Air & Waste Management Association
Louisiana Section 2010 Fall Conference

Haynesville Shale Natural Gas Development
Waste and Water Regulatory Issues

Presented by:
Gary W. Snellgrove
Louisiana Department of Natural Resources
Office of Conservation
Presentation Overview

Focus on Water Resources Management

- Haynesville Shale Area
- Water Demand
- Water Resources
- Agency Action
  - Ground Water Use Advisory
  - Water Use Reporting
  - E&P Waste Fluid / Frac Water Supply Use Regulation
  - ACT 955 of 2010 (Running Surface Water Use Mgmt.)
- Proposed Action
  - Fracture Stimulation Reclamation Fluid Regulation
- Resource Management Summary
- Agency Contact Information
Haynesville Shale Area
Louisiana Hayneville Shale Activity

- Producing Well (702)
  - Permitted Well
  - Waiting on Completion/
    Fracturing/Testing/
    Other Operations (478)
- Permitted Well
  - Drilling in Progress (141)
- Permitted Well
  - Not Drilling (298)

1,619 Total Wells

- Adopted Unit (1,980)

1,980 Adopted Units
# Haynesville Shale Stratigraphic Location

<table>
<thead>
<tr>
<th>ERA</th>
<th>SYSTEM</th>
<th>FORMATION</th>
<th>DEPTH (Feet)</th>
<th>LITHOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>CENOZOIC</td>
<td>TERTIARY Paleocene</td>
<td>Wilcox USDW</td>
<td>400</td>
<td>Sand, Gravel, Clay, Lignite (Exposed at Surface)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Midway Shale</td>
<td>600</td>
<td>Shale</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>600</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nacatox Sand</td>
<td>1,000</td>
<td>Sandstone, Chalk, Limestone, Shale</td>
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<tr>
<td></td>
<td></td>
<td>Paluxy</td>
<td>2,000</td>
<td>Sandstone/Shale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mooringsport Shale</td>
<td>3,000</td>
<td>Sandstone, Shale, Anhydrite</td>
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<tr>
<td></td>
<td></td>
<td>Rodessa</td>
<td>4,000</td>
<td>Limestone, Shale</td>
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<tr>
<td></td>
<td></td>
<td>Pine Island Shale</td>
<td>5,000</td>
<td>Shale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sligo</td>
<td>6,000</td>
<td>Sandstone, Shale</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hosston</td>
<td>7,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8,000</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Cotton Valley</td>
<td>9,000</td>
<td>Sandstone, Shale, Limestone</td>
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<td></td>
<td></td>
<td></td>
<td>10,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>JURASSIC</td>
<td></td>
<td>11,000</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Bossier Shale</td>
<td>12,000</td>
<td>Organic Rich Black Shale</td>
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<tr>
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<td>Haynesville Shale</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Smackover</td>
<td></td>
<td>Limestone</td>
</tr>
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</table>
## Water Demand

Water Usage from 10/1/2009 to 9/30/2010

<table>
<thead>
<tr>
<th>Source</th>
<th>Volume (Gallons)</th>
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</thead>
<tbody>
<tr>
<td>Frac Groundwater</td>
<td>453,316,316</td>
</tr>
<tr>
<td>Frac Surface Water</td>
<td>2,163,131,485</td>
</tr>
<tr>
<td>Drilling Rig Groundwater Supply</td>
<td>217,404,498</td>
</tr>
<tr>
<td>Drilling Rig Surface Water Supply</td>
<td>32,684,169</td>
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<tr>
<td>Other Groundwater</td>
<td>4,033,153</td>
</tr>
<tr>
<td>Other Surface Water</td>
<td>10,001,189</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frac Stages</th>
<th>5695</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Frac Water Used (gallons)</td>
<td>2,626,728,527</td>
</tr>
<tr>
<td>Volume per Frac Stage (gallons)</td>
<td>461,234</td>
</tr>
<tr>
<td>Average Frac Stages per Well</td>
<td>9.4</td>
</tr>
<tr>
<td>Average Water Use per Well</td>
<td>4,734,750</td>
</tr>
<tr>
<td>Average Frac Water Use per Well</td>
<td>4,320,277</td>
</tr>
</tbody>
</table>
Water Resources

Surface Water
- Red River
- Toledo Bend Reservoir
- Other Lakes and Bayous

Ground Water
- Red River Alluvial
- Upland Terrace
- Carrizo-Wilcox

Waste Water
- Reserve Pits
- Other
Red River & Toledo Bend Yield Capacity

Sources: Jim Pratt, Executive Director – Sabine River Authority  
Northwest Louisiana Aquifers
Ground Water Use Advisory

For Release: October 16, 2008

Web Posting

Ground Water Use Advisory:
Commissioner of Conservation Recommends Wise Water Use Planning in the Haynesville Shale

Commissioner of Conservation Jim Welsh recommends that oil and gas operators with interest in developing the Haynesville Shale in Northwest Louisiana choose their water sources for use in drilling or hydraulic fracture stimulation operations wisely. Of particular interest are areas in the lower Caddo and Bossier Parishes and DeSoto Parish where the Carrizo - Wilcox aquifer is used as the main source of drinking water supply for domestic

Therefore, if ground water must be used for drilling or hydraulic fracture stimulation purposes, it is recommended that the Red River Alluvial aquifer be utilized for these purposes, where feasible, as the source of ground water supply in lieu of the Carrizo - Wilcox aquifer.

Based on USGS and other published information on ground water resources in Northwest Louisiana, the Red River Alluvial aquifer system is a high yield system comprised of coarse gravel and sand formations continuously recharged by the surface waters of the Red River. It is further documented that the Red River Alluvial aquifer system, due to its hardness and high dissolved solids, is seldom used for domestic and public supply

The Commissioner further encourages oil and gas operators to use the available surface water resources or other acceptable alternative water sources in Northwest Louisiana, where practical and feasible.

Provided below are links to published documents, resources and references available for water quality and use in Northwest Louisiana. If you have any questions or need further clarification, please contact Environmental Division staff at 225-342-8244 or by email at http://dnr.louisiana.gov/gwater.
Water Use Reporting Requirement

Specifically, the water source and associated volume must be reported on page two (2) of the ‘Well History and Work Resume Report’ (Form WH-1) which must be filed within twenty days after completion or recompletion operations. The water sources must be identified by either the water well number or water body name, as appropriate. Separate water volumes for rig supply use and stimulation operation use must be provided. A completed example of page two (2) of the ‘Well History and Work Resume Report’ (Form WH-1) is attached.

At this time, the policy shall only apply to wells for which a work permit is issued to conduct hydraulic fracturing stimulation operations.

A revised ‘Well History and Work Resume Report’ (Form WH-1) is available from the department web site at the following address: http://dnr.louisiana.gov/cons/CONSEREN/documents/WH1.dot

The policy is effective immediately. Questions on implementation may be directed to Mr. Robert “Bob” Romero at (225) 342-8242 or robert.romero@la.gov.
E&P Waste Fluids Use for Frac Water Supply
LAC 43:XIX.Subpart 1.Chapter 3 Amendment

Allows Operators to Use E&P Waste Fluids for Frac Supply Purposes

1) Promulgated November 20, 2009
2) Amended June 20, 2010
3) Limitations:
   i. Used as Frac Supply Only
   ii. By the Same Operator
   iii. With Operator Affidavit Confirming Landowner Consent
ACT 955 of 2010
Running Surface Water Management

DNR Responsibility to Implement:

• Surface Water Use Application

• Cooperative Endeavor Agreement
Fracture Stimulation Reclamation Fluid
LAC 43:XIX.Subpart 1.Chapters 3 & 5
Proposed Amendment

Allows Off-site (Commercial) Waste Fluid Treatment for On-site Frac Water Supply Purposes

1) NOI Published September 20, 2010
2) Public Hearing Held October 25, 2010
3) Limitations:
   i. Commercial Facility Permit Required
   ii. Frac Supply Use only at OC Permitted Frac Operations
   iii. Well Operator Held Solely Responsible for Use
   iv. Waste Disposition Reporting Required
DNR / Conservation
Haynesville Shale Water Resource Management Summary

Agency Action:

1. Timely Response

2. Sufficient Oversight
   i. Policy and Regulation Adjustments
   ii. Resource Use Reporting and Monitoring
   iii. Increased Waste Minimization / Recycling Opportunities
   iv. Industry and Public Education / Outreach
Contact Information

LAC 43:XIX.Subpart 1.Chapter 3 (On-site Pollution Control)
Waste Fluid / Frac Supply Amendment
Mr. Chris Sandoz
Phone: 225-342-5524
Email: Chris.Sandoz@LA.GOV

LAC 43:XIX.Subpart 1.Chapter 5 (Commercial Facility Regulations)
Proposed Fracture Stimulation Reclamation Fluid Amendment
Mr. John Adams
Phone: 225-342-7889
Email: Johnny.Adams@LA.GOV

ACT 955 of 2010 (Running Surface Water Use Management)
Mr. O. C. Smith
Phone: 225-342-5524
Email: O.C.Smith@LA.GOV

Gary Snellgrove
Phone: 225-342-7222
Email: Gary.Snellgrove@LA.GOV
Website Links

Haynesville Shale Webpage
http://dnr.louisiana.gov/haynesvilleshale/

LAC 43:XIX.Subpart 1.Chapter 3 (On-site Pollution Control)
Waste Fluid / Frac Supply Amendment

LAC 43:XIX.Subpart 1.Chapter 5 (Commercial Facility Regulations)
Proposed Fracture Stimulation Reclamation Fluid Amendment

ACT 955 of 2010 (Running Surface Water Use Management)
http://dnr.louisiana.gov/sec/955/955.htm

Ground Water Resources Management Webpage
http://dnr.louisiana.gov/cons/groundwater/

E&P Waste Management Webpage
http://dnr.louisiana.gov/cons/CONSERIN/Waste.ssi

Water Use Reporting (Form WH-1: Work History and Well Resume’ Report)