

WSLCA Conference Omaha, NE

E&P Upstream Issues
July 2013



Current E&P Issues

- Hydraulic Fracturing
- Water Management
- Infrastructure Issues
- Environmental Considerations
- Other Issues

EOG RESOURCES

EOG Resources

- One of the largest independent (non-integrated)
- NYSE ticker symbol "EOG"
- 12/31/2012
 - estimated net proved reserves
 - 1,811 MMBoe



HYDRAULIC FRACTURING

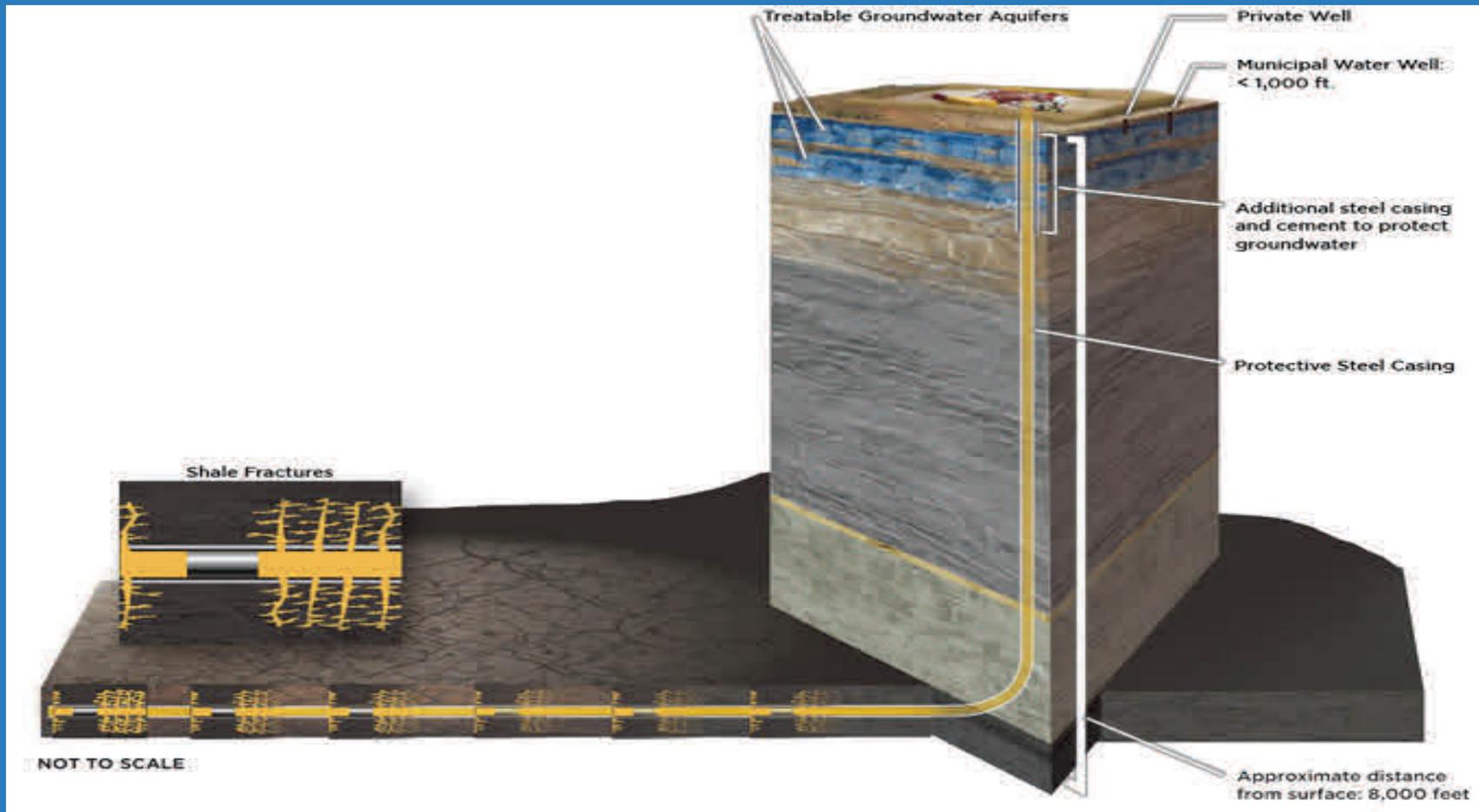
Hydraulic Fracturing

- Proven technology
 - Used for 60 years, over 1 million wells
- Water pressure, sand, crack rock
- Transforming energy future
 - US economic competitive advantage
 - Changing world geopolitics – Middle East
- Highly regulated process

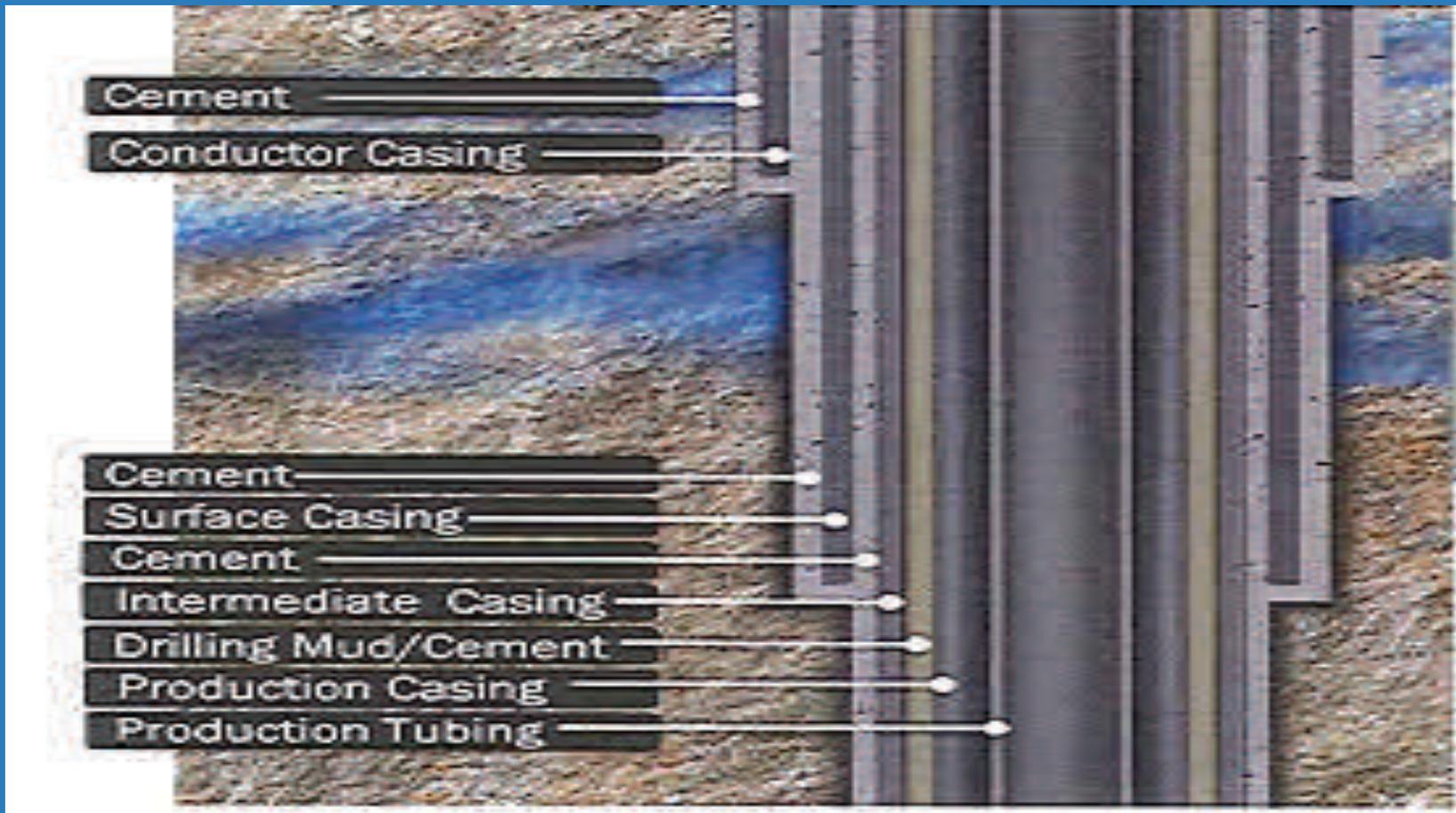
Hydraulic Fracturing

- <http://www.youtube.com/watch?v=vvRCYLnVWG8>
- **Frac Focus – chemical disclosure**
 - DOE, Ground Water Protection Council
 - Over 50,000 wells entered
 - New format to search the data
- **A lot of Media Misinformation**

Hydraulic Fracturing

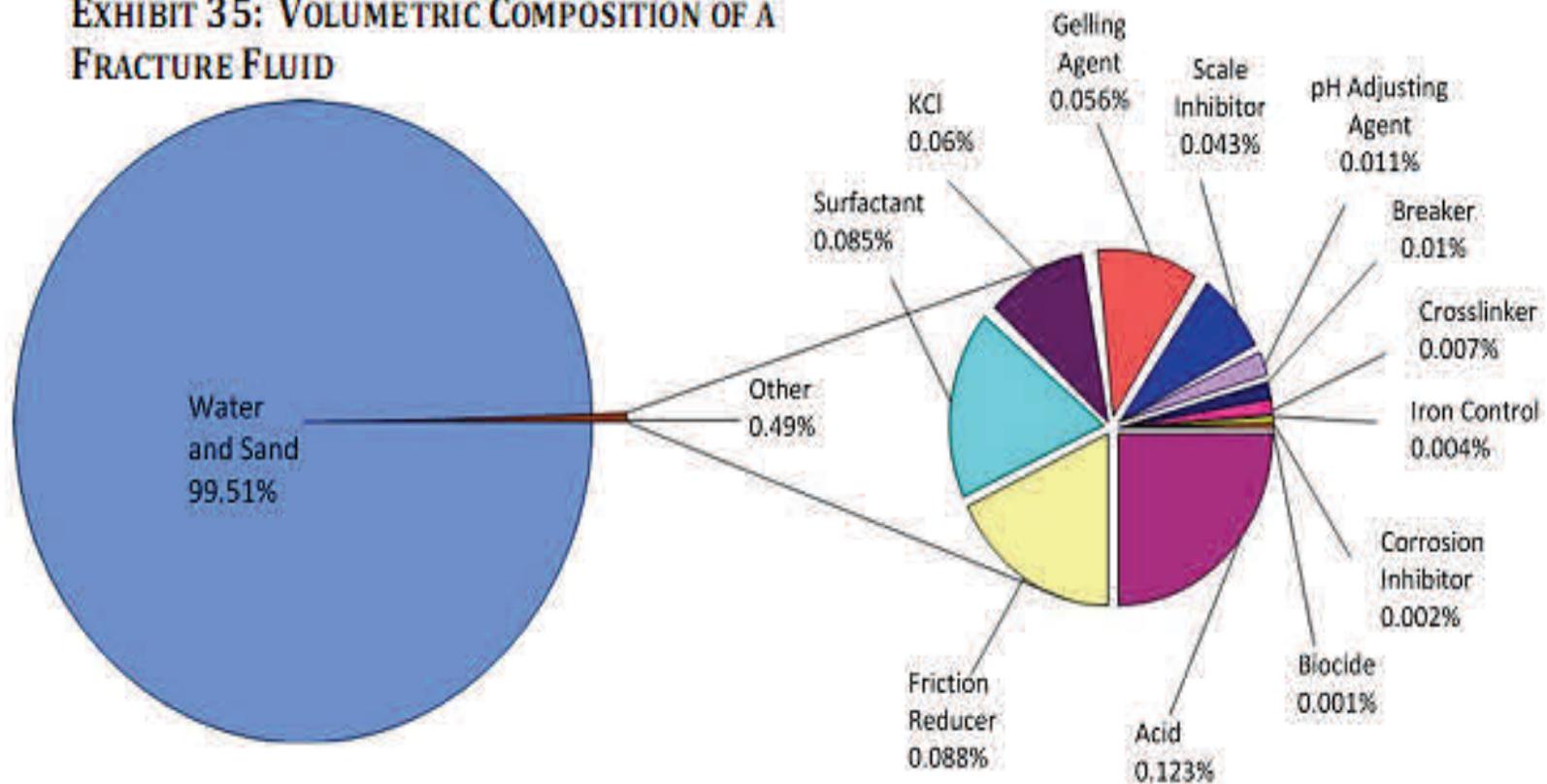


Hydraulic Fracturing



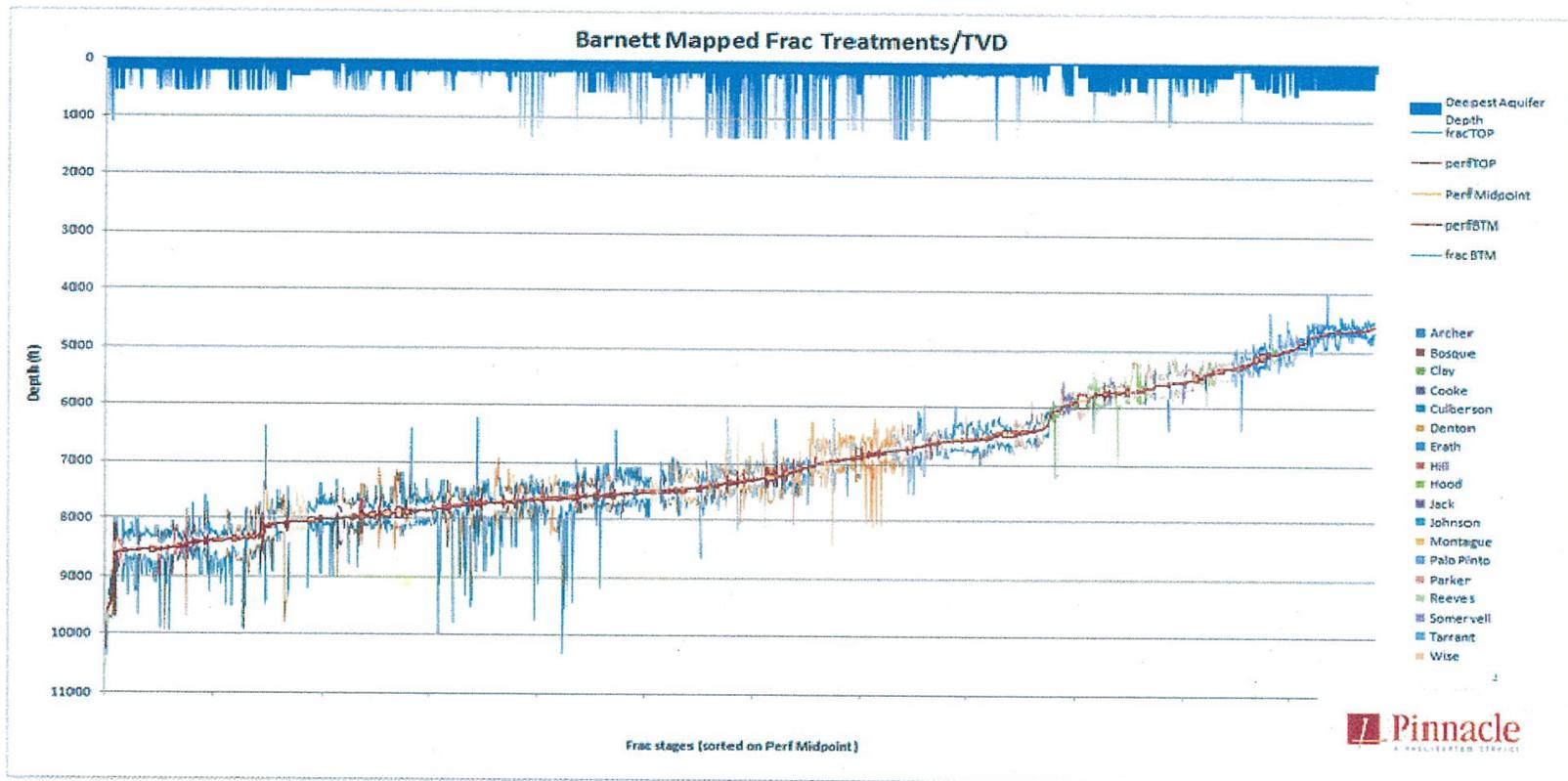
Hydraulic Fracturing

EXHIBIT 35: VOLUMETRIC COMPOSITION OF A FRACTURE FLUID



Source: ALL Consulting based on data from a fracture operation in the Fayetteville

Shale, 2008



<http://nwis.waterdata.usgs.gov/nwis/inventory>

WATER MANAGEMENT

Water Management

- Lifecycle management
- Myths
- Recycling
- Chemicals – replace/
reduce
- Groundwater Monitoring

Water Management

- Water Value Chain Management
 - Water Source
 - EIA – in 2010 all energy production 400 B bbls
 - <0.1 % of U.S. consumable water
 - Active counties have higher impact
 - Drilling
 - 5,000 – 20,000 bbls
 - Completions
 - 50,000 – 150,000 bbls
 - Disposal/treatment
 - 150,000 registered UIC wells in U.S.

Water Management

- Myths
 - Require potable water
 - Do not need potable water for completions
 - Using saline/non-potable water
 - Using produced water
 - Not recycling
 - industry is recycling – mud, produced

Water Management

- **Recycle Produced Water**
 - North Dakota
 - Cost of building and processing equipment
 - Save 5 million gallons/yr
 - Max = 85 million gallons/yr
 - Operate 500-5000 bbls/day





Water Management

- Groundwater Sampling
 - Becoming a BMP for industry
 - Reasons
 - Protect the resource
 - Insurance for the company – WY, TX, PA
 - Only 2 states currently require
 - CO and NM

INFRASTRUCTURE

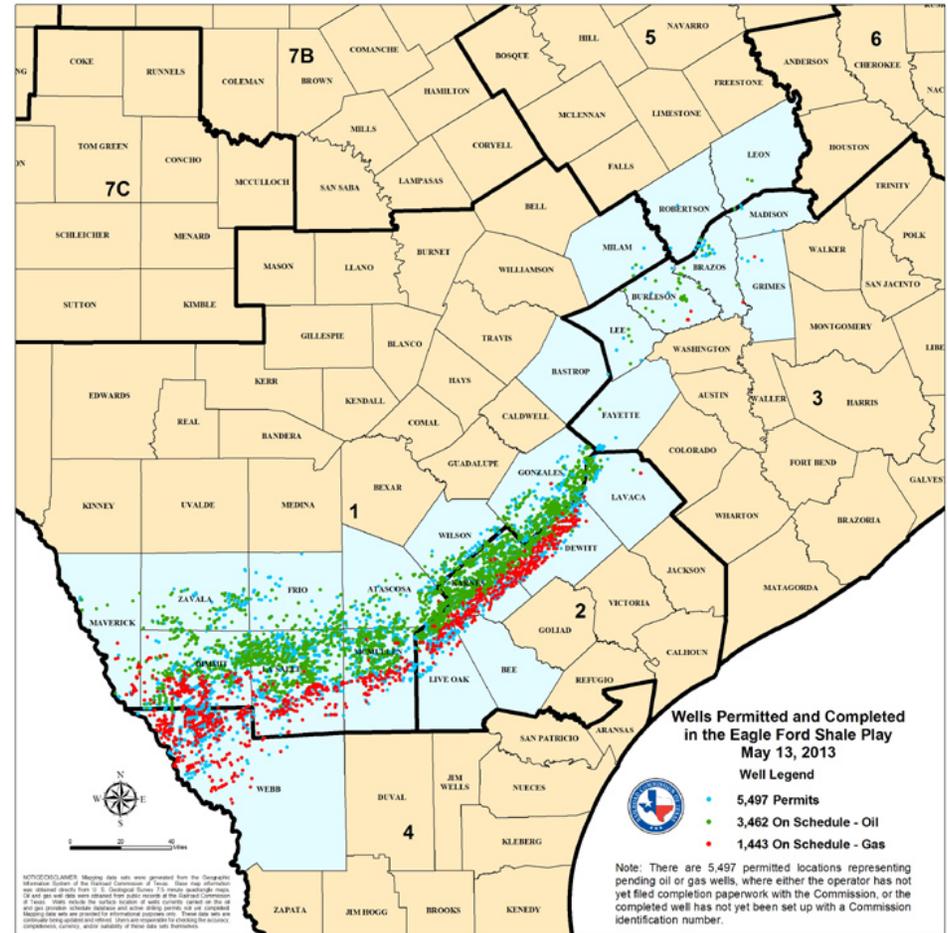
Infrastructure

- **Challenges**
 - Unconventional - large aerial extent
- **Flaring**
 - Chicken and egg
- **Pipeline issues**
 - Economics
 - Rights of way
- **Rail**
 - Reversing history
 - Quebec – implications?

BIG!



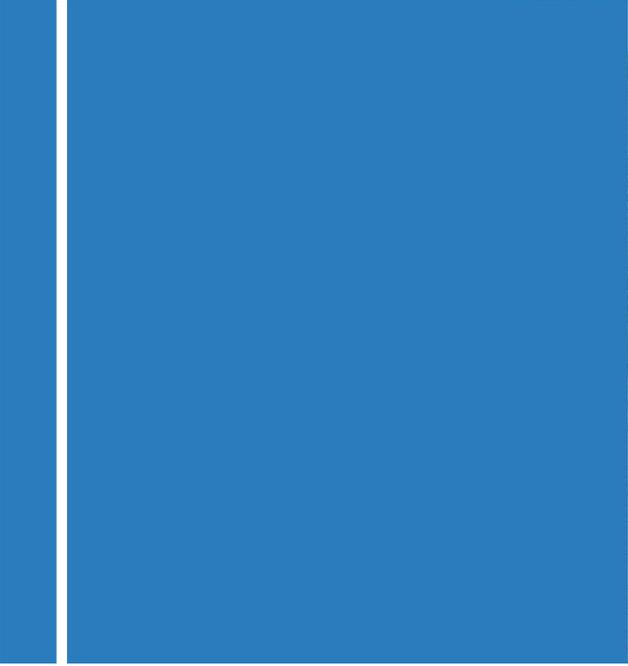
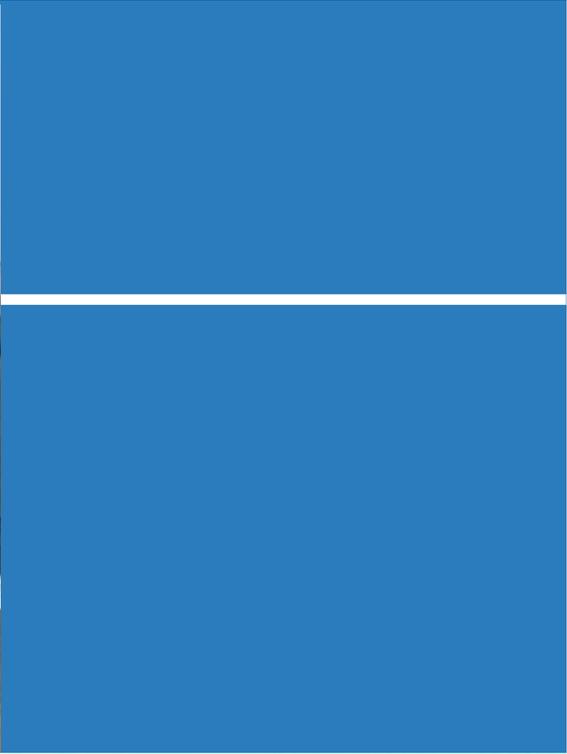
Williston Basin Areal/Structural Map



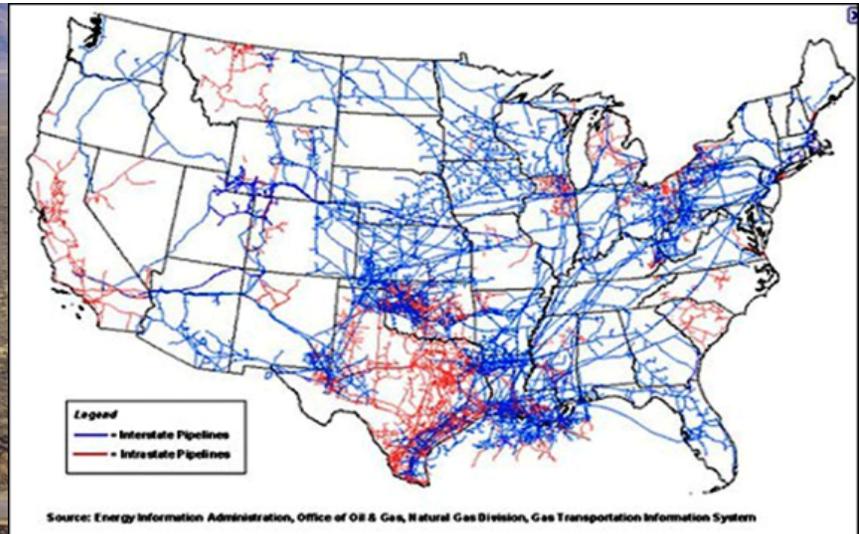
Flaring

- Why?
 - Safety
 - Lack of gas gathering infrastructure
 - Large investment - step out, exploration
- Industry wants revenue
- Necessary - trend is to capture
 - Green completions – can do, can't do





Pipelines



Pipelines

- Many pipelines are full
- Not where unconventional plays are occurring
- Long acquisition, permitting and construction time - Keystone
- Price differential
- Less flexibility

Rail

- Reversing history
- New plays not enough pipeline take away capacity
- EOG solution: use rail
 - Existing RR routes in place
 - Little time to develop
 - High amount of market flexibility
 - Use existing RR infrastructure



















ENVIRONMENTAL CONSIDERATIONS

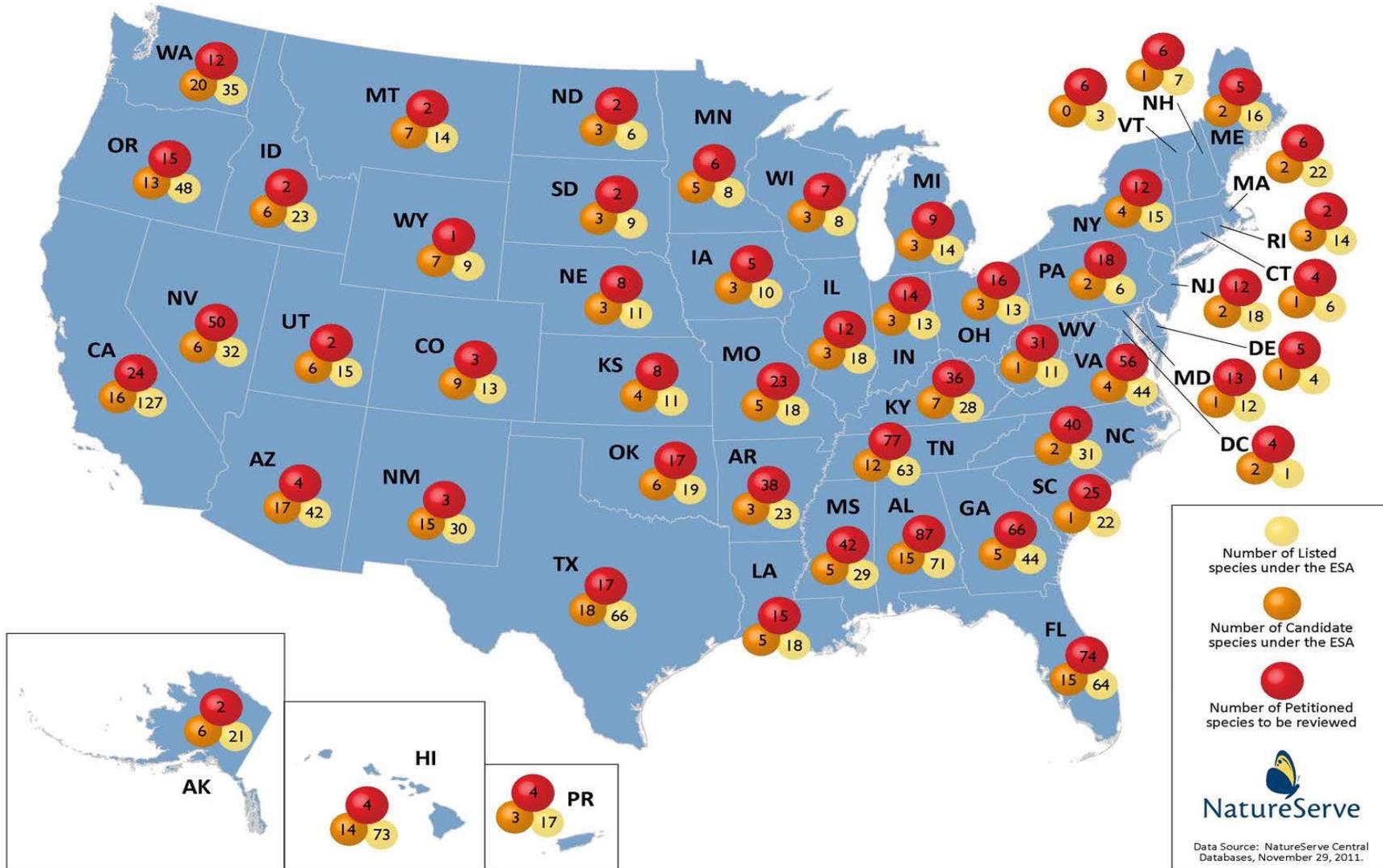
Environmental

- A few of the many
 - ESA
 - Reclamation
 - Air

Endangered Species Act

- ESA is 40 years old
- 1400 listed species in the U.S.
- 251 Candidates species
 - Not consider for protection
- 28 species delisted = 1.4% recovery rate
 - 10 extinct after listing
 - 5 delisted due to new classification
 - 11 delisted result of new data
- “Sue and settle” – current management ???
- Take away: better to not get listed and manage species instead
- Hotel California – never delisted

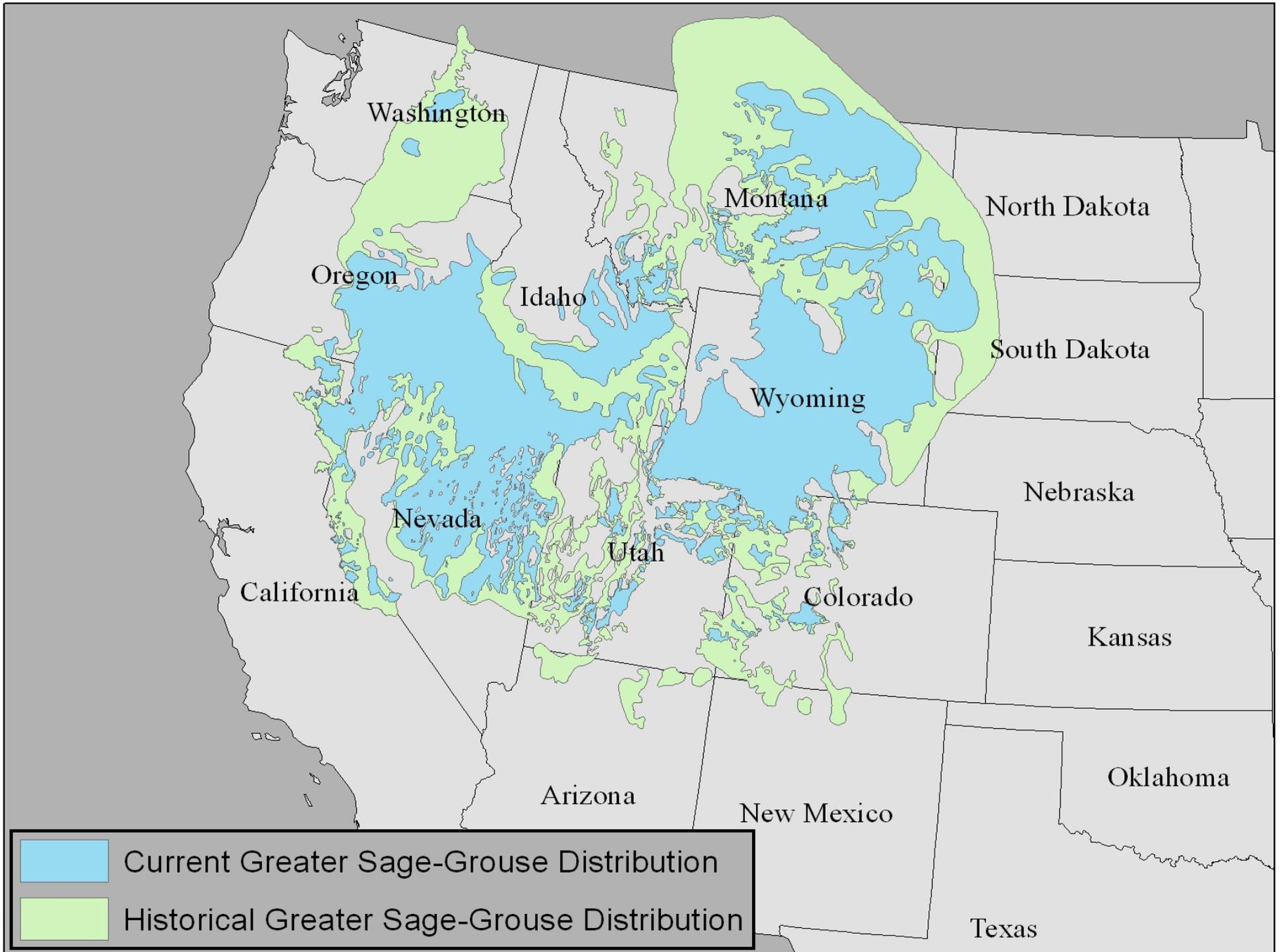
ESA











Reclamation

- Important visual impact mitigation
- Challenges
 - Topography issues
 - Top soil viability
 - Invasive/Noxious weed control
 - Varying precipitation









Air Issues

- **OZONE!!!**
- **Rig engine emissions**
- **Off road (construction) engines**
- **Flaring – temporary capture systems, etc.**

Air



OTHER ISSUES

Social License to Operate

- New paradigm
- Urban/drilling interface
 - Drill pads
 - Noise
 - Visual impacts
 - Odors

Enhanced Oil Recovery

- Next wave for unconventional resources
 - Less water
 - Gas injection - emissions
 - Technology innovation must have less impact

QUESTIONS?