

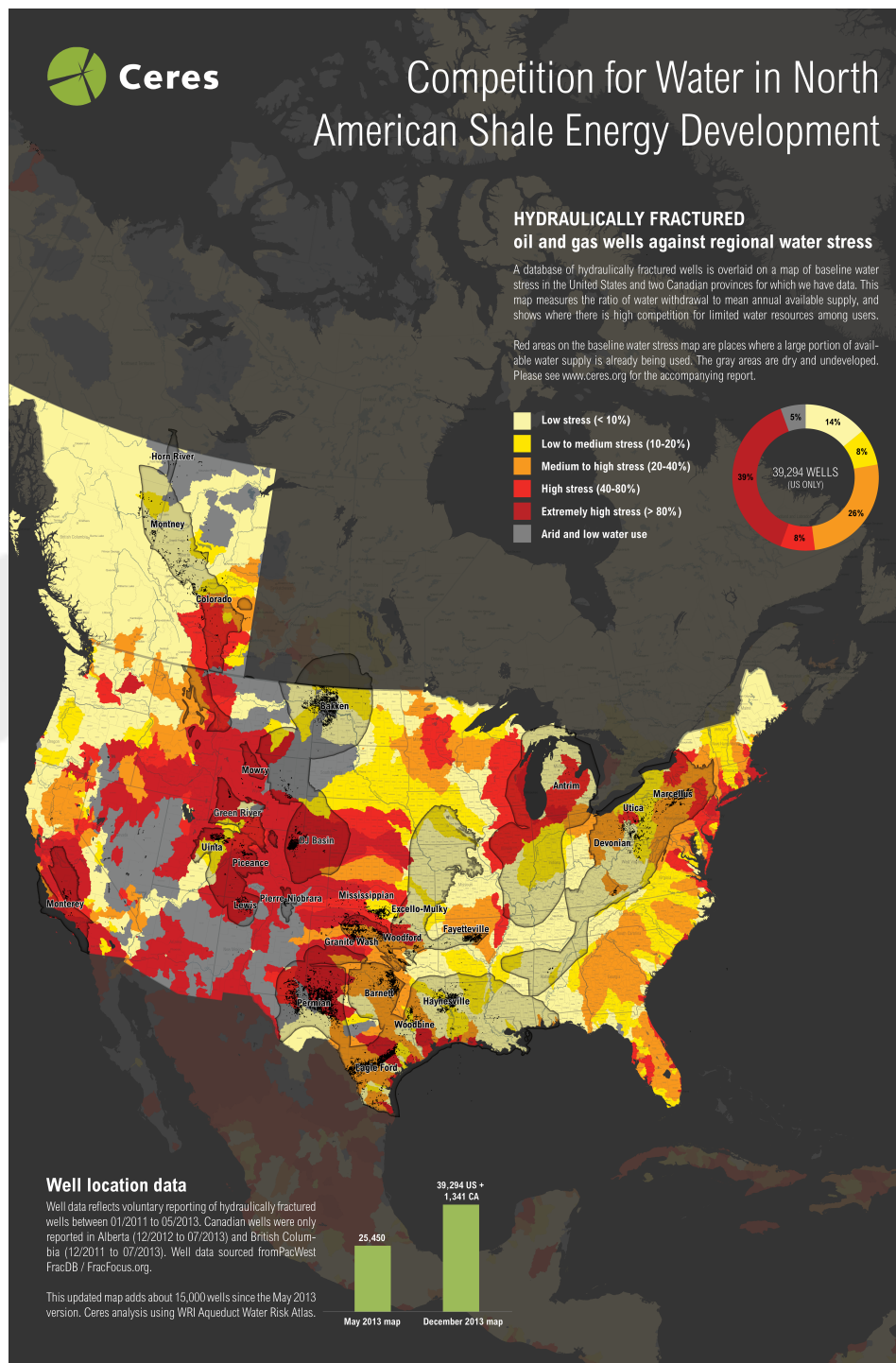


Trends in Water Use for Hydraulic Fracturing

Shareholder, Lender & Operator Guide to Water Sourcing

Monika Freyman, Water Program, Ceres
October 21 2014

www.ceres.org/shalemaps



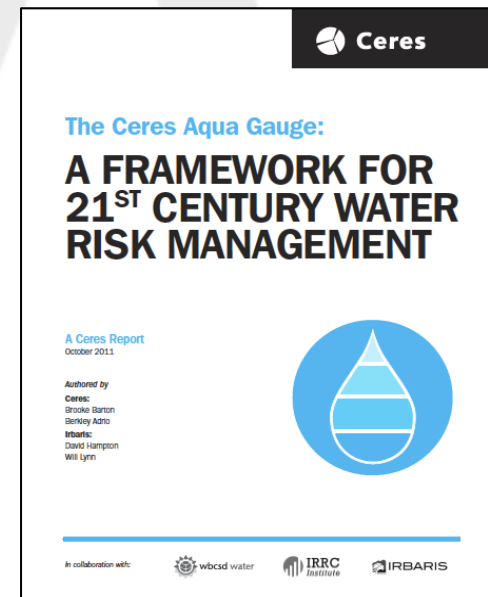
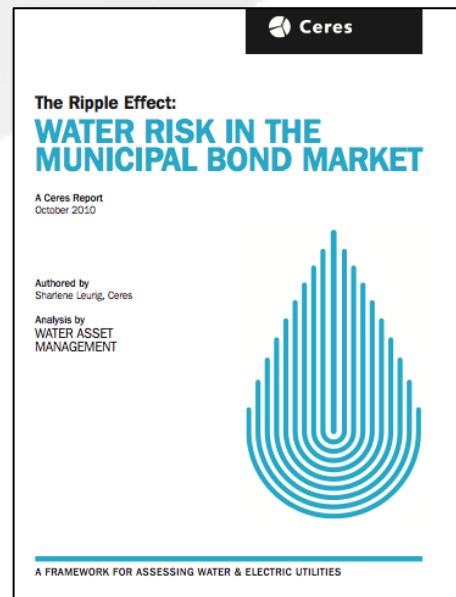
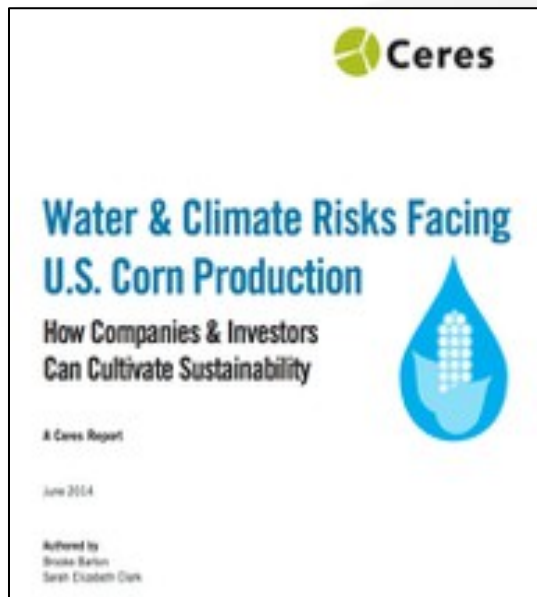


Ceres works with NGO partners, investors and companies to build a thriving and sustainable global economy



Milestones:

- ➔ Catalyzed the corporate **sustainability reporting** movement
- ➔ Introduced **climate and water risk** as key investment considerations
- ➔ **Mitigate water impacts** from company and investor activities and play productive role in **water resource protection**.



<HELP> for explanation.

Screen Printed

XOM US Equity 96) Settings 97) Actions 98) Output 99) Feedback Financial Analysis

Exxon Mobil Corp

Periods 10) Annuals

Currency USD

1) Key Stats	2) I/S	3) B/S	4) C/F	5) Ratios	6) Segments	7) Addl	8) ESG	9) Custom
11) Overview	12) Environmental	13) Social	14) Governance	15) Exec & Dir Comp	16) ESG Ratios	17) Carbon Discl Proj		
In Millions (except Per Share)		FY 2011	FY 2010	FY 2009	FY 2008	FY 2007	FY 2006	
12 Months Ending		2011-12-31	2010-12-31	2009-12-31	2008-12-31	2007-12-31	2006-12-31	
ESG Disclosure Score		58.51	57.26	56.43	53.11	53.11	50.62	
Environmental								
Environmental Disclosure Score		57.02	54.55	52.89	46.28	46.28	41.32	
Total GHG Emissions		143,000.00	140,000.00	139,000.00	n/a	n/a	n/a	
NOx Emissions		140.00	120.00	130.00	150.00	160.00	161.00	
SO2 Emissions		130.00	140.00	160.00	190.00	210.00	236.00	
Total Energy Consumption		430,555.54	408,777.77	405,638.89	416,666.66	430,555.54	433,649.99	
Water Consumption		372,348.24	340,392.00	347,386.99	352,316.01	323,000.00	309,000.00	
Hazardous Waste		190.00	130.00	80.00	40.00	168.00	246.00	
Environmental Fines #		65	83	n/a	n/a	n/a	n/a	
Environmental Fines \$		1.30	11.00	5.10	13.00	3.80	12.80	
Social								
Social Disclosure Score		53.13	53.13	53.13	53.13	53.13	53.13	
Number of Employees		82,100	83,600	80,700	79,900	80,800	82,000	
% Women in Workforce		26.00	26.00	26.00	25.00	25.00	24.00	
% Women in Mat		14.00	14.00	13.00	12.00	12.00	12.00	

Zoom 100%

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
 Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000 Copyright 2013 Bloomberg Finance L.P.
 SN 458588 H454-4109-0 12-Mar-13 15:26:13 EDT GMT-4:00



Shareholder and Lender Concerns

- U.S, and Canada over 40 shareholder resolutions filed with companies primarily requesting greater transparency and data reporting on environmental and social impacts and policies to mitigate risks. Many more backroom conversations.
- U.S. Security and Exchange Commission sent over 70 letters to companies to improve disclosure related to environmental risks related to use of hydraulic fracturing and horizontal drilling technologies.
- Globally one of the most active investor issues with United Nations Principals for Responsible Investors coordinating corporate engagement.
- Transparency and disclosure the biggest investor requests.
- Loss of social license to operate.





Ceres

Well Locations + Water Stress Maps...

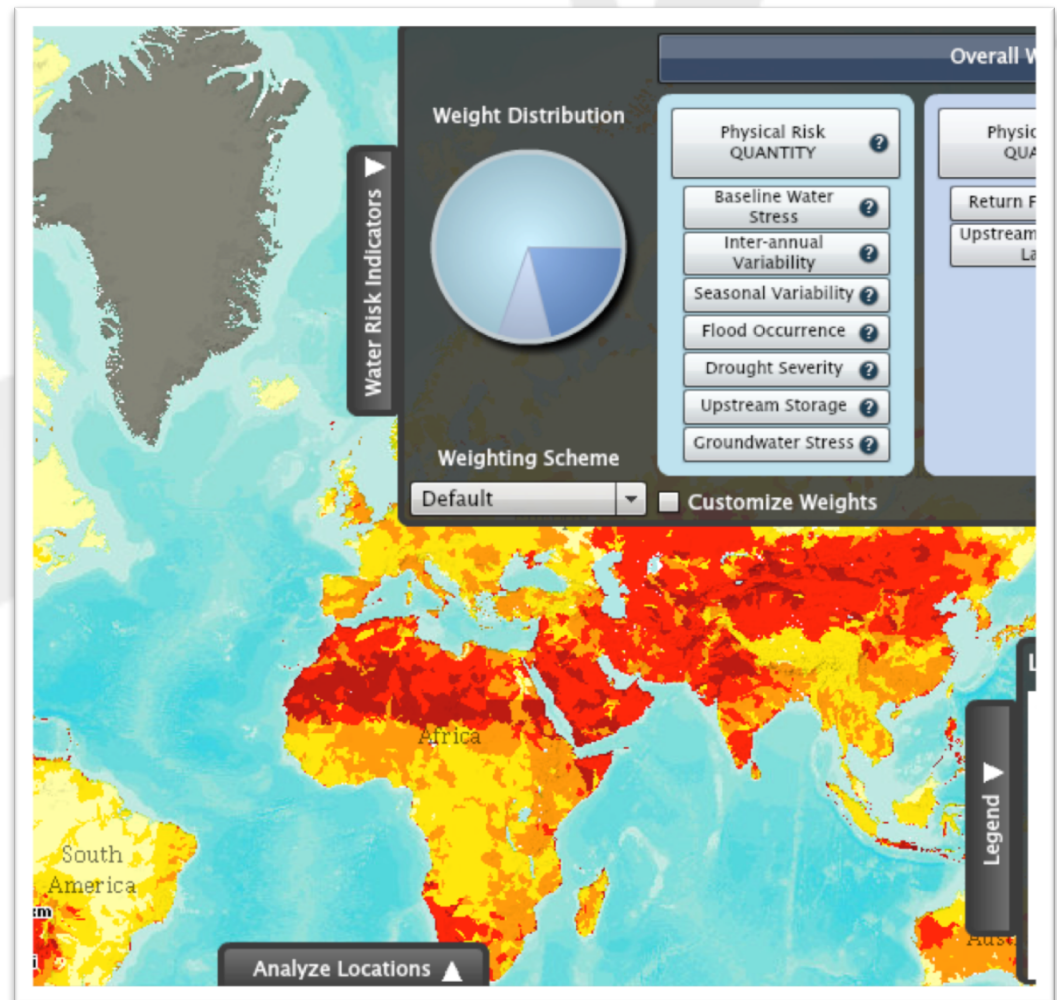


+

WRI Aqueduct
Water Risk Atlas*

+

Drought &
Groundwater Data**



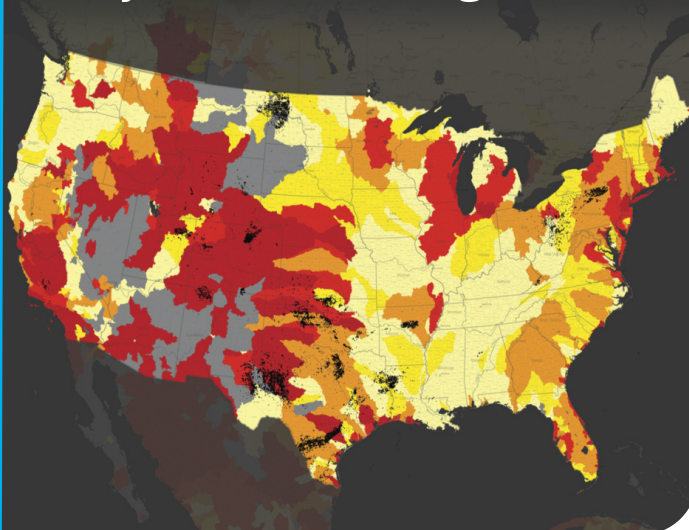
*Francis Gassert, Matt Landis, Matt Luck, Paul Reig and Tien Shiao, "Aqueduct Metadata Document, Aqueduct Global Maps 2.0," World Resources Institute, January 2013.

** Konikow Groundwater Depletion Study USGS Study, Report 2013-5079

United States

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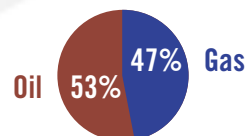
Water Use Trends for Hydraulic Fracturing



OPERATING TRENDS



Type of
Wells
Reported:



Number of Operators Reporting
to FracFocus (1st Quarter 2013)

253

U.S. Data Summary (January 1, 2011 - May 31, 2013) as reported by FracFocus

WATER USE TRENDS

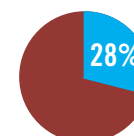
Number of Wells	
Used to Calculate Water Volume Data:	39,294
Total Water Use (gallons):	97.5 billion
Average Water Use (gallons/well):	2.5 million

EXPOSURE TO WATER RISKS

Proportion of Wells in High or Extreme Water Stress:	48%
Proportion of Wells in Medium or Higher Water Stress:	73%
Proportion of Wells in Drought Regions (as of Jan. 7, 2014):	56%

LOCAL WATER USE IMPACTS

Water Use in Top 10 Counties
as Proportion of Water Use Nationally



Number of Counties with Hydraulic Fracturing Activity: **402**

Highest Water Use by a County (gallons):
Dimmit County, Texas **4 billion**

OPERATORS

Top Three in U.S. by Water Use:

- Chesapeake
- EOG
- XTO

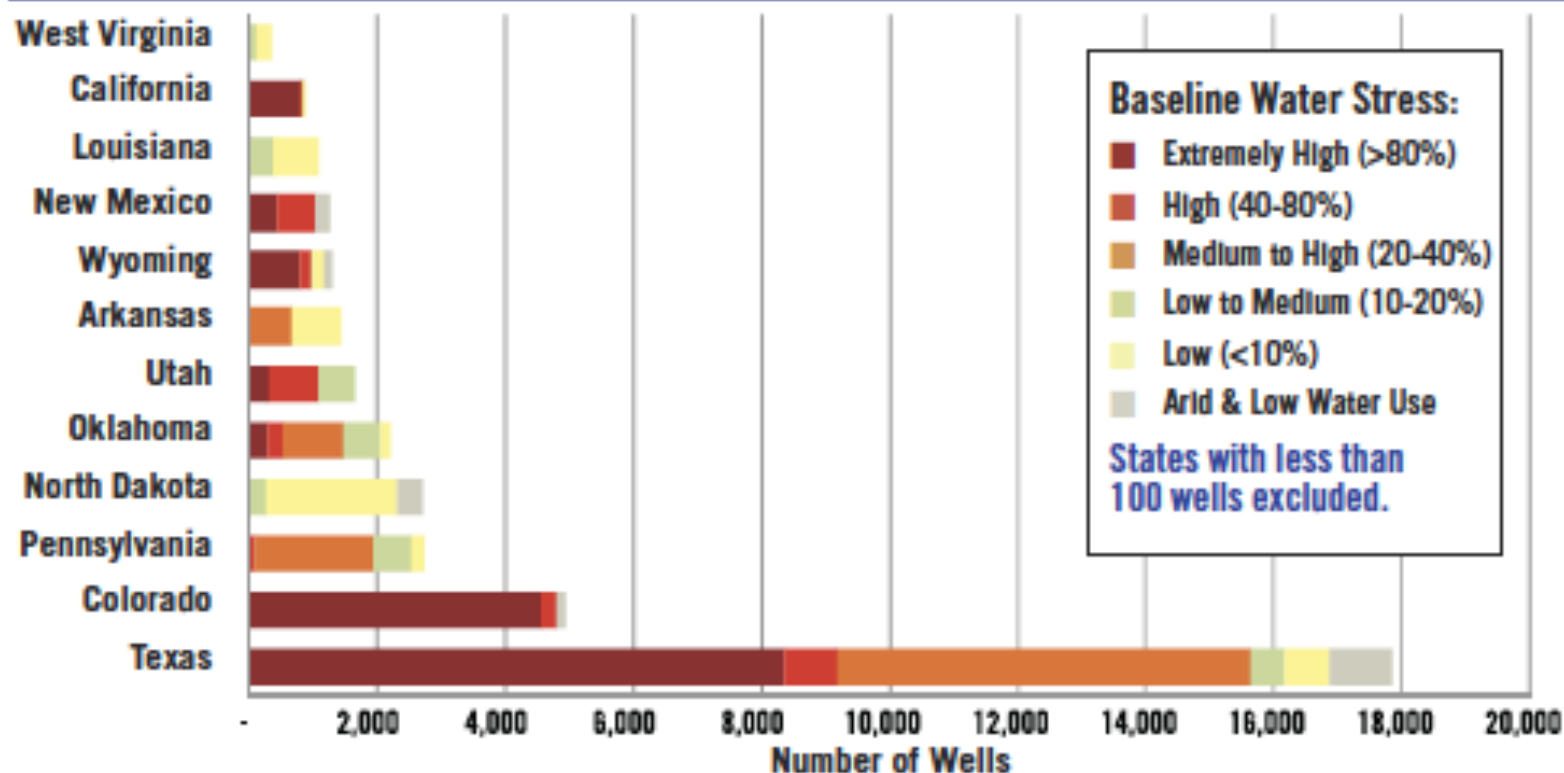
SERVICE PROVIDERS

Top Three in U.S. by Water Use:

- Halliburton
- Schlumberger
- Baker Hughes

State Trends

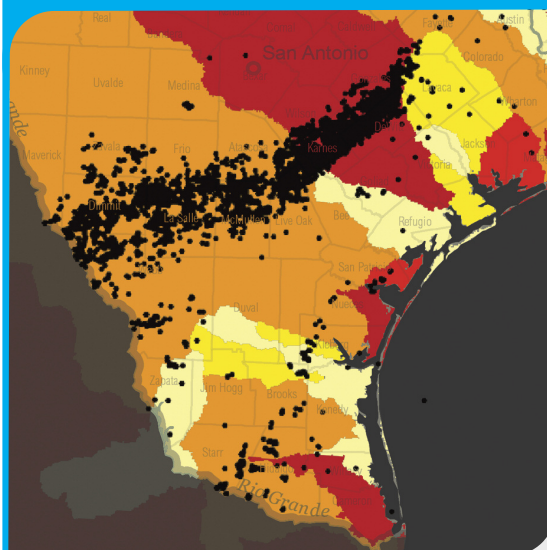
FIGURE 6: STATES WITH MOST REPORTED HYDRAULIC FRACTURING ACTIVITY BY WATER STRESS CATEGORY





REGIONAL CASE STUDIES

Eagle Ford



Eagle Ford Data Summary (January 1, 2011 - May 31, 2013)

WATER USE TRENDS

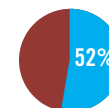
Total Water Use (gallons):	19.2 billion
Average Water Use (gallons/well):	4.5 million

EXPOSURE TO WATER RISKS

Proportion of Wells in High or Extreme Water Stress :	28%
Proportion of Wells in Medium or Higher Water Stress :	98%
Drought Region as of January 7, 2014 (yes or no):	Yes
Groundwater Challenges (yes or no):	Yes

LOCAL WATER USE IMPACTS

Concentration of Water Use: Top Three Water Use Counties as a Proportion of Total Water Use in Play



OPERATING TRENDS

	Total Wells Reported:	Gas
		Oil
		1,516
		2,795

Number of Operators in Region:

68

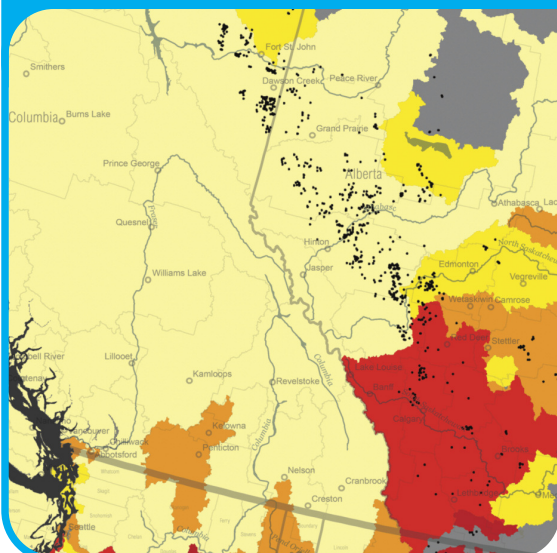
OPERATORS
Top Three by Water Use

- Chesapeake
- Anadarko
- EOG

SERVICE PROVIDERS
Top Three by Water Use

- Halliburton
- Schlumberger
- C&J

Alberta



Alberta Data Summary (January 1, 2011 - May 31, 2013)

EXPOSURE TO WATER RISKS

Proportion of Wells in High or Extreme Water Stress :	14%
Proportion of Wells in Medium or Higher Water Stress :	20%

OPERATING TRENDS

Number of Operators in Region:

88

OPERATORS
Top Three by Wells Reported

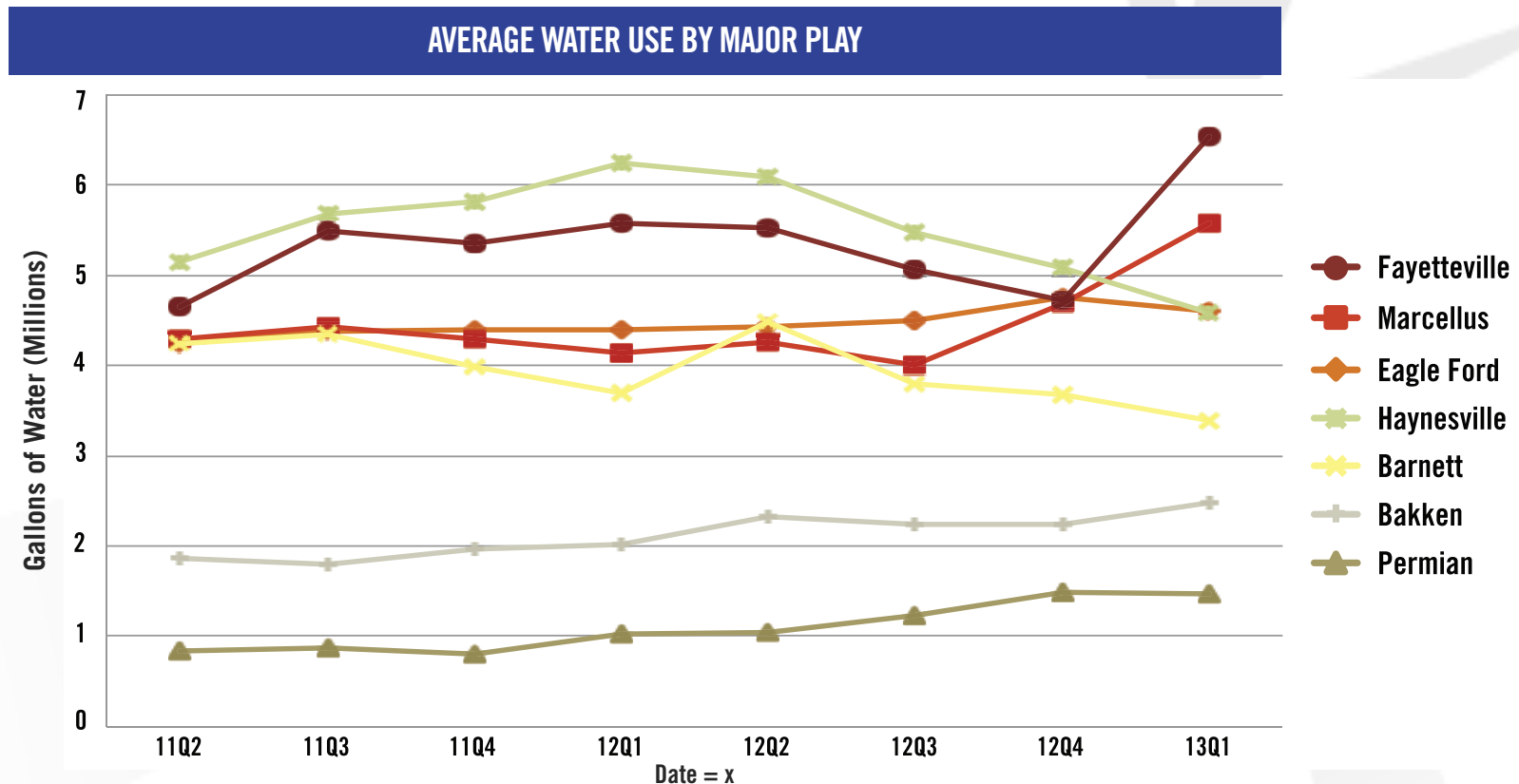
- Encana
- Apache
- Peyto

SERVICE PROVIDERS
Top Three by Wells Reported

Not available



Average Water Use by Play/Basin



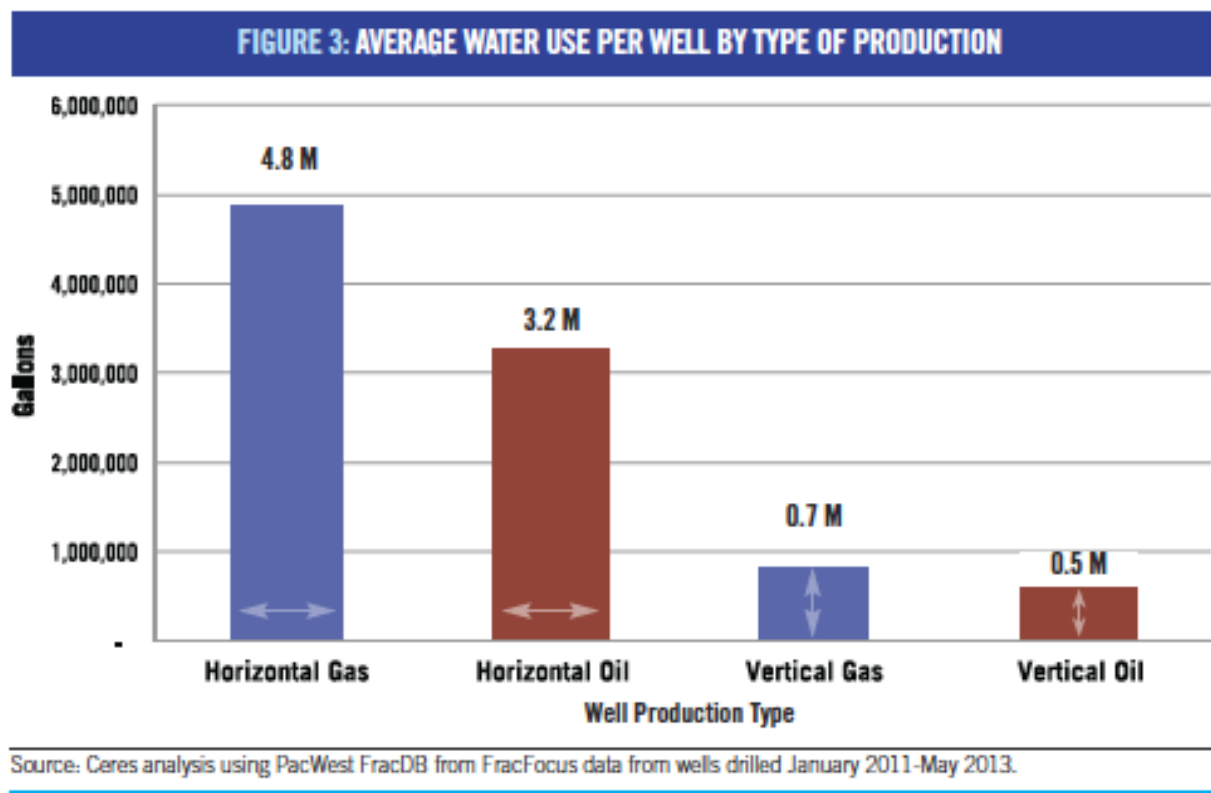
Average water use for major plays/basins from the first quarter of 2011 to end of the first quarter of 2013. Average water use can increase due to technical or geologic factors, movement from vertical to horizontal drilling or increasing length of pipes used in horizontal drilling.

Source: Ceres analysis using PacWest FracDB from FracFocus.org.

www.ceres.org/shalemaps

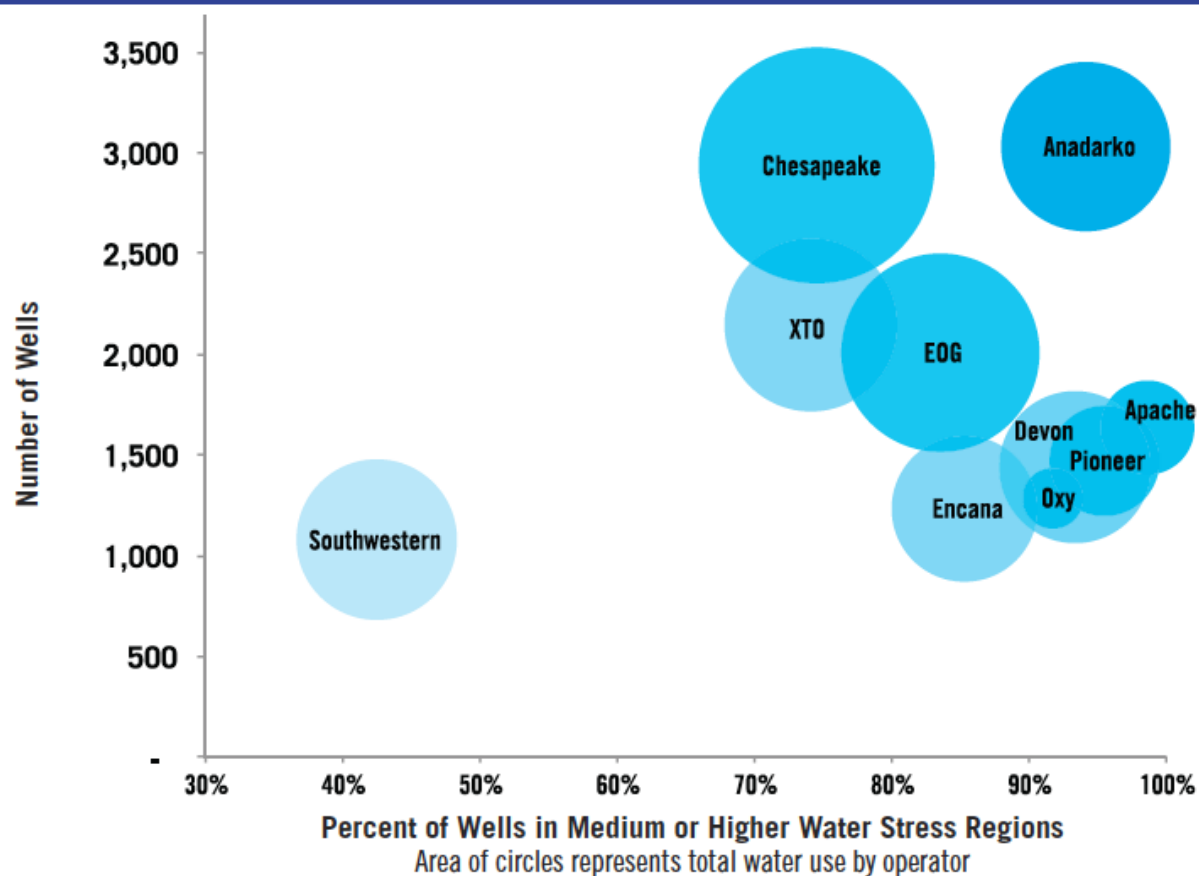


Average Water Use per Well



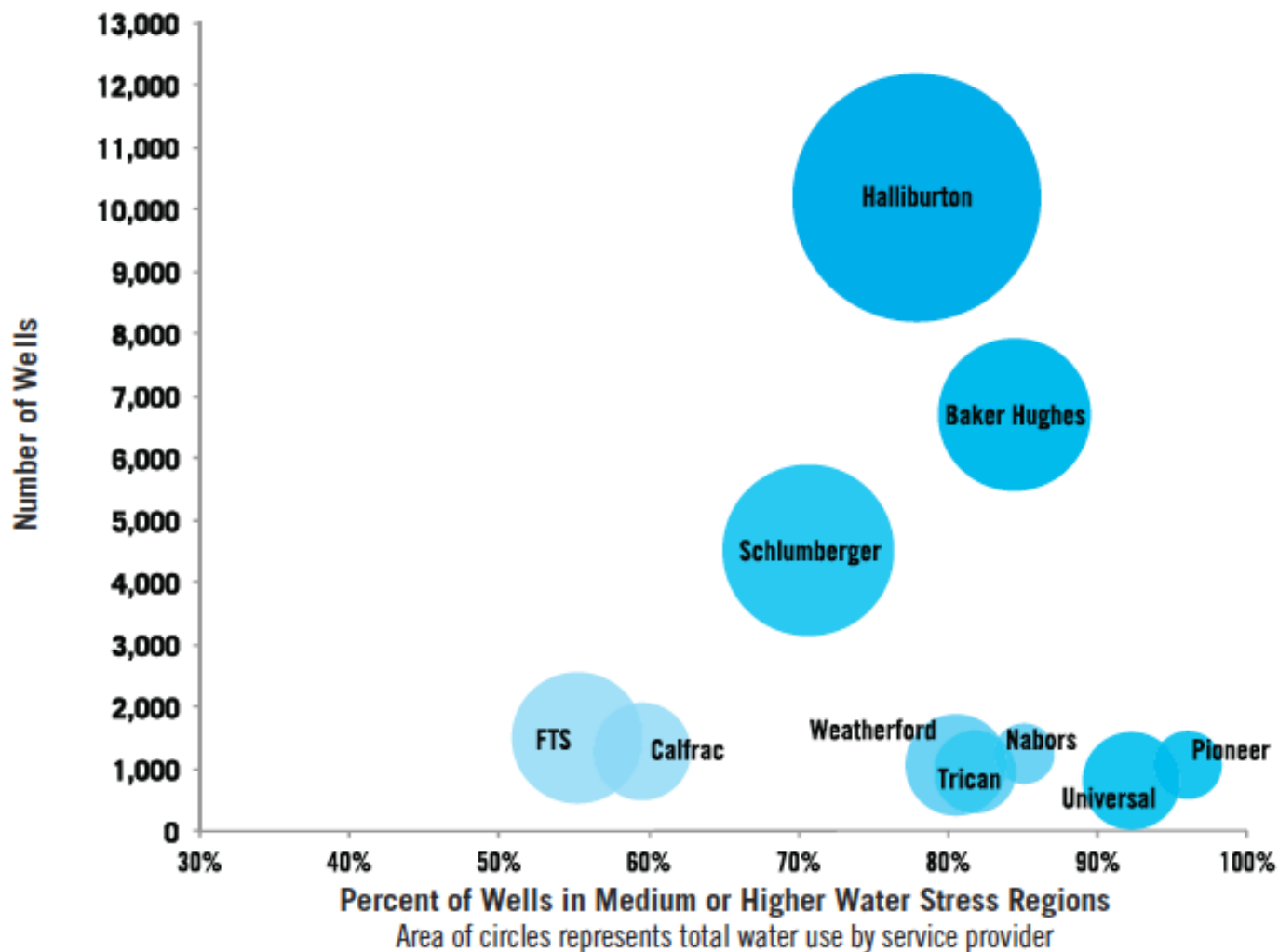
Corporate Exposure: Operators

FIGURE ES4: TOP TEN OPERATORS BY NUMBER OF WELLS & EXPOSURE TO WATER STRESS



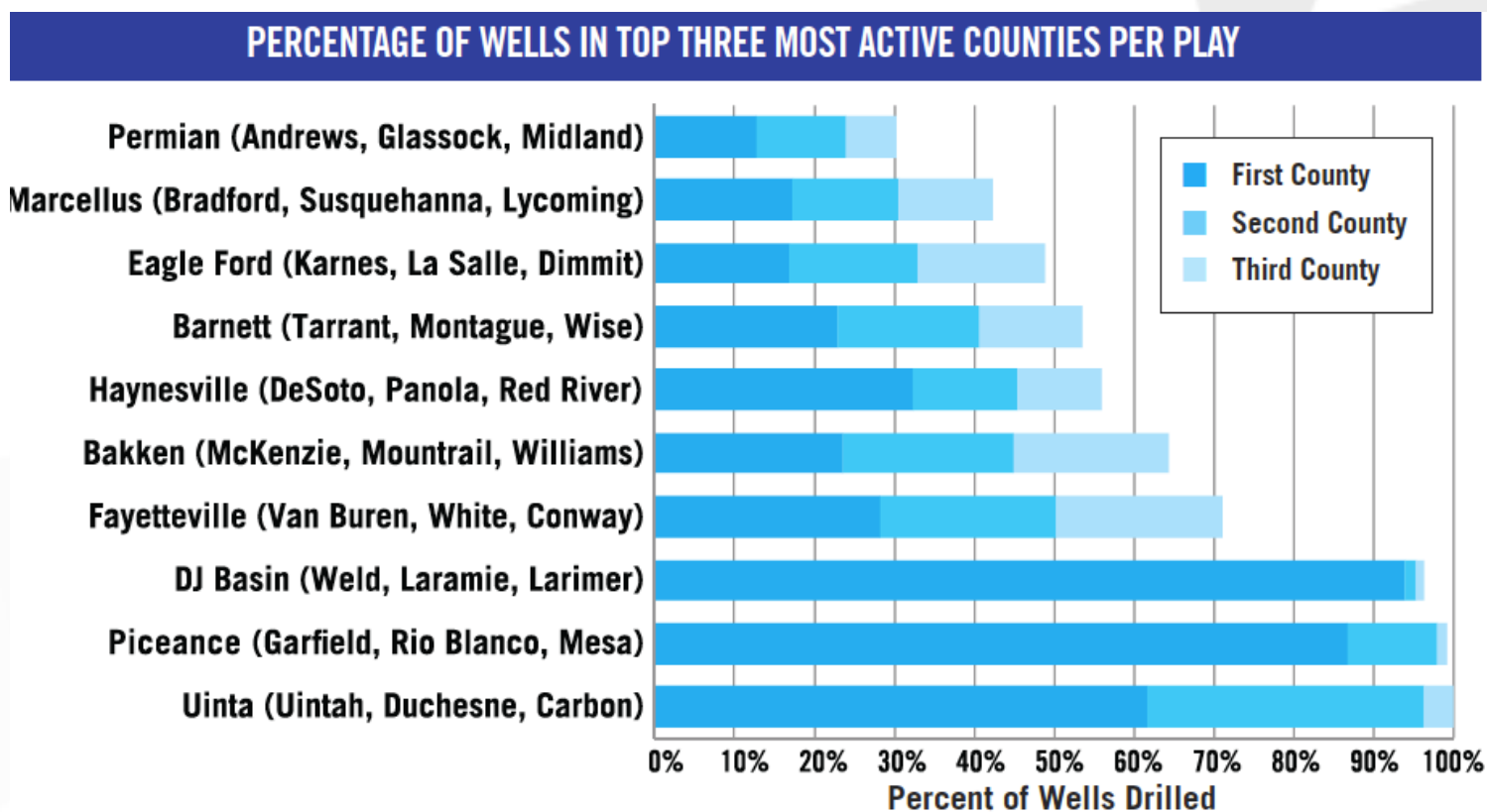
Corporate Exposure: Service Providers

FIGURE ES5: TOP TEN SERVICE PROVIDERS BY WATER USE & WATER STRESS CATEGORY





Development and Water Use Very Localized



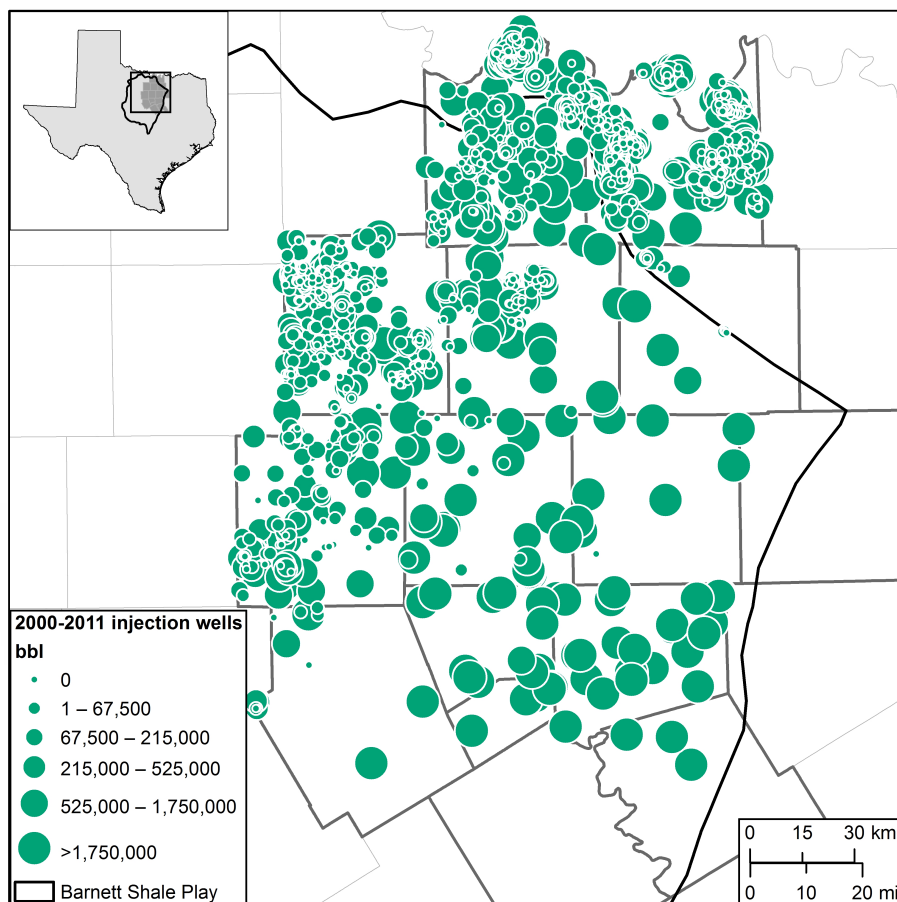
Proportion of wells developed in top three counties by activity versus all wells developed for entire play/basin.

www.ceres.org/shalemaps



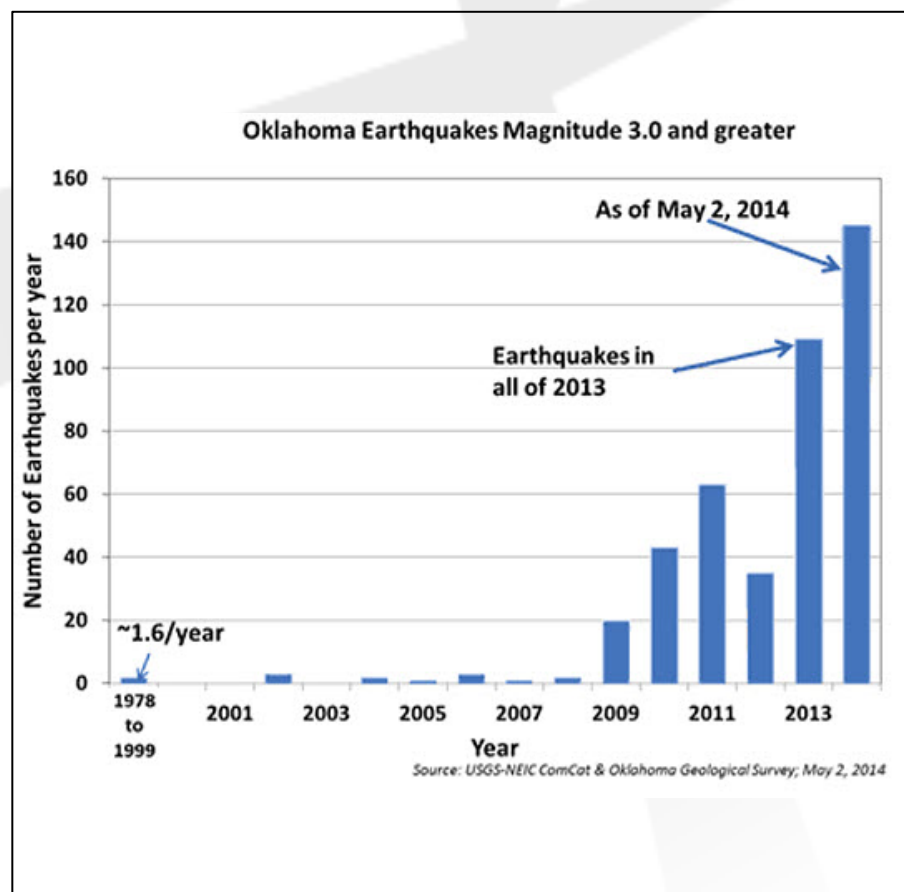
Wastewater Management and Disposal Wells

Barnett Disposal Volumes



Source: Jean-Philippe Nicot, Bridget R. Scanlon, Robert C. Reedy, and Ruth A. Costley, Source and Fate of Hydraulic Fracturing Water in the Barnett Shale: A Historical Perspective, S38 (Nov. 29, 2013).

Earthquakes and Disposal Wells

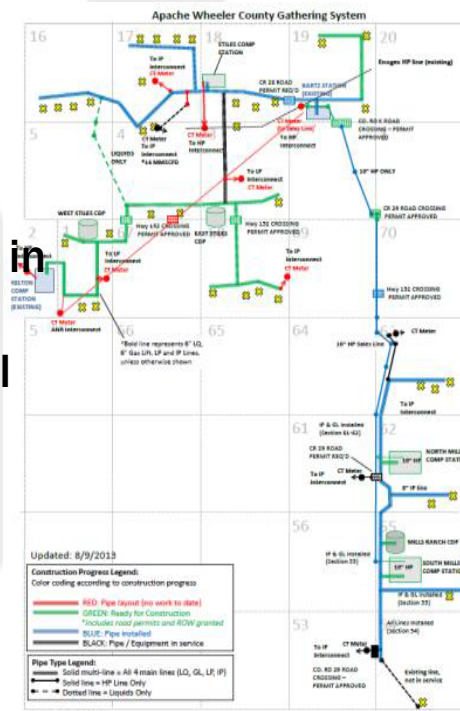


Source: USGS Advisory http://www.usgs.gov/newsroom/article.asp?ID=3880#.U_aAEvMqUs

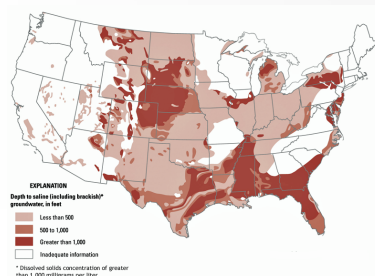


Water Sourcing and Governance

- **Transparency** in current **AND FUTURE** regional water requirements in context of local needs (amounts and sources)
- **Transparency** in current **AND FUTURE** regional wastewater disposal requirements (amounts and fate)
- **Proactive** stakeholder engagement
- **Recycling and beneficial reuse** – careful management
- **Better Groundwater** management
- **Brackish** groundwater use risks
- Stakeholder issues **consult versus consent**
- Wastewater management and deep well injection issues.
- **Water Allocation and Better Management:** groundwater, surface water, cumulative impacts, population growth, climate change.

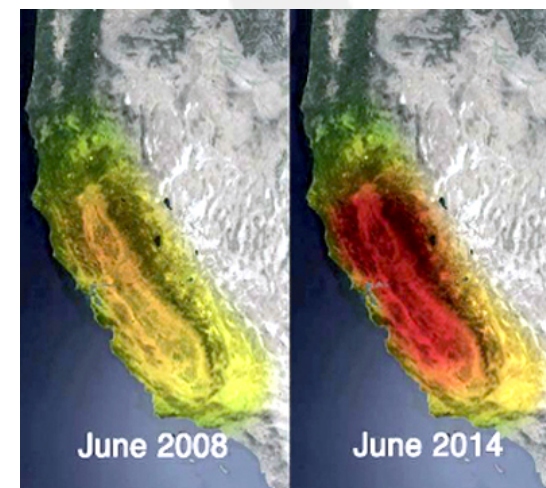


Apache's Water Network



Ground water change in California, Nasa's GRACE

USGS National Brackish Groundwater Assessment





Thank you

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