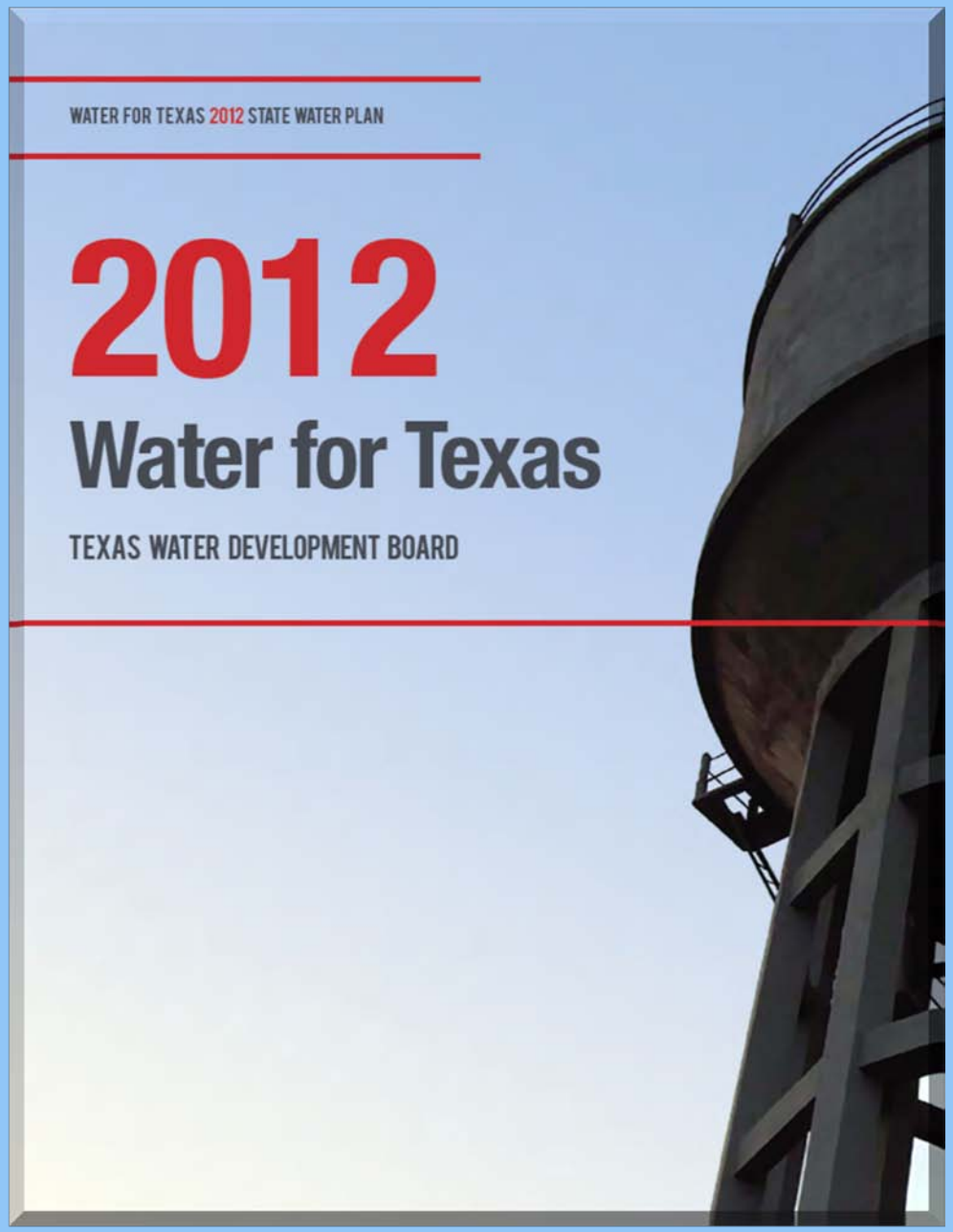
Geologic Characterization for the Corpus Christi ASRCD Project

January 24, 2012

John E. Meyer, P.G.

Texas Water Development Board
Water Science and Conservation
Innovative Water Technologies

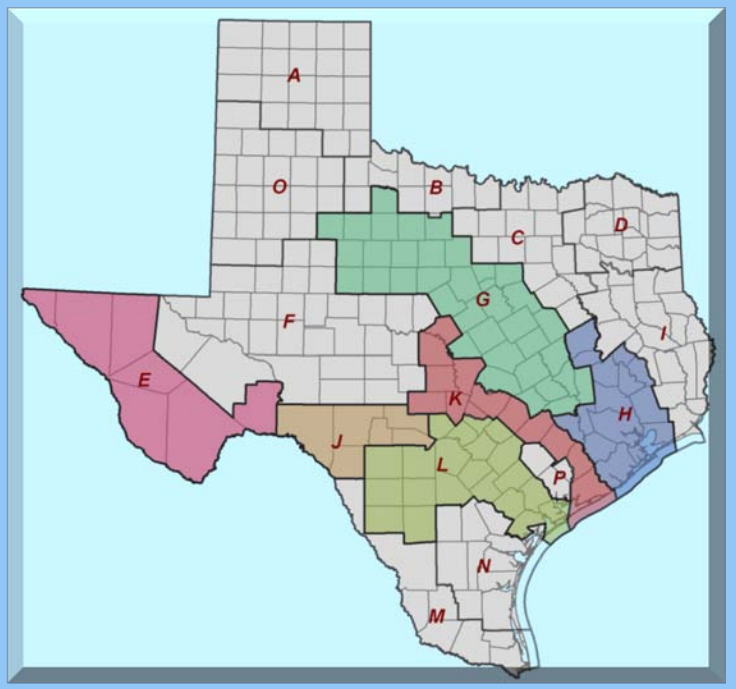
State and regional water planning



Recommended Water Management Strategies include:

Aquifer Storage and Recovery

- Develop 80,869 acre-feet/year by 2060
- 6 regions recommended strategy (E, G, H, J, K, L)



What is ASR?

- Aquifer Storage and Recovery (ASR) is the storage of water in a suitable aquifer through a well during times when water is available, and the recovery of water from the same well during times when it is needed – Pyne, 2005
- Other frequently used broader terms are Managed Aquifer Recharge (MAR) and Managed Underground Storage of Recoverable Water (MUS) – National Research Council, 2008
- In Texas statute, an ASR project is a project:
  - with two phases (Phase I and Phase II)
  - that anticipates the use of a Class V aquifer storage well
  - with injection into a geologic formation capable of underground storage for subsequent retrieval and beneficial use – Chapter 297 (Definitions)

History of Early ASR Studies at TWDB

- Upper Guadalupe River Authority, Kerrville

  studies completed in 1992, system operational in 1998

- Brownsville Public Utility Board

  studies completed in 1996, no plant to date

- San Antonio Water System

  study completed in 1998, Twin Oaks plant built in 2004

- City of Laredo

  study completed in 1999, no plant to date

An Assessment of Aquifer Storage and Recovery in Texas (report, 2011)

Goal: Ascertain the reasons for ASR not being used more widely in Texas and make recommendations

Conclusion:

- Technical factors not major impediments to implementation of ASR
- Main challenge is perceived lack of ability to protect stored water

Recommendations:

- TWDB/TCEQ joint demonstration program and interagency coordination
- Legal and regulatory modifications
- Develop incentives for utilities to gather and keep accurate cost data
- Fund statewide data gathering program
- Research
- Additional focused education

Statutory Authority for TWDB in ASR Studies

- TWDB shall participate in pilot projects
- Pilot projects are eligible for grants from the water loan assistance fund
- TWDB may authorize use of money from the research and planning fund for pilot projects
- TWDB shall make other studies, investigations, and surveys of the aquifers in the state as it considers necessary

Texas Water Code §11.153, 11.154, 11.155

Corpus Christi Aquifer Storage and Recovery Conservation District

- Created in 2005 by the 79th Texas Legislature
  (enactment SB 1831, Section 1, Subtitle H, Title 6)

- Prepared a groundwater management plan (2008)

- District is committed to maintaining a sustainable, adequate, reliable, cost-effective and high quality source of groundwater to promote the vitality, economy, and environment of the district.

- Prepared a five-year plan for district operation and evaluation of ASR (2009)

Corpus Christi Aquifer Storage and Recovery Conservation District (CCASRCD)

Project objective is to:

Collect well data

Append data to relational database

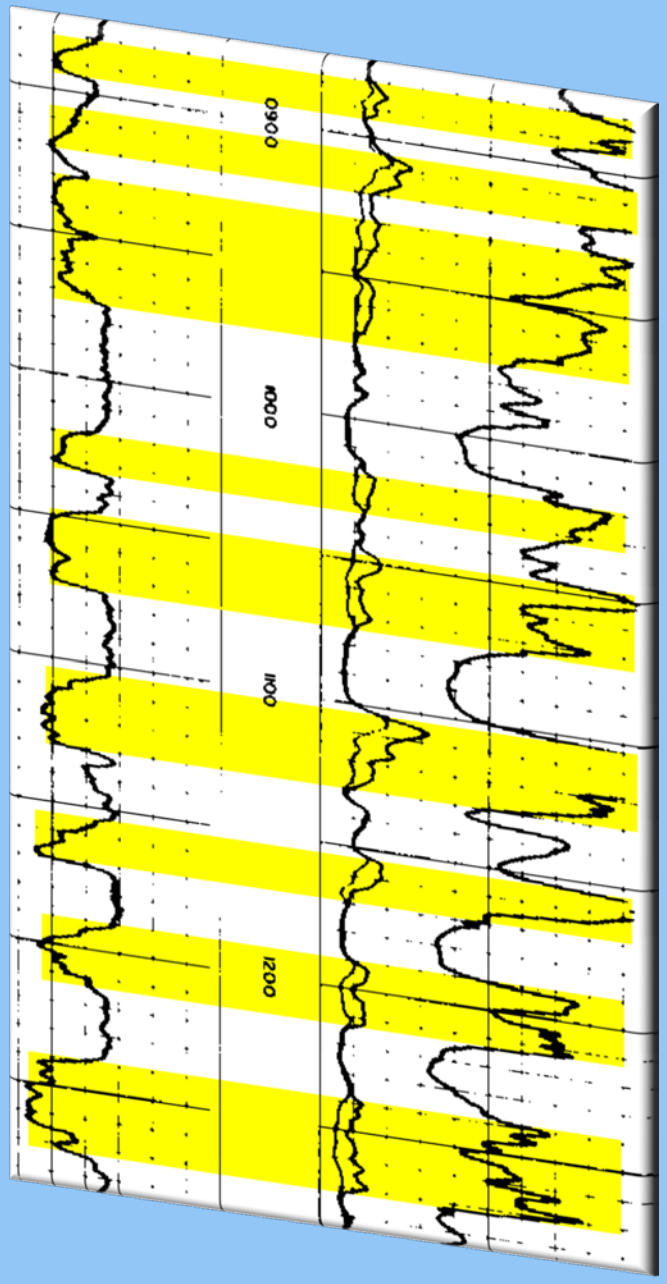
Characterize geology within ASR District :

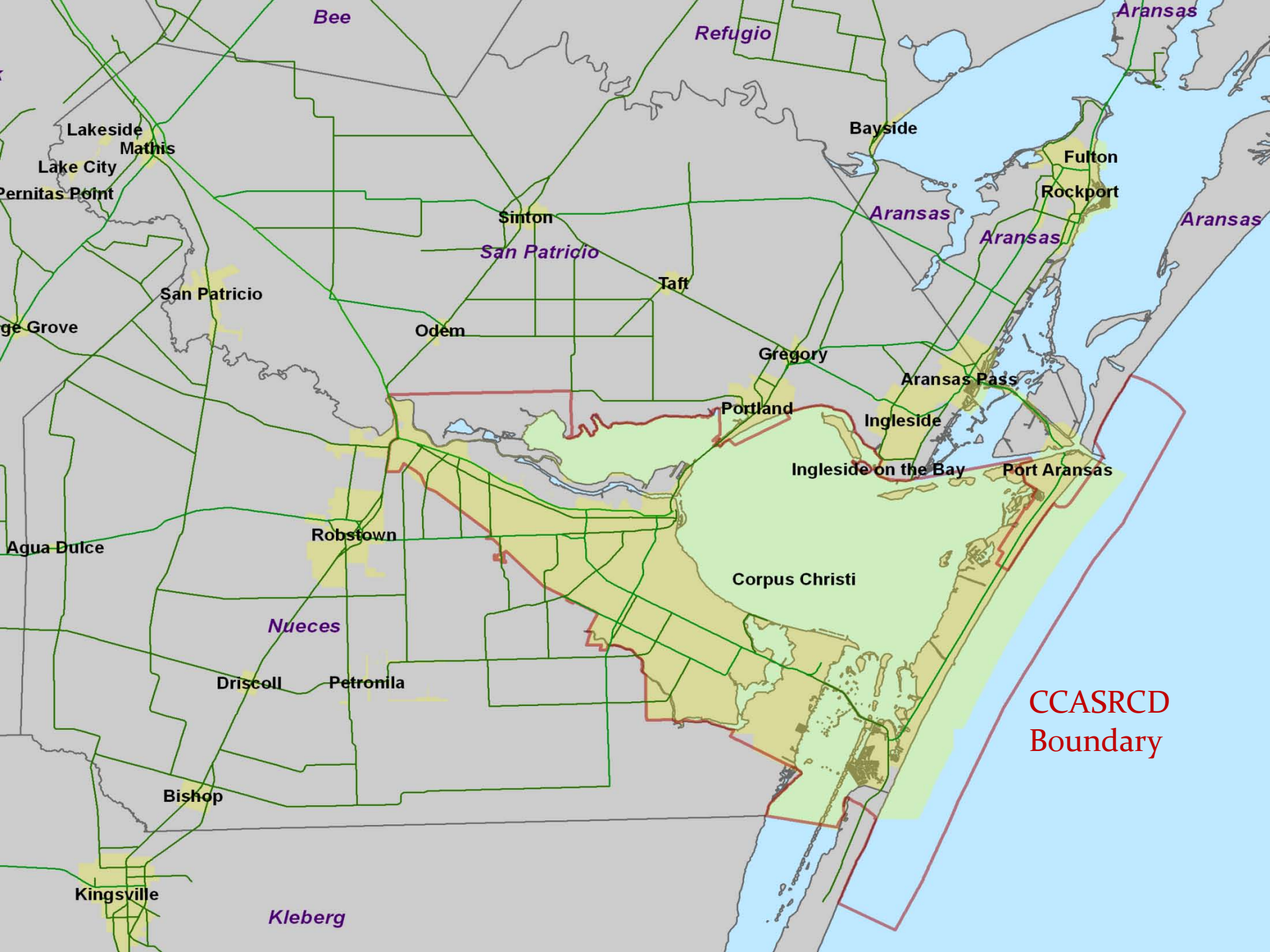
- sand and clay sequences
- water chemistry
- aquifer parameters
- potential problems:
  - hydrocarbons
  - high gamma ray spikes

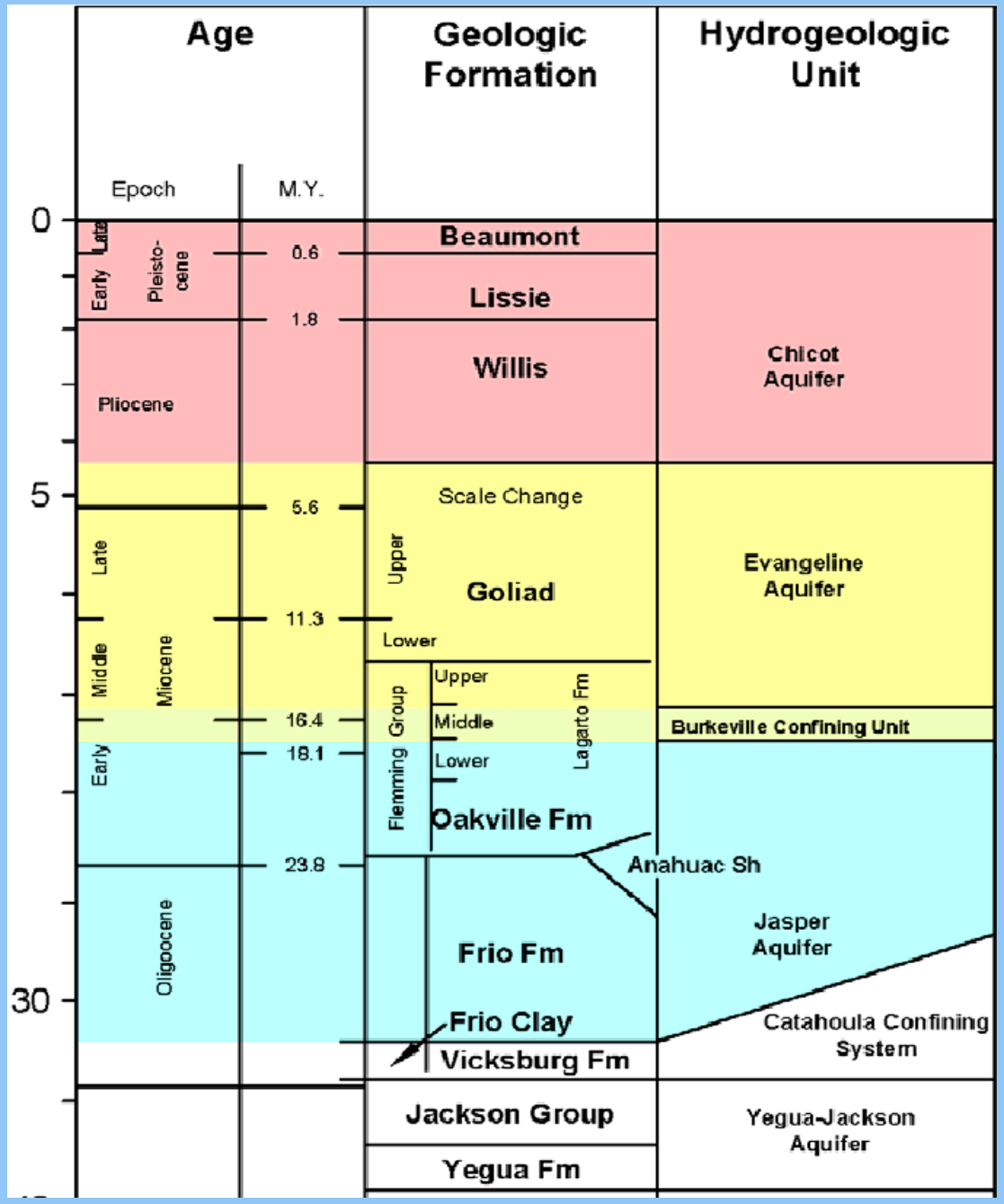
Project focus is on the Evangeline Aquifer in the area of the Stevens Water Treatment Plant at the west end of the district

Provide database, GIS datasets, raw well data, and summary report

Project Completion Date: February 29, 2012




Bee
Refugio
Aransas
Lakeside
Mathis
Lake City
Pernitas Point
Bayside
Fulton
Rockport
Aransas
Aransas
Aransas
Sinton
San Patricio
Taft
San Patricio
ge Grove
Odem
Gregory
Aransas Pass
Portland
Ingleside
Ingleside on the Bay
Port Aransas
Robstown
Agua Dulce
Corpus Christi
Nueces
Driscoll
Petronila
Bishop
Kingsville
Kleberg
CCASRCD
Boundary



District Geology

Will use hydrostratigraphy of the Gulf Coast Aquifer developed for the TWDB groundwater availability model program (Young and others, 2010)

Collect and interpret water well and geophysical well logs within San Patricio and Nueces counties

Extrapolate water chemistry and aquifer test information to CCASRCD region

Source: Young and others, 2010

TWDB Relational Database Primary Tables

TWDB Groundwater Database

Well Data
Remarks
Water Levels
Water Chemistry (2 tables)
Casing

TWDB BRACS* Database

Well Data (location, depth, owner, …)

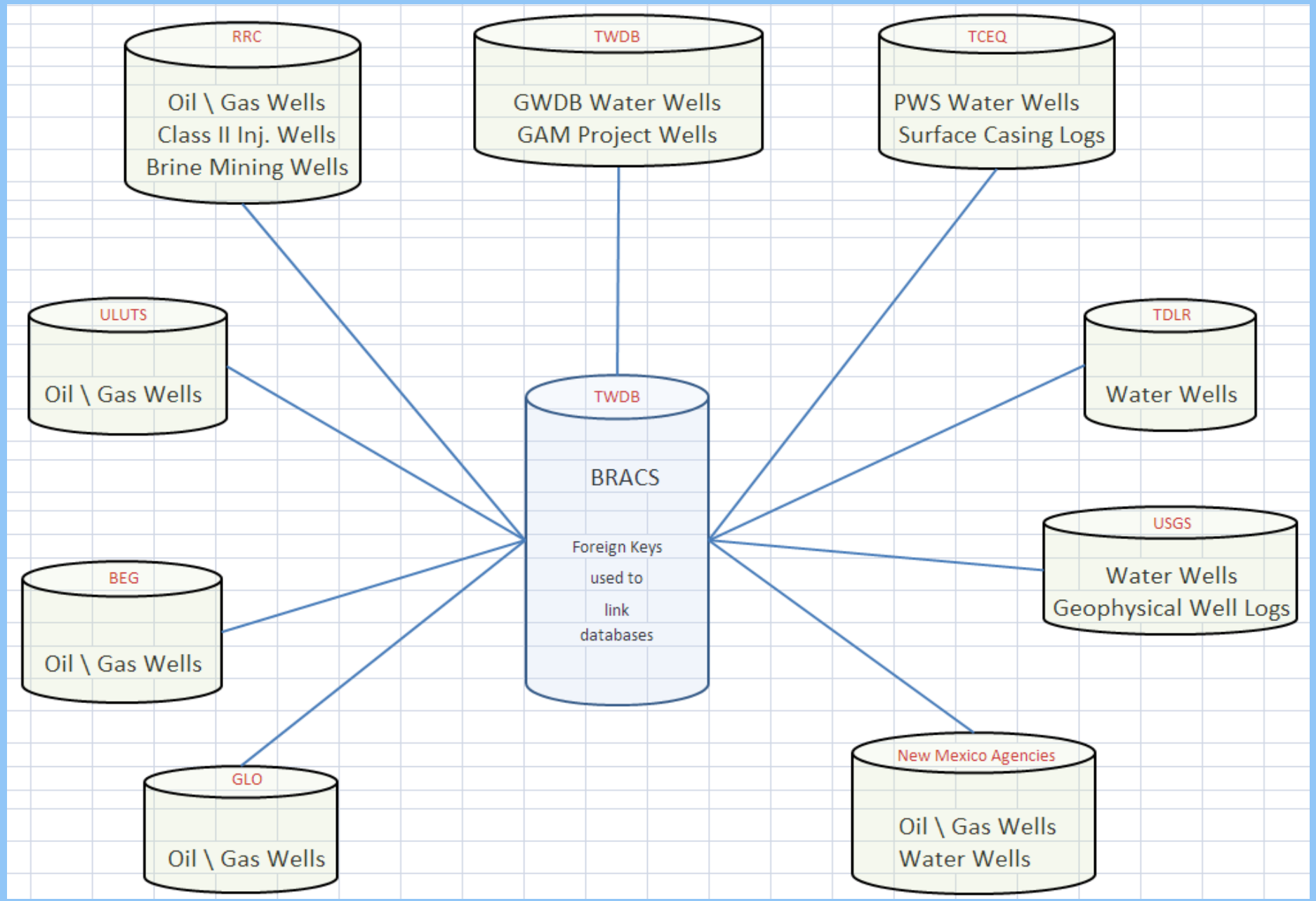
Water Levels
Water Chemistry (2 tables)
Casing

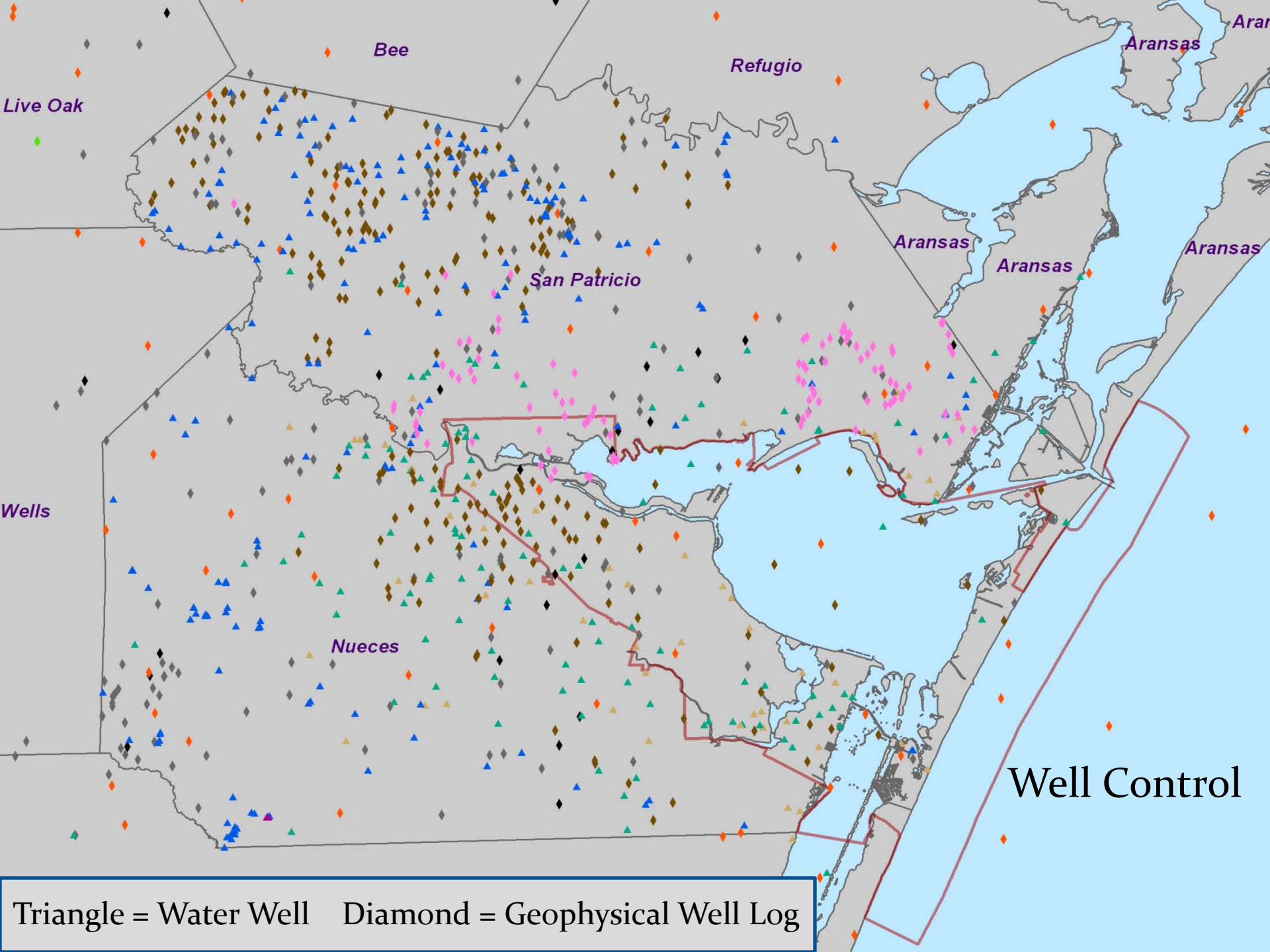
New Tables

Foreign Keys (well ids)
Well Geology (lithology/stratigraphy)
Net Sand and Sand Percent
Interpreted TDS from Geophysical W.L.
Aquifer Determination Analysis
Digital Water Well Reports
Digital Geophysical Well Logs
Geophysical Well Log Suites
Aquifer Test Information

** BRACS: Brackish Resources Aquifer Characterization System*

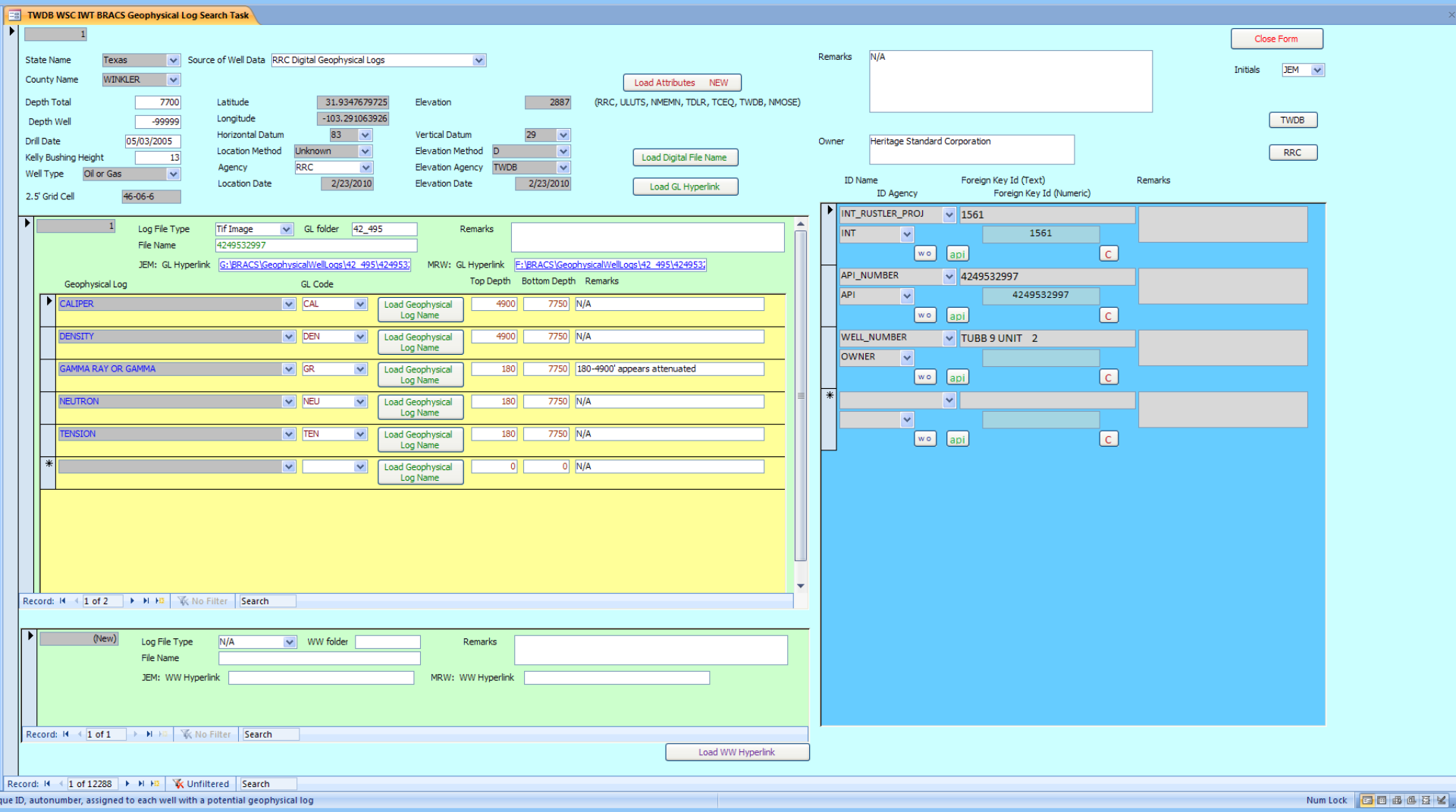
BRACS Supporting Well Databases




Bee
Refugio
Live Oak
Aransas
Aransas
Aransas
Aransas
San Patricio
Wells
Nueces
Well Control
Triangle = Water Well
Diamond = Geophysical Well Log

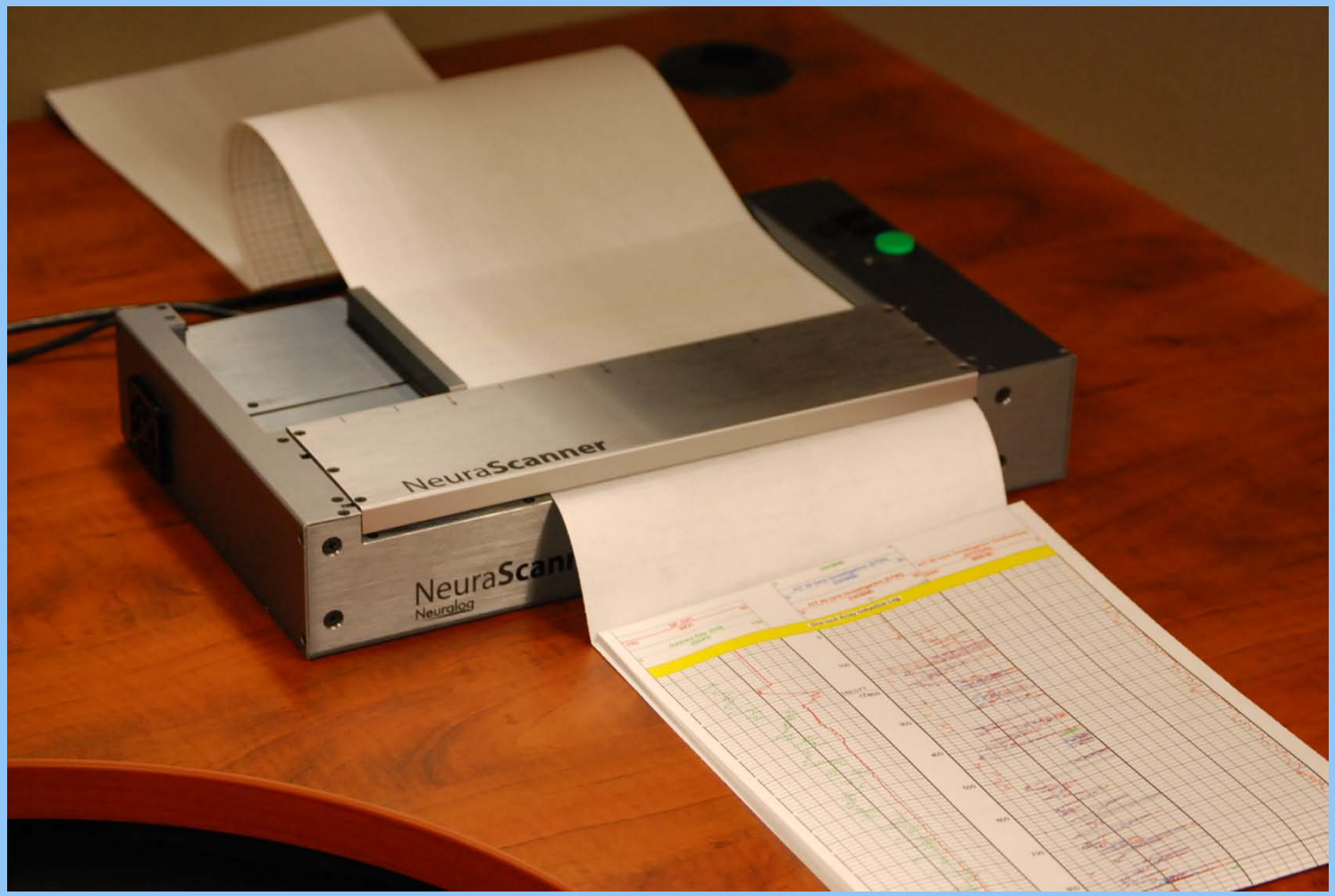
Well Attributes: location, source, log types, well numbers, …

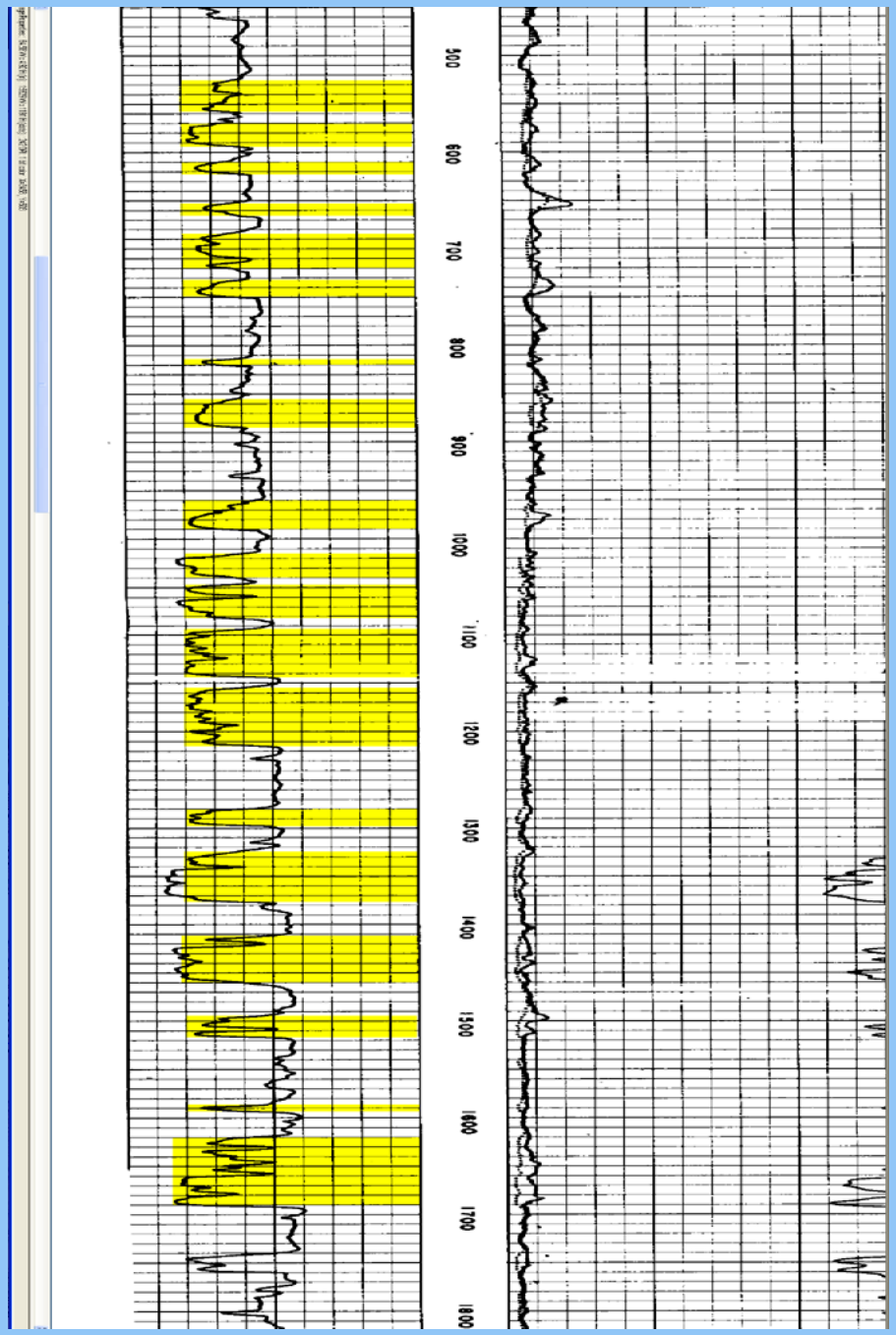
Well logs are hyperlinked to database, simplifying retrieval.



TWDB staff are using a NeuraScanner to scan paper geophysical well logs.

The TWDB has hundreds of paper logs in its files and the Railroad Commission of Texas has over 300,000 paper geophysical well logs in the Groundwater Advisory Unit collection.





Upper Goliad Sands (yellow; SP response) in the upper Evangeline Aquifer

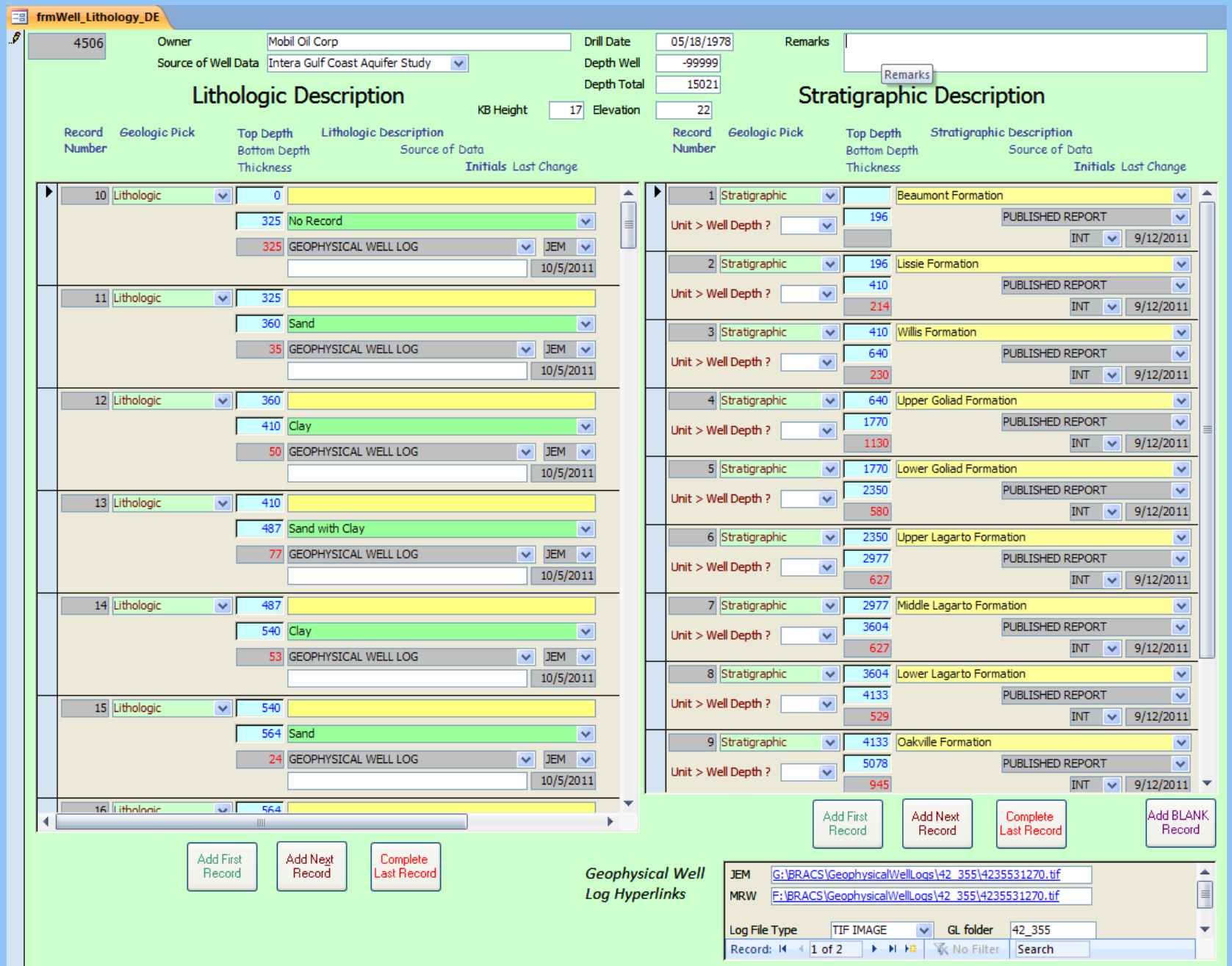
The lithology of geophysical well logs was interpreted from base of surface casing to several hundred feet below the Oakville Formation (base of Jasper Aquifer).

Lithology from each water well was loaded into the database and a simplified lithology was applied to the driller ‘s descriptions.

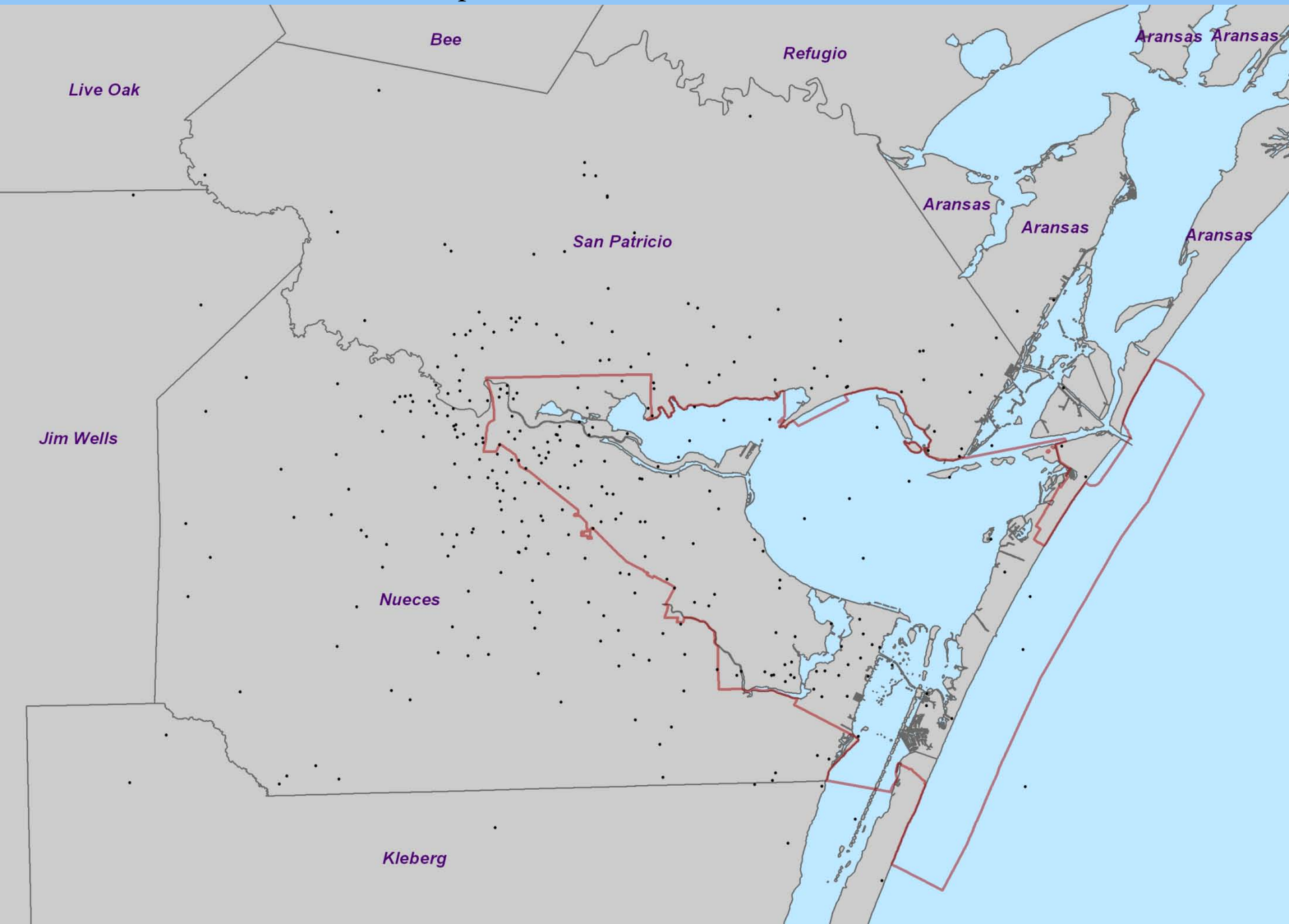
Lithology top/bottom depths and thickness were loaded into the database and net sand and sand percent maps can be made for any formation or combination of formations.

The upper and lower formation boundaries were obtained from the Gulf Coast Hydrostratigraphy report by Young and others (2010) and applied to each well in the two-county project area.

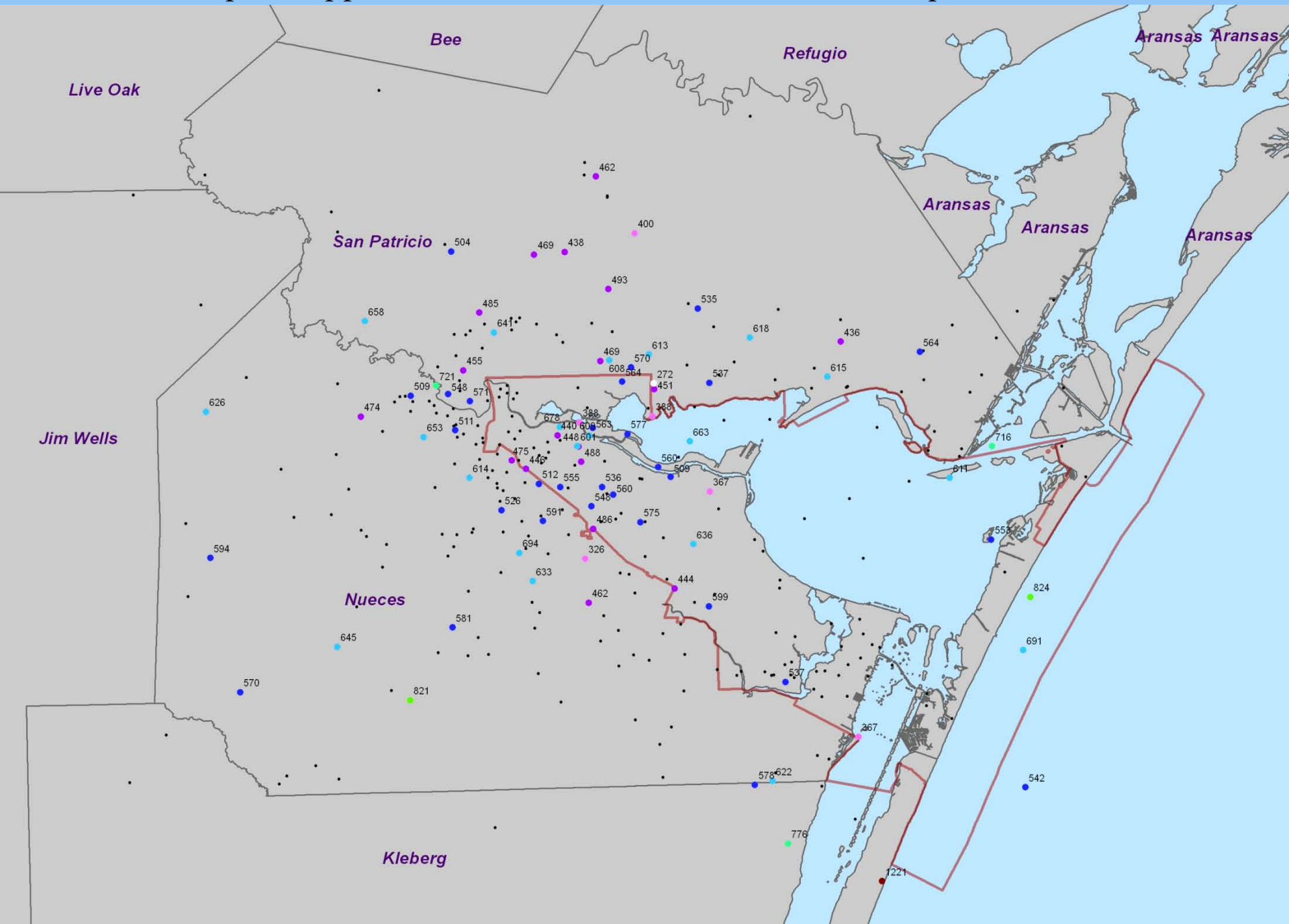
Geology Table



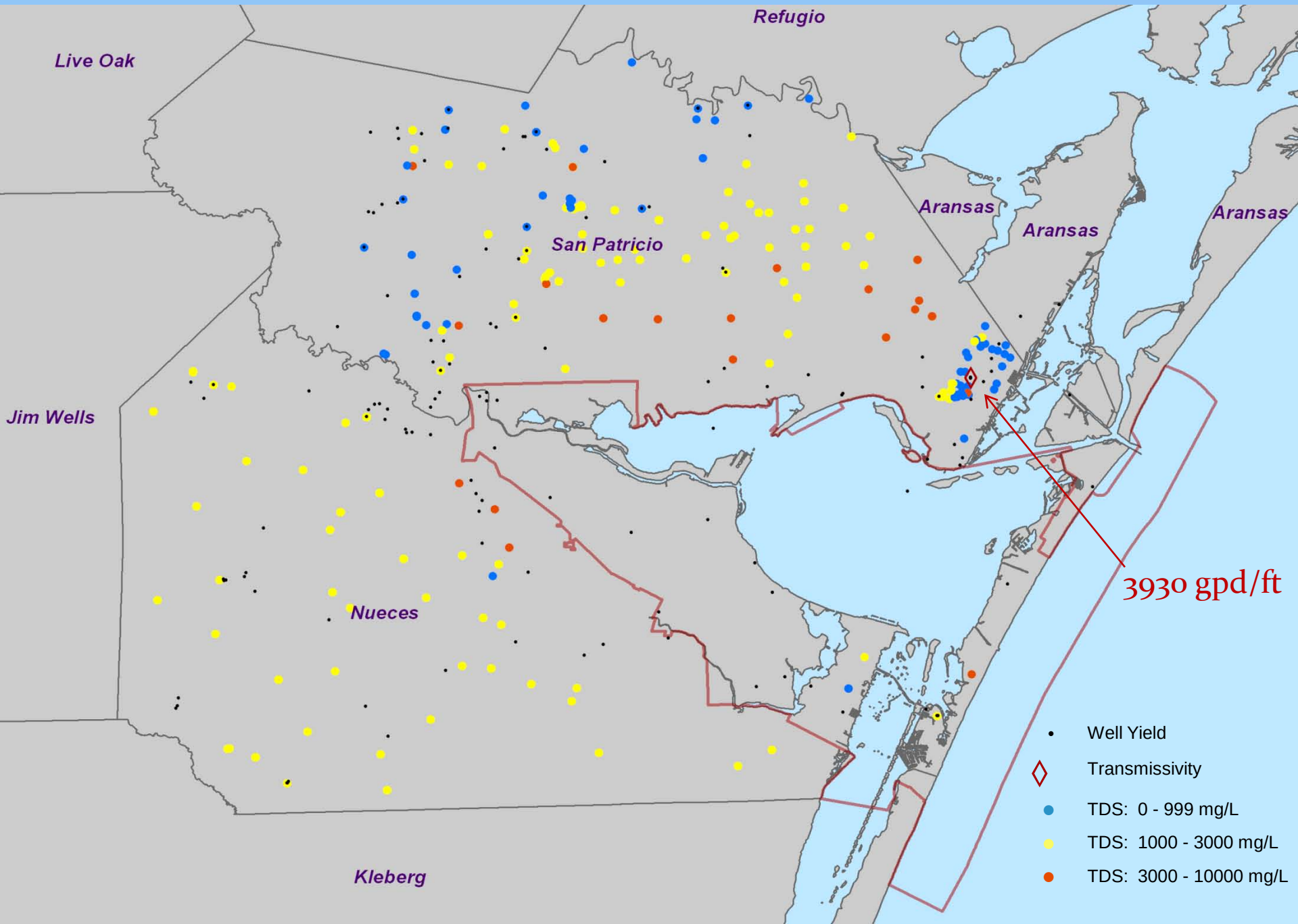
Wells with net sand evaluations performed.



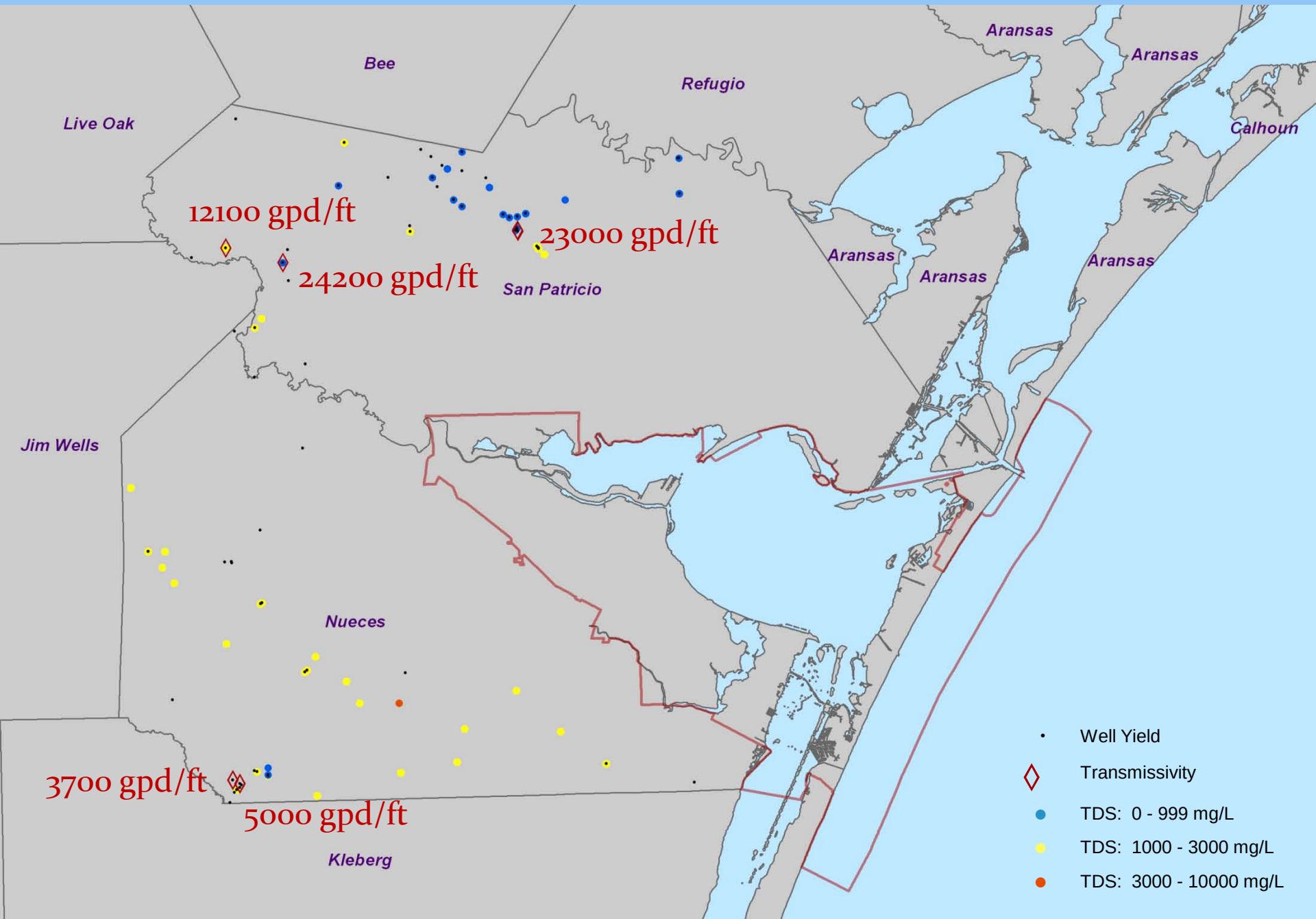
Wells with complete Upper Goliad Formation net sand evaluation performed.



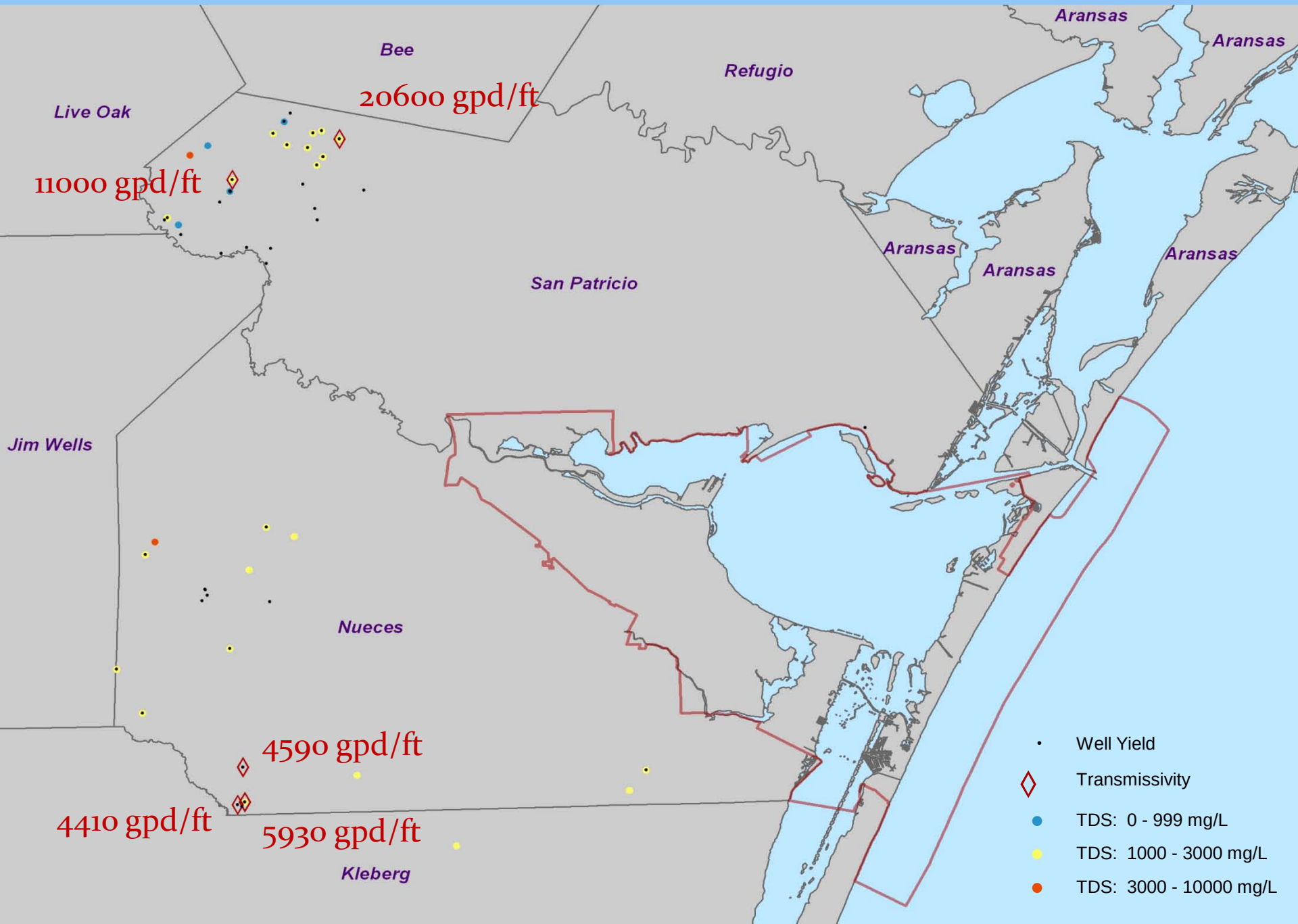
Chicot Aquifer wells showing TDS, well yield, and transmissivity data



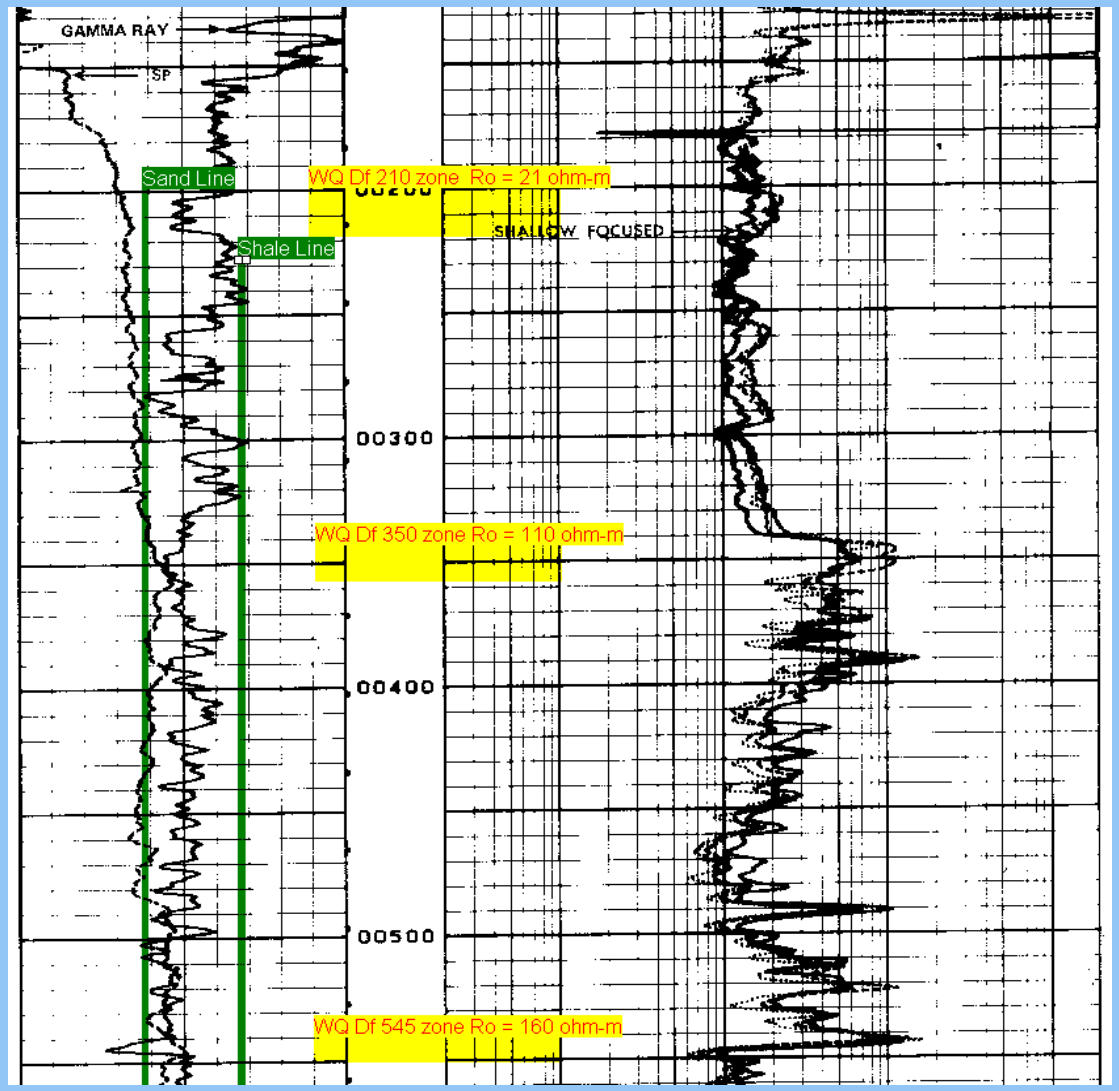
Chicot - Evangeline Aquifer wells showing TDS, well yield, and transmissivity data



Evangeline Aquifer wells showing TDS, well yield, and transmissivity data



Determining resistivity values for calculating TDS



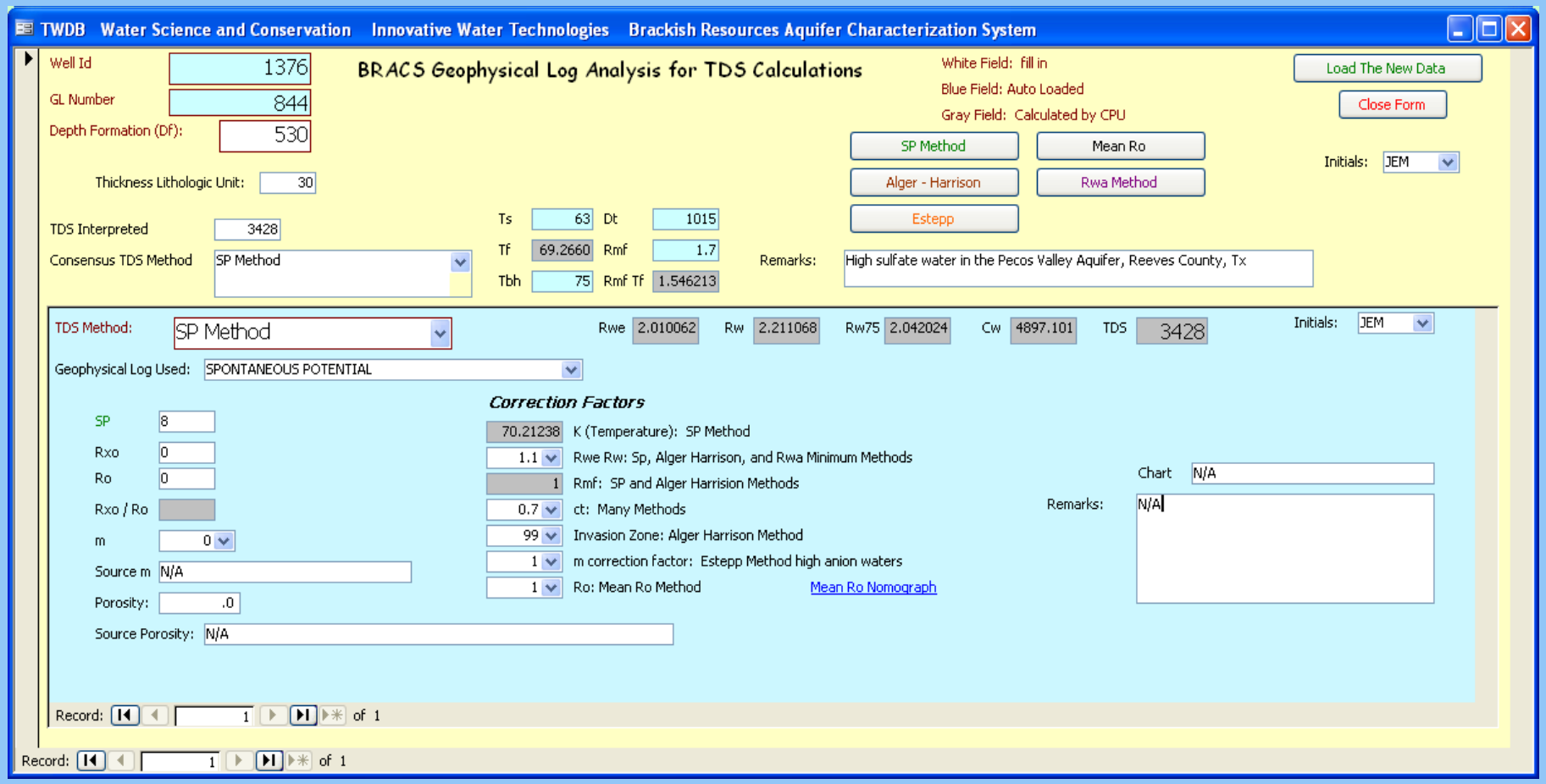
Can use:

SP Log
(Spontaneous Potential)

Resistivity Tools
- Induction
- Laterolog
- Resistivity
- Electric
- Lateral

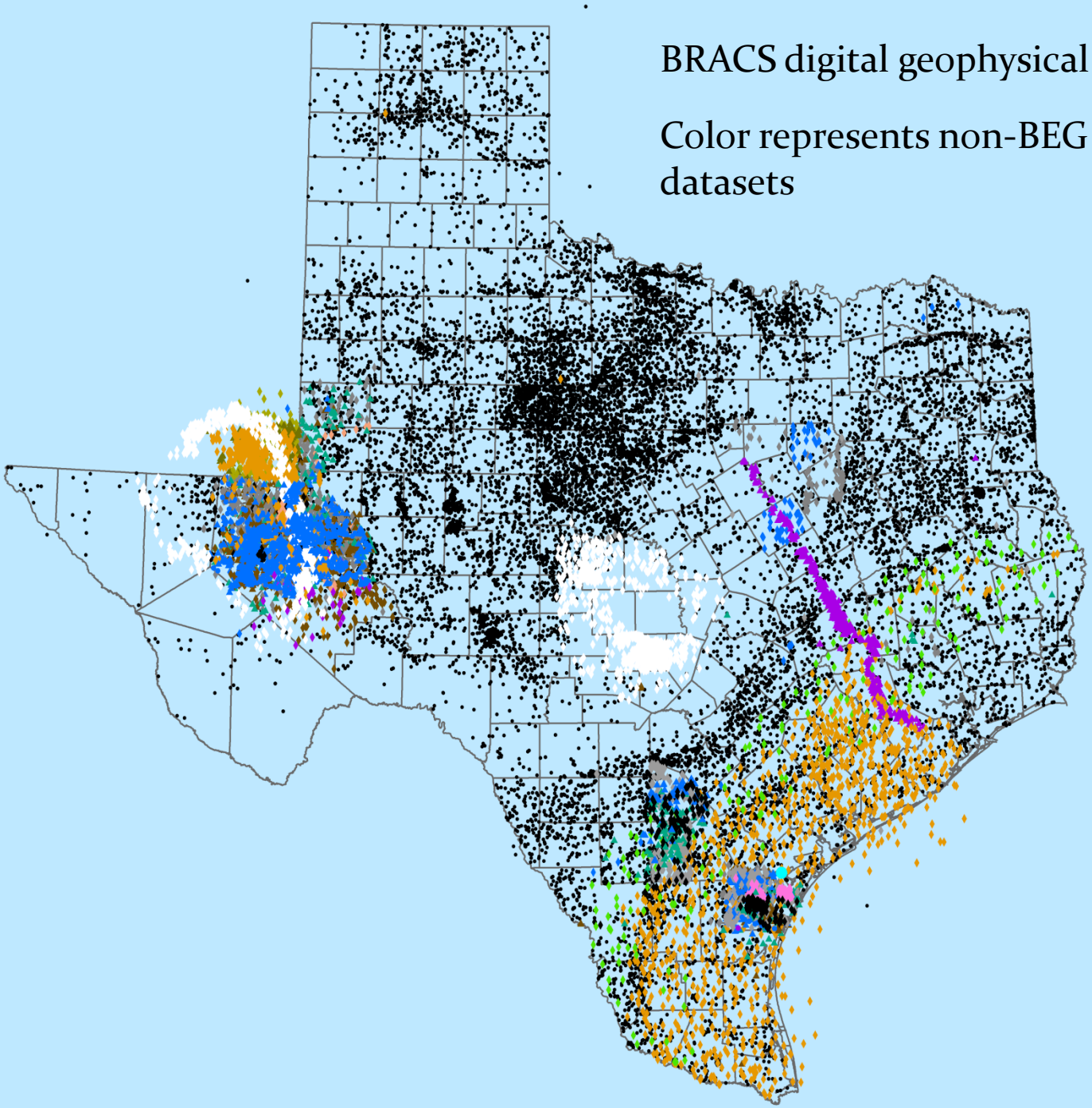
Calculation of TDS from geophysical well logs

Staff load method-specific log values and correction factors and the analysis is performed by the software



BRACS digital geophysical well logs

Color represents non-BEG derived datasets



Recent ASR Reports available on the TWDB Website:

- ASR Feasibility in Bandera County (2009)[1]
- Water Rights Analysis and ASR Feasibility in Kerr County (2009)[1]
- An Assessment of Aquifer Storage and Recovery in Texas (2011)[2]

1 www.twdb.texas.gov /wrpi/rwp/rwp_study.asp

2 www.twdb.texas.gov/innovativewater

Summary

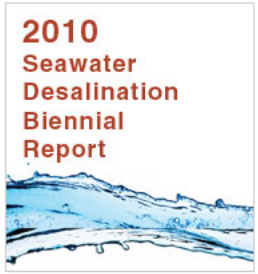
- The project was structured to collect as much data as possible in the region, and evaluate the entire Gulf Coast Aquifer sequence to offer CCASRCD flexibility on site and target depth selection.
- Additional data can be loaded into the database should CCASRCD decide to move to an area other than the Stevens WTP site.
- Database and analysis techniques developed for the BRACS program are well suited to characterize region geology for other ASR projects.
- The variability of geophysical log quality, age, and completeness precluded automated analysis of net sand using LAS files.
- Each aquifer is different and techniques of analysis will need to fit data available.
- The methods to characterize the geology are only a preliminary step before the site-specific development drilling and evaluation is performed.
- Future well drilling information can be loaded into the database, and GIS maps can be updated with site-specific test results.

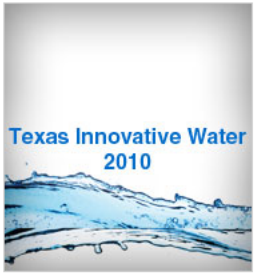
Texas Water Development Board

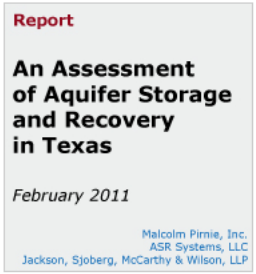
Sustainable, affordable, quality water for Texans, our economy, and our environment.

Home | Financial Assistance | Water Planning | Groundwater | Surface Water | Conservation | Innovative Water | Publications

Introduction | ASR | BRACS | Desalination | Rainwater Harvesting | Water Reuse







Innovative Water Technologies

- Aquifer Storage and Recovery
- BRACS
- Desalination
- Rainwater Harvesting
- Water Reuse

Innovative Water Technologies

The mission of the Innovative Water Technologies is to educate the water community on the use of nontraditional water supplies. This mission is accomplished by participating in research needed to advance technology demonstration projects; developing publications and educational materials; making presentations to the public; and, actively participating in key water organizations.

To promote and advance the use of non-traditional water supply development and management technologies such as desalination; rainwater and stormwater harvesting; water reuse; and aquifer storage and recovery in Texas, Innovative Water Technologies:

- funds and participates in research and demonstration projects; and,
- disseminates information through outreach activities.

Innovative Water Technologies (IWT) is primarily involved in the areas of nontraditional water supply and management activities including: desalination, rainwater and stormwater harvesting, water reuse, and aquifer storage recovery.

Through our desalination program, we administer grants for brackish groundwater desalination projects and seawater desalination pilot studies. To date, TWDB has funded eight brackish groundwater desalination demonstration projects worth a total of about $2.2 million, and two seawater desalination pilot plant studies worth approximately $3.13 million.

We promote rainwater and stormwater harvesting and water reuse through grants for research and demonstration projects and outreach activities.

Texas Water Development Board, 1700 North Congress Avenue, Austin, TX 78711 | TEL: 512-463-7847

Questions?

TWDB: (512) 463-7847

http://www.twdb.texas.gov

john.meyer@twdb.texas.gov

sanjeev.kalaswad@twdb.texas.gov