



Department of the Environment

Drilling for Gas in the Marcellus Shale Formation in Maryland



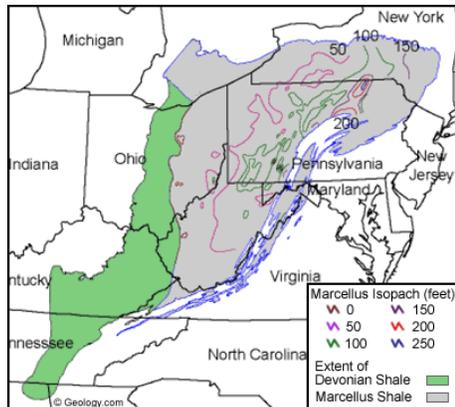
19th Annual Ground Water Symposium

September 29, 2010



The Marcellus Shale

- The Marcellus Shale is an organic rich Devonian Shale located in the Appalachian Basin.
- In 2006 The Department of Energy announced that the Marcellus Shale is potentially the largest natural gas reserve in the United States.
- Advances in horizontal drilling and hydraulic fracturing have made gas recovery feasible and economical from the Marcellus Shale.



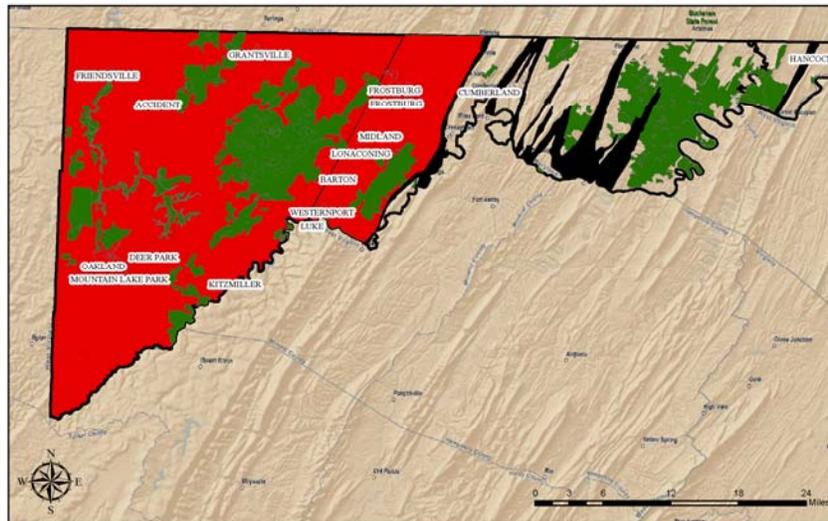


Limits of the Marcellus Shale In Maryland

- Marcellus Shale is located in Garrett, Allegany & Washington Counties.
- The most feasible drilling locations include Garrett County and western Allegany County.
- In Garrett County the Marcellus shale is found at depths ranging between 3,500 to 9,000 feet below the surface.
- In Allegany County, near Frostburg, the Marcellus is found as deep as 9,000 feet below the surface.

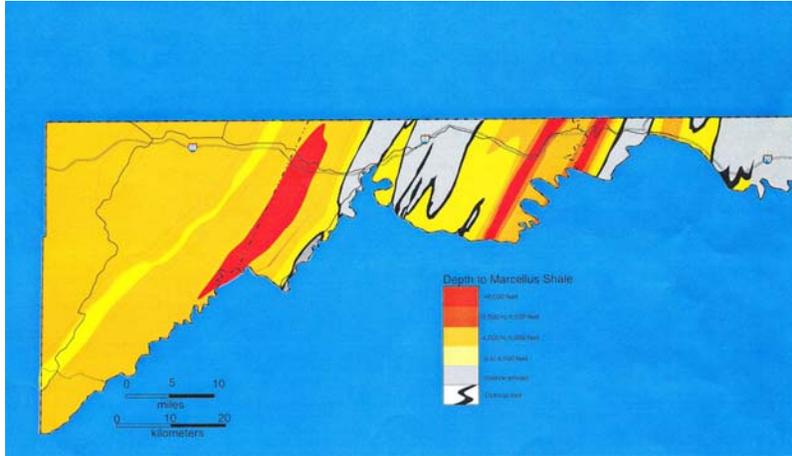


Potential Areas for Marcellus Shale Exploration



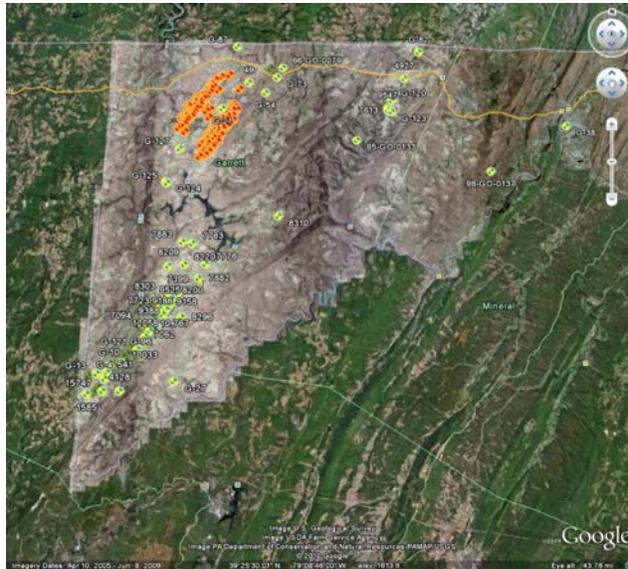
Legend Marcellus Shale Outcrops Potential Areas for Marcellus Exploration State Owned Land





Activity in Maryland

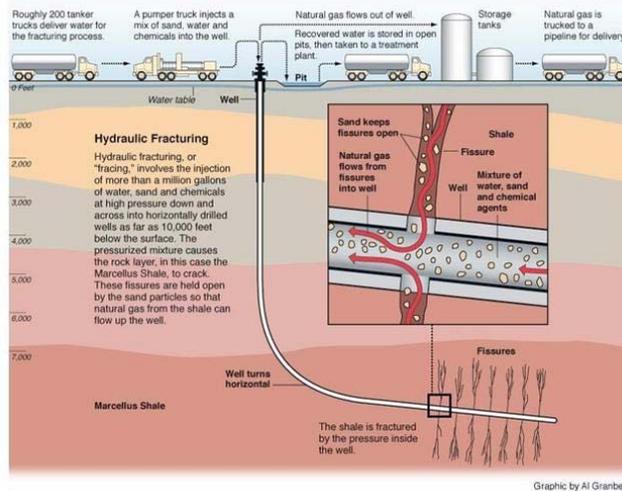
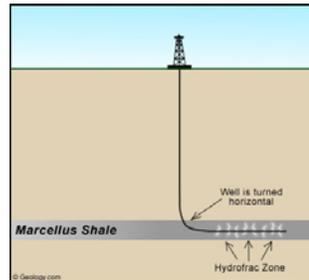
- Gas drilling in Maryland is not a new activity.
- Several hundred producing wells were drilled in Western Maryland in the 1950's and 60's. (yellow) Last well drilled in 1994
- 10 Gas production wells are currently permitted.
- Approximately 90 permitted wells are used for gas storage. (orange)





Gas Extraction Process From the Marcellus Shale Formation

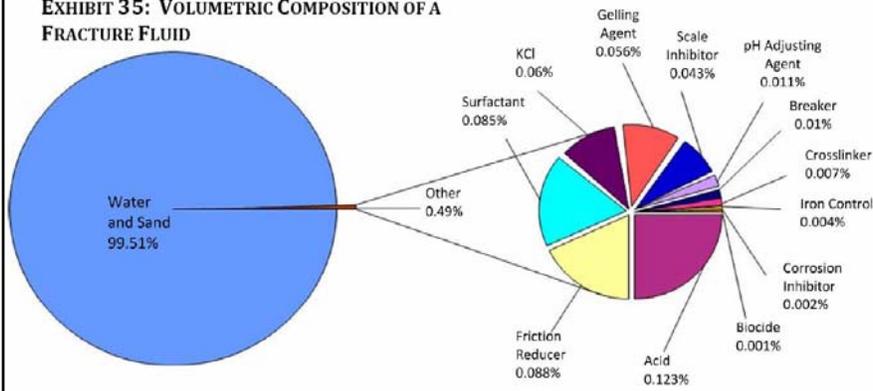
- A vertical well is drilled 4,000-9,000 feet below the ground surface
- The well bore is then drilled horizontally into the target formation
- The well is then hydraulically fractured by pumping one to five million gallons of water, sand & chemicals into the well bore.





Breakdown of Fracture Fluid

EXHIBIT 35: VOLUMETRIC COMPOSITION OF A FRACTURE FLUID



Source: ALL Consulting based on data from a fracture operation in the Fayetteville Shale, 2008



Permitting Process

- Application
- Plans
- Supporting Documents
 - Environmental Assessment
 - Copy of gas leases
 - Spill Prevention, Control and Countermeasures Plan
 - Fire prevention and Control Plan
 - Certificate of Liability
 - Performance bond
 - Approved Sources for Fresh Water
 - Wastewater disposal plan





Permitting Process Continued

- Request for Comments from other agencies
 - Maryland Historical Trust
 - Non-Tidal Wetlands Division (MDE)
 - Maryland DNR
 - Maryland Geological Survey
 - Bureau of Mines (MDE)
 - Maryland Agricultural Land Preservation Foundation
- Initial site inspection
- Public notice and comment period
- Public Information Hearing
- Well borehole must be located at least 1,000 feet from un-leased lands, schools, churches, and occupied dwelling.



Inspections

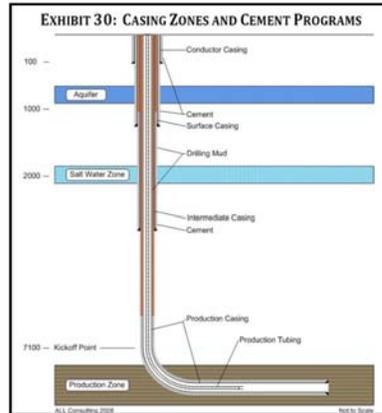
- Initially to review site with pending application
- Drilling of gas well
- Hydro-fracturing process
- Reclamation of pits and area around well head
- Annually during the life of the gas well (minimum)
- Investigate complaints





Typical Well Construction - Casings

- 4 Layers of Casing:
 - 20" Conductor Casing
 - 13 3/8" Surface Casing
 - 8 5/8" Intermediate Casing
 - 5 1/2" Production Casing
- Grouted between each casing layer
- Intermediate casing is extended at least 100' below the deepest freshwater aquifer
- A mechanical integrity test will be conducted which will be a pressure test used to verify there are no leaks in the casing or grout



Frack Water Disposal

- Currently no underground injection points permitted in Maryland
- Wastewater Treatment Plants would have to have MDE approval to take waste water, currently no plants have the capacity
- An offsite discharge would require an NPDES permit





Post Drilling Procedures

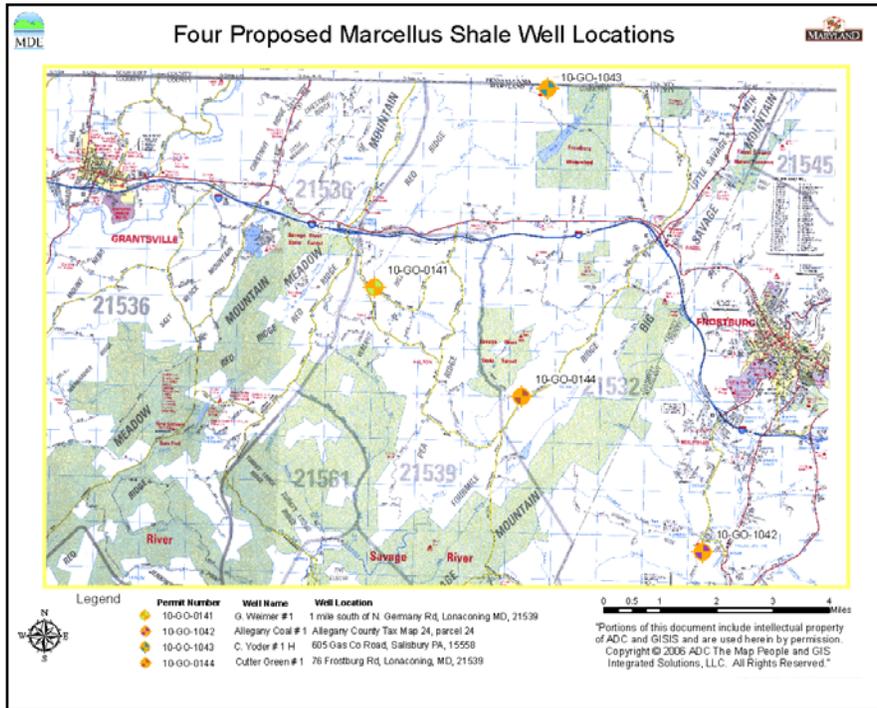
- Site restoration
 - Reclamation of pad
 - Removal of liners, filling ponds
- Cuttings disposal
 - Approved landfill
- Production procedure
 - Installation of well head and transmission lines
 - Separating of produced water
- Product transport



Samson Resources

- In October 2009 Samson Resources applied for 4 permits to drill for Natural Gas in the Marcellus shale Formation in Maryland.
- The Mining Program has coordinated the review of the applications with other agencies.
- The Water Supply Program, Wastewater Discharge Permits Program, and the Air & Radiation Management Administration have also been consulted regarding the proposed wells and their permit process.





Current Status (Pending)

- Approved Sediment & Erosion Control Plans signed by the Garrett County Soil Conservation District.
- Undergoing internal review within MDE.
- Notification, public comment period and opportunity for a public hearing.
- Only 1 Samson application is being pursued at this time.



C. Yoder # 1

- Water for drilling will be purchased from the City of Cumberland's WWTP treated effluent & through the City of Frostburg's water appropriation permit at Piney Reservoir.
- An ARMA permit has been applied for at the C. Yoder Well for a compressor.
- According to DNR there are no rare & endangered species at the proposed well site location
- The site is currently an agricultural field
- The applicant has proposed to treat the spent frac water on-site via reverse osmosis and is to then reuse the treated water at another well.
- No waste water disposal is planned in Maryland.



C. Yoder # 1





Gas Production - Future

- If the Samson wells are successful it is anticipated there will be a sharp increase in permit applications from multiple Gas Companies.



Questions? [Video](#)





Work Cited

- <http://www.api.org/policy/exploration/hydraulicfracturing/hydraulicfracturing.cfm>
- API
- Geology.com

