Oklahoma Governor's Water Conference – Oct 31, 2017
Water Management in Oklahoma Oil and Gas

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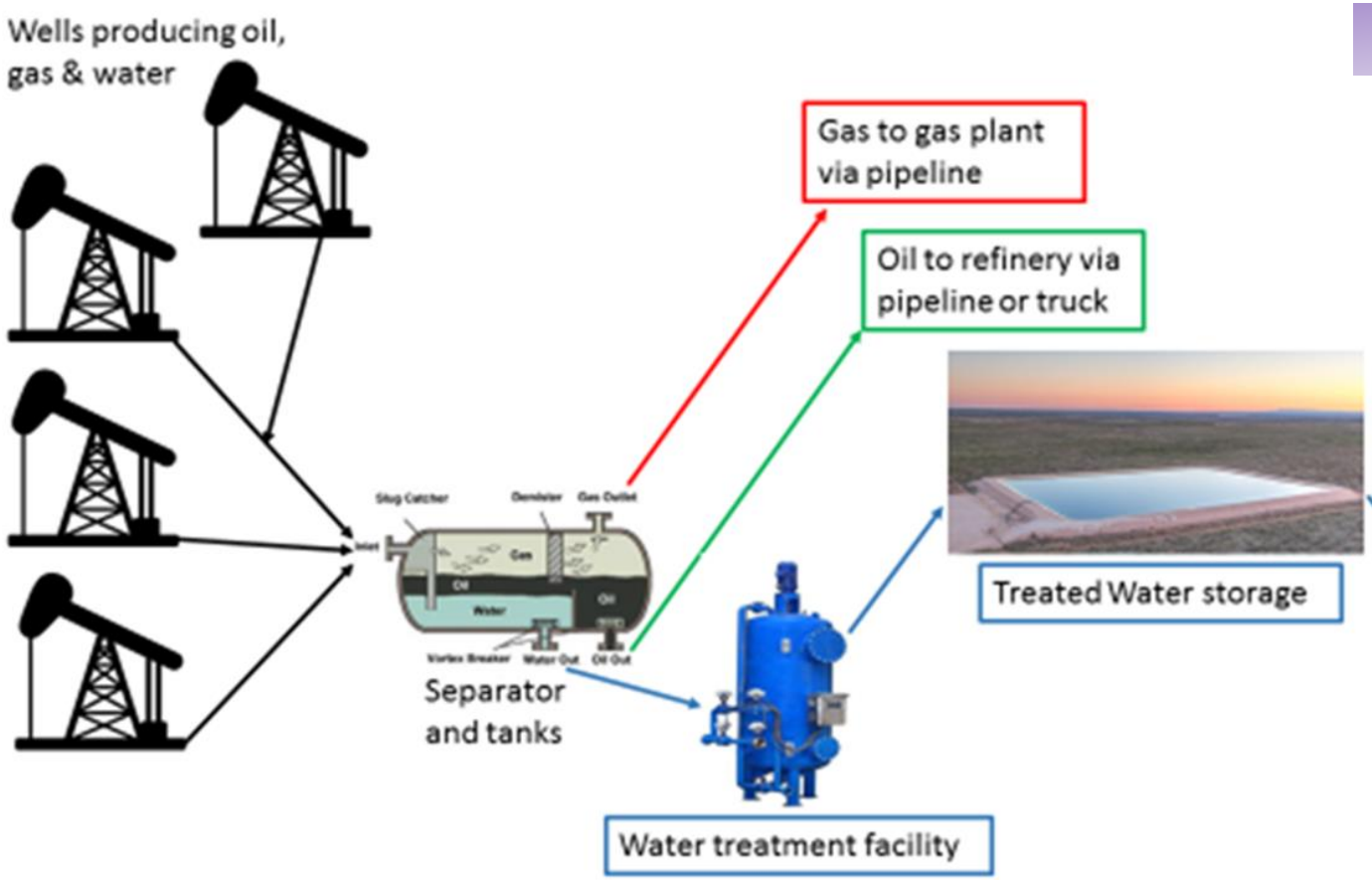
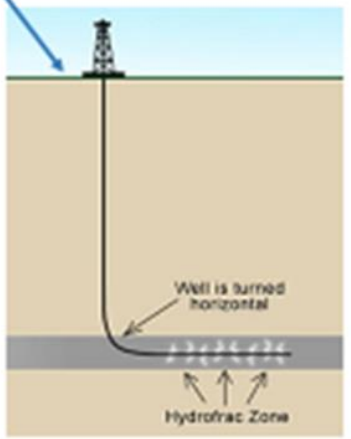
Outline

1. History of water management in shale plays
2. Benefits and Challenges
3. Infrastructure examples
4. OWRB Oklahoma study
5. New studies

Red River

Water Lifecycle for Oil and Gas Production



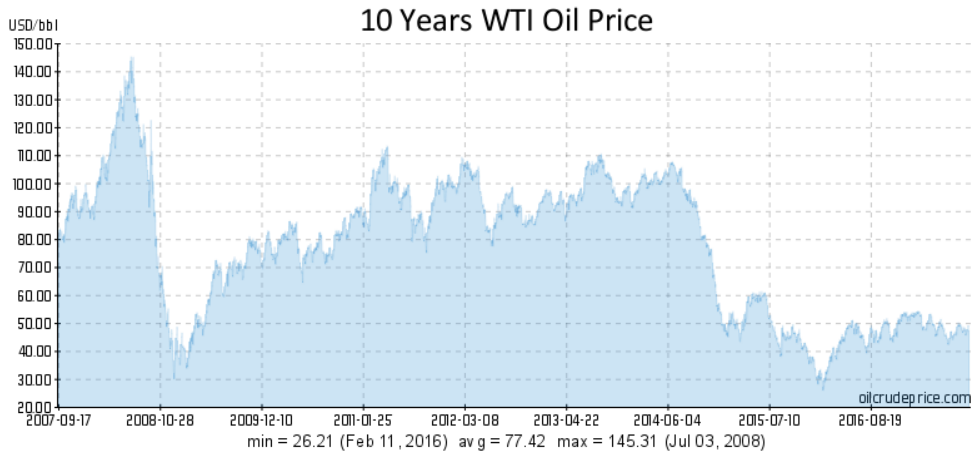


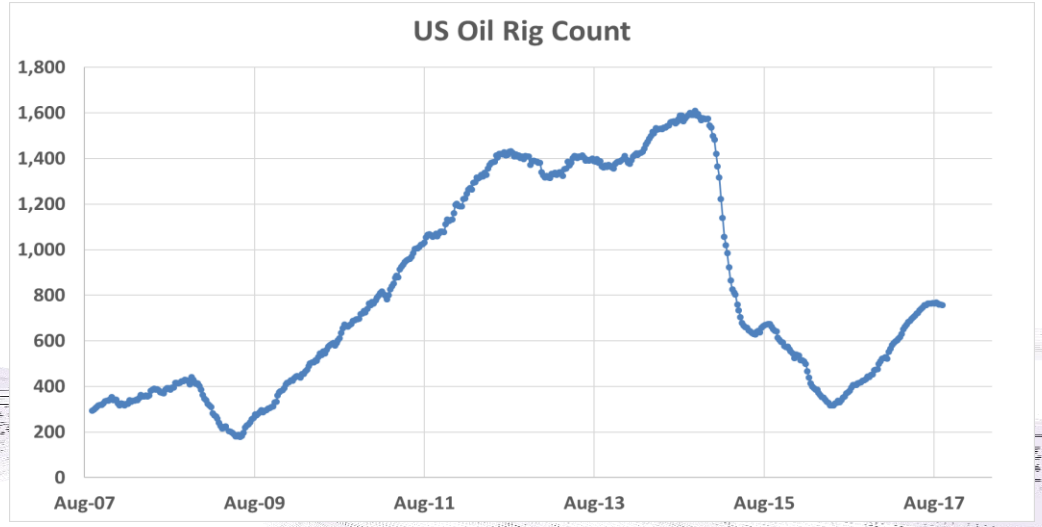
Important Aspects:

- Sourcing
- Disposal
- Re-use
- Transport

History of Water for Unconventionals

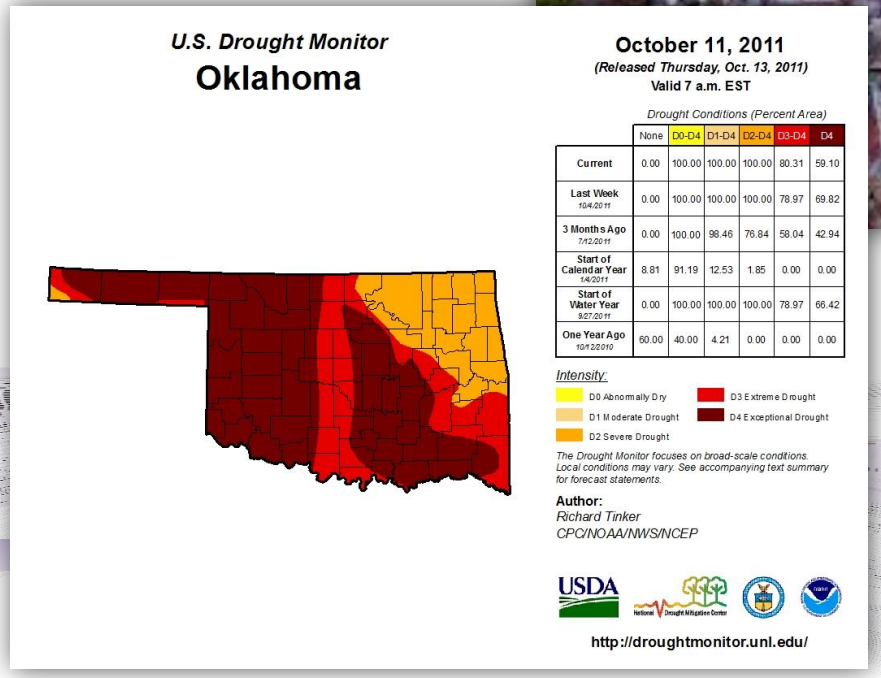
- *Barnett Shale - drilling - late 1990s*
- *Water management - an after-thought*
- *Local groundwater or surface water sources*
- *2005 - new plays – economic viability*
- *2010 - horizontal rigs 900+ =* Sustainability





Water Management – Challenges Emerge

- EPA - 2010 - study of potential impacts of hydraulic fracturing
- 2011 & 2012 - Oklahoma - drought
- 2014 Ceres - unconventional development & water stress
- Induced seismicity - concern in OH, AR, TX & OK



Water Management Forecast

Short Term

- Few restrictions on sourcing
- Limited restrictions on disposal

Long Term

- Expect volatility (droughts, disposal limits, activity spikes)
- Water planning needed

Objectives of Water Management (Companies & Public)

1. *Maintain or reduce lifecycle costs*
2. *Use distant non-fresh sources – brackish or municipal*
3. *Aggregate volumes: economics of scale with treatment*
4. *Reduce trucking*
5. *Build stakeholder support*

Challenge to Re-use

1. Cost: transport & treat — Companies
2. Right-of-way & landowner — Slow progress
3. Legal — State
    a. Selling water between producers
    b. Environmental liability if transferred
    c. Water for re-use in other industry
4. State regulations — State
5. Federal Rules for Discharge — State

Oklahoma Water Infrastructure for Oil and Gas

- Continental Res. - water recycling facilities in 2 areas.

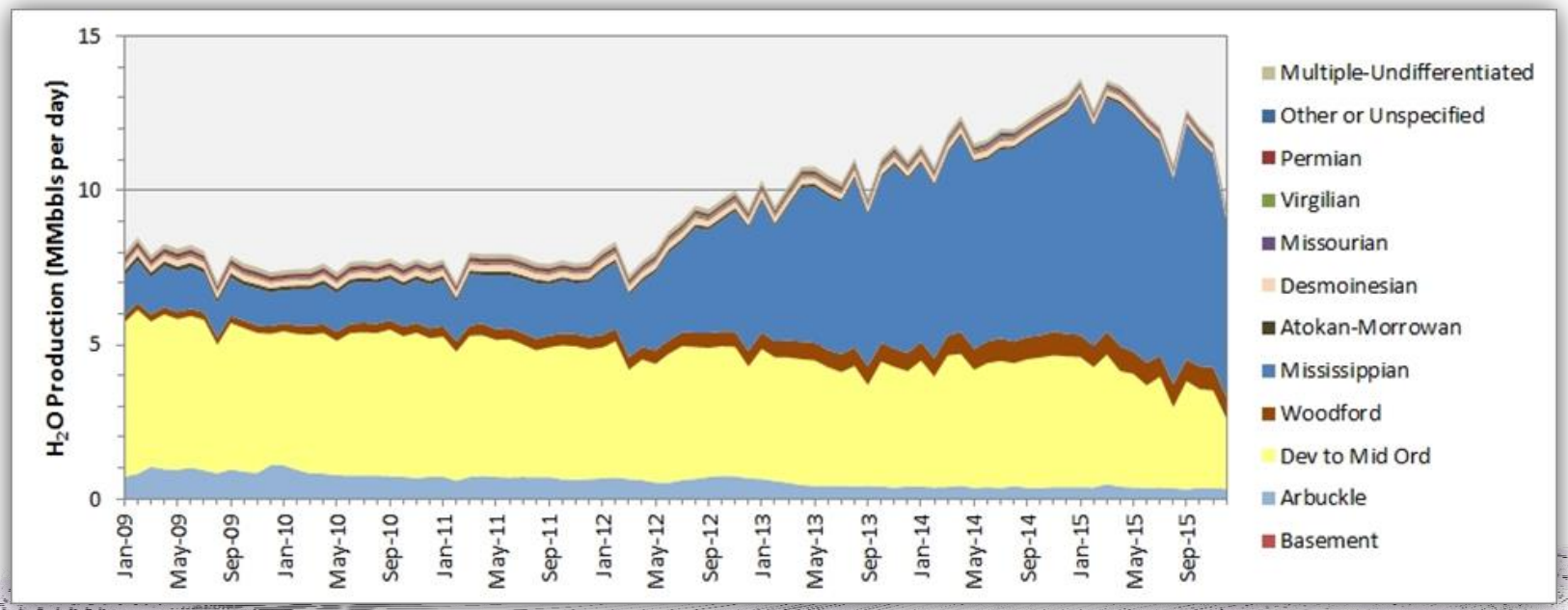
- Newfield Exploration –
  - 160 miles of water pipelines.
  - New plant announced for Kingfisher Co.

Oklahoma Water Infrastructure for O&G (Cont.)

- Devon Energy –
  - Initiated a water re-use system
  - Includes a network of pipelines
  - Deal with OKC to use treated wastewater
- Chesapeake & White Star
  - Pipe networks – reduce trucking

Oklahoma Initiatives

- OK Corp. Comm. (OCC) - reduced water disposal.
- Governor Fallin established committee for produced water.
- OWRB & CH2M - study of re-use options.



OK Re-use Study – Economic Conclusions

1. Re-use by the oil and gas industry is the most cost-effective alternative to injection in disposal wells

2. Surplus produced water in Alfalfa County could be gathered and conveyed to Blaine County for re-use.

3. Evaporating produced water is the third most cost-effective alternative category

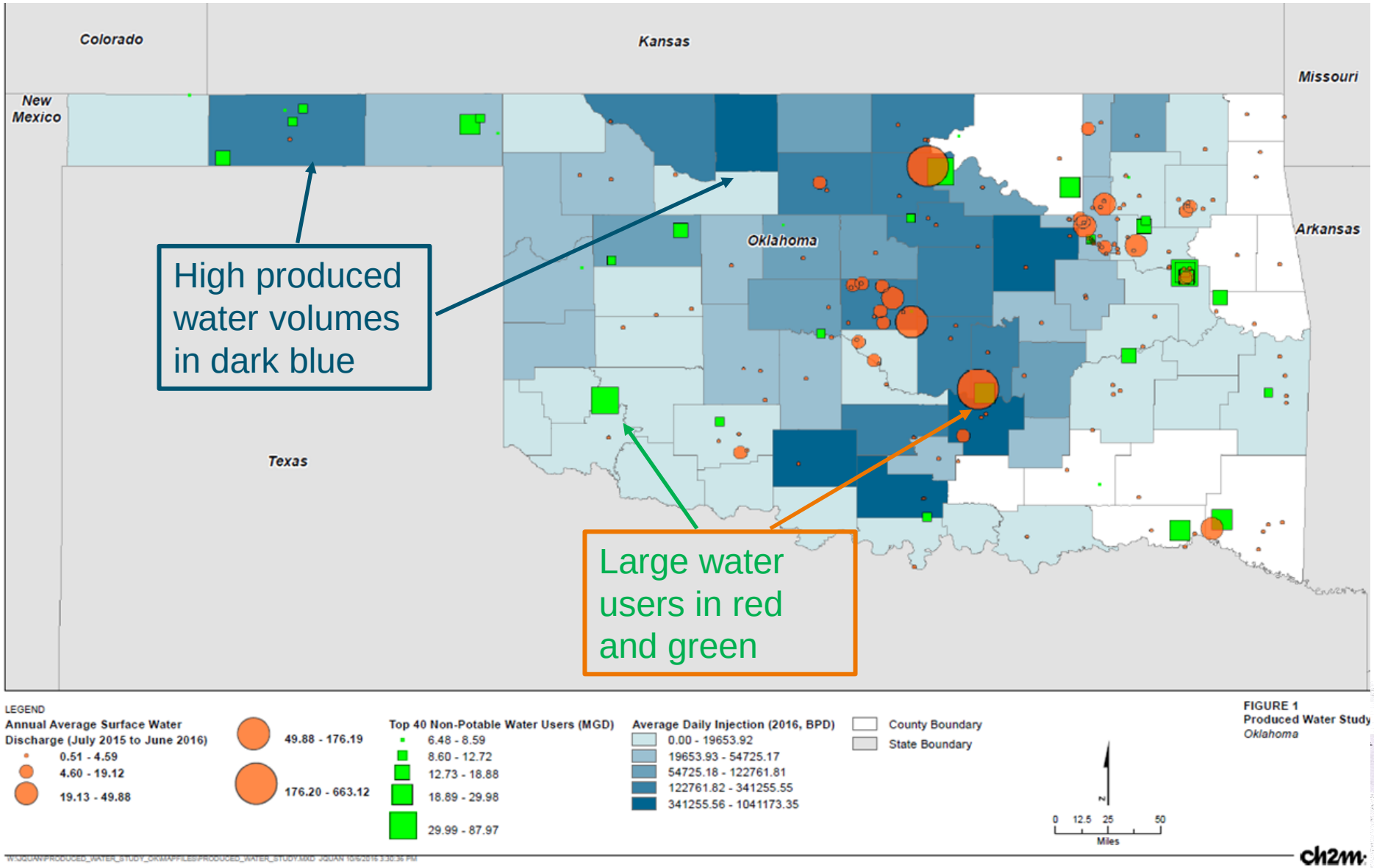
4. Desalination for power, industrial plants or discharge to rivers is technically implementable, but is the most expensive

Short term | Medium term | Long term

Re-use Summary - Recommendations

1. Reduce the challenges to re-use via targeted legislation.
2. Continue to facilitate the re-use of produced water
3. Continue study of transferring the Miss. Lime produced water to the STACK
4. Continue evaluation of evaporation
5. Consider all negative and positive environmental and stakeholder impacts

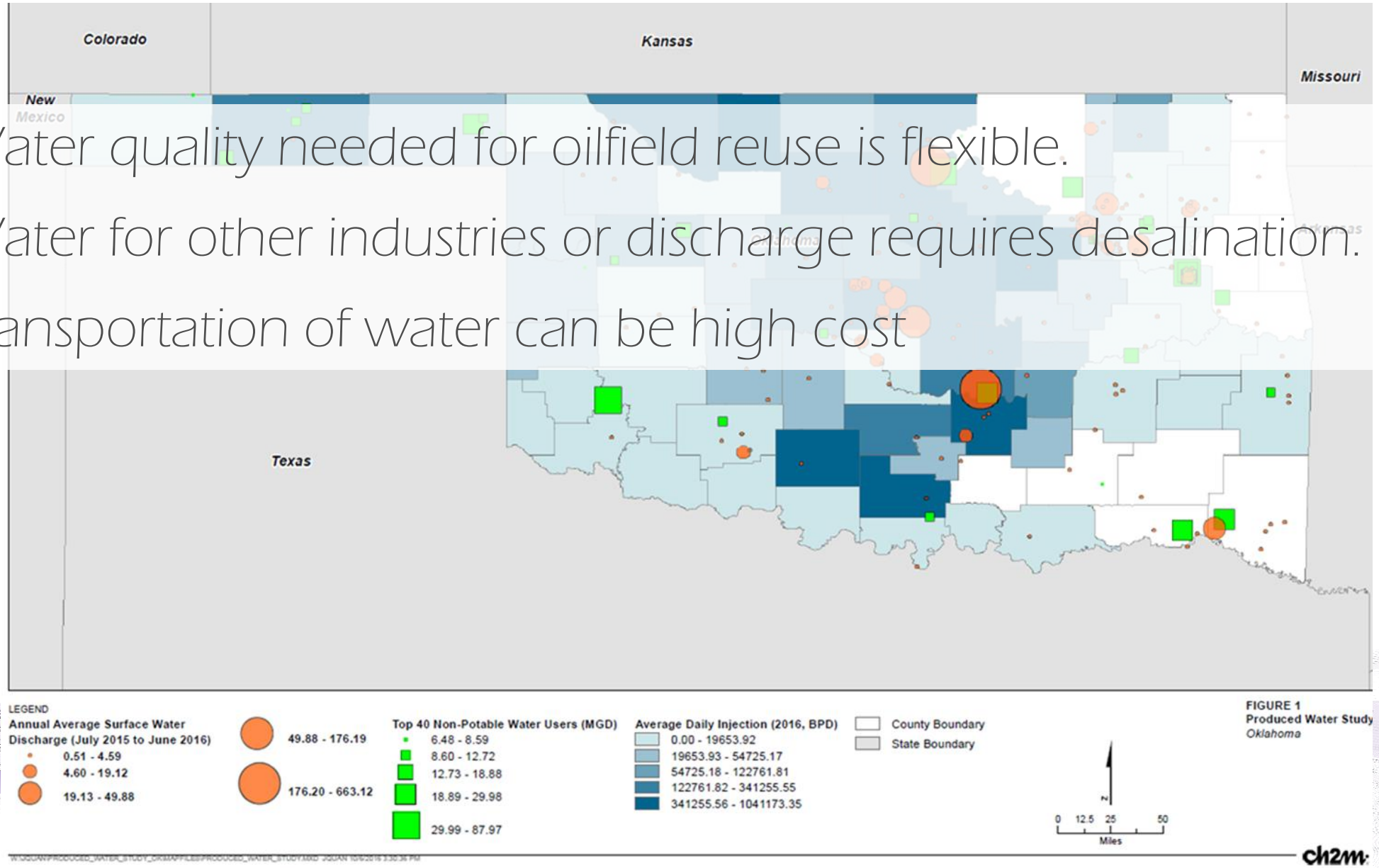
Produced Water in Oil and Gas Operations



Matching Produced Water with potential users.

Produced Water in Oil and Gas Operations

- Water quality needed for oilfield reuse is flexible.
- Water for other industries or discharge requires desalination.
- Transportation of water can be high cost



Produced Water Re-use Scenarios

New Case	Case Description	Total Capital ($Millions)	Capacity BWPD	County	Assumed Wtr TDS (mg/L)	Normalized $/BW
1	Typical Source and Dispose - STACK & SCOOP	NA	NA	Central OK	NA	1.09
2	**Oil and gas re-use (treatment cost only)**	**NA**	**NA**	**State-wide**	**NA**	**0.57**
3	Clean Bri[illegible]	[illegible]	[illegible]	Alfalfa	[illegible]	1.03
4	Evaporat[illegible]	NA	20,000+	Beckham	17,000	1.66
5	Evaporat[illegible]	NA	20,000+	Alfalfa	213,000	1.79
6	Desalinat[illegible]	22	15,000	Beckham	9,000	3.58
7	Desalinat[illegible]	88	130,000	Pawnee	125,000	4.37
8	Desalinat[illegible]	95	120,000	Seminole	180,000	4.43
9	Desalination for Industrial Use	35	30,000	Grant	227,000	7.41
10	Desalination for Surface Discharge	38	30,000	Grant	227,000	7.49

Without transportation included, re-use costs less than sourcing and disposing.

New transfer lines will allow re-use to grow.

Short term | Medium term | Long term

OWRB Ongoing Study

- Using US Bureau of Reclamation Grant
  - Study of water transfer
  - Study evaporation option
- Partners

GROUNDWATER PROTECTION COUNCIL

EDF ENVIRONMENTAL DEFENSE FUND

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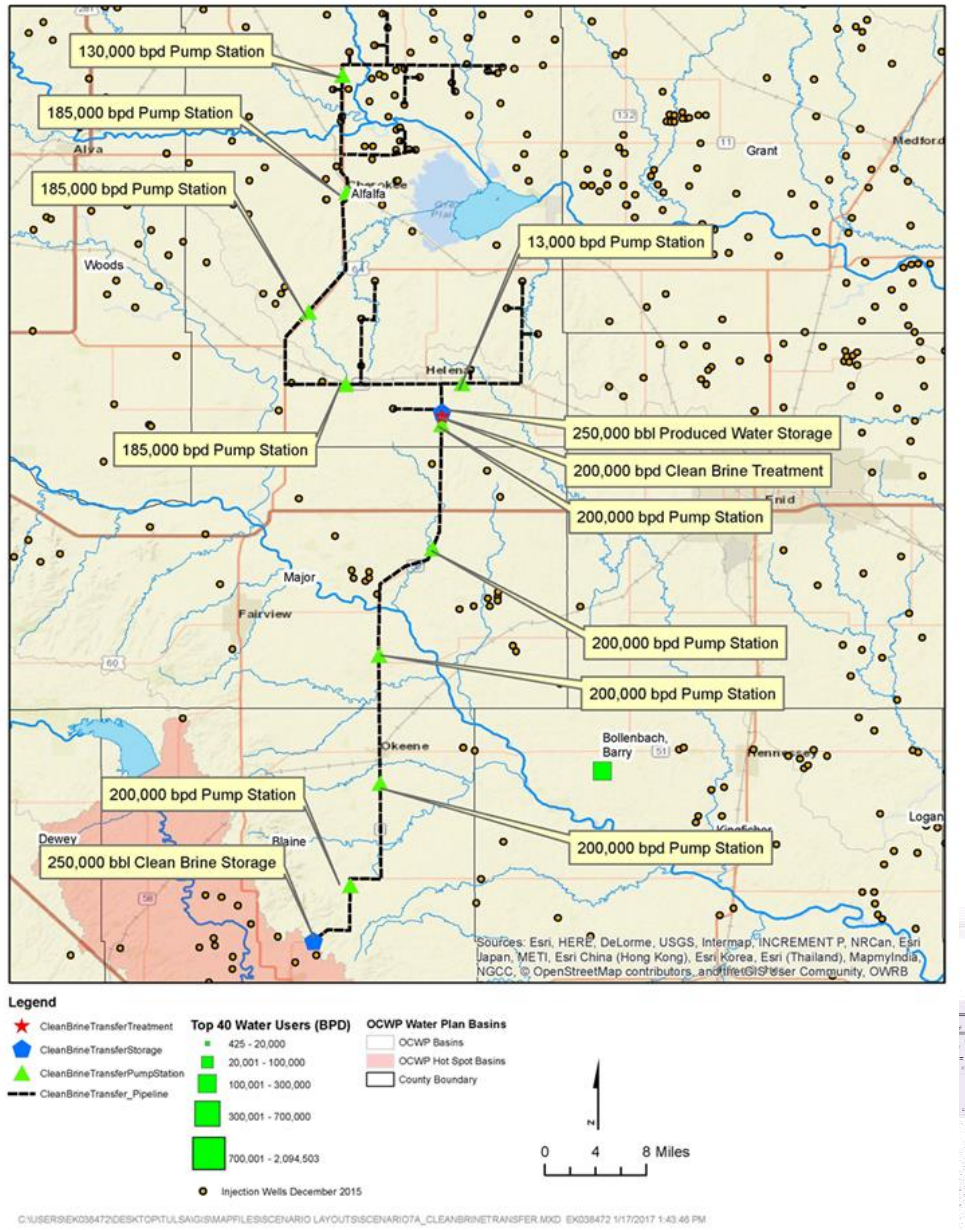
BUREAU OF ECONOMIC GEOLOGY

- Collaboration with PWWG and industry



GWPC National Produced Water Report

- Scope of work
  - Regulations
  - Re-use within oil and gas
  - Recycling for use in other industries
- Collaboration with regulators and industry
  - OWRB, ODEQ and CH2M involved
- Study to extend throughout 2018

Groundwater Protection Council

- Based in OKC
- Non-profit working with regulators and industry
- Worked national water issues including FracFocus & seismicity

Thank You

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