

The Marcellus Shale in Maryland



*Briefing to House Environmental Matters
Committee*

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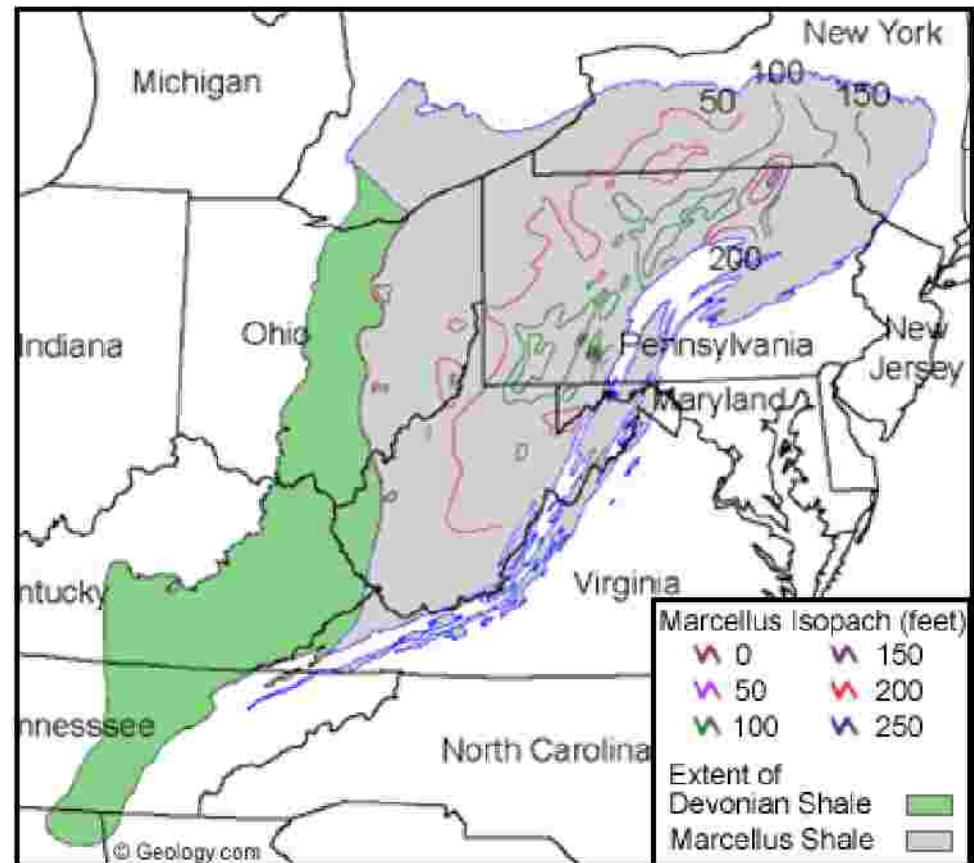
John R. Griffin

Secretary

Maryland Department of Natural Resources

The Marcellus Shale

- Found throughout the Allegheny Plateau region of the northern Appalachian Basin
- In Maryland, it is found in Garrett County and part of Allegany County
- Recovering gas from the Marcellus has become economically feasible
 - Advances in horizontal drilling and hydraulic fracturing
 - Higher wellhead prices for gas



The Marcellus Shale

- The Marcellus Shale covers an area of 95,000 square miles in NY, PA, MD, WV and Ohio
- Depth of 4000 to 8500 feet
- Average thickness of 50 ft to 200 ft
- An average well spacing in the Marcellus is 40 to 160 acres per well

Source: Modern Shale Gas Development in the United States, prepared for the US Dept. of Energy (April 2009),
http://www.netl.doe.gov/technologies/oil-gas/publications/epreports/shale_gas_primer_2009.pdf

Potential Production

- The Marcellus Shale is thought to be the largest gas reserve in the United States
- All of Marcellus Shale is estimated to contain 363 trillion cubic feet – enough to supply the needs of the US for 15 years at the current rate of consumption
- Over its lifetime, each horizontal well on an 80-acre surface spacing can be expected to produce a total of about 2.5 BCF (billion cubic feet) of gas

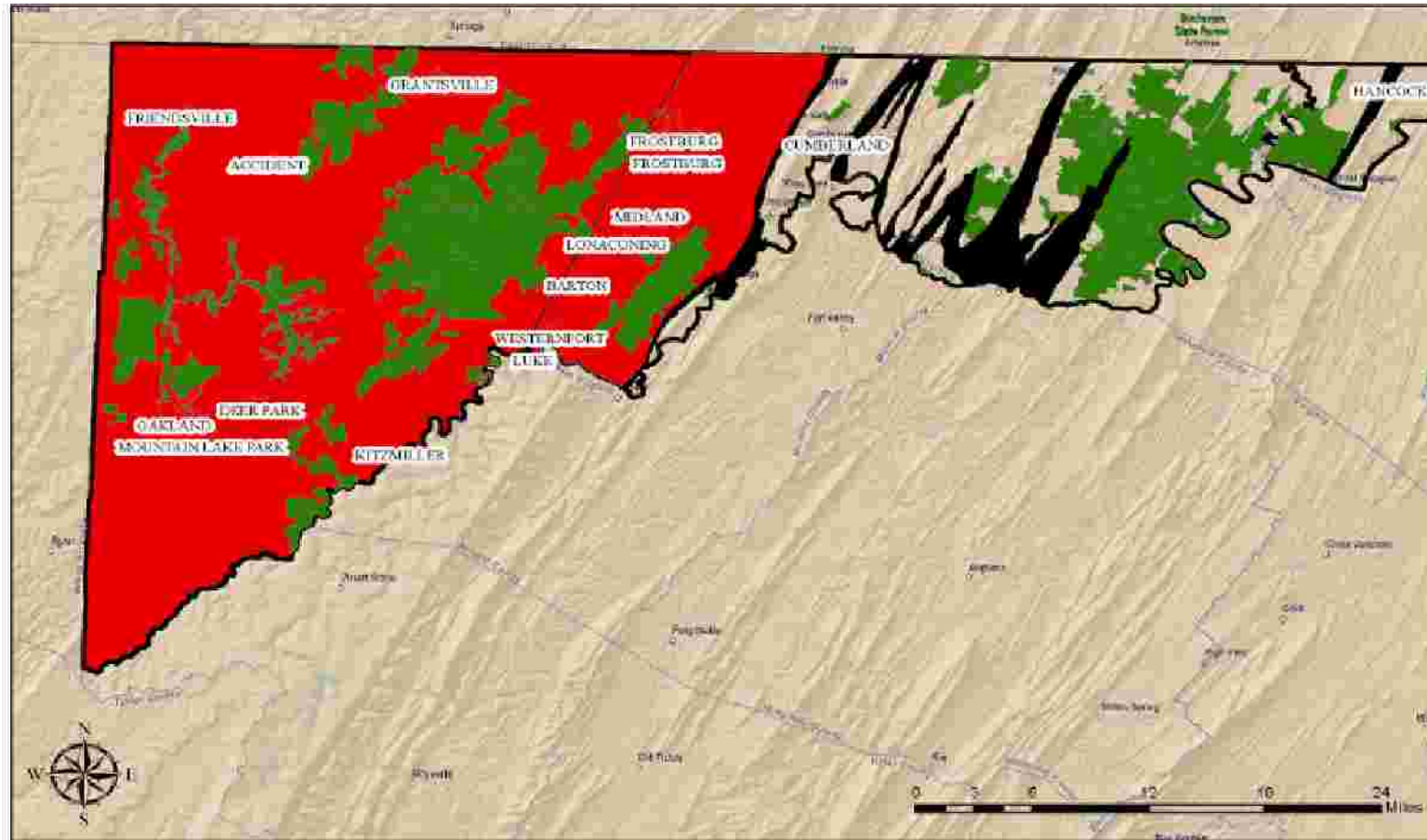
Water Resources and Natural Gas Production from the Marcellus Shale, USGS FS-2009-3032

By Daniel J. Soeder et al., U1 and William M. Kappel <http://md.water.usgs.gov/publications/fs-2009-3032/fs-2009-3032.pdf>

Potential Exploration Areas in MD



Potential Areas for Marcellus Shale Exploration



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

Opportunities

- Improved energy independence
- Lower greenhouse gas emissions from natural gas than coal or oil
- Economic development in Garrett and Allegany Counties until gas is depleted (jobs, goods and services, local severance tax)

Environmental Concerns

- Protection of drinking water supplies
- Protection of stream and groundwater quality
- Protection of aquatic living resources
- Erosion and sediment from drill pad and pipeline construction
- Forest and habitat fragmentation

Environmental Concerns

- Spills or leaks of fuel, fracking fluids or chemical additives
- Discharge of flowback and other waste water
- Waste disposal of drilling muds and other materials from site
- Air emissions



Public Health and Safety Concerns

- Heavy truck traffic
- Impact on roads and bridges
- Noise
- Risk of Fires and Explosions
- Emergency Response



Typical Wells

Source: API Standard HF1

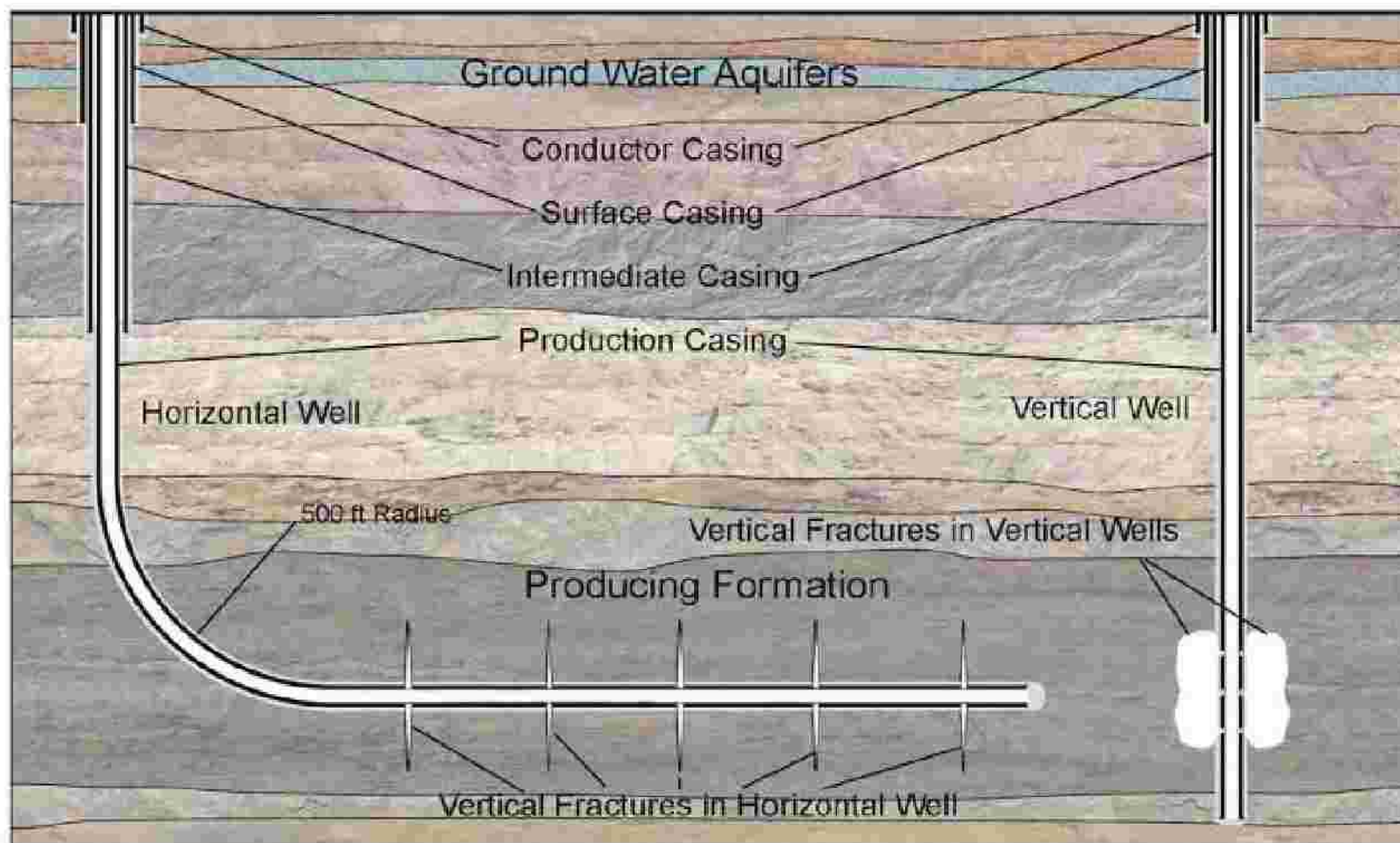
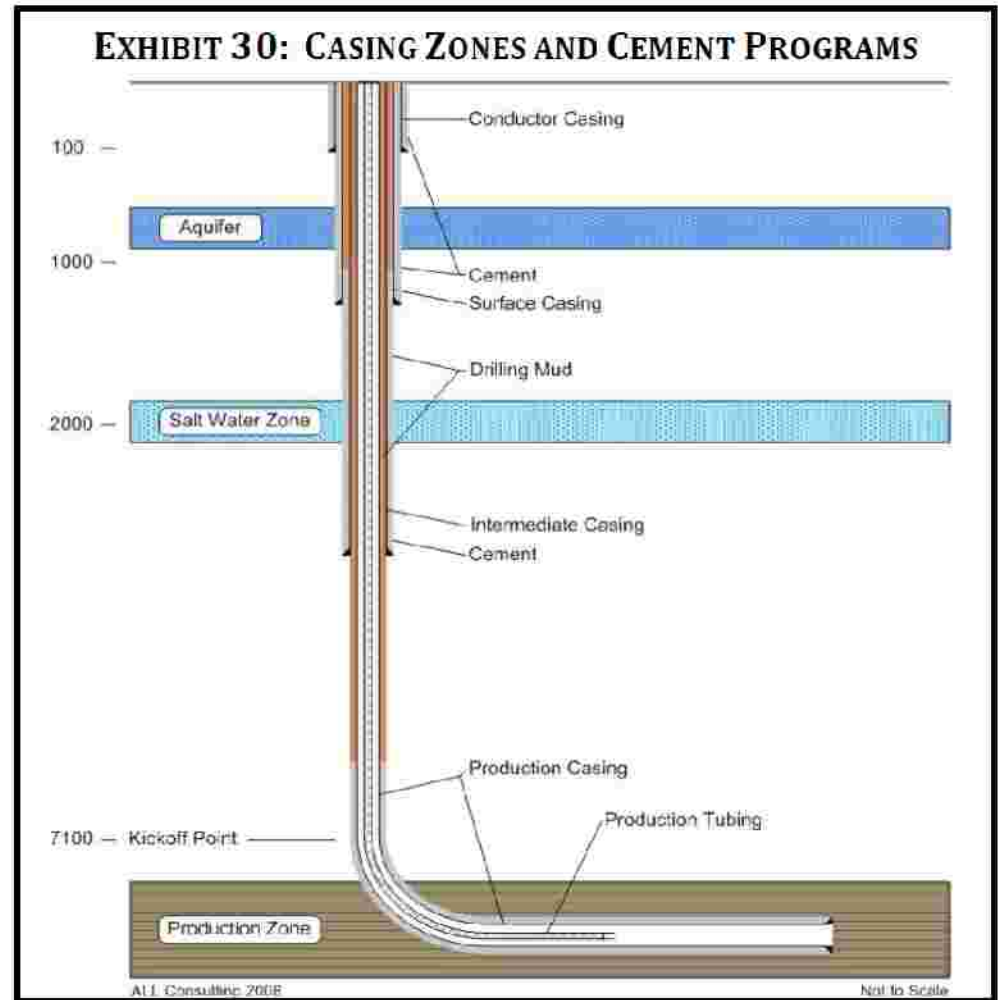


Figure 3—Example of a Horizontal and Vertical Well

Protection of Aquifers

- A well is drilled vertically past potential drinking water aquifers, then horizontally in the shale.
- The vertical portion of the well is cased and cemented to a depth at least 100 feet below the deepest fresh water zone.
- A mechanical integrity test (a pressure test) is required to verify there are no leaks in the casing or grout.



MDE Gas Well Permit

- A permit is required before a person drills any gas well
- COMAR regulations establish application requirements and criteria for construction and operating
- MDE now has authority to collect annual fees and permit fees; regulations to establish fees are under development

Other Permits

- MDE
 - Water Appropriation permit
 - Air Quality permit
 - Wastewater discharge permit
 - Wetlands permit
- Local
 - Planning and zoning requirements
 - Grading
 - Erosion and sediment control



Application and Permit Status

- Samson Resources
 - Filed applications in 2009 for 4 wells
 - Proceeding with an application for a single well in an area near the Pennsylvania border northwest of Frostburg, in the Youghiogheny River watershed
 - One 3,000 foot lateral
 - Water to be obtained from Frostburg's municipal drinking water supply; adequate volume available within Frostburg's current appropriation
 - The site is currently farm field, and located very close to an existing pipeline





Application and Permit Status

- Chief Oil and Gas
 - Filed applications in 2011 for two wells in the Friendsville area
 - One 3,200 foot lateral; second lateral 2,587 feet
 - Water to be obtained from a Preston County, WV Public Service District Number 4
 - The sites are currently a farm field and a vegetated open space



Drilling Application

- Locations of vertical and horizontal well and adjoining properties
- An Environmental Assessment
- Liability insurance and a performance bond
- Proof of mineral rights
- Right of access for MDE
- Certification that adjoining properties owners have been notified
- Written approval by local zoning authority
- Plans for
 - Sediment & Erosion Control Plan
 - Stormwater management
 - Reclamation of roads, well sites, and pits
 - Pit design
 - Spill prevention, control & countermeasures
 - Detection, prevention and containment of gas leaks and oil spills

Other Information Required

- Drilling and Fracking fluid
 - Constituents
 - Information on Toxicity
- Plan for casing and cement
- Source for water
- Waste disposal plan
 - Drill cuttings
 - Flowback water
 - Produced water

Public Notice

- Once the application is complete, notice is posted in a local newspaper, advertising the opportunity to request a public informational hearing and submit comments
- Property owners adjacent to the drilling site are notified individually

Comment, Hearing, Appeal

- Comment period closes after the public informational hearing
- MDE considers comments and decides whether to issue permit and, if so, with what conditions
- Person aggrieved by the decision can appeal to Circuit Court

Outreach

- MDE sponsored or participated in numerous meetings open to the public
 - Presentations by experts
 - Opportunity for Q&A
- MDE is a member of Garrett County Commissioners Marcellus Shale Advisory Committee

Potential Long-Term Cumulative Impacts

- Contamination of groundwater and streams
- Availability of drinking water
- Environmental liability from unknown, future adverse impacts
- Boom and bust economic cycle
- Potential impact on tourism and aesthetics

Potential Long-Term Cumulative Impacts

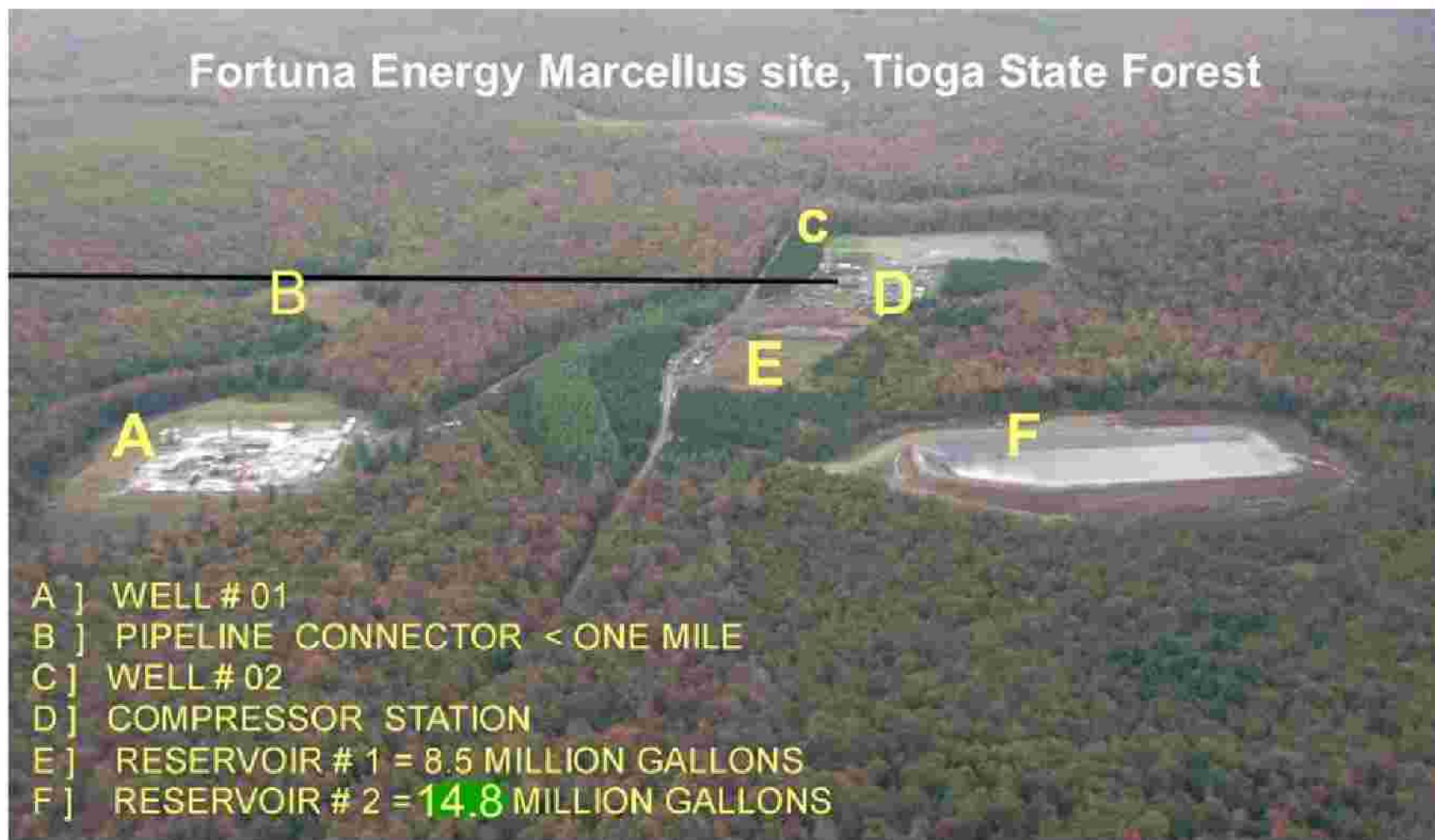
Alteration of Landscape and
Loss of regional character

- Changes to quality of life
- Impacts on rural towns
- Loss of tourism

State Conservation Lands (fee and easement)

- Impact on public investment for open space and agriculture
- Impacts to recreational opportunities

Landscape Impacts



Drilling Pad



Placing Drilling Mud into Pit



Draining Drilling Mud



Gas Well Flaring



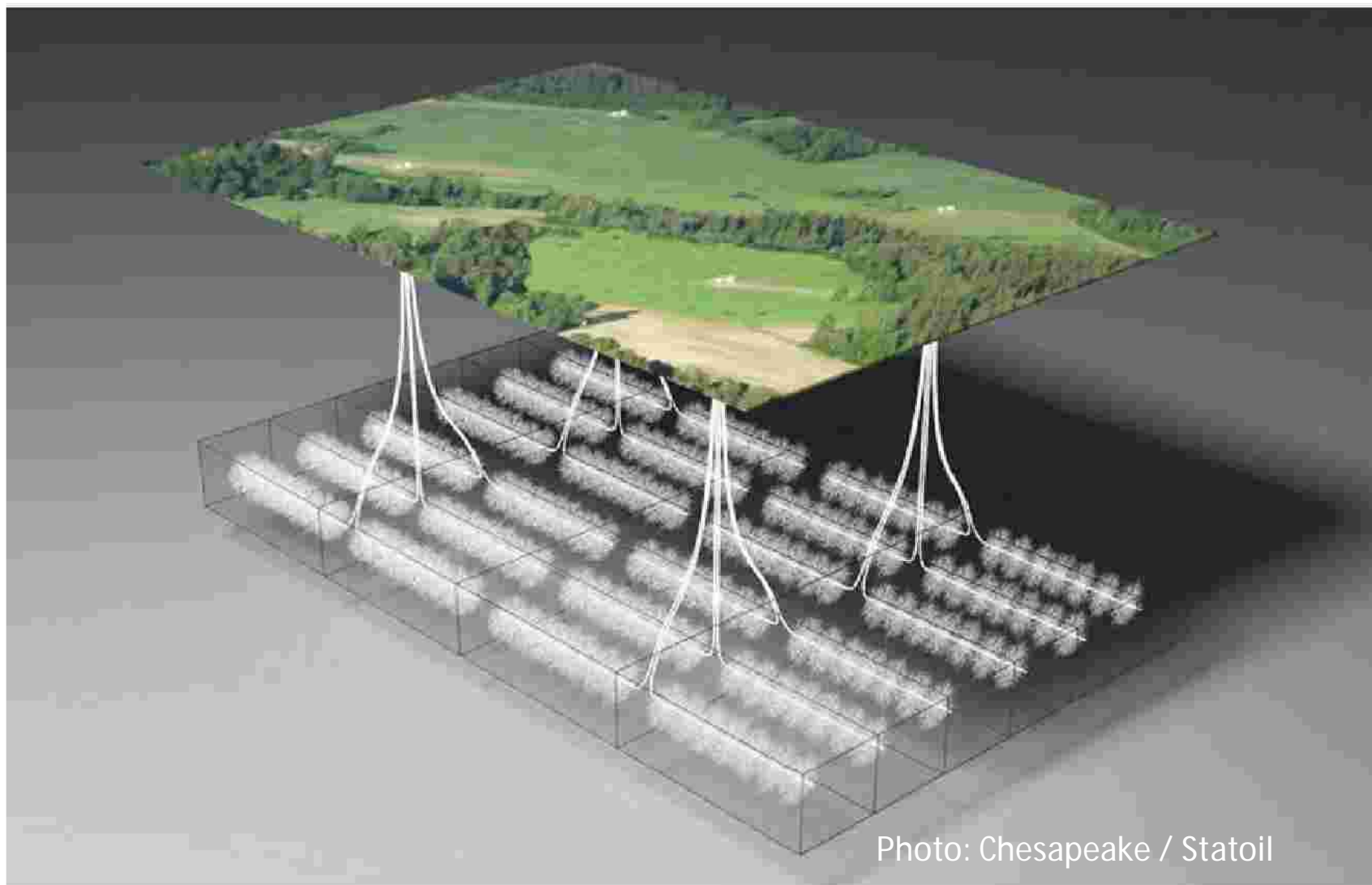
Pipeline Construction



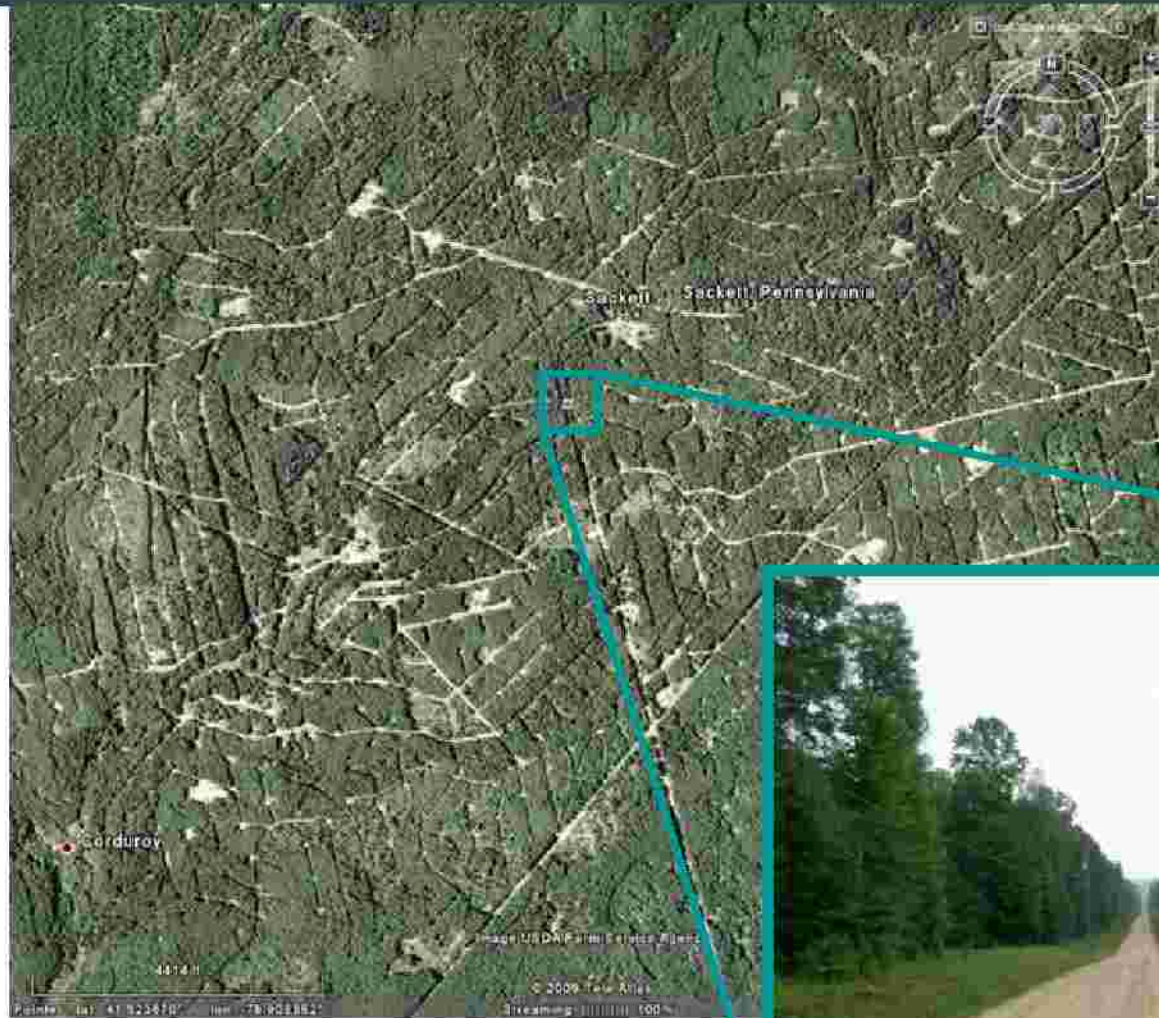
Marcellus Separation Facility – West Virginia



Marcellus Development Plan



Well Sites and Fragmentation



(images from GoogleEarth, 2009)

(from Coleman and others, 2009)



Well Sites - Wyoming

SKYTRUTH

Jonah Natural Gas Field - Wyoming, May 2006

Taken from a small plane this image shows 3 to 5 acre gas well pads in a 40 acre spacing. In our area of NEPA and Sullivan Cty. NY, the spacing is predicted to be a well every 25 to 30 acres - so the proposed gas wells would be even closer together here than these pictured in Wyoming. These were built in about seven years time.

www.DamascusCitizens.org

Maryland's Approach

- Exercise Precautionary Principle
- MDE permits developed in consultation with DNR
- Learn from experiences of other states, especially Pennsylvania & New York
- Consult with experts from other states, Commissions, EPA, DOE, DOI and USGS
- Make permit decision based on science
- Require best practices
- Address cumulative impacts



Maryland Department of the Environment

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