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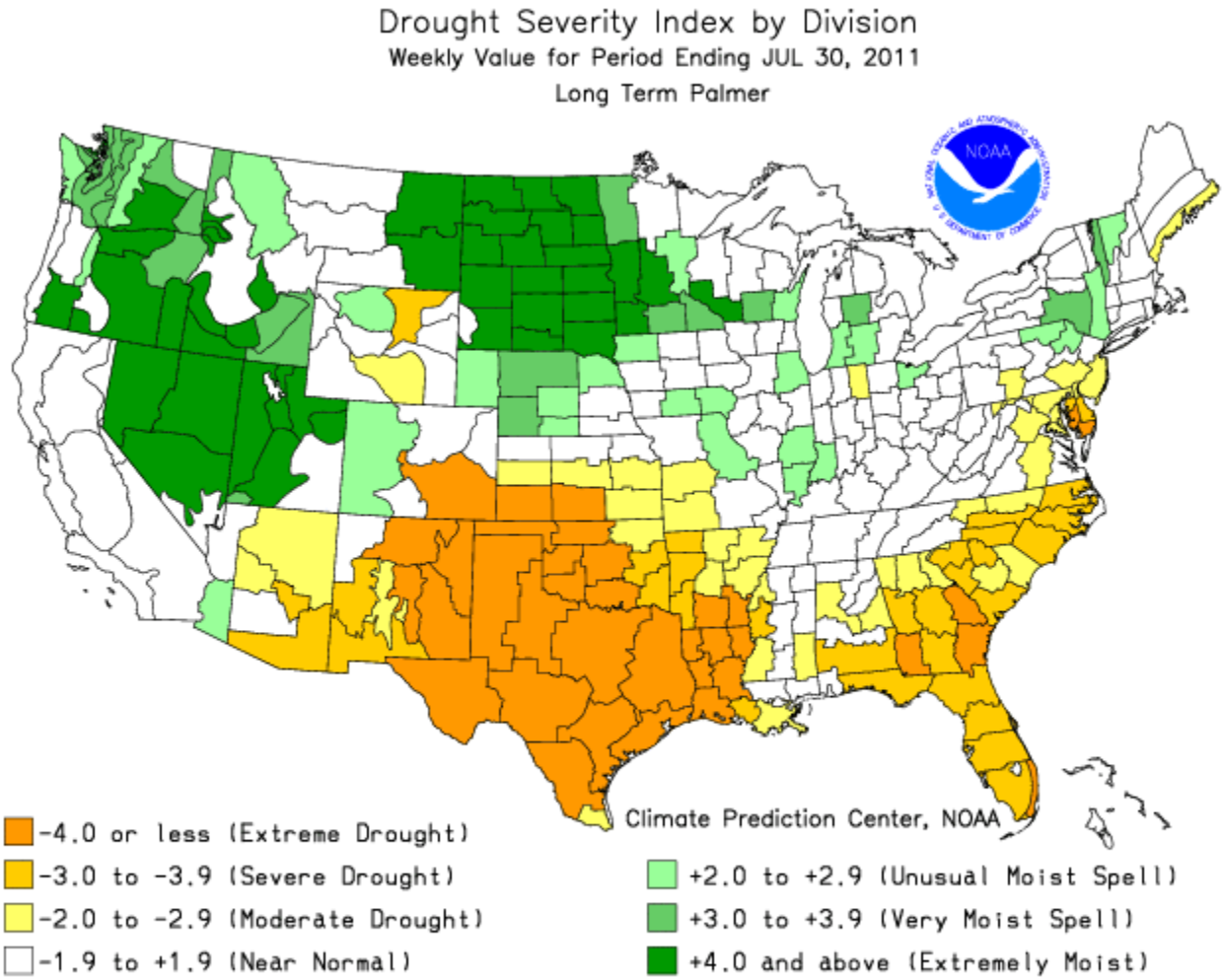
Upstream Development Water Needs: Supply and Permitting Considerations

24th Annual Energy Law Institute
South Texas College of Law
August 31, 2011
Houston, Texas

(Revised 08-29-2011)

Introduction

- Current Drought Conditions
- State Water Planning Process
- Oil & Gas Needs/Usage
- Water Supply Regulatory & Permitting
  - Surface Water
  - Groundwater
  - Reuse


Drought Severity Index by Division
Weekly Value for Period Ending JUL 30, 2011
Long Term Palmer
NOAA
Climate Prediction Center, NOAA
-4.0 or less (Extreme Drought)
-3.0 to -3.9 (Severe Drought)
-2.0 to -2.9 (Moderate Drought)
-1.9 to +1.9 (Near Normal)
+2.0 to +2.9 (Unusual Moist Spell)
+3.0 to +3.9 (Very Moist Spell)
+4.0 and above (Extremely Moist)

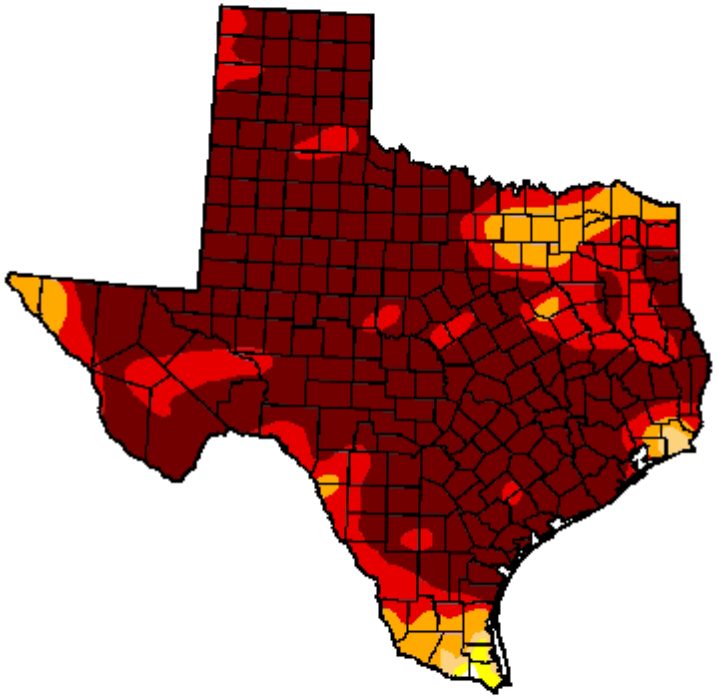
U.S. Drought Monitor

August 2, 2011
Valid 7 a.m. EST

Texas

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.07	99.93	99.48	98.67	91.73	73.49
Last Week (07/26/2011 map)	0.00	100.00	99.85	96.88	91.65	75.23
3 Months Ago (05/03/2011 map)	0.00	100.00	98.86	93.99	73.73	25.96
Start of Calendar Year (12/28/2010 map)	7.89	92.11	69.43	37.46	9.59	0.00
Start of Water Year (09/28/2010 map)	75.57	24.43	2.43	0.99	0.00	0.00
One Year Ago (07/27/2010 map)	89.01	10.99	2.74	0.44	0.00	0.00



Intensity:

- *D0 Abnormally Dry*
- *D1 Drought - Moderate*
- *D2 Drought - Severe*
- *D3 Drought - Extreme*
- *D4 Drought - Exceptional*

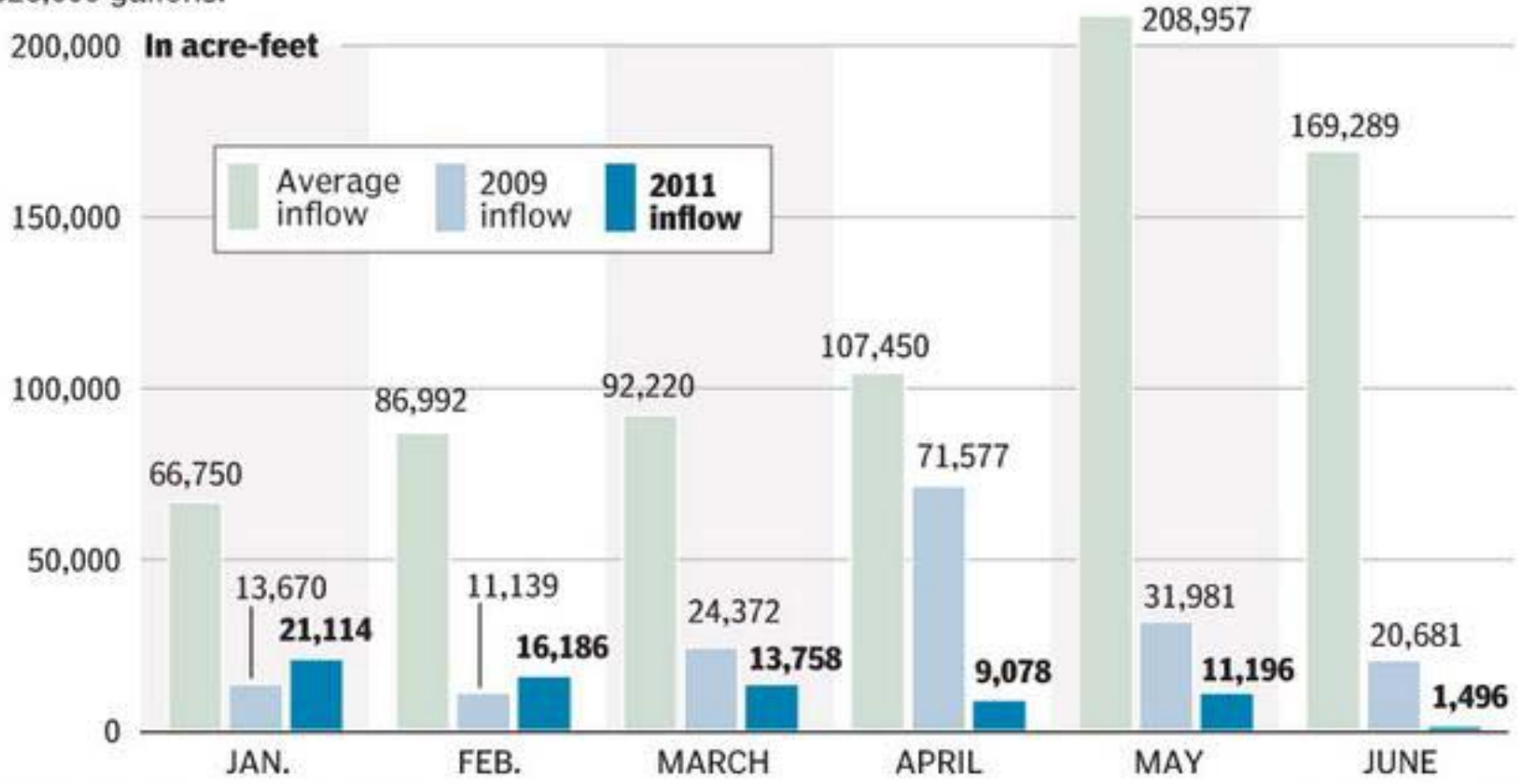
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, August 4, 2011
Brad Rippey, U.S. Department of Agriculture

Less water flowing into the Highland Lakes

The amount of water from rivers and streams flowing into the Highland Lakes, as measured in acre-feet, has been dropping in recent months. An acre-foot equals about 326,000 gallons.



Source: Lower Colorado River Authority

AMERICAN-STATESMAN

Surface Water Resources

an important natural resource providing water for human use and a habitat for aquatic ecosystems

Surface Water Resources Home | Evaporation Monitoring | Drought Summary | Reservoir-Map Tool | Texas Water Conditions

Location: TWDB Home » Water Science & Conservation » Surface Water Resources » Texas Water Conditions » South Central

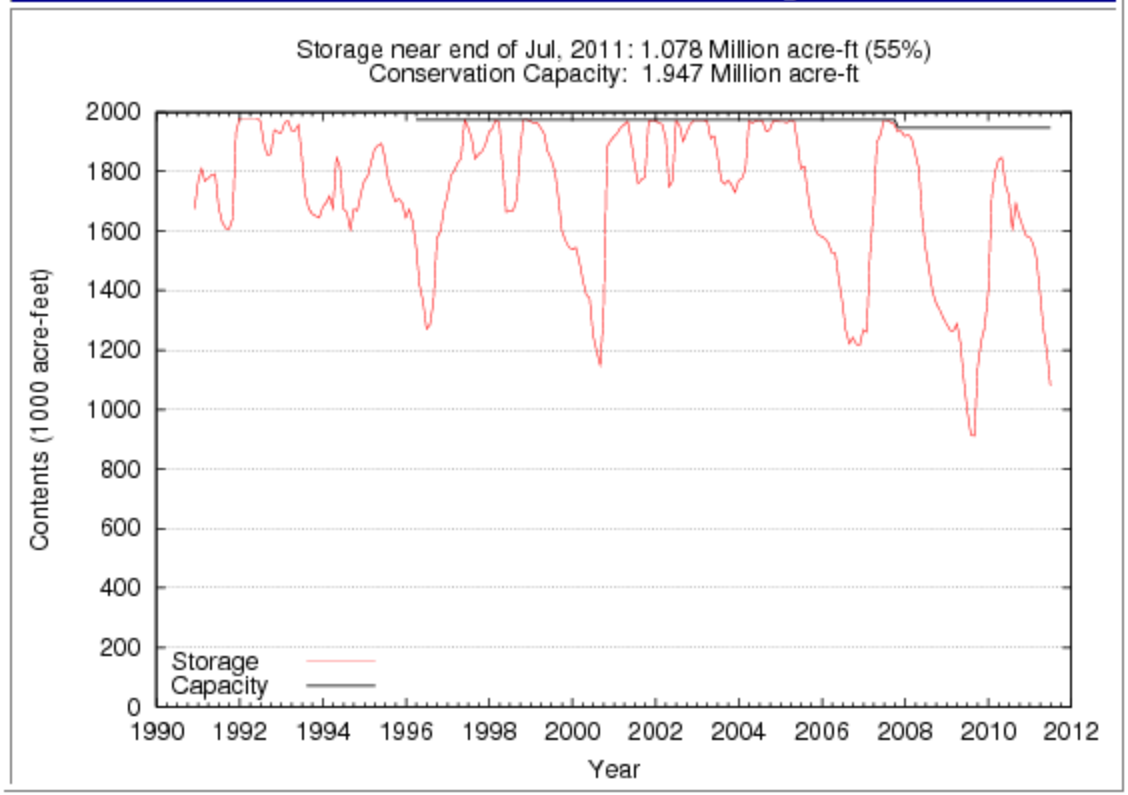
Reservoir Storage

- Regional Storage Map
- Reservoir Storage Map
- North Central Reservoirs
- State Total

Regions:

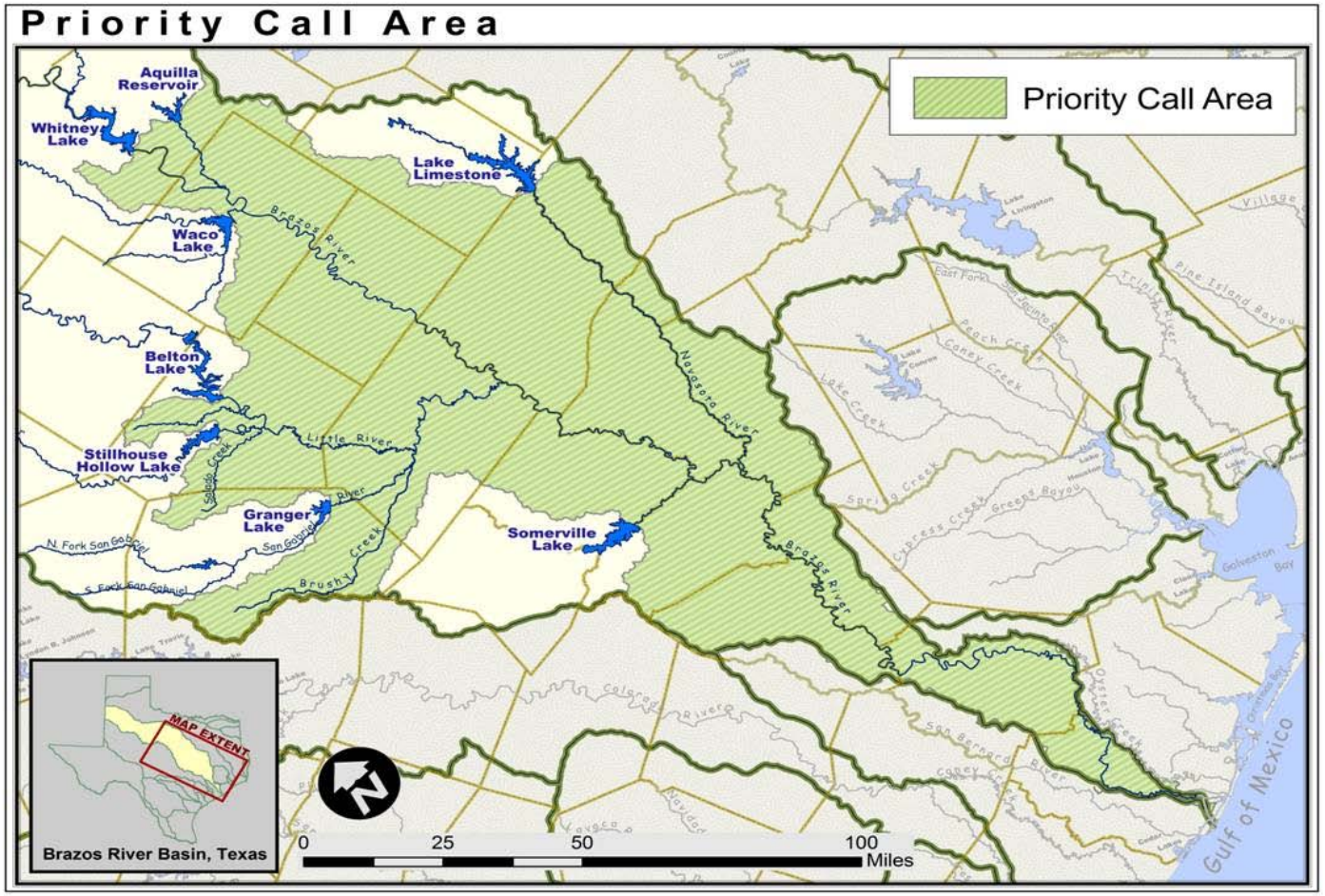
- East Region
- Edwards Plateau
- High Plains
- Low Rolling Plains
- North Central Region
- South Central Region
- Southern Region
- Trans-Pecos
- Upper Coast

South Central Texas Storage



Brazos River Priority Call Area

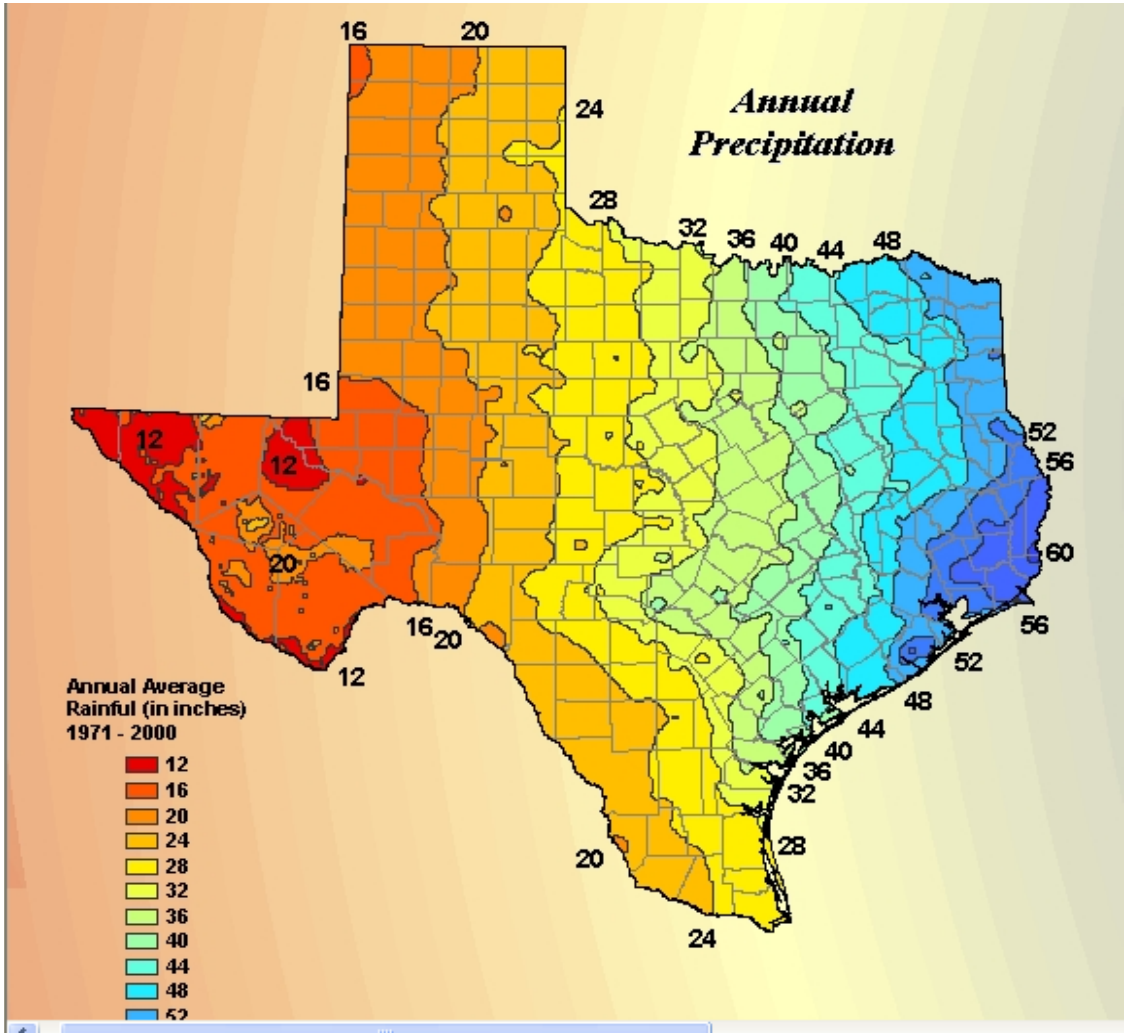
This map depicts the area of the Brazos River where junior surface water rights have been curtailed.



Source: TCEQ

Where is Our Water Supply?

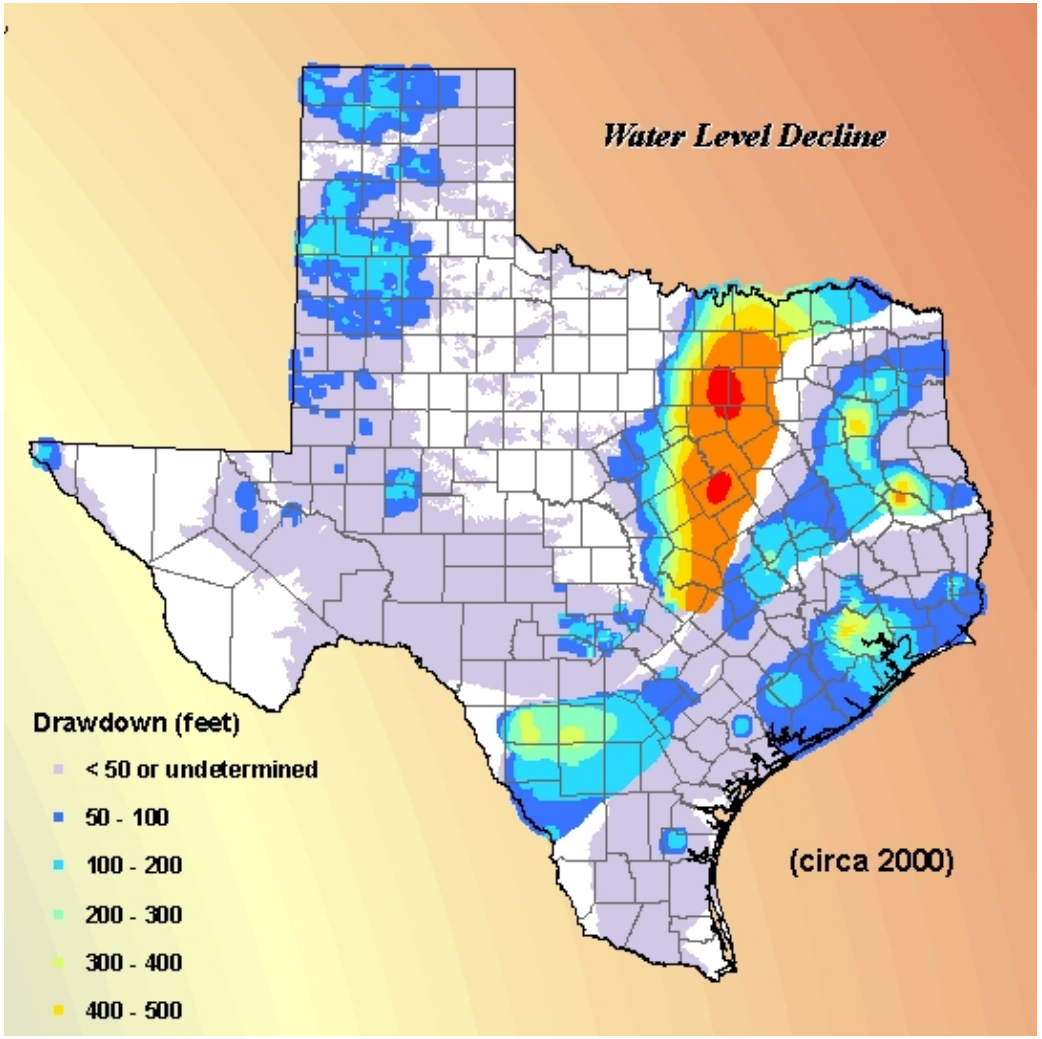
- Scarce in West Texas
- Abundant in East Texas
- Nearly 3M acre ft/yr. Potential Development in Sabine and Neches Basins
- Limitation on New Interbasin Transfers



Source: TWDB

Groundwater Status

- Nearly 60% Current Water Use from Groundwater
- 100+ Groundwater Conservation Districts



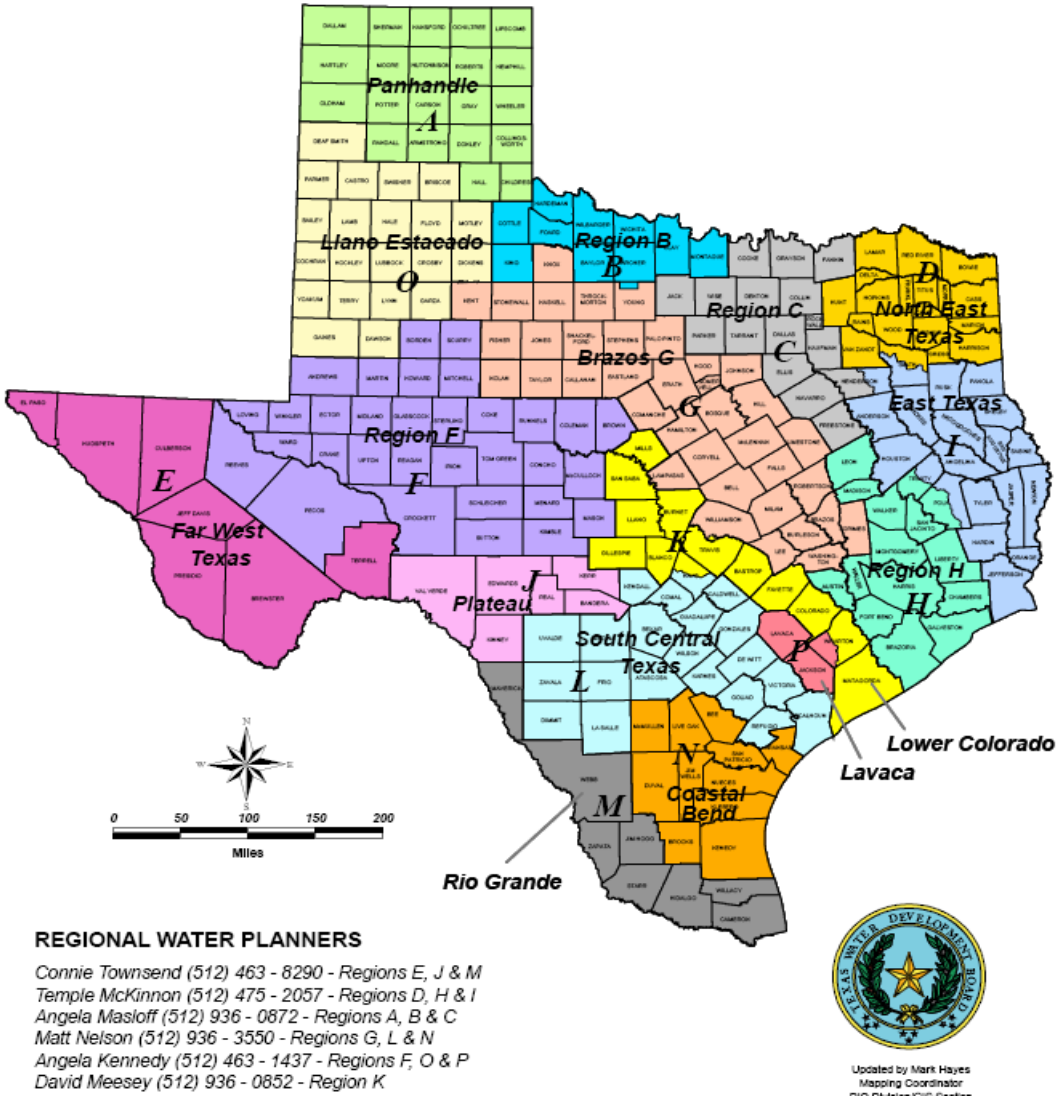
Source: Texas Water Development Board

State Water Plan 2012

- Planning Process – Every 5 Years
- Locally Developed Regional Water Plans
- Total Texas 2060 Water Stats:
  - Supply = 15 million AcFt
  - Demand = 22 million AcFt
- Capital Cost $53B to Meet Demand

Source: Water for Texas: Summary of the 2011 Region Water Plans, Texas Water Development Board, January 2011.

Regional Water Planning Areas



REGIONAL WATER PLANNERS

Connie Townsend (512) 463 - 8290 - Regions E, J & M
Temple McKinnon (512) 475 - 2057 - Regions D, H & I
Angela Masloff (512) 936 - 0872 - Regions A, B & C
Matt Nelson (512) 936 - 3550 - Regions G, L & N
Angela Kennedy (512) 463 - 1437 - Regions F, O & P
David Meesey (512) 936 - 0852 - Region K

Updated by Mark Hayes
Mapping Coordinator

Projected O&G Sector Water Use

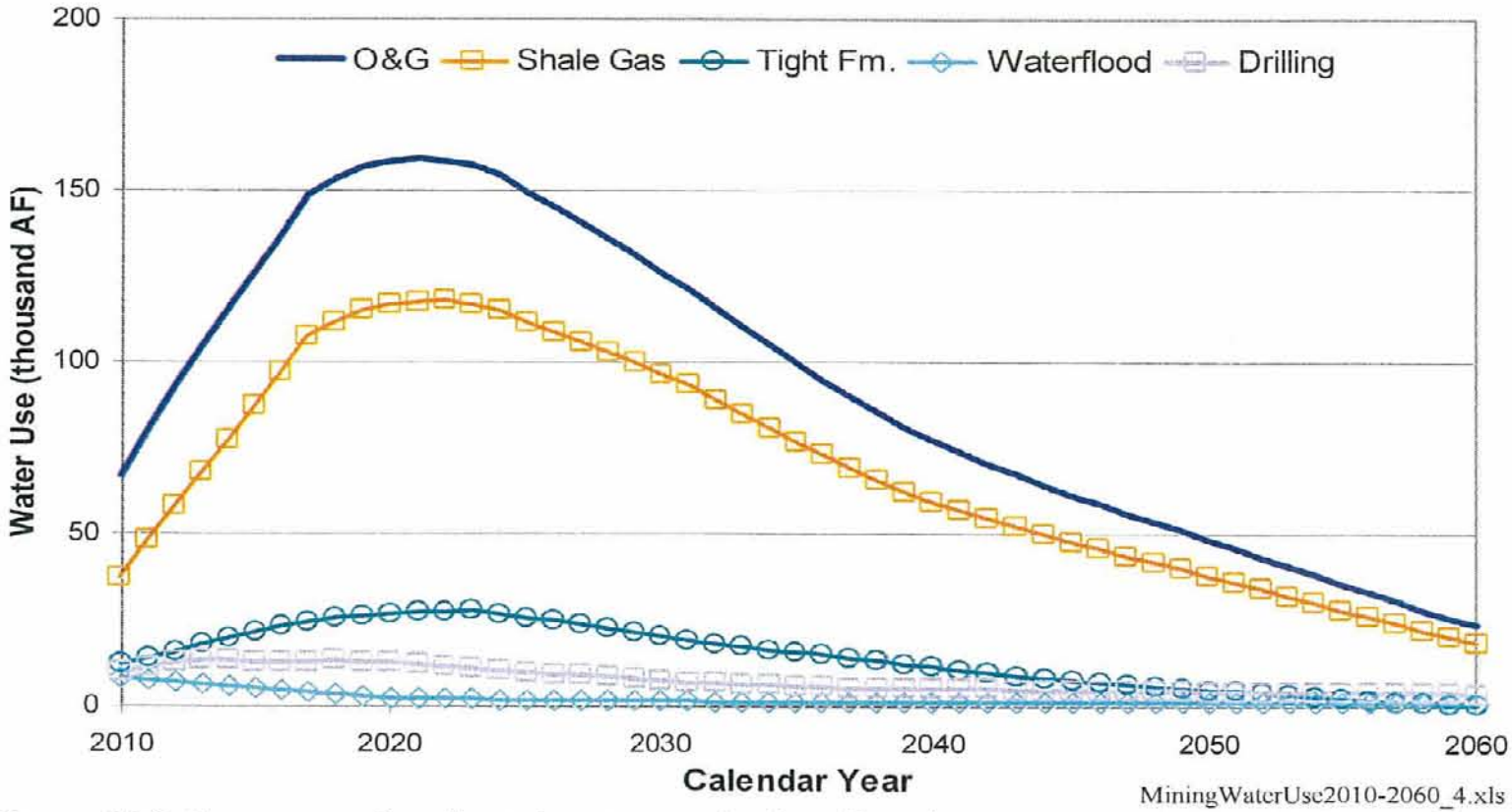
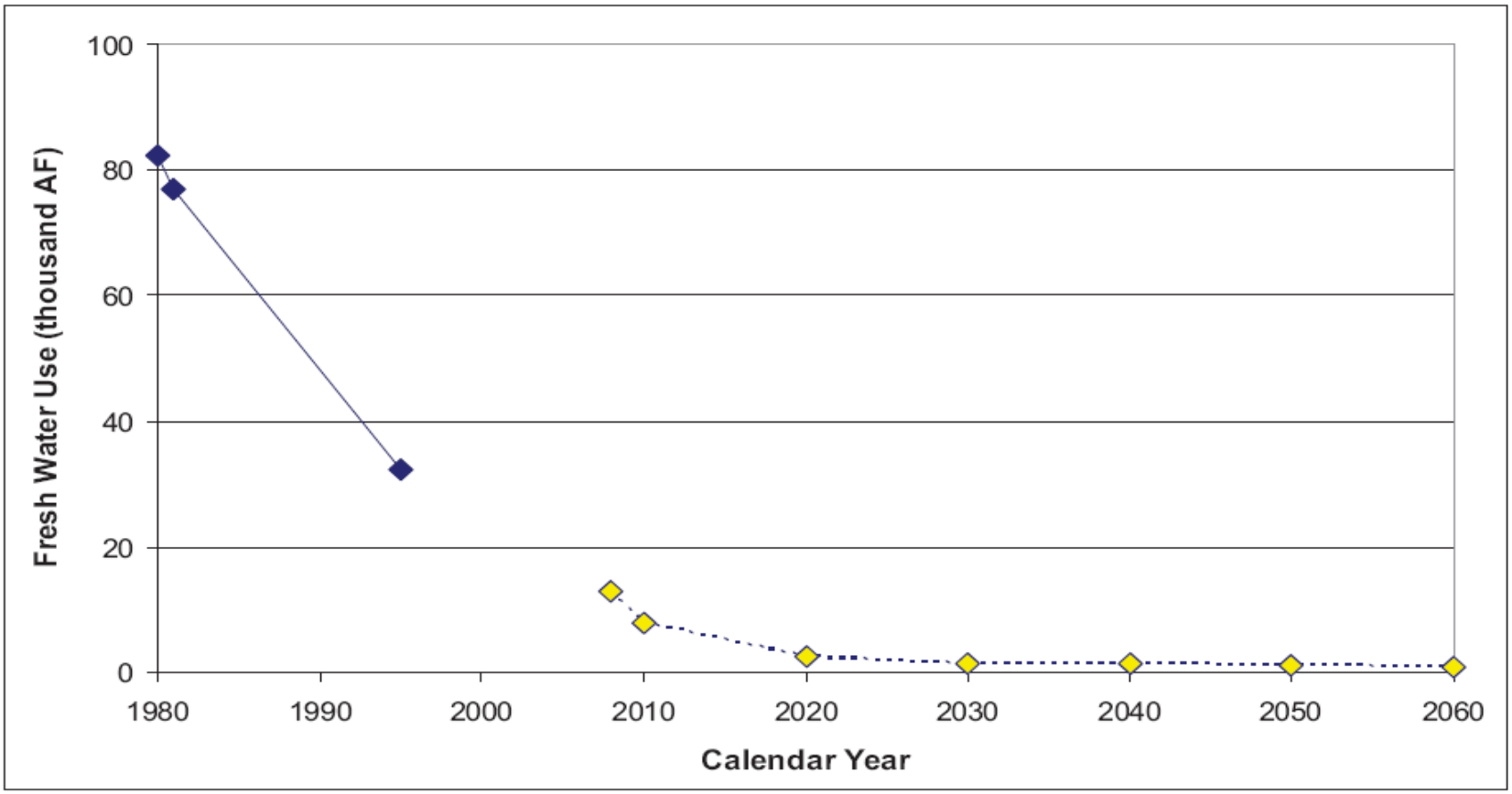


Figure 136. Summary of projected water use in the oil and gas segment (2010–2060)

Source: BEG/TWDB June 2011

Actual and Projected Water Use by O&G Secondary and Tertiary Recovery

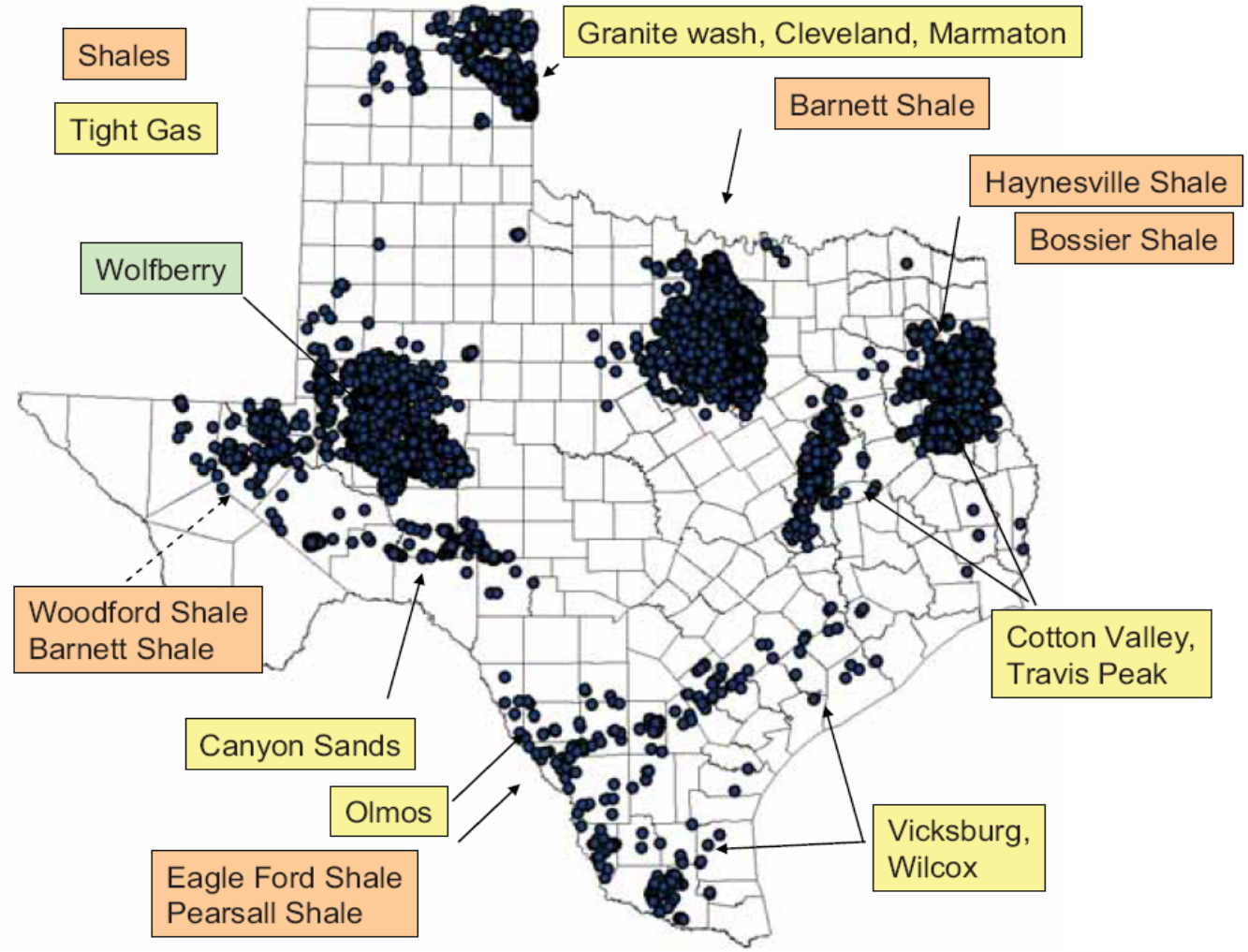


Source: RRC (1982) and De Leon (1996) for historical data

Historical Injection 2=fromRRC1982Report.xls

Source: BEG/TWDB June 2011

Location of Frac Jobs (2005-2009)



Source: IHS database

Figure 24. Map showing locations of all frac jobs 2005–2009, and main (mostly) gas plays

Source: BEG/TWDB June 2011

Projected Fracing Water Use (Texas)

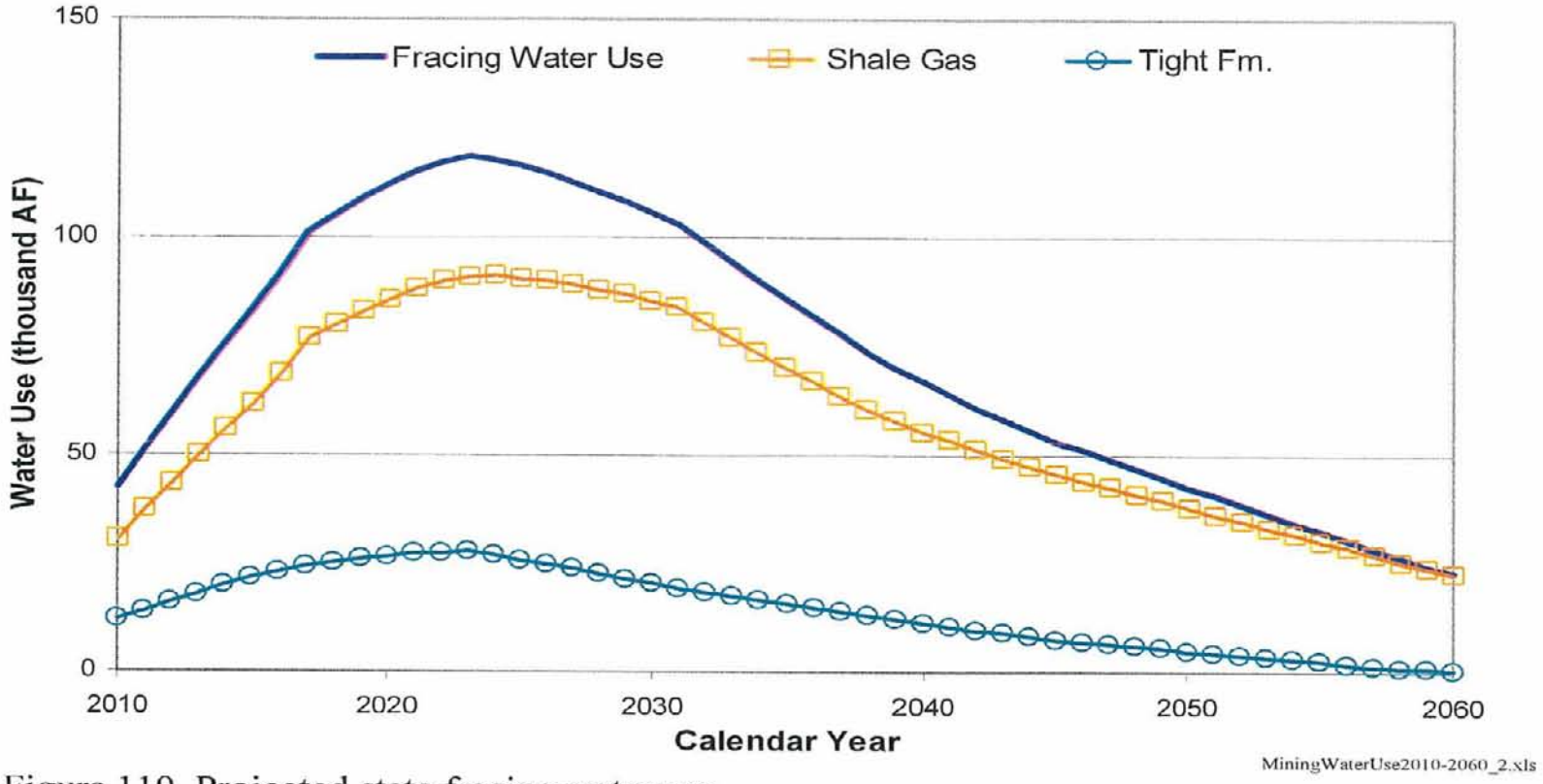
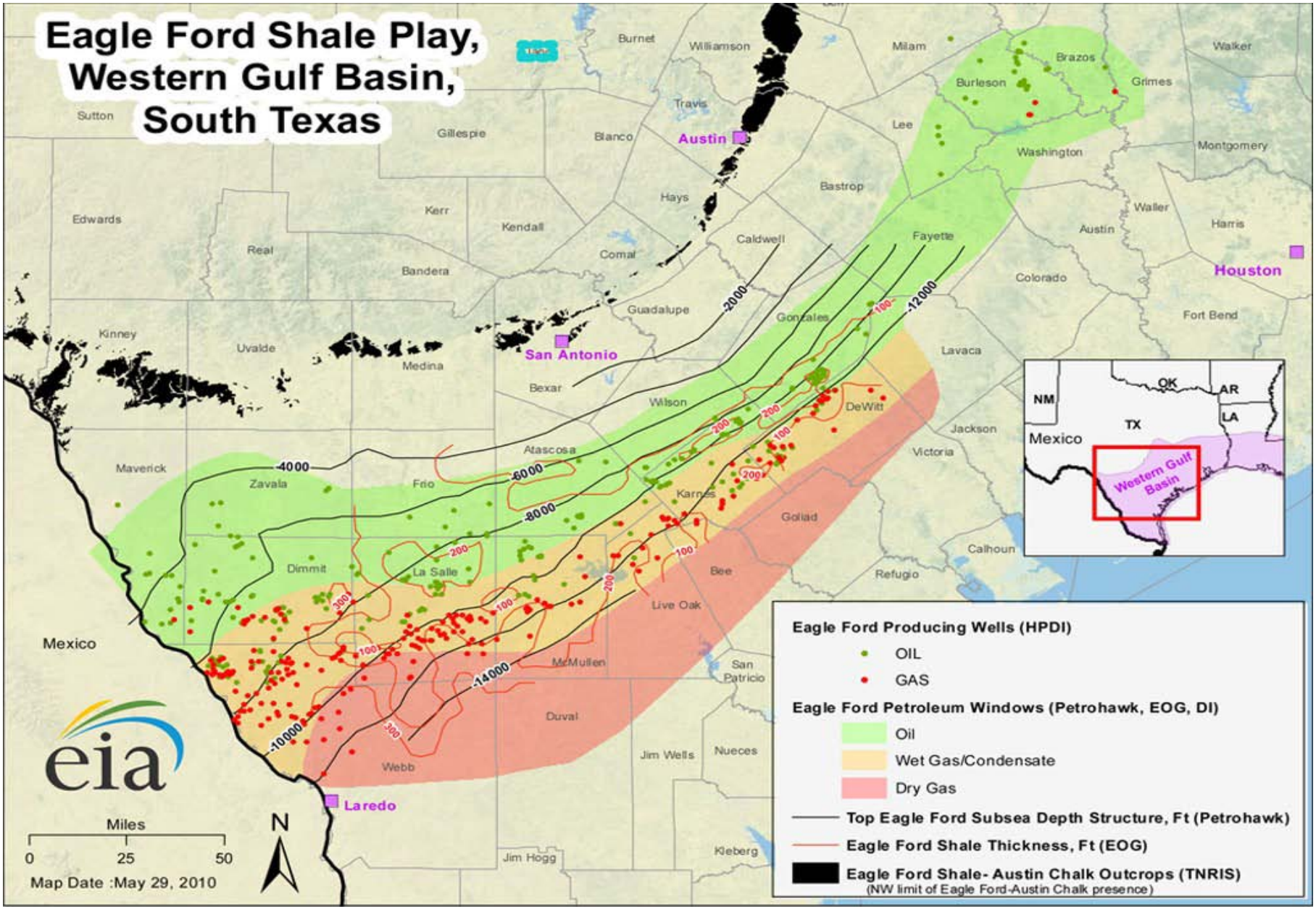


Figure 119. Projected state fracing water use

Source: BEG/TWDB June 2011

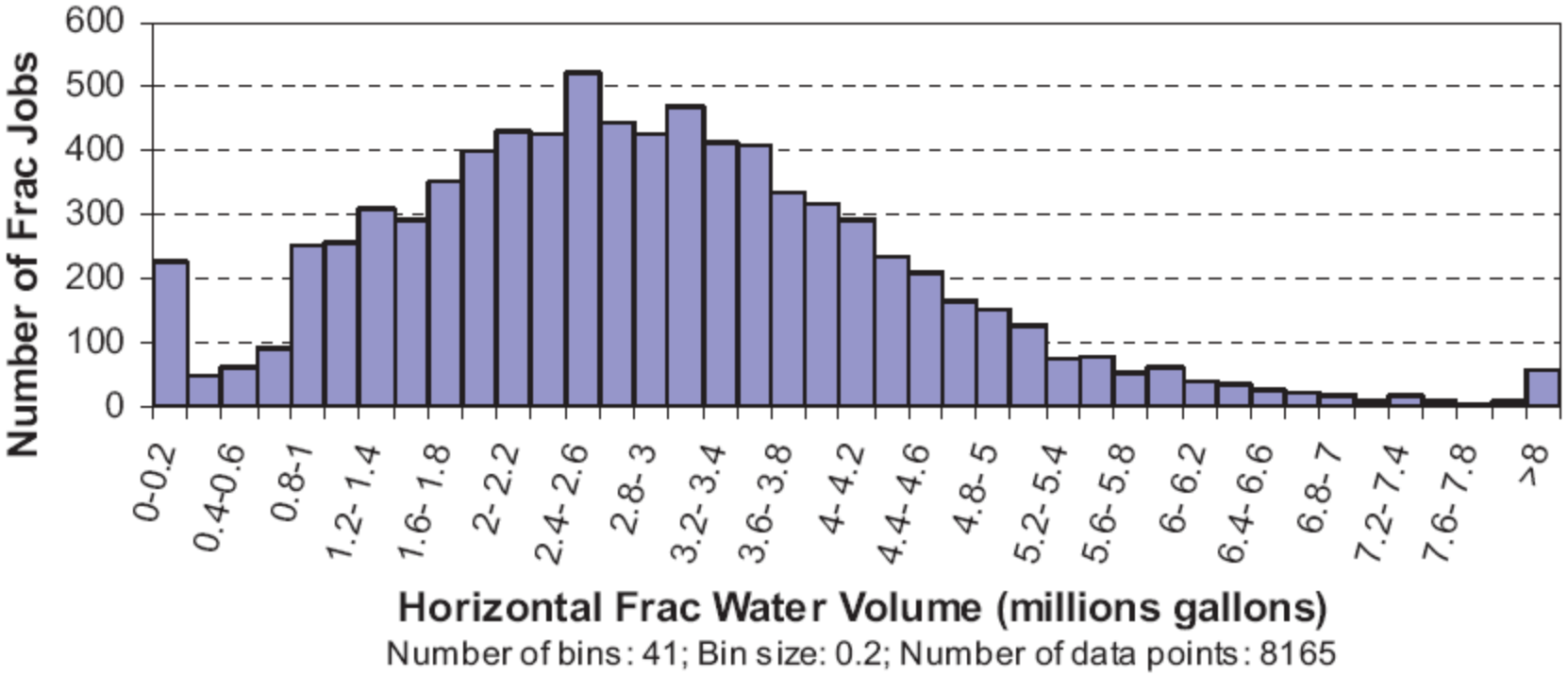


Source: EIA

Reported Average Frac Water Use (gallons/well)

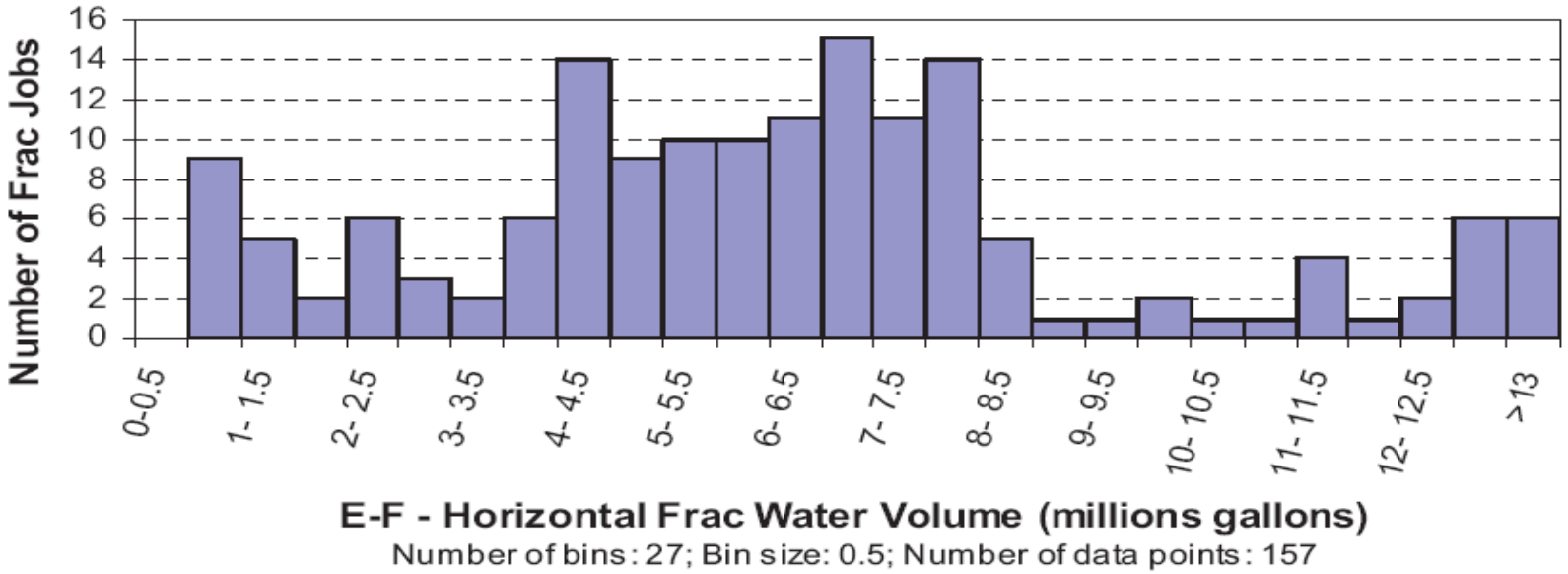
- Barnett 2,300,000
- Haynesville 2,700,000
- Marcellus (PA) 3,800,000
- Eagle Ford 6,000,000

Barnett Shale – Frac Water Use (per Well)



Source: BEG/TWDB June 2011

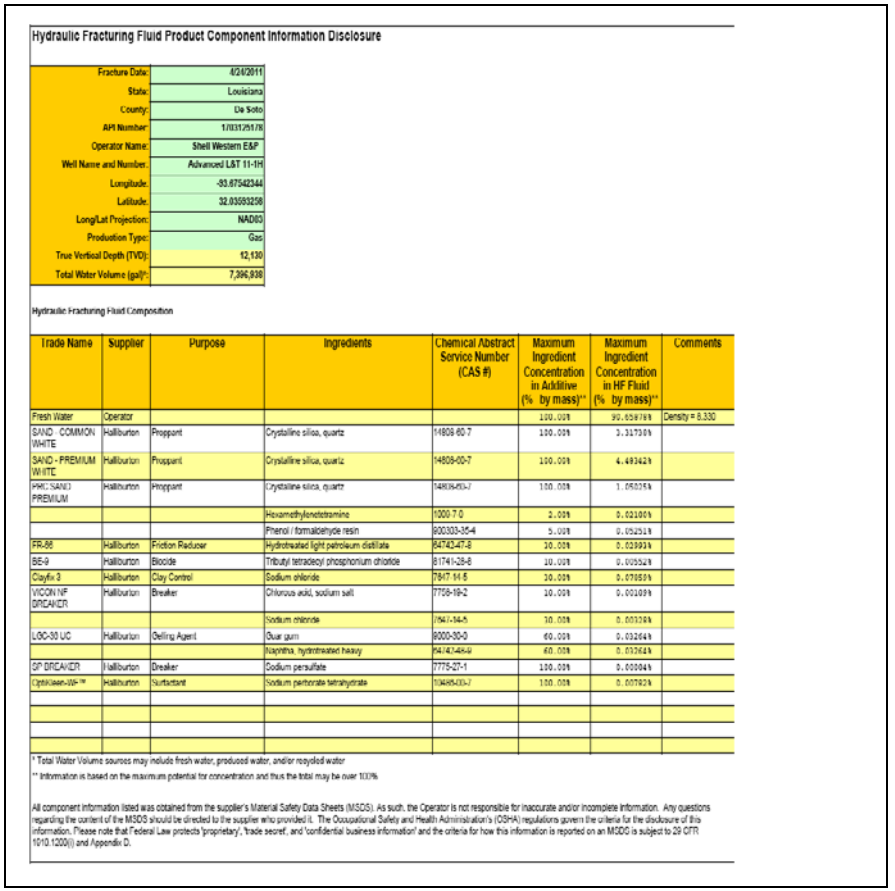
Eagle Ford – Frac Water Use
(per well)



(a)

Source: Figure 43 Eagle Ford; BEG/TWDB June 2011

FracFocus.Org



Hydraulic Fracturing Fluid Product Component Information Disclosure

Fracture Date:	4/24/2011
State:	Louisiana
County:	De Soto
API Number:	1/0331/2178
Operator Name:	Shell Western E&P
Well Name and Number:	Advanced L&T 11-1H
Longitude:	-93.87542344
Latitude:	32.03593258
Long/Lat Projection:	NAD83
Production Type:	Gas
True Vertical Depth (TVD):	12,130
Total Water Volume (gal)*:	7,396,938

Hydraulic Fracturing Fluid Composition

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
Fresh Water	Operator				100.00%	90.65979%	Density = 8.330
SAND - COMMON WHITE	Halliburton	Proppant	Crystalline silica, quartz	14808-60-7	100.00%	3.31730%	
SAND - PREMIUM WHITE	Halliburton	Proppant	Crystalline silica, quartz	14808-60-7	100.00%	4.48342%	
PRC SAND PREMIUM	Halliburton	Proppant	Crystalline silica, quartz	14808-60-7	100.00%	1.05025%	
			Hexamethylenetetramine	100-97-0	2.00%	0.02100%	
			Phenol / formaldehyde resin	900303-35-4	5.00%	0.05251%	
FR-66	Halliburton	Friction Reducer	Hydrotreated light petroleum distillate	64742-47-8	30.00%	0.02993%	
BE-9	Halliburton	Biocide	Tributyl tetradecyl phosphonium chloride	81741-28-8	10.00%	0.00552%	
Clayfix 3	Halliburton	Clay Control	Sodium chloride	7647-14-5	30.00%	0.07058%	
VICON NF BREAKER	Halliburton	Breaker	Chlorous acid, sodium salt	7758-19-2	10.00%	0.00108%	
			Sodium chloride	7647-14-5	10.00%	0.00108%	
LOC-33 UC	Halliburton	Gelling Agent	Guar gum	9000-30-0	60.00%	0.03264%	
			Naphtha, hydrotreated heavy	64742-48-9	60.00%	0.03264%	
SP BREAKER	Halliburton	Breaker	Sodium persulfate	7775-27-1	100.00%	0.00004%	
OptiKleen-WF™	Halliburton	Surfactant	Sodium perborate tetrahydrate	10486-00-7	100.00%	0.00782%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

All component information listed was obtained from the supplier's Material Safety Data Sheets (MSDS). As such, the Operator is not responsible for inaccurate and/or incomplete information. Any questions regarding the content of the MSDS should be directed to the supplier who provided it. The Occupational Safety and Health Administration's (OSHA) regulations govern the criteria for the disclosure of this information. Please note that Federal Law protects 'proprietary', 'trade secret', and 'confidential business information' and the criteria for how this information is reported on an MSDS is subject to 29 CFR 1910.1200(i) and Appendix D.

Water Sources

- Surface Water
  - Owned by the State
  - TCEQ Permit Needed to Appropriate
  - Texas Water Code, Ch. 11
- Groundwater
  - Owned by Landowner (SB 332)
  - Rule of Capture, Modified
  - Local GW Conservation Districts (100+)
- Reuse/Recycling

Surface Water Regulatory Definition

State Water – The water of the ordinary flow, underflow, and tides of every flowing river, natural stream, and lake . . . and the stormwater, floodwater, and rainwater of every river, natural stream, and watercourse in the state.

30 TAC § 297.1

What is Not State Water?

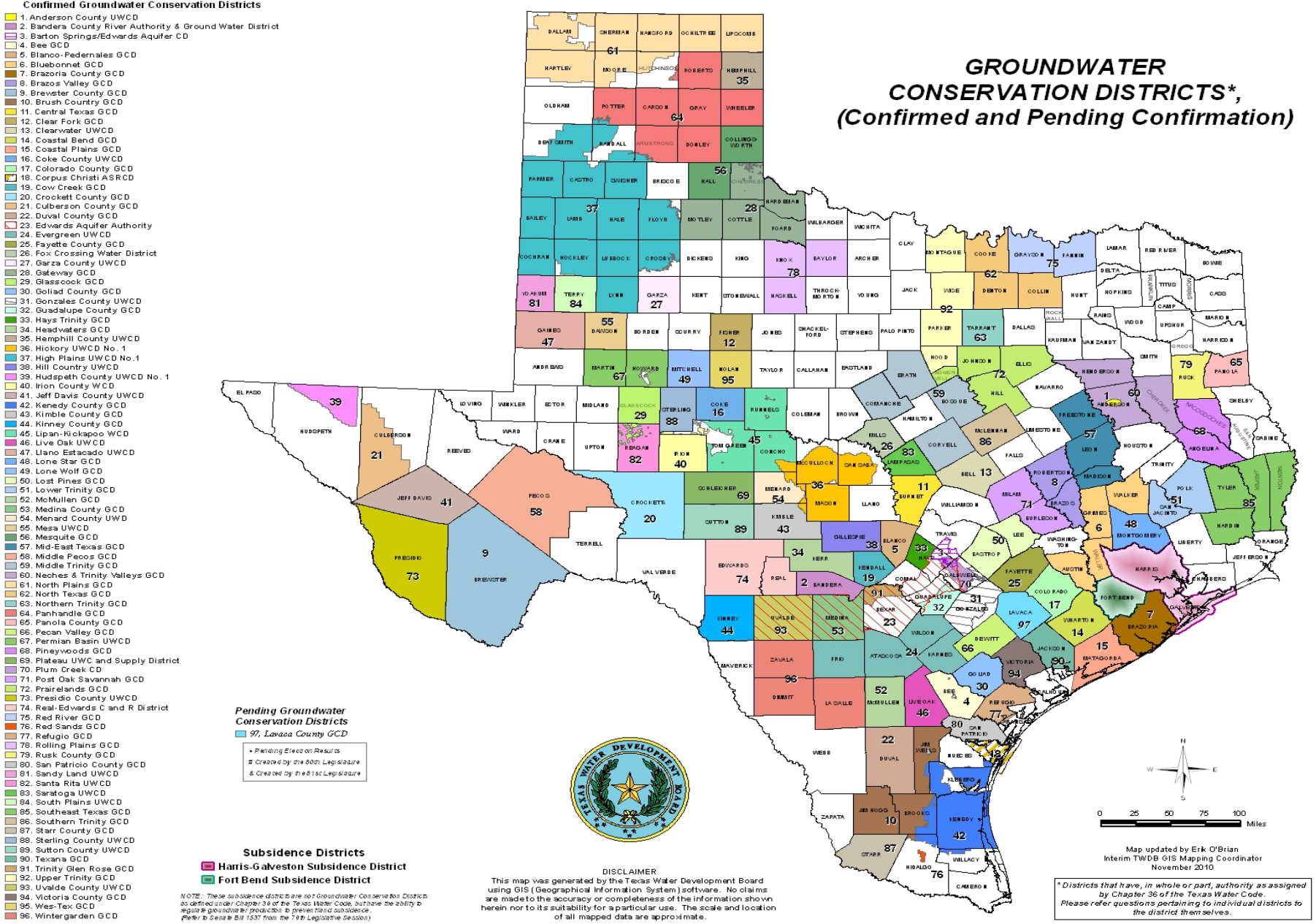
- Diffuse Surface Water (Rainfall)
  Turner v. Big Lake Oil Co. (Tex. 1936).
- Groundwater Seepage and Springwater
- Certain Gulf of Mexico Water
- Developed Water
  - Reuse of privately owned groundwater
  - Water from interbasin transfers
  - Capture of diffused surface water

Surface Water Issues

- Most Basins are Fully Appropriated
- Permitting Timeframe is Long
  - Notice to Existing WR Holders
  - Hearing
- New Permit Priority will be Junior to All Existing WR Holders
- Term Permit Option

Groundwater Regulation

- Locally Controlled GCDs
  - Elected Board
  - Preference for Regional GCDs
- Rules Vary by District
  - Permits for Drilling & Operating Wells
  - Spacing or Acreage Requirements
  - Transfer of Rights Between Wells
  - Transport Groundwater Out of District



Looming Groundwater Conflict

Landowner Rights v. GW Regulation

- **Desired Future Conditions**
  - DFC = Management Goal for Aquifer
  - DFC's Due to TWDB by Sept. 2010
  - TWDB Then Calculates **MAG**
  - MAG Sets Permitting Target for GW
- **The Conflict**
  - MAG Will Limit Future Permits and GW Production

O&G Groundwater Permit Exemption Water Code 36.117(b)(2)

A [groundwater conservation] district may not require any permit issued by the district for . . . the drilling of a water well used solely to supply water for a rig that is actively engaged in drilling or exploration operations for an oil or gas well permitted by the Railroad Commission of Texas provided that the person holding the permit is responsible for drilling and operating the water well and the well is located on the same lease or field associated with the drilling rig.

Purchasing Water

- Contract with WR Holder
  - River Authorities
- Pricing and Terms Vary
  - Colorado Basin = $150/AcFt
  - Guadalupe = $110/AcFt
  - Brazos = $ 63/AcFt
- Drought and Population Growth are Increasing Demand

Reclaimed Water

THE TEXAS TRIBUNE

- WWTP Treated Effluent
- Recycled Frac Flowback
- Industrial Reclaimed Water
  - Cooling Water Blowdown
  - Washwater, Condensate
- TCEQ Regs at 30 TAC 210

Cost of Frac Water (Large Frac)

Assume 10M Gal/Well

- $0.70 per bbl =$167,000
- $3.00 per 1000gal =$ 30,000
- $100 per AcreFt =$ 3,070

QUESTIONS?

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