

Gas Drilling in the Marcellus Shale and Pennsylvania's Coldwater Resources

Pennsylvania Council of Trout Unlimited

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Introduction

A major natural gas boom is underway in Pennsylvania. Energy companies from across the US have come to this region to drill for gas in a geological formation known as the Marcellus Shale. PA Trout Unlimited believes the Marcellus Shale gas boom has the potential to significantly damage Pennsylvania's coldwater resources and trout fisheries, if not managed properly.

What is the Marcellus Shale?

Marcellus Shale is located in the Appalachian region of the US. It spans approximately 600 miles from the southern tier of New York through Pennsylvania and Ohio, and into West Virginia. Its area is estimated to cover about 54,000 square miles, and it coincides with the location of many of Pennsylvania's wild trout streams. Marcellus Shale is variable in depth. A majority of the shale is about a mile deep, and in some areas it is as deep as 9,000 feet below the surface. Marcellus Shale is a low-density rock with tight pores that hold natural gas. It is estimated that the Marcellus Formation holds 363 trillion cubic feet (TCF) of recoverable natural gas. In 2006, the US consumed more than 21 TCF of natural gas, and current estimates state that the US now uses approximately 30 TCF of natural gas per year.

How is gas extracted from Marcellus Shale?

Natural gas has long been produced from shallow shale formations. However, recent advances in deep well drilling combined with horizontal drilling, and advances in hydrofracturing (fracking), have made gas extraction from deep shale formations economically feasible.

Depending on the geology, gas companies use both vertical and horizontal wells to capture the gas. Wells can be drilled vertically for several thousand feet. Then the drilling can be angled, creating an arc to the horizontal, and drilling can be continued horizontally through the shale formation for several thousands of feet. Multiple wells may be drilled from the same well pad site, radiating out horizontally from a central vertical well. Well pad sites can vary in size from 3 acres up to 30 acres, or more.

Fracking is a technique used to release natural gas from the tight pores of the shale. A mixture of water, chemicals and proppant (usually sand) is pumped down the well and into the shale at high pressures. The pressure creates fractures in the shale and the proppant holds open the fractures to allow gas flow from the shale and into the well. Chemicals used in fracking may include friction reducers, biocides, surfactants and scale inhibitors.

Fracking requires large quantities of water. Horizontal projects typically use between 1 and 3 million gallons of water for the initial fracking. It is important to note that wells drilled in Marcellus Shale may have to be hydrofractured several times over the course of their lifetimes to keep the gas flowing.

The millions of gallons of water must be piped or transported by truck to the well site prior to a fracture treatment. The flowback water (waste water) from the fracking operation must also be trucked out to a disposal facility. A large percentage (20% to 40%) of the injected fluid remains underground for some time. Fracking and treatment fluids do not come back all at one time. At first, the flowback is primarily treatment/fracking fluids, but this is diluted by formation water. As time goes on, the percentage of treatment/fracking fluids decrease and the percentage of formation water increases. Flowback of fracking fluids and water can continue over a period of years.

Presently there are 63,000 registered wells in Pennsylvania, including those currently producing natural gas, and those which have been drilled and capped for future production. The vast majority of these are vertical wells that have been developed using fracking with water and sand, similar to the fracking techniques used within the Marcellus Shales.

Brines from vertical wells have been treated at several treatment plants throughout Pennsylvania that are dedicated to brine disposal. Other methods of disposal include use as dust suppression on dirt roads, use by the Pennsylvania Department of Transportation (PennDOT) for road treatment for ice and snow, and dilution through sewage treatment plants. While abuses have occurred, especially on the over-application of brines for dust suppression, major environmental impacts have been addressed and enforcement actions taken. Unfortunately, these brine treatment facilities are not currently equipped to effectively deal with some of the production fluids used in the Marcellus gas extraction process.

What permits are required?

- Well Drilling Permit and Addendum – The operator must obtain a drilling permit, pursuant to the Oil and Gas Act, as well as an application addendum outlining a water management plan for that operation, pursuant to Title 25 PA Code 78.11-33.
- Earth Disturbance Permit (ESCGP-1) – The operator must obtain a permit from the PA Department of Environmental Protection (PA DEP) for implementation of erosion and sediment controls, including stormwater management, if the site disturbance area is greater than 5 acres. A plan for erosion and sedimentation control is required if under 5 acres. Sites in excess of 5 acres must obtain a general sediment and erosion control permit under Chapter 102.
- Preparedness, Prevention and Contingency (PPC) Plan – The operator is required to prepare and implement a PPC Plan and make it available to PA DEP upon request. The plan must address the types of wastes generated, disposal methods and a spill prevention plan. Construction and operation of on-site storage impoundments must also be described.
- Water Withdrawal Permits – PA DEP has required water withdrawal permits for all withdrawals of surface or ground water. For projects located in the Delaware or Susquehanna Basins, a separate Delaware River Basin Commission (DRBC) or Susquehanna River Basin Commission (SRBC) water withdrawal permit is required.
- Chapter 105 Obstruction and Encroachment Permit – An operator must obtain a permit from PA DEP for construction, excavation, or operation in a wetland, stream, or body of water. A similar requirement is also required under the Oil and Gas Act.
- Water Quality Management Permit – An operator must obtain this permit if a centralized impoundment will hold fluids other than fresh water (such as drilling or fracking fluids). The siting, construction, use and closure of temporary pits are regulated under Chapter 78. Permits are only required if the pit is part of a treatment facility. However, permanent impoundments to hold drilling or fracking fluids are rare. *In the case of freshwater impoundments, strict adherence to design and safety standards must be met and adequately enforced.*

Pennsylvania TU's position on gas drilling

We understand that natural gas drilling and other energy developments are important to the economy of the Commonwealth and the nation. However, we are adamant that this drilling be done in a manner that does not damage our natural resources. Deep gas well drilling is relatively new to Pennsylvania, and the environmental concerns have not been fully evaluated prior to numerous permits being issued. Adequate permit restrictions and oversight are necessary. We encourage our regulatory agencies to actively ensure that all protections be enforced to protect our water resources as afforded under the Clean Water Act and the Clean Streams Law.

What are our concerns?

1. The removal of millions of gallons of water from streams and aquifers to frack the Marcellus gas producing zones.
2. The potential environmental damage the fracking water will do; both on site and during its disposal.

3. Drilling activity in Special Protection Watersheds (HQ and EV streams) and Wilderness Trout Designated areas may permanently affect these areas.
4. Bonding is inadequate to deal with plugging/closing of wells and to deal with any long-term environmental implications of orphan/abandoned well sites.
5. Potential increase in sediment and stormwater from the well pad sites.
6. Resource agencies may be inadequately staffed to deal with the increase in permit requests and on site enforcement.

What should happen?

1. Marcellus Shale drilling and production presents a new series of problems. Namely, the need for millions of gallons of water for fracking, and the need to properly treat and dispose of this water when it returns to the wellhead. Simply put, Pennsylvania must enact criteria and disposal methods not yet employed in the Commonwealth. As an organization concerned with coldwater fisheries and the water quality and quantity needed to support these fisheries, Pennsylvania Trout Unlimited (PATU) insists that PA DEP must meet this new challenge. For example, PA DEP should encourage the use of reverse osmosis units to remove salts and any associated heavy metals from production waters and reuse the resulting water for future fracking.
2. PATU strongly believes that Marcellus Shale development cannot be permitted within Exceptional Value (EV) watersheds. We do not see how the existing Best Management Practices (BMPs) for sediment and erosion control, given the significant earth disturbances associated with road and pad construction, can comply with the anti-degradation standards required under the Clean Streams Law.
3. PATU sees an urgent need for PA DEP to change its present bonding requirements for existing vertical wells, and to cover the likely higher plugging costs for Marcellus wells. PA DEP needs to take immediate steps to determine the anticipated costs of closing Marcellus wells. PA DEP needs to consult with surrounding states regarding their existing or proposed bonding rates for this class of wells. PA DEP also needs to work closely with the Interstate Oil and Gas Compact Commission (IOGCC) to assure that bonding rates meet the necessary closing costs for Marcellus wells. Without adequate bonding, Pennsylvania will inherit more abandoned wells that cannot be properly closed, and that risk the spewing of contaminants into our waterways, much as we presently see from pre-Act drilling, and where bonding was inadequate to close the wells.
4. PATU sees an urgent need for PA DEP to require a severance fee adequate to meet the Department's costs for permitting, inspections and enforcement, including the logistical needs of the program.
5. In High Quality-Coldwater Fishery (HQ-CWF) watersheds, PA DEP should, at minimum, require individual permits for gas development. Individual permits assure that the public has an opportunity to review, object to, or request a public meeting on, the proposed drilling operation and its associated discharges prior to the issuance of the permit. These options are not available with the present practice of issuing general permits pursuant to Chapter 102. Appeal rights, under the general permit, are limited to a short window after issuance of the permit. We find this practice unacceptable.
6. Drilling projects have the potential to cause multiple impacts on our environment. Permit approvals should consider all of the impacts before issuing a permit, including water needs for drilling, treatment and discharge of backflows and brine, habitat destruction from drill site pads, and erosion from road construction and pipeline construction.

7. PATU urges state agencies to prohibit any oil and gas development in Exceptional Value (EV) watersheds, Wilderness Trout Stream watersheds, EV wetlands or areas containing threatened or endangered species. Increased oversight should be applied in High Quality-Coldwater Fishery (HQ-CWF) watersheds.
8. We insist that water withdrawal permitting by SRBC, DRBC and PA DEP be closely monitored. Namely, flows from the permitted watershed need to be documented at the time of withdrawal to assure that the stream uses are protected. This will require that flow monitoring devices are part of the permit, thus assuring that the Q-7/10* is not violated.
9. PA DEP is obligated to consider the cumulative impacts these drilling sites will pose in a watershed. In addition, resource agencies should evaluate the overall impacts to groundwater and surface flows and place a cap on permits to prevent Total Maximum Daily Loads (TMDLs) from being reached. While any one project may do minimal damage, the cumulative impacts from multiple projects could cause significant damage.
10. Surface landowners must consider the cumulative impacts of site development as it pertains to forest fragmentation and its potential impacts on our coldwater resources.
11. Roads built to and around well pad sites should be required to incorporate Environmentally Sensitive Maintenance principles as outlined by the Center for Dirt and Gravel Roads Program.
12. Fracking water must be treated at facilities built to meet NPDES permit requirements. Municipal sewage treatment plants are not capable of treating chlorides and toxins present in fracking water.
13. The public has the right to know what materials the industry is injecting for Marcellus Shale development. It also has the right to know the chemical analysis of the flowback water.

*Q-7/10 is defined as a consecutive 7- day low streamflow during a ten year drought. Water quality modeling is based on this low flow condition to assure that stream uses are maintained.

Whom should I contact with concerns?

If you believe that drilling activities have affected water resources or caused pollution, you should contact your nearest PA DEP Regional office, County Conservation District (CCD), Pennsylvania Game Commission (PGC), or the Pennsylvania Fish and Boat Commission (PFBC). The numbers are as follows:

PA DEP Regional Offices:

- Northeast: (866) 255-5158
- Northcentral: (570) 327-3636
- Northwest: (814) 332-6945
- Southeast: (484) 250-5900
- Southcentral: (877) 333-1904
- Southwest: (412) 442-4000
- Toll free, after hours and weekend:
1-800-541-2050 or 1-866-255-5158

Pennsylvania Game Commission Regional Offices:

- Northeast: (570) 675-1143
- Northcentral; (570) 398-4744
- Northwest: (814) 432-3187
- Southeast: (610) 926-3136
- Southcentral: (814) 643-1831
- Southwest: (724) 238-9523

Pennsylvania Fish and Boat Commission Regional Offices:

Northeast: (570) 477-5717

Northcentral: (814) 359-5250

Northwest: (814) 337-0444

Southeast: (717) 626-0228

Southcentral: (717) 486-7087

Southwest: (814) 445-8974

References:

- PA DEP's Marcellus Shale Page: http://www.dep.state.pa.us/dep/deputate/minres/oilgas/new_forms/marcellus/marcellus.htm
- Penn State Cooperative Extension Natural Gas Page: <http://naturalgas.extension.psu.edu/>
- Oil and Gas Accountability Project: www.ogap.org
- Pennsylvania Land Trust Association Oil and Gas Page: <http://conserveland.org/pp/naturalgas>
- Natural Gas Lease Forum: http://www.pagaslease.com/natural_gas_well_mapper.php