

Brackish Groundwater Characterization System (BRACS)

Andrea Croskrey, P.G.

*Texas Ground Water Association
Annual Convention & Trade Show
January 24, 2018*

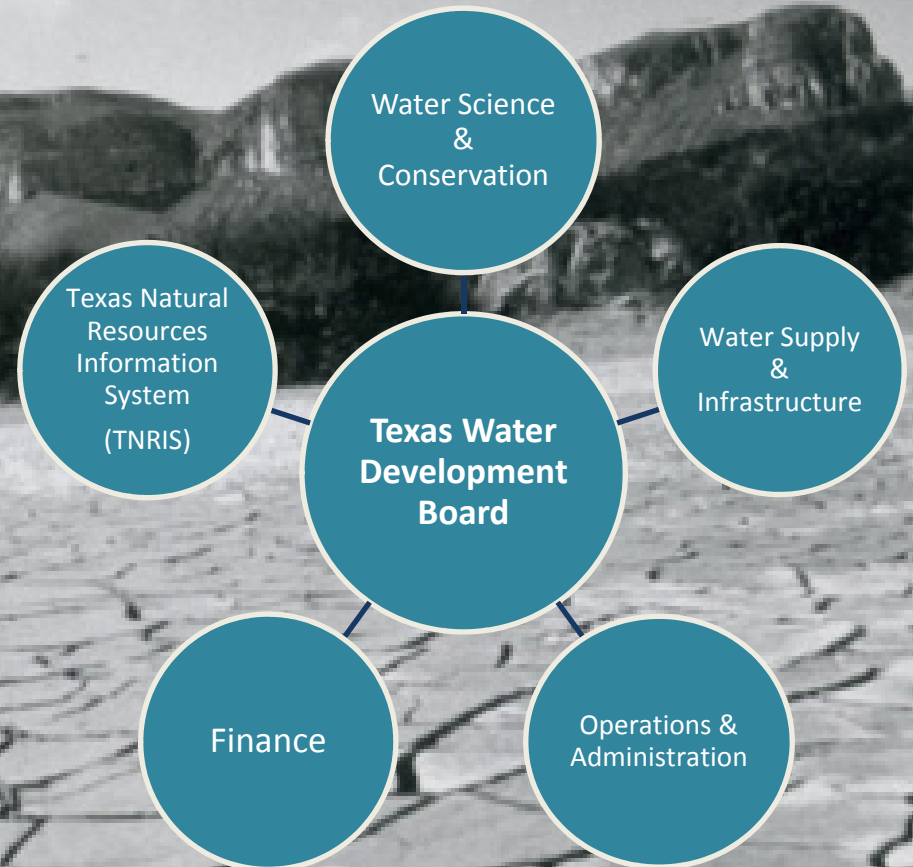
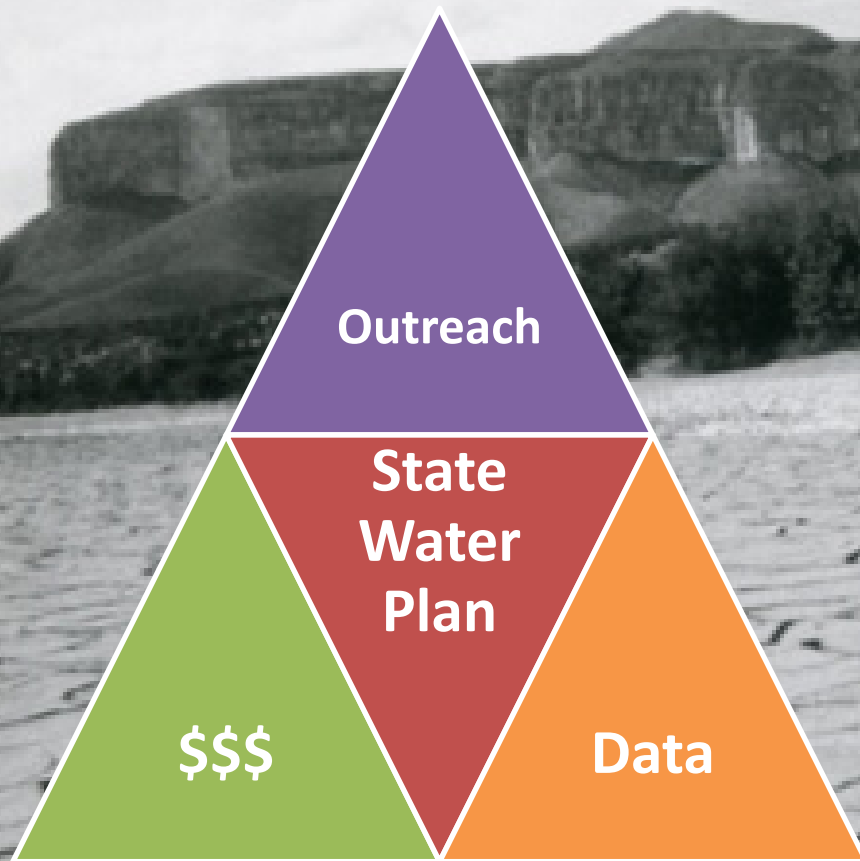
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Texas Water 
Development Board

Texas Water Development Board



"To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas"

Innovative Water Technologies

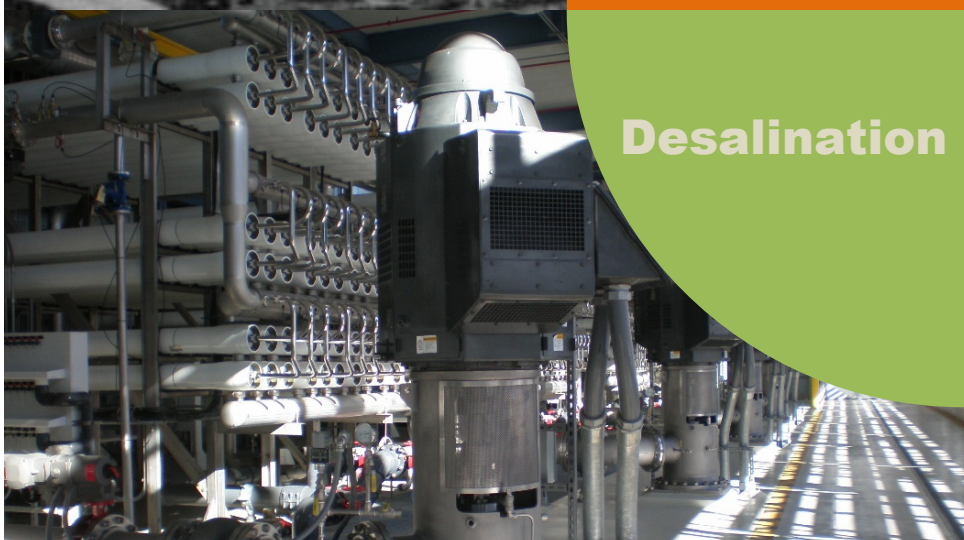


**Brackish
Groundwater**

**Water
Reuse**

Desalination

**Aquifer
Storage &
Recovery**



“Our mission is to educate the water community on the use of nontraditional water supplies.”

What is brackish groundwater?

saltier than fresh water, less salty than seawater

Groundwater Salinity Classification	Salinity Zone Code	Total Dissolved Solids Concentration (units: milligrams per liter)
Fresh	FR	0 to 1,000
Slightly Saline	SS	1,000 to 3,000
Moderately Saline	MS	3,000 to 10,000
Very Saline	VS	10,000 to 35,000
Brine	BR	Greater than 35,000

Drinking Water
Limit

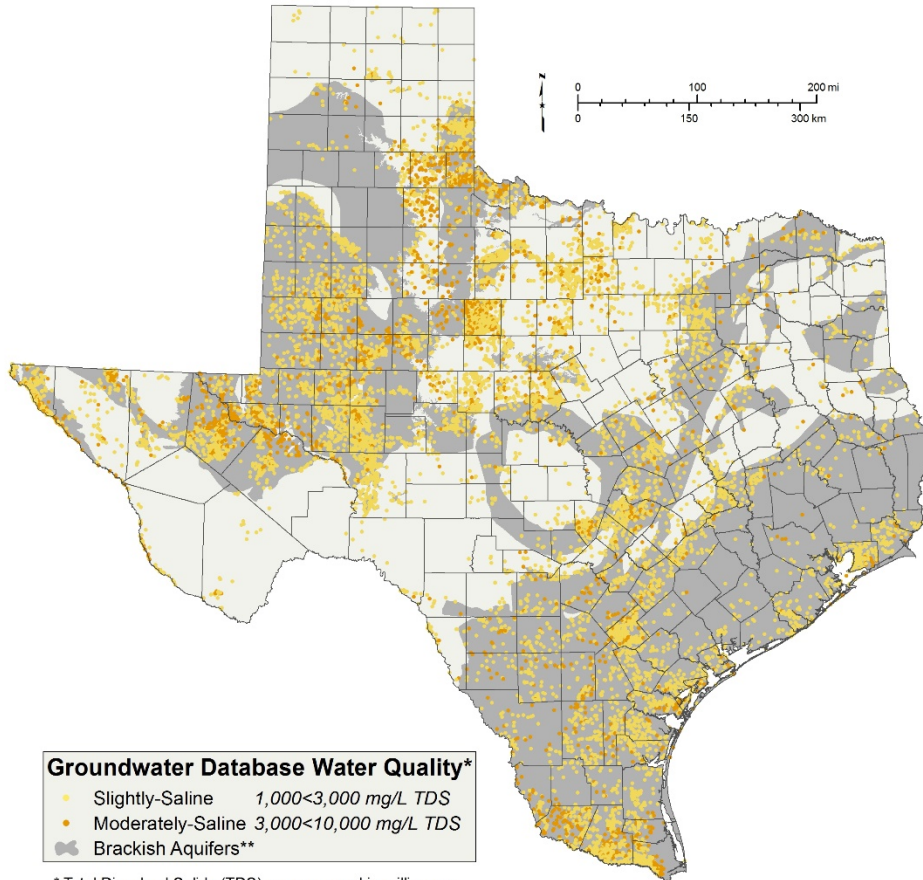
Major/Minor
Aquifer
Mapped Limit

Seawater

1 acre-foot (AF) = 326,000 gallons or 43,560 cubic feet or 1,233 cubic meters
(approximately)

Why study brackish aquifers?

Brackish Wells and Brackish Aquifers



* Total Dissolved Solids (TDS) are measured in milligrams per liter (mg/L)

**Regions underlain by one or more brackish aquifers (TDS is 1,000<10,000 mg/L)

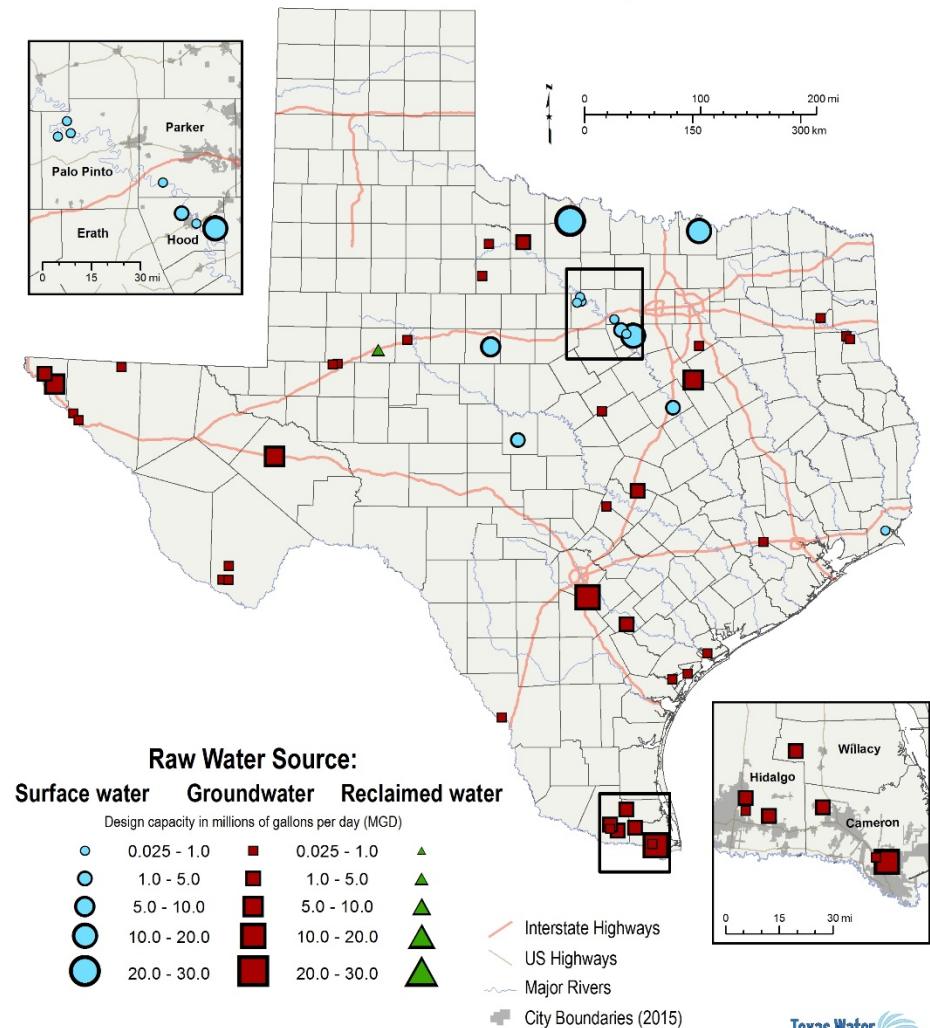
If a well had more than one Total Dissolved Solids (TDS) measurement, the most recent measurement was used.
No claims are made to the accuracy or completeness of the information shown herein or to its suitability for a particular use.
For more information visit <http://www.twdb.texas.gov/innovativewater/bracs/index.asp>.

- ✓ 2.7 billion acre-feet in Texas!
 - 2003 study
 - Statewide
 - 30 major and minor aquifers
 - Contracted report by LBG-Guyton
- ✓ Need detailed information
 - Typically deeper
 - Fewer existing wells
 - Aquifer extents limited

Why study brackish aquifers?

- ✓ Growing interest in desalination
- ✓ It can be used today!
 - Over 30 plants already in Texas
 - Salt tolerant crops
 - Oil and gas industry
- ✓ Available throughout the state
- ✓ Less expensive than seawater
 - Location and abundance
 - Energy costs
 - Existing infrastructure
 - Technology
 - Concentrate disposal

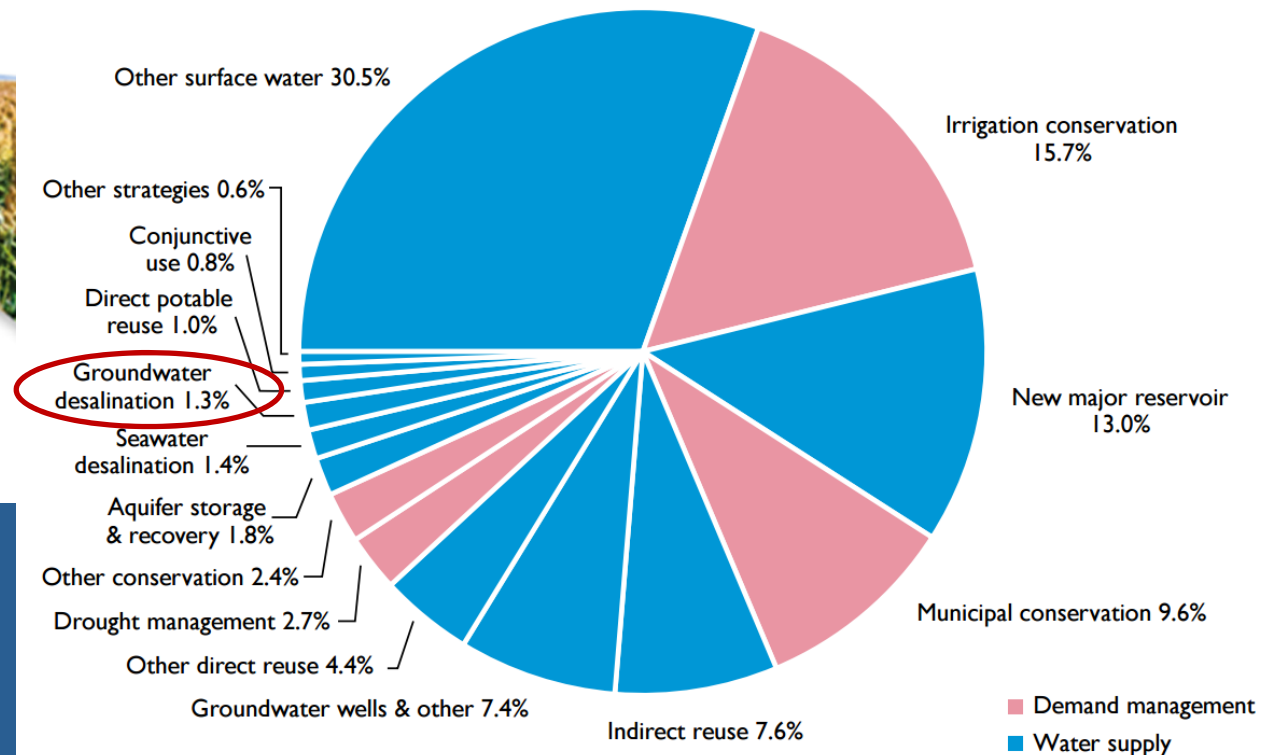
Public Water Supply Desalination Plant Capacities



Why study brackish aquifers?



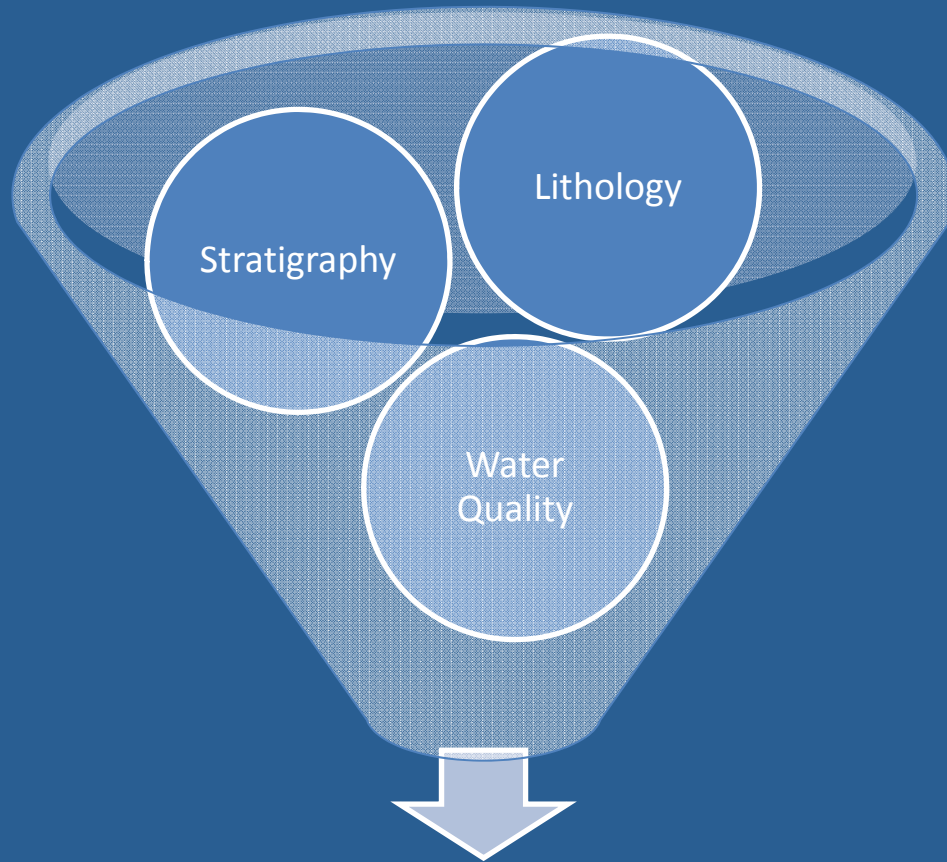
Figure ES.7 - Share of recommended water management strategies by strategy type in 2070



- ✓ It is part of the plan!
 - 2017 State Water Plan
- ✓ 111,000 acre-feet (1.3%) water supply filling the gap between projected 2070 demand and supply
- ✓ 8 of the 16 Regional Water Planning Areas

How to conduct a BRACS study?

General Methodology



Area (Extent)

X

Thickness (Net Sand)

X

Porosity (Specific Yield)

=

Volume (acre-feet)

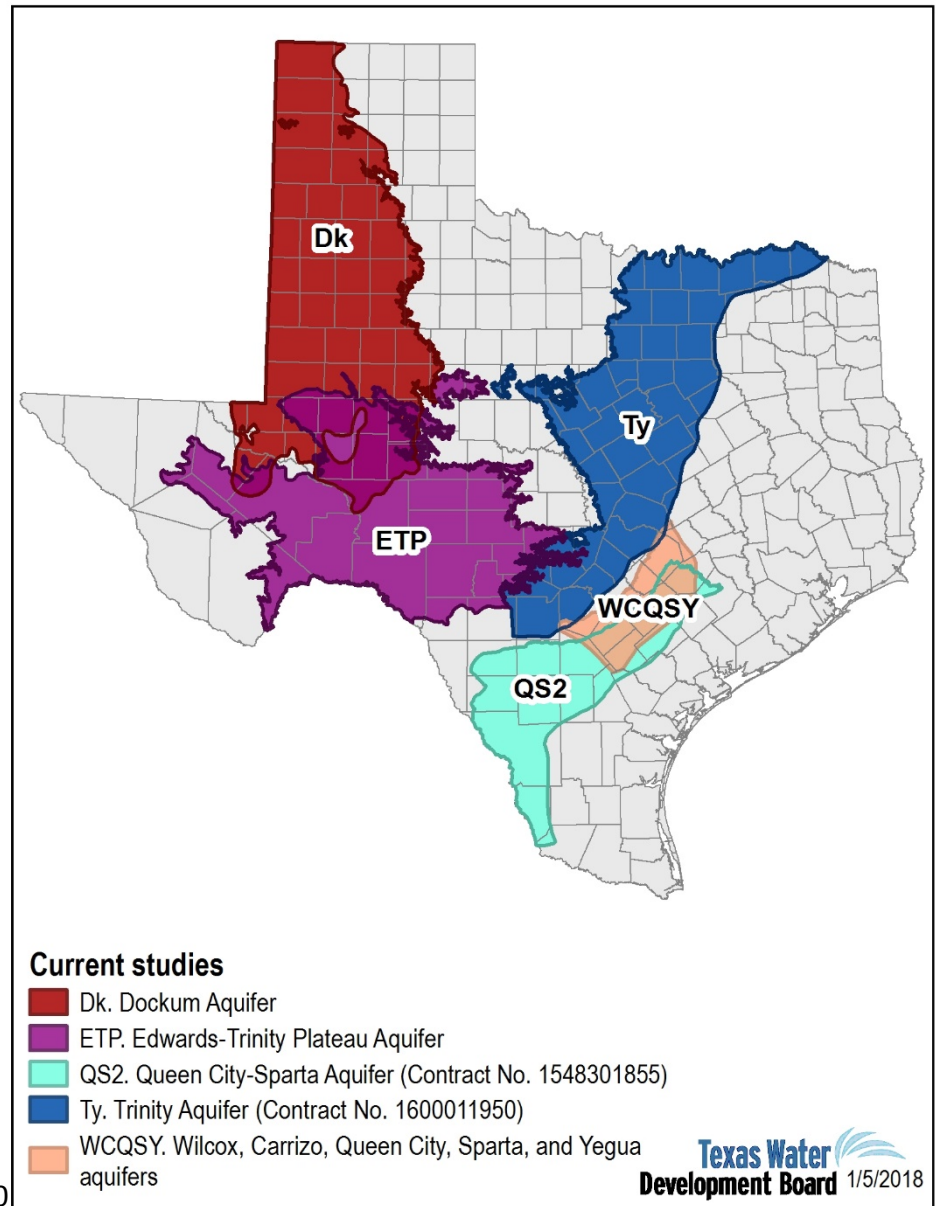
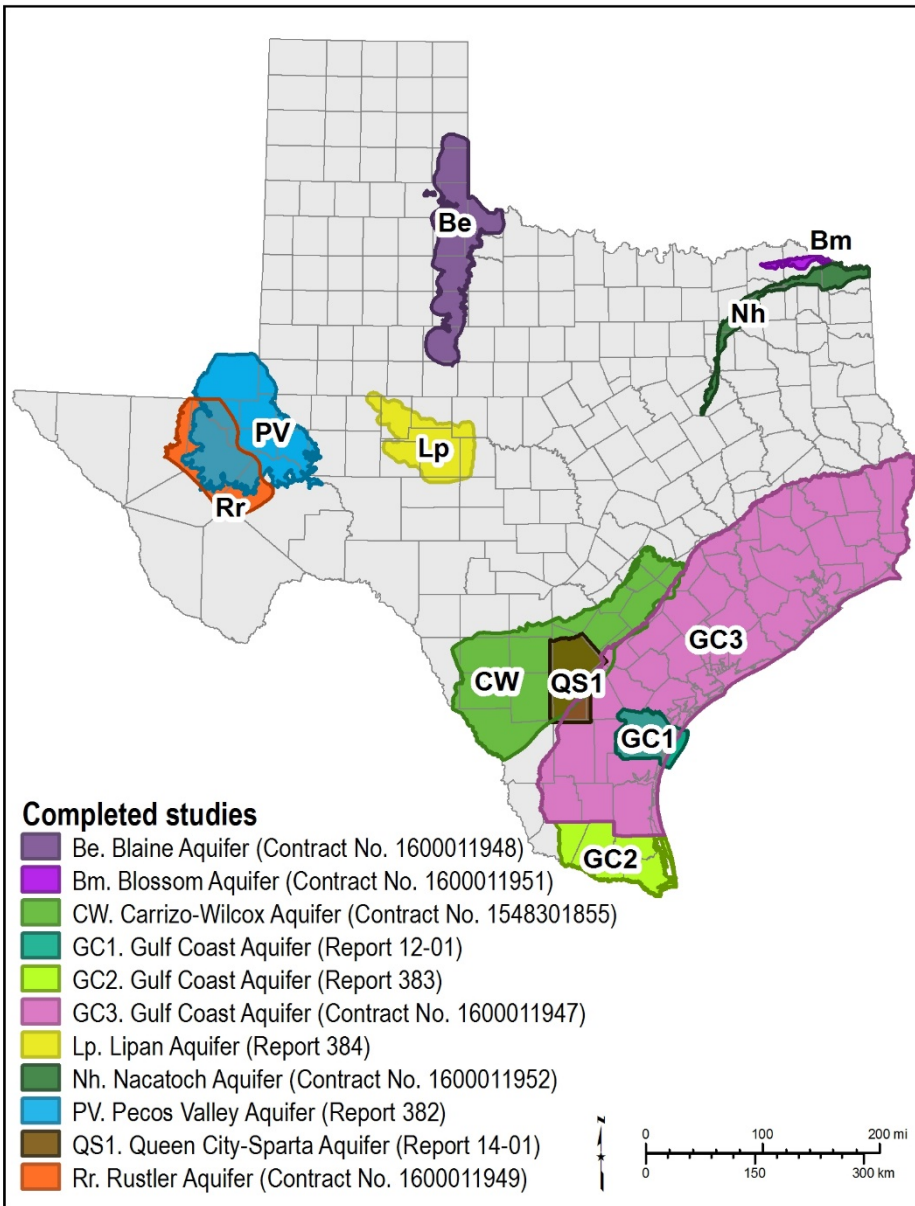
**Volume and Quality of
Brackish Groundwater**

How to conduct a BRACS study?

- ✓ Collect data
 - Contact stakeholders
 - Well logs (water, oil/gas)
 - Enter data into database
 - Build GIS files
- ✓ Compile aquifer properties
 - Establish the framework
 - Estimate saturated zones
 - Net sand and/or porosity analysis
 - Chemistry
 - Productivity
- ✓ Chemical parameters important to desalination
- ✓ Estimate volumes of water
- ✓ Provide data to stakeholders

Aquifer requires unique analysis based on data availability and local hydrogeology

Brackish Resources Aquifer Characterization System (BRACS) Program



Project Deliverables

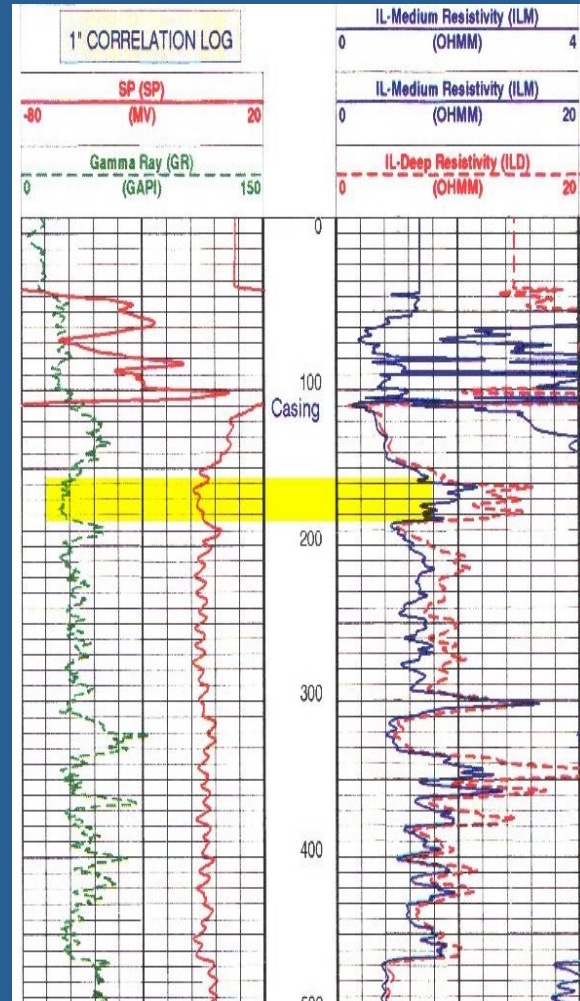
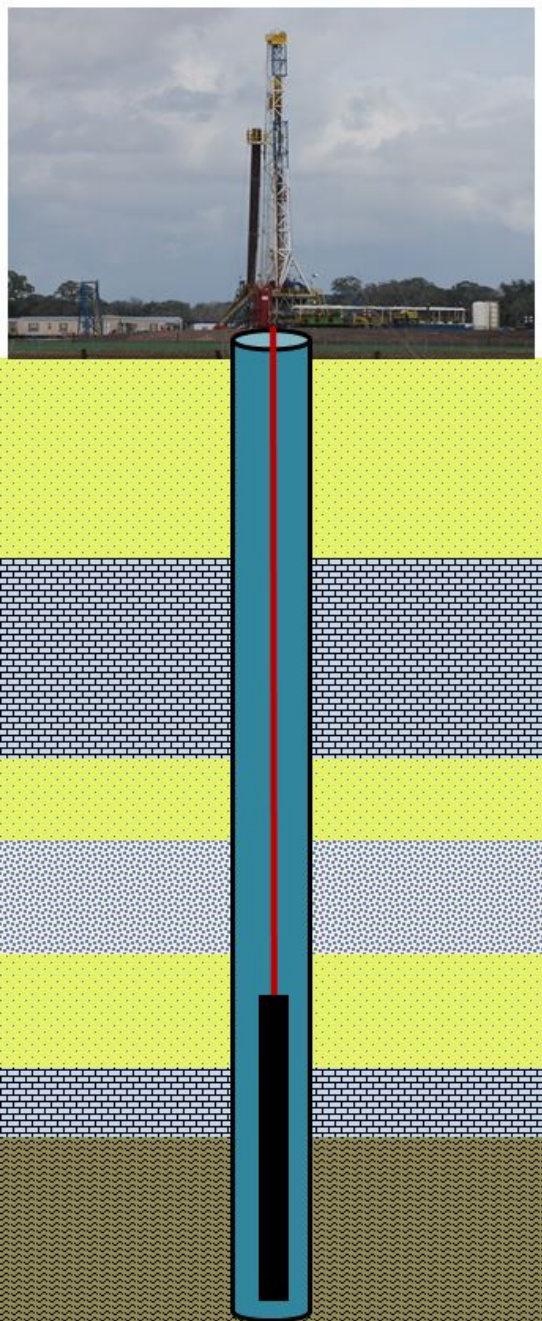


The real value of a study is in the data!

Stakeholders can use this to evaluate potential groundwater exploration areas.


- Published reports
- BRACS Database
- GIS Datasets
- Well logs

What is a Geophysical Well Log?




- ✓ “electrical logging” and “wireline logging”
- ✓ A tool or combination of tools lowered into a borehole on a wireline and retrieved to the surface.
- ✓ Tools are designed to record specific parameters.
- ✓ Tool response recorded in left and right tracks.
- ✓ Logs must be corrected for a number of parameters.
- ✓ Complete and accurate header information vital to performing the corrections.


BRACS Database


The  [Brackish Resources Aquifer Characterization System \(BRACS\) Database](#) was designed to store well and geology information in support of projects to characterize the brackish groundwater resources of Texas. The BRACS database is fully relational, with self-documenting object naming. The database design relies on extensive use of lookup tables. The BRACS database is a Microsoft Access 2007 format that has been compressed with the WinZip utility. This database will be updated periodically; the date of the last update is embedded in the filename.

This database was developed for use by TWDB staff in support of the BRACS program. The information changes on a daily basis and users should read the disclaimer below. If you have any questions, please contact John Meyer at 512-463-8010.

A data dictionary to accompany the BRACS Database is now available for download. The dictionary describes each primary table in the database and custom tables developed for a study.

 [Brackish Resources Aquifer Characterization System Database Data Dictionary](#), Third Edition, TWDB Open File Report 12-02, April 2017 (3 MB)

 [Brackish Resources Aquifer Characterization System Database Data Dictionary](#), Second Edition, TWDB Open File Report 12-02, September 2014 (3 MB)

 [Brackish Resources Aquifer Characterization System Database Data Dictionary](#), First Edition, TWDB Open File Report 12-02, November 2012 (13.6 MB)

[Aquifer Storage and Recovery](#)

[Brackish Resources Aquifer Characterization System](#)

- [BRACS FAQs](#)
- [BRACS Studies](#)
- [Brackish Groundwater Production Zones](#)
- [BRACS Database](#)
- [BRACS GIS Data](#)
- [BRACS Well Logs](#)
- [BRACS TWDB Documents](#)
- [BRACS Useful Links](#)

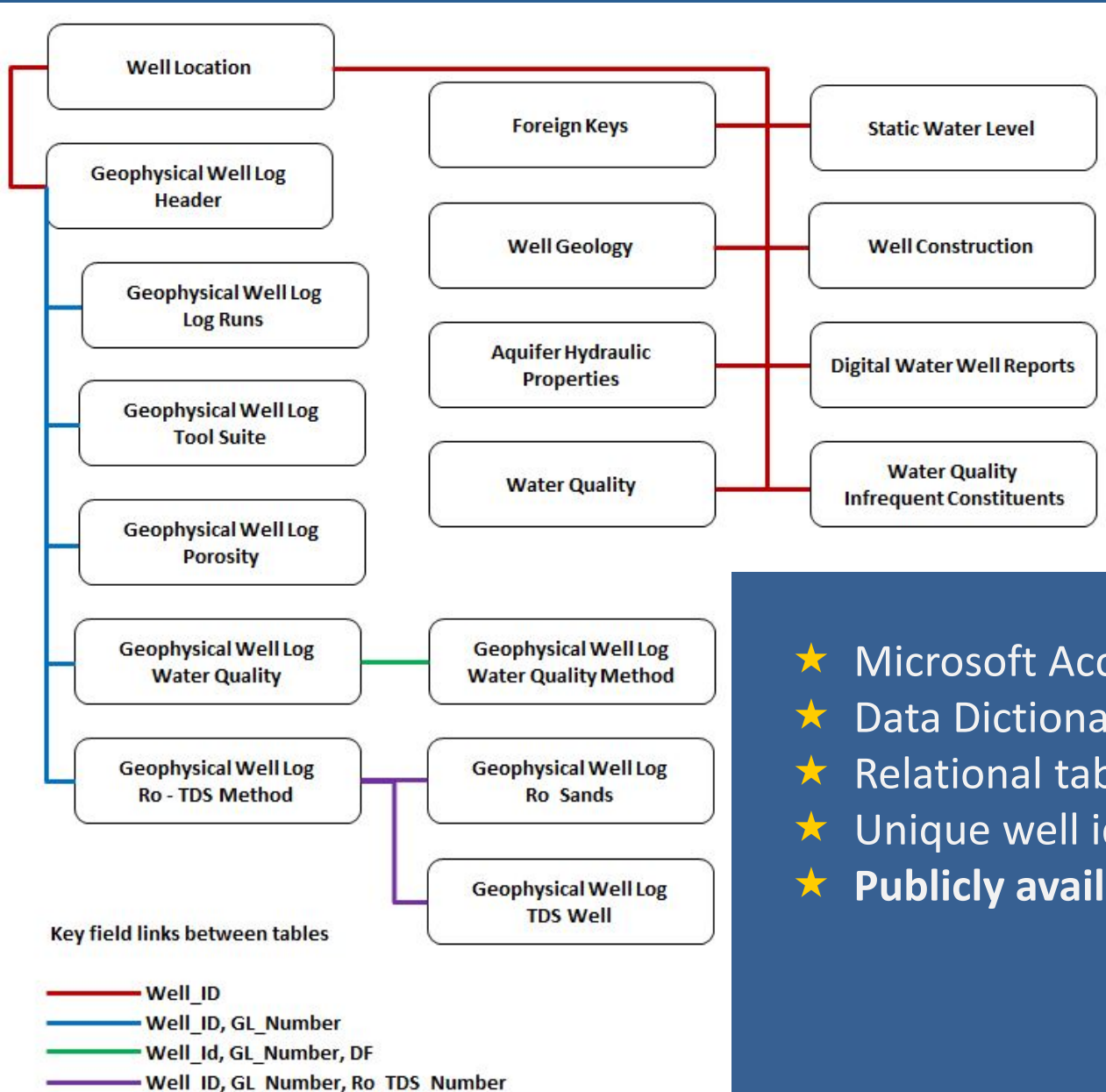
[Desalination](#)

[Rainwater Harvesting](#)

[Water Reuse](#)

[Innovative Water Technologies Staff](#)

What is the BRACS Database?



Tables of related data!

- ★ Microsoft Access Database
- ★ Data Dictionary
- ★ Relational table design
- ★ Unique well ids link records together
- ★ Publicly available on the TWDB website!

BRACS Public Database

Security Warning Some active content has been disabled. Click for more details. [Enable Content](#)

Tables
gBracs_AD_PE_sTx
gBRACS_ST
gBRACS_ST_GC
gBRACS_ST_PE_sTx
gBRACS_ST_SpQC
tblAquiferDetermination_GulfCoast
tblAquiferDetermination_GulfCoast_ccasr
tblAquiferDetermination_PaleoceneEocene_sTx_QcSp
tblAquiferDetermination_PecosValley
tblBRACS_AquiferTestInformation
tblBracs_Casing
tblBracs_ForeignKey
tblBRACS_GC_MasterWaterQuality
tblBRACS_GC_MasterWaterQuality_ccasr
tblBRACS_GC_WQ_Radionuclide
tblBRACS_GC_WQ_Radionuclide_ccasr
tblBRACS_Lipan_Aquifer_Test
tblBRACS_Lipan_Aquifer_Test_Select
tblBRACS_Lipan_AquiferDetermination
tblBRACS_Lipan_MasterWaterQuality
tblBRACS_Lipan_SWL
tblBRACS_PE_sTx_MasterWaterQuality
tblBRACS_PV_MasterWaterQuality
tblBRACS_QcSp_MasterWaterQuality
tblBracs_SWL
tblBracsInfrequentConstituents
tblBracsProjectWells
tblBracsWaterQuality
tblBRACSWaterWellReports
tblGeophysicalLog_Header
tblGeophysicalLog_Header_LogRuns
tblGeophysicalLog_Suite
tblGeophysicalLog_WQ
tblGeophysicalLog_WQ_Method
tblGisFile_NamingConventions
tblILk_m
tblILkAgency
tblILkAq_Decision
tblILkAquifer
tblILkBRACS_Aquifer_AD

BRACS Database, Navigation to Forms

Close Form

1: Select a form to display

BRACS Database Master Well Form

TWDB Report 382, 2012, Pecos Valley Aquifer, West Texas: Structure and Brackish Groundwater

- Pecos Valley Aquifer Study: Aquifer Determination Form
- Pecos Valley Aquifer Study: Net Sand Form

TWDB Technical Note 14-01, 2014, Queen City and Sparta Aquifers, Atascosa and McMullen Counties, Texas: Structure and Brackish Groundwater

- Queen City and Sparta Aquifer Study: Aquifer Determination Form
- Queen City and Sparta Aquifer Study: Net Sand Form

TWDB Open-file Report 12-01, 2012, Geologic Characterization of and Data Collection in the Corpus Christi Aquifer Storage and Recovery Conservation District and Surrounding Counties

- Gulf Coast CCASRCD Study: Aquifer Determination Form
- Gulf Coast CCASRCD Study: Net Sand Form

TWDB Report 383, 2014, Brackish Groundwater in the Gulf Coast Aquifer, Lower Rio Grande Valley, Texas

- Gulf Coast Lower Rio Grande Valley Study: Aquifer Determination Form
- Gulf Coast Lower Rio Grande Valley Study: Net Sand Form
- Gulf Coast Lower Rio Grande Valley Study: Salinity Zone Form

2: Press Button

Open Form

Location and Foreign Key tables

TWDB WSC IWT BRACS Geophysical Log Search Task

1737
BRACS Well ID

Close Form

Location and Well IDs | Lithology and Stratigraphy | Digital Well Logs | TDS Analysis using Geophysical Well Logs | Aquifer Test Information | Water Quality | Static Water Level | Well Construction

Location Attributes

Source of Well Data: TCEQ PWS Water Wells

Owner: NORTH CAMERON REGIONAL WATER TREATMENT FACILITY

State Name: Texas | Latitude: 26.24930796
County Name: CAMERON | Longitude: -97.7818281
Depth Total: 600 | Horizontal Datum: 83
Depth Well: 601 | Location Method: GPS-S
Drill Date: 07/19/2005 | Agency: TCEQ | Location Date: 6/12/2008

Kelly Bushing: 5 | Elevation: 43
Well Type: Withdrawal of Water | Vertical Datum: 29
2.5' Grid Cell: 88-50-3 | Elevation Method: D
Elevation Agency: TWDB | Elevation Date: 5/7/2012

Remarks: pumping tests plotted in BRACS pdf files. Driller's lithology replaced by geophysical log simplified lithology. Driller's log available in PDF file.

Foreign Keys

ID Name	Foreign Key Id (Text)	Foreign Key Id (Numeric)	Remarks
ID Agency	Foreign Key Id (Numeric)	Foreign Key Report Hyperlink (TDLR SDR and TWDB GWDB and USGS Station Number)	
WELL_NUMBER	1		
OWNER			
TRACK_NUMBER	180500		
TDLR	180500		https://www2.twdb.texas.gov/apps/waterdatainteractive/GetReport
PWS_Plant_ID	21206		
TCEQ	21206		
DESAL_Plant_ID	33		
TWDB	33		
STATE_WELL_NUMBER	8850305		
TWDB	8850305		http://s3.amazonaws.com/wellndfs/documents/8850305/8850305.pdf
WATER_SOURCE	G0910152A		
TCEQ			

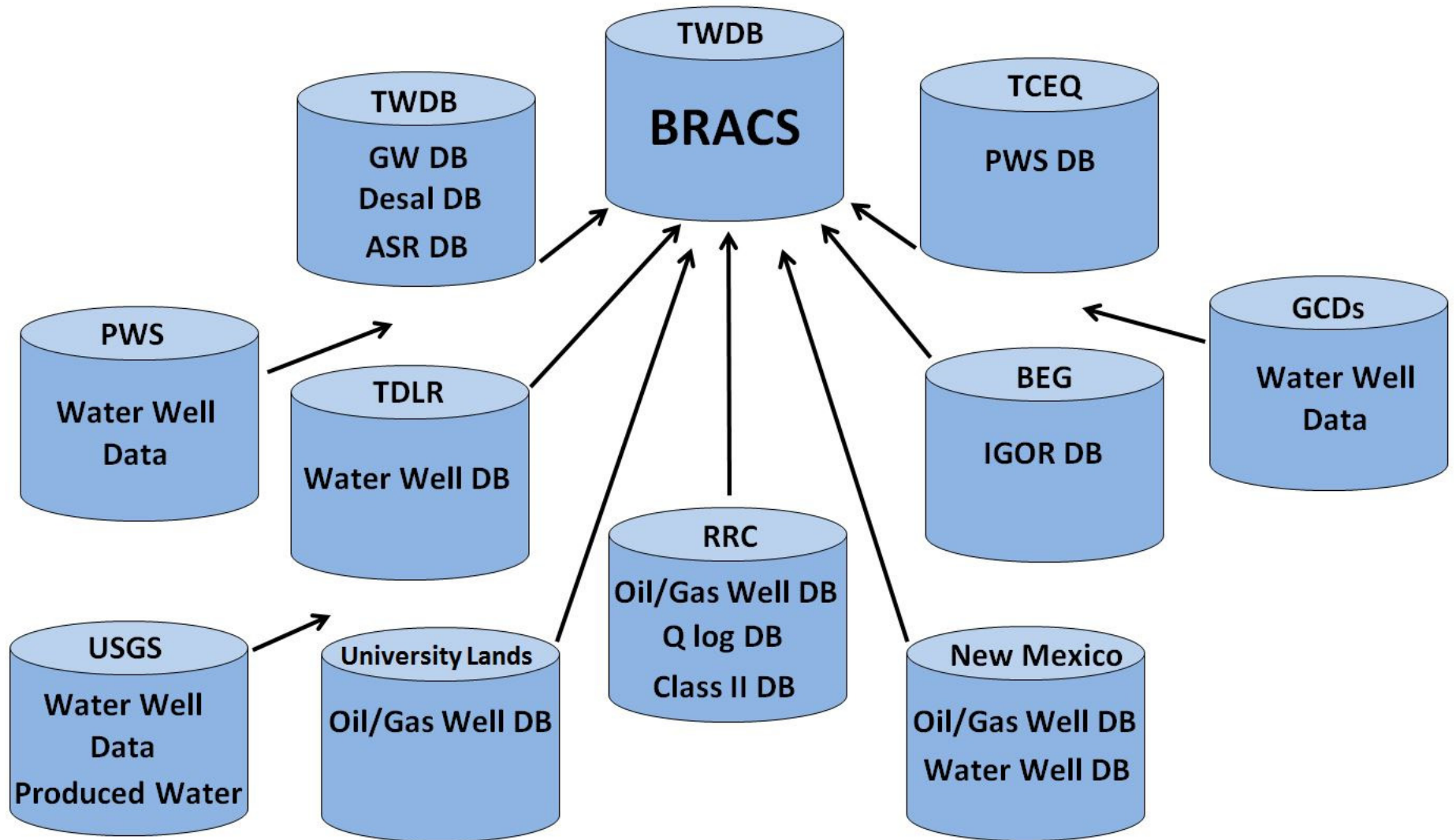
Navigation Pane

Refer to: Brackish Resources Aquifer Characterization System Data Dictionary for Table Definitions. TWDB OF 12-02, Third Edition, 2011
Refer to: Pecos Valley Aquifer, West Texas: Structure and Brackish Groundwater. TWDB Report 382, 2012
Refer to: Queen City and Sparta Aquifers, Atascosa and McMullen Counties, Texas: Structure and Brackish Groundwater. TWDB TN14-01, 2014
Refer to: Brackish Groundwater in the Gulf Coast Aquifer, Lower Rio Grande Valley, Texas. TWDB Report 383, 2014
Refer to: Brackish Groundwater in the Lipan Aquifer Area, Texas. TWDB Report 384, 2017

Record: 14 | 1683 of 77003 | Unfiltered | Search

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Supporting Databases



Geology table

TWDB WSC IWT BRACS Geophysical Log Search Task

1737

Close Form

BRACS Well ID

Location and Well IDs Lithology and Stratigraphy Digital Well Logs TDS Analysis using Geophysical Well Logs Aquifer Test Information Water Quality Static Water Level Well Construction

Lithologic Description

Record Number	Geologic Pick	Top Depth	Lithologic Description	Bottom Depth	Simplified Lithologic Description	Source of Data	Thickness	Remarks	Last Change
---------------	---------------	-----------	------------------------	--------------	-----------------------------------	----------------	-----------	---------	-------------

22	Lithologic	70	No Record	70	GEOPHYSICAL WELL LOG				12/20/2013
23	Lithologic	70		110	Sand with Clay		40	GEOPHYSICAL WELL LOG	12/20/2013
24	Lithologic	110		130	Clay		20	GEOPHYSICAL WELL LOG	12/20/2013
25	Lithologic	130		180	Sand with Clay		50	GEOPHYSICAL WELL LOG	12/20/2013
26	Lithologic	180		196	Clay		16	GEOPHYSICAL WELL LOG	12/20/2013
27	Lithologic	196		210	Sand with Clay		14	GEOPHYSICAL WELL LOG	12/20/2013
28	Lithologic	210							

Stratigraphic Description

Record Number	Geologic Pick	Top Depth	Stratigraphic Description	Bottom Depth	Source of Data	GT Flag	Thickness	Last Change
---------------	---------------	-----------	---------------------------	--------------	----------------	---------	-----------	-------------

17	STRATIGRAPHIC	0	Beaumont Formation	406	PUBLISHED REPORT		406	5/7/2012
18	STRATIGRAPHIC	406	Lissie Formation	732	PUBLISHED REPORT		326	5/7/2012
*								

Simplified Lithologic Description

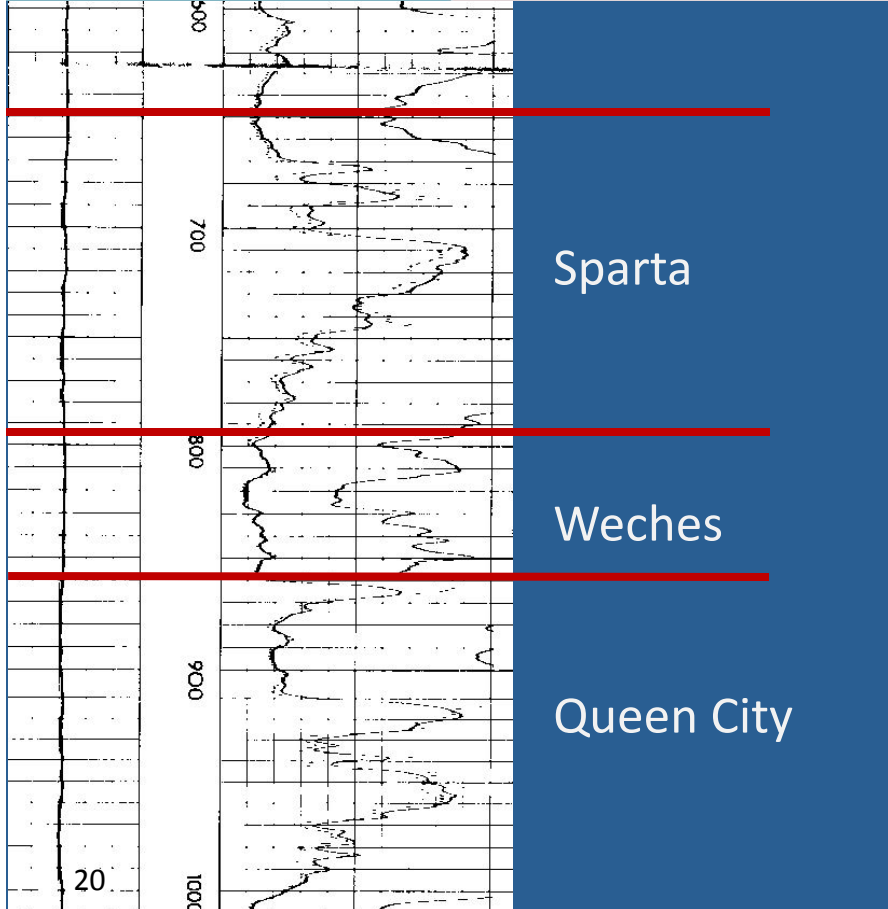
Lithologic Description

Record Number	Geologic Pick	Top Depth	Lithologic Description	Bottom Depth	Simplified Lithologic Description	Source of Data	Remarks	Last Change
1	LITHOLOGIC	0	SAND	3	Sand	WATER WELL LOG, DRILLER		3/23/2012
2	LITHOLOGIC	3	RED CLAY	8	Clay	WATER WELL LOG, DRILLER		3/23/2012
3	LITHOLOGIC	8	RED CLAY AND SAND MIX	12	Sand and Clay	WATER WELL LOG, DRILLER		3/23/2012
4	LITHOLOGIC	12	YELLOW CLAY	15	Clay	WATER WELL LOG, DRILLER		3/23/2012
5	LITHOLOGIC	15	RED SAND	36	Sand	WATER WELL LOG, DRILLER		3/23/2012
6	LITHOLOGIC	36	YELLOW SAND	40	Sand	WATER WELL LOG, DRILLER		3/23/2012

Description from well report

Simplified description from well report or geophysical log interpretation

Link map to log to database



Stratigraphic Description

Record Number	Geologic Pick	Top Depth Bottom Depth Thickness	Stratigraphic Description Source of Data	Initials	Last Change
1	Stratigraphic	0	Yegua Formation Geophysical Well Log		#####
2	Stratigraphic	650	Cook Mountain Formation Geophysical Well Log		#####
3	Stratigraphic	650 797 147	Sparta Formation Geophysical Well Log		3/18/2013
4	Stratigraphic	797 860 63	Weches Formation Geophysical Well Log		3/18/2013
5	Stratigraphic	860 1450 590	Queen City Formation Geophysical Well Log		3/18/2013
6	Stratigraphic	1450 1740 290	Reklaw Formation Geophysical Well Log		3/18/2013
7	Stratigraphic	1740 2460 720	Carrizo Formation Geophysical Well Log		#####
8	Stratigraphic	2460 4790 2330	Wilcox Group Geophysical Well Log		#####
9	Stratigraphic	4790	Midway Formation Geophysical Well Log		#####
*					

Digital log tables

TWDB WSC IWT BRACS Geophysical Log Search Task

1737 Close Form

BRACS Well ID

Location and Well IDs | Lithology and Stratigraphy | **Digital Well Logs** | TDS Analysis using Geophysical Well Logs | Aquifer Test Information | Water Quality | Static Water Level | Well Construction

Digital Geophysical Well Logs

1014 Log File Type: TIF IMAGE GL Folder Name: 42_061 REMARKS: no BHT on GL header; use Gg from BRACS 3999. Ts from Larkin, LP-192 avg annual temp 73-74 F.

File Name: G0310152A_

GL_HYPERLINK: B:\GeophysicalWellLogs\42_061\G0310152A .tif

Geophysical Log	Top Depth	Bottom Depth	Remarks
GAMMA RAY OR GAMMA	0	552	N/A
INDUCTION	70	600	N/A
SPONTANEOUS POTENTIAL	70	576	N/A
*	0	0	N/A

Record: 1 of 1 No Filter Search

Digital Water Well Logs

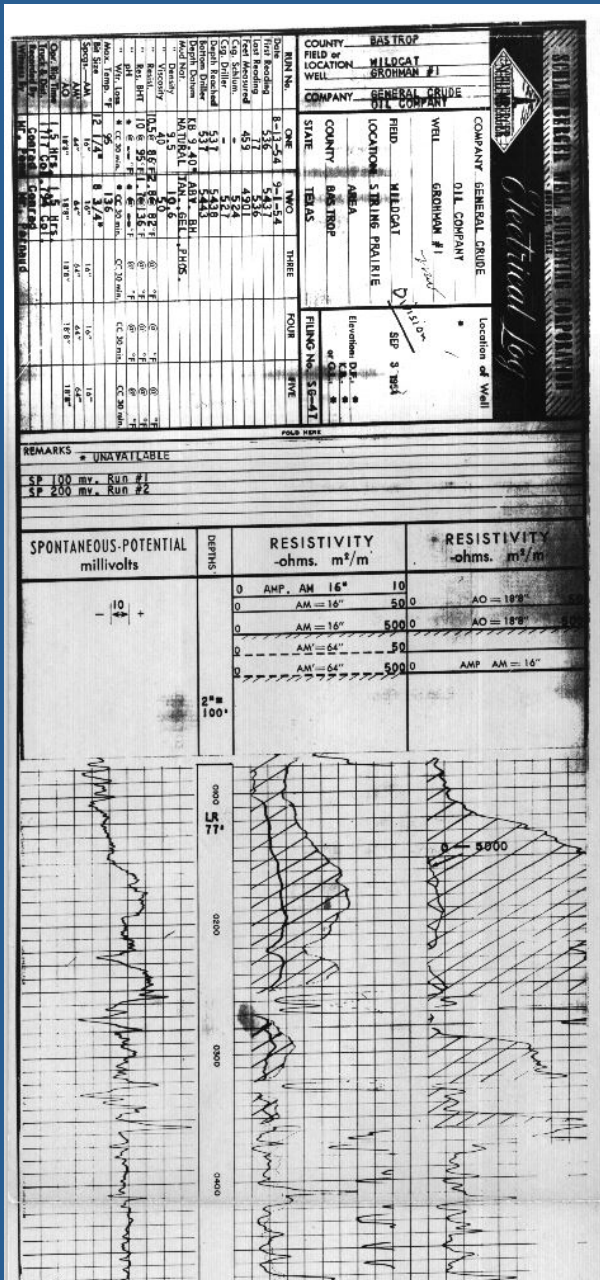
756 Log File Type: PDF Image WW folder: 42_061 Remarks:

File Name: G0310152A

WW Hyperlink: B:\DrillerWellLogs\42_061\G0310152A.pdf

Record: 1 of 1 No Filter Search

Digital geophysical and water well logs



Original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087 40890006D

Please use black ink.

State of Texas
WELL REPORT
Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER Gonzales County Water Supply Corp. ADDRESS 1903 Sarah DeWitt Dr., Gonzales, Texas 78629
(Name) (Street or RFD) (City) (State) (Zip)

2) ADDRESS OF WELL: County Gonzales 8 miles N. of Gonzales (F.M. 794 well) GRID # 67-20-9
(Street, RFD or other) (City) (State) (Zip)

3) TYPE OF WORK (Check): New Well Deepening Reconditioning Plugging

4) PROPOSED USE (Check): Monitor Environmental Soil Boring Domestic Industrial Irrigation Injection Public Supply De-watering Testwell
If Public Supply well, were plans submitted to the TNRCC? Yes No

5) Air Rotary Mud Rotary Bored Air Hammer Cable Tool Jetted Other

6) WELL LOG: DATE DRILLING: Started 10-24-1996 Completed 11-10-1996

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
18 1/2	Surface	748
11 1/2	748	830

7) DRILLING METHOD (Check): Driven Air Rotary Mud Rotary Bored Air Hammer Cable Tool Jetted Other

8) Borehole Completion (Check): Open Hole Straight Wall
 Underreamed Gravel Packed Other
If Gravel Packed give interval from _____ ft. to _____ ft.

CASINO, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.)		Casing Casting Screen
			From	To	
12 7/8	New	Steel	4	748	
8 5/8	New	Steel	702	750	
8 5/8	New	Screen Mfg.	750	820	

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 0 ft. to 748 ft. No. of sacks used 420
_____ ft. to _____ ft. No. of sacks used _____
Method used Pressure
Cemented by International Services, Inc.
Distance to septic system field lines or other concentrated contamination 200 ft.
Method of verification of above distance measured

10) SURFACE COMPLETION
 Specified Surface Slab Installed [Rule 338.44(2)(A)]
 Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
 Pitless Adapter Used [Rule 338.44(3)(b)]
 Approved Alternative Procedure Used [Rule 338.71]

11) WATER LEVEL:
Static level 65 ft. below land surface Date 12-23-96
Artesian flow _____ gpm. Date _____

12) PACKERS: Type _____ Depth _____
N/A

13) TYPE PUMP: N/A
 Turbine Jet Submersible Cylinder Other _____
Depth to pump bowls, cylinder, jet, etc. _____ ft.

14) WELL TESTS:
Type test: Pump Bailor Jetted Estimated
Yield: 1471 gpm with 252 ft drawdown after 36 hrs.

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
 Yes No If yes, submit 'REPORT OF UNDESIRABLE WATER'
Type of water? Good Depth of strata 750-820
Was a chemical analysis made? Yes No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Cude Drilling, Inc. WELL DRILLER'S LICENSE NO. 2738W
(Type or print)

ADDRESS P. O. Box 8 Pleasanton Texas 78064
(Street or RFD) (City) (State) (Zip)

(Signed) Richard R. ... (Signed) _____
(Licensed Well Driller) (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

TNRCC-0199 (Rev. 11-01-94)

Log analysis to interpret Total Dissolved Solids

TWDB WSC IWT BRACS Geophysical Log Search Task

1737 Close Form

BRACS Well ID

Location and Well IDs | Lithology and Stratigraphy | Digital Well Logs | **TDS Analysis using Geophysical Well Logs** | Aquifer Test Information | Water Quality | Static Water Level | Well Construction

GL NUMBER: 1014 **GL FILE TYPE:** TIF IMAGE **Log Run:** 1

GL FILE NAME: G0310152A_ **Depth Top:** 0 **Tbh:** 81 **Rm Rm Temp:** 0.9 **Rmf Rmf Temp:** 0.7 **Tbh corrected:** -99999 **Mud Weight:**
GL Co: Baker Hughes **Depth Bot:** 603 **Rm Rm Temp:** 75 **Rmf Rmf Temp:** 75 **Method used:** n/a **Mud Type:** no BHT on GL header; use Gg from
Temperature Surface: 74 **Remarks:** water base

Remarks: no BHT on GL header; use Gg from BRACS 3999. Ts from Larkin, LP-192 avg annual temp 73-74 F.

* **Log Run:** * **Depth Top:** **Tbh:** 0 **Rm Rm Temp:** 0 **Rmf Rmf Temp:** 0 **Tbh corrected:** -99999 **Mud Weight:**
Depth Bot: **Rm Rm Temp:** 0 **Rmf Rmf Temp:** 0 **Method used:** **Mud Type:** N/A

Record: 1 of 1 No Filter Search

Depth Formation (Df): 296 **TDS Interpreted:** 0 **TF:** 77 **Stratigraphic Name:** Beaumont Formation

Thickness Lithologic Unit: 12 **Consensus TDS Method:** N/A **Rmf TF:** 0 **Remarks:** N/A

TDS Method: Rwa Method **Rwe:** 1.08 **Rw:** 0.92 **Rw75:** 0.94 **Cw:** 10638.3 **TDS:** 5638

Geophysical Log Used: INDUCTION

Correction Factors

SP: 0	K (Temperature): SP Method: 0
Rxo: 0	Rwe Rw: Sp, Alger Harrison, and Rwa Minimum Methods: 1.17
Ro: 6	Rmf: SP and Alger Harrison Methods: 0
Rxo / Ro: 0	ct: Many Methods: 0.53
m: 1.6296	Invasion Zone: Alger Harrison Method: 99
Source m: Eq. 1.18 (Estepp, 1998)	m correction factor: Estepp Method high anion waters: 1
Porosity: 0.35	Ro: Mean Ro Method: 1
Source Porosity: N/A	

Chart: N/A

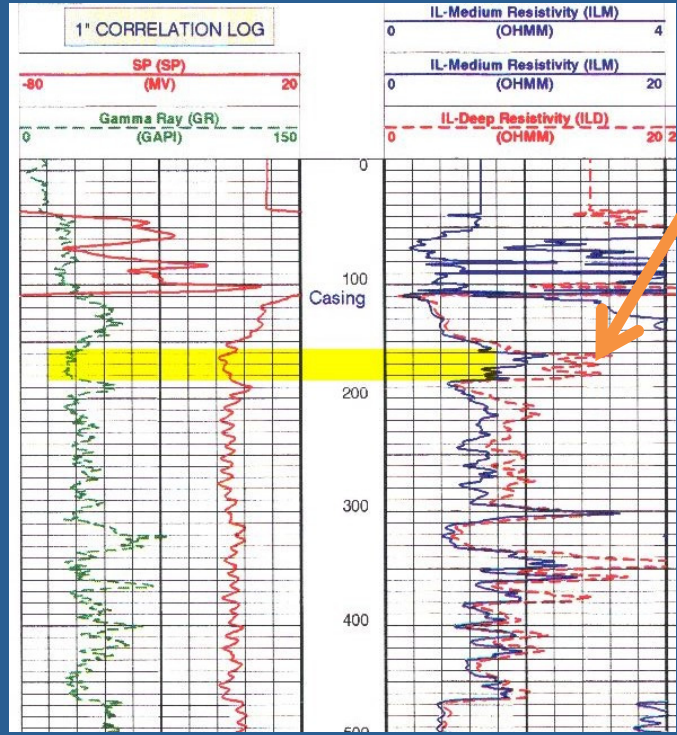
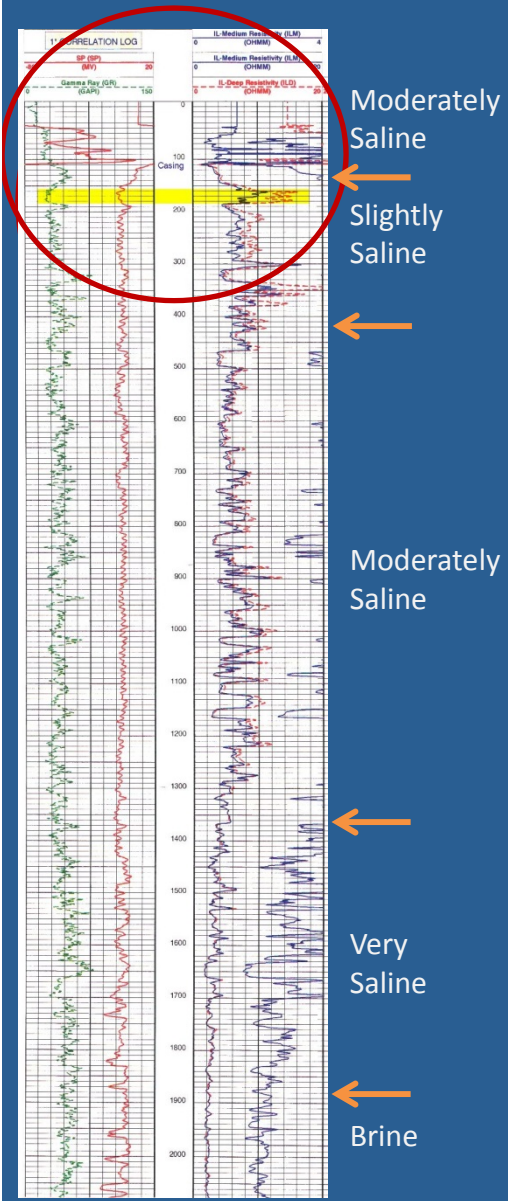
Remarks: WQ: 8850305 (2005) TDS: 3817 ct: 0.53 HCO3/TDS: 0.04 SO4/TDS: 0.35 Rwe NaCl cf: 1.17

Record: 1 of 1 No Filter Search

Record: 1 of 3 No Filter Search

Record: 1 of 1 No Filter Search

Log analysis example



At 160 ft = 15 ohm-meter

R_{wa} Minimum Method
interpreted TDS = 2,500 mg/L

Water Well
TDS concentration = 2,264 mg/L
(well screen 170-349 ft)



BRACS Well ID 42889

Source: Lower Rio Grande Valley BRACS Study

Aquifer properties table

TWDB WSC IWT BRACS Geophysical Log Search Task

1737

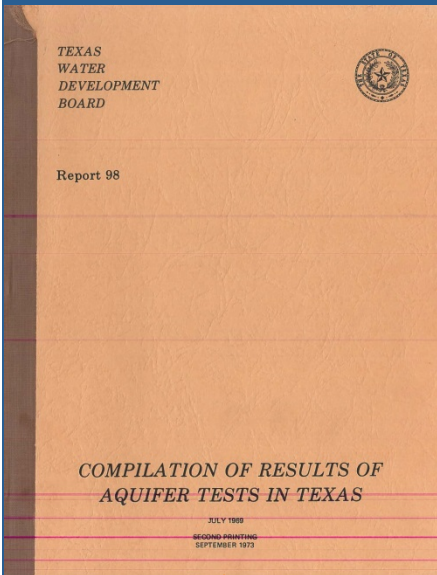
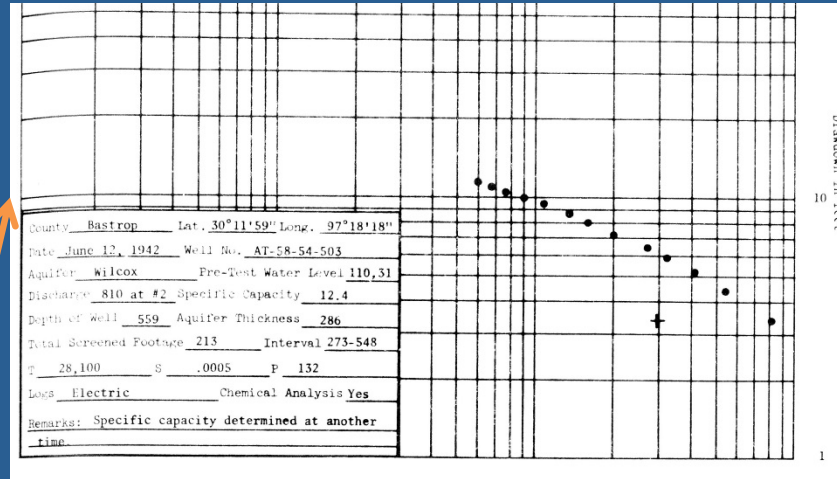
Close Form

BRACS Well ID

Location and Well IDs Lithology and Stratigraphy Digital Well Logs TDS Analysis using Geophysical Well Logs **Aquifer Test Information** Water Quality Static Water Level Well Construction

Record Number	0	State Well Number	8850305	Source AT Data	TWDB Groundwater Database
Date Test	09/01/2005	Test Length	36	Depth Well	541
Pumping Rate	1476	Static Water Level	-22.85	Screen Top	364
Well Yield Method	Pumped	Pumping Water Level	-168.15	Screen Bottom	541
		Drawdown	145	D/R	D
Transmissivity	-99999	* If T is expressed as a range of values, then place larger value in [Transmissivity] field and smaller value in [Transmissivity 2] field			
Transmissivity 2*	-99999	Units			
Hydraulic Conductivity	-99999	Units			
Storage Coefficient	-99999				
Specific Yield	-99999				
Specific Capacity	10.17	gpm/ft			
Remarks					
Analysis Remarks					
Report 98 Page No					

Link aquifer properties to source



frmBracsAT_DE

Well ID: 39245 Owner: Univ. of Texas Cancer

BRACS Aquifer Test Data Entry

Record Number: 0 State Well Number: 5854503 Source AT Data: TWDB Published Reports

Date Test	06/12/1942	Test Length	0	Depth Well	559
Pumping Rate	810	Static Water Level	-110.31	Screen Top	273
Well Yield Method		Drawdown	-99999 D/R	Screen Bottom	548
		Pumping Water Level			
Transmissivity	28100	Units	gpd/ft	Specific Capacity	
Transmissivity 2*	-99999				
Hydraulic Conductivity	132	Units	gpd/ft2		
Storage Coefficient	0.0005				
Specific Yield	-99999				
Specific Capacity	-99999	Units			

Remarks:

Analysis Remarks: Test results only in TWDB files. Also R 109, Table 6, p. 30

Report 98 Page No: 63

Water quality table

TWDB WSC IWT BRACS Geophysical Log Search Task

1737

Close Form

BRACS Well ID

Location and Well IDs | Lithology and Stratigraphy | Digital Well Logs | TDS Analysis using Geophysical Well Logs | Aquifer Test Information | Water Quality | Static Water Level | Well Construction

BRACS Water Quality

State Well Number	8850305	Sample Date	Sample Number	Date Entered							
		Month Day Year		5/7/2012							
Source Data	Driller/Engineer Well Development Sample	9	16	2005	1						
Silica	Calcium	Magnesium	Sodium	Potassium	Bicarbonate	Sulfate	Chloride	Nitrate	TDS	Spec. C.	pH
13.7	155	81	1070	17.9	250	1120	1230	0.05	3818	6000	7.3

Record: 1 of 1 | No Filter | Search

BRACS Infrequent Constituents

State Well Number	8850305	Sample Date	Sample Number
		Month Day Year	
Source Data	Driller/Engineer Well Development Sample	9	16
		2005	1
Storet Code	00405	Iron = 01045	
flag			
Value	245		
plus / minus			

Record: 1 of 32 | No Filter | Search

Static water level table

TWDB WSC IWT BRACS Geophysical Log Search Task

1737

Close Form

BRACS Well ID

Location and Well IDs Lithology and Stratigraphy Digital Well Logs TDS Analysis using Geophysical Well Logs Aquifer Test Information Water Quality Static Water Level Well Construction

Static Water Level	Date Measured	Method	Agency	Remarks	State Well Number	Track Number	Water Source
-22.85	9/1/2005	07	DRILL		8850305	0	
*						0	

Well construction table

TWDB WSC IWT BRACS Geophysical Log Search Task

1737 Close Form


BRACS Well ID









































Location and Well IDs | Lithology and Stratigraphy | Digital Well Logs | TDS Analysis using Geophysical Well Logs | Aquifer Test Information | Water Quality | Static Water Level | Well Construction

Group	CSO	Diam	Top Depth	Bottom Depth
1	C	24	0	56
2	C	16	0	285
3	C	11	250	290
4	S	11	290	301
5	c	11	301	385
6	s	11	385	439
7	c	11	439	478
8	s	11	478	531
9	c	11	531	601

C = casing
S = screen
O = open

Study specific tables

 **Security Warning** Some active content has been disabled. Click for more details. [Enable Content](#)

Tables
 gBracs_AD_PE_sTx
 gBRACS_ST
 gBRACS_ST_GC
 gBRACS_ST_PE_sTx
 gBRACS_ST_SpQC
 tblAquiferDetermination_GulfCoast
 tblAquiferDetermination_GulfCoast_ccasr
 tblAquiferDetermination_PaleoceneEocene_sTx_QcSp
 tblAquiferDetermination_PecosValley
 tblBRACS_AquiferTestInformation
 tblBracs_Casing
 tblBracs_ForeignKey
 tblBRACS_GC_MasterWaterQuality
 tblBRACS_GC_MasterWaterQuality_ccasr
 tblBRACS_GC_WQ_Radionuclide
 tblBRACS_GC_WQ_Radionuclide_ccasr
 tblBRACS_Lipan_Aquifer_Test
 tblBRACS_Lipan_Aquifer_Test_Select
 tblBRACS_Lipan_AquiferDetermination
 tblBRACS_Lipan_MasterWaterQuality
 tblBRACS_Lipan_SWL
 tblBRACS_PE_sTx_MasterWaterQuality
 tblBRACS_PV_MasterWaterQuality
 tblBRACS_QcSp_MasterWaterQuality
 tblBracs_SWL
 tblBracsInfrequentConstituents
 tblBracsProjectWells
 tblBracsWaterQuality
 tblBRACSWaterWellReports
 tblGeophysicalLog_Header
 tblGeophysicalLog_Header_LogRuns
 tblGeophysicalLog_Suite
 tblGeophysicalLog_WQ
 tblGeophysicalLog_WQ_Method
 tblGisFile_NamingConventions
 tblILk_m
 tblILkAgency
 tblILkAq_Decision
 tblILkAquifer
 tblILkBRACS_Aquifer_AD

BRACS Database, Navigation to Forms

[Close Form](#)

1: Select a form to display

BRACS Database Master Well Form

TWDB Report 382, 2012, Pecos Valley Aquifer, West Texas: Structure and Brackish Groundwater

- Pecos Valley Aquifer Study: Aquifer Determination Form
- Pecos Valley Aquifer Study: Net Sand Form

TWDB Technical Note 14-01, 2014, Queen City and Sparta Aquifers, Atascosa and McMullen Counties, Texas: Structure and Brackish Groundwater

- Queen City and Sparta Aquifer Study: Aquifer Determination Form
- Queen City and Sparta Aquifer Study: Net Sand Form

TWDB Open-file Report 12-01, 2012, Geologic Characterization of and Data Collection in the Corpus Christi Aquifer Storage and Recovery Conservation District and Surrounding Counties

- Gulf Coast CCASRCD Study: Aquifer Determination Form
- Gulf Coast CCASRCD Study: Net Sand Form

TWDB Report 383, 2014, Brackish Groundwater in the Gulf Coast Aquifer, Lower Rio Grande Valley, Texas

- Gulf Coast Lower Rio Grande Valley Study: Aquifer Determination Form
- Gulf Coast Lower Rio Grande Valley Study: Net Sand Form
- Gulf Coast Lower Rio Grande Valley Study: Salinity Zone Form

2: Press Button

[Open Form](#)

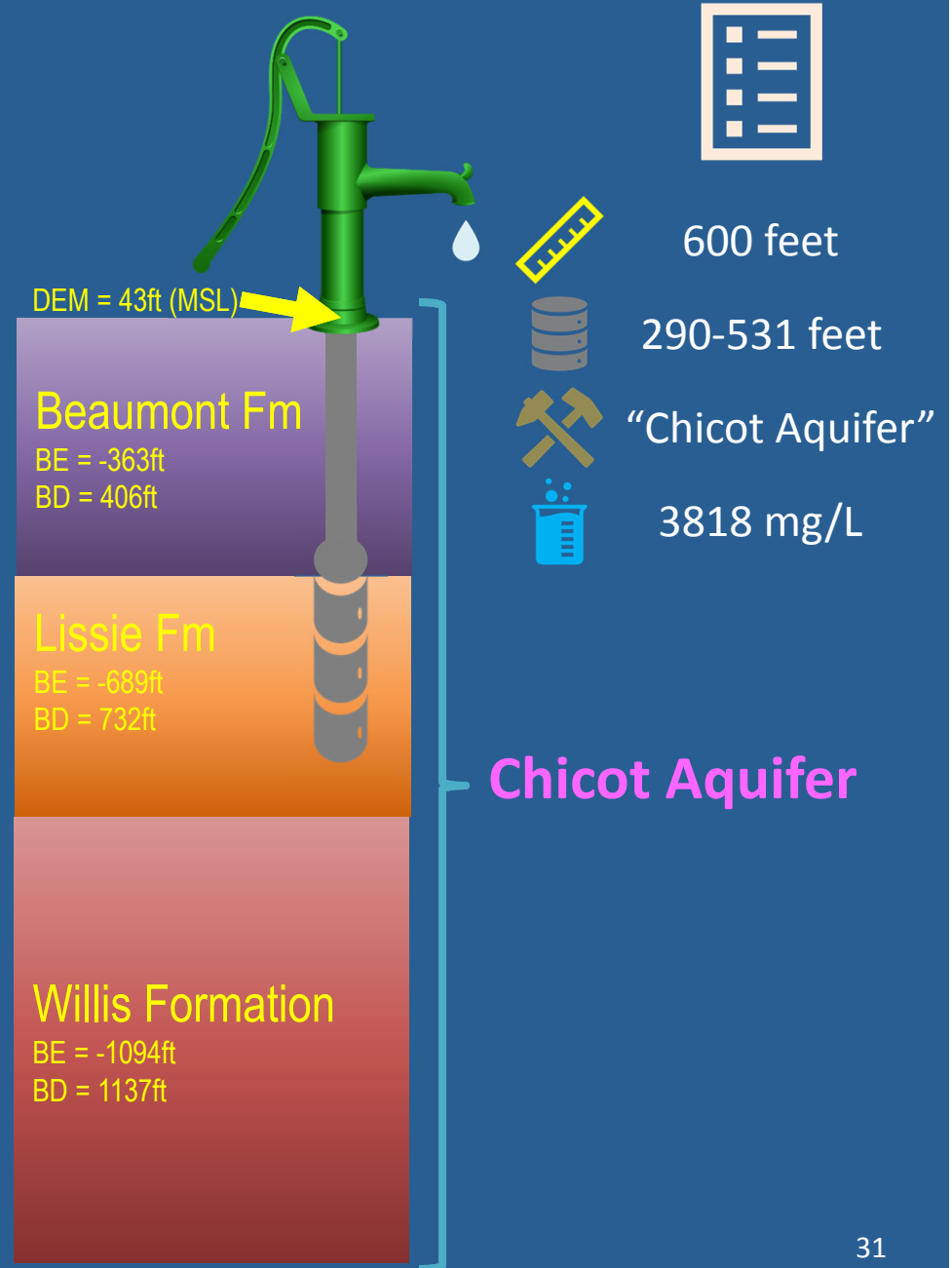
How and why aquifer determination?

How?

1. Use screen top & bottom or well depth or total depth of hole
2. Use the GIS-derived 3-D formation surfaces as vertical control
3. Assign aquifer(s) to each well in the study area

Why?

- ✓ Many new wells do not have TWDB aquifer code
- ✓ Some TWDB wells have incorrect aquifer code
- ✓ Compare wells completed in same aquifer
- ✓ Consistent evaluation of aquifer water quality and properties



Aquifer determination table

TWDB WSC IWT BRACS Aquifer Determination CCASR

State Well Number

BRACS Well ID

Well Owner

BRACS Aquifer Determination Code Lower Rio Grande Valley BRACS Study

Aquifer

Aquifer (New)

Remarks

Depth Well
 Depth Hole
 Screen Top
 Screen Bottom
 Multiple Screens
 ELEVATION

<i>Chicot Aquifer</i>	<i>Beaumont Fm.</i>	B_T_D: <input type="text" value="0"/>	Caq_T_D: <input type="text" value="0"/>
		B_B_D: <input type="text" value="406"/>	
	<i>Lissie Fm.</i>	L_T_D: <input type="text" value="406"/>	
		L_B_D: <input type="text" value="732"/>	
<input type="text" value="Yes"/>	<i>Willis Fm.</i>	W_T_D: <input type="text" value="732"/>	
		W_B_D: <input type="text" value="1137"/>	Caq_B_D: <input type="text" value="1137"/>
<i>Evangelina Aquifer</i>	<i>Upper Goliad Fm.</i>	UG_T_D: <input type="text" value="1137"/>	
		UG_B_D: <input type="text" value="2251"/>	Eaq_T_D: <input type="text" value="1137"/>
	<i>Lower Goliad Fm.</i>	LG_T_D: <input type="text" value="2251"/>	
		LG_B_D: <input type="text" value="3270"/>	
<input type="text" value="No"/>	<i>Upper Lagarto Fm.</i>	UL_T_D: <input type="text" value="3270"/>	
		UL_B_D: <input type="text" value="4080"/>	Eaq_B_D: <input type="text" value="4080"/>
<i>Burkeville Confining Unit</i>	<i>Middle Lagarto Fm.</i>	ML_T_D: <input type="text" value="4080"/>	
		ML_B_D: <input type="text" value="4936"/>	
<i>Jasper Aquifer</i>	<i>Lower Lagarto Fm.</i>	LL_T_D: <input type="text" value="4936"/>	Jaq_T_D: <input type="text" value="4936"/>
		LL_B_D: <input type="text" value="5660"/>	
	<i>Oakville Fm.</i>	OK_T_D: <input type="text" value="5660"/>	
		OK_B_D: <input type="text" value="6906"/>	Jaq_B_D: <input type="text" value="6906"/>

Why net sand?

Stratigraphy

Beaumont Fm

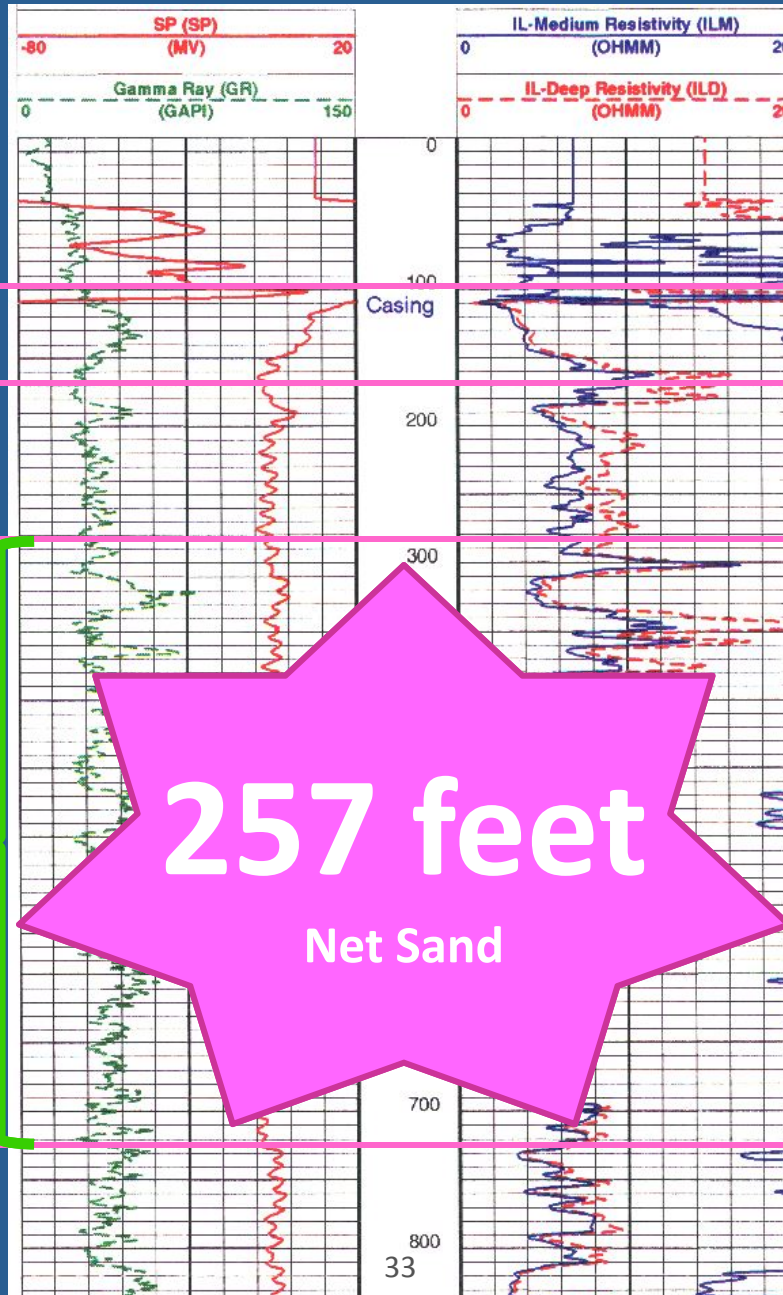
Lissie Fm

Willis Fm

Upper Goliad Fm

Upper Goliad Fm

458ft Thick



Simplified Lithology

Lithology	Percent Sand	Lithology Thickness (ft)	Sand Thickness (ft)
no data			
clay			
sand			
sand			
sand with clay			
	65%	20	13
	0%	30	0
	100%	25	25
sand with clay	65%	105	68
	0%	30	0
	100%	15	15
sand with clay	65%	90	59
clay with sand	35%	50	18
sand with clay	65%	45	29
sand	100%	30	30
sand with clay			
			Sum =257

Net sand determination tables

TWDB WSC IWT BRACS Net Sand Determination

BRACS Well ID

Lower Rio Grande Valley BRACS Study Net Sand Gulf Coast Aquifer

[Close Form](#)

Net Sand Processing Table

Record Number	Simplified Lithologic Description	Top Bottom Thickness	Sand %
23	Sand with Clay	65	
		105	
		40	0.65
25	Sand with Clay	125	
		175	
		50	0.65
27	Sand with Clay	191	
		205	
		14	0.65
28	Sand	205	
		215	
		10	1
29	Clay with Sand	215	
		285	
		70	0.35
30	Sand	285	
		349	
		64	1

Formation	Formation Net Sand	Formation Present	Partial Geology	Aquifer Net Sand	Aquifer Present	Aquifer Determination Table			
	Sand %	Well Partial Penetration	Desc	Sand %	Well Partial Penetration				
Beaumont Fm	200	Yes		Chicot Aquifer		Depth Well	601	B_T_D:	0
	-99999	No	Yes			Depth Hole	600	B_B_D:	406
Lissie Fm	100	Yes		300	Yes	Screen Top	290	L_T_D:	406
	-99999	Yes	No	26	Yes	Screen Bottom	531	L_B_D:	732
Willis Fm	0	Yes						W_T_D:	732
	-99999	Yes	No					W_B_D:	1137
Upper Goliad Fm	0	Yes		Evangeline Aquifer				UG_T_D:	1137
	-99999	Yes	No					UG_B_D:	2251
Lower Goliad Fm	0	Yes		0	Yes			LG_T_D:	2251
	-99999	Yes	No	0	Yes			LG_B_D:	3270
Upper Lagarto Fm	0	Yes						UL_T_D:	3270
	-99999	Yes	No					UL_B_D:	4080
Middle Lagarto Fm	0	Yes		Burkeville Confining Unit				ML_T_D:	4080
	-99999	Yes	No					ML_B_D:	4936
Lower Lagarto Fm	0	Yes		Jasper Aquifer				LL_T_D:	4936
	-99999	Yes	No	0	Yes			LL_B_D:	5660
Oakville Fm	0	Yes		0	Yes			OK_T_D:	5660
	-99999	Yes	No					OK_B_D:	6906

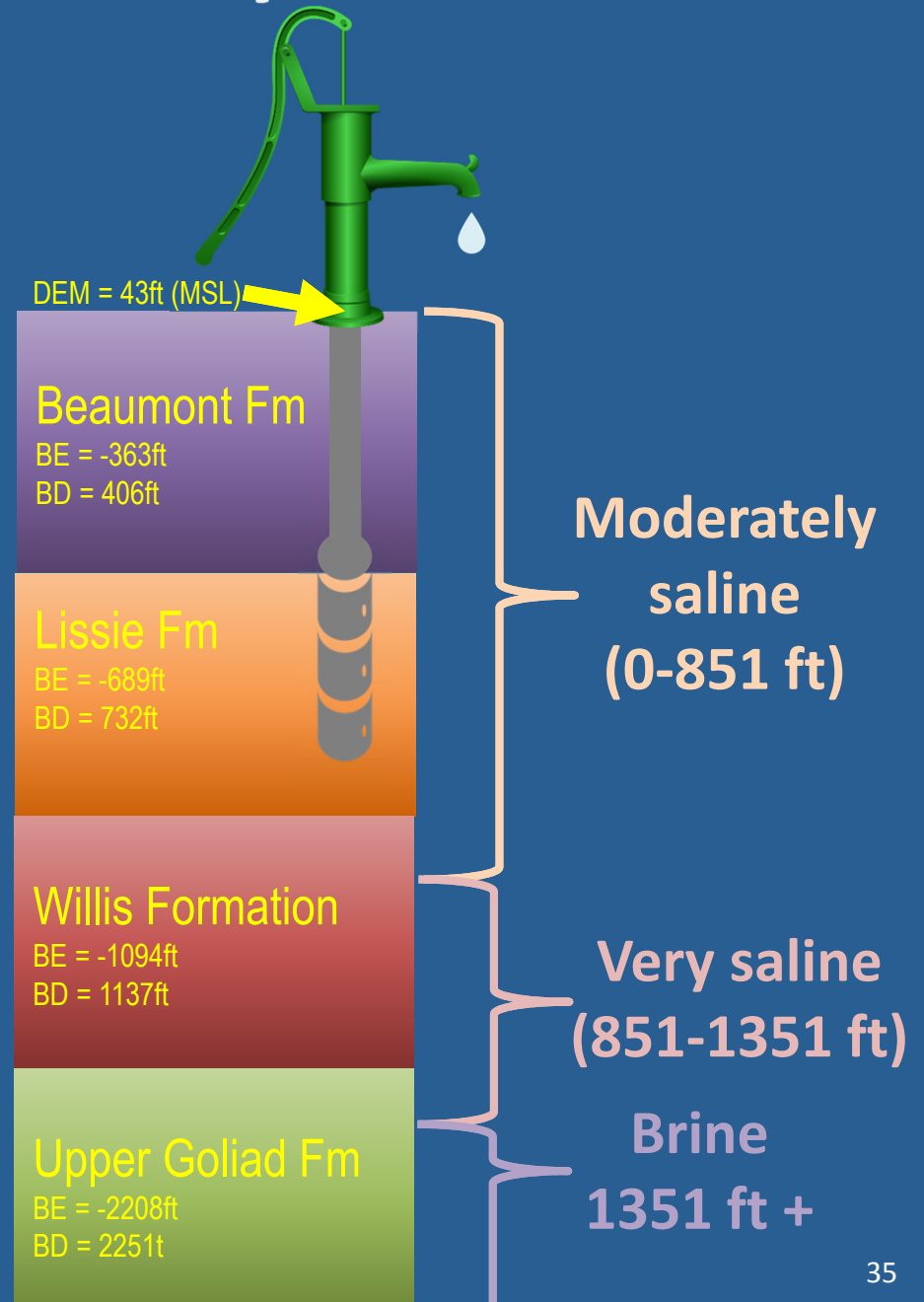
How and why salinity zones?

How?

1. Use measured and interpreted water quality
2. Use the GIS-derived 3-D salinity zone surfaces as vertical control
3. Assign salinity zone(s) to each well in the study area

Why?

- ✓ Some formations contain multiple salinity zones
- ✓ Salinity does not always increase with depth in shallower portions of the aquifer
- ✓ Some salinity zone boundaries exist independent of the stratigraphic formations



Salinity zone table

frmSalinityZone_GulfCoast

BRACS Well ID: 1737 State Well Number: 8850305

Lower Rio Grande Valley BRACS Study
Salinity Zone Profile Form

Close Form

OWNER: NORTH CAMERON REGIONAL WATER TREATMENT FACIL




Project Salinity Zone: J

Salinity Zone Profile at Well Site

Moderately Saline	Top Depth	0
	Bottom Depth	851
Very Saline	Top Depth	851
	Bottom Depth	1351
Brine	Top Depth	1351

DEPTH_WELL: 601
Depth Total: 600
SCREEN_TOP: 290
SCREEN_BOTTOM: 531
MULTIPLE_SCREEN: Yes

Salinity Zone Legend


	Slightly Saline (1,000 - 3,000 milligrams per liter Total Dissolved Solids)
	Moderately Saline (3,000 - 10,000 milligrams per liter Total Dissolved Solids)
	Very Saline (10,000 - 35,000 milligrams per liter Total Dissolved Solids)
	Brine (> 35,000 milligrams per liter Total Dissolved Solids)

Month	Day	Year	Sample Number	Silica	Calcium	Magnesium	Sodium	Potassium	Bicarb	Carb	Sulfate	Chloride	Nitrate	TDS	Spec. C.
9	16	2005	1	13.7	155	81	1070	17.9	250	-99999	1120	1230	< 0.05	3818	6000
7	16	2013	1	26.5	138	74	855	10.3	333.15	0	976	1120	< 0.02	3371	4130
				-99999	-99999	-99999	-99999	-99999	-99999	-99999	-99999	-99999	-99999	-99999	-99999

Download Our Database!


<http://www.twdb.texas.gov/innovativewater/bracs/database.asp>

BRACS Database

The  [Brackish Resources Aquifer Characterization System \(BRACS\) Database](#) was designed to store well and geology information in support of projects to characterize the brackish groundwater resources of Texas. The BRACS database is fully relational, with self-documenting object naming. The database design relies on extensive use of lookup tables. The BRACS database is a Microsoft Access 2007 format that has been compressed with the WinZip utility. This database will be updated periodically; the date of the last update is embedded in the filename.

This database was developed for use by TWDB staff in support of the BRACS program. The information changes on a daily basis and users should read the disclaimer below. If you have any questions, please contact John Meyer at 512-463-8010.

A data dictionary to accompany the BRACS Database is now available for download. The dictionary describes each primary table in the database and custom tables developed for a study.

 [Brackish Resources Aquifer Characterization System Database Data Dictionary](#), Third Edition, TWDB Open File Report 12-02, April 2017 (3 MB)

Brackish Resources Aquifer Characterization System Database Data Dictionary

Open File Report 12-02, Second Edition

September 2014

John E. Meyer, P.G.



www.twdb.texas.gov

 www.facebook.com/twdbboard  @twdb

Texas Water 
Development Board

How to get geophysical well logs?

1. Download logs on a per well basis using Water Data Interactive website

<https://www2.twdb.texas.gov/apps/waterdatainteractive/groundwaterdataviewer>

...or search "TWDB Water Data Interactive" ...

The screenshot shows the Water Data Interactive website interface. The 'Groundwater' layer is selected in the top navigation bar. The left sidebar contains a search bar and various map controls. The main map area displays a cluster of green circular markers representing wells. A popup window titled 'Brackish Groundwater' is open, showing details for Well Id: 59287 - Logs. The popup includes a table of geophysical well logs and contact information for assistance.

WATER DATA Interactive Groundwater Layers Base Maps

Find address

TWDB Groundwater

Brackish Groundwater

Filters: -Select a Filter-

Labels: None

Submitted Driller's Reports

Well Reports

Plugging Reports

Brackish Groundwater

Well Id: 59287 - [Logs](#)

Geophysical Well Logs for Well Id: 59287 [close](#)

Log Id	File Type	File Size
72129	tif	0.1 MB

For Geophysical Well Log assistance contact: BRACS-SUPPORT@twdb.texas.gov

Data Source: RRC GAU Q Paper/Digital Geophysical Logs

API Number:

County: WINKLER

Well Depth (ft):

Total Depth (ft): 8661

Drill Date: 10/19/1950

Requesting a large volume of logs

2. Instructions for requesting a large volume of logs on a county basis

<http://www.twdb.texas.gov/innovativewater/bracs/WellLogs.asp>

Email: BRACS-SUPPORT@twdb.texas.gov

- ★ Contact a BRACS team member
- ★ We can provide a few logs via email if the file size is < 10 megabytes
- ★ We can provide logs per county
 - You provide an empty USB drive
 - You provide a postage-paid, return envelope
- ★ File type is generally a TIFF (tagged image file format)
- ★ Geophysical logs are free of charge



Schlumberger Blueview
free log viewing software

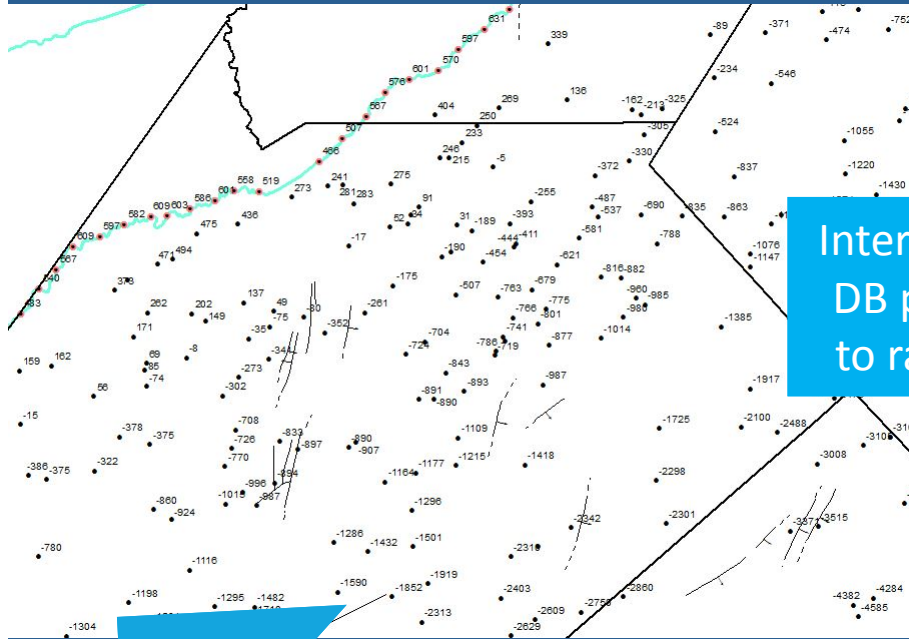
BRACS Geophysical Well Log Collection

- ★ Non-confidential oil, gas, and water well logs
- ★ Scan paper into digital TIFF image files
- ★ Some .LAS files
- ★ QC well location as needed
- ★ Entire collection available

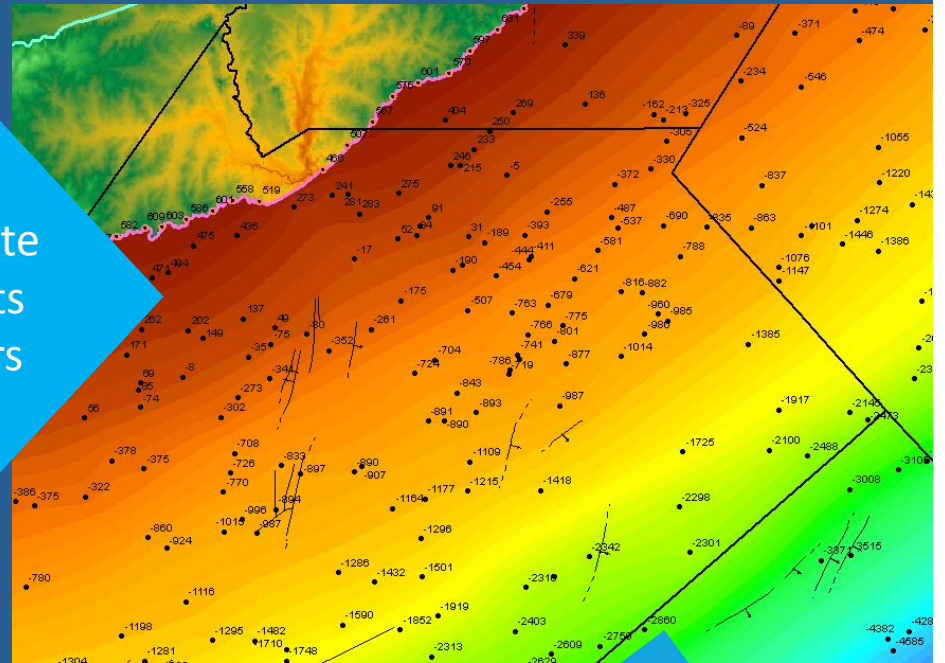
36,000+ BRACS Database wells with logs!



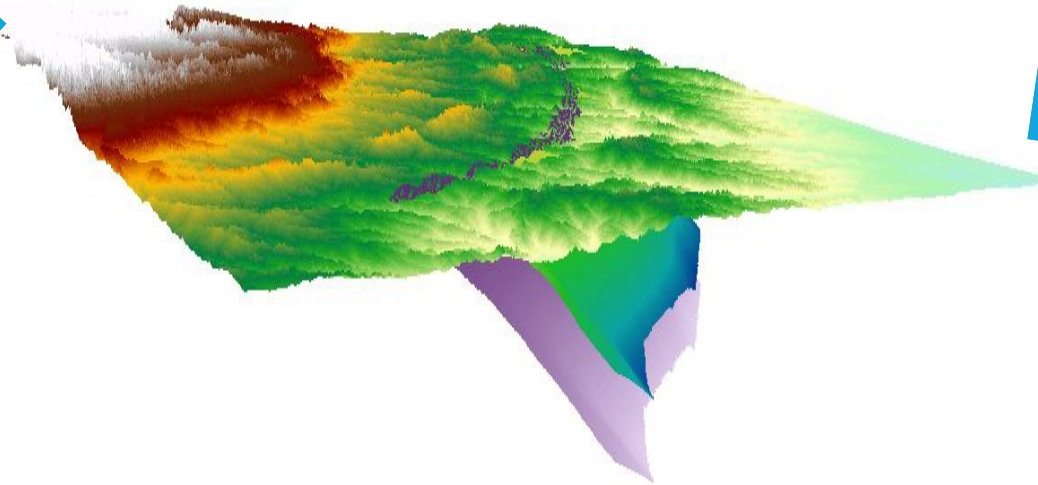
What about GIS data?



Interpolate
DB points
to rasters

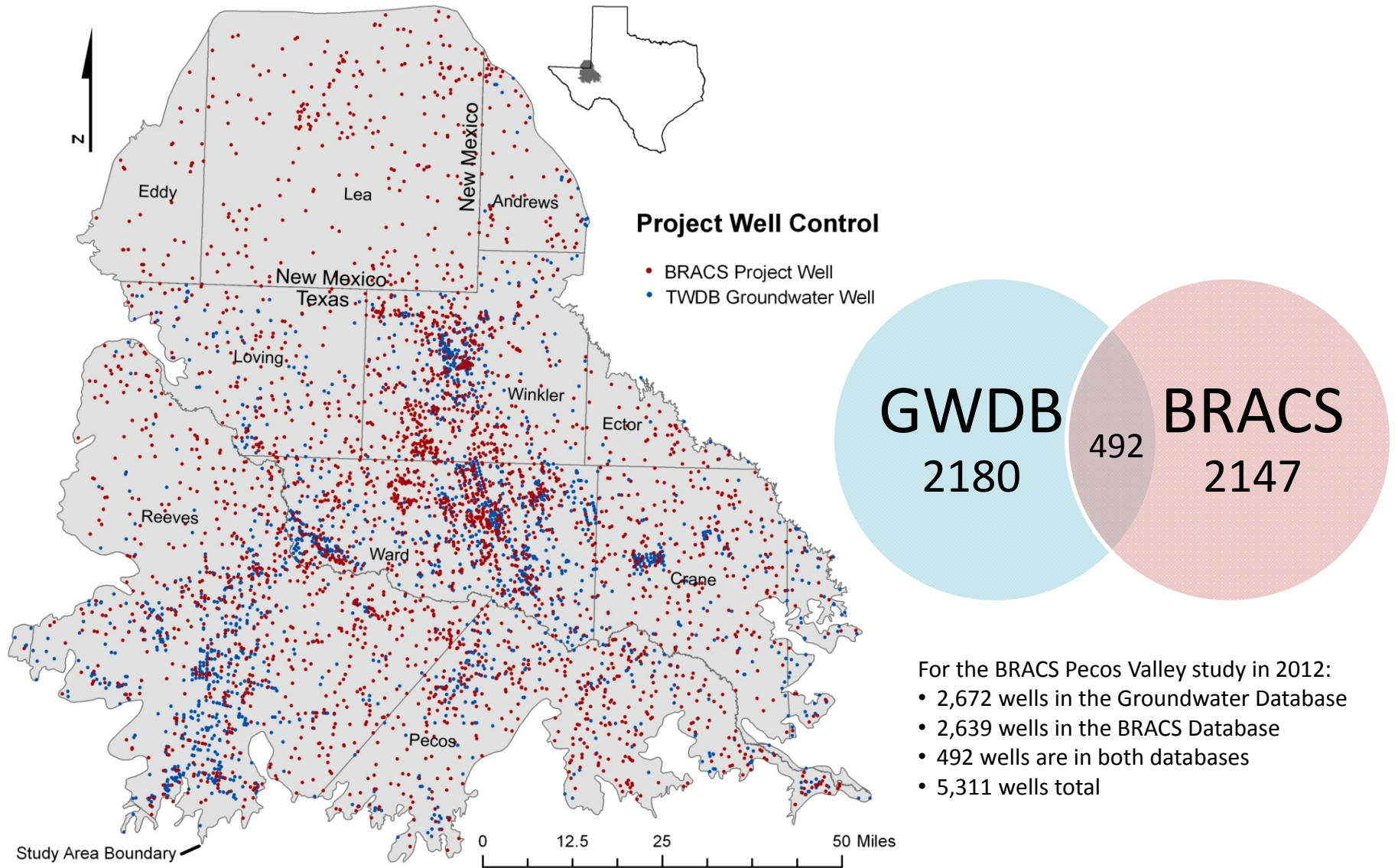


Correct
picks in
the DB

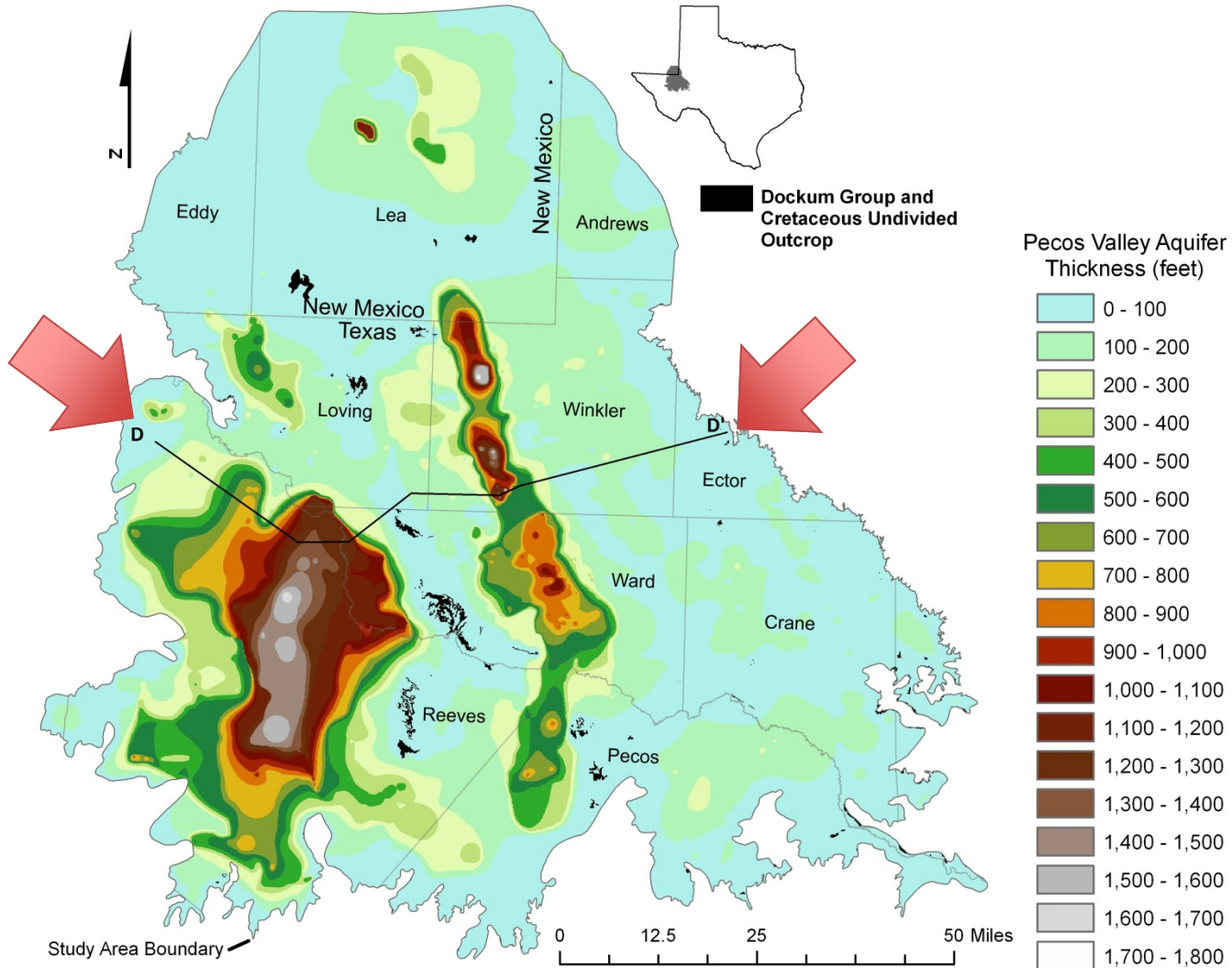


3D Raster
quality
control

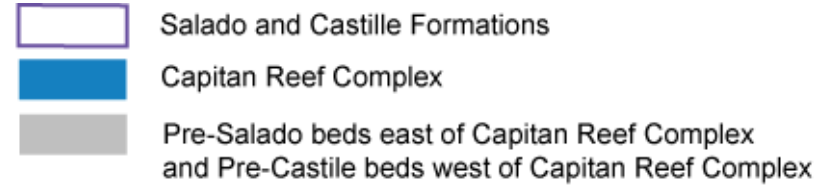
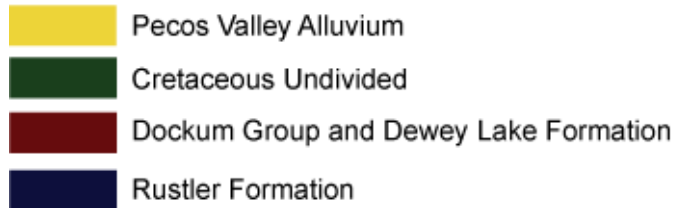
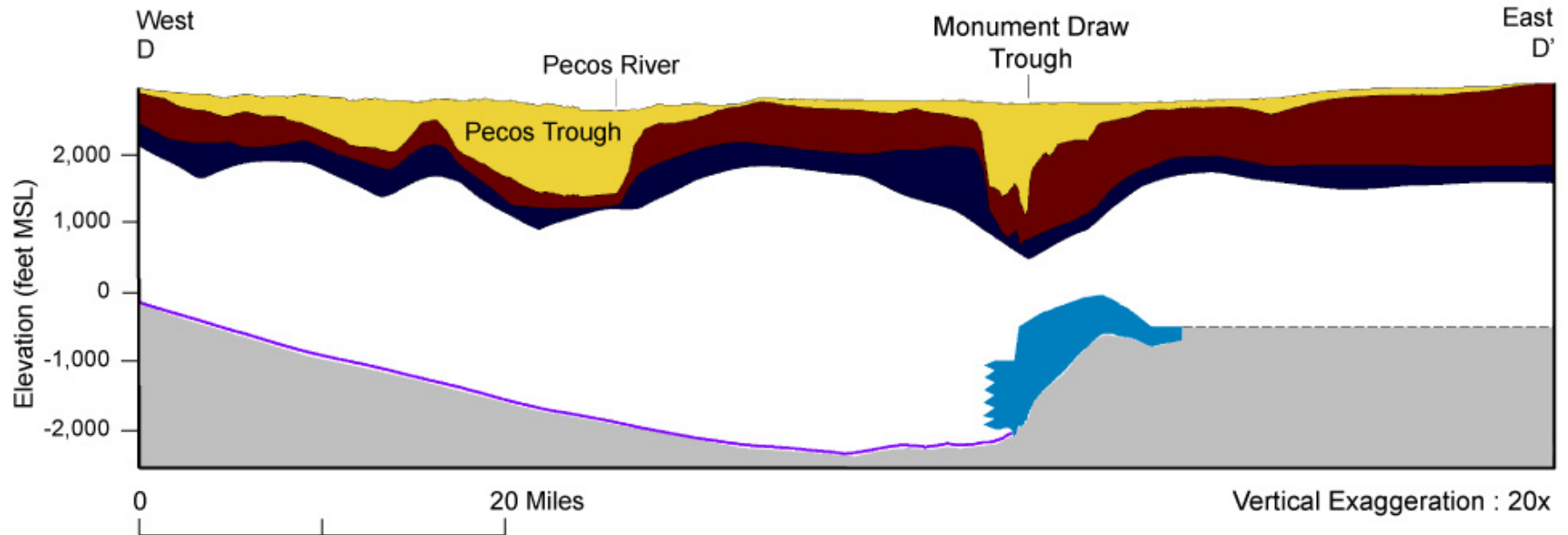
Pecos Valley Aquifer Study GIS



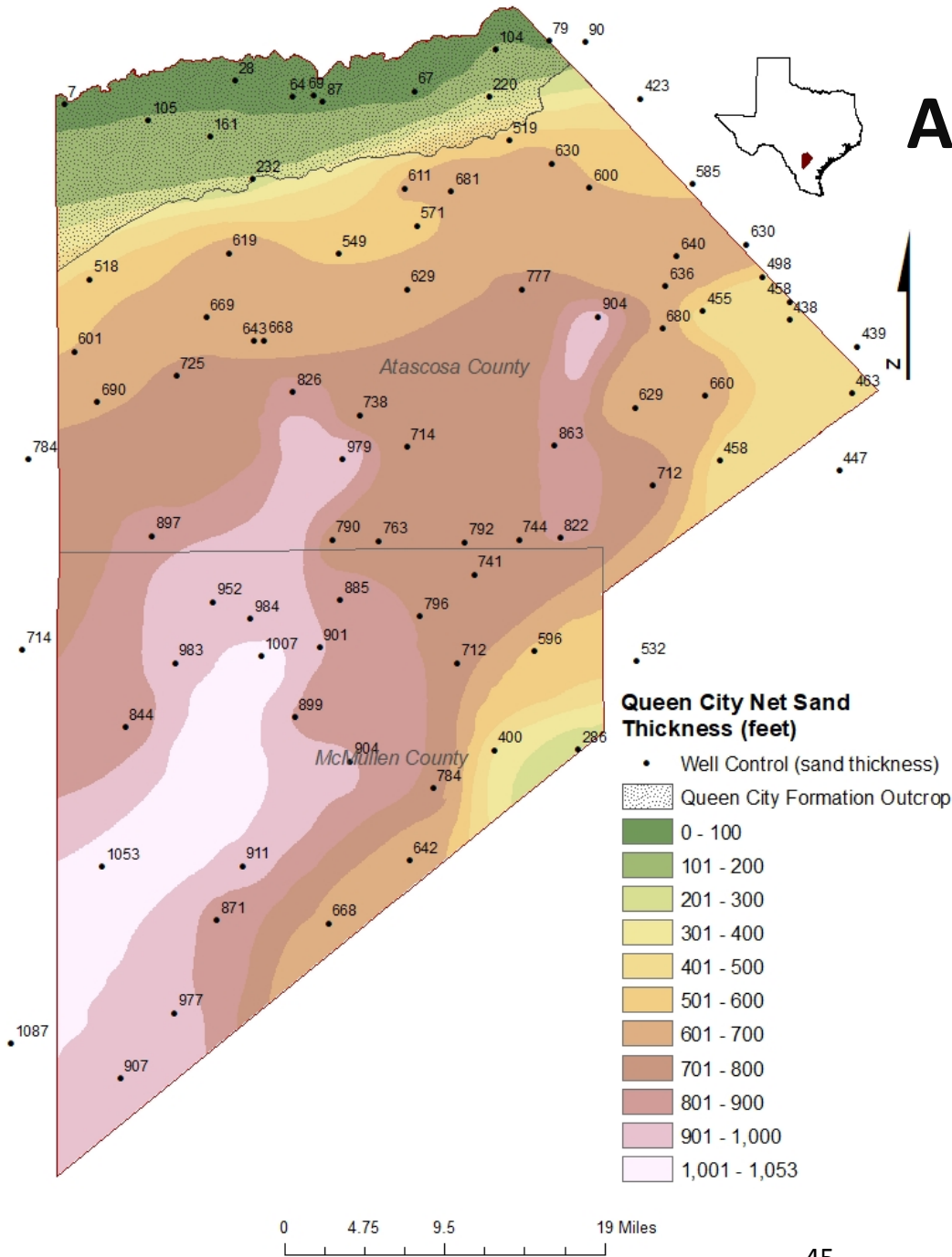
Pecos Valley Aquifer Study GIS



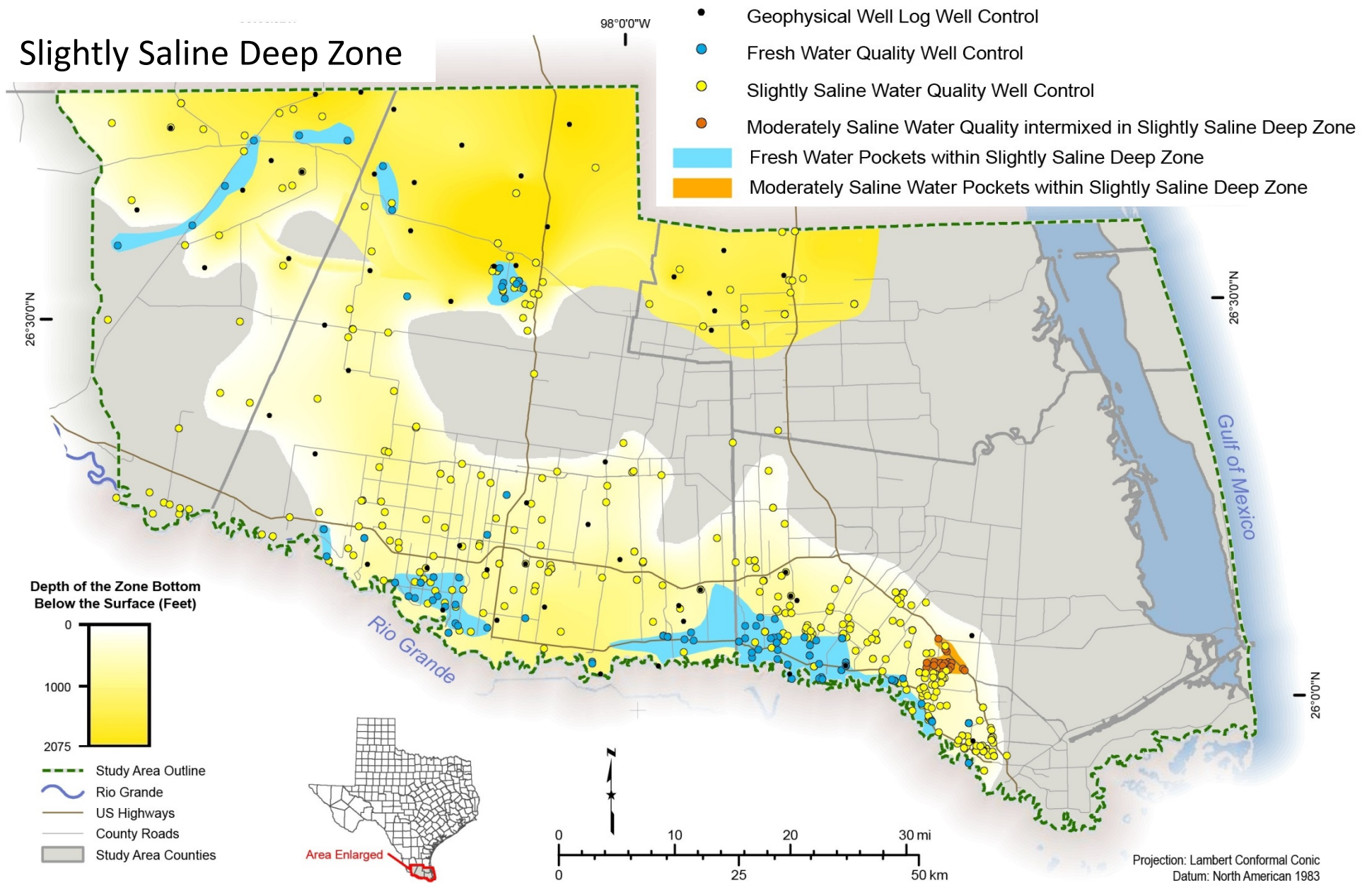
Pecos Valley Aquifer Study



Queen City and Sparta Atascosa and McMullen GIS example

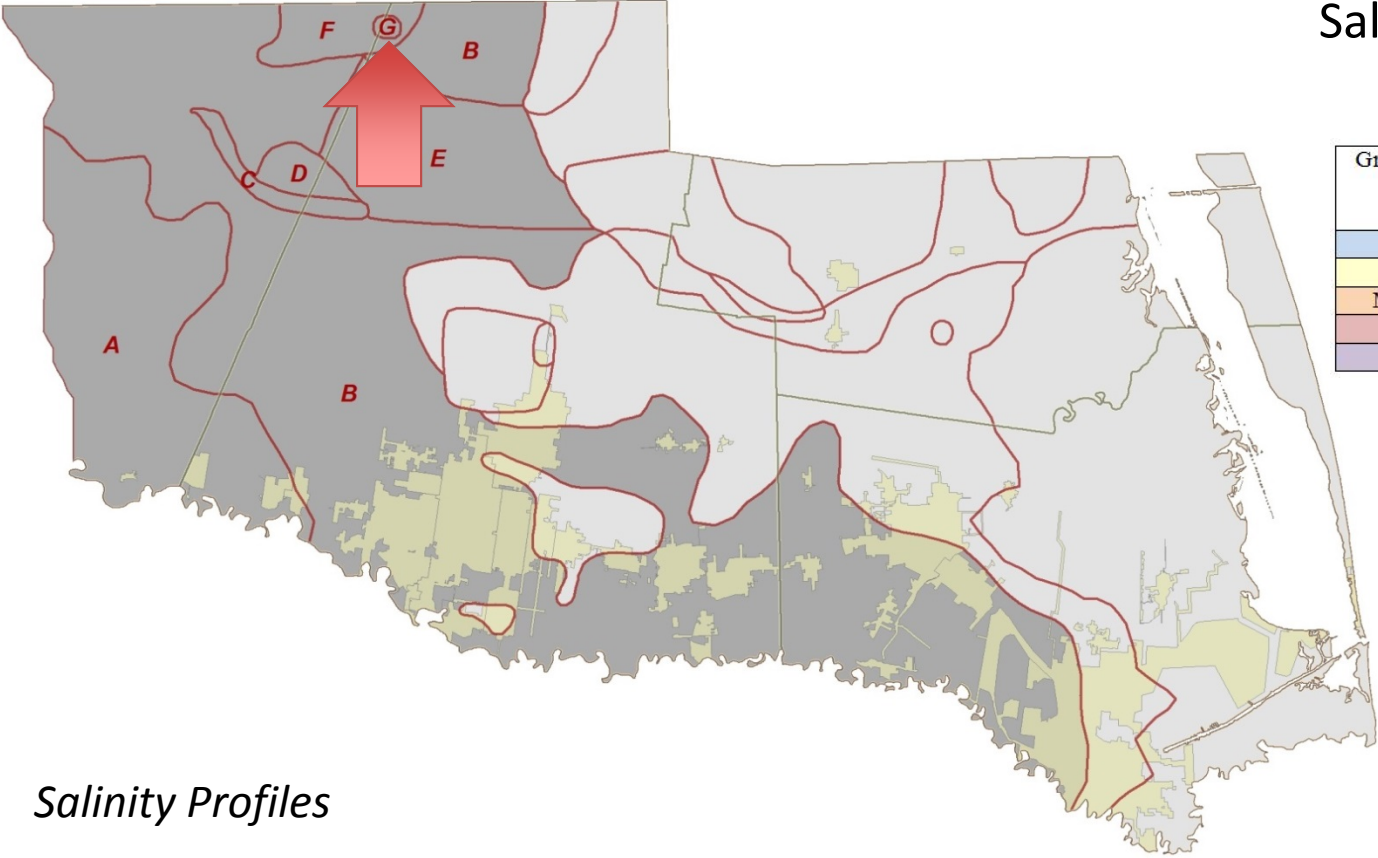


Lower Rio Grande Valley Study GIS



Source: Lower Rio Grande Valley BRACS Study

Salinity Areas A through G



Groundwater Salinity Classification	Total Dissolved Solids Concentration (units: milligrams per liter)
Fresh	0 to 1,000
Slightly Saline	1,000 to 3,000
Moderately Saline	3,000 to 10,000
Very Saline	10,000 to 35,000
Brine	Greater than 35,000

Salinity Profiles

A	B	C	D	E	F	G
				SS Shallow 2		VS Shallow 1
		MS Shallow 5		MS Intermediate 1	MS Shallow 4	MS Shallow 4
	SS Deep	SS Deep		SS Deep	SS Deep	SS Deep
MS Deep	MS Deep	MS Deep	MS Deep	MS Deep	MS Deep	MS Deep
VS Deep	VS Deep	VS Deep	VS Deep	VS Deep	VS Deep	VS Deep
BR Deep	BR Deep	BR Deep	BR Deep	BR Deep	BR Deep	BR Deep

Source: Lower Rio Grande Valley BRACS Study

Lipan Study GIS example

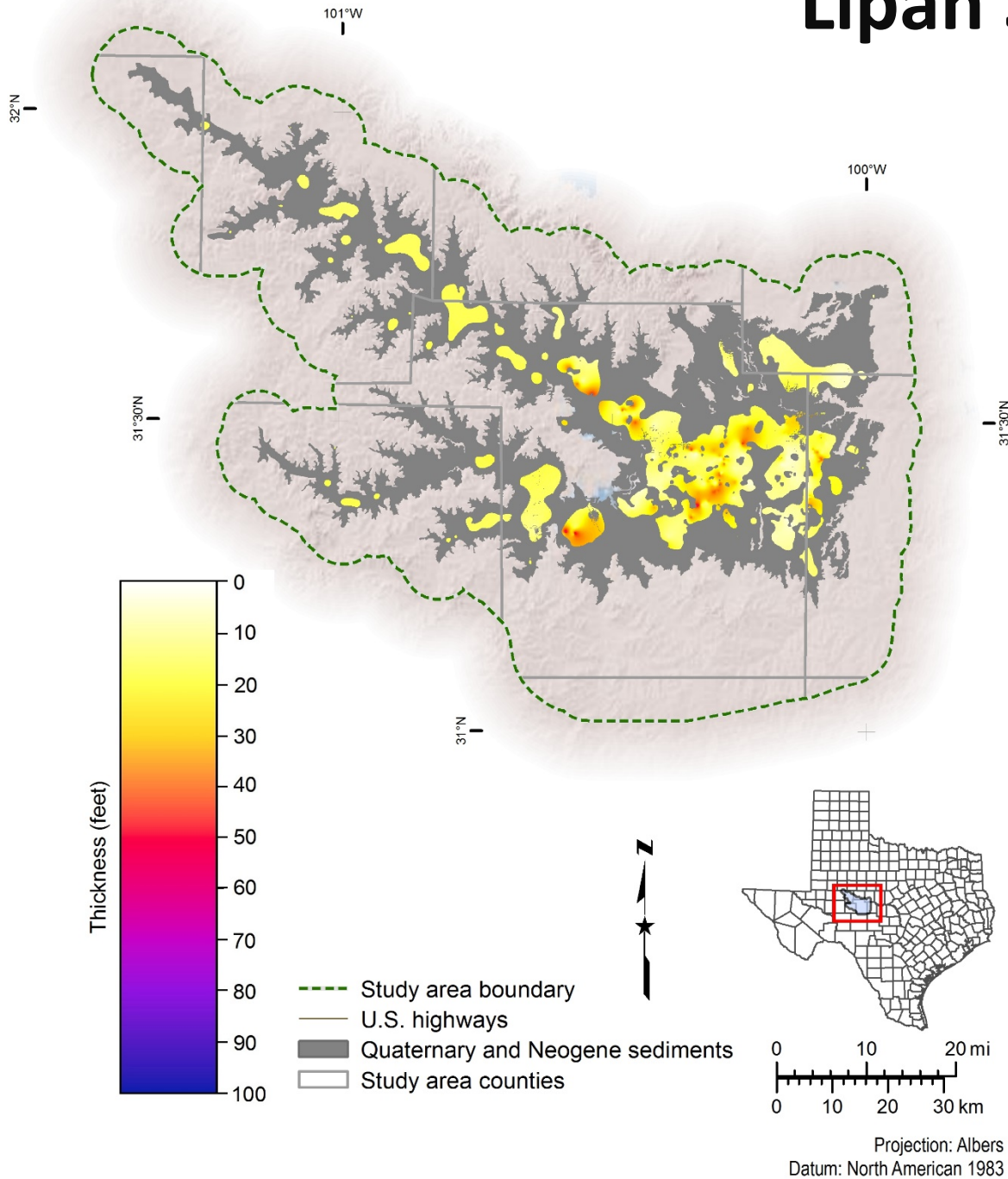
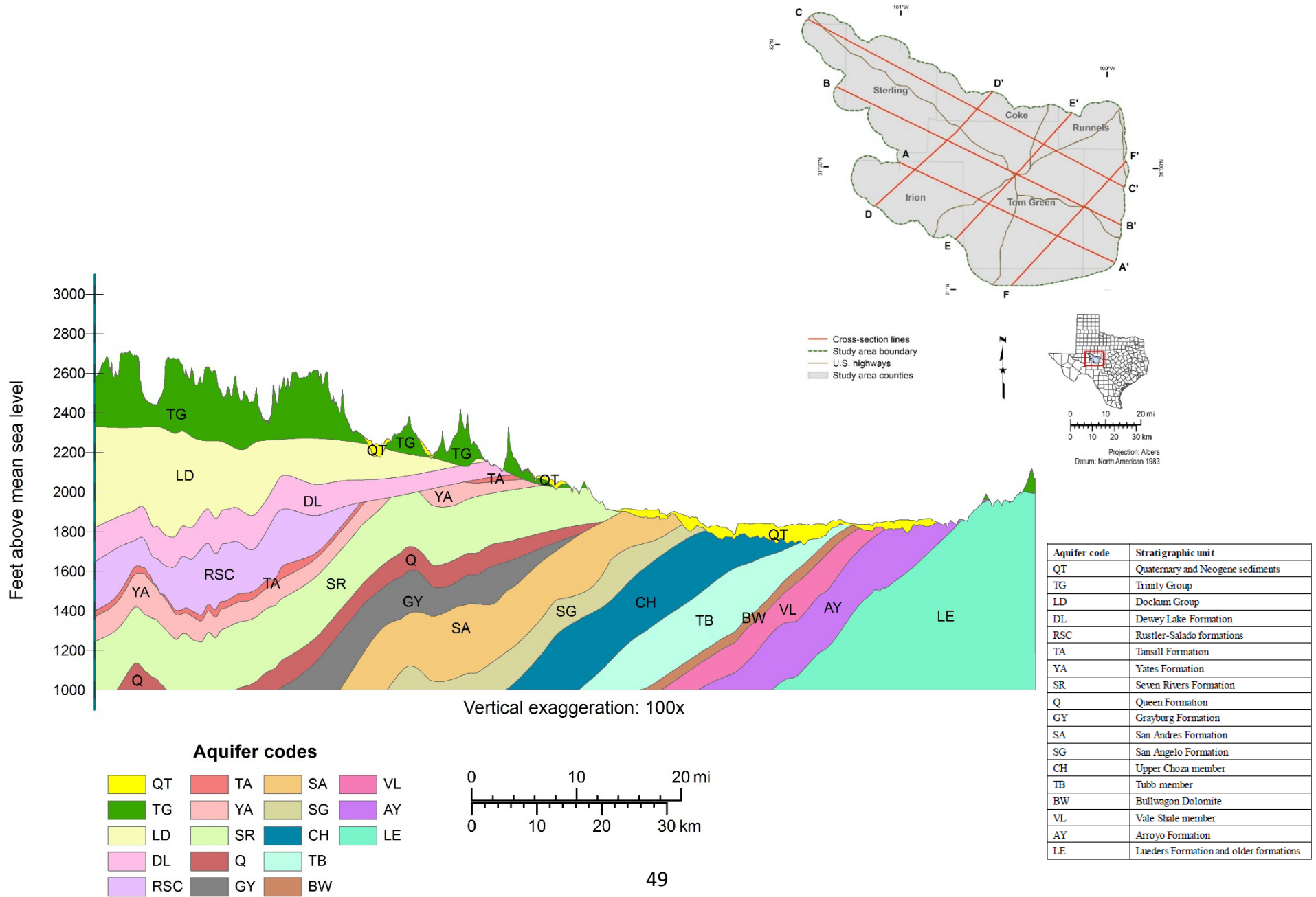


Figure 7.2-4. Isochore map of the caliche zone. Thickness values are in feet. The dark gray area denotes the areal extent of the Quaternary and Neogene sediments.

Lipan Study GIS example



Other contract reports of interest...

Guidance Manual

Fiberglass Casing Use in Texas Public Supply Wells

Prepared for:

Texas Water Development Board



Prepared by:

R W HARDEN & ASSOCIATES, INC.

In association with:

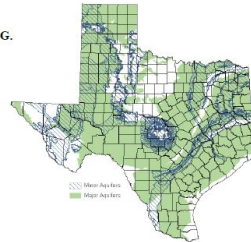
NORRISLEAL
ENGINEERING WATER

Aquifers of Texas Bibliography to Support the Brackish Resources Aquifer Characterization System (BRACS) Program

Final Report

Prepared by

Steven C. Young, Ph.D., P.E., P.G.
Bridget Ronayne



Prepared for:

Texas Water Development Board
P.O. Box 13231, Capitol Station
Austin, Texas 78711-3231

Texas Water
Development Board

November 2011

Brackish Groundwater Exploration Guidance Manual



Prepared for:

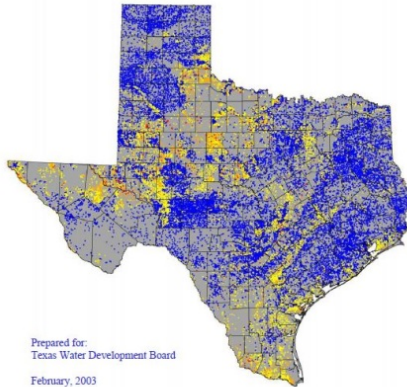
Upper Colorado River Authority and
Texas Water Development Board

April 2008

LBG-GUYTON ASSOCIATES
in association with
Freese and Nichols, Inc.



Brackish Groundwater Manual for Texas Regional Water Planning Groups



Prepared for:
Texas Water Development Board

February, 2003

LBG-GUYTON ASSOCIATES
in association with
NRS Consulting Engineers

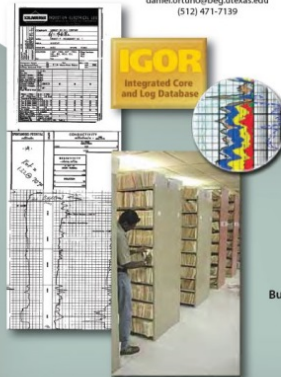


Locating, Scanning, and Delivering Digital Geophysical Well Logs and Associated Data for Brackish Resources Aquifer Characterization System (BRACS)

by

Daniel H. Ortuno, Aaron R. Averett, Sigrid J. Clift, and Jeffrey G. Paine

Corresponding author
daniel.ortuno@beg.utexas.edu
(512) 471-7139



Report prepared for
Texas Water Development Board
under Contract No. 1100011198

BUREAU OF
ECONOMIC GEOLOGY
JACKSON SCHOOL OF GEOLOGICAL SCIENCES
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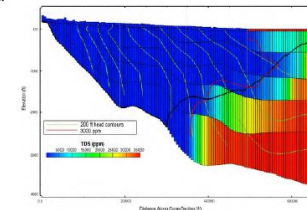
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Assessment of Groundwater Modeling Approaches for Brackish Aquifers

Final Report

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Texas Water
Development Board

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<http://www.twdb.texas.gov/innovativewater/desal/projects.asp>
<http://www.twdb.texas.gov/innovativewater/bracs/studies.asp>

Summary

- ★ Groundwater Desalination is part of the Texas Water Plan
- ★ Detailed brackish groundwater resource evaluation
- ★ Studies can be used to support aquifer storage and recovery evaluations by characterizing an aquifer in great detail
- ★ BRACS study deliverables available on TWDB website
 - Well logs
 - GIS data
 - Database
- ★ Bulk geophysical well log files by county available upon request

Thank you for your support and patience!



We
appreciate
data!

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www.twdb.texas.gov/innovativewater/index.asp

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