Coalbed Methane Development and Regulation: The Alabama Experience

Nick Tew
State Geologist and Oil and Gas Supervisor
Geological Survey of Alabama and
State Oil and Gas Board of Alabama
Tuscaloosa, Alabama

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Rio de Janeiro, Brazil
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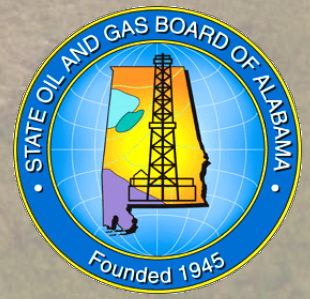
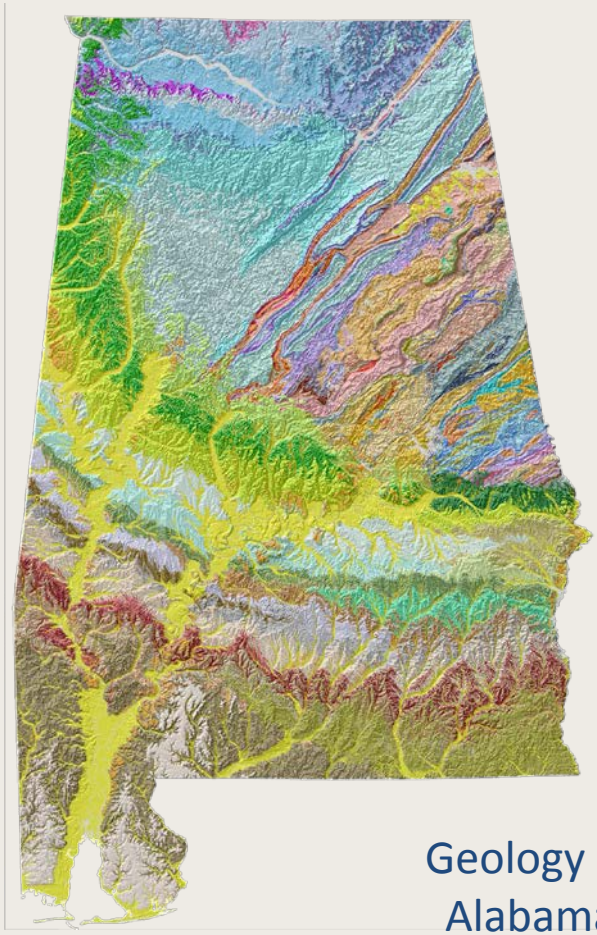


Where is Alabama?

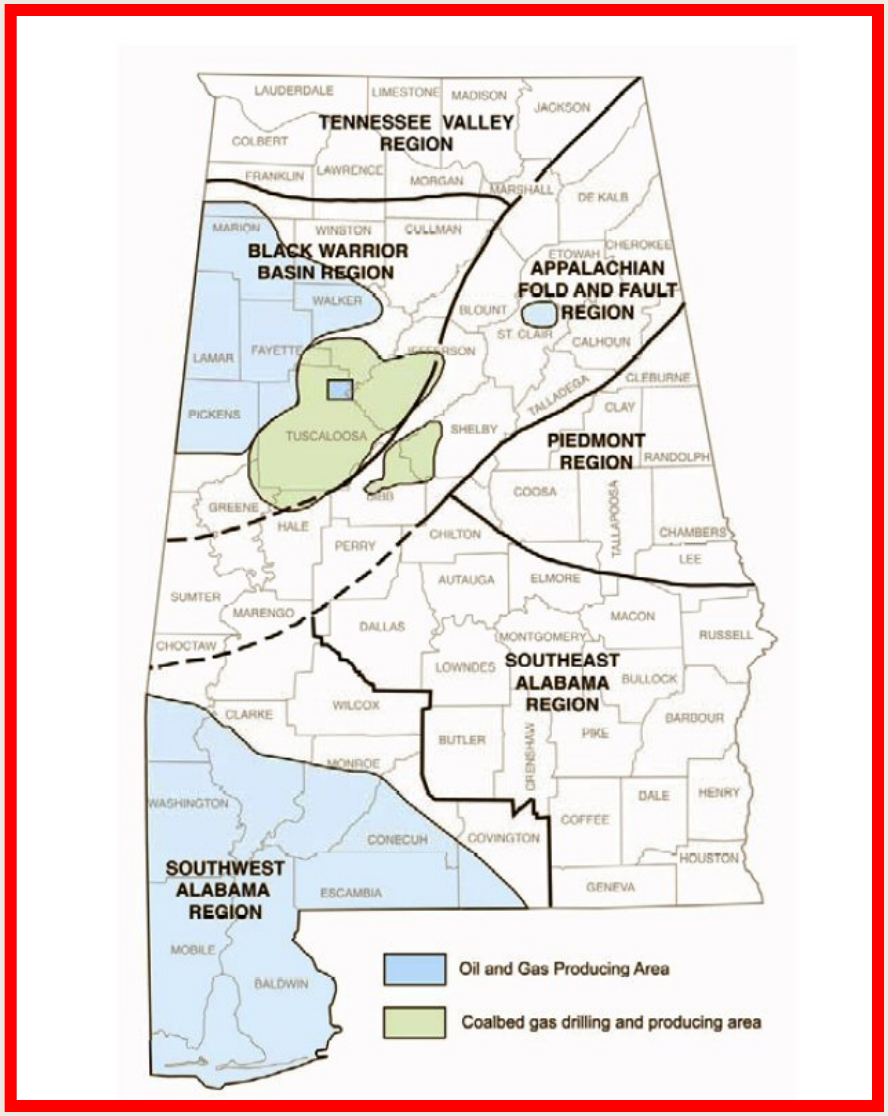
Alabama's Fossil Fuel Energy Endowment

- **Coal**
  - Black Warrior Basin Coal Measures
  - Coastal Plain Lignites (low-rank coal)
- **Oil**
  - Conventional
    - SW Alabama Oil and Condensate
    - Black Warrior Basin Oil
  - Unconventional
    - Oil Sands of North Alabama
    - Oil Shale of North Alabama
- **Natural Gas**
  - Conventional
    - SW Alabama
    - Black Warrior Basin
  - Unconventional
    - Coalbed Methane of Black Warrior Basin
    - Paleozoic Gas Shales of North Alabama

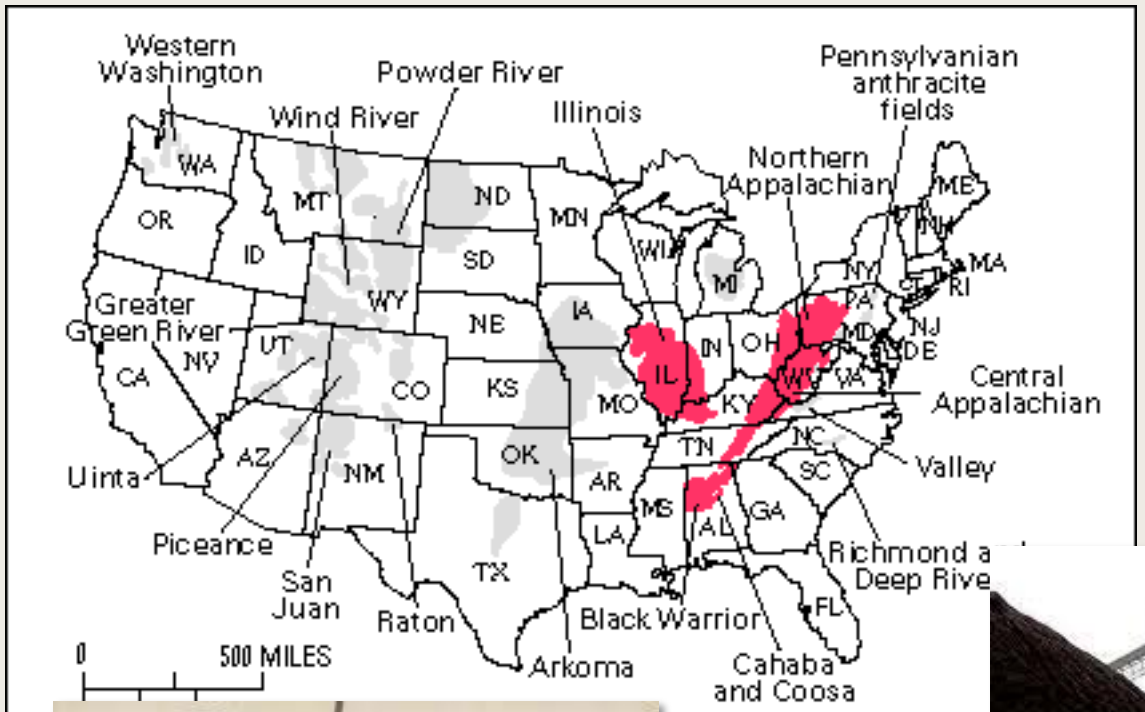


Geology of Alabama

Significant Oil and Gas Activity Areas in Alabama

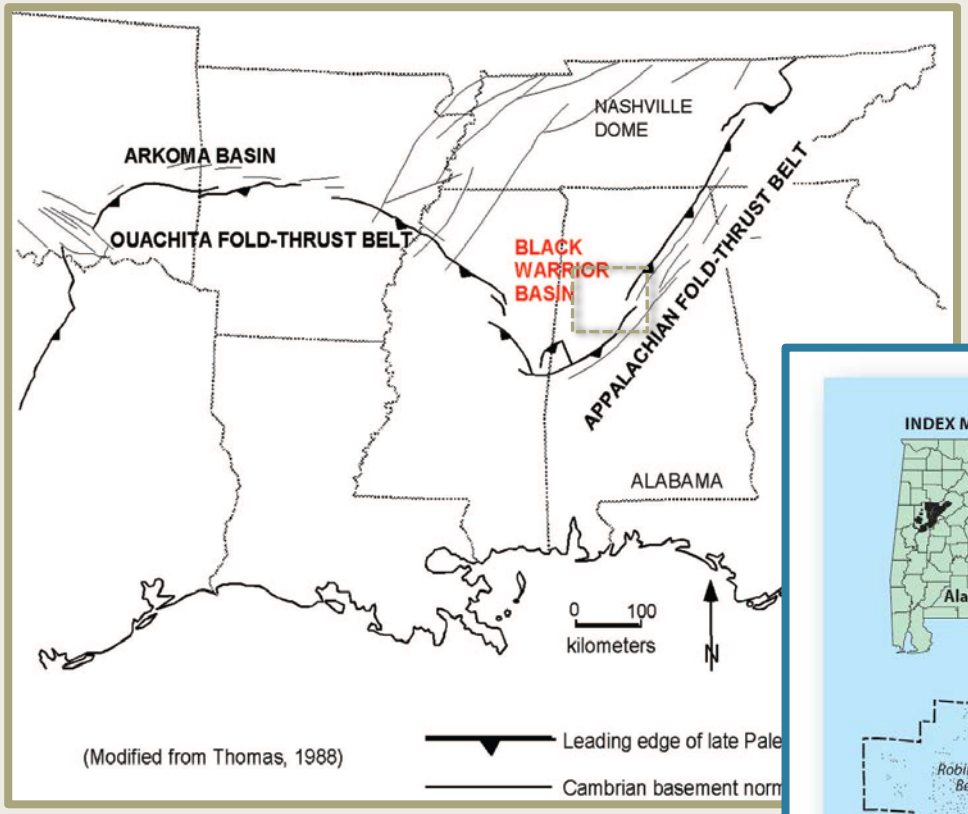


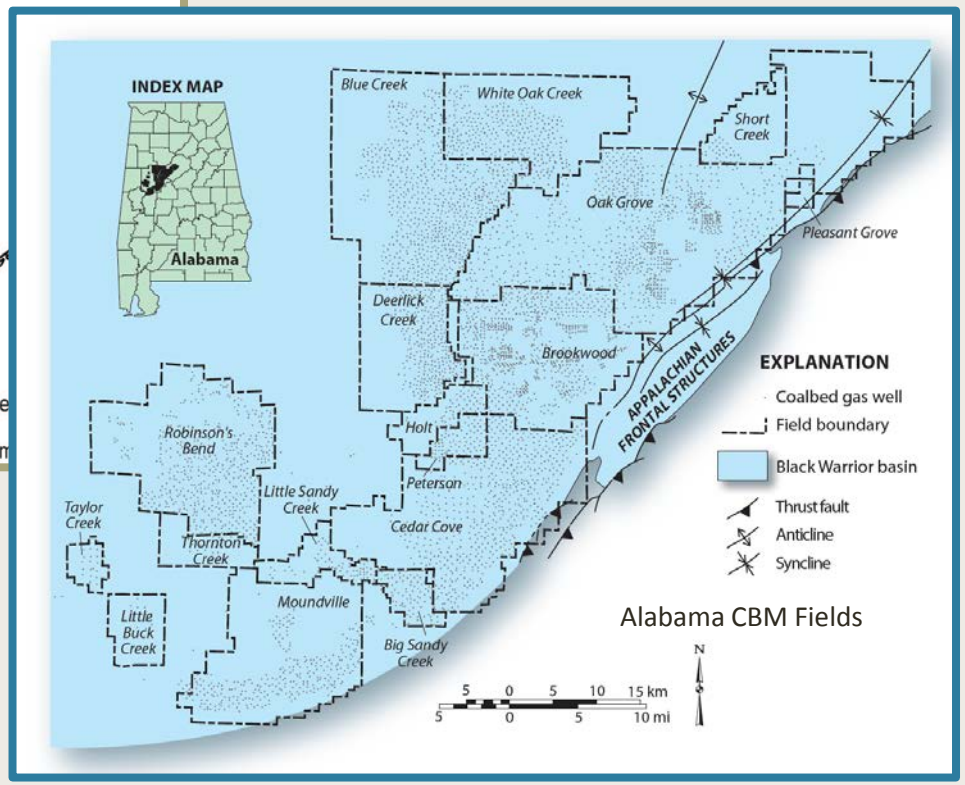
Alabama Coal



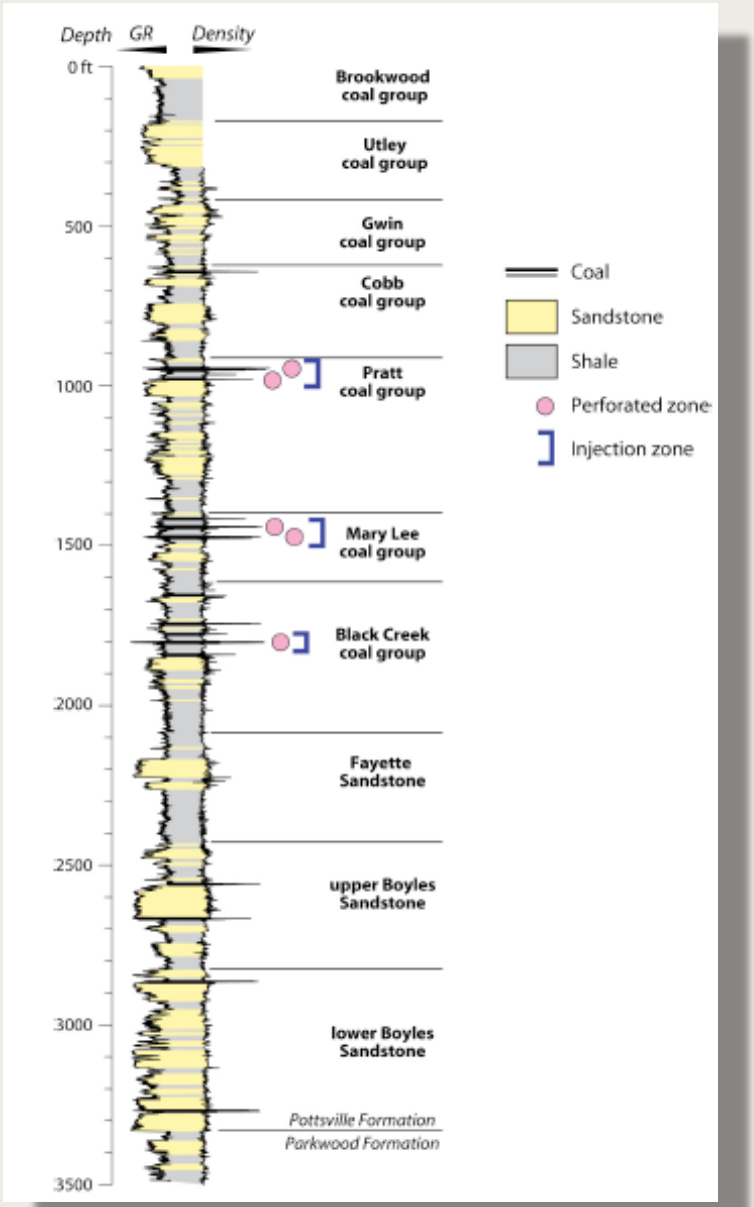
Coalbed Methane in Alabama

- Degasification experiments for mine safety began in the mid-1970s.
- Commercial production began in 1980.
- Currently close to 5,000 active wells in 20 fields.
- Annual gas production between 105 and 121 Bcf for the last 20 years.
- Over 2.5 Tcf cumulative gas production.
- Over 1.7 billion barrels of water produced.

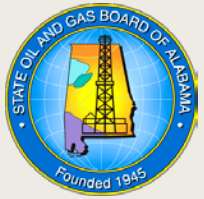




Alabama CBM Fields



Black Warrior Basin Coal Stratigraphy

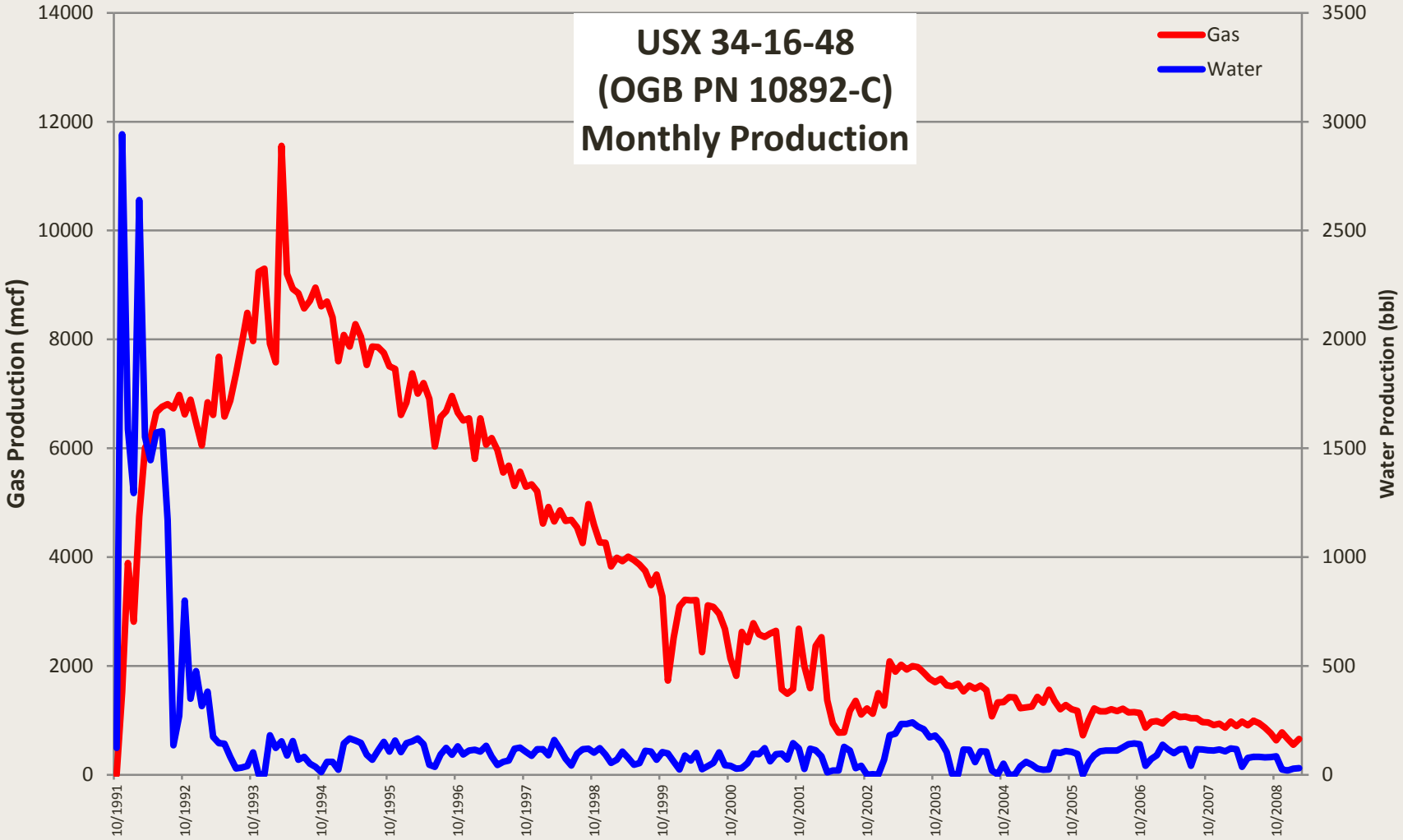


CBM Wells in Alabama

- Relatively shallow (<5000 ft.).
- Majority are vertical wellbores, typically encountering several coal groups/seams.
- Coal seams are hydraulically fractured, typically several fracture stimulations per well.
- Average about 100 Mcf of natural gas per day.

Production Characteristics

- CBM production is pressure driven and usually requires dewatering of coals to lower hydrostatic pressure for gas production.
- Water production is generally high early in a well's life and decreases rapidly.
- Gas production generally peaks in the first few years, after peak water, then decreases.
- High water production can limit how often and how much a well can be pumped, limiting gas production.

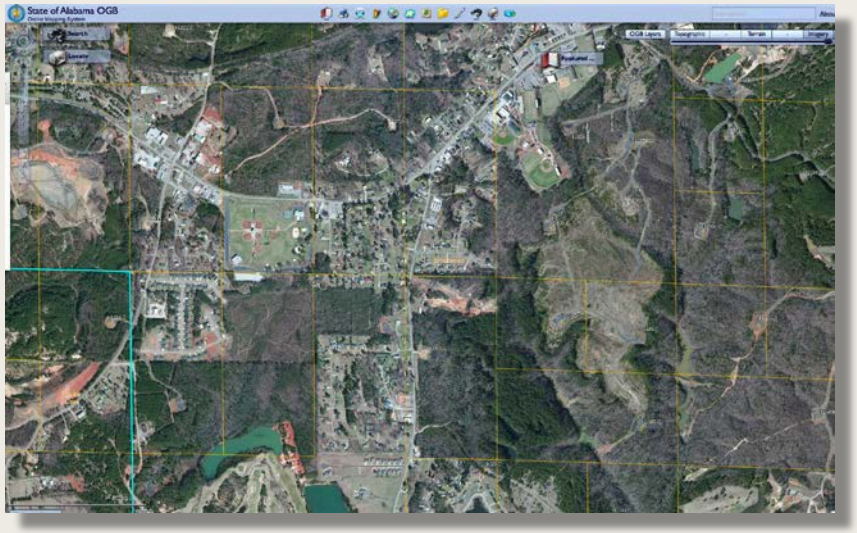


Typical Decline Curve

Potential Issues with Development

- Environmental Considerations
  - Water Use & Availability
  - Frac Fluid Components
  - Produced Water Management
- Regulatory Considerations
  - Well Types, Construction, & Spacing
  - Agency Jurisdictions
  - Competing Land Uses

Drill Site in Area of Cultivation
Tuscaloosa County, Alabama



Vicinity of Brookwood, Alabama

GEOLOGICAL SURVEY OF ALABAMA
Founded 1848

STATE OIL AND GAS BOARD OF ALABAMA
Founded 1945

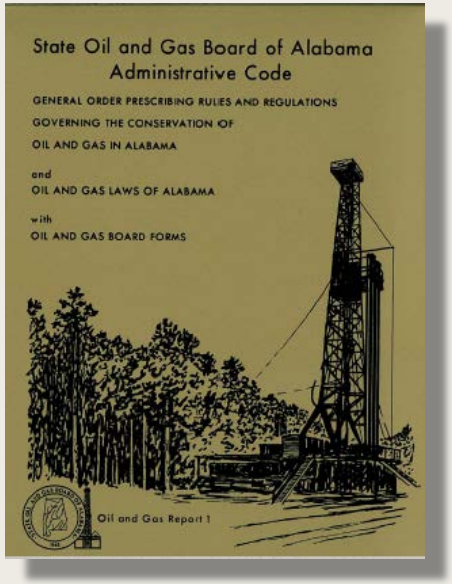
Regulatory Adaptability

- Environmental Considerations
  - Water Use & Availability – Best Management Practices
  - Frac Operations Approval & Disclosure
  - Produced Water Use & Disposal Options

- Regulatory Considerations
  - Alternative Well Types, Construction, & Spacing
  - Interagency Coordination
  - Regulatory Flexibility

Regulatory Framework

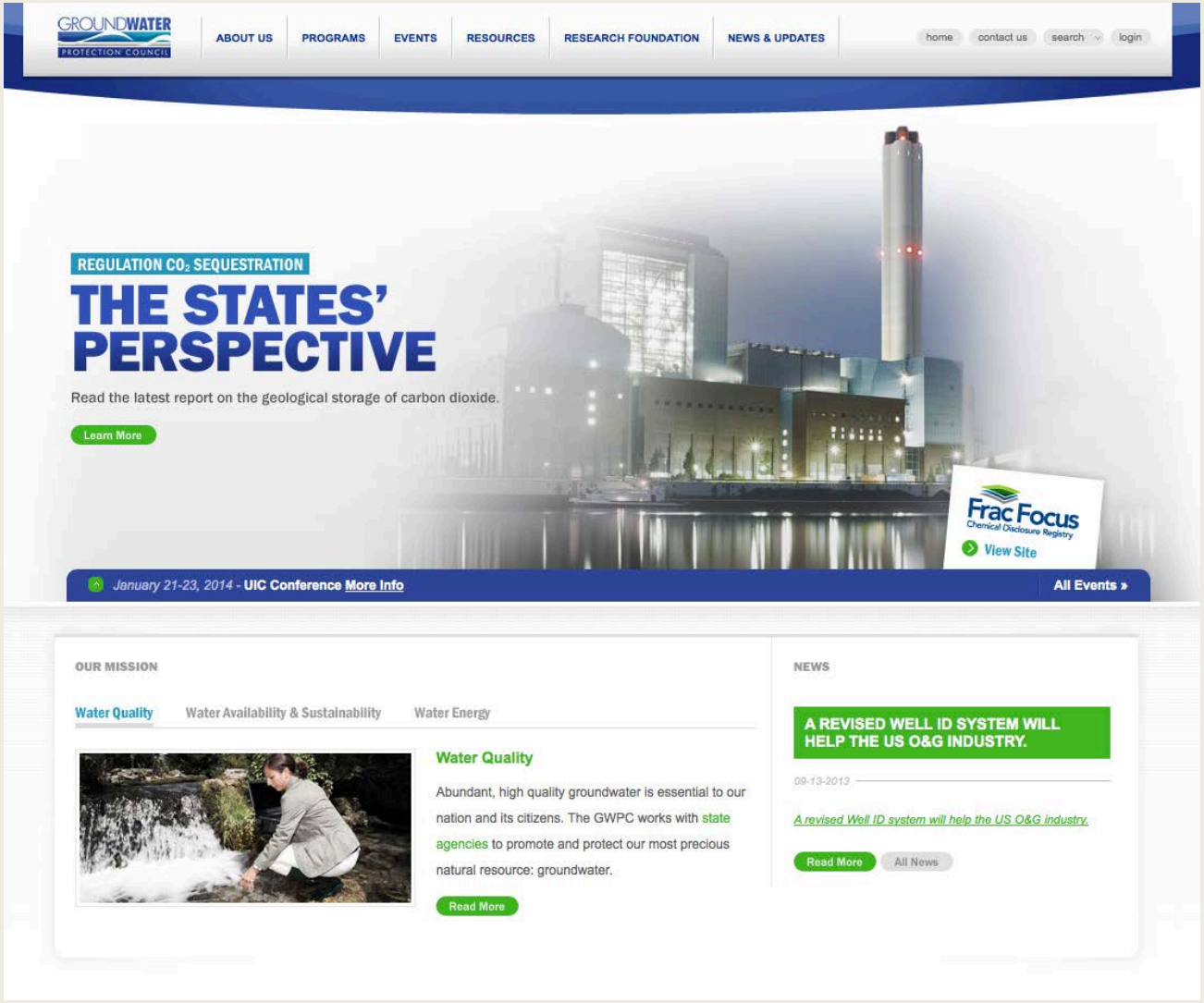
- O&G Statutes, with Legislative amendments as needed & necessary
- Regulations, with Administrative amendments & Waivers as appropriate
- Special Field Rules for each new field established
- Interagency Coordination
- Interaction with, and assistance from, national associations of states
  - Interstate Oil & Gas Compact Commission
  - Ground Water Protection Council



The Alabama Oil & Gas "Goldbook"

http://iogcc.org

http://iogcc.org



http://gwpc.org

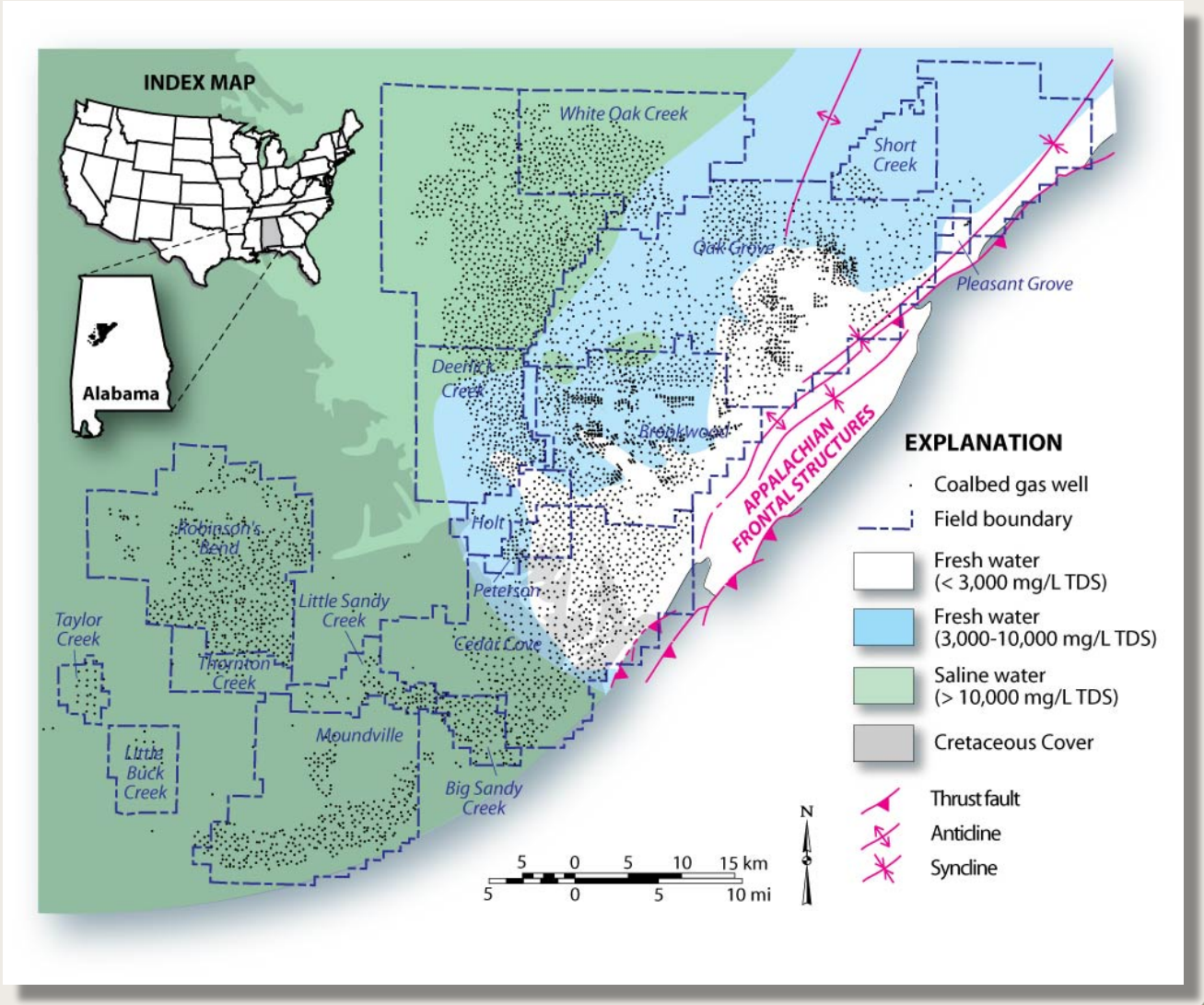
http://fracfocus.org

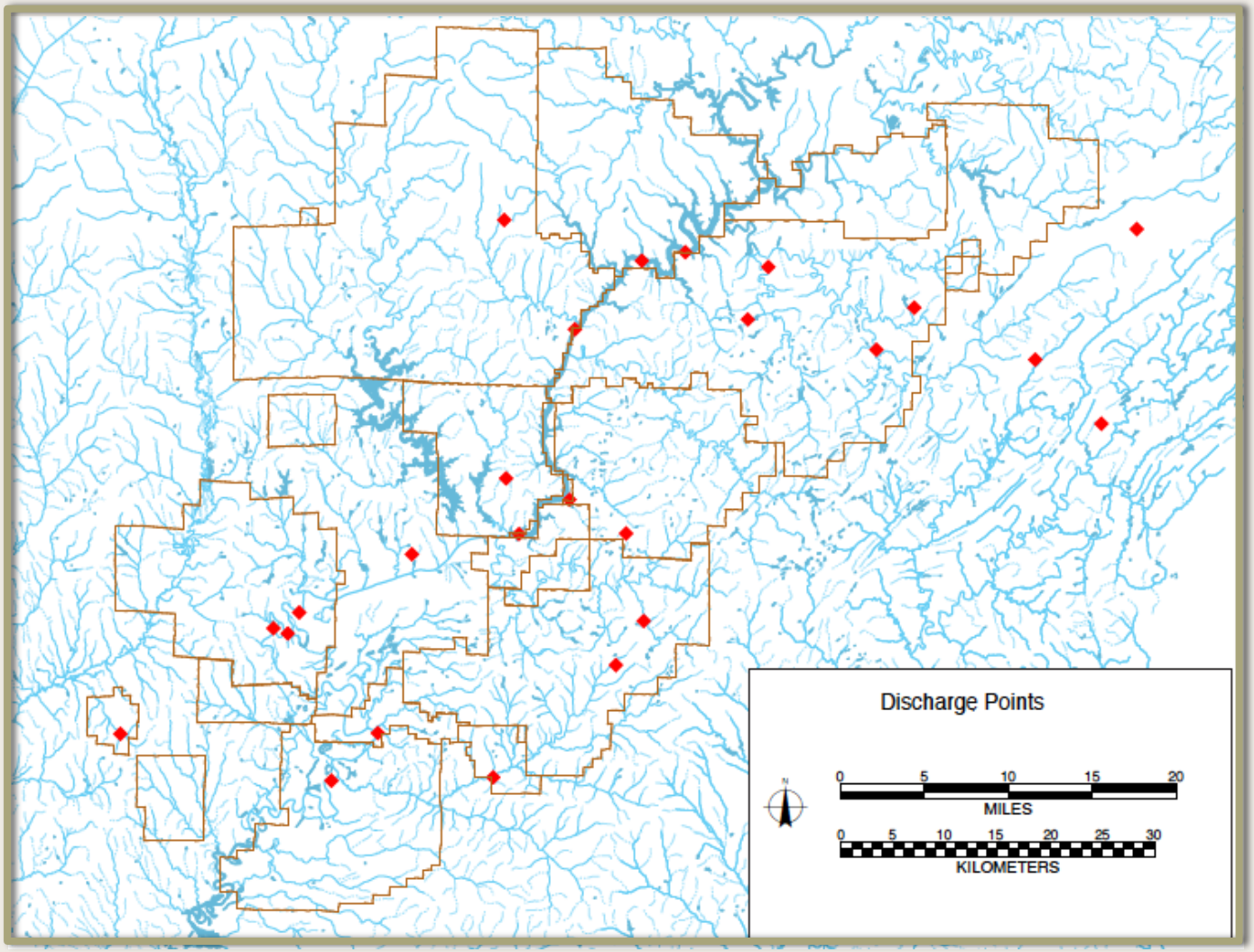
CBM Water Treatment and Disposal

- In-stream disposal is the dominant practice in the Black Warrior Basin.
- Prior to disposal, water is treated to remove silt, clay, iron, and manganese compounds.
- Underground injection can augment in-stream disposal in areas of highly saline water; however, currently all produced water is disposed of in-stream.
- Potential beneficial uses exist for produced water with less than 3,000 mg/L TDS.
- In the southwestern CBM fields, water is more saline and limits the ability to pump wells.

Coalbed Methane Water Treatment Ponds near the Black Warrior River, Alabama (photo by Nelson Brooke)

Coalbed Methane Development Area





Produced Water Discharge Points

CBM Produced Water in Alabama

- Potential Beneficial Uses:
  - Aquaculture and irrigation water, in particular, shrimp farming
  - Water for drilling and hydraulic fracturing
  - Municipal supply
- Alternative water treatment:
  - Reverse osmosis systems
  - Artificial wetlands
- Alternative to in-stream disposal:
  - SWD wells, however, no consistent high capacity zones identified

Alabama Inland Farm-raised Shrimp

CBM Development and Regulation in Alabama

- Alabama has had a long and overall positive experience with CBM development.
- This resource is extremely important in Alabama's overall fossil fuel energy portfolio.
- The State has developed a strong, but flexible, regulatory regime that has led to orderly development of CBM resources in the state.
- Future potential for CBM in the state is significant and development will proceed for many years into the future..

Contact Information

Nick Tew

Geological Survey of Alabama/State Oil and Gas Board of Alabama

E-mail: ntew@gsa.state.al.us

Web: www.gsa.state.al.us or www.ogb.state.al.us