

Haynesville Shale Water Use

Marcellus Summit, State College, PA

October 11, 2010

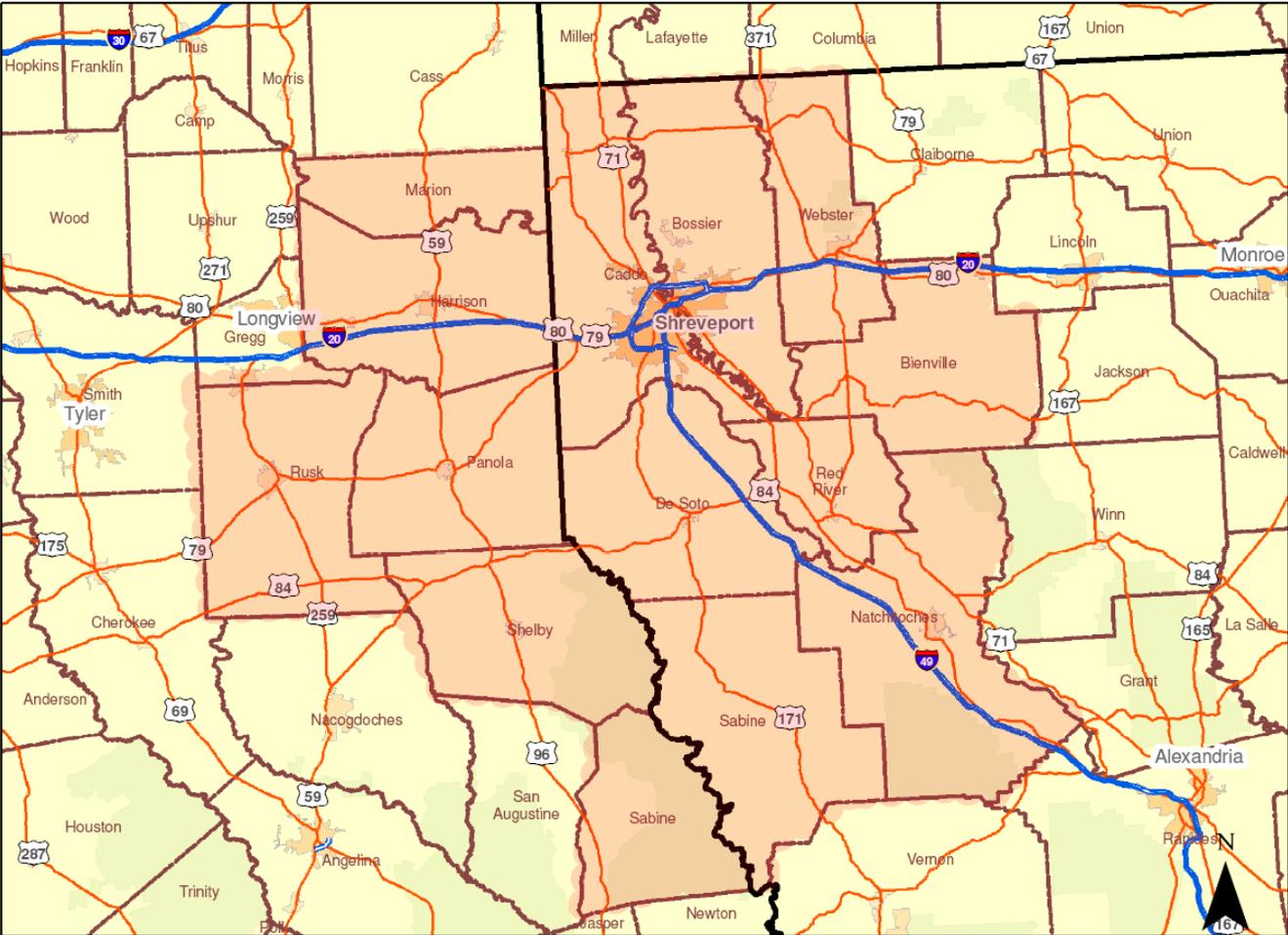


Mike Mathis, Regulatory Affairs, Water Planning



NATURAL GAS: FUELING AMERICA'S FUTURE

Haynesville Shale Map



Water Resources Management

- **Chesapeake has more than 50 professionals dedicated to water – setting the standard for the E&P industry**
 - ▶ Advance water needs assessments
 - ▶ Working with state & local water resource managers to ID least impactful water sources
 - ▶ Permitting and constructing water acquisition and conveyance facilities
 - ▶ Water reuse and treatment technologies
 - ▶ Dedicated water teams in all of our plays
- **Industry groups have staff and technical groups dedicated to water use and management**
 - ▶ Intra-company water teams developed at state, national and play specific level
 - ▶ The industry is committed to getting it right

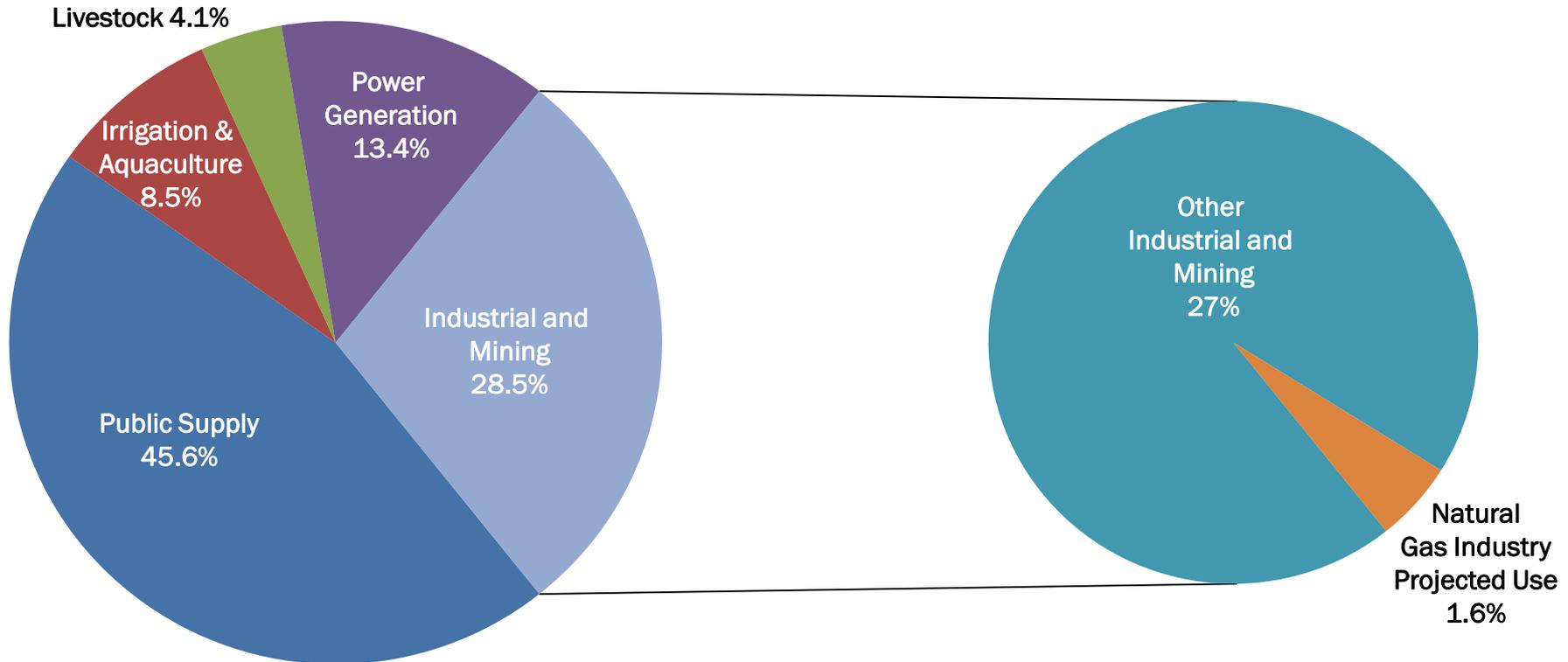
Water Usage in the Haynesville



- Chesapeake formed a dedicated water management team in Q4, 2008; the team's sole responsibility is finding and acquiring sources of surface water to use in our operations
- Currently, 90% of all water used in our completions processes has come from surface sources; these sources include ponds, lakes, bayous, rivers and streams
- In May 2009, Chesapeake was the first operator to receive a Army Corps of Engineers' permit to draw water from the Red River
- Our industry uses about 1.6% of all the water consumed annually in the eight-parish and four-county area in the Haynesville Shale.
- Chesapeake works collaboratively with appropriate state, federal, regional, and local agencies & entities to ensure that water used for deep shale gas development is consistent with state water use plans.

Water Use in Haynesville Shale Area

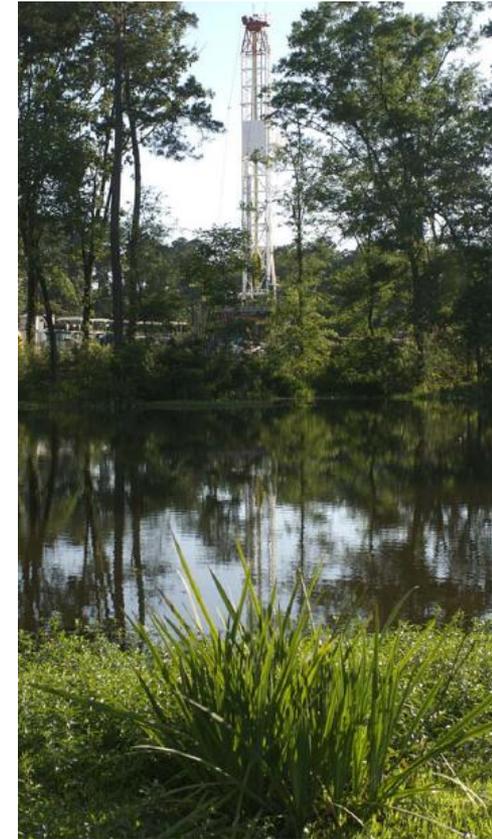
NW Louisiana (8-parish area) and east Texas (6-county area)
total water use (surface water and groundwater) by sector



Total water use in Haynesville area:
90 billion gallons per year

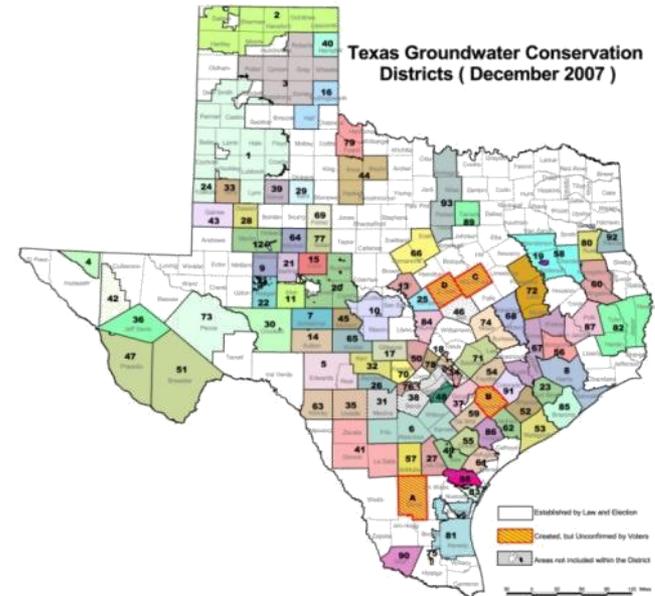
Regulatory Coordination: Louisiana

- **Surface Water Regulated by State**
 - ▶ Cooperative Endeavor Agreements
 - ▶ Water use reporting
- **Lead Agency that Supervise and Control Surface Water**
 - ▶ Louisiana Dept of Natural Resources (LDNR)
- **Other Agencies Involved in Surface Water Regulations**
 - ▶ Army Corps of Engineers
 - ▶ Louisiana Dept of Wildlife and Fisheries (LDWF)
 - ▶ Louisiana Dept of Transportation and Development (LDOTD)
 - ▶ Louisiana Dept of Environmental Quality
 - ▶ Sabine River Authority, Red River Waterway Commission, among others
- **Ground Water**
 - ▶ Regulated by LDNR Office of Conservation (OC)
 - ▶ Required notification and reporting



Regulatory Coordination: Texas

- **Ground Water in Texas is Privately Owned**
- **Rule of Capture Provides that Ground Water Must be Beneficially Used**
 - ▶ Cannot be pumped maliciously to harm a neighbor or cause land subsidence
- **Many areas managed by Ground Water Conservation Districts (GWCD)**
 - ▶ Districts are empowered to regulate ground water
 - ▶ Protects future ground water availability
- **Surface Water in Texas is owned by the State (held in trust for citizens)**
 - ▶ State (TCEQ) grants right to use surface water
 - ▶ Utilizes a priority in time system
 - ▶ Many river basins have own authorities



Haynesville Shale Water Sources

- **Surface water sources**
 - ▶ Red River
 - ▶ Sabine River
 - ▶ Toledo Bend Reservoir
 - ▶ Local public lakes
 - ▶ Local bayous
- **Private water sources**
 - ▶ Private lakes and ponds
- **Municipal / RWD water purchases**
 - ▶ Municipal and RWD water purchase when capacity is available
- **Water supply wells**
 - ▶ Minimize groundwater use
- **Reuse water**
 - ▶ Rule change facilitating “temporary use of E&P waste” in LA
- **Marginal groundwater resources**

Surface Water Sources



Rivers



Lakes



Bayous



Ponds

Completions



Water Use Comparison

Drilling and Completion Operations vs. Golf Course Maintenance

- One natural gas well, during its projected 45 to 70 day drilling and completion period uses about 135,000 barrels of water
- Shreveport-Bossier's 10 golf courses, during a span of three days, use about 140,000 barrels of water*



Drilling a **CHK well**

About 15,000 barrels

Completing a well

About 120,000 barrels

(includes fracing)

Total usage per well:

About 135,000 barrels



(One barrel = 42 gallons)

Water Use Comparison

Toledo Bend and Red River Examples

Use

At 150 wells per year and 135,000 barrels per well, Chesapeake will use approx 20 million barrels of water a year

Comparisons

Equivalent to about a 0.1-inch elevation change in the Toledo Bend Reservoir

Equivalent to less than 2 hours of Red River flow (as measured at Shreveport) or about 0.02% of the average annual flow volume



(One barrel = 42 gallons)

Water Resource Challenges and Opportunities Moving Forward



- **Competition for resources**
 - ▶ Multiple users in areas
 - ▶ Proper planning
 - ▶ Open communication with agencies and public
- **Target least impactful resources**
 - ▶ Major surface water sources
 - ▶ Strategic capture of surface flows during wet season
 - ▶ Ensure adequate pass-by flows
- **Short and long-range view**
 - ▶ Active participation in State water planning processes
 - ▶ Education
- **Use of treatment technologies where practical**
 - ▶ No magic bullet
 - ▶ Recycling/treatment of flowback and produced waters
 - ▶ Continual evaluation of emerging technologies and enhancement

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