



Marcellus Shale:

Protecting the Commonwealth's Aquatic Resources

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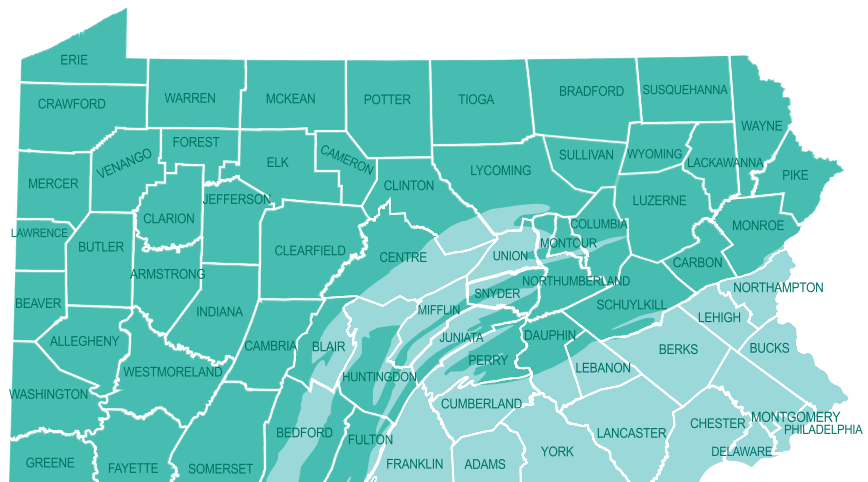
Editor's Note: With the continuing statewide interest in Marcellus Shale development, *Pennsylvania Angler & Boater* is presenting a series of articles about natural gas extraction and shale development. This first installment provides background about this resource and concerns for monitoring possible environmental impacts on Pennsylvania's aquatic resources. Future installments will provide information about the Commission's role and our new natural gas leasing and water access programs.

Marcellus Shale natural gas development is the fourth major wave of natural resource extraction in Pennsylvania in the past 200 years. Extracting coal and oil and harvesting timber for charcoal and forest products have provided energy for a growing country. Clearly, this activity reshaped our culture, economy and landscape. Today, the largest deposit of extractable natural gas known in the United States underlies two-thirds of the Commonwealth. The natural gas is in the Marcellus Shale rock formation. Developing this important energy source has created a "gas rush" in western, north-central and northeastern Pennsylvania. The clean burning qualities of natural gas make it a favored energy source.

Extracting natural gas from the Marcellus Shale formation is cause for concern about the state's aquatic resources. Pennsylvania Fish and Boat Commission's (PFBC) core mission is to protect, conserve and enhance Pennsylvania's aquatic resources. In carrying out its mission and "Resource First" philosophy, PFBC is working hard to reduce the impacts of extraction on Pennsylvania's aquatic resources.

Aquatic resources

Pennsylvania's abundant aquatic resources include 83,000 miles of streams and nearly 4,000 lakes, ponds and reservoirs. More than 120 species of fish, 45 species of amphibians and reptiles, and approximately 1,000 species of aquatic insects are found in these waters. These waters are home to thirty-eight species of mussels, many endangered or threatened. The more than 870,000 anglers and 2.5 million boaters using Pennsylvania's



■ MARCELLUS SHALE

waters value clean water and healthy aquatic communities.

Past development of natural resources greatly affected aquatic resources. Coal mining produced acid mine drainage that continues to impact water quality. The oil industry had its birth in Titusville, and the scars from boom and bust days remain. Barren hillsides resulted from harvesting timber for market or burning to produce charcoal for the iron industry. Warming of streams resulted from the loss of shade. Increased sedimentation and scouring further changed our waters. Generations removed from this exploitation, the landscape is recovering naturally, but this legacy drives efforts to protect resources in the midst of this new boom. The PFBC wants to protect the Commonwealth's aquatic resources while allowing extraction of clean burning natural gas from the Marcellus formation.

Natural gas extraction

The Marcellus Shale formation is a unit of fine-grained rock formed from ocean sediments. Estimates are that this layer was formed between 380-390 million years ago. Natural gas formed in the sediment is tightly captured in a 50- to 300-foot-thick rock layer. This layer of rock is located about one mile underground. The Pennsylvania State University estimates that, at the current rate of use, this natural gas reserve holds a 20-year supply for the country. Conveniently, it is near major urban markets. Below the Marcellus layer are other shales of the Devonian period. One layer being investigated is the Utica shale. Together these deposits are similar in area to the state of Florida. As technology improves, it may be possible to extract natural gas from deeper shale formations.

Gas development requires not only a well but also roads, pad development, gathering lines, transmission lines, water

storage and waste disposal. Vertical gas wells only capture gas in the area of the vertical bore. Horizontal drilling technology has made the recovery of shale gas economically viable. Sophisticated drilling equipment bores thousands of feet vertically, then thousands of feet horizontally into the Marcellus Shale formation. Fracturing or “fracking” of a well occurs by isolating sections of the well and pumping in a water-chemical-sand mixture. Extreme high-pressure cracks the formation and natural gas flows more readily. Sand keeps the tiny cracks open after fracturing. The fracking process typically uses 3 to 6 million gallons of water per well. Chemicals are added to keep the well bore clean and prevent well-clogging bacterial growth. Other chemicals make the solution slippery, much like detergent in a washing machine. Typically 12–20% of the water used in the fracking process is recovered. An increasing portion of this water is being reused, which reduces concerns about treatment, discharge and cost. The industry recently has taken steps to dispose of solid drilling waste in landfills instead of lined pits on site. Marcellus well pads are typically five acres in area and have six wells, each with a vertical and horizontal bore. This footprint is needed to contain all the equipment and put the well into production.

Regulations

The Pennsylvania Department of Environmental Protection (DEP) regulates gas well permitting, development, disturbance and waste disposal. The Susquehanna River Basin Commission and Delaware River Basin Commission regulate water withdrawal and use in their respective river basins. The PFBC is working closely with these organizations.

Resource First

The PFBC believes the potential risks to aquatic resources from Marcellus Shale extraction, in priority order, are:

1. *The cumulative impacts of natural gas development*

The footprint of an individual site may be small compared to a strip mine or clear-cut; however, the impacts of a site extends beyond the well pad. Development includes construction and other activities stretching for miles.

2. *Water quality impairment*

Pollution of water may occur through sedimentation, the release or spill of fluids, or leaching of waste. While many of the chemicals used in extraction are similar to those around our homes, the accidental release into a stream may have severe impacts. The accidental release of aquatic invasive species is also a threat to aquatic communities.

3. *Stream and wetland disturbance*

Construction of well sites, roads and pipelines often involve crossing or excavation near streams, lakes or wetlands. If done improperly, this disturbance can lead to erosion and sedimentation and loss of important habitats.

4. *Reduced water quantity*

Fracking requires large volumes of water. Removing that water from lakes, streams and aquifers may reduce available water. Low-flow periods are critical times where withdrawal can be limited in the permitting process.

PFBC Role

PFBC recommends changes to laws and regulations and provides advice on regulatory and monitoring process and policy changes. PFBC staff review permit applications for stream and wetland disturbances and impoundment construction. Reducing the impact of development on endangered and threatened species and species of special concern is a high priority. The presence or absence of such species is determined by a Pennsylvania Natural Diversity Inventory (PNDI) review by Commission staff. PFBC staff conducted more than 584 permit reviews in 2010, related to natural gas development.

PFBC staff monitors water quality and fish communities near Marcellus development. The agency also identifies waters

at greatest risk of impairment through its Unassessed Waters Program. Under this program, PFBC staff along with staff from colleges and universities survey streams for the presence of wild trout.

While the PFBC would like to be as proactive as possible in dealing with other regulators and the natural gas industry, its capacity is limited due to funding and staffing constraints. Many people do not realize that the PFBC relies almost entirely on fishing license sales, boat registration fees, and federal funding tied to fishing and boating to support everything it does. This includes trying to keep pace with and stay ahead of the curve on the current and projected impacts of Marcellus Shale development to fishing, boating, and the resources it is entrusted to protect. Until the PFBC receives alternative funding in the form of a portion of state gas permit fees, an impact fee, or some other source, it will struggle to fulfill its role on behalf of the Commonwealth's aquatic resources.

Some of Pennsylvania's highest quality and most sensitive waters are in areas of Marcellus Shale development. PFBC will continue to advocate improvements to the Oil and Gas Act and focus surveillance on sensitive waters. The PFBC will respond to pollution events and work with our partners to protect the Commonwealth's aquatic resources during these changing times. ☐

For more information on Marcellus Shale and natural gas extraction, visit these websites.

PFBC: www.fishandboat.com

DEP: www.dep.state.pa.us

DCNR: www.dcnr.state.pa.us

To report suspected pollution or waterway disturbance:

PFBC pollution hotline
(24 hrs/day, 7 days a week)
1-855-347-4545 (855-FISH-KIL)

DEP pollution hotline
(24 hrs/day, 7 days a week)

1-800-541-2050

PFBC regional law enforcement offices: listing at
www.fishandboat.com

Some of the laws regulating gas development in Pennsylvania:

- ✓ Pennsylvania's oil and gas laws
- ✓ Clean Streams Law
- ✓ Dam Safety and Encroachments Act
- ✓ Water Resources Planning Act
- ✓ Solid Waste Management Act
- ✓ Susquehanna River Basin Compact
- ✓ Delaware River Basin Compact
- ✓ Sections of the Fish and Boat Code