

# The Texas Water Quality Inventory – Groundwater Assessment

AKA: The “305(b)” Report

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Texas Commission on Environmental Quality



- In 2003, groundwater provided 57 percent of the 16.2 million acre-feet
- Farmers used about 79 percent of this groundwater
- Municipalities relied on groundwater for about 36 percent of their water supplies



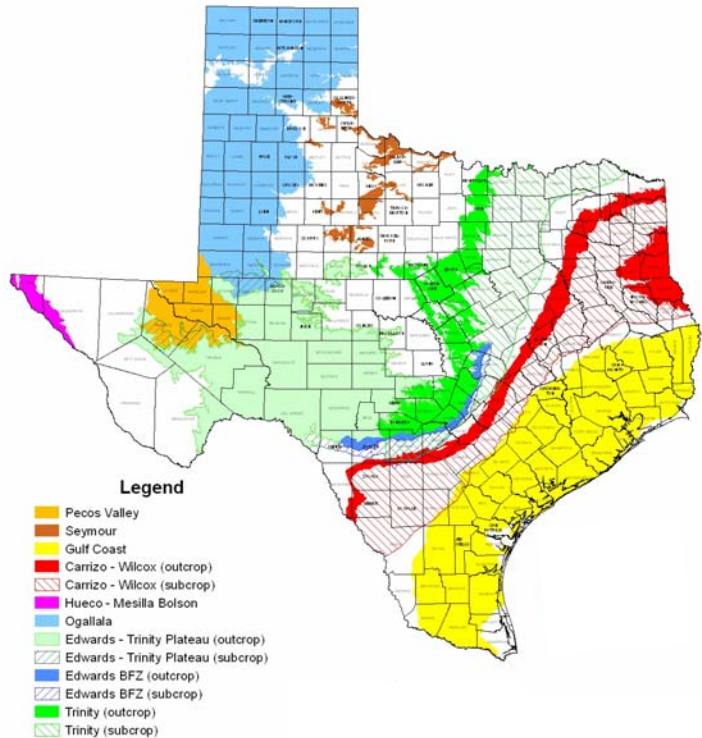
# The Water Quality Inventory data depends heavily on

- the ambient water quality data from the TWDB
- but also incorporates some data from TCEQ's Public Drinking Water program and other sources



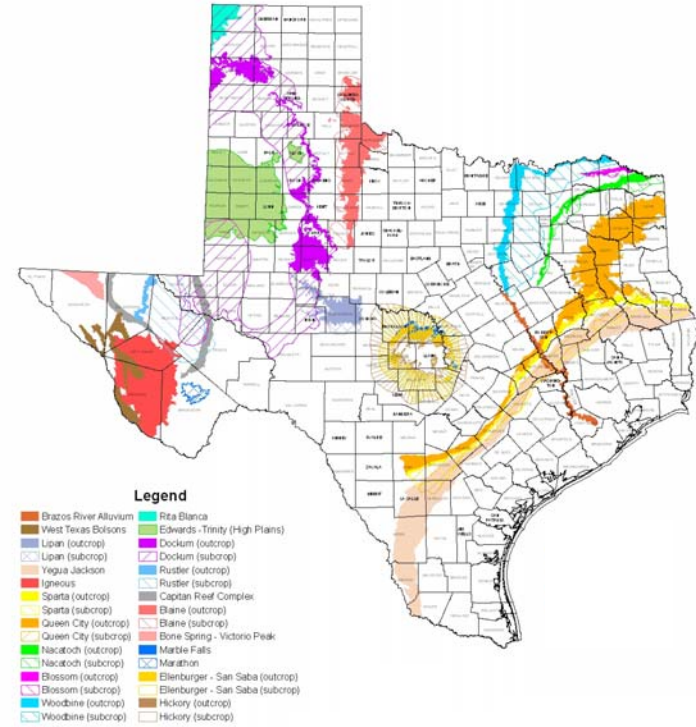
# Aquifers

## Major Aquifers



of

Texas

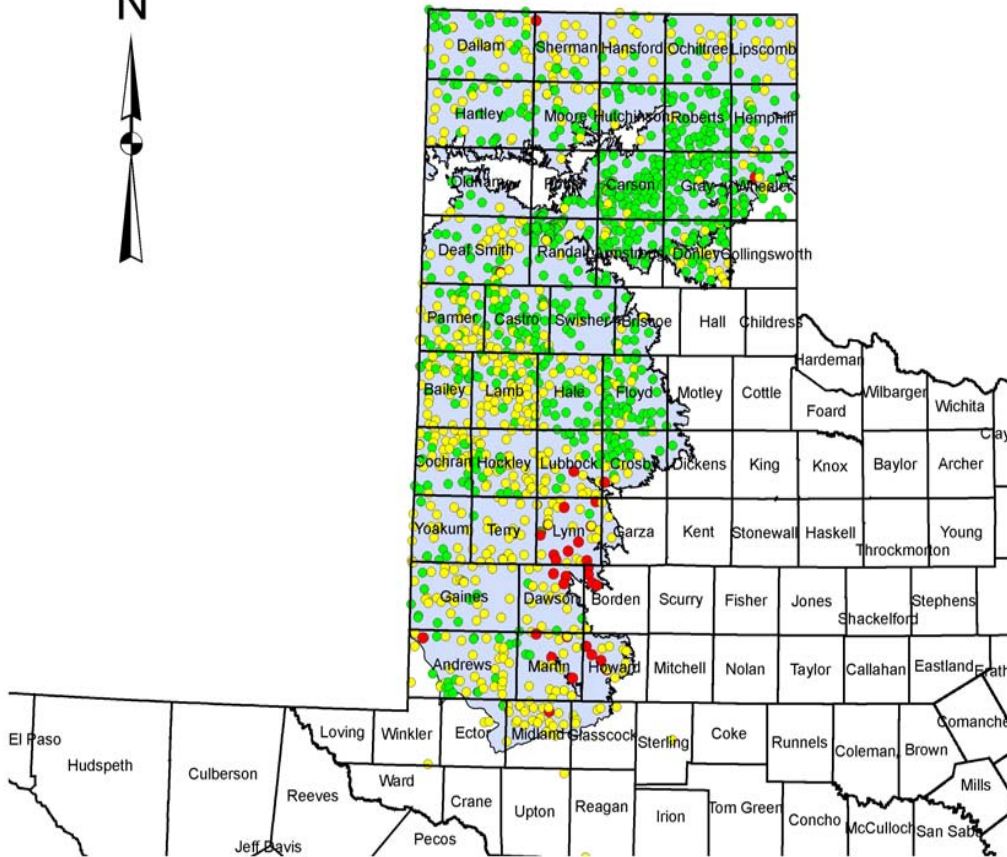


## Minor Aquifers



We will begin in aquifers underlying  
the High Plains of Texas, Ogallala  
Aquifer and will generally move  
South from there ...





### Nitrate Concentration

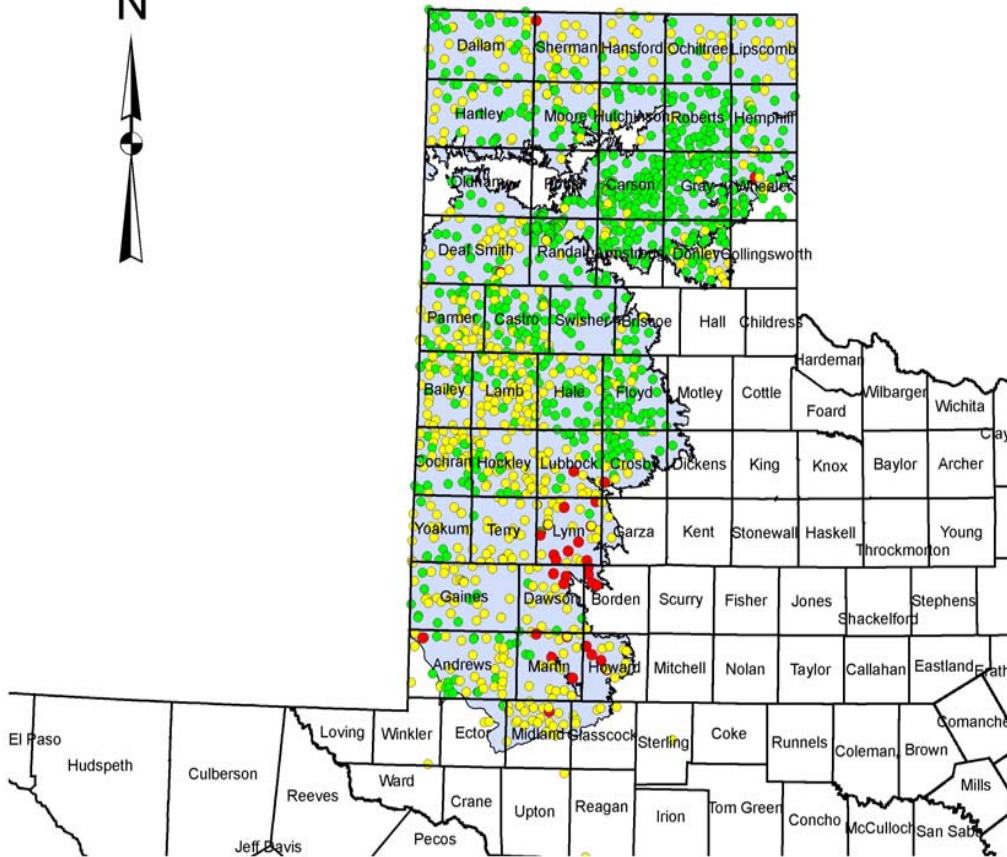
- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l, but Less Than 100 mg/l
- Greater Than or Equal to 100 mg/l

■ Ogallala Aquifer

Nitrate is a constituent of concern for the Ogallala aquifer.







Nitrate Concentration

- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l, but Less Than 100 mg/l
- Greater Than or Equal to 100 mg/l

■ Ogallala Aquifer

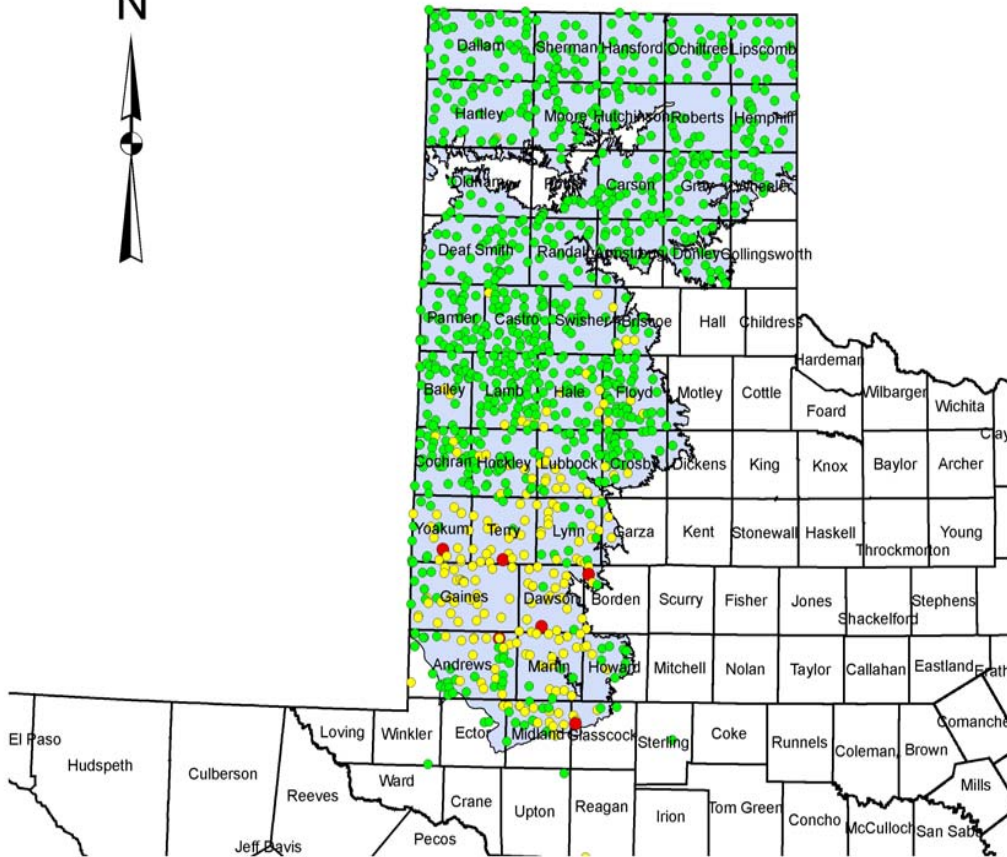
Newborn and nursing infants exposed to high nitrates in drinking water may develop methemoglobinemia, or “blue baby syndrome”



- A special study on Nitrate loading to Texas aquifers was completed in 2007
- The study was done by the Bureau of Economic Geology, Jackson School of Geosciences, University of Texas at Austin







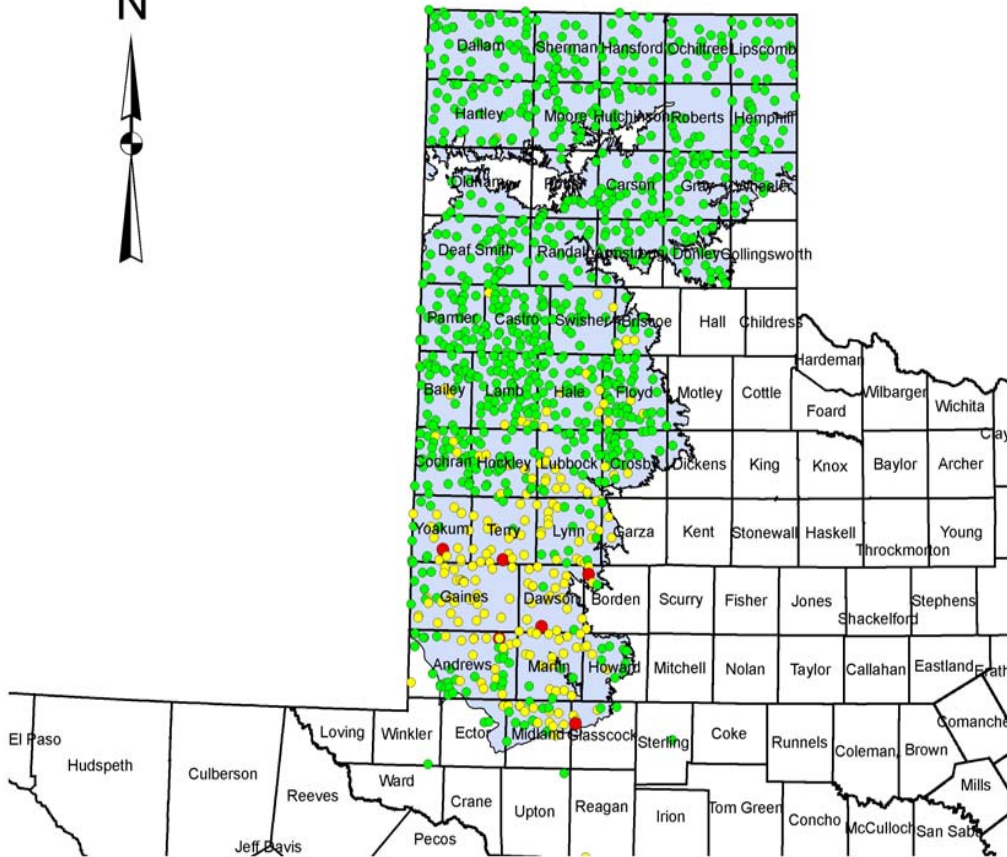
Arsenic Concentration

- Less than 10 ug/l
- Greater Than or Equal to 10 ug/l, but Less Than 50 ug/l
- Greater Than or Equal to 50 ug/l

■ Ogallala Aquifer

Arsenic is also present at concentrations of concern in the Ogallala aquifer.





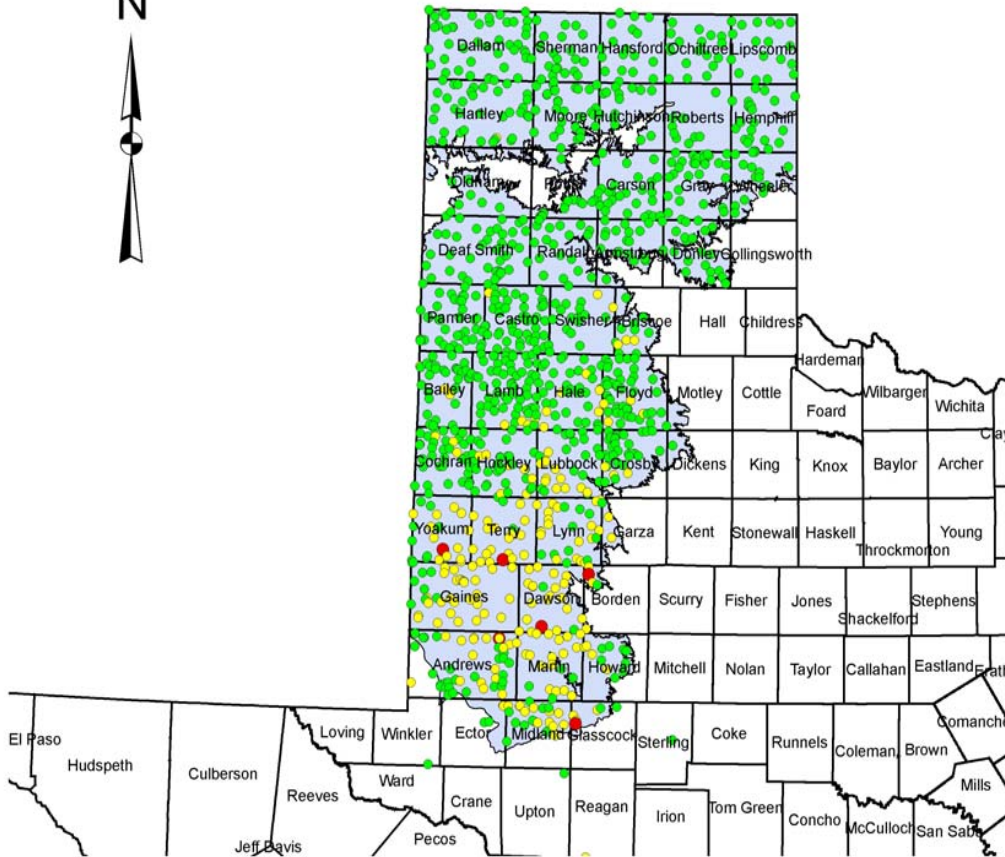
Arsenic Concentration

- Less than 10 ug/l
- Greater Than or Equal to 10 ug/l, but Less Than 50 ug/l
- Greater Than or Equal to 50 ug/l

■ Ogallala Aquifer

Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate.





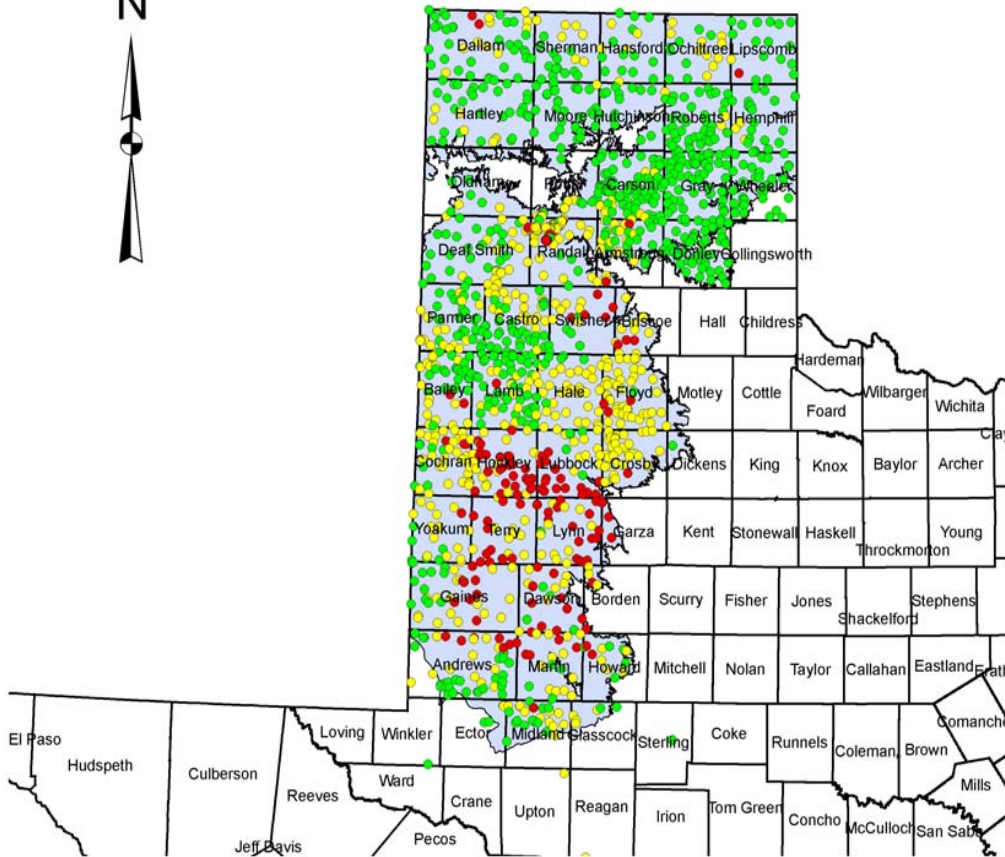
Arsenic Concentration

- Less than 10 ug/l
- Greater Than or Equal to 10 ug/l, but Less Than 50 ug/l
- Greater Than or Equal to 50 ug/l

■ Ogallala Aquifer

Non-cancer effects from arsenic can include thickening and discoloration of the skin, stomach pain, nausea, numbness in extremities, partial paralysis and blindness.





Fluoride Concentration

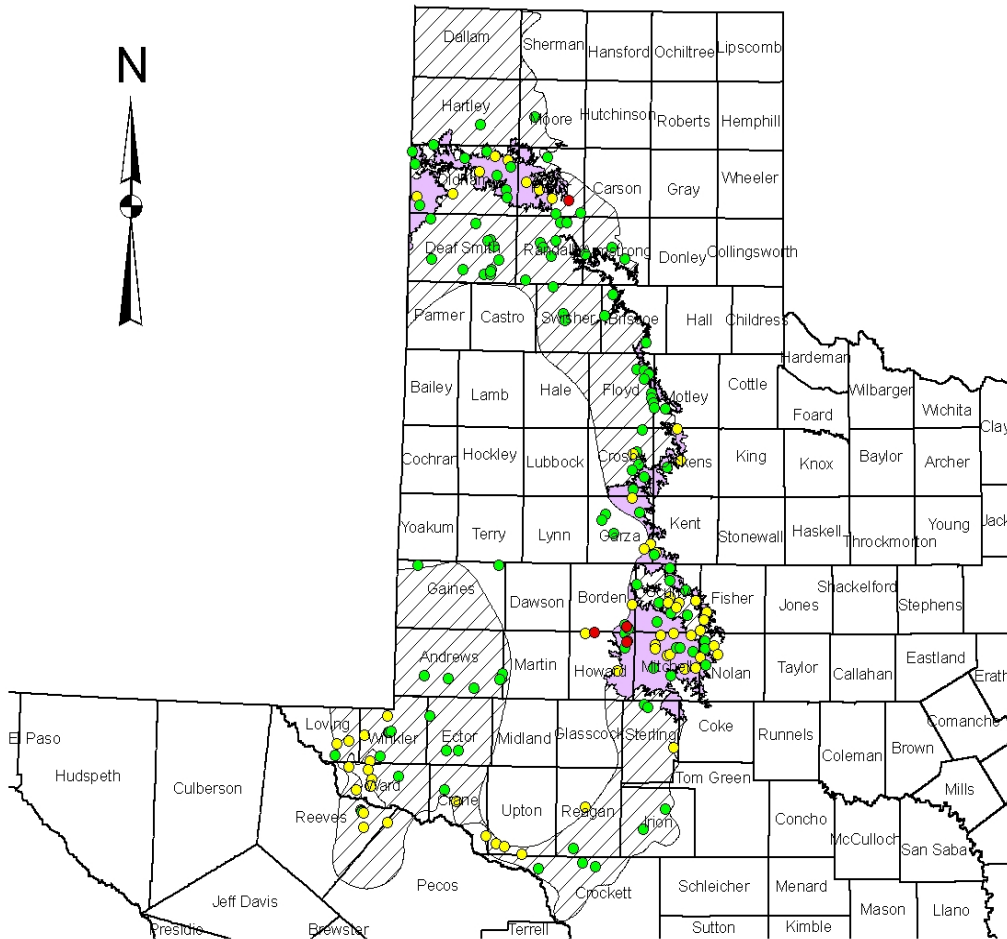
- Less than 2 mg/l
- Greater Than or Equal to 2 mg/l, but Less Than 4 mg/l
- Greater Than or Equal to 4 mg/l

■ Ogallala Aquifer

Exposure to levels of fluoride above the primary MCL of 4 mg/l may result in bone disease. Levels above 2 mg/l may result in staining or pitting of teeth.





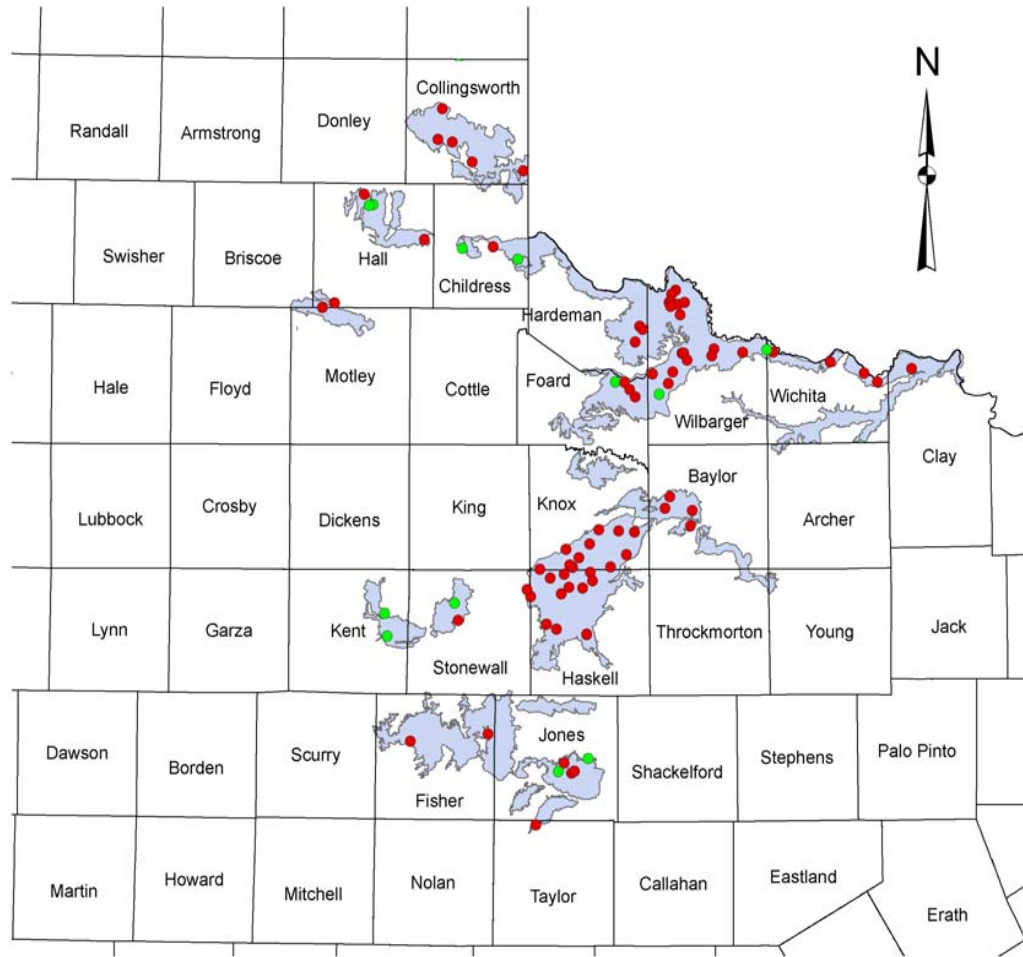


### Nitrate Concentration

- Less than 10 mg/l
  - Greater Than or Equal to 10 mg/l, but Less Than 100 mg/l
  - Greater Than or Equal to 100 mg/l
- (Outcrop) Dockum Aquifer  
▨ (Downdip)  
(Adjacent or Overlying Aquifers Omitted for Clarity)

The Dockum aquifer generally underlies the Ogallala. It has some issues with nitrate as well.

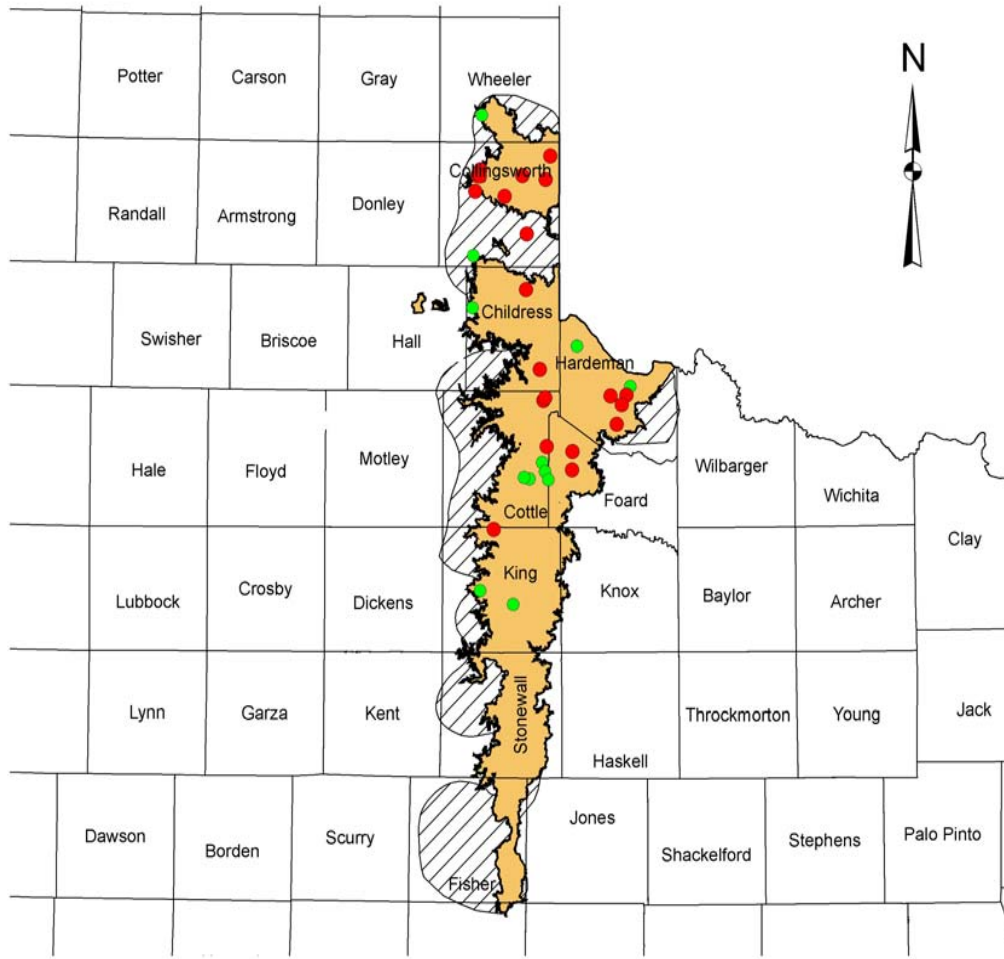




Nitrates are a concern in Seymour Aquifer.







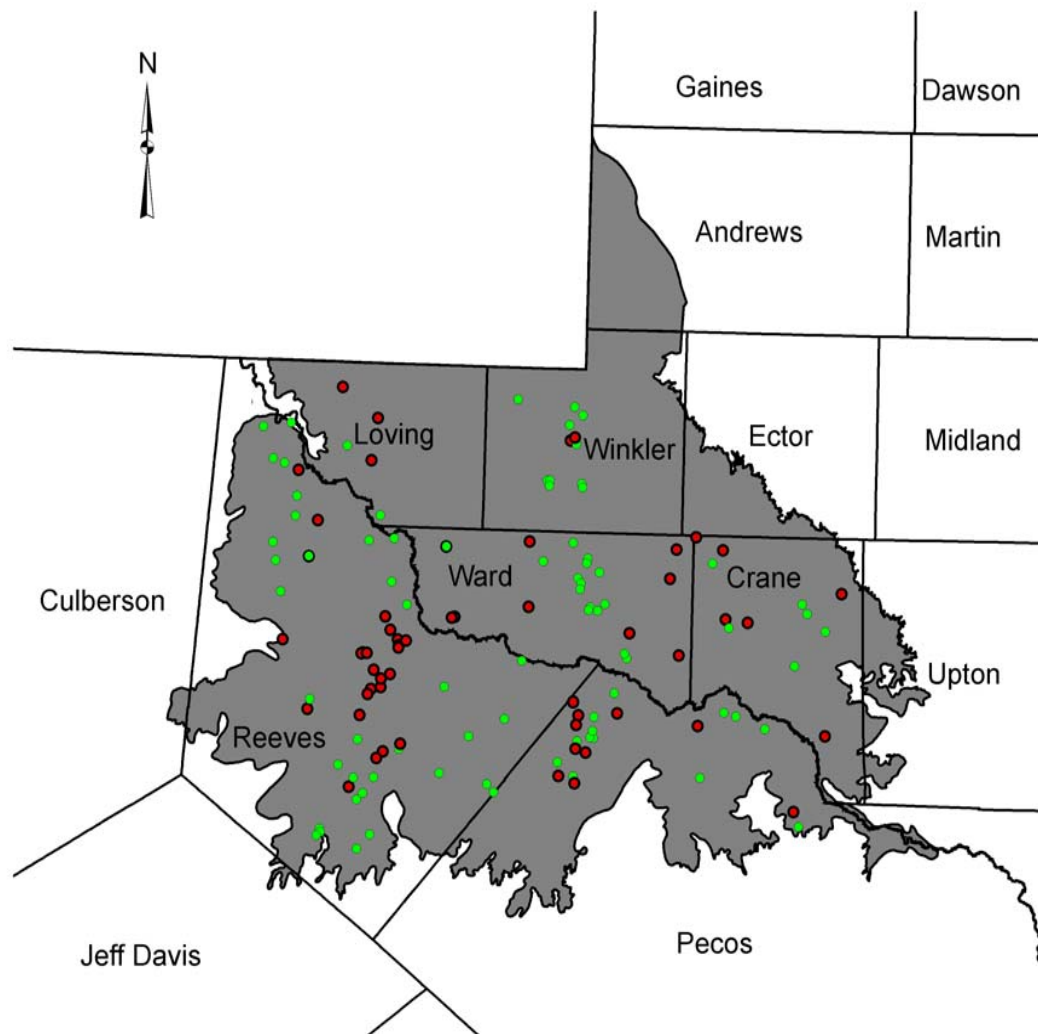
Nitrate Concentration

- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l

- (Outcrop) Blaine Aquifer
- ▨ (Downdip)  
(Adjacent or Overlying Aquifers Omitted for Clarity)

A similar situation exists with the Blaine aquifer.





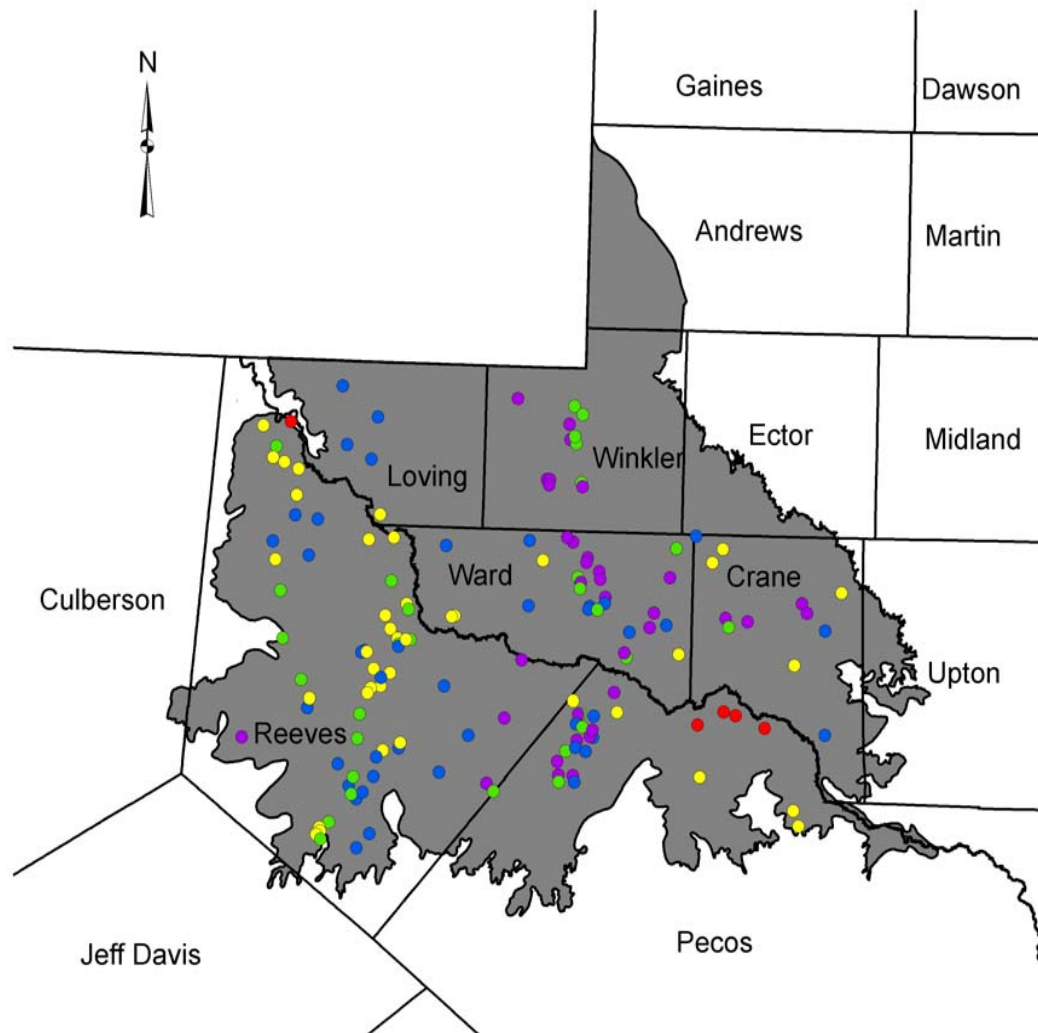
Nitrate Concentration

- Less than 10 mg/l
- Greater than or Equal to 10 mg/l

■ Cenozoic Pecos Alluvium Aquifer  
(Adjacent or Overlying Aquifer Omitted for Clarity)

The Cenozoic Pecos Alluvium aquifer is classified as a major aquifer. It has some pretty major issues with nitrate . . .





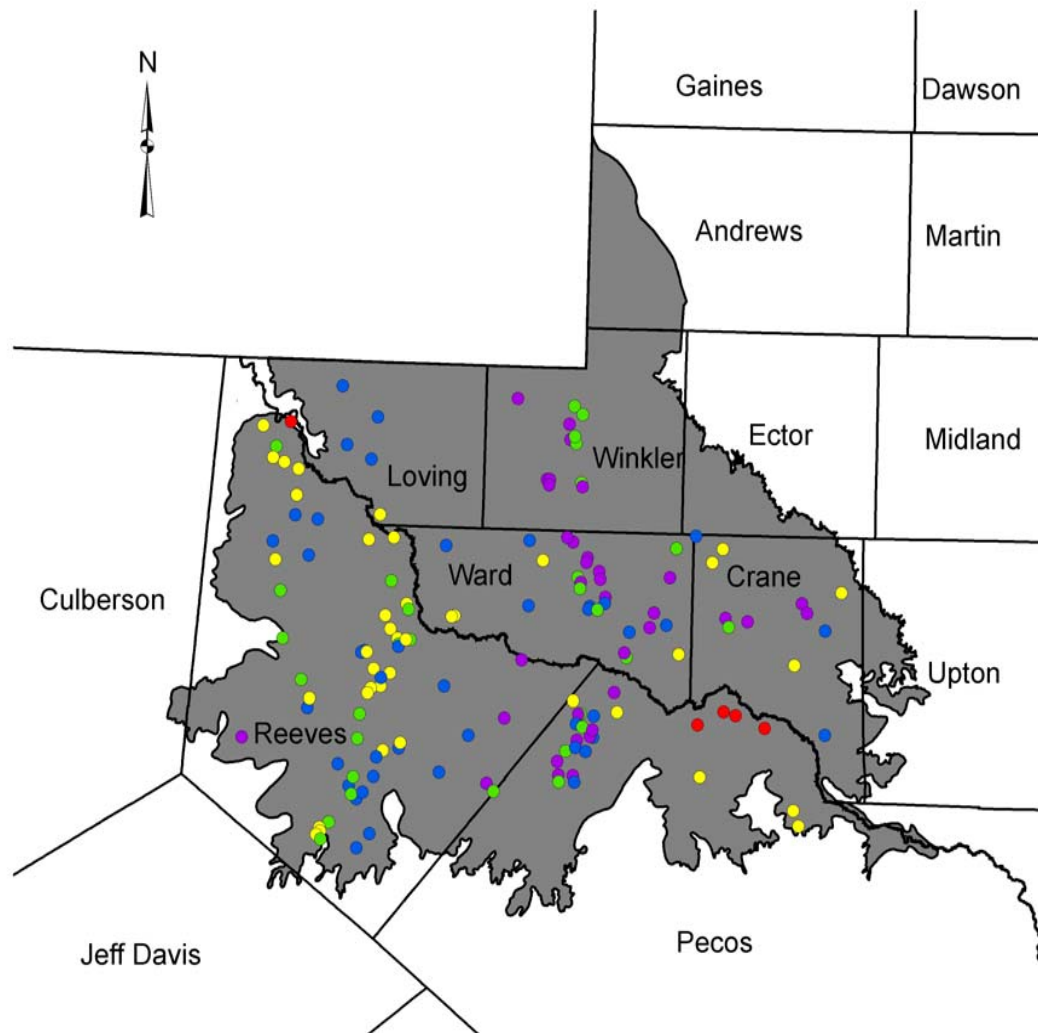
Total Dissolved Solids Concentration

- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

■ Cenezoic Pecos Alluvium Aquifer  
(Adjacent or Overlying Aquifer Omitted for Clarity)

... and total dissolved solids. Total dissolved solids (TDS) is referred to by EPA as a nuisance constituent.





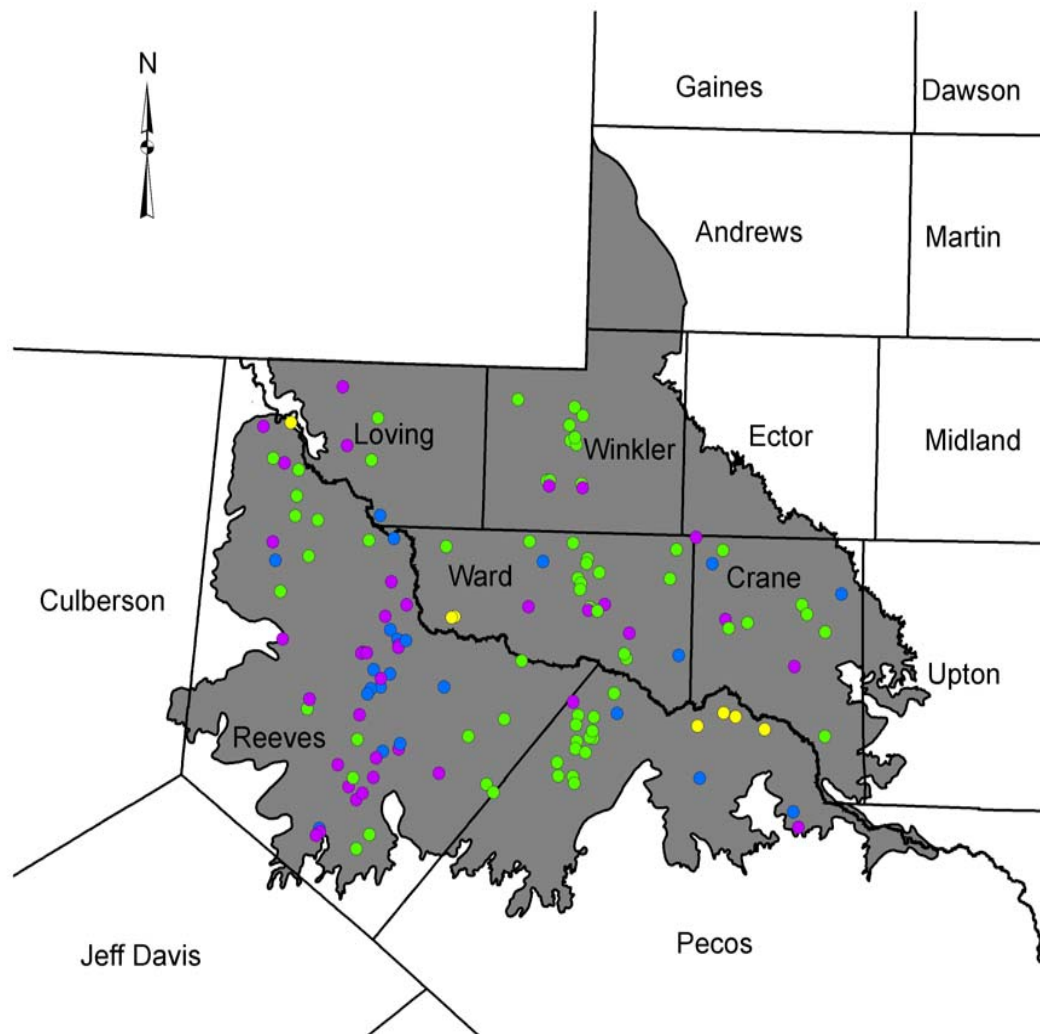
Total Dissolved Solids Concentration

- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

■ Cenezoic Pecos Alluvium Aquifer  
(Adjacent or Overlying Aquifer Omitted for Clarity)

High TDS concentrations are not considered a health risk, however, hardness, chemical deposits, staining and salty taste are all usability issues.





Chloride Concentration

- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

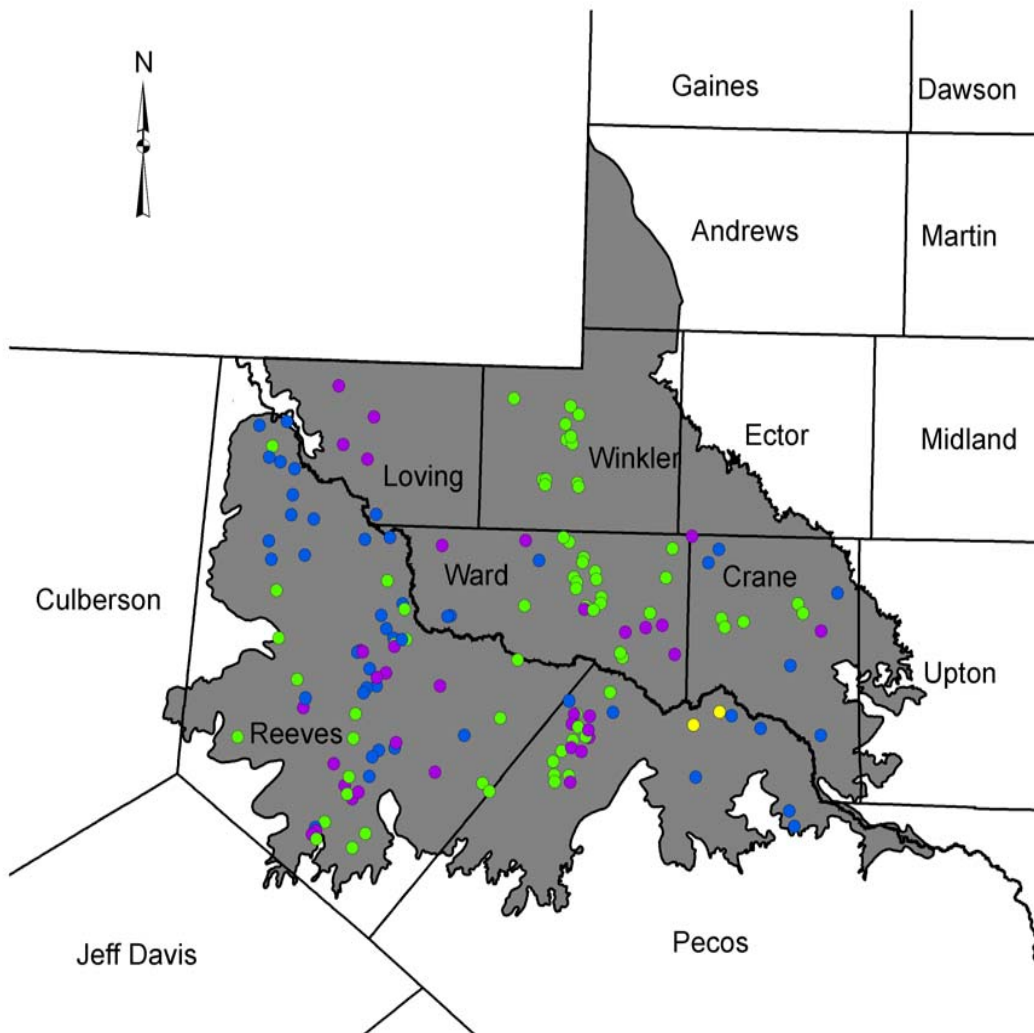
■ Cenozoic Pecos Alluvium Aquifer  
(Adjacent or Overlying Aquifer Omitted for Clarity)

High chloride concentrations, which are not a health risk, but again goes toward usability of the resource, are an issue in the Cenozoic Pecos Alluvium, . . .





... as are sulfates.



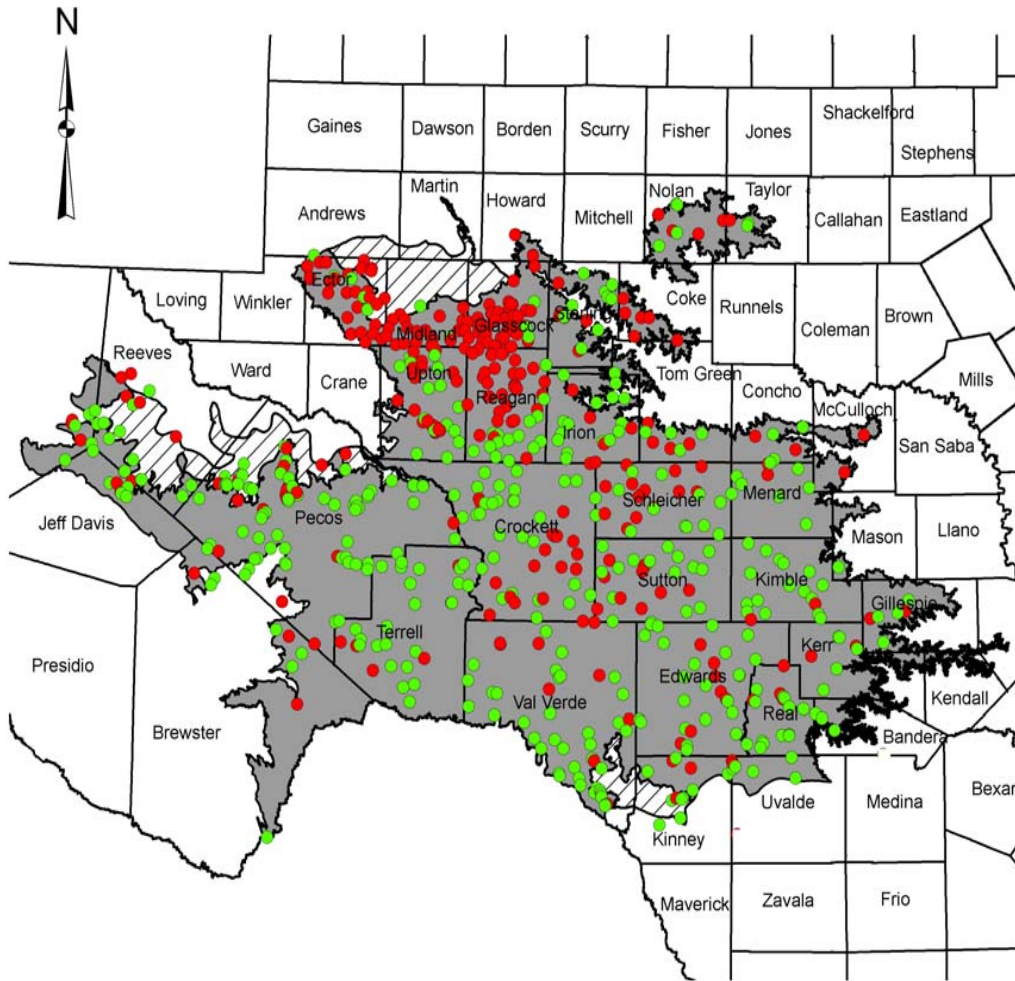
Sulfate Concentration

- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

■ Cenezoic Pecos Alluvium Aquifer  
(Adjacent or Overlying Aquifer Omitted for Clarity)







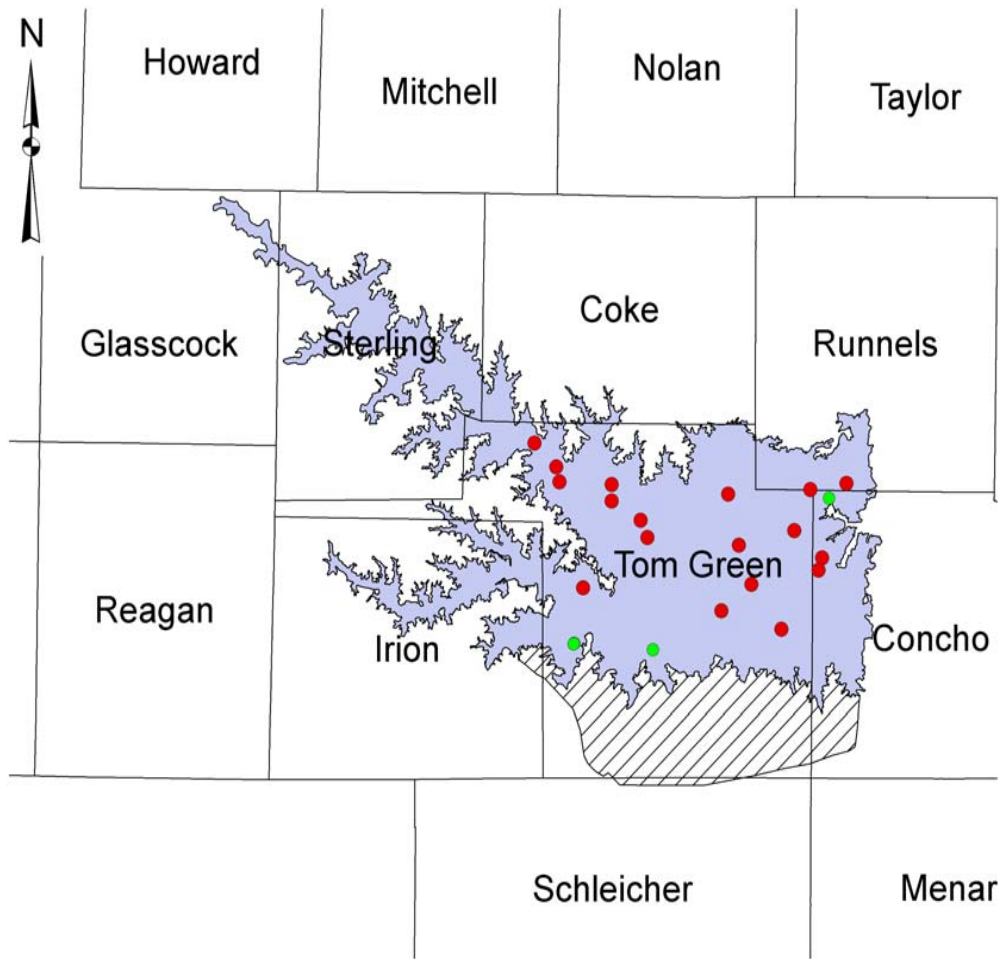
Nitrate Concentration

- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l

- (Ourcrop) Edwards-Trinity (Plateau) Aquifer
- ▨ (Downdip)  
(Adjacent or Overlying Aquifers Omitted for Clarity)

Nitrate is again a constituent of concern for the Edwards-Trinity (Plateau) aquifer.





Nitrate Concentration

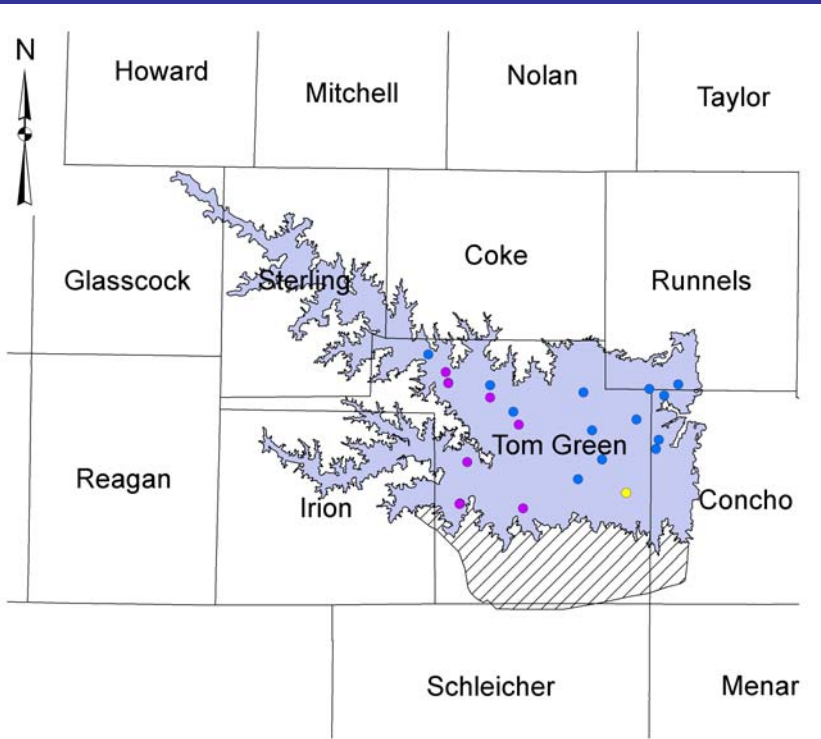
- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l

- (Outcrop) Lipan Aquifer
- ▨ (Downdip)
- (Adjacent or Overlying Aquifers Omitted for Clarity)

The Lipan aquifer, near San Angelo, has high nitrate concentrations. The red dots indicate nitrate values greater than 10 mg/l.



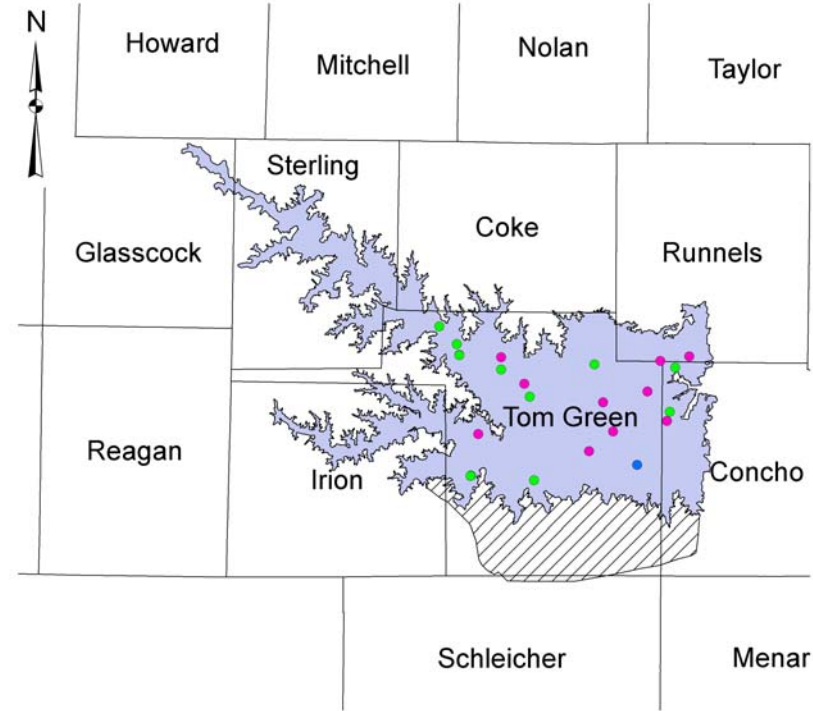
# Here too, TDS . . .



### Total Dissolved Solids Concentration

- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

- (Outcrop) Lipan Aquifer
- ▨ (Downdip)  
(Adjacent or Overlying Aquifers Omitted for Clarity)



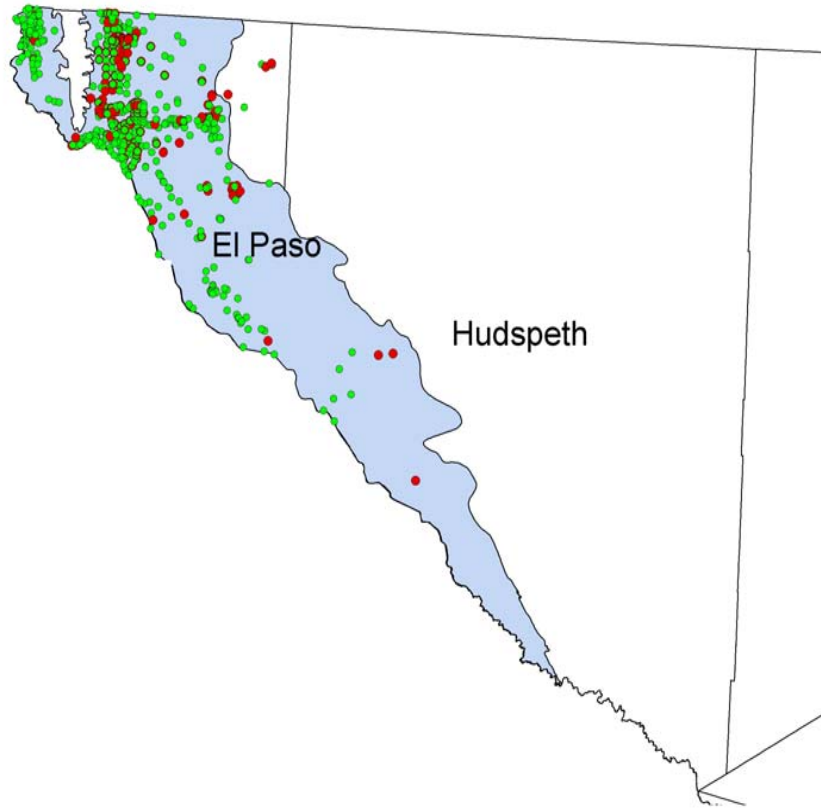
### Chloride Concentration

- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

- (Outcrop) Lipan Aquifer
- ▨ (Downdip)  
(Adjacent or Overlying Aquifers Omitted for Clarity)

... and chlorides are concerns.





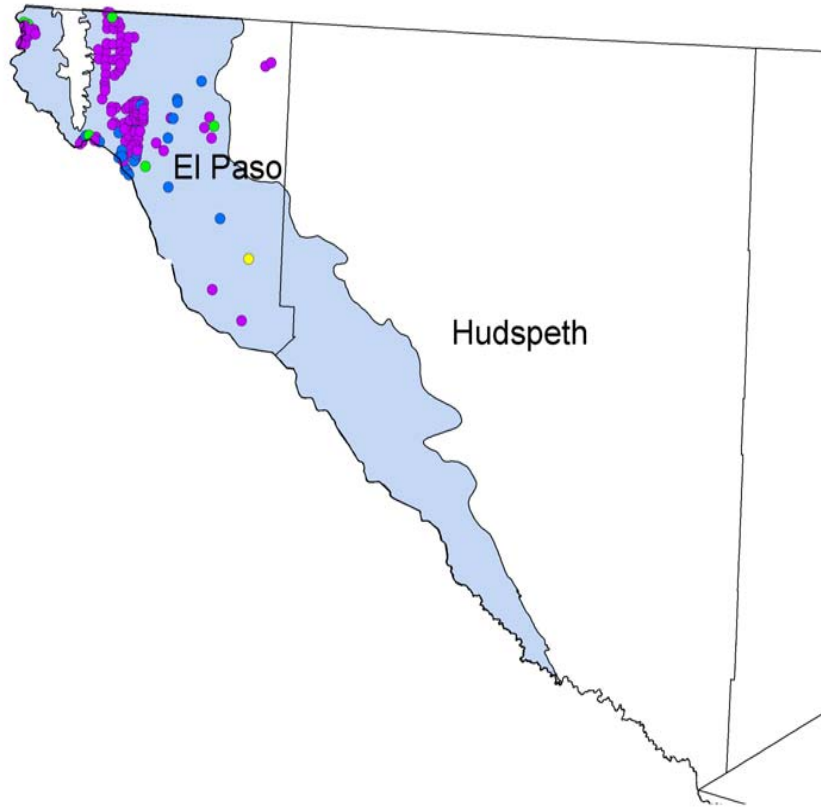
Nitrate Concentration

- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l

■ Hueco-Mesilla Bolsons Aquifer  
(Adjacent or Overlying Aquifers Omitted for Clarity)

The Hueco-Mesilla Bolsons supply water to El Paso Texas, and Ciudad Juarez, in the Mexican state of Chihuahua. Nitrates are a concern here.





Total Dissolved Solids Concentration

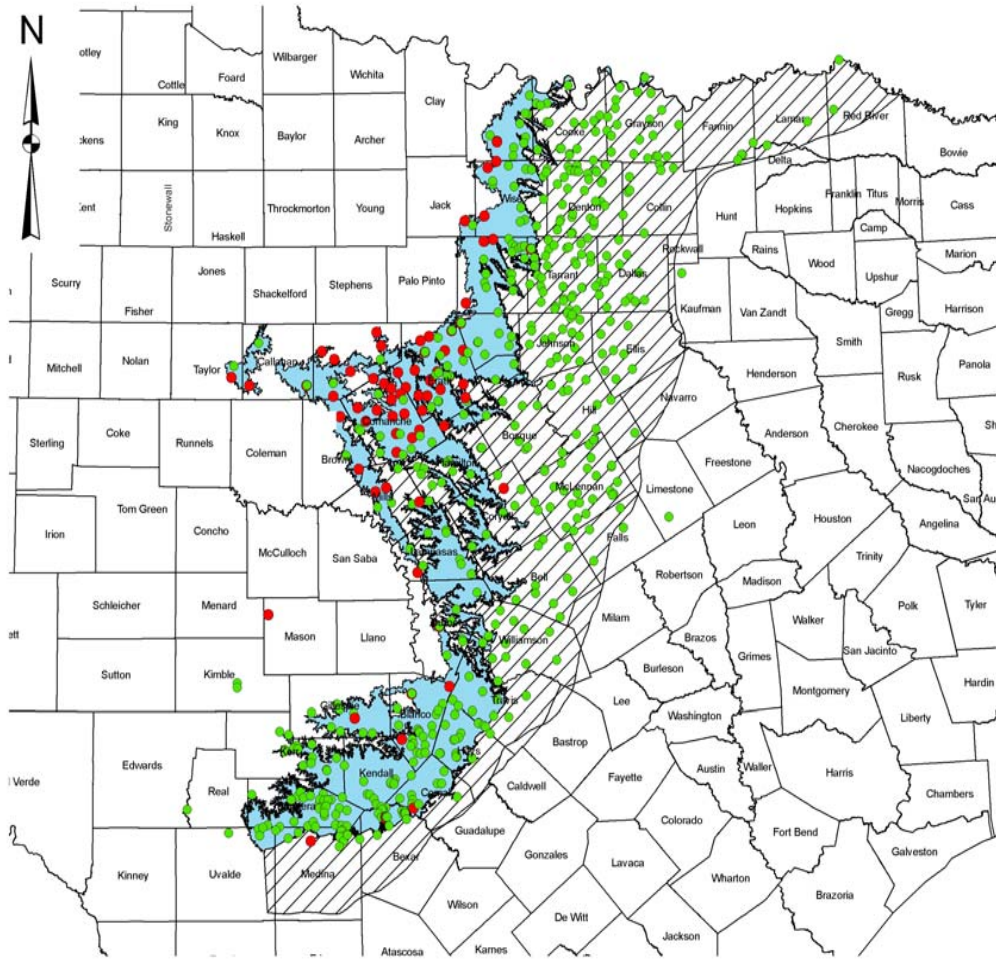
- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

■ Hueco-Mesilla Bolsons Aquifer  
(Adjacent or Overlying Aquifers Omitted for Clarity)

Groundwater becomes increasingly saline with depth in the Hueco Bolson, so TDS and chlorides are also concerns here.







#### Nitrate Concentration

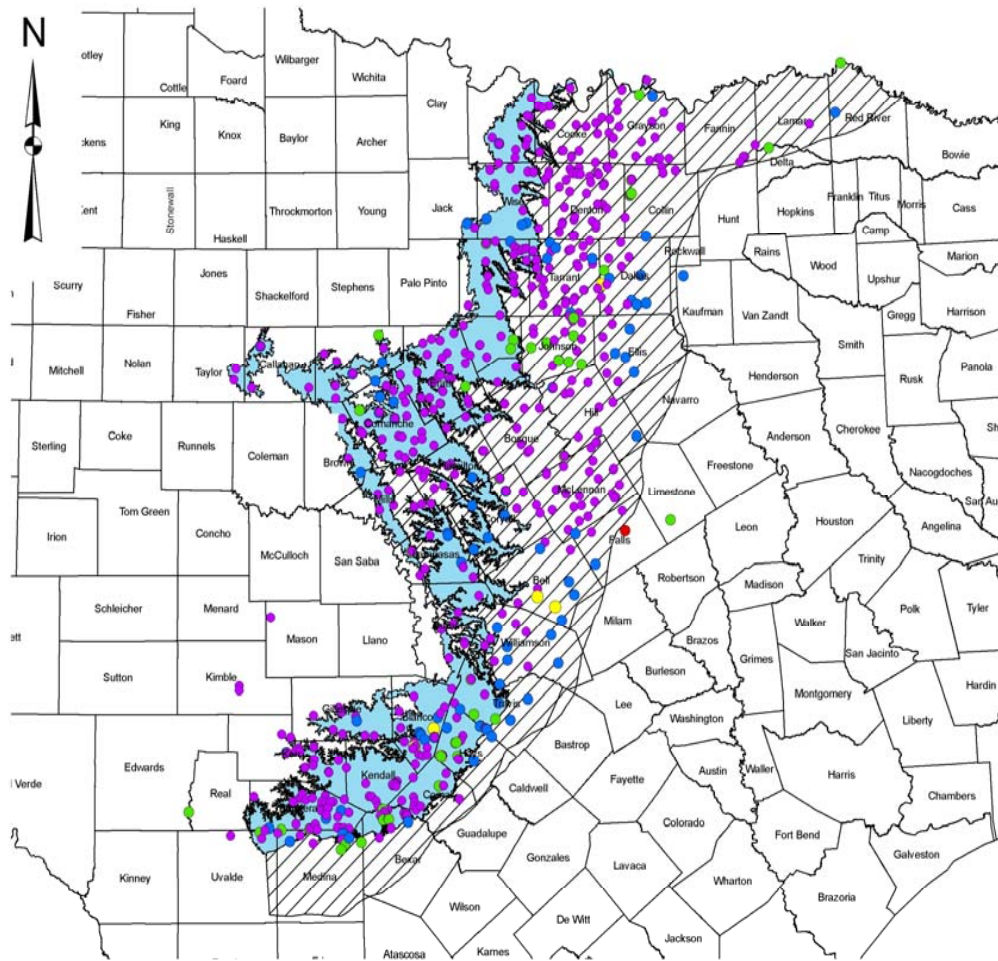
- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l

- (Outcrop) Trinity Aquifer
- ▨ (Downdip)  
(Adjacent or Overlying Aquifers Omitted for Clarity)

The Trinity aquifer supplies water to a large area in the middle of Texas. Nitrates are a concern for this aquifer.







**Total Dissolved Solids Concentration**

- Less than 300 mg/l
- Greater than or Equal to 300 mg/l, but less than 1000 mg/l
- Greater than or Equal to 1000 mg/l, but less than 3000 mg/l
- Greater than or Equal to 3000 mg/l, but less than 10000 mg/l
- Greater than or Equal to 10000

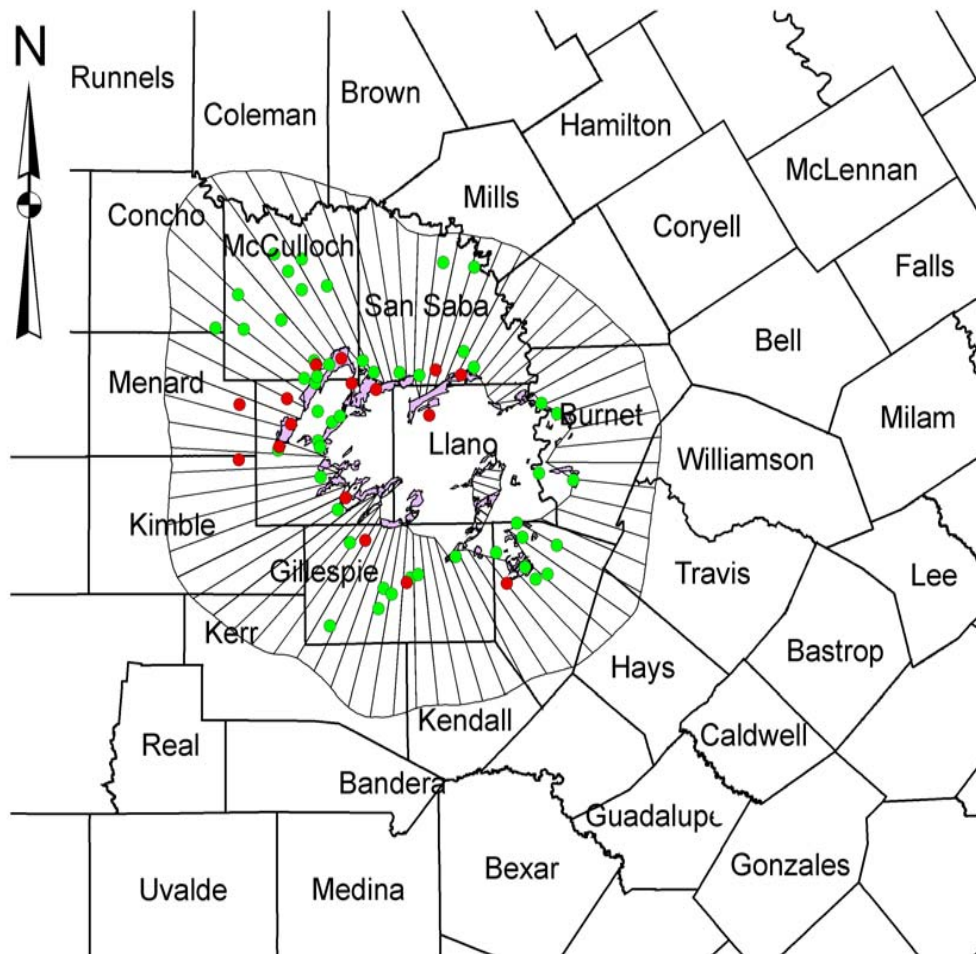
■ (Outcrop) Trinity Aquifer

▨ (Downdip)

(Adjacent or Overlying Aquifers Omitted for Clarity)

TDS is also an issue in the Trinity aquifer. There is no apparent pattern to the distribution of TDS concentrations.





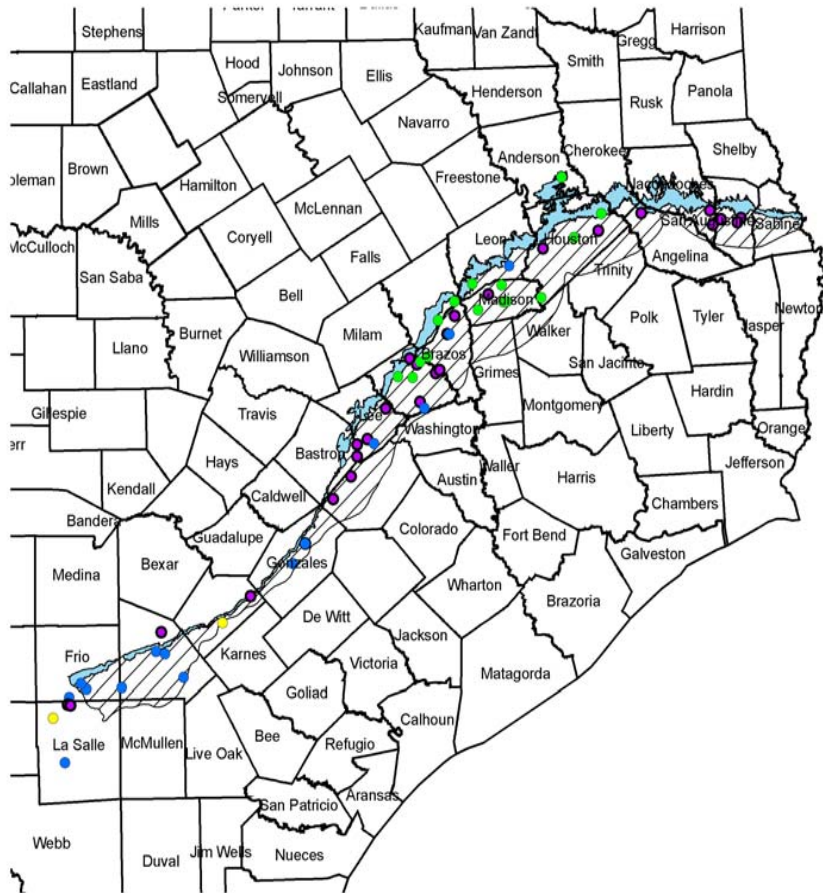
Nitrate Concentration

- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l

- (Ourcrop) Hickory Aquifer
- ▨ (Downdip)
- (Adjacent or Overlying Aquifers Omitted for Clarity)

The Hickory aquifer is unusually shaped, due to the uplift of pre-Cambrian rocks in the Llano area. Nitrate is a particular concern for the Hickory aquifer.





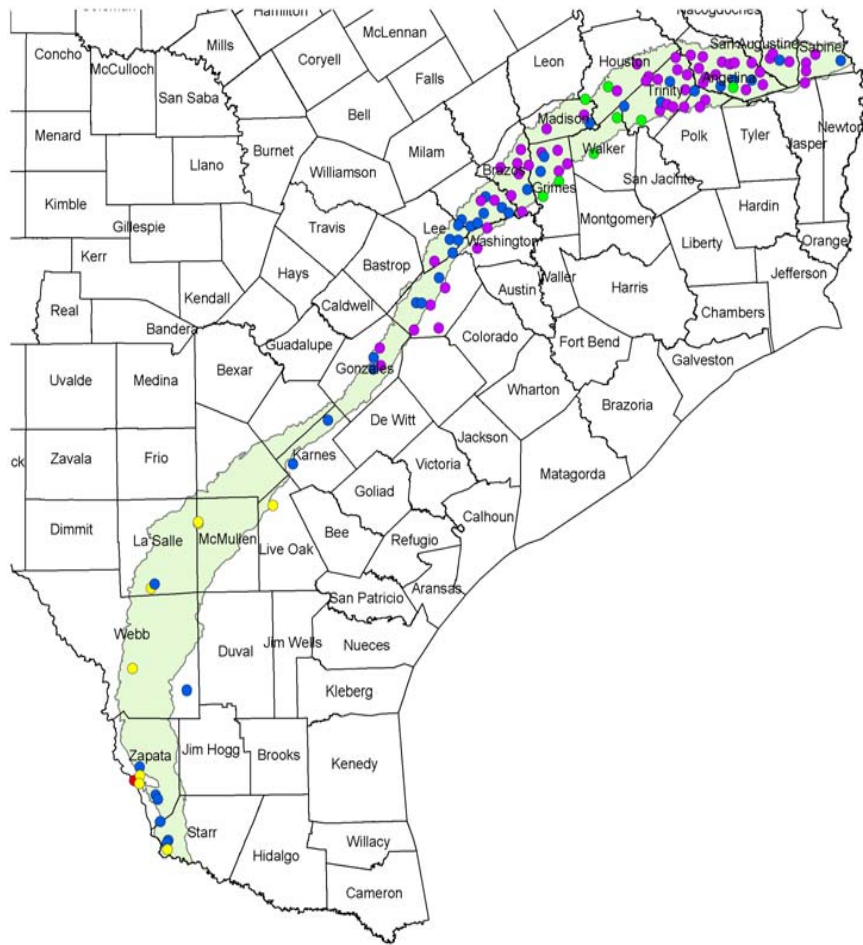
TDS is the main concern in the Sparta aquifer.

Total Dissolved Solids Concentration

- Less than 300 mg/l
  - Greater Than or Equal to 300 mg/l, but Less Than 1000 mg/l
  - Greater Than or Equal to 1000 mg/l, but Less Than 3000 mg/l
  - Greater Than or Equal to 3000 mg/l, but Less Than 10000 mg/l
  - Greater Than 10000 mg/l
- (Outcrop) Sparta Aquifer  
 (Downdip)  
 (Adjacent or Overlying Aquifers Omitted for Clarity)







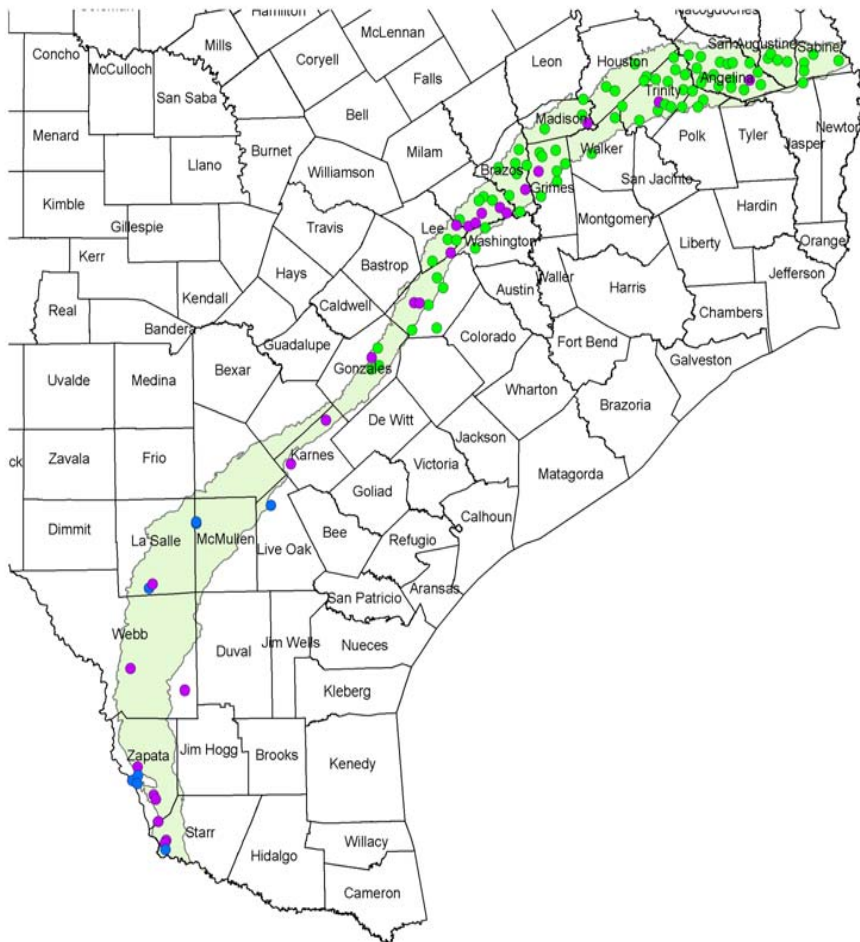
The Yegua-Jackson aquifer is the most recently designated minor aquifer. TDS values are a concern in the aquifer . . .

Total Dissolved Solids Concentration

- Less than 300 mg/l
  - Greater Than or Equal to 300 mg/l, but Less Than 1000 mg/l
  - Greater Than or Equal to 1000 mg/l, but Less Than 3000 mg/l
  - Greater Than or Equal to 3000 mg/l, but Less Than 10000 mg/l
  - Greater Than 10000 mg/l
- Yegua-Jackson Aquifer  
(Adjacent or Overlying Aquifers Omitted for Clarity)



... as are chlorides.



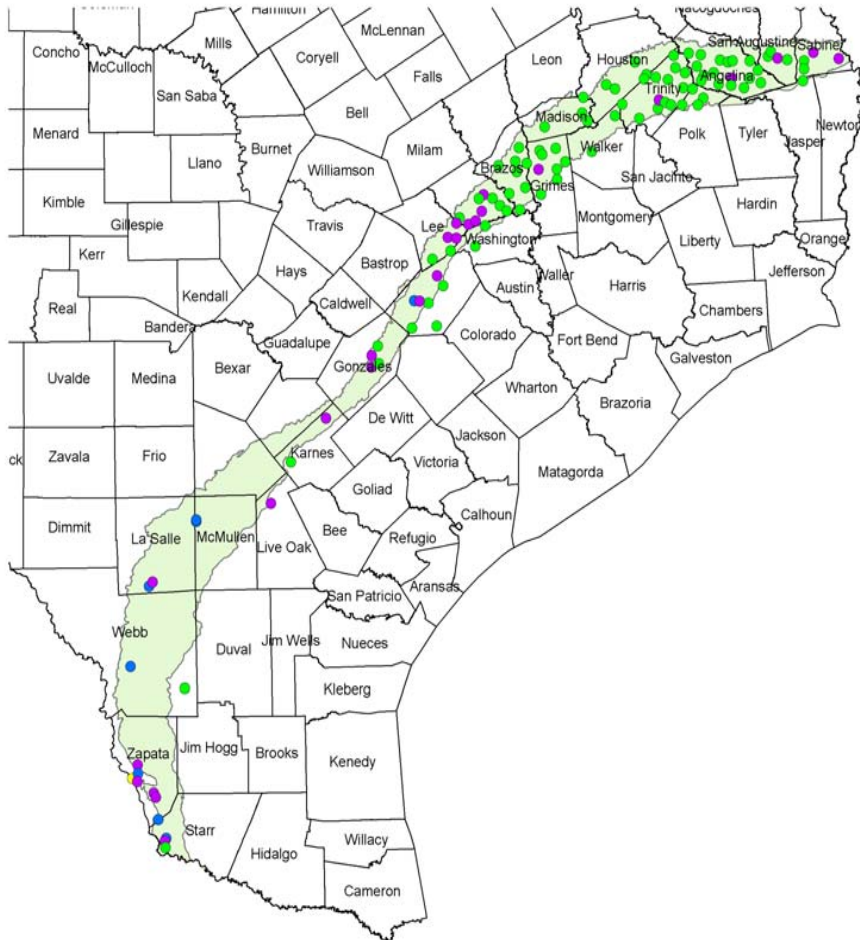
Chloride Concentration

- Less than 300 mg/l
  - Greater Than or Equal to 300 mg/l, but Less Than 1000 mg/l
  - Greater Than or Equal to 1000 mg/l, but Less Than 3000 mg/l
  - Greater Than or Equal to 3000 mg/l, but Less Than 10000 mg/l
  - Greater Than 10000 mg/l
- Yegua-Jackson Aquifer  
(Adjacent or Overlying Aquifers Omitted for Clarity)





... as are sulfates

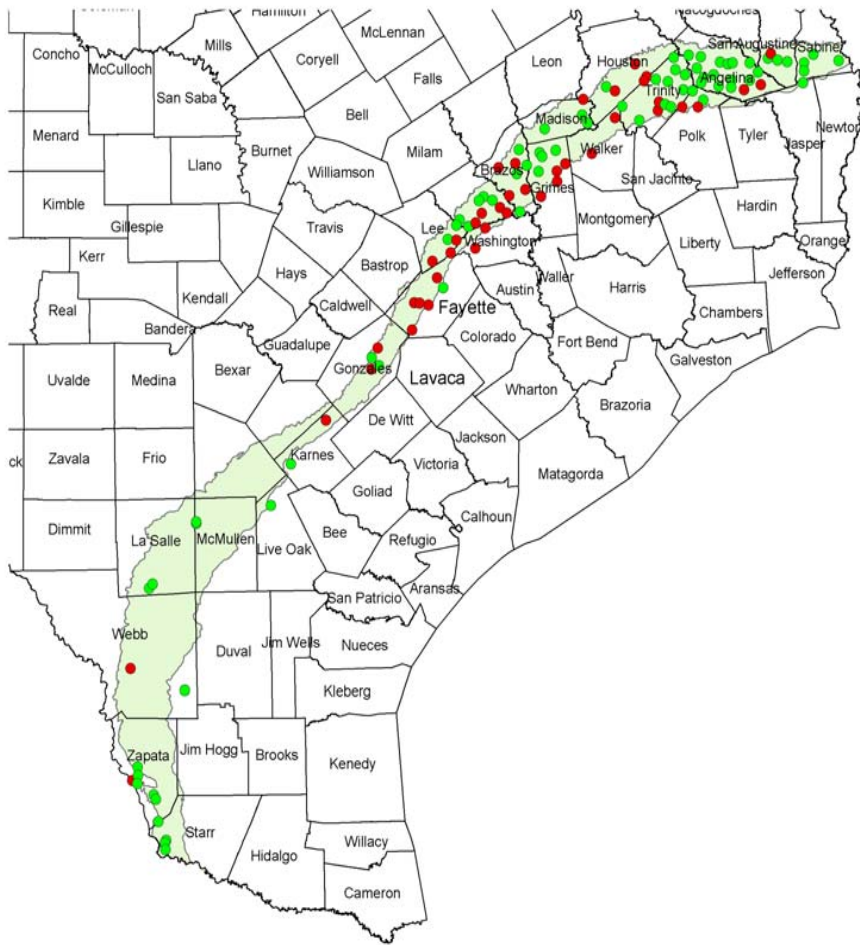


Sulfate Concentration

- Less than 300 mg/l
  - Greater Than or Equal to 300 mg/l, but Less Than 1000 mg/l
  - Greater Than or Equal to 1000 mg/l, but Less Than 3000 mg/l
  - Greater Than or Equal to 3000 mg/l, but Less Than 10000 mg/l
  - Greater Than 10000 mg/l
- Yegua-Jackson Aquifer  
(Adjacent or Overlying Aquifers Omitted for Clarity)



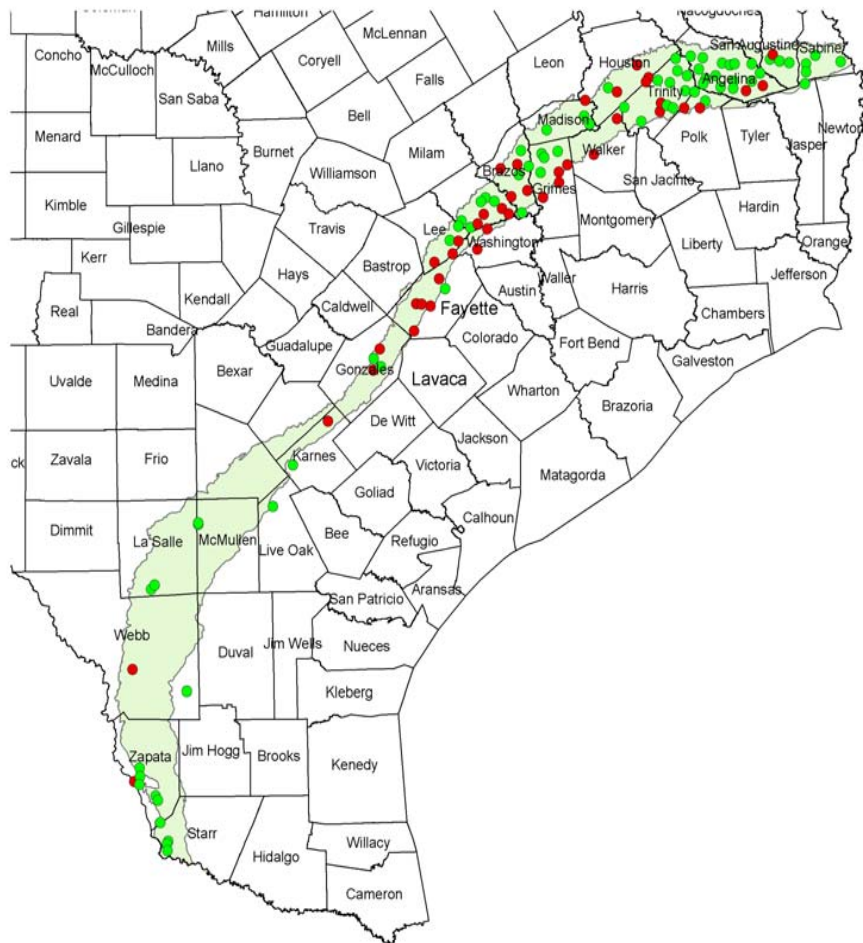
The Yegua-Jackson aquifer has some high concentrations of the dissolved element manganese.



Manganese Concentration

- Less than 50 ug/l
- Greater than or Equal to 50ug/l
- Yegua-Jackson Aquifer  
(Adjacent or Overlying Aquifers Omitted for Clarity)



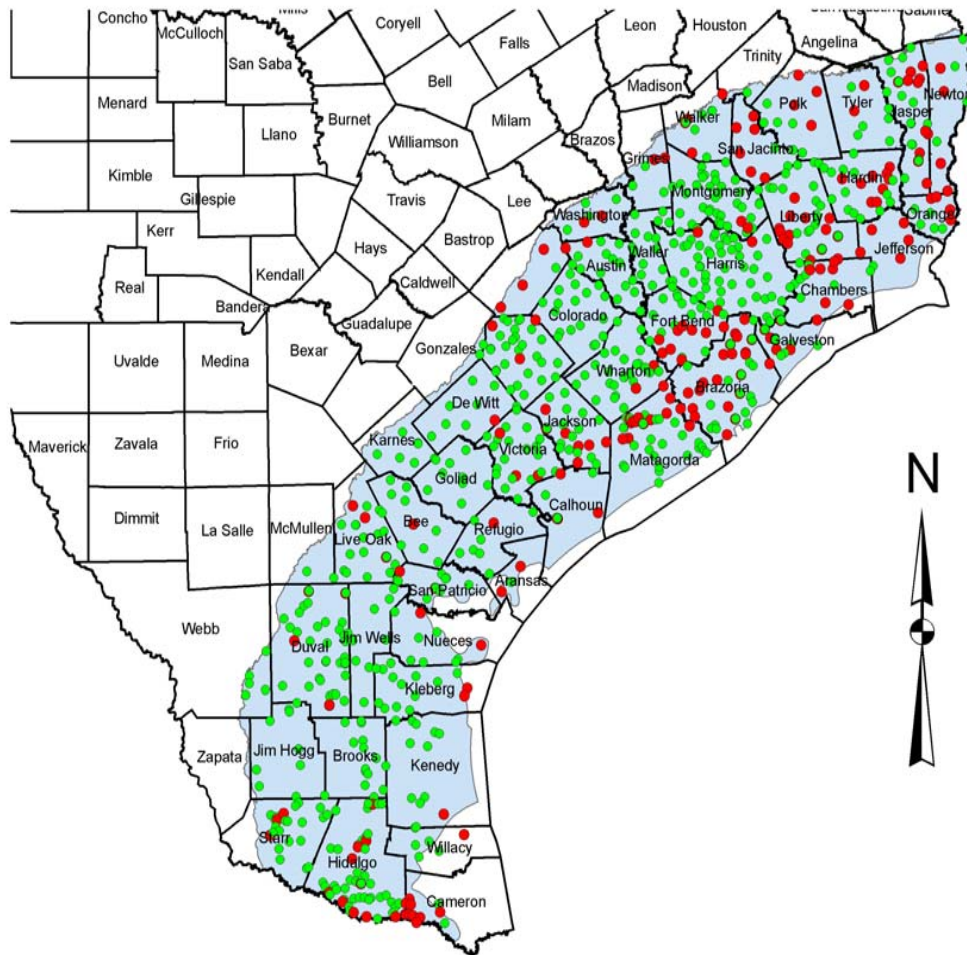


Manganese Concentration

- Less than 50 ug/l
- Greater than or Equal to 50ug/l
- Yegua-Jackson Aquifer  
(Adjacent or Overlying Aquifers Omitted for Clarity)

There is no published health-effect level for Manganese. Another “nuisance” constituent, its presence can cause discoloration, turbidity and formation of a black precipitant.





Manganese Concentration

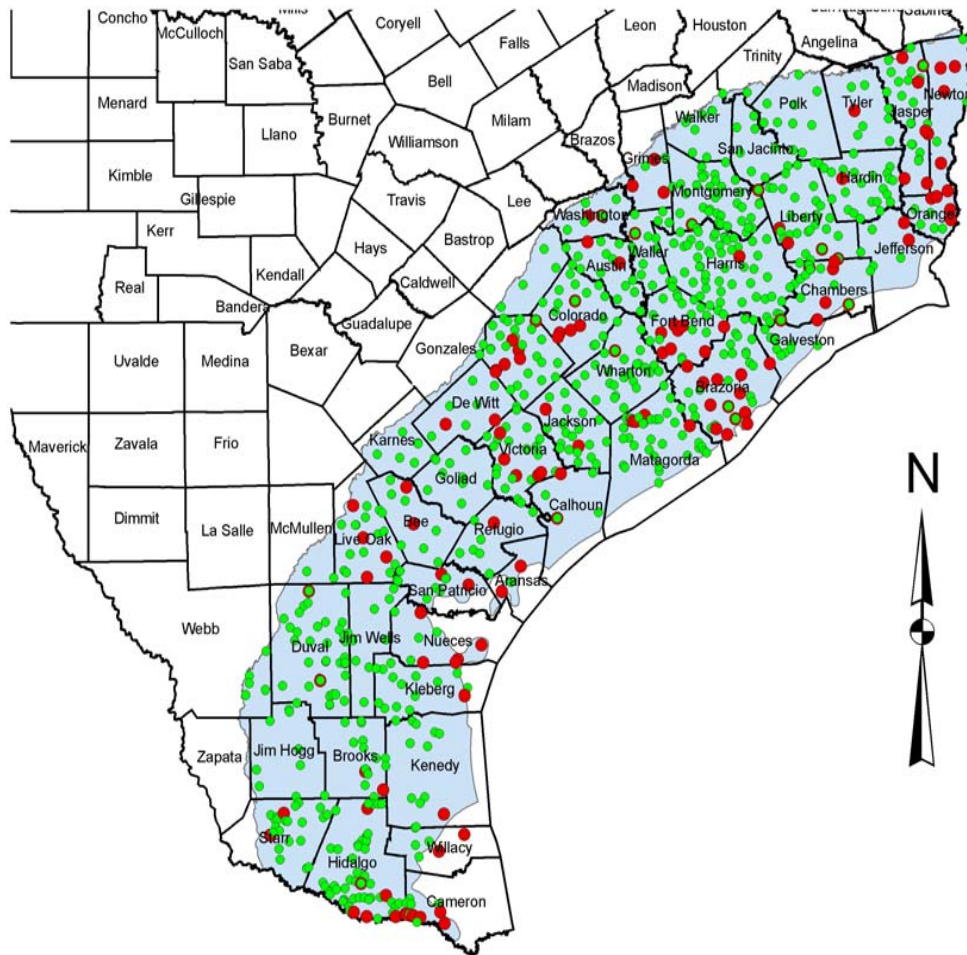
- Less than 50 ug/l
- Greater Than or Equal to 50 ug/l

■ Gulf Coast Aquifer

As with the Yegua-Jackson aquifer, the adjacent Gulf Coast aquifer has some high concentrations of manganese.







Iron Concentration

- Less than 300 ug/l
- Greater Than or Equal to 300 ug/l

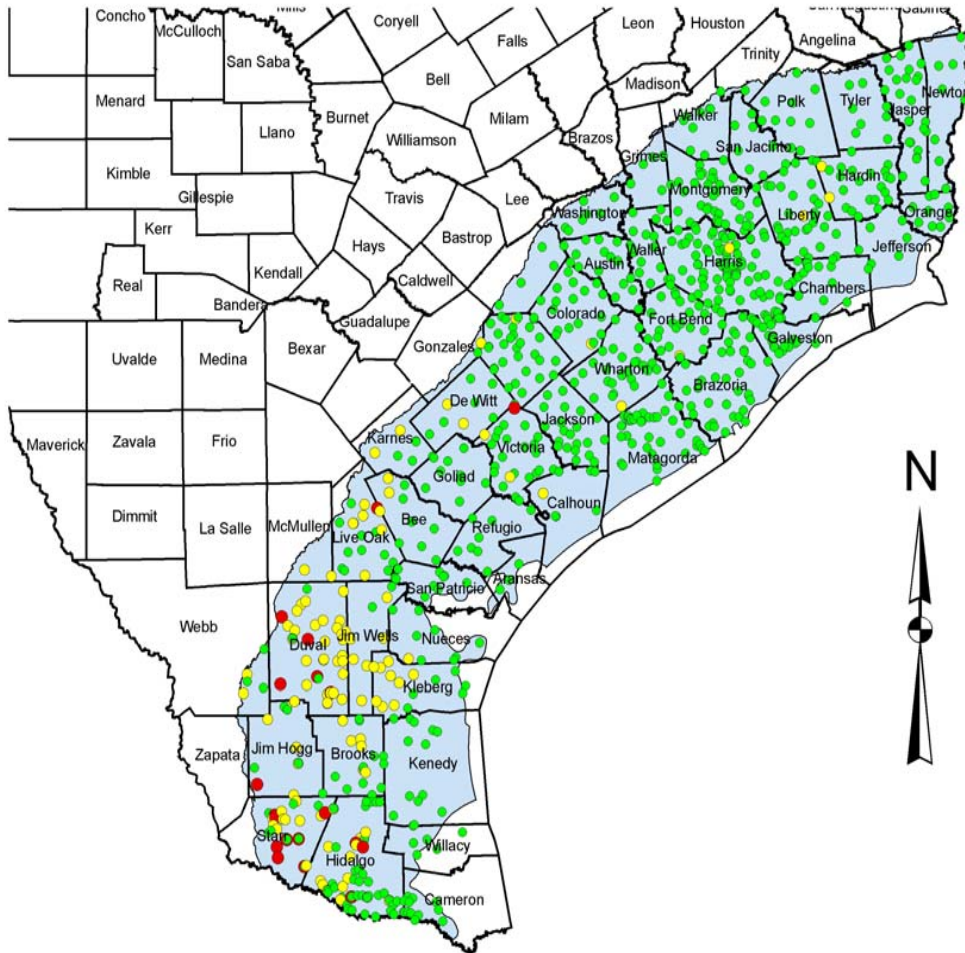
■ Gulf Coast Aquifer

The distribution of iron concentrations in the Gulf Coast aquifer is similar to that of manganese. Iron isn't considered a health risk either, but water with high concentrations will have a dark color.





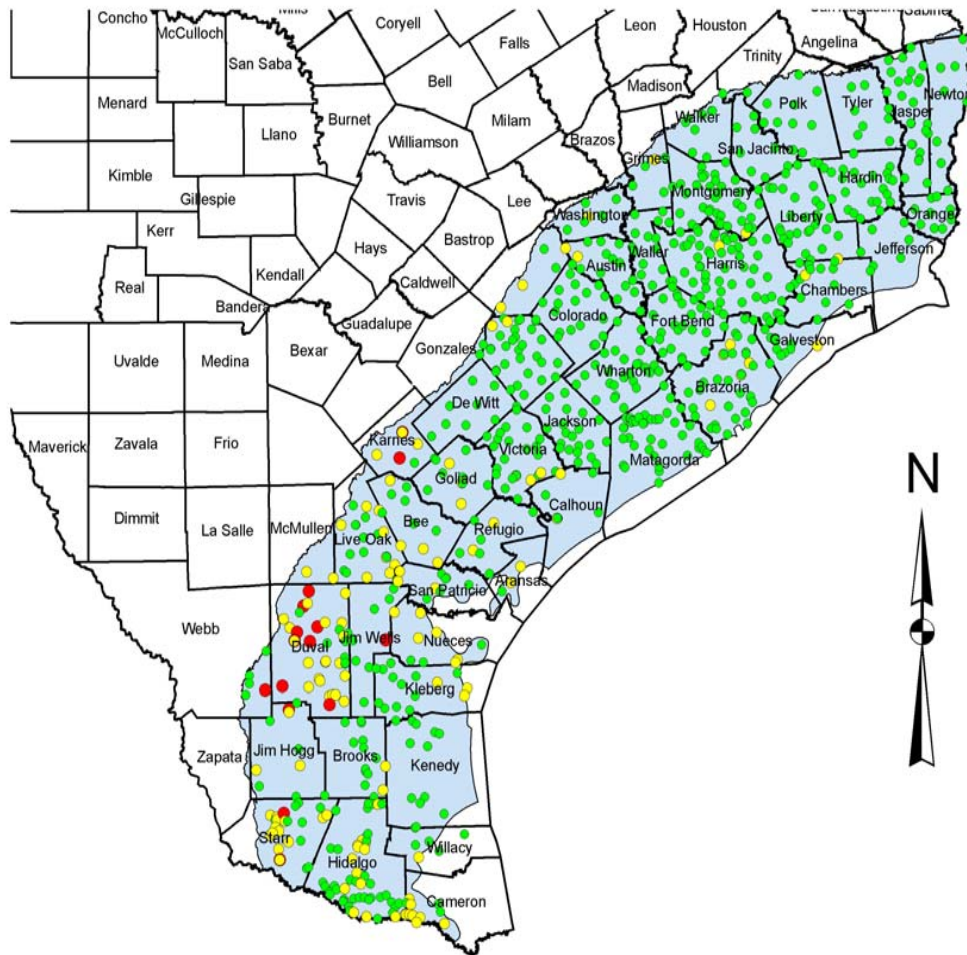
In the Rio Grande Valley/Winter Garden area, nitrate is a significant concern.



Nitrate Concentration

- Less than 10 mg/l
- Greater Than or Equal to 10 mg/l, but Less Than 50 mg/l
- Greater Than 50 mg/l
- Gulf Coast Aquifer





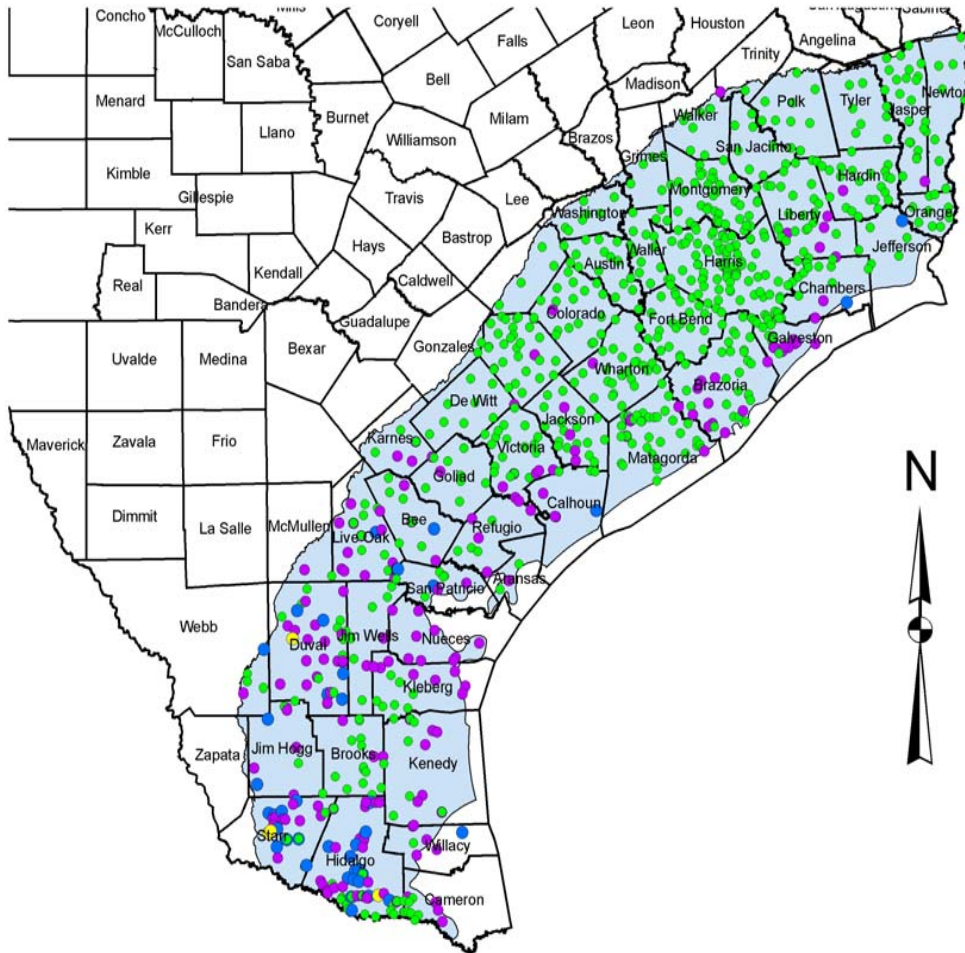
Arsenic Concentration

- Less than 10 ug/l
- Greater Than or Equal to 10 ug/l, but Less Than 50 ug/l
- Greater Than 50 ug/l
- Gulf Coast Aquifer

The same area has high concentrations of arsenic. Some deeper portions of the aquifer, further up the coast, have high arsenic concentrations as well.



# Chlorides are yet another concern in the Gulf Coast aquifer.



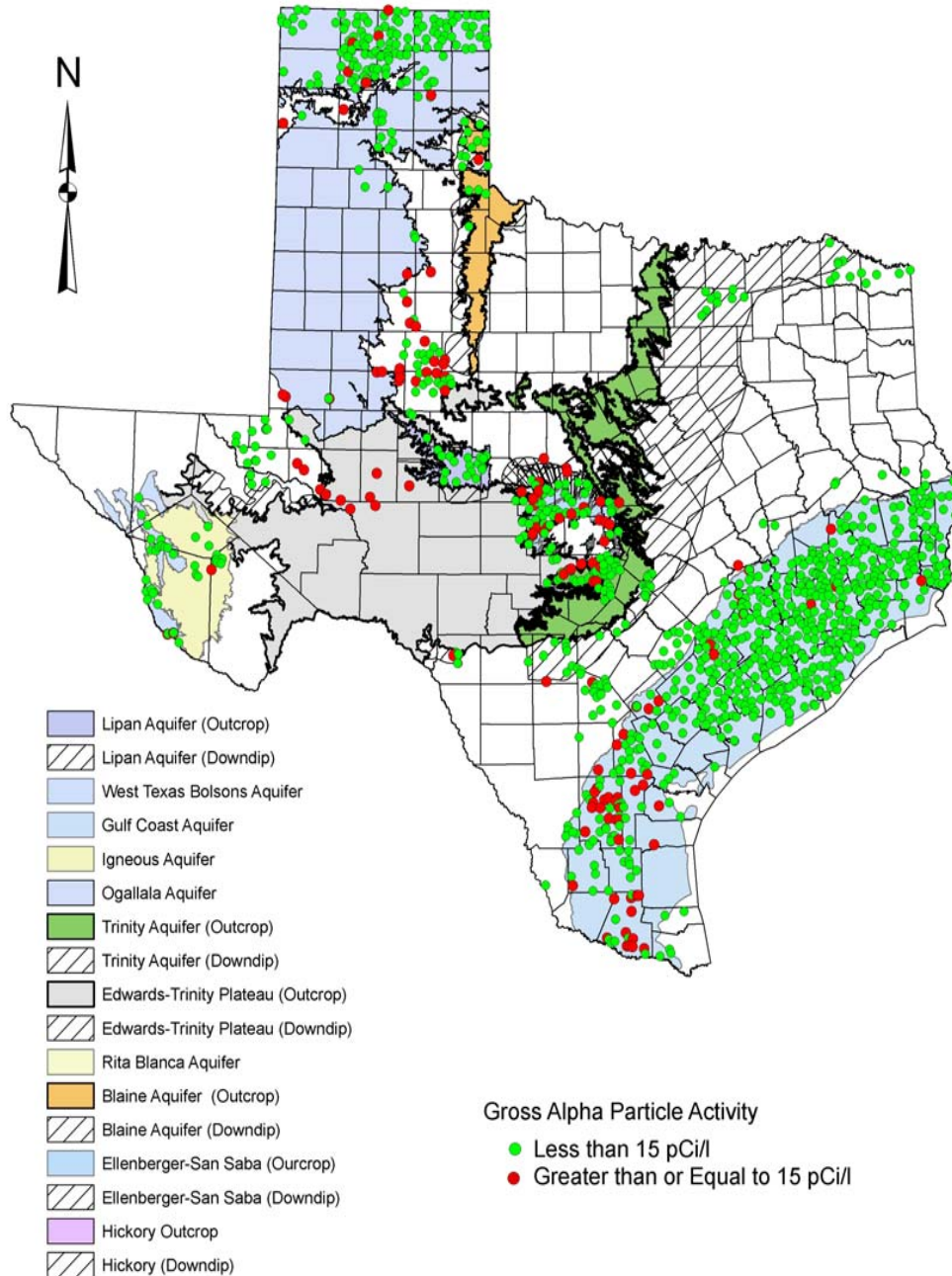
## Chloride Concentration

- Less than 300 mg/l
- Greater Than or Equal to 300 mg/l, but Less Than 1000 mg/l
- Greater Than or Equal to 1000 mg/l, but Less Than 3000 mg/l
- Greater Than or Equal to 3000 mg/l, but Less Than 10000 mg/l
- Greater Than 10000 mg/l

■ Gulf Coast Aquifer

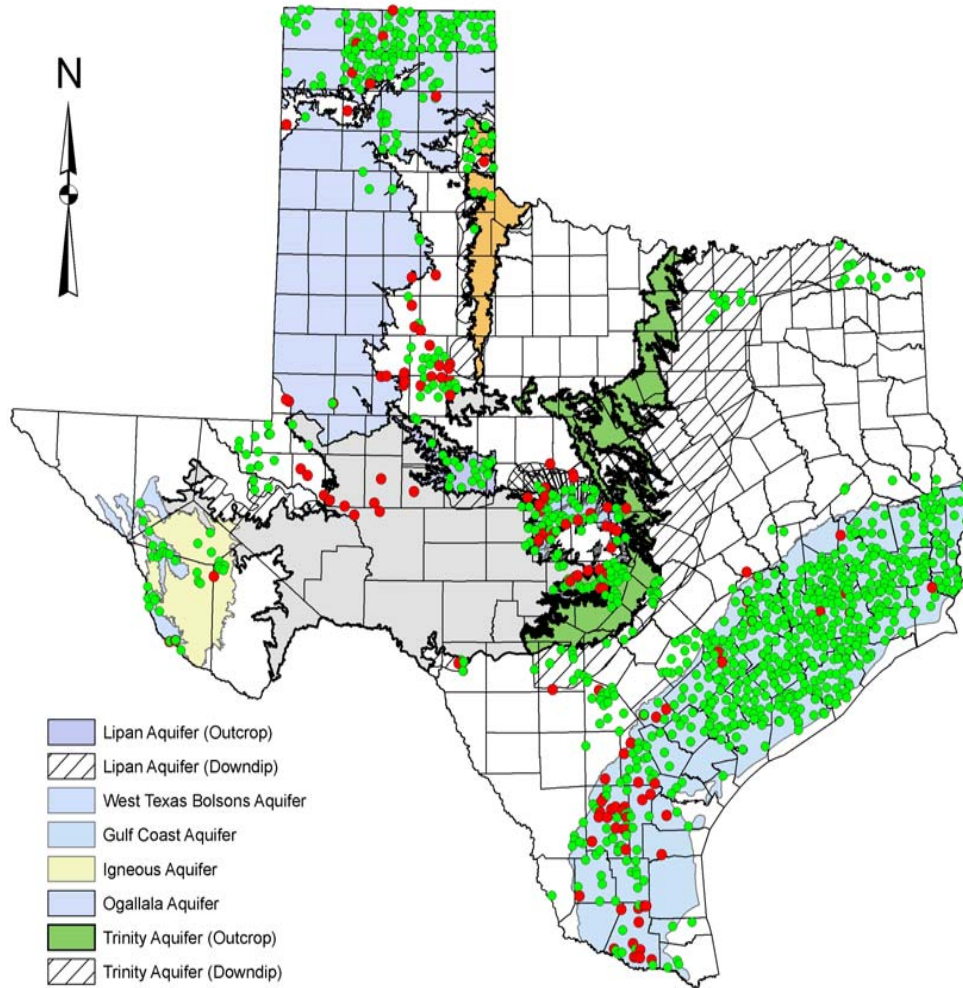






There are some constituents that have an effect statewide. One of these is radionuclides.





- Lipan Aquifer (Outcrop)
- Lipan Aquifer (Downdip)
- West Texas Bolsons Aquifer
- Gulf Coast Aquifer
- Igneous Aquifer
- Ogallala Aquifer
- Trinity Aquifer (Outcrop)
- Trinity Aquifer (Downdip)
- Edwards-Trinity Plateau (Outcrop)
- Edwards-Trinity Plateau (Downdip)
- Rita Blanca Aquifer
- Blaine Aquifer (Outcrop)
- Blaine Aquifer (Downdip)
- Ellenberger-San Saba (Ourcrop)
- Ellenberger-San Saba (Downdip)
- Hickory Outcrop
- Hickory (Downdip)

Gross Alpha Particle Activity

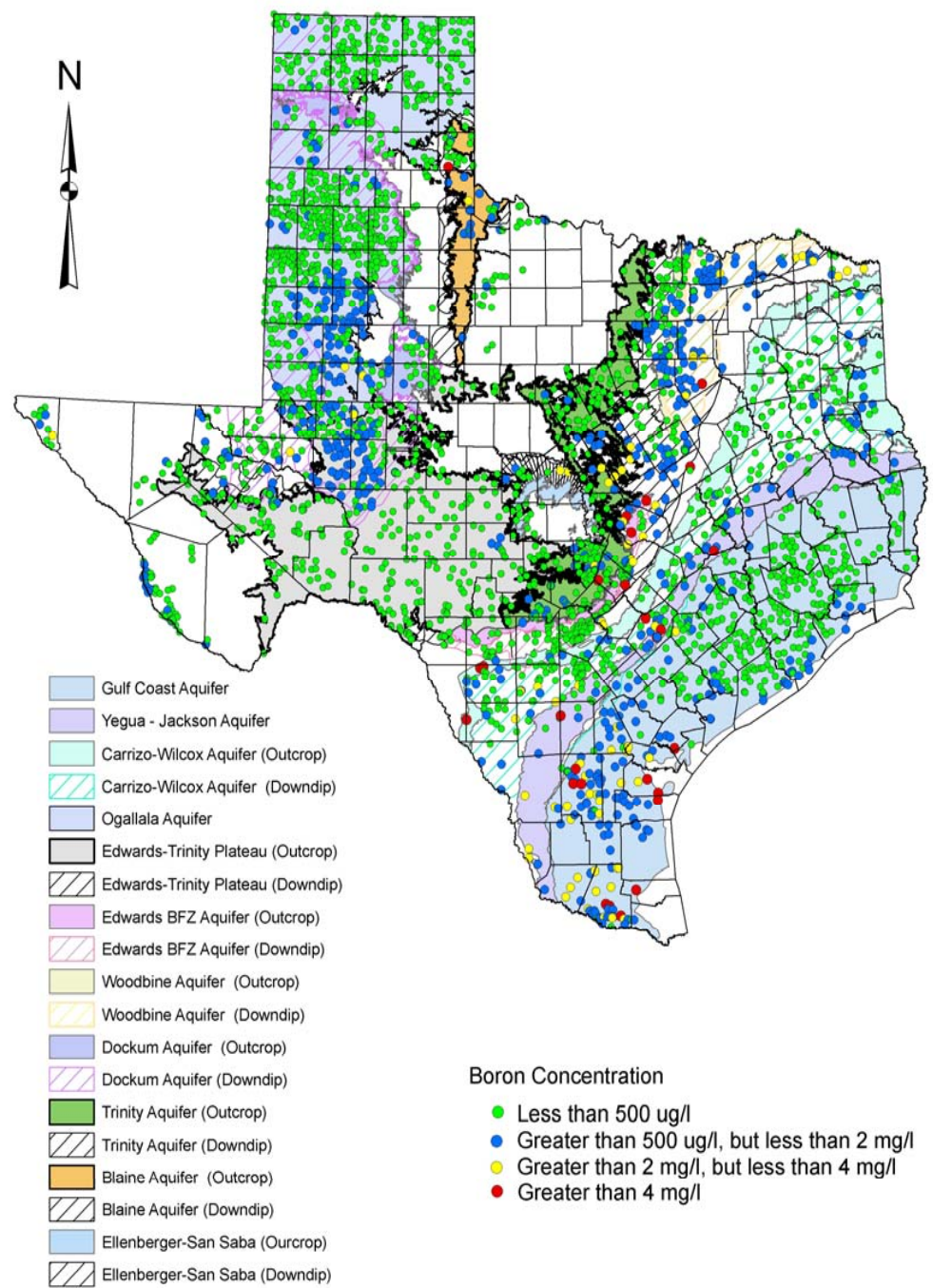
- Less than 15 pCi/l
- Greater than or Equal to 15 pCi/l

The highest Gross Alpha particle activity are present in the Hickory, Ellenberger-San Saba aquifers.





# Boron is another statewide concern.





There will also likely be some additional information from special studies in the future similar to the nitrate or arsenic studies.



# Thank You.

For more information, Contact  
Groundwater Planning and Assessment Team  
Water Supply Division  
Texas Commission on Environmental Quality  
Tel. (512) 239-5480

