State of Oklahoma
OWRB
WATER RESOURCES BOARD
the water agency

Fracking and Oil & Gas Water Permitting in Oklahoma

Present Situation and Future Estimates

Quick History: Fracking in Oklahoma

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- 1949 first hydrologic fracturing by Haliburton in Stephens County, OK
- In the 1950's fracking reached 3000 wells/mo in the US
- By 2008 there were 50,000 treatment stages worldwide completed, mostly in US
- Horizontal drilling + fracking = "Shale Gale"
- In Woodford Shale in OK in 2004 only 24 gas wells, by 2008 there were 750 gas wells

Present Regulatory Framework

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Water Quality & Pollution:

- Corporation Commission oversees drilling activities, pit construction & injection wells
  - Surface casing to 50 ft below the base of treatable water with cementing to the surface
  - Pits with capacities to 50,000 barrels
  - Special construction & operating rules near protected wellheads (municipal water supply)
  - Prohibition against any pollution to ground or surface water

Present Regulatory Framework

- Dept. of Environmental Quality oversees discharge permits and sets drinking water standards including wellhead protection areas for public water supply.

Present Regulatory Framework

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Water Quantity

- Water Resources Board oversees Water Rights & water use permitting for both groundwater & surface water

1. Groundwater permits are indefinite & based on property & underlying aquifer yield
2. Surface Water permits are on a seven year use it or lose it basis and allocation based on justification of use & availability

Water Use Permitting

Long-Term Permits

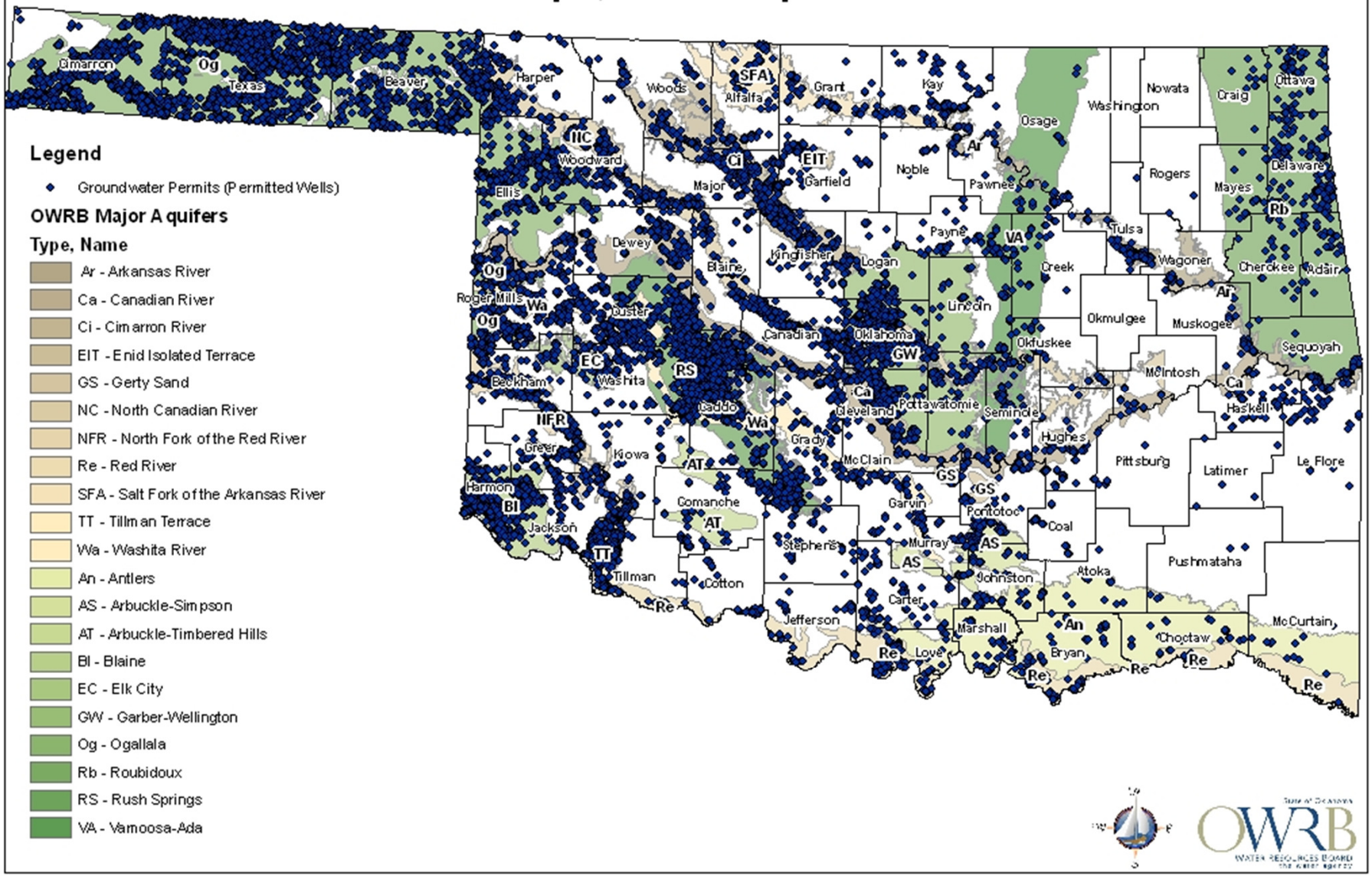
- Groundwater:

1. 10,550 active permits
2. 611 contain mining for oil & gas (by SIC Code)
3. 2010 Reported Use for oil & gas was 1514 AF

- Surface Water:

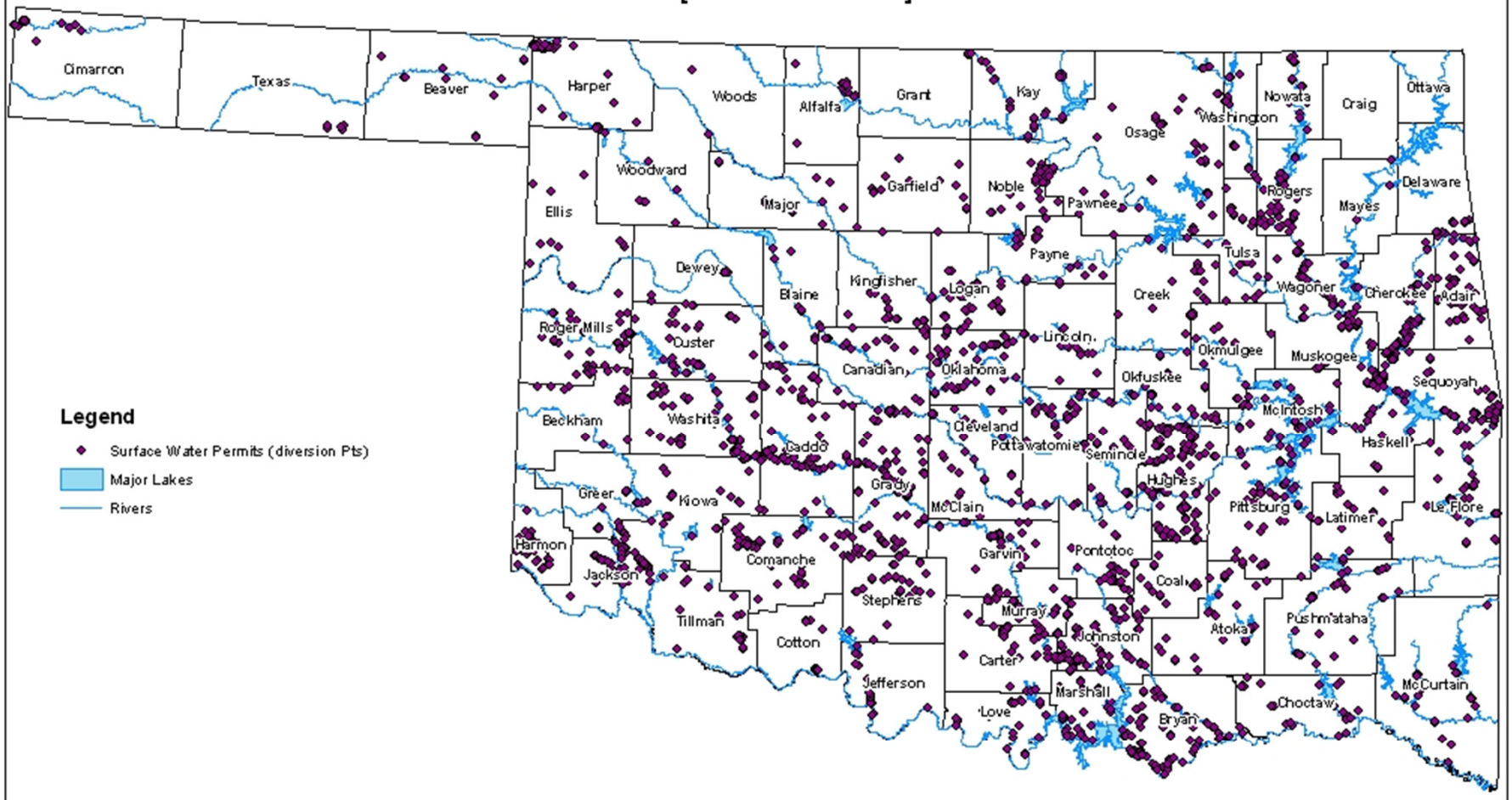
1. 1,961 active permits
2. 30 contain mining for oil & gas (by SIC Code)
3. 2010 Reported Use for oil & gas was 97 AF

All Long-term Groundwater Permit Locations
With Major Aquifers
[10,550 Permits]



Created by: RH Wicker
Date: 10/10/2011

All Long-term Surface Water Permit Locations
With Major Rivers & Lakes
[1961 Permits]



Legend

- Surface Water Permits (diversion Pts)
- Major Lakes
- Rivers

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0 50 100 Miles

Water Use Permitting

<u>90-Day Provisional Temporary Permits</u> provide the bulk of oil & gas mining permits

- One year total is 15,598 AF (9/2010 – 9/2011)
- Both surface & groundwater permits handled the same way
- Can be obtained same day
- Double price for “Post-use” (the only penalty)
- Requires landowner right-of-access permission
- SW 90-Day PTs can be cancelled if they interfere with domestic riparian use

Water Use Permitting

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90-Day Provisional Temporary Mining Permits					
	2008	2009	2010	2011*	9/1/10 – 9/13/11
Groundwater	462	150	295	455	521
Surface Water	1530	723	988	988	1349
Total	1992	873	1283	1443	1870
* Jan 1, 2011 to Oct 6, 2011					

Water Use Permitting

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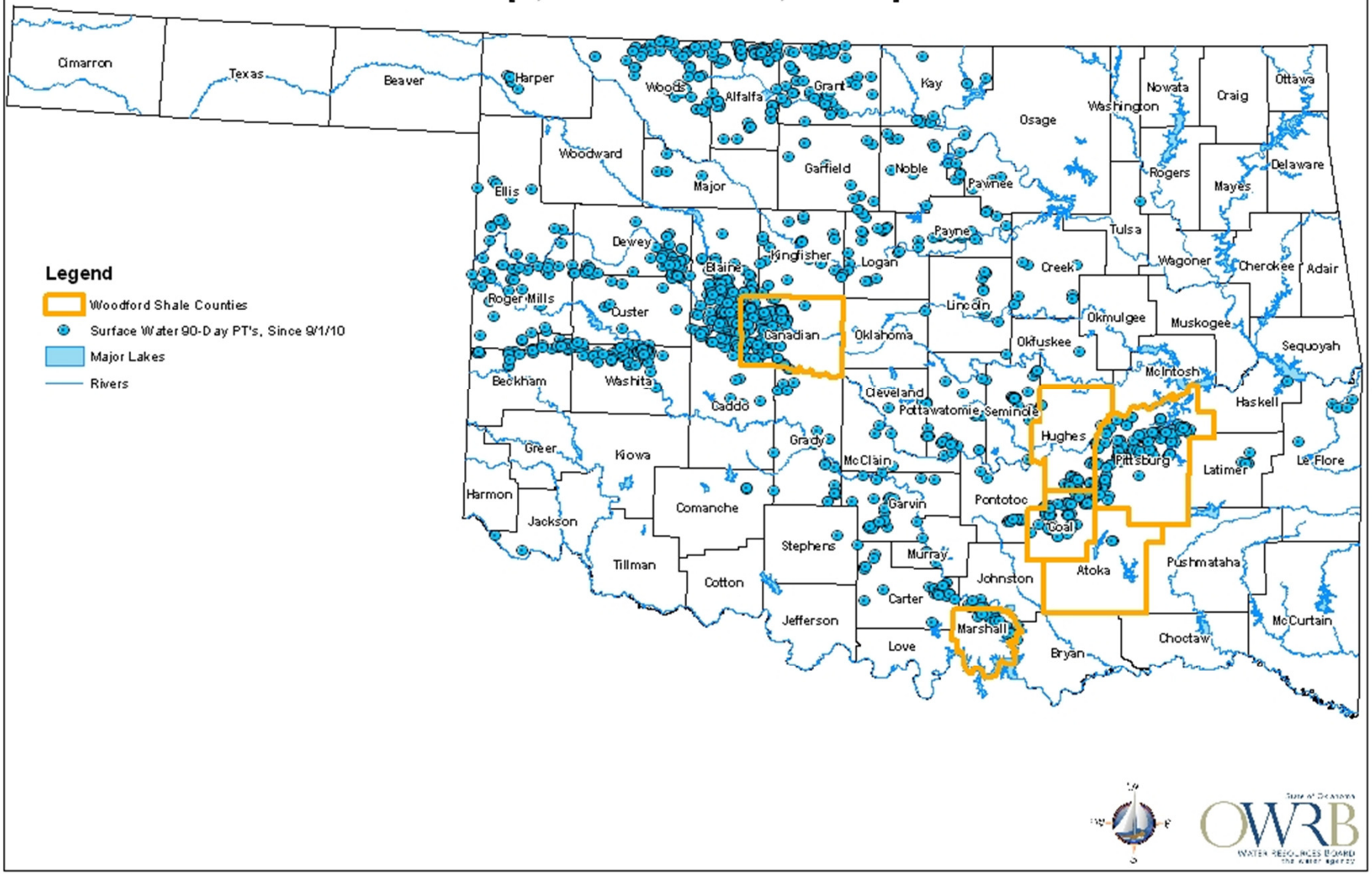
90-Day Permits Used for Fracking *				
	2008	2009	2010	2011 (YTD)
Groundwater:				
Number of wells	35	35	62	83
Amt. of water requested (AF)	750	934	1,289	2,338
Average amt. per permit	21.4	26.7	20.8	28.2
Surface Water:				
Number of diversions	167	150	226	312
Amt. of water requested (AF)	4,290	4,156	5,833	6,646
Average amt. per permit	25.7	27.7	25.8	21.3
* Permits with requested water amount greater or equal to 9 AF				

Water Use Permitting

Problems with 90-Day PTs:

1. Penalty fees are not high enough
2. Requires monitoring of spuding records to verify compliance – time consuming
3. Amount of water requested is often not the amount of water actually pumped & used
4. We probably only permit ½ to 1/3 of the actual amount used

Surface Water 90-Day Provisional Temporary Permits
Since 9/1/2010
[1,349 Permits - 11,519 AF]



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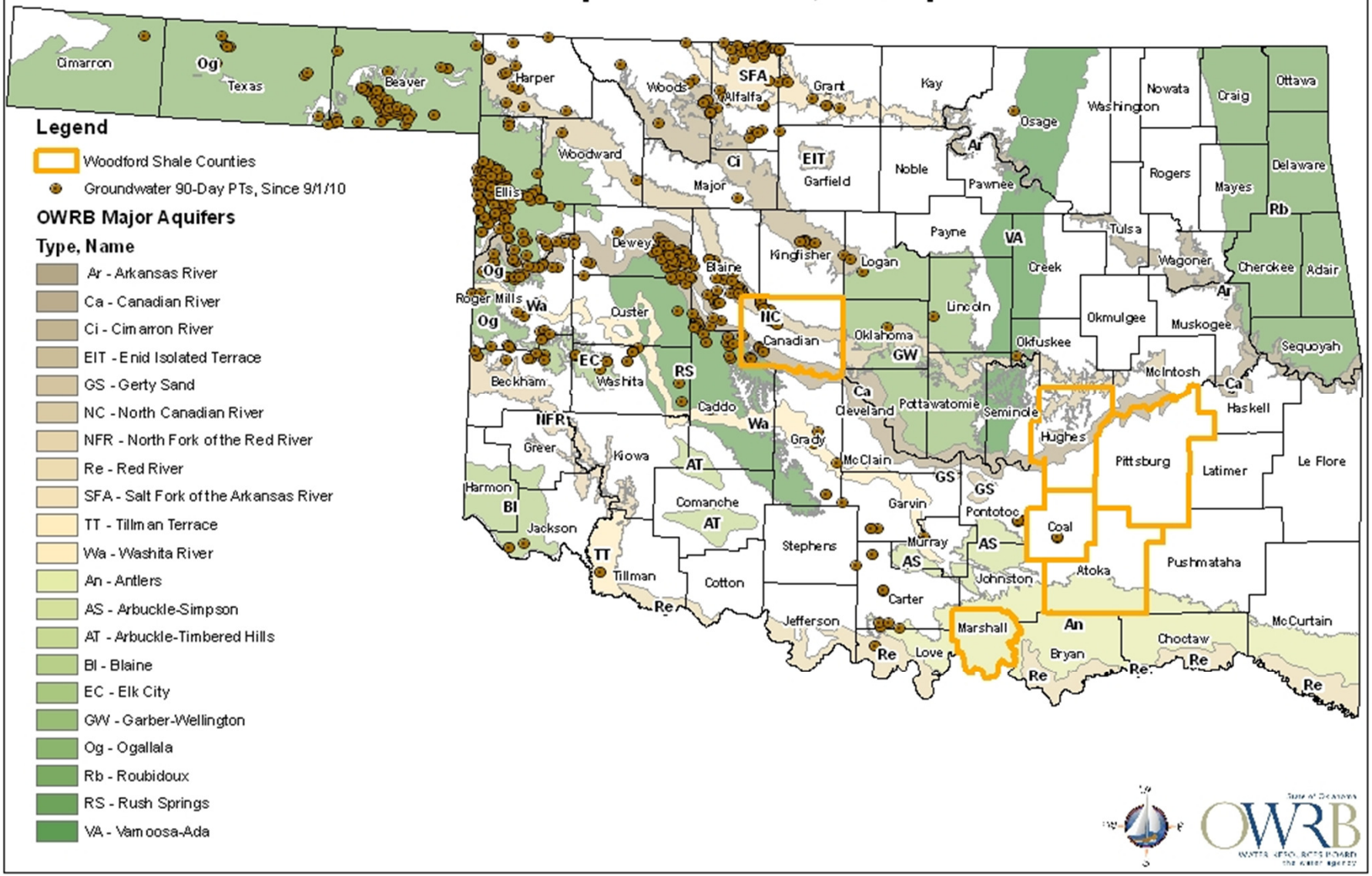
Date: 10/10/2011

Groundwater 90-Day Provisional Temporary Permits
Issued Since 9/1/2010
[521 Permits - 4,079 AF]



Created by: RH Wicker
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0 50 100 Miles

The Perfect Storm

- Oklahoma in historic drought since 9/2010
- 1st driest for last 365 days in Panhandle, West Central, Central & Southwest; 2nd driest in North Central & South Central
- July was the hottest month on record for any state since records began
- Oil & gas drilling continues to ramp up in the same areas as the drought

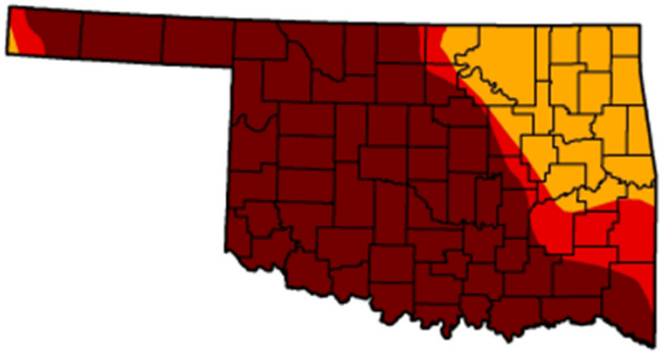
U.S. Drought Monitor

Oklahoma

October 4, 2011
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	100.00	78.97	69.67
Last Week (09/27/2011 map)	0.00	100.00	100.00	100.00	78.97	66.42
3 Months Ago (07/05/2011 map)	0.00	100.00	93.77	60.75	44.18	32.78
Start of Calendar Year (12/28/2010 map)	13.82	86.18	47.90	1.50	0.00	0.00
Start of Water Year (09/27/2011 map)	0.00	100.00	100.00	100.00	78.97	66.42
One Year Ago (09/28/2010 map)	66.28	33.72	4.21	0.00	0.00	0.00



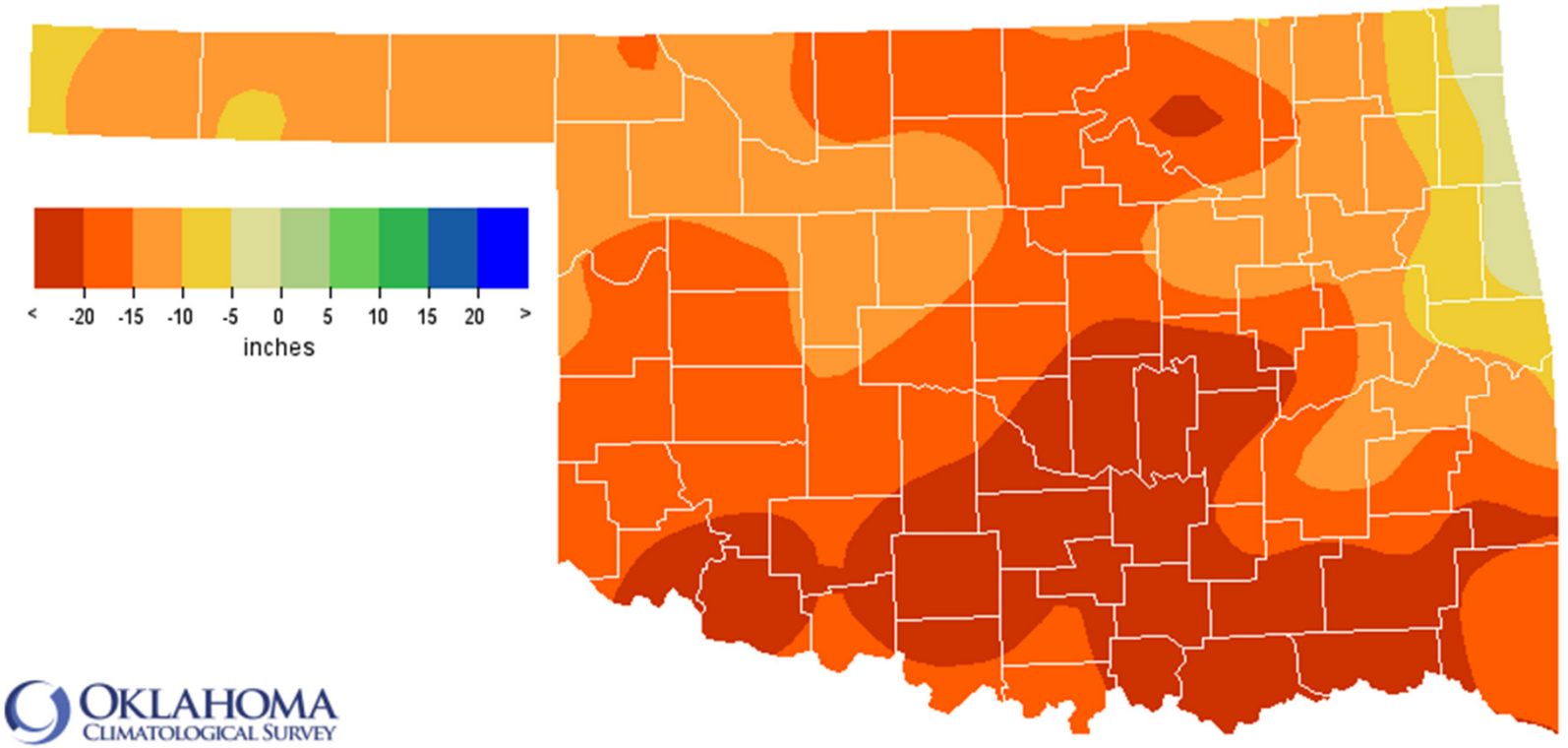
Intensity:

- 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://droughtmonitor.unl.edu

Released Thursday, October 6, 2011
Rich Tinker, Climate Prediction Center/NOAA



OKLAHOMA CLIMATOLOGICAL SURVEY

Departure from Normal Rainfall

Water Year

Oct 1, 2010 through Oct 5, 2011

Planning for the Future

- The next 50 years: Oklahoma Comprehensive Water Plan, 2012 Update
- Includes many study group reports including marginal water quality, artificial recharge, instream flows & climate change
- Demand & supply estimates from 2008 to 2060
- The plan took 5 years to prepare & is set to be approved at the October Board Meeting

Planning for the Future

Oil & Gas Drilling Present:

- In 2008 total drilling used 29,107 AF
- Estimated 2010 total drilling was 42,107 AF which is 2% of the total state water demand
- Data from industry & other agencies included, for greater accuracy (OIPA, OCC, BIA (for Osage Co.) and Mid-Continental Oil & Gas Asso.)
- Drilling divided into Conventional, horizontal, and Woodford Shale

Planning for the Future

Estimated Present & Future Water Use for Oil & Gas Drilling by Drilling Type (AF/Y)					
Drilling Type	2008	2010	2020	2030	2060
Conventional	11,200	15,700	21,500	28,200	53,600
Horizontal	3,200	5,100	11,800	20,800	61,500
Woodford Shale	14,700	21,300	41,100	29,200	420
Total All Drilling	29,100	42,100	74,400	78,200	115,600
% of Total State Demand		2%			5%
From the *Oklahoma Comprehensive Water Plan, 2012 Update, Water Demand Forecast Report*, CDM, 3/2011, pg 4-14					

Oklahoma Comprehensive Water Plan
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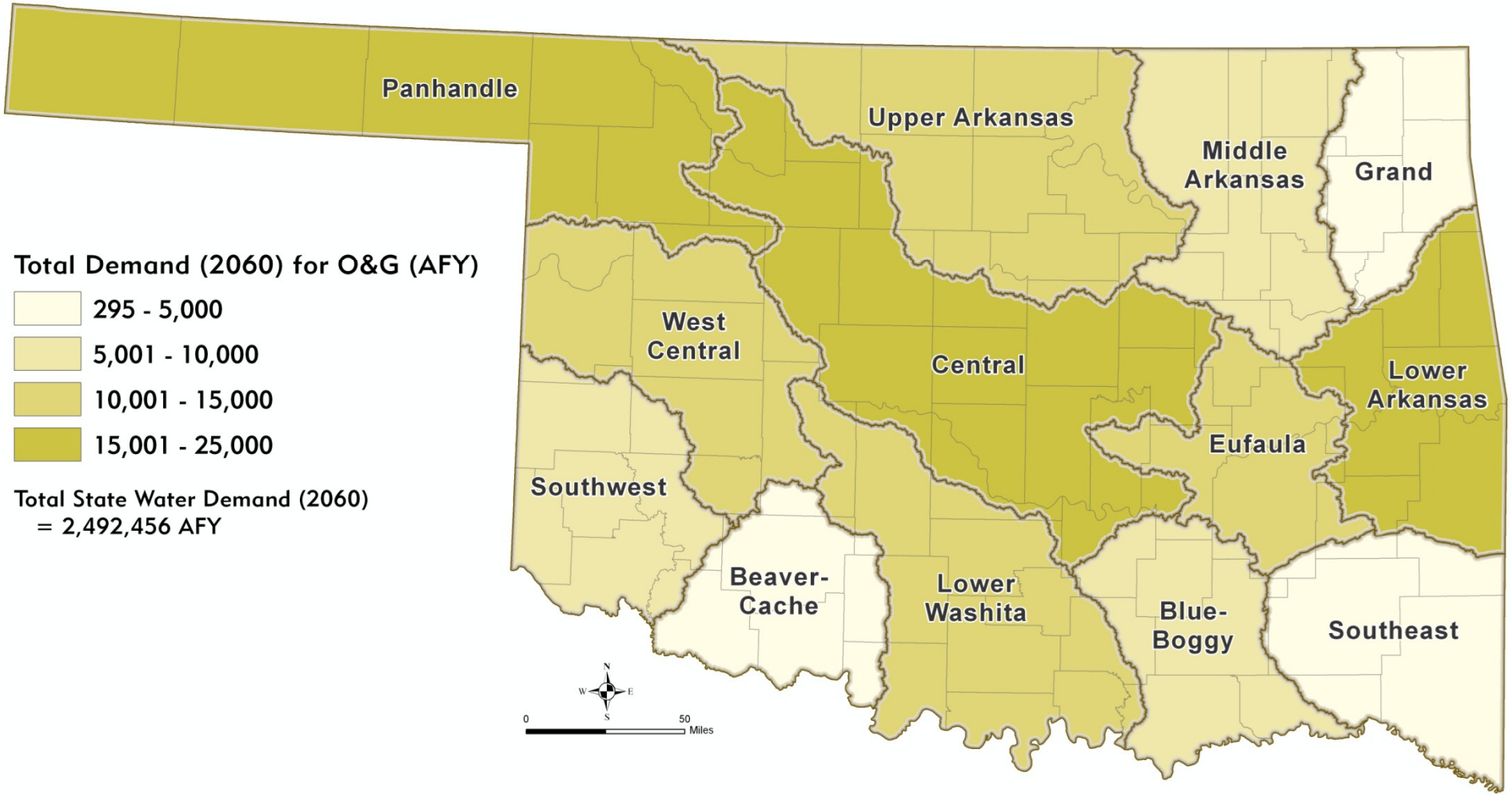
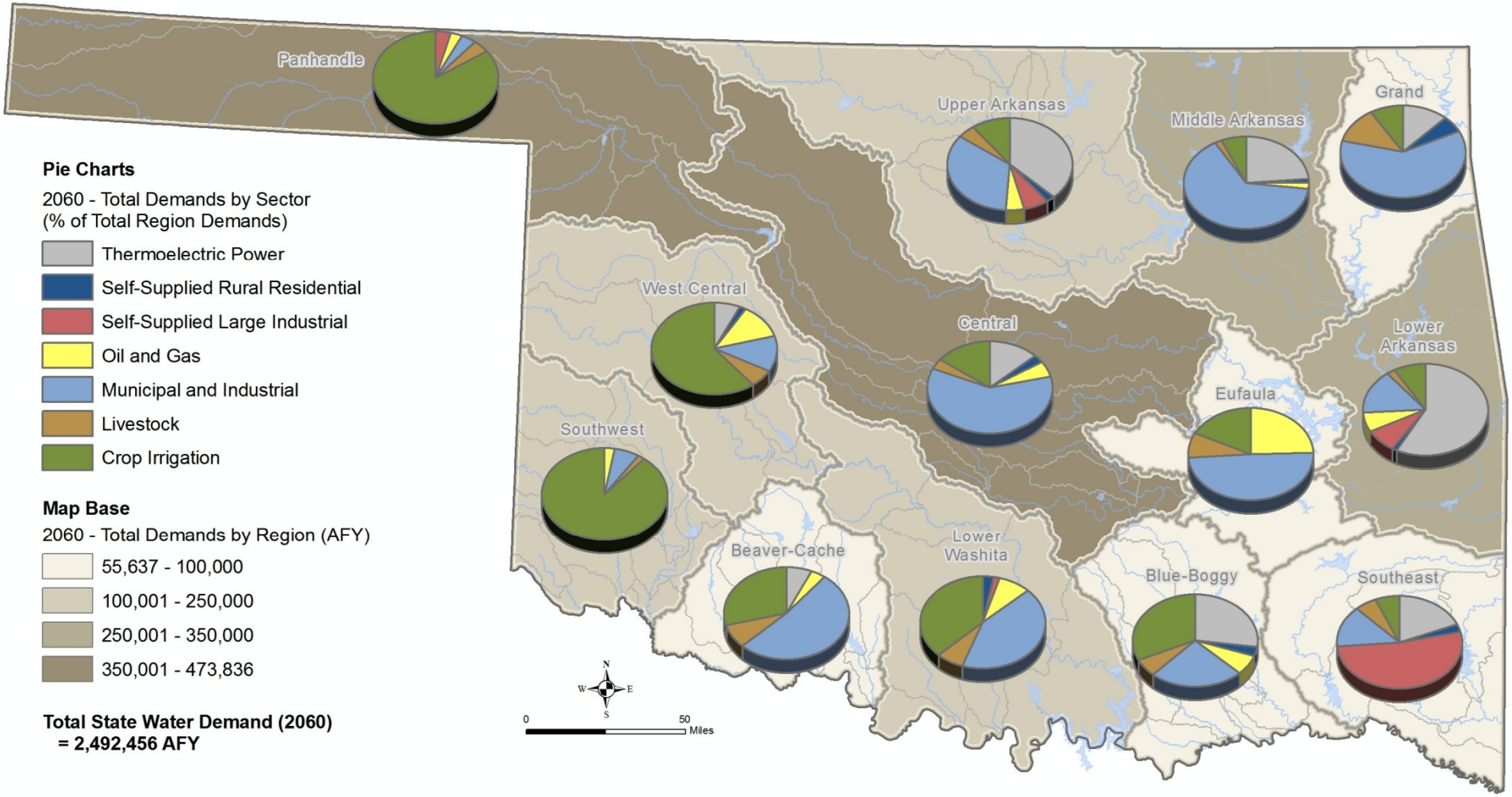
2060 Oil & Gas Water Demand



Oklahoma Comprehensive Water Plan 2012 Update, Executive Report, Sept, 2011, pg 66

2060 Total Regional Water Demand & Water Sector Demand Distribution



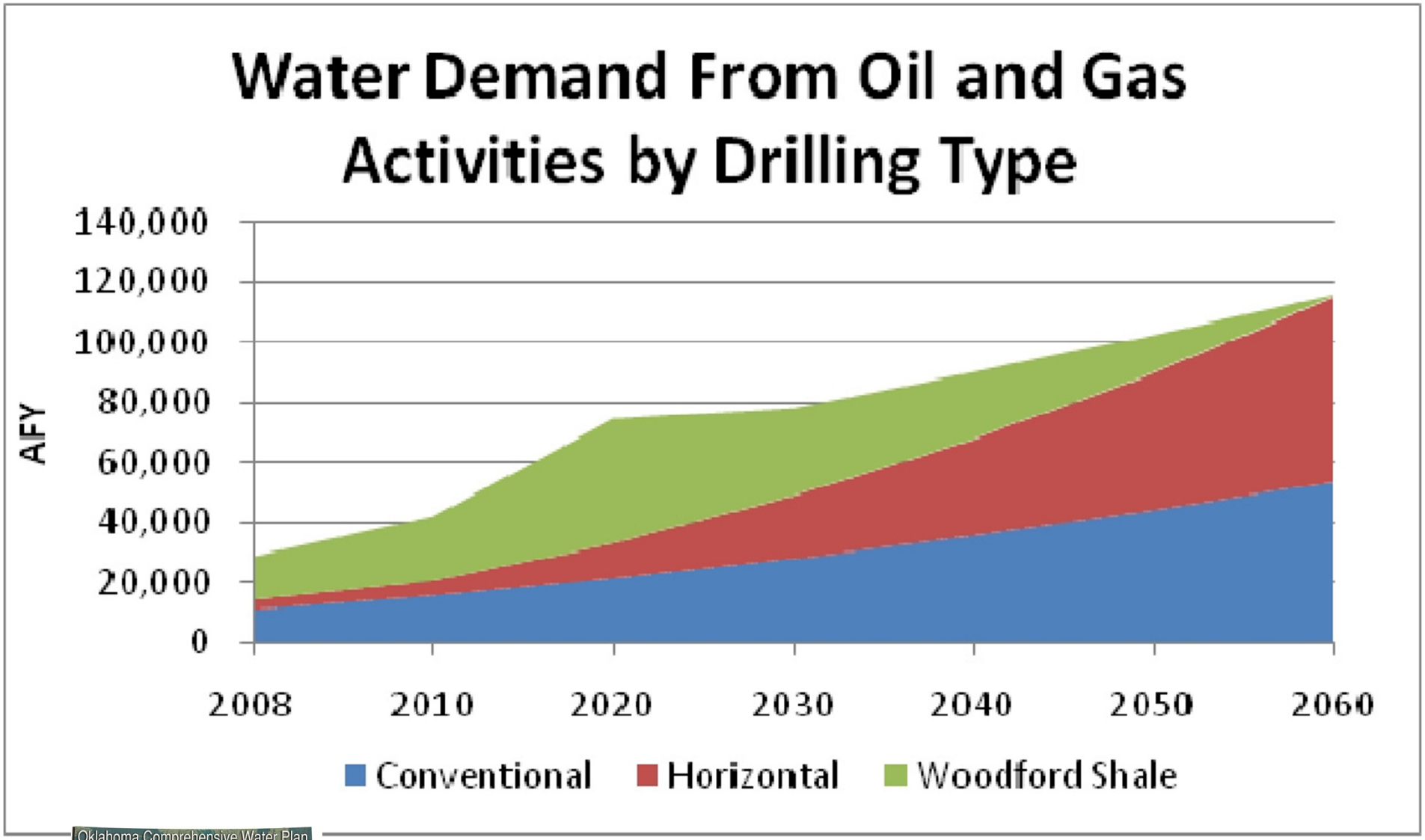


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Figure 7 - Water Demands from Oil and Gas Activities by Drilling Type

Planning for the future

Estimates of Water Use per Well by Drilling Type (AF)				
Operation		Conventional	Horizontal	Woodford Shale
Drilling & Cementing	< 12,000 ft	1	1.5	1
	>12,000 ft	2.7	3	2.7
Completion		3.2	10	19.3
Total		4.3 – 5.9	12 - 13	20 - 22
From *Oklahoma Comprehensive Water Plan 2012 Update, Water Demand Forecast Report*, CDM, March, 2011				

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Conclusions

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- Oil & Gas Drilling (incl. fracking) will increase in Oklahoma by 300% over the next 50 years
- We need better mechanisms to identify drilling sites & how much water is used
- We need more regulatory hammers with greater penalties for non-compliance
- We have successfully navigated through the “Perfect Storm”, but it may get worse