined, they will be sent to the Regional Water Planning Groups.
- ❑ The MAGs will be incorporated into each Regional Water Plan (another 50 year plan)
- ❑ Once the Regional Water Plans are completed, they will be incorporated into the State of Texas Water Plan

# Onward Through the Fog...


Chapter 36 requires an iterative process...

- ❑ GMAs must meet at least annually to review the DFCs, the MAGs, and the Groundwater Management Plans of each GCD.
- ❑ GMAs must review the DFCs at least once every five years
- ❑ The RWPG and TWDB must review the Regional and State Water Plans every five years

Can All This Be Accomplished?

well...

“Even a blind squirrel  
will find an acorn once  
in a while.”



**Ronald G. Fieseler, P.G.**

**[manager@blancogw.org](mailto:manager@blancogw.org)**

**(830) 868-9196**

**[www.blancocountygroundwater.org](http://www.blancocountygroundwater.org)**

**Jim Totten**

**[jtotten@lostpineswater.org](mailto:jtotten@lostpineswater.org)**

**(512)360-5088**

**[www.lostpineswater.org](http://www.lostpineswater.org)**