

Report on the Potential Impact to Pennsylvania Farms of Shale Gas Development and Proposed Solutions

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Purpose of the Report

Greg Boulos, the owner of Blackberry Meadows Farm, LLC, requested that the Clinic draft a report on the potential adverse impacts to Pennsylvania farms of extensive shale gas development in the Commonwealth. Mr. Boulos requested the report to allow the agricultural industry in the Commonwealth to discuss amongst themselves both the benefits and burdens associated with shale development on farmland and properties adjacent to farmland. As requested, this report summarizes existing reports, news, and literature on the burdens to farmers of shale gas development. The authors acknowledge that we have not attempted to address the benefits of shale gas development. Similarly, we have not attempted to weigh the benefits against the burdens of such development.

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Marcellus Shale and the Need to Protect Pennsylvania's Farms

Marcellus Shale is the name given to the shale rock formation that spans southern New York, Pennsylvania, Maryland, Ohio, and into Western Virginia.¹ It is difficult to estimate how much natural gas is contained in the Marcellus Shale.² The Natural Resource Economics, Inc. cites a report that estimates there may be as much as 489 trillion cubic feet of natural gas.³ The Department of Energy estimates that there may only be 141 trillion cubic feet of natural gas contained the Marcellus Shale.⁴ In either case, Marcellus Shale drilling has dramatically increased in recent years.⁵ The increase in drilling activity is partly explained by increases in natural gas prices and advances in drilling technology.⁶ As Marcellus Shale development is expected to continue in rural areas of Pennsylvania, it is necessary that the Pennsylvania General Assembly adopt the appropriate legislation to protect Pennsylvania's farmers so that

they can co-exist with the Shale industry. The purpose of this report is to raise awareness of the potential negative consequences Shale development could have on the environment and urge the Pennsylvania General Assembly to protect Pennsylvania farmers from those impacts.

Pennsylvania's Existing Laws and Policies Protecting Farms

According to data from the United States Department of Agriculture, there are approximately 63,200 farms in Pennsylvania amounting to a net income of over \$1.3 billion.⁷ Due to the importance of the agriculture industry to Pennsylvania, the State government has consistently encouraged a strong policy in favor of protecting its farmers.⁸ In an article about the need to protect agricultural operations from unlawful municipal regulation, Ross H. Pifer, the director of Penn State's Agricultural Law and Resource Center, argues that the State's policy is evidenced by numerous statutes that protect the industry.⁹ Such statutes, cited by Pifer, include the Pennsylvania Farmland and Forest Land Assessment Act of 1974,¹⁰ the Agricultural Area Security Law,¹¹ the Right to Farm Act,¹² the Conservation and Preservation Easements Act,¹³ and the Agriculture, Communities and Rural Environment Act.¹⁴ These statutes demonstrate the importance of the agriculture industry in Pennsylvania's economy and the Commonwealth's desire to protect the industry in a multifaceted way.¹⁵ Pifer points out that the Right to Farm Act exemplifies the State's policy by stating that "[i]t is the declared policy of the Commonwealth to conserve and protect and encourage the development and improvement of its agricultural land for the production of food and other agricultural products."¹⁶ In addition, the Agricultural Area Security Law states that "[i]t is also the declared policy of the Commonwealth to conserve and protect agricultural lands as valued natural and ecological resources which provide needed open spaces for clean air, as well as for aesthetic purposes."¹⁷ Furthermore, the Agricultural Area Security Law makes it clear that the statute is intended to "provide means by which agricultural land may be protected and enhanced as a viable segment of the Commonwealth's economy and as an economic and environmental resource of major importance."¹⁸ Finally, the Agriculture, Communities and Rural Development Act also shares a similar policy view, by stating that "the Commonwealth has a vested and sincere interest in ensuring the long-term sustainability of agriculture."¹⁹ Although these statutes demonstrate Pennsylvania's commitment to protecting its agriculture industry, new legislation needs to be enacted so that the industry is adequately protected from potential adverse environmental impacts related to Marcellus Shale development. The next section of the report explores potential threats to the agricultural industry.

Hydraulic Fracturing and Its Potential Impacts on the Environment

The Marcellus Shale consists of “a rock that is predominantly comprised of consolidated clay and silt sized particles.”²⁰ These particles include “organic matter . . . [that] was compressed and heated deep within the Earth over geologic time, forming hydrocarbons, including natural gas.”²¹ Within the Shale, “[t]he gas occurs in fractures, in the pore spaces between individual mineral grains, and is chemically adsorbed onto organic matter within the shale.”²² Because the Shale was formed under great pressure, the Shale is said to have a “low permeability.”²³ This means that the Shale must be stimulated, or broken up, in order to extract large quantities of the natural gas.²⁴ The current practice is to stimulate the Shale through a process known as hydraulic fracturing.²⁵

Hydraulic fracturing is performed after the gas well is drilled and cased.²⁶ Once this process is completed, a “perforation gun shoots holes through the casing and cement at predetermined locations.”²⁷ Next, the well operator pumps hydrofracture fluids into the well.²⁸ The fluid is typically a water-based substance.²⁹ However, some companies have been using liquid petroleum gas instead of a water-based fluid.³⁰ In either case, the fluid is launched out of the holes predrilled into the well and breaks up the Shale.³¹ This results in a “highly fractured reservoir that is 984 m (3000 ft) or more long in each direction from the wellbore.”³² Finally, “the viscosity of the hydrofracture fluids is expected to breakdown quickly, so the fluids can be . . . removed from the ground and the gas is extracted.”³³

Hydraulic fracturing is a highly controversial practice because of potential adverse impacts to the environment, human health, and the agriculture industry. Potential adverse impacts to the environment include depletion of water resources, exposure to harmful chemicals, and wastewater disposal concerns.

Water Quantity Issues

Hydraulic fracturing fluid is mainly comprised of water.³⁴ It is estimated that each horizontal well requires 2 to 4 million gallons of water to complete the fracturing process.³⁵ The amount of water needed will vary “[d]epending on the depth and permeability of the formation.”³⁶ ALL Consulting reports that wells drilled into the

Marcellus Shale typically require close to 3,880,000 gallons of water.³⁷ This figure places per-well Marcellus Shale water consumption above Barnett, Fayetteville, and Haynesville.³⁸ Due to the impracticability of transporting such large amounts of water, Shale gas companies try to use water located on-site for the fracturing process.³⁹ Consequently, the water is taken from “surface water bodies such as rivers and lakes, but can also come from ground water, private water sources, municipal water, and re-used produced water.”⁴⁰ Although the amount of water needed for Shale gas development is large, it only accounts for roughly 0.1% to 0.8% “of the total water resource use in the Shale gas basin.”⁴¹ However, the problem is that well operators demand the water “over a relatively short period of time,” which “may have a cumulative impact to watersheds over the short term.”⁴² This can be especially problematic during periods of low precipitation.⁴³

This increased demand for water supplies is likely to have detrimental impacts on the agriculture industry, which also depends on access to fresh water supplies.⁴⁴ As a result, efforts need to be taken to preserve or limit the amount of water being consumed by Shale gas developers. A report prepared by the Groundwater Protection Council and ALL Consulting for the U.S. Department of Energy noted that a well operator in Arkansas was in the process of “constructing a 500-acre-ft impoundment to store water withdrawals from the Little Red River . . . during periods of high flow.”⁴⁵ Texas, home to the Barnett Shale, has adopted another solution where local agencies “closely monitor volumes of water used during drilling, and a consortium of Barnett Shale drilling companies have developed best management practices for water conservation, with the goal of keeping the pace of drilling . . . within the bounds of sustainable water use.”⁴⁶ The use of propane as the fracturing agent also presents an effective solution because it eliminates the need for water during the fracturing process.⁴⁷

The Potential for Exposure to Fracturing Fluid, Flowback, or Production Fluids and Air Emissions

Fracturing fluid is typically water-based.⁴⁸ Yet, certain chemicals are added to the fluid to perform various functions.⁴⁹ For instance, acids may be added “to remove drilling mud near the wellbore, biocides to prevent microbial growth that produce gases, . . . scale inhibitors to control the precipitation of carbonates and sulfates, and surfactants to increase the recovery of injected fluid.”⁵⁰ The exact chemical make-up of fracturing fluid as a general matter is not known, but researchers have been able to pinpoint at least some of the potentially harmful additives.⁵¹ Environmental Protection Agency (EPA) scientists David M. Kargbo, Ron G. Wilhelm, and David J. Campbell write that fracturing fluid may contain “hydrochloric or muriatic acid, hydroxyethyl

cellulose as gel, glutaraldehyde as biocide, petroleum distillate (or diesel) as friction reducer, ammonium bisulfate as oxygen scavenger, 2 hydroxy-1,2,3-propanetricarboxylic acid for iron control, *N,N*-dimethyl formamide as corrosion inhibitor, ethylene glycol (or 2-butoxyethanol) as scale inhibitor, and methanol-based surfactants.⁵² The EPA scientists further state that “[m]any of these chemicals are either carcinogenic or associated with numerous health problems affecting the eyes, skin, lungs, intestines, liver, brain, and nervous system.”⁵³ Due to the potential harmful effects of these chemicals, several states including Texas, Arkansas, Montana, Wyoming, and Louisiana have recently passed statutes that require gas companies to disclose the chemicals contained in the fracturing fluid.⁵⁴

Although the chemicals in the fracturing fluid typically amount to less than 0.5 percent of the fluid, the amount of fracturing fluid used “is so large that the additives in a three million gallon hydrofrac job . . . would result in about 15,000 gallons of chemicals in the waste.”⁵⁵ Furthermore, in order to extract the gas from the well, most of this fluid needs to be returned the surface.⁵⁶ This raises many concerns about exposure to these fluids and how to properly dispose of the wastewater.

States manage the wastewater in a number of ways.⁵⁷ In Pennsylvania, the wastewater is recycled, injected into underground wells, or treated in a wastewater treatment plant.⁵⁸ From June 2009 to December 2010, Pennsylvania well operators reported that they recycled about 47% of the “680 million gallons of wastewater produced” during that 18 month period.⁵⁹ This wastewater is recycled in several ways.⁶⁰ One method is to distill the water after having it filtered then evaporated to separate the water from the contaminants.⁶¹ Another option is to “add fresh water . . . to dilute the salts and other contaminants,” and then re-use the water for drilling purposes.⁶² Any remaining waste will be sent to landfills or underground injection wells.⁶³ Recycling the wastewater is particularly useful because it reduces the overall demand for fresh water.⁶⁴ However, “[s]ome methods can leave behind salts or sludge highly concentrated with radioactive material and other contaminants that can be dangerous to people and aquatic life if they get into waterways.”⁶⁵

The leftover wastewater may also be sent to underground injection wells.⁶⁶ Wastewater disposal through underground injection wells is done by injecting the wastewater to saltwater disposal wells “thousands of feet underground in porous rock formations that are separated from treatable groundwater by multiple layers of impermeable rock thousands of feet thick.”⁶⁷ In order for the underground rock formations to properly receive the wastewater, the underground rock must be porous and permeable.⁶⁸ As a result, the use of this method is limited in Pennsylvania because such “geological formations” are often unavailable.⁶⁹

Another method of disposal in Pennsylvania is to have the wastewater processed in wastewater treatment plants.⁷⁰ Daniel J. Soeder and William M. Kappel of U.S. Geological Survey argue that “the effectiveness of standard wastewater treatments on these fluids is not well understood.”⁷¹ This is because “salts and other dissolved solids in brines are not usually removed successfully by wastewater treatment, and reports of high salinity in some Appalachian rivers have been linked to the disposal of Marcellus Shale brines.”⁷² Environmental Protection Agency scientists David M. Kargbo, Ron G. Wilhelm, and David J. Campbell also recognize that treatment in wastewater treatment plants may not be a viable option.⁷³ The EPA scientists argue that “contaminants and total dissolved solids (TDS) may complicate wastewater treatment.”⁷⁴ They even cite to a case where “the discharge of inadequately treated natural gas drilling wastewater with high TDS and other chemicals was *suspected* to be a source for the elevated TDS levels in [the] Monongahela River.”⁷⁵ This suspicion caused the Pennsylvania Department of Environmental Protection “to issue a water-quality advisory for 325,000 customers to use bottled water.”⁷⁶

Even if it is possible to properly dispose of the contaminated wastewater, there is still the potential for exposure when accidents occur. There have been many fracturing fluid and wastewater spills reported in Pennsylvania.⁷⁷ The following section gives a brief overview of several spills that have occurred in Pennsylvania.

In the spring of 2010, farmers Don and Carol Johnson discovered that wastewater “from a large storage pond leaked through its plastic liner and flowed onto cow pasture in Shippen Township, Tioga County.”⁷⁸ After testing, it was found that the wastewater contained numerous chemicals and “killed all vegetation in an area 30 feet by 40 feet.”⁷⁹ Due to safety concerns, Pennsylvania’s Department of Agriculture quarantined the cows.⁸⁰ There was a major spill in Lawrence Township, Pennsylvania in June of 2010 when a well blowout preventer failed.⁸¹ The Pittsburgh Business Times reported that “[t]he accident . . . spewed at least 35,000 gallons of wastewater into the air for 16 hours until the well was finally capped the following day.”⁸² This spill caused the Department of Environmental Protection to order “the well completion firm C.C. Forbes to stop all post-fracing activities in the state” until an investigation could be completed.⁸³ In September of 2010, Dimock, Pennsylvania reported a spill of as much as 8,000 gallons of fracturing fluid.⁸⁴ In January of 2012, the Department of Environmental Protection reported a spill “of up to 20,000 gallons of wastewater created by the hydraulic fracturing process” in Bradford County.⁸⁵ In November of 2010, an inspector working for the Department of Environmental Protection discovered “an open bottom valve on a 21,000 gallon tank containing fluids left over from the hydraulic fracturing process” in Lycoming County, Pennsylvania.⁸⁶ This open valve caused about 2,400 gallons of wastewater to be spilled in the vicinity.⁸⁷ Currently, the Department of Environmental

Protection is investigating the “second spill of condensate fluids in three months at a Chevron-Appalachia Marcellus Shale gas well operation in Robinson, Washington County.”⁸⁸ The spilled condensate, which is “a mixture of liquid hydrocarbons . . . and drilling fluids,” was found to have entered a nearby waterway.⁸⁹ The Department of Environmental Protection continues to investigate the amount and cause of the spill.⁹⁰

In addition to accidental surface spills, Shale gas wells can also malfunction and lead to harmful environmental impacts such as groundwater contamination.⁹¹ It is difficult to obtain precise well failure rate statistics for a variety of reasons. For instance, States may lack the resources to adequately monitor well failures or States may have different reporting procedures. However, sufficient data exists to gain some understanding of Shale gas well failure rates in Pennsylvania and throughout the United States. Data from Colorado and New Mexico suggests “that natural gas development in western states degrades groundwater quality at a rate of 1.2 to 1.8 incidents per 100 gas wells.”⁹² In West Virginia, data shows that groundwater is impacted “from approximately 1.5% of active gas wells.”⁹³ In Pennsylvania, “[t]he Pennsylvania Land Trust Association identified a total of 1614 violations accrued by 45 Pennsylvania Marcellus Shale drillers between 1/1/2008 and 8/20/2010, using records obtained by the PA Department of Environmental Protection.”⁹⁴ Out of these 1,614 violations, the Pennsylvania Land Trust Association determined that only 1,056 violations had “the most potential for direct impact on the environment.”⁹⁵ Therefore, of these 1,056 violations, the Association noted 50 violations for improper well-casing construction; 155 violations for discharge of industrial waste; 212 faulty pollution prevention practices; and 4 violations for “[i]n adequate blowout prevention” mechanisms.⁹⁶ Dr. Ronald E. Bishop of SUNY Oneonta, in a report assessing the chemical and biological risks associated with natural gas extraction in New York, notes that the Pennsylvania Land Trust Association’s “data suggests that at least 7% of Pennsylvania’s shale gas projects had negative impacts on their environment.”⁹⁷ Pennsylvania’s 7% well failure rate is higher than that of other States because Pennsylvania “producers . . . drill through coal seams close to the surface that contain methane to get the shale gas much deeper underground,” which “has led to a higher percentage of failures,” according Bruce Baizel, the senior staff attorney at Earthworks Action.⁹⁸ In any case, the well failure rate percentages need to be improved in all Shale gas producing States. To help put these figures in perspective, plane crashes resulting in at least one fatality occur on about 1 in 11.4 million flights or in about .000008% of total flights.⁹⁹ Whereas, 7 in every 100 Marcellus Shale gas wells impact the environment. Although plane crashes often result in more immediate and noticeable consequences, Pennsylvania needs to adopt stricter regulations to ensure the integrity of Shale gas wells and protect the groundwater resources of its citizens.

Even when the hydraulic fracturing process goes according to plan, some air emission tests confirm that hydraulic fracturing produces toxic flowback air emissions.¹⁰⁰ In Colleyville City, Texas and Southville, Texas residents hired GD Air Testing, Inc., to test the “emissions released during fracking and flowback” activities.¹⁰¹ The test found that the emissions “contain[ed] dangerous levels of toxic chemicals.”¹⁰² Specifically, the test found 26 chemicals including “carbon disulfide, a neurotoxin at twice the state level for short-term exposure. Benzene, a known carcinogen, and Napthaline, a suspected carcinogen.”¹⁰³ Both of these chemicals were “over state long-term exposure levels by more than 9 times and more than 7 times, respectively.”¹⁰⁴ These airborne chemicals are obviously problematic for humans and livestock that breathe the air, but it is also important to note that these chemicals may settle on the pastures where livestock feed.¹⁰⁵

Impacts to Soil

These potential environmental issues have obvious concerns for farmers and the agricultural industry, which depend on quality soil, water, and other natural resources. Adverse environmental impacts to farms have already been seen. For instance, according to Robert Schindelbeck of the Cornell Health Soil Team, “[t]he construction necessary to extract natural gas from the Marcellus Shale . . . could affect the soil around drilling sites and pipeline right-of-ways.”¹⁰⁶ As a solution, New York “has established different construction and reclamation standards for varying land use types, with more sensitive land uses having stricter soil protection standards for construction activities.”¹⁰⁷ Furthermore, New York requires developers to document “how they . . . meet these standards.”¹⁰⁸ Fortunately, Schindelbeck’s research has found that “[o]n agricultural land use areas where the contractors follow the state-mandated practices of removing topsoil construction, replacing it and then decompacting the soil, . . . the soil quality is almost the same as it was before construction.”¹⁰⁹ On the other hand, in areas that do not have the same requirements, Schindelbeck has found the soil “to have marked negative effects.”¹¹⁰

Conversion of Farmland to Well Development Land

In addition to compromising soil health, Shale gas developers are converting farmland to well pads at a high rate.¹¹¹ A recent study by the Pennsylvania State University revealed that “[a]pproximately 46-62%” of all well pads in Pennsylvania are being constructed on agricultural land.¹¹² This result is particularly troubling because Shale gas well pads are often 1 ha¹¹³ larger than traditional shallow gas wells.¹¹⁴ In total, the study found that “647-1078 ha of agricultural land” would be converted to Shale gas well pads “if all pads permitted as of June 3, 2011 are developed.” Furthermore, this figure may be substantially larger because it does not account for other land disturbances stemming from Shale gas exploration like road development, “freshwater storage pond creation for hydraulic fracturing,” and treatment facilities.¹¹⁵ If these other related activities are considered, then each well pad converts about 12 hectares of land.¹¹⁶ Consequently, the study claims that “drilling is now competing with food production for space on the [Pennsylvania] landscape.”¹¹⁷

The Perception of Environmental Impacts

Another problem for farmers is the public’s negative perception of the environmental impacts caused by Shale gas production. The public’s perception is especially problematic for farms that sell directly to customers because the customers can see any machinery or pollution associated with Shale gas production when shopping for produce. In Pennsylvania, Trax Farms leased a portion of its land for natural gas production.¹¹⁸ Consequently, Trax Farms has received e-mail complaints and has had customers post on “Facebook and other websites that they will stop buying from the farm.”¹¹⁹ Trax Farms has also had “about two dozen customers . . . walk[] out [of] the door after seeing the rig.”¹²⁰ Because Trax Farms decided to open its own land for natural gas production, Trax Farms can supplement its shrinking customer base through Shale gas royalties. This is not true for similarly situated farms that have neighbors who decided to lease their property for natural gas production. In this situation, the farms may lose customers due to the visual impacts of gas production, but will not be able to make up this lost income through Shale gas royalties. This situation forces farmers to risk going out of business or leasing their property for Shale gas development.

Long-term Economic impacts of Marcellus Shale Development:

A 2010 study released by the Pennsylvania State University revealed that in 2009 “Marcellus gas producers spent a total of \$4.5 billion to develop Marcellus shale gas resources.”¹²¹ Moreover, the study found that “this spending generated \$3.9 billion in value added [to the economy], \$389 million in state and local tax revenues, and more than 44,000 jobs.”¹²² By the year 2020, the study estimates that Marcellus shale gas production will expand to “over 13 billion cubic feet per day.”¹²³ If this expansion occurs, then the study predicts that this would result in 200,000 jobs and “annual gains in state and local tax revenues would exceed \$1 billion.”¹²⁴ Although these figures appear to be promising, Jannette M. Barth, the former Chief Economist at the New York Metropolitan Transportation Authority, argues that “positive economic impact” resulting from Marcellus Shale development is “more of an assertion than a proven fact.”¹²⁵ To support her position, Barth cites remarks made by Alan B. Krueger, Chairman of the Council of Economic Advisers for President Barack Obama, to the American Tax Policy Institute.¹²⁶ Krueger stated that oil and gas development is not a major job creator because “[t]he oil & gas industry is about ten times more capital intensive than the US economy as a whole.”¹²⁷

In addition to citing Krueger, Barth supports her position by investigating several economic reports related to Marcellus Shale development. For instance, Barth examines the economic analysis relied upon by the New York State Department of Environmental Conservation in drafting the 2009 SGEIS report.¹²⁸ A portion of this report focused on the “multiplier effect” of the oil and gas sector.¹²⁹ The report, which primarily focused on the oil industry, found that the “multiplier effect [was] 1.4.”¹³⁰ This means “that for every \$1.00 of well/drilling output, \$1.40 is contributed to the State’s economy through both direct and indirect effects.”¹³¹ In contrast, a similar study done by Cornell Cooperative Extension, found that the multiplier effect for agricultural crops is 2.28.¹³² Barth also points out that the “Broome County, New York, Agricultural Economic Development Plan” relied on this figure to conclude that “[i]ncome from agriculture goes further than other sectors in helping the economy.”¹³³ A reason why the agriculture multiplier is so high, as the Broome County study aptly recognizes, is that “[f]arms create rural character and attract tourism . . . [which] help[s] support some 217 bed and breakfast rooms offered throughout [Broome] County.”¹³⁴

Although these studies were completed in New York, Barth suggests that they are applicable to Pennsylvania.¹³⁵ For instance, “employment has not increased dramatically in the oil & gas extraction industry from 2001 through 2007.”¹³⁶ More specifically, in Indiana County, which “had the greatest number of employees” in the oil and gas industry “had only 316 employees out of 28,613 employees county-wide.”¹³⁷ These numbers increase the need for legislation that protects the agriculture industry.

In addition to the poor jobs numbers, a study on dairy farms performed by Pennsylvania State University supports the notion that Marcellus Shale gas development may have adverse long-term economic impacts in Pennsylvania.¹³⁸ The study applied statistics from the National Agricultural Statistics Service to Marcellus shale impacts on Pennsylvania dairy farms.¹³⁹ The statistics indicate that from 2007 through 2010, the number of milk cows decreased by 1.7% across Pennsylvania.¹⁴⁰ Although this is only a slight decrease in the number of total milk cows across the state, the statistics demonstrate that “[c]ounties with 150 or more Marcellus shale wells on average experienced an 18.7 percent decrease in dairy cows.”¹⁴¹ The statistics also confirmed that “[c]ounties with more than 150 Marcellus wells on average experienced a 18.5 percent decrease in total milk production, compared to an average increase of 0.9 percent in counties with no Marcellus shale wells.”¹⁴² The study notes that the decrease in dairy cows and milk production is a particularly troublesome in these Marcellus counties because “[d]eclining cow numbers mean fewer dollars spent locally by farmers to maintain their herd, and lower milk production similarly means fewer dollars coming into the local economy from milk sales.”¹⁴³ This problem is compounded by the fact that a “variety of local businesses typically depend on local farming for their success.”¹⁴⁴ This conclusion is supported by Michael Shuman, author and research director for the Business Alliance for Local Living Economies, who notes that “[e]very dollar spent at a locally owned food grocer . . . probably contributes two to four times as many economic benefits as does a non-locally owned food business like a Walmart Supercenter.”¹⁴⁵ In addition to local businesses, the study finds that dairy farms “also ha[ve] important connections with other segments of the agricultural sector, including crop farms and beef farms, and provides support for local agricultural input supply firms on which other farms rely.”¹⁴⁶

A study by the University of Minnesota also demonstrates the importance of local agricultural activity to local economies.¹⁴⁷ The study “analyzed the specific spending patterns of 30 farmers” in southwest Minnesota and found that “[t]he percentage of total local expenditures by the smaller farms was often twice that made by the larger farms in the sample.”¹⁴⁸ This finding is particularly relevant to Pennsylvania because its agriculture sector is mostly composed of smaller-sized farms.¹⁴⁹ Specifically, the 2007 Census of Agriculture in Pennsylvania revealed that only 947 of Pennsylvania’s 63,163 farms had total revenues over one million dollars.¹⁵⁰ If these smaller farms continue to be converted for natural gas extraction, then it is likely that the entire local economy will feel the effect.

Another related issue to the long-term economic impacts of Marcellus Shale development is the industry’s impact on property values. There have been specific instances of property devaluation across the country resulting from Shale gas

extraction. For instance, a family in Wise County, Texas leased their property to allow a drilling company to extract natural gas from the underlying Barnett Shale, and a year later saw “their home and 10-acre horse property” drop from \$257,330 to \$75,240 after a series accidents caused by the drilling company.¹⁵¹ The Wise County Central Appraisal District Review Board made it clear that the “drilling company’s use of the [family’s] land warranted the extraordinary reduction” in value.¹⁵² Incidents like this are partly responsible for causing the United States Department of Agriculture to consider “requiring . . . extensive environment review before issuing mortgages to people who have leased their land for oil and gas drilling.”¹⁵³ These incidents have also caused “some banks and federal agencies [to] start revisiting their lending policies to account for the potential impact of drilling on property values.”¹⁵⁴

Protect Pennsylvania’s Farmers Through Legislation

Pennsylvania has a strong existing statutory and regulatory framework for protecting its agriculture industry.¹⁵⁵ However, more can be done to further strengthen the existing framework. Pennsylvania’s farmers need to be protected from a host of problems including soil contamination, spills, and water depletion. In order to strengthen the existing framework, the Pennsylvania General Assembly should adopt new legislation or amend existing legislation to protect the agriculture industry. For instance, new legislation may impose stricter casing regulations on Shale gas well operators to ensure the integrity of wells and protect the groundwater. New legislation could also require Shale gas developers to post sufficient bond to cover environmental damages resulting from spills. Additionally, new laws could be implemented to require Shale gas developers to better monitor soil health and air pollution around extraction sites. New legislation could even be adopted to place a hold on future Shale gas drilling in Pennsylvania so that the state can further assess the risks Shale gas extraction presents to the Commonwealth’s agricultural before allowing continued risks of exposure and impacts to farms and farmers.

As noted, there are a couple options available to regulate Pennsylvania’s Marcellus Shale industry. First, the Pennsylvania legislature could adopt new legislation to specifically address the concerns of the farming community. This option is particularly attractive because it offers a clean slate to address any relevant concerns; however, it would require a considerable amount of resources to draft and survive the political process. A second option is to amend an existing statute. For instance, Pennsylvania’s Agricultural Area Security Law protects agricultural operations from

“local laws or ordinances which would unreasonably restrict farm structures or farm practices”¹⁵⁶ within an Agricultural Security Area (ASA),¹⁵⁷ but the statute expressly states that a designated ASA does not prevent the “exploration, development, storage, or removal of . . . oil and gas by the owner of the subject land or the owner” of any subsurface mineral rights.¹⁵⁸ An amendment to the Agricultural Area Security Law could place protective conditions on the ability of a party to extract natural gas from a designated ASA. For instance, the ASA may be amended to prohibit Shale gas development within several miles of certain farming operations. The Oil and Gas Act is another good example of a Pennsylvania statute that could be amended to better protect the environment. For instance, the Oil and Gas Act currently allows the well owner or operator to “dispose of residual waste, including contaminated drill cuttings, in a pit at the well site” provided certain conditions are met.¹⁵⁹ An amendment could be made to restrict the type of waste that is allowed to be buried on the well site when protected farm land is developed. Whether an amendment to existing legislation or a new statute altogether, both legislative options provide a viable path for balancing the risks of natural gas development and the need to protect Pennsylvania’s agriculture industry.

¹ DANIEL J. SOEDER & WILLIAM M. KAPPEL, WATER RESOURCES AND NATURAL GAS PRODUCTION FROM THE MARCELLUS SHALE 1 (May 2009).

² TIMOTHY J. CONSIDINE, THE ECONOMIC IMPACTS OF THE MARCELLUS SHALE: IMPLICATIONS FOR NEW YORK, PENNSYLVANIA, AND WEST VIRGINIA 1 (2010); U.S. ENERGY INFORMATION ADMINISTRATION, ANNUAL ENERGY OUTLOOK 2012 EARLY RELEASE OVERVIEW 9 (2012) *available at* <http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282012%29.pdf>.

³ CONSIDINE, *supra* note 2, at 1.

⁴ U.S. ENERGY INFORMATION ADMINISTRATION, ANNUAL ENERGY OUTLOOK 2012 EARLY RELEASE OVERVIEW 9 (2012) *available at* <http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282012%29.pdf>.

⁵ *Id.*

⁶ SOEDER, *supra* note 1, at 3.

⁷ USDA ECONOMIC RESEARCH SERVICES, <http://www.ers.usda.gov/StateFacts/pa.HTM> (last visited Mar. 26, 2012).

⁸ Ross H. Pifer, *The Agriculture, Communities and Rural Environmental Act: Protecting Pennsylvania’s Agricultural Operations from Unlawful Municipal Regulation*, 15 Drake J. Agric. 109, 112 (2010).

⁹ *Id.* at 111.

¹⁰ 72 PA. STAT. ANN. §§ 5490.1 – 5490.13

¹¹ 3 PA. STAT. ANN. §§ 901- 915.

¹² 3 PA. STAT. ANN. §§ 951-957

¹³ 32 PA. STAT. ANN. §§ 5051-5059.

¹⁴ 3 PA. CONS. STAT. §§ 311-522.

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- ¹⁵ Pifer, *supra* note 8, at 113.
- ¹⁶ 3 PA. CONS. STAT. § 951; Ross H. Pifer, *The Agriculture, Communities and Rural Environmental Act: Protecting Pennsylvania's Agricultural Operations from Unlawful Municipal Regulation*, 15 Drake J. Agric. 109, 113 (2010).
- ¹⁷ 3 PA. CONS. STAT. § 902.
- ¹⁸ *Id.*
- ¹⁹ H.R. 1646, (Pa.2005) available at http://www.attorneygeneral.gov/uploadedFiles/The_Office/ACRE.pdf.
- ²⁰ DANIEL J. ARTHUR, BRIAN ROHM & MARK LAYNE, HYDRAULIC FRACTURING CONSIDERATIONS FOR NATURAL GAS WELLS OF THE MARCELLUS SHALE 2 (2008).
- ²¹ SOEDER, *supra* note 1, at 1.
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