



MARCELLUS SHALE SAFE DRILLING
INITIATIVE STUDY
PART I

DECEMBER 2011

Prepared By:

Maryland Department of the Environment
Maryland Department of Natural Resources

Prepared For:

Martin O'Malley, Governor
State of Maryland

Thomas V. Mike Miller, Jr., Senate President
Maryland General Assembly

Michael E. Busch, House Speaker
Maryland General Assembly

Prepared pursuant to Executive Order 01.01.2011.11



MARCELLUS SHALE SAFE DRILLING INITIATIVE STUDY PART I

DECEMBER 2011

Prepared By:

Maryland Department of the Environment
Maryland Department of Natural Resources

Prepared For:

Martin O'Malley, Governor
State of Maryland

Thomas V. Mike Miller, Jr., Senate President
Maryland General Assembly

Michael E. Busch, House Speaker
Maryland General Assembly

TABLE OF CONTENTS

EXECUTIVE SUMMARY	v
SECTION I – OVERVIEW	1
A. MARCELLUS SHALE	1
B. DEVELOPMENTS IN MARYLAND.....	1
C. THE EXECUTIVE ORDER AND THE ADVISORY COMMISSION.....	2
D. THE WORK OF THE ADVISORY COMMISSION	3
SECTION II – REVENUE	5
A. INTRODUCTION	5
B. MARYLAND ACTIVITIES RELATING TO HYDRAULIC FRACTURING.....	5
C. SOURCES OF REVENUE.....	8
D. PROJECTED AMOUNT OF REVENUE	10
E. DISCUSSION AND RECOMMENDATIONS	12
SECTION III – LIABILITY	17
A. INTRODUCTION	17
B. THE CURRENT LIABILITY STRUCTURE IN MARYLAND	17
C. CRITICISMS OF THE CURRENT LIABILITY STRUCTURE	19
D. DISCUSSION AND RECOMMENDATIONS	20
SECTION V – CONCLUSIONS.....	24
APPENDIX A – MEMBERS OF THE COMMISSION	A-1
APPENDIX B – BASELINE DATA	B-1
APPENDIX C – COST OF COLLECTING BASELINE DATA.....	C-1
APPENDIX D – REMEDIATION COST ESTIMATES	D-1
APPENDIX E – CONSULTATION WITH THE ADVISORY COMMISSION.....	E-1

EXECUTIVE SUMMARY

Governor O'Malley's Executive Order 01.01.2011.11 established the Marcellus Shale Safe Drilling Initiative. An Advisory Commission was established to assist State policymakers and regulators in determining whether and how gas production from the Marcellus Shale in Maryland can be accomplished without unacceptable risks of adverse impacts to public health, safety, the environment, and natural resources. The State has not yet determined whether gas production can be accomplished without unacceptable risk and nothing in this report should be interpreted to imply otherwise.

The Executive Order tasks the Maryland Department of the Environment (MDE) and the Department of Natural Resources (DNR), in consultation with the Advisory Commission, with conducting a three-part study and reporting findings and recommendations. The completed study will include:

- i. findings and related recommendations regarding sources of revenue and standards of liability for damages caused by gas exploration and production;
- ii. recommendations for best practices for all aspects of natural gas exploration and production in the Marcellus Shale in Maryland; and
- iii. findings and recommendations regarding the potential impact of Marcellus Shale drilling in Maryland.

This document is Part I of the study, a report on findings and recommendations regarding sources of revenue and standards of liability. After consultation with the Advisory Commission, the Departments make the following recommendations:

Revenue

A successful revenue structure to offset the costs of State activities will protect the local economy, social well-being, public infrastructure, and natural environment; and internalize the costs attributable to gas exploration and production to individual operators where possible, and to the industry producing gas in Maryland where the impact cannot be attributed to a specific operator, or for which there is no solvent responsible entity. The Departments make the following recommendations regarding revenue:

- R-1 The General Assembly should impose a fee on gas leases to fund studies of the issues set forth in the Executive Order.
- R-2 The General Assembly should enact an appropriate State-level severance tax.
- R-3 The severance tax revenue should be deposited into a Shale Gas Impact Fund to be used for continuing regional monitoring and to address impacts of gas exploration and production that cannot be attributed to a specific operator, or for which there is no solvent responsible entity.
- R-4 The General Assembly should amend the law that limits the amount of a performance bond by deleting any reference to a dollar amount and directing

MDE to establish the proper amount of bond by regulation, based on a consideration of the likely costs of complying with permit provisions, properly closing the well and performing site reclamation.

Liability

A liability system should be fair and equitable; promote the goals of environmental sustainability, public health, and safety; and incentivize the prevention of harm. The Departments make the following recommendations regarding liability:

- L-1 The General Assembly should enact a law creating a rebuttable presumption that certain damages occurring close in space and time to exploration and production activities are caused by those activities, and an administrative process for requiring the permittee to remediate the damage, pay compensation, or both.
- L-2 The General Assembly should enact a comprehensive Surface Owners Protection Act.
- L-3 Community impacts should be addressed through mediation or by use of community benefits agreements.

The majority of members of the Advisory Commission support these recommendations. A summary of the deliberations of the Advisory Commission can be found in Appendix E.

Section I – Overview

A. Marcellus Shale

Geologists have long known about the gas-bearing underground formation known as the Marcellus Shale, which lies deep beneath portions of the Appalachian Basin, including parts of Western Maryland. Until advances in horizontal drilling and hydraulic fracturing and the combination of these two technologies, few thought that significant amounts of natural gas could be recovered from the Marcellus Shale. Drilling in the Marcellus Shale using horizontal drilling and high-volume hydraulic fracturing began around 2005 in Pennsylvania and has accelerated rapidly.

The production of natural gas has the potential to benefit Maryland and the United States. By tapping domestic sources, it could advance energy security for the United States. When burned to generate electricity, natural gas produces lower greenhouse gas emissions than oil and coal, which could help to reduce the impact of energy usage as we transition to more renewable energy sources. The exploration for and production of natural gas could boost economic development in Maryland, particularly in Garrett and Allegany Counties.

As gas production from deep shale and the use of hydraulic fracturing has increased, however, so have concerns about its potential impact on public health, safety, the environment and natural resources. Although accidents are relatively rare, exploration for and production of natural gas from the Marcellus Shale in nearby states have resulted in injuries, well blowouts, releases of fracturing fluids, releases of methane, spills, fires, forest fragmentation, damage to roads, and allegations of contamination of ground water and surface water. Other states have revised or are in the process of reevaluating their regulatory programs for gas production or assessing the environmental impacts of gas development from the Marcellus Shale. A significant amount of research has been completed on hydraulic fracturing and gas production from the Marcellus Shale, but additional research by governmental entities, academic organizations, environmental groups and industry is currently underway focused on drinking water, natural resources, wildlife, community and economic implications, production technologies and best practices.

B. Developments in Maryland

The Maryland Departments of the Environment (MDE) and Natural Resources (DNR) have roles in the evaluation of natural gas projects. Each would be involved in any future permitting decisions for drilling in the Marcellus Shale.

The mission of the Maryland Department of the Environment is to protect and restore the quality of Maryland's air, water, and land resources, while fostering smart growth, economic development, healthy and safe communities, and quality environmental education for the benefit of the environment, public health, and future generations. In addition, MDE is specifically authorized by statute to issue permits for gas exploration and production. The Department of the Environment is required to coordinate with the Department of Natural Resources in its evaluation of the environmental assessment of any proposed oil or gas well.

The Department of Natural Resources leads Maryland in securing a sustainable future for our environment, society, and economy by preserving, protecting, restoring, and enhancing the State's natural resources. In addition, DNR owns or has conservation easements on substantial acreage in the State, including western Maryland.

The Department of the Environment's regulations on oil and gas wells have not been revised since 1993 and thus were written before recent advances in technology and without the benefit of more recent research. Maryland law nevertheless allows MDE to place in a permit conditions that the Department deems reasonable and appropriate to assure that the operation shall not only fully comply with the requirements of the law, but also provide for public safety and the protection of the State's natural resources.

The first application for a permit to produce gas from the Marcellus Shale in Maryland using horizontal drilling and high volume hydraulic fracturing was received in 2009.¹ In the 2011 legislative session, bills were introduced regarding further study and development of new regulations before permits could be issued. A bill passed the House that would have funded the study by assessing a fee on those who hold gas leases in Maryland, but it died in the Senate committee at the close of the session. To address the need for information, the Governor issued the Marcellus Shale Safe Drilling Initiative in Executive Order 01.01.2011.11 on June 6, 2011.

C. The Executive Order and the Advisory Commission

Executive Order 01.01.2011.11 directs MDE and DNR to assemble and consult with an Advisory Commission in the study of specific topics related to horizontal drilling and hydraulic fracturing in the Marcellus Shale.² The Advisory Commission is to assist State policymakers and regulators in determining whether and how gas production from the Marcellus Shale in Maryland can be accomplished without unacceptable risks of adverse impacts to public health, safety, the environment, and natural resources. The Advisory Commission includes a broad range of stakeholders. Members include elected officials from Allegany and Garrett Counties, two members of the General Assembly,

¹ Additional applications were received in 2011. Applications for a total of seven wells have been received by MDE; no permits have been issued.

² Although the Governor's Executive Order is directed specifically at the Marcellus Shale and hydraulic fracturing, there is a potential for gas extraction from other tight shale gas formations, including the Utica Shale, and by well stimulation techniques other than hydraulic fracturing. The findings and conclusions regarding gas exploration in the Marcellus Shale may also apply to other formations and techniques.

representatives of the scientific community, the gas industry, business, agriculture, environmental organizations, citizens, and a State agency. Appendix A is a list of the Commissioners.

The Executive Order tasks MDE and DNR, in consultation with the Advisory Commission, with conducting a three-part study and reporting findings and recommendations. The Commission is staffed by DNR and MDE. The completed study will include:

- i. By December 31, 2011, a presentation of findings and related recommendations regarding the desirability of legislation to establish revenue sources, such as a State-level severance tax, and the desirability of legislation to establish standards of liability for damages caused by gas exploration and production;
- ii. By August 1, 2012, recommendations for best practices for all aspects of natural gas exploration and production in the Marcellus Shale in Maryland; and
- iii. No later than August 1, 2014, a final report with findings and recommendations relating to the impact of Marcellus Shale drilling including possible contamination of ground water, handling and disposal of wastewater, environmental and natural resources impacts, impacts to forests and important habitats, greenhouse gas emissions, and economic impact.

This document is Part I of the study, a report on findings and recommendations regarding sources of revenue and standards of liability, in anticipation of gas production from the Marcellus Shale that may occur in Maryland. The State has not yet determined whether gas production can be accomplished without unacceptable risk and nothing in this report should be interpreted to imply otherwise.

D. The Work of the Advisory Commission

The Governor announced the membership of the Advisory Commission in July, 2011, and the Commission has met on four occasions: August 4, October 7, November 15 and December 12, 2011. Meetings were held in Western Maryland.

Resources were provided to the Commission through MDE's web page, and included articles from scientific journals, government publications, industry standards and guidelines, and publications and reports by non-governmental organizations. These included the New York State Department of Environmental Conservation, Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program (Revised Draft 2011), the Pennsylvania Governor's Marcellus Shale Advisory Commission Report (2011), and The Secretary of Energy Advisory Board (SEAB) Shale Gas Production Subcommittee: Ninety-Day Report (August 11, 2011). The

Secretaries of DNR and MDE provided initial briefings on Marcellus Shale issues, and staff prepared briefing memoranda on revenue and liability issues. Members of the public submitted comments to the Commission. Lastly, the Commissioners themselves, a well-informed and diverse assemblage, shared information and brought their expertise to bear.

Section II – Revenue

A. Introduction

The Executive Order requires the Departments to report on the desirability of establishing:

- one or more sources of revenue, such as a State level severance tax or other assessment, to fund
- State activities relating to hydraulic fracturing - including impact assessments, research, broad area monitoring, and remediation where no liable entity can be identified.

This section of the report addresses the items in reverse order, assessing the need before considering revenue sources. To identify impacts, the Departments examined a wide variety of sources describing potential environmental and natural resource damages from Marcellus Shale drilling and related operations. In considering sources of revenue, the Departments investigated Maryland’s general taxing practices; taxes specific to gas production; permit fees; and a fee on leases. Using information developed by the United States Geological Survey, the Departments have also preliminarily developed a rough estimate of the amount of potential revenue from the Marcellus Shale play in Maryland. The Departments’ findings and a recommended cost and revenue structure are presented below.

B. Maryland Activities Relating to Hydraulic Fracturing

The impacts of gas production by hydraulic fracturing (fracking³) occur both on and off the permitted site. In order to assess these impacts, the following information and actions are required: site-specific data and regional data at the pre-drilling, drilling, fracking, production and post-production stages, and monitoring and enforcement throughout.

Impacts Associated with a Specific Well or Site

On-site impacts are the immediate actual and potential impacts from the drilling operation.

Pre-Drilling

The permit applicant is required to provide pre-operational data for the site and its immediate environs so that the application can be properly evaluated. In addition, these

³ The correct spelling is “fracing” but the alternate spelling “fracking” has become common and is used herein.

data are needed so that, if impacts occur, they can be identified and addressed.⁴ The applicant is responsible for providing this information at its own expense. The cost to the Departments will include reviewing the data presented by the permit applicant.

Drilling, Fracking, Production and Post-Production

The permittee will be required to comply with regulations and permit provisions and to monitor, report and correct impacts associated with the drilling, fracking, production and post-production stages. Activities may include:

- Site-specific air quality, surface water and ground water monitoring
- Appropriate on-site presence of a State or State-certified inspector during drilling and fracking, paid for by the permittee, either through permit fees or directly
- Construction of new roads and pipelines in accordance with regulations and permit conditions
- Periodic testing of air quality and nearby public and private water wells
- Recordkeeping and reporting to document that all wastes, including flow-back, are properly transported, treated, and disposed of
- Repair of public facilities (roads, road signs, bridges, etc.) damaged by vehicles traveling to or from the drilling site
- Remediation of site-related surface or ground water contamination
- Remediation of site-related natural resource damages, short-term and long-term
- Proper plugging/sealing of well post- production or if production is deferred
- Removal of temporary facilities and equipment and partial reclamation of the site during production
- Full reclamation of the site.

The permittee will be responsible for performing these actions at its own expense.

Non-Site Specific (General or Regional) Impacts

Gas exploration and production may have impacts that extend beyond the site. In order to assess these impacts, the Departments first must develop pre-drilling baseline data so that impacts, if they occur, can be identified and addressed. The data will also be helpful for avoiding and minimizing impacts to sensitive resources.

Pre-Drilling

Baseline studies would include:

- Regional water quantity
- Regional water quality
- Air quality⁵

⁴ Some of this information is provided by the applicant in the form of an Environmental Assessment. The appropriate scope of the Environmental Assessment may be considered in future discussions of best practices.

⁵ At this time, it is not clear whether establishing a baseline for regional air quality is feasible; site-specific pre-operational monitoring may be more appropriate.

- Specific stream data
- Mapping data.⁶

It is critical to determine existing water quality and quantity within the area of Western Maryland underlain by the Marcellus Shale before gas extraction from the formation begins. Data produced from future monitoring of streams and wells in the region will be compared to the baseline data to identify impacts that may be associated with gas development activities including drilling, hydraulic fracturing, trucking, etc. Baseline ground water and stream data for at least two years is needed to capture seasonal and annual variability.

Other non-site specific baseline data are also needed. The first is development of best practices for all aspects of gas production and exploration in the Marcellus Shale. The second is a study to predict the impacts, both positive and negative, of gas exploration and production in the Marcellus Shale on the economy and the community. Data should be assembled on housing, transportation, recreation/tourism, local land use patterns, rural character, habitat, and wildlife.⁷ The study should identify ways to maximize the positive impacts and avoid or minimize negative impacts on the economy and community.

A description of existing baseline data and additional information required is attached as Appendix B. The estimated cost of collecting and obtaining additional baseline information -- \$1.5 million -- is summarized in Appendix C.

Drilling, Fracking, Production and Post-Production

There may be impacts on natural resources and the environment from gas development and production that cannot be attributed to a specific permittee or party. Impacts may occur on the State and local level. The State could incur expenses for additional activities, such as:

- Increased presence of the Maryland State Police Commercial Vehicle Enforcement Division to monitor and enforce compliance with trucking regulations
- Repair of State roads⁸
- Regional surface and ground water monitoring
- Investigating incidents of environmental impact or damage to determine cause and whether it can be attributed to a particular well site or permittee (who can then be billed)
- Mitigation/remediation of contamination from drilling mud, drill cuttings, fracking fluid, gas, etc.
- Mitigation/remediation of any damages or impact on public water supplies

⁶ An explanation of the mapping needs can be found in Appendix B.

⁷ County and municipality planning documents contain information on many of these topics and will be utilized to the maximum extent possible.

⁸ Oversize and overweight vehicles traveling on State roads must obtain a permit and post bond to guarantee that damage will be repaired, but it appears the State has not required permits and bonds to cover accelerated wear or damage to roads from intensive use by vehicles that are not oversize or overweight.

- Mitigation/remediation of natural resource damages – both short term and long term
- Restoration of natural resources and ecological resources and services
- Response to seepages of gas or fluid that appear to have a connection to gas well activity
- Review new technologies and management practices developed by industry or others to determine if Maryland should require them as Best Practices.

The probability of occurrence of a significant adverse environmental impact on important resources is unknown; hydraulic fracturing in the Marcellus Shale is a relatively new phenomenon. However, such impacts, should they occur, will be expensive to address. If, hypothetically, the drinking water source of a community of 400 households (1,000 persons) should become contaminated with high levels of dissolved solids, providing clean drinking water to the community could easily cost on the order of \$10 million. The basis for this estimated cost is described in Appendix D.

The local governments could incur expenses for additional activities, such as:

- Increased local law enforcement (both traffic and crime)
- Increased local emergency services (fire and rescue first responders)
- Increased demand for health services
- Other demands for social services
- Repair of local roads⁹
- Maintenance and improvement of community social wellbeing
- Improvement of other economic sectors in preparation for the end of the “gas boom” and economic adjustment assistance
- Creation of public amenities for tourism and other sectors to improve the “post gas boom” local economy.

C. Sources of Revenue

The Departments identified five potential sources of revenue that may be used to offset the costs and impacts of Marcellus Shale gas production. The State should anticipate that gas exploration and production could also result in additional revenue from corporate and personal income tax, sales tax, and fuel taxes. These, however are directed to the General Fund or already dedicated to other specific uses.

Real property taxes are assessed against the value of the property. The Maryland statute regarding property taxes provides: “If minerals and mineral rights are owned separately from the land in which they are located, the supervisor may assess the minerals and mineral rights separately from the land.” Md. Tax-Property Code Ann. § 8-229. According to State Department of Assessment and Taxation, this provision has not been

⁹ Two companies have voluntarily entered into agreements with Garrett County concerning certain County roads they will use in connection with wells in other states. They agreed to repair the roads, if necessary, during the project and restore it after the project ends, and they posted performance bonds.

used, mainly because it is so difficult to estimate the value of mineral rights when the minerals are still in the ground.

Personal property taxes may be assessed against the value of the property. Personal property is exempt from State property tax. Md. Tax-Property Code Ann., §§ 7-301. However, local jurisdictions may impose a tax on personal property. Md. Tax-Property Code Ann., §§ 6-202 and 6-203. If natural gas were considered a mineral or earthen material, the machinery and equipment used to extract it would be considered manufacturing property under Md. Tax-Property Code Ann. §1-101(r), which is generally exempt under Md. Tax-Property Article Code Ann. §7-225. . At this time, this property would not be taxed in Garrett County because the County does not tax any personal property and would not be taxed in Allegany County because it is exempt manufacturing equipment. Md. Tax-Property Article Code Ann. §7-108(a).”.

Other states assess personal property taxes on the value of equipment or other assets used to produce oil or gas, ranging from 2% in Alaska, 6.2% in Wyoming, and 27% in New Mexico.

A severance tax is a tax imposed on the value of natural resources such as coal, oil or gas extracted from the earth. Severance taxes are determined when the resource is extracted and can be measured. Generally, a gas severance tax is based on the value of the gas extracted at the wellhead, the volume or weight when it is extracted, or a combination of the two.

Maryland and Pennsylvania are the only gas-producing states in the Mid-Atlantic area that do not have some form of state-level severance tax. Most states apply a statewide tax while some authorize counties to impose the tax. States generally direct revenue from a state severance tax to general funds. Statutory tax rates¹⁰ from selected states are :

Alaska	25% of net value at production
Kansas	8% of gross value
Texas	7.5% of market value at well
Oklahoma	7% of average monthly price
Wyoming	6% of gross value, including royalties
West Virginia	5% of gross value

Garrett County levies a tax of 5.5 % on the wholesale market value of gas produced from wells in Garrett County. Ten-elevenths of the money received is distributed to the County, and one-eleventh to the municipalities in the County, on a per capita basis. Public Local Laws of Garrett County, Sections 51.01 through 51.07.

Allegany County levies a 7% tax on the wholesale market value of natural gas produced in Allegany County. Chapter 394, Allegany County Code. It is likely that a bill to change Allegany’s severance law to match Garrett’s will be introduced in the 2012 General Assembly.

¹⁰ Many states apply credits and deductions, so that the tax paid is lower than the statutory rate.

A permit fee is a fee assessed to defray the costs of regulatory review and enforcement. In Maryland, a person must obtain a permit from MDE's Minerals, Oil, and Gas Division before drilling a well for the exploration, production, or underground storage of gas or oil in Maryland. MDE is required to set and collect permit and production fees related to oil and gas well drilling. Fees must be set at a rate necessary to cover all costs incurred by the State to (1) review, inspect, and evaluate monitoring data, applications, licenses, permits, and other reports; (2) perform and oversee assessments, investigations, and research; (3) conduct permitting, inspection, and compliance activities; and (4) develop and implement regulations to address the risks to public safety, human health, and the environment from oil and gas well drilling and development.

Unlike most taxes, permit fees generate revenue in advance of the actual gas production; however, the fees would be assessed only against those who apply for permits.

A study fee is a fee that could be imposed on an industry to enable regulators to collect baseline data and other information prior to allowing a regulated activity. In 2011, the Maryland General Assembly considered House Bill 852 (HB 852) that would have imposed a fee prior to the extraction of any gas.¹¹ Under HB 852, certain persons with gas interests in Garrett and Allegany Counties would have been required to pay a fee of \$10 per acre per year for two years to Maryland's Oil and Gas Fund. The purposes for which the fee would have been used included studies of most of the issues mentioned in the Executive Order, including installation of well and stream gages for baseline ground and surface water monitoring and studies of best practices for gas exploration and production.

D. Projected Amount of Revenue

The U.S. Geological Survey (USGS) recently completed a reassessment of the undiscovered oil and gas potential of the Marcellus Shale within the Appalachian Basin Province of the eastern United States. The assessment is based on the geologic elements of the formation's total petroleum system, including its characteristics as a petroleum source rock as well as a reservoir rock.¹² The USGS did the reassessment to take into account newer drilling and completion technologies and additional, timely production data available for Marcellus wells. Using the USGS estimates of the portion of the

¹¹ The Departments are not aware of a similar study fee having been proposed or adopted in Maryland or elsewhere. There have been voluntary contributions, however, toward regional monitoring. For example, East Resources, Inc. contributed \$750,000 to the Susquehanna River Basin Commission to support deployment of a monitoring network.

¹² Coleman, J.L., *et al.*, Assessment of Undiscovered Oil and Gas Resources of the Devonian Marcellus Shale of the Appalachian Basin Province, 2011: U.S. Geological Survey Fact Sheet 2011-3092, 2 p., available at <http://pubs.usgs.gov/fs/2011/3092/>.

resource within each state,¹³ Maryland is estimated to have the following amounts of technically recoverable natural gas at the 95%, 50% and 5% confidence levels.

Estimated Marcellus Shale Gas Resource in Maryland			
	F95 ¹⁴ - Min	F50	F5 - Max
Natural Gas (billion cubic feet)	711	1,302	2,383

The new USGS estimate of the volume of recoverable gas in Maryland is lower than some other estimates.¹⁵

A large amount of uncertainty still exists in estimates of the amount of gas recoverable from the formation, and the future price of natural gas. Using the USGS estimates and assuming a constant price of \$3.93 per million cubic feet,¹⁶ each 1% of severance tax on Marcellus Shale gas is estimated to result in revenues ranging between \$27.9 million and \$93.7 million over the lifetime of the gas extraction. Assuming a 50 year lifetime of the Marcellus play in Maryland, the average annual receipts per 1% of severance tax range from \$559K to \$1.9M; at a 50% confidence level, \$1M.

	F95 - Min	F50	F5 - Max
Total Play Value Over 50 Years	\$ 2,794,325,499	\$ 5,115,416,118	\$ 9,365,344,842
Total Receipts Over 50 Years per 1% of Severance Tax	\$ 27,943,255	\$ 51,154,161	\$ 93,653,448
Average Annual Receipts per 1% of Severance Tax	\$ 558,865	\$ 1,023,083	\$ 1,873,069

The actual annual severance tax receipts would depend on the pace of drilling and the production curve of the wells. The total amount will be realized only if all the technically recoverable gas is produced and sold. Some portion of that gas will not be recovered in practice.¹⁷

¹³ Coleman, J.L., *et al.*, USGS Re-Assessment of the Undiscovered, Technically Recoverable Oil and Gas Resources of the Marcellus Shale, Appalachian Basin, USA. PowerPoint presentation, MD-DE-DC Water Science Center, U.S. Geological Survey, Baltimore, MD. (October 21, 2011).

¹⁴ F95 represents a 95 percent chance of at least the amount tabulated; other fractiles are defined similarly.

¹⁵ The USGS minimum is less than half, and the maximum is less than 20%, of the volume estimated by a representative of Samson Resources and used as a basis for calculations by an extension agent. UMD Extension Agent, Estimated Marcellus Shale Natural Gas Value, <http://marcellusshale.garrettcountry.org/images/documents/Economic%20Value%20Estimates.pdf>.

¹⁶ This is the same price for wellhead natural gas used by the extension agent.

¹⁷ Some gas may be inaccessible for a variety of reasons, such as the unwillingness of an owner to lease mineral rights.

E. Discussion and Recommendations

A successful cost and revenue structure to offset the costs of State activities will satisfy the following three objectives:

- The local economy, social wellbeing, public infrastructure, and natural environment (including natural resources and the ecological functions of healthy ecosystems) will be protected during gas well drilling and production, and maintained or restored to the same or better condition when the drilling and production cease.
- Each permittee will be responsible for all activities and costs related to the well site and all impacts attributable to its activities. Where possible, the costs should be internalized and paid directly by the permittee.
- As part of internalizing the costs of all impacts of Marcellus Shale drilling, permittees should collectively be responsible for impacts of industry activities that cannot be attributed to a specific operator, or for which there is no solvent responsible entity.

The two identified sets of impacts to State resources are (a) costs associated with a specific well or site, and (b) costs of non-site specific (regional or general) impacts. Here are potential funding mechanisms for each set of costs that could satisfy the foregoing objectives.

Costs Association with a Specific Well or Site

Pre-Drilling– To Be Paid by the Applicant

At the pre-drilling phase, the applicant would bear the cost of collecting and presenting the data required by the State for permit review, such as an Environmental Assessment and site-specific surface and ground water information. State costs for review will be included in the drilling permit fee.

Drilling, Fracking, Production and Post-Production – To Be Paid by Permittee

During drilling, fracking,¹⁸ and production, on-site costs would be the responsibility of the permittee, and permit conditions will require monitoring, reporting, and correction of associated impacts. State activities relating to inspections and compliance will be funded by permit fees. Permit provisions might require:

- Site-specific air quality, surface water and ground water monitoring
- Appropriate on-site presence of a State or State-approved inspector during drilling and fracking site operations
- Collection and reporting of specific data during drilling, *e.g.*, geophysical logs, and collection of drill cuttings
- Periodic testing of air quality and nearby public and private water wells

¹⁸ Fracking includes re-fracking, should it occur.

- Recordkeeping and reporting to document that all wastes, including flow-back, are properly transported, treated, and disposed of
- Repair of public facilities (roads, road signs, bridges, etc.) damaged by vehicles traveling to or from the drilling site.
- Remediation of site-related surface or ground water contamination
- Remediation of site-related natural resource damages, both short-term and long-term.

The Department of the Environment currently requires the applicant for an oil or gas permit to provide a performance bond, the release of which is conditioned on compliance with the law, regulations, permit, and orders of the Department, including those relating to reclamation of the site. Bonds are a form of financial assurance; that is, they guarantee that some funds will be available to pay for work if the permittee fails to perform.¹⁹ By State statute, bonds for oil and gas wells cannot exceed \$100,000 per well, or \$500,000 as a blanket bond for all of the applicant's wells. The Departments do not have enough experience with the well drilling technologies utilized to extract natural gas and oil from tight geologic formations to know whether the amount is adequate. A recent article estimated the cost of plugging a Marcellus Shale well in Pennsylvania to be “in the vicinity of \$100,000” and noted that Cabot Oil & Gas Corporation estimated that it spent about \$700,000 per well to close three vertical wells in Susquehanna County, Pennsylvania.²⁰

The Departments recommend that the General Assembly amend the law that limits the amount of a performance bond by deleting reference to a dollar amount and directing MDE to establish the proper amount of bond by regulation, based on a consideration of the likely costs of complying with permit provisions, properly closing the well and performing site reclamation.

Non-Site Specific (General or Regional) Impacts

Pre-drilling Study Fee – To Be Paid by Leaseholders

In order to assess regional impacts related to operations, the Departments would need to know the preexisting conditions. General or regional baseline data, including ground water and surface water information, must be gathered before operations start.²¹ Other issues identified in the Executive Order, such as best practices for gas exploration and production, must also be completed before permits are issued. The Departments recommend that, to fund these pre-operational studies, the General Assembly should require those who acquired an interest in real property in Allegany or Garrett Counties for the purpose of drilling for natural gas to pay a Marcellus Shale study fee on a per-acre basis. It is estimated that gas interests on 120,000 acres of land have been acquired in Garrett County for this purpose. At an estimated study cost of \$1,538,320, the study fee on a per-acre basis is \$6.41 per acre per year for two years, or \$8.41 for the first year and

¹⁹ Md. Env. Code Ann., § 14-111(a)(5).

²⁰ Mitchell, A.L., and E.A. Casman. 2011. Economic Incentives and Regulatory Framework for Shale Gas Well Site Reclamation in Pennsylvania, 45 *Environmental Science & Technology* 22:9506-9514, 9508.

²¹ These data might be useful to the State for other purposes, but if there were no prospect of drilling in the Marcellus Shale in western Maryland, there would be no need to gather this data.

\$4.32 for the second year. If leases have been signed for land in Allegany County, the per-acre cost might be lower.

Operation and Post-operational – To Be Paid by a Severance Tax

The State will need to address general or regional impacts of gas exploration and production that cannot be attributed to a specific operator, or for which there is no solvent responsible entity.²² Subject to approval by the General Assembly, the Departments recommend establishing a Shale Gas Impact Fund paid for by a reasonable severance tax assessed on the industry.²³

The Departments recommend a severance tax as the best source of revenue for the Fund because a severance tax is directly proportional to the level of gas production, and is levied on those who realize income from the production. MDE's Acid Mine Drainage and Treatment Fund, used for reclamation of abandoned mines for which there is no continuing reclamation responsibility on any party, is an example of such a fund. Md. Env. Code Ann. § 15-1103. Trust Funds established in other states, such as New Mexico and Colorado, could also serve as models. The Shale Gas Impact Fund could be set up as a subaccount within MDE's existing Oil and Gas Fund. This would require minor amendments to Md. Env. Code Ann. § 14-122 and 14-123.

The formulas for calculating severance taxes vary considerably across the states in both the basis for calculation and the amount of the taxes. If Maryland decides to impose a severance tax, a number of factors should be considered:

- The range and potential magnitude of environmental and natural resource damage, including a margin of safety
- The risk that persons responsible for the damage may be insolvent or judgment-proof
- Severance tax rates in other jurisdictions
- The amount of potentially available revenue
- Whether credits and deductions should apply to the calculation of the tax
- Whether pre-existing (non-Marcellus Shale) wells should be exempt.

Garrett County has already established a severance tax, as has Allegany County. Severance taxes based on the value of the gas produced are likely to be volatile and unpredictable. Local governments will rightly be cautious about incorporating these funds into their budgets, and avoid using them to fund continuing governmental services. The local jurisdictions should be free to decide how they will use severance tax revenue, but it would be prudent to deposit the revenue into a special fund directed toward programs and services that build the counties' human and physical capital, aid other sectors of the economy that may have been adversely impacted by gas development, and encourage diversification of their economies. This would address the local impacts and

²² The Fund could also be structured so that, if there is a responsible entity, but it fails to address the impact in a timely way, MDE could take action and sue the responsible entity for cost recovery.

²³ The severance tax could be structured to advance other public interests. For example, a tax credit could be granted for every full time job filled by a Maryland resident.

prepare for the day when the gas resources are depleted and the industry no longer contributes substantially to the local economy.

Attempts have been made to determine the effects of imposing or raising a severance tax on exploration, production, and economic metrics. It has been asserted that the imposition of a significant tax on Marcellus Shale gas could cause companies to redirect their attention to other shale plays, and that any revenues from a severance tax could be offset by losses in sales and income tax revenue.²⁴ Many studies have found that taxation has little or no effect on exploration or production.²⁵

Analyzing the effect of a severance tax is anything but simple and straightforward. A severance tax is just one factor among many that influence a company's decision about where to devote its efforts. The total tax burden is a more relevant figure than any one tax,²⁶ and other factors may be more important, such as gas price, labor costs, and access to pipelines.

Headwaters Economics, an independent, nonprofit research group, conducted a detailed study comparing data about taxing and spending policies from Colorado, Montana, New Mexico, Utah and Wyoming.²⁷ A major conclusion of the study is that "States can increase effective tax rates and realize higher revenue from energy development with little risk of affecting the local energy economy."²⁸ The study found no evidence to suggest that different tax rates led to more or less energy investment, citing the example of Montana – which cut tax rates to stimulate drilling but experienced less energy development than Wyoming, which did not cut tax rates.

Another study of Wyoming used a model to simulate the effect of raising severance taxes.²⁹ The study found raising the severance tax does little to affect production, so that tax collections increase. However, the authors noted that their simulations showed that a tax increase slows down drilling in the early years of the program and shifts it to the future compared to a scenario of no tax increase.³⁰

²⁴ Considine, T.J., R. Watson and S. Blumsack. 2010. The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update at 3, available at <http://marcelluscoalition.org/wp-content/uploads/2010/05/PA-Marcellus-Updated-Economic-Impacts-5.24.10.3.pdf>.

²⁵ For a discussion of the literature, see Chakravorty, U., S. Gerking and A. Leach. 2009. State Tax Policy and Oil Production: The Role of the Severance Tax and Credits for Drilling Expenses, at 10-13, available at <http://apps.business.ualberta.ca/uchakravorty/Documents/Research/CGLStateTaxesDec09.pdf>.

²⁶ The situation is further complicated by the fact that state and local taxes are generally deductible on federal corporate income tax returns.

²⁷ Headwaters Economics. 2008. Energy Revenue in the Intermountain West: State and Local Government Taxes and Royalties from Oil, Natural Gas, and Coal, available at http://headwaterseconomics.org/pubs/energy/HeadwatersEconomics_EnergyRevenue.pdf.

²⁸ *Id.* at 3.

²⁹ Kunce, M., *et al.*. 2003. State Taxation, Exploration, and Production in the U.S. Oil Industry. 43 *Journal of Regional Science* 4:749-770.

³⁰ *Id.* at 759. Several Commissioners have suggested that Maryland should ramp up drilling activity slowly in the early years.

Looking specifically at Pennsylvania, another study³¹ concluded that a severance tax potentially would have small negative effects on some economic metrics,³² but that these would probably be more than offset by the positive effects of state and local government spending made possible by the severance tax.

The studies reach differing conclusions. Thus it is difficult to predict exactly what effect the imposition or increase of a severance tax in Maryland. Nevertheless, the literature suggests that a tax will raise revenue without a significant negative impact on gas exploration and production activity and the economy generally.

³¹ Baker, R.M. and D.L. Passmore. Benchmarks for Assessing the Potential Impact of a Natural Gas Severance Tax on the Pennsylvania Economy (September 13, 2010) at 15. Available at <http://ssrn.com/abstract=1667022>.

³² Total employment, private nonfarm employment, gross state product, real disposable personal income and population. *Id.* at 15.

Section III – Liability

A. Introduction

Executive Order 01.01.2011.11 directs the Departments to investigate the desirability of legislation that would define standards of liability for gas exploration and production. In consultation with the Advisory Commission, the Departments examined the current liability structure in Maryland, problems and gaps in this structure, and a range of responses available to the legislature or Administration. To guide the analysis, several goals were identified:

- Support a healthy, sustainable economy and environment.
- To the extent that adverse impacts cannot be eliminated, ensure that those who suffer negative impacts are appropriately compensated and damage is mitigated.
- Incentivize prevention of harm and foster prompt remediation.
- Craft solutions that are fair to all parties.

B. The Current Liability Structure in Maryland

The only statute directly addressing liability for gas well operators states that “[a]ny person who drills for oil or gas on the lands or in the waters of the State is strictly liable for any damages that occur in exploration, drilling, or producing operations or in the plugging of the person's oil or gas wells, including liability to the State for any environmental damage.” Md. Nat. Res. Code Ann. § 5-1703. The scope or applicability of the section has not been tested.

There are also statutory requirements that oil and gas permittees must post a performance bond and maintain liability insurance. Under current law, the Department may not require a bond in excess of \$100,000 per well, or \$500,000 as a blanket bond for all wells of a permittee. The bond is released only after MDE determines that the well has been properly plugged, the site reclaimed, required records submitted, and obligations under the statute, regulations, and permit fulfilled.

The statute requires liability insurance coverage of at least \$300,000 per person and \$500,000 per occurrence or accident. This insurance must cover injury to persons or property damage caused by drilling, production, or plugging. MDE’s regulations expand the requirement of liability insurance coverage to \$1,000,000 per person and \$5,000,000

per occurrence or accident, but do not otherwise address liability. The regulations allow an applicant to self-insure if it meets certain criteria. COMAR 26.19.01.06 C(4)

Many states recognize the common law³³ rule that mineral rights are considered the dominant estate, meaning those rights are considered legally superior to, and take precedence over, the rights of the surface owner. Even in those states, however, mineral owners are not free completely to disregard the rights of surface owners and must limit their interference to what is reasonably necessary to develop the mineral estate. The rule reflects a judgment that it is in the public interest that natural resources, such as minerals, not be wasted. It appears that Maryland courts have not explicitly decided whether the common law rule applies in Maryland, but the Maryland legislature has both recognized the economic importance of oil and gas production, and indicated that the environmental cost of extracting oil and gas could, in certain circumstances, justify prohibition of oil and gas exploration and production. Env. Code Ann. § 14-101 provides:

The General Assembly finds and declares that the production and development of oil and gas resources is important to the economic well-being of the State and the nation. The drilling and production of oil and gas should be conducted in a manner that will minimize their effects on the surrounding environment. Furthermore, proper evaluation of a project and the use of the most environmentally sound drilling and production methods are necessary to prevent adverse environmental consequences that would be detrimental to the general welfare, health, safety, and property interests of the citizens of the State. In addition, there are certain circumstances where oil and gas exploration or production should be prohibited, such as when these operations will have a significant adverse effect on the environment. The General Assembly finds that the conduct of exploration or production of oil and gas resources under this subtitle will allow the safe utilization of the State's natural resources and will provide for the protection of the State's environment.

Maryland recognizes several common law tort claims that may potentially be used by persons who believe they have been damaged by Marcellus Shale gas production:

Trespass

A person who owns land generally has the right to exclude others from the land. If someone intentionally or negligently enters onto that land (either on the surface or subsurface) without authority, he or she has committed trespass. The essential element of trespass is the entry, regardless of whether harm has occurred, although the existence of harm will affect the award of damages. The “entry” need not be by a person; in some circumstances the movement of pollutants onto property could be a trespass.

³³ Common law is the system of law based on custom and judicial precedent rather than laws enacted by a legislature.

Negligence

A person can be liable if he or she negligently causes harm to another.³⁴

Private Nuisance

If a person intentionally causes unreasonable, substantial interference with another person's right to use and enjoy his or her land, he or she can be liable for nuisance. A court might order the person to stop the interference, award money damages, or both. Nuisance is different from trespass in that nuisance involves no physical entry onto land.

Strict Liability (Liability for Abnormally Dangerous Activity)

Strict liability means liability without fault. The basis for strict liability is the creation of an undue risk of harm to other members of the community, regardless of how much care was exercised in undertaking an abnormally dangerous activity (ADA). In the absence of a statutory definition of ADA, the issue of whether an activity is an ADA is a fact-intensive inquiry involving the consideration of multiple factors, including whether the activity is inappropriate to the place where it is carried on and the value of the activity to the community. The person seeking damages under strict liability must still prove the cause and effect between the action and the harm.

C. Criticisms of the Current Liability Structure

The current liability structure has been criticized on several grounds. Parties most likely to be injured by gas well drilling and operation are the surface landowner, neighboring property owners, or members of the general public near the drilling site. A dispute between such an individual and an oil and gas company is a classic example of asymmetry of resources. The company is likely to be prepared to defend a suit because it has experience with such litigation and ample resources to engage counsel and experts. Individuals, on the other hand, have probably not been involved in similar cases, and would be at a disadvantage in hiring lawyers and experts. Individuals with valid claims who do bring challenges can anticipate considerable expense and may have to wait for the appeals process to be exhausted before receiving any compensation for their damages.

Second, any legal theory currently available will probably require the individual to produce evidence on complex and cutting edge issues of engineering, geology and hydrogeology. Opposing experts may draw opposite conclusions from the same facts, especially where scientific understanding is incomplete.

Third, there are few meaningful remedies for those who do not own their mineral rights, but are nevertheless injured in some way by the activities. People who own mineral and surface rights can negotiate for some protection when contracting for the sale or lease of those rights to another party. A contract or lease may incorporate protections against damage or include provisions for compensation. For example, the location for an access

³⁴ If a person has a duty to act in a certain way, *e.g.*, to exercise reasonable care, and fails to do so, and that failure causes damage that is natural, probable, proximate, and not too remote, the person may be liable for the damage. A familiar example would be an automobile accident caused by a driver's momentary inattention.

road could be specified to avoid cropland, or payment for crop damage could be stipulated. However, some surface owners never owned mineral rights in their land because those rights were reserved by the seller or transferred to someone else before the surface owner acquired the property. There is no way for these individuals to obtain any contractual protection.³⁵

Lastly, there are few meaningful remedies for neighboring residents, landowners, or businesses whose lands are not directly involved in drilling, but who may incur damage. As described above, a patchwork of common law tort claims provides the main source of remedies for these injured parties. Availability of a remedy differs depending on the situation and even when an injury seems to fall within one of the recognized torts, certain elements may be difficult for the injured party to prove under the circumstances.

D. Discussion and Recommendations

Creating a Presumption of Causation

Maryland could create a statutory presumption that certain types of damage were caused by the drilling activity or operation of the gas well if the damage occurred close in time and place to the gas operations. The presumption should be limited to the sorts of damage that logically could be associated with the activity. The Departments recommend that such a statute be enacted.

Other states have such statutes for gas wells. West Virginia recognizes a presumption of causation for contamination or deprivation of a water source within 1,000 feet of the site of drilling. West Virginia Code §22-6-35. In Pennsylvania, currently there is a presumption of causation for pollution of a water supply within 1,000 feet of a well and within 6 months of completion of drilling. 58 P.S. § 601.208. Proposals have been made to extend the presumption to 2,500 feet and 1 year, as recommended by Pennsylvania's Marcellus Shale Advisory Commission.

Maryland already has a similar law that could serve as a model. It applies to surface mines, such as sand and gravel mines, within karst terrain. Mine owners must obtain an MDE water appropriation permit in order to dewater the mine pit. When issuing the permit, MDE establishes a zone of dewatering influence around the surface mine. If drinking water wells in the zone of influence fail because of declining ground water levels, or the surface suddenly subsides within that area, the permittee must replace the water supply or compensate the landowner for the other damage. Md. Env. Code Ann. §§ 15-812, 15-813. The presumption is rebuttable; that is, if the mine operator can prove by clear and convincing evidence that its operations were not the cause of the damage, it can prevail and avoid liability. Essentially, the burden is shifted to the operator, so that it must prove its actions were *not* the cause of damage, rather than the individual needing to prove that its actions were the cause.

³⁵ The Departments acknowledge that responsible companies routinely work with surface owners, regardless of lease or contractual provisions, to minimize interference with the rights of the surface owner. In addition, companies will sometimes agree to accommodate the surface owner in order to avoid a challenge to the permit.

In the context of gas well drilling, a similar law could be enacted that would require MDE to establish, a “presumptive impact area” surrounding gas wells in deep shale deposits.³⁶ Determining the area would be more complex than in the dewatering example, where pump tests can verify the connection between the dewatering, the water table, and individual wells. At this time, any choice of area should be based on our current understanding of impact zones, but with the expectation that experience may justify a change. The authors of a 2011 study found elevated levels of methane in drinking water wells within about 600 meters of gas wells in active drilling areas.³⁷ The distances are measured from the vertical borehole.³⁸

MDE would also be responsible for designating the types of damage that the gas well could cause within the presumptive impact area. For example, the presumption might be applied to contamination of well water by methane or other pollutants.

Finally, MDE would identify a reasonable time period within which the damage would be presumed to have been caused by the activity. If the time period is long, there is more of a chance that other factors or intervening events could have caused the damage. One year or more from completion of hydraulic fracturing may be appropriate.

A program would be established by which MDE would oversee the remediation or compensation of affected property owners. As under the dewatering law, the permittee would be able to rebut the presumption by proving its activities were not the proximate cause of the damage. After the time period under the law passes, an allegedly injured party would not be without a remedy, but he or she would have to prove causation rather than take advantage of the presumption.

Such a law would provide an incentive to the driller to test drinking water wells to document pre-existing problems before undertaking any site activities. If a landowner refused to allow the driller to test his or her water, the landowner would not be able to take advantage of the law.

A Surface Owners Protection Act

Maryland could enact a law specifically for the protection of surface owners on whose, or under whose, land exploration or production activities occur. These laws have already been enacted in over a dozen states. The Departments recommend that such a law be adopted in Maryland.

³⁶ It is preferable to set the distance on a site-by-site basis or by regulation, rather than in a statute, because a regulation would be easier to amend if new information became available to justify a different distance.

³⁷ Osborn, S.G., *et al.* 2011. Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing, PNAS Early Edition, Fig. 3, available at <http://www.pnas.org/content/early/2011/05/02/1100682108.full.pdf+html>.

³⁸ The interface between the vertical borehole and the drinking water aquifer is the most likely point of contamination. Because of the depth of the horizontal borehole, contamination of drinking water aquifers is less likely to occur and the pathway and presumptive impact area more difficult to predict.

The provisions of Surface Owners Protection Acts (SOPA) vary from state to state. Commonly, however, a method of identifying all persons having surface rights is identified. Before performing any work on the site, the permit applicant gives notice to surface owners; the notice must sufficiently disclose the plan of work and operations to enable the surface owners to evaluate the effect of drilling operations on the surface owners' use of the property. The notice must include an offer to discuss with the surface owners all surface activities and the placement of roads, pipelines, points of entry and the like, as well as a method of placing a monetary value on any damages due to the activity such as destruction of crops, lost timber, and diminution in property value. If the parties reach agreement on these issues, the terms are recorded in a legally enforceable document. States take differing approaches in the event agreement is not reached. Some SOPAs require one party or the other to bring a court action; others allow the driller to enter after posting bond for possible future damage; and some allow mediation or arbitration. It is essential that there be time limits on negotiations, and that the consequences of failure to agree are clear.

SOPA should apply to all leases entered into after the effective date of the statute, unless there is disclosure of those rights and an explicit written waiver by the lessor. Laws designed to protect consumers could provide a model. See, *e.g.*, Md. Real Property Code Ann. § 10-603 (relating to the new home warranty security plan).

Protect Residents, Landowners, and Business Owners Other than Surface Owners

Strict Liability

One option to address the problems of residents, landowners, or business owners who might be adversely impacted by exploration or production, but who are not covered under a Surface Owners Protection Act, would be for the General Assembly to pass a law declaring that hydraulic fracturing is an abnormally dangerous activity. The new law could provide that a permittee would be strictly liable to the resident, landowner, or business for damage caused by the activity as long as the party can show that the damage was caused by the permittee's on-site or off-site activities. The injured party would have to file a civil suit but would not need to show that there was any intent, negligence or fault on the part of the permittee. This is what is meant by "strict liability" and is appropriate where the activity is abnormally dangerous.

The Departments do not recommend this option. The factual basis for applying such a strict liability standard to gas exploration and production is not clear. Also, there are other legitimate business activities that have the potential to have an adverse impact on the community; any move to impose strict liability on one industry should take this into account. At this time, the Departments do not recommend that Maryland designate, as a matter of law, that Marcellus Shale drilling and fracking be considered abnormally dangerous activities subject to strict liability. In any particular situation, the injured party would be free to bring a claim under a theory of strict liability, but the court would make a factual determination, based on several factors, whether drilling and fracking are abnormally dangerous.

Mediation or a Community Benefits Agreement

There may be instances where particular members of the community would be disproportionately affected by a proposed activity; for example, a home may be located very close to the only access road to a proposed drill site. Although responsible companies are often willing to address the concerns of such individuals, some members of the community may not feel equipped to discuss matters with a permit applicant. Mediation or another form of alternative dispute resolution (ADR) could facilitate this process. Local government or non-governmental organizations could play an important role in reaching out to community members and providing ADR services. ADR can also be used to address perceived damage after it occurs, as an alternative to litigation.

Where the impacts are community-wide, a different approach may be appropriate. Community Benefits Agreements (CBAs) are legally binding, enforceable agreements between a developer and a community coalition. They allow community groups to press for community benefits that are tailored to their particular needs, and to enforce developers' promises. Each CBA is unique. Some communities are interested in deriving benefit from of the development activity, such as local hiring preferences, or new green space, recreation facilities, and parks. Communities can also negotiate to mitigate adverse impacts, such as vehicle traffic, noise or dust, with controls that are above minimum legal requirements.

The Departments recommend that a process for ADR and the negotiation of Community Benefits Agreements be established.

Section V – Conclusions

Executive Order 01.01.2011.11 tasks the Departments of Natural Resources and the Environment MDE and DNR, in consultation with the Advisory Commission, to conduct a three-part study and reporting findings and recommendations. The first part of the study relates to revenue and liability. The Departments developed four recommendations regarding revenue (R) and three recommendations regarding standards of liability (L). They are:

- R-1 The General Assembly should impose a fee on gas leases to fund studies of issues set forth in the Executive Order.
- R-2 The General Assembly should enact an appropriate State-level severance tax.
- R-3 The severance tax revenue should be deposited into a Shale Gas Impact Fund to be used for continuing regional monitoring and to address impacts of gas exploration and production that cannot be attributed to a specific operator, or for which there is no solvent responsible entity.
- R-4 The General Assembly should amend the law that limits the amount of a performance bond by deleting any reference to a dollar amount and directing MDE to establish the proper amount of bond by regulation, based on a consideration of the likely costs of complying with permit provisions, properly closing the well and performing site reclamation.
- L-1 The General Assembly should enact a law creating a rebuttable presumption that certain damages occurring close in space and time to exploration and production activities are caused by those activities, and an administrative process for requiring the permittee to remediate the damage, pay compensation, or both.
- L-2 The General Assembly should enact a comprehensive Surface Owners Protection Act.
- L-3 Community impacts should be addressed through mediation or by use of community benefits agreements.

The majority of members of the Advisory Commission support these recommendations. A summary of the deliberations of the Advisory Commission can be found in Appendix E.

APPENDIX A – MEMBERS OF THE COMMISSION

Chair

David A. Vanko, Ph.D., *geologist and Dean of The Jess and Mildred Fisher College of Science and Mathematics at Towson University*

Commissioners

George C. Edwards, *State Senator, District 1*

Heather Mizeur, *State Delegate, District 20*

James M. Raley, *Garrett County Commissioner*

William R. Valentine, *Allegany County Commissioner*

Peggy Jamison, *Mayor of Oakland*

Shawn Bender, *division manager at the Beitzel Corporation and president of the Garrett County Farm Bureau*

Steven M. Bunker, *director of Conservation Programs, Maryland Office of the Nature Conservancy*

John Fritts, *president of the Savage River Watershed Association*

Jeffrey Kupfer, *senior advisor, Chevron Government Affairs*

Dominick E. Murray, *deputy secretary of the Maryland Department of Business and Economic Development*

Paul Roberts, *Garrett County resident and co-owner of Deep Creek Cellars winery*

Nick Weber, *chair of the Mid-Atlantic Council of Trout Unlimited*

Harry Weiss, Esq., *partner at Ballard Spahr LLP*

APPENDIX B – BASELINE DATA

Marcellus Shale Baseline Studies

Introduction

Determining existing water quality and quantity within the area of Western Maryland underlain by the Marcellus Shale is critical for establishing baseline data prior to gas well development. Data produced from future monitoring of streams and wells in the region will be compared to the baseline data to identify impacts that may be associated with gas development activities including drilling, hydraulic fracturing, trucking, etc. Collection of baseline ground water and stream data for at least two years is necessary to fully understand the magnitude of variations caused by different weather and seasonal events.

Garrett County is expected to see more Marcellus Shale gas development than Allegany County. Not only is the land area underlain by the Marcellus Shale greater in Garrett County than in Allegany County, but Garrett County is located over the Interior Marcellus Assessment Unit, which is thought to be more productive than the Foldbelt Marcellus Assessment Unit that underlies Allegany County. Due to the significant potential for high production levels, large numbers of wells and risks associated with trucking activities, Garrett County will be the focus of baseline studies in the immediate future. Baseline studies will not be initiated in Allegany County until such time as number of gas leases increases, indicating a greater potential for drilling. That study, if and when it occurs, will be funded from severance tax revenues.

Regional Water Quantity

Understanding the dynamics of ground water use and recharge is important for protecting both the quantity and quality of drinking water supplies in the region. Data are also needed to understand the influence of drought and the seasonal impacts of ground water withdrawal on the water resource and on the health of stream biota.

In Garrett and Allegany Counties, ground water exists in fractured rock aquifers. Surface water and ground water are important and interconnected water sources in such areas. Streamflow characteristics vary in response to different land use, geology, topography, soil, and other factors. Water availability depends upon the size of fractures as well as the interconnections between fractures. Water in this region moves down through the soil and decomposed rock and along joints, faults, and fractures in the underlying rock. Surface contamination can easily reach ground water.

The Maryland Department of the Environment is directed by statute to manage both the quality and quantity of water for public supplies, propagation of wildlife, fish and aquatic life, and domestic, agricultural, industrial, recreational, and other legitimate beneficial uses. Currently, requests for water appropriation permits are evaluated one permit request

at a time, and it is difficult to assess cumulative effects of multiple withdrawals on a watershed. The Advisory Committee on the Management and Protection of the State's Water Resources (the Wolman Committee) studied water supply State-wide, and made detailed recommendations for actions to obtain needed data. The Committee recommended drilling additional monitoring wells in fractured rock areas like Garrett and Allegany Counties and adding gages on associated streams to inform State decisions on how much water can be withdrawn from wells and streams without causing adverse impacts to the resource or other users.

There are currently three monitoring wells in the Marcellus play area of Garrett County and one in the Marcellus play area of Allegany County. One of the wells in Garrett County is measured only twice a year so is not suitable for tracking water level changes related to precipitation.

Regional Water Quality

To establish baseline conditions for regional water quantity, the State will drill six deep and six co-located (nested) shallow wells to monitor water levels and hydrologic conditions monthly at depths that are utilized by domestic and local municipal water supplies. The State will also establish or reactivate six stream gages at sites within the Marcellus development region. The United States Geological Survey (USGS) has thirteen gages that measure stream depth and flow in Garrett County and eight in Allegany County. Data from those gages will be included in the baseline analysis.

The existing water monitoring wells in Garrett and Allegany Counties are monitored for ground water levels only, not for water quality. The State will begin monitoring those and the newly drilled wells for water quality parameters such as trace metals, salts, methane, radioactivity, groundwater invertebrates, etc. The State will also establish real-time water quality monitoring of temperature and conductivity at four new stream gage sites and will periodically sample the surface water for other selected constituents.

Most of the existing USGS stream gages measure only stream depth and flow. The very limited data on water quality parameters that is available from the USGS will be included in the baseline analysis.

Specific Stream Data

Sampling of surface streams and the living organisms in them is key to establishing a baseline against which to assess the potential impacts of increased gas drilling, hydraulic fracturing, and production activity. DNR has identified a total of 652 stream reaches in Garrett County. Existing biological sampling programs have sampled 64 of those reaches, or about 10%, since 2007.

In 2011 DNR deployed twelve continuously-recording data loggers in Garrett County streams that are located down slope from potential Maryland or West Virginia gas drilling sites. The data loggers measure temperature and conductivity every hour.

Conductivity is a good surrogate parameter for detecting discharges of salts and other dissolved substances that could find their way into streams and rivers from gas well activities. While the twelve data loggers are located throughout Garrett County, they are not sufficient to provide baseline stream data.

Because the estimated gas resource, leasing activity and immediate interest in drilling are all higher in Garrett County than in Allegany County, the Departments believe it is reasonable to focus initial background monitoring and baseline studies on the potential gas play area in Garrett County.

About one-third (231/652) of the stream reaches in Garrett County are currently associated with parcels that have been leased for gas well activity. The Departments believe that through careful prioritization and in conjunction with the existing twelve data loggers, a sample of 50 of those stream reaches will be sufficient to establish baseline conditions. Criteria for selection of the stream reaches to be monitored will include areas associated with the highest density of leases, areas where the percentage of stream reaches already sampled is lowest, areas where the numbers of imperiled aquatic species are highest, and areas where the earliest drilling is expected to occur.

Each of the 50 stream reaches will be sampled by DNR during at least two consecutive years to give an adequate picture of seasonal and annual variations in those streams. The baseline monitoring will collect data on continuous conductivity and temperature, specific water quality parameters determined via laboratory analysis, and assessment of biological communities and physical habitat conditions. In 2012 DNR will also begin conducting biological sampling at the twelve data logger sites. Collectively, the existing 12 data loggers and the 50 additional stream reach monitoring sites will encompass over 25% of the stream reaches in Garrett County associated with parcels that have been leased for gas well activity.

To supplement the 50 thoroughly sampled locations, DNR plans to recruit, train, and equip teams of local volunteers to collect baseline conductivity, pH, water temperature, and possibly other data at additional stream locations.

Mapping and Survey Data

In order to assess potential future impacts to State resource and recreational lands as required by the Executive Order, the Departments are working to identify, locate and map severed mineral rights under State lands in Garrett County. Until the advent of Marcellus Shale drilling, it has not been necessary to map contiguous parcels owned by the Department or to locate severed mineral interests. The following land units with associated acreages are potentially impacted.

Land Unit	Acres
Savage River State Forest	54,324
Potomac State Forest	10,079
Garrett State Forest	7,639
Youghiogheny Natural Resource Management Area	3,993
Deep Creek Lake State Park	1,818
Mt. Nebo Wildlife Management Area	1,854

The work includes reviewing deeds, identifying mineral interests, and locating monuments referenced in the deeds with known monuments surveyed and mapped by DNR on the ground. In some cases, however, DNR does not have sufficient information to locate an individual parcel. Survey work in the field will be required to complete the mapping task and establish a complete baseline for assessing and mitigating potential impacts to State lands.

Study of Best Management Practices

Under Governor O'Malley's Executive Order 01.01.2011.11, the Maryland Departments of Natural Resources (DNR) and the Environment (MDE), in consultation with the Advisory Commission, are to report no later than August 1, 2012, on best practices for all aspects of gas exploration and production in the Marcellus shale in Maryland. These activities will range from site preparation activities through final closure, including drilling, hydraulic fracturing, handling of water, wastewater and chemicals, and installation of gathering lines and pipelines. The Departments are unable to accomplish this task with their existing staff and resources. MDE will contract for technical assistance in Best Management Practices for Marcellus Shale gas development. The contractor will (1) provide information on best practices identified by other states, the industry, the federal government, and other sources, (2) suggest a suite of best practices that will provide the maximum protection of public health, safety, the environment and natural resources in Maryland, and (3) provide a draft of regulations to require best practices.

Economic and Resource Impact Study

An economic and resource impact study is needed to quantify the impacts, both positive and negative, of increased gas drilling, hydraulic fracturing, and production on other sectors of the economy including housing, transportation, food supply, and recreation/tourism. The study should identify ways to avoid or minimize adverse impacts on scenic landscapes, local land use patterns, rural character, forest habitat fragmentation, wildlife and other natural values that provide the basis for the recreation and tourism sectors of the region's economy. The Departments expect to enter into a contract for this study.

APPENDIX C – COST OF COLLECTING BASELINE DATA

Marcellus Shale Baseline Study Costs	Year 1	Year 2	Basis of Calculation
Regional Groundwater			
Well and stream gage construction, monitoring equipment	\$265,000		Drilling 6 deep and 6 co-located (nested) shallow wells, purchasing 6 stream gages
Water sampling, equipment maintenance	\$70,000	\$70,000	Estimated annual cost of acquiring and analyzing monitoring data
Geologist	\$75,000	\$75,000	1 dedicated FTE geologist
Specific Stream Data	\$410,000	\$338,320	Estimated \$8050 per site x 50 sites = \$402,500/yr plus \$8,400/yr to recruit, train, equip volunteer teams; less equipment purchase in year 2
Survey Data	\$35,000		Yearlong effort by contractual employee
Economic and Resource Impact Study	\$65,000	\$35,000	Estimated cost of contract
Study of Best Management Practices	\$100,000		Estimated cost of contract
Totals	\$1,020,000	\$518,320	

APPENDIX D – REMEDIATION COST ESTIMATES

Cost Estimates for Providing Drinking Water to a Community

The probability of occurrence of a significant adverse environmental impact on important resources is unknown; hydraulic fracturing in the Mid-Atlantic region is a relatively new phenomenon. However, such impacts, should they occur, will be expensive to address. Consider a hypothetical example: contamination by dissolved metals of a drinking water aquifer used by a community of 1,000 people in 400 homes, with an average daily demand of 100,000 gallons per day. Two options, one for a community was served by a public water system and one for a community with individual wells, with cost estimates, are described below:

Option I: If the community was served by a public water system whose wells have become contaminated, the system could install a reverse osmosis treatment system

- Estimated Capital Cost = \$5,000,000 (including required pre-treatment)
- Additional Operation and Maintenance (O&M) Cost = \$300,000 per year
- Present Value of O&M (at 4% for 20 years) = $300,000 \times 13.5903 = \$4,077,090$
- **Total Estimated Cost is approximately \$9,077,000**

Option II: If the community was served by individual wells which became contaminated, but a public system (assumed for purposes of the hypothetical to be 4 miles away) with sufficient quantities of clean water is available, water could be provided by that system

- Force Main Estimated Cost = $21,120 \text{ LF} \times \$100 \text{ per LF} = \$2,112,000$
- Pumping Station = \$1,000,000
- Storage tank and distribution system = \$3,000,000
- Estimated Capital Cost = \$6,112,000
- Additional O&M Cost = \$300,000
- Present Value of O&M = \$4,077,090
- **Total Estimated Cost is approximately \$10,190,000**

APPENDIX E – CONSULTATION WITH THE ADVISORY COMMISSION

The purpose of the Marcellus Shale Safe Drilling Initiative Advisory Commission is to assist State policymakers and regulators in determining whether and how gas production from the Marcellus Shale (and, presumably, similar gas-bearing formations) can be carried out in Maryland without unacceptably and negatively impacting public health, safety, the environment and natural resources. The Advisory Commission's role, therefore, is to serve as a body with which representatives of the Department of Natural Resources and of the Department of the Environment may consult during their (DNR and MDE) preparation of and production of the three reports called for in Executive Order 01.01.2011.11. The Advisory Commission helps identify and discusses issues surrounding shale gas development. It conducts its affairs openly and transparently and actively seeks and considers public commentary. Public comments are received through the Advisory Commission's web site and at Commission meetings.

Advisory Commission members include representatives from local and State government, the gas industry, environmental organizations, businesses, private citizens and landowners, a geology professor, and an environmental lawyer. The members have different perspectives and opinions, as well as a range of expertise and, consequently, achieving unanimity on all the issues discussed is difficult. This section of the report explains which recommendations enjoy broad support, which recommendations elicit a significant difference of opinion, and, finally, a number of other issues that were brought up in Advisory Commission meetings that are not part of the recommendations but that, nevertheless, are worthy of mentioning.

From its inception, members of the Advisory Commission have agreed that if shale gas production is to proceed in Maryland, it needs to be done "right." Although the definition of "right" may vary to some extent among the Commissioners, all agree that safety is of paramount importance.

Commissioners also largely agree that the pre-drilling costs of required data collection associated with a specific well or site should be the burden of the permit applicant. Furthermore, during drilling, fracking and production at a specific site, certain costs as listed in the report should be the responsibility of the permittee.

The Departments' recommendations were presented to the Commission at the meeting on November 15 and further discussed during a meeting on December 12, 2011. With respect to the findings and recommendations in the current report:

Revenue recommendation 1 (R-1). In the case of possible non-site specific impacts, the report argues for the need for baseline data relating to ground water and surface water. The majority of Commissioners agree in principle that baseline studies are needed. Some

Commissioners question the exclusion of regional air quality studies, and the Departments are still considering whether baseline air quality can be established on a regional basis or only on a site-by-site basis.

Commissioners expressed both positive and negative views on the proposed study. Those in favor noted that Maryland is in a unique position to obtain environmental information before any shale gas development takes place, for comparison to data obtained during and after drilling, fracking and production. This would make it possible to observe changes in environmental indicators that might be due to the development activities. Advocates of the study argue that the data will be needed in the event drilling is ultimately permitted, and that establishing the baseline now would actually facilitate permitting in the future.

There is disagreement among the Commissioners on how much responsibility the industry should bear in funding the studies. Because DNR currently has no resources to conduct baseline studies without new funds, the Departments suggest a Marcellus Shale study fee paid for by the industry. Those opposed to the fee argue that there is no precedent for billing industry before it has an opportunity to commence activity.

Some Commissioners suggested that if companies ultimately produce gas, they could be allowed to recoup their contributions to the study through tax credits or deductions. One Commissioner also suggested that the State should reimburse companies for the cost of the study even if drilling is never permitted.

R-2 and R-3. Commissioners are nearly unanimous about the need for a severance tax as long as the tax rate is appropriate. The proceeds could be devoted largely to address general or regional impacts that are not easily attributable to a single company or a single well site. The report recommends the establishment of a special fund for this purpose (revenue recommendation R-3).

The statewide severance tax will be in addition to the county severance taxes already in place. There is general agreement among Commissioners that the county tax should be controlled by each county as it sees fit. There is also general agreement that the statewide tax should be used primarily for Marcellus impacts. Finally, it is agreed that the Fund would be used for immediate remediation of environmental impacts that cannot be traced to a single party, or where the party at fault cannot pay.

R-4. Commissioners agree that an applicant for a permit should provide a performance bond. The current statutes dictate a bond that cannot exceed \$100,000 per well, or \$500,000 as a blanket bond for all of an applicant's wells. Some Commissioners expressed the opinion that these ceilings are too low. The Commissioners generally agree that the amount of the bond should be adequate to allow the State to complete the permittee's obligations if it fails to perform. The Commissioners suggested that the Departments should review the bonding requirements of other states.

Liability recommendation 1 (L-1). Commissioners generally agree that a statute creating a rebuttable presumption of causation should be enacted. Three parameters that need to

be determined are (a) what kinds of damages are included, (b) within what time period should the presumption be in effect, and (c) within what distance of the wellhead should the presumption apply. There is a strong consensus among Commissioners that the most important damages to be covered are the pollution of well water and surface water. Air pollution and health effects were also mentioned. A one-year time frame was generally thought adequate, although some Commissioners think a longer period would be better. A distance of 3000 feet from the wellhead was most often mentioned in Commission discussions.

Commissioners asked the Departments to collect comparable information from neighboring states on what parameters they apply to the presumption of causation (*i.e.*, kinds of damages covered, length of time and distance within which the presumption applies). This information was provided shortly before the December 12 meeting but has not yet been discussed by the Commission.

L-2. Commissioners agreed that a Surface Owners Protection Act is advisable. Surface owners who do not own or control the mineral rights beneath their land need some form of protection from significant negative impacts that drilling and fracking might have on their land.

L-3. Commissioners are in favor of a mediation approach to addressing incidents where shale gas development results in community-wide negative impacts. One Commissioner stated opposition to such an approach if it is mandatory, but support for a voluntary process.

The Departments considered, but ultimately did not recommend, the option of imposing strict liability on permittees for damages caused to non-surface owners and surface owners under whose land no drilling is done (so-called “innocent bystanders”). Some Commissioners strongly prefer to see such a recommendation, noting their view that hydraulic fracturing is an “abnormally dangerous activity” subject to strict liability. Some other Commissioners strongly oppose this. In the absence of new legislation, parties claiming damages related to exploration or production could still seek a court remedy under the theory of strict liability.

The Advisory Commission identified a number of additional issues that it feels should be answered or considered. Among them are the following:

1. There are many issues surrounding the topic of leases. There is an apparent need for public education and/or consumer protection so that citizens are not lured into signing unfavorable leases. One Commissioner questioned whether any states regulate or license the “landmen” who offer to lease mineral rights. The question of whether leases could by law have to contain standard language was asked.

2. Another issue related to leases is how they are frequently bought and sold on a secondary market in a way that largely avoids having to pay Maryland tax. If the State could tax these sales, a new revenue source would be created.

3. Should Maryland establish a minimum royalty that all lessors should receive? Some states have a minimum royalty, and the Advisory Commission has asked the Departments to explore which states do so and at what level. This information was provided shortly before the December 12 meeting but has not yet been discussed by the Commission
4. Realtors have concerns about property values and their fluctuations depending on whether mineral rights beneath a property or a nearby property have been leased. One realtor group contacted the Advisory Commission and requested consideration of a Maryland Gas Lease Registry, which could assist realtors in helping their clients. Commissioners noted that such a registry could also collect registration fees, providing another possible revenue source.
5. Commissioners discussed whether gas development could take place on State lands. Where the State owns the mineral rights, the issue is whether the State should lease them and under what circumstances. In addition, there is a significant portion of State-owned land in Western Maryland where the State does not own the mineral rights. If the State is obligated to provide reasonable access for the mineral rights owner, what types of access and activities are reasonable on these lands that are used by the public?
6. One perceived problem of shale gas development in other states is a large influx of out-of-state workers. Some Commissioners would prefer that drilling and gas companies train and hire local workers to the maximum extent possible. One way to incentivize this would be to build in a reward for doing so, possibly in the form of a severance tax deduction.
7. Some Commissioners suggest that careful control of the rate of permitting, if and when it begins to take place, will be one way to “keep a handle” on shale gas development and its possible impacts. By some estimates, there may be potential for as many as 2200 wells in Garrett and Allegany Counties combined. By pacing the issuance of permits, the intensity of the activity, and presumably the impact, could be reduced.
8. One Commissioner suggested that the State consider whether its laws and regulations regarding coal mining and water appropriations are sufficient to regulate shale gas exploration and production.
9. Finally, the Advisory Commission largely agrees that environmental monitoring and strict regulatory enforcement are critical, because “it costs much more to clean up a spill than to prevent a spill.”