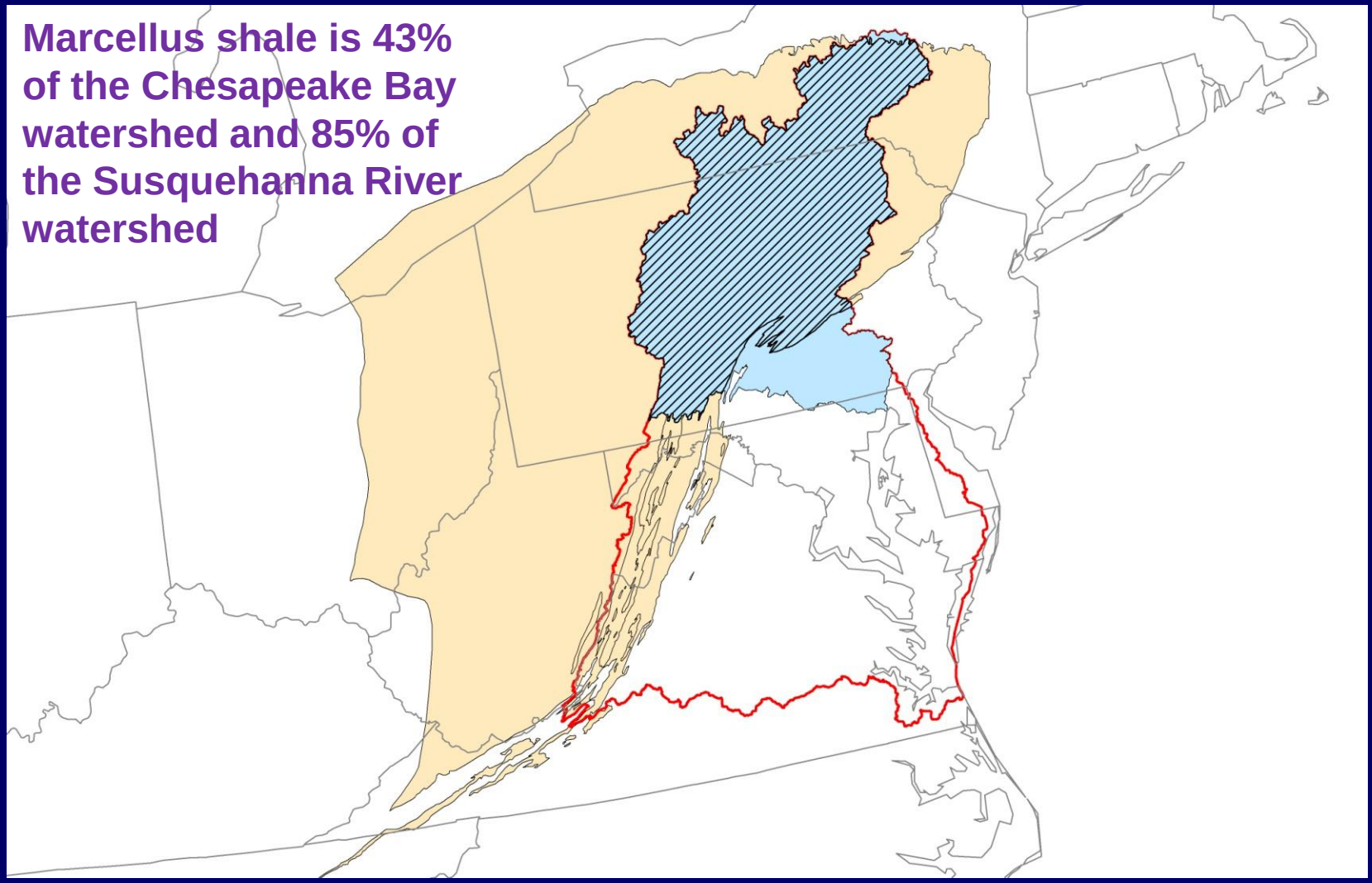
Exploring the Environmental Effects of Shale Gas Development in the Chesapeake Bay Watershed

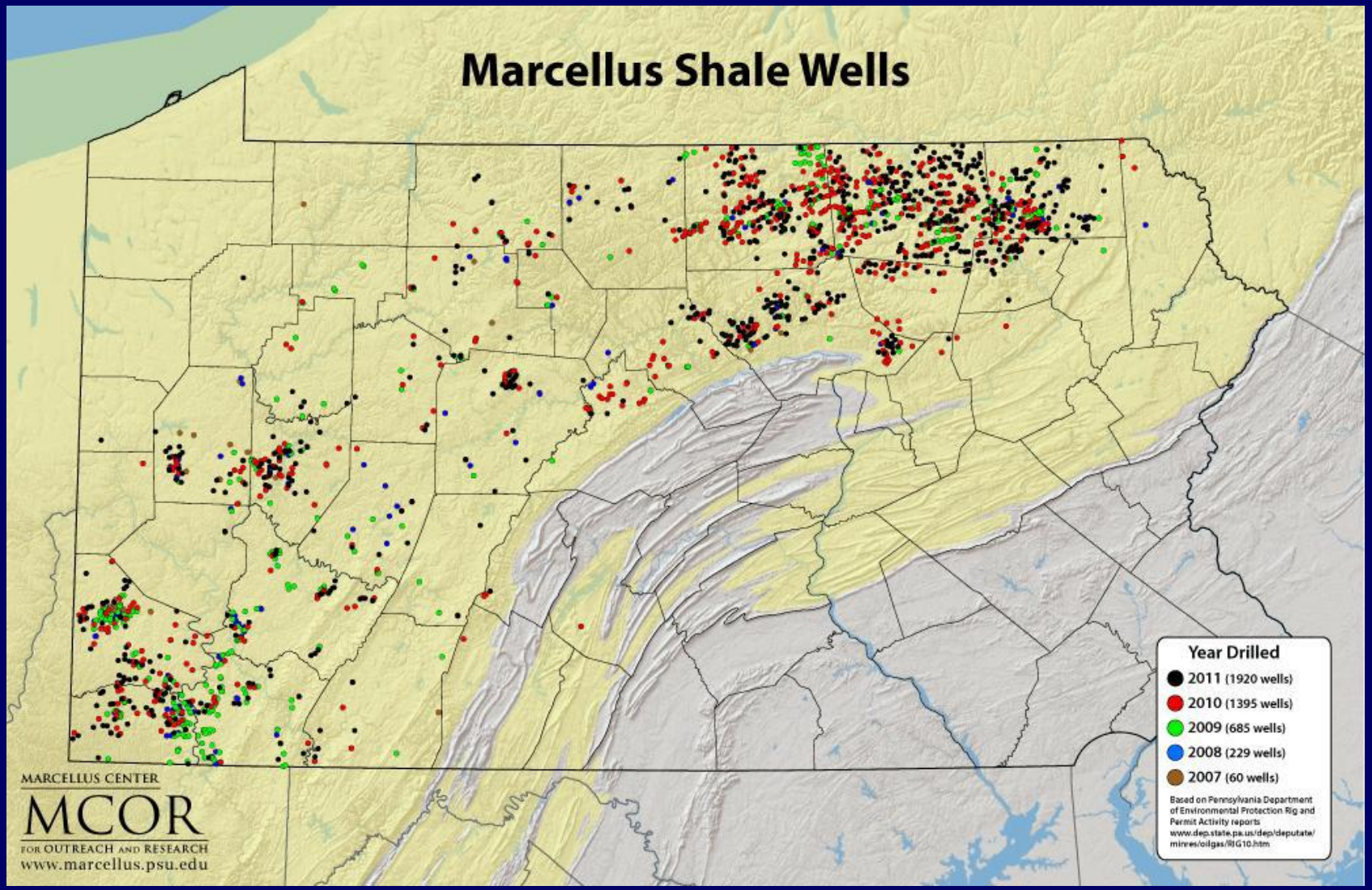
A Workshop by the
Chesapeake Bay Program's
Scientific and Technical
Advisory Committee
April 11-12, 2012

Why Chesapeake Bay and STAC?



Map and data prepared by Randy Chambers

Why Marcellus Shale Gas Development?



Well Pad Development

Images courtesy of Nels Johnson & Tamara Gagnolet, The Nature Conservancy

Pipeline and Road Development

Images courtesy of Nels Johnson, The Nature Conservancy and Sally Entrekin, University of Central Arkansas

Forest Area Effects

Average Spatial Disturbance for Marcellus Shale Well Pads in Forested Context (acres)		
Forest cleared for Marcellus Shale well pad	3.1	
		8.8
Forest cleared for associated infrastructure (roads, pipelines, containment pits, etc.)	5.7	
Indirect forest impact from new edges		21.2
TOTAL DIRECT AND INDIRECT IMPACTS		30

Information courtesy of Nels Johnson, The Nature Conservancy

Land Area Effects

- The Nature Conservancy study estimated based on their spatial footprint assessment and development projections, 45,000 – 110,000 acres of forest cover could be cleared by Marcellus gas development in PA's Susquehanna Basin by 2030.

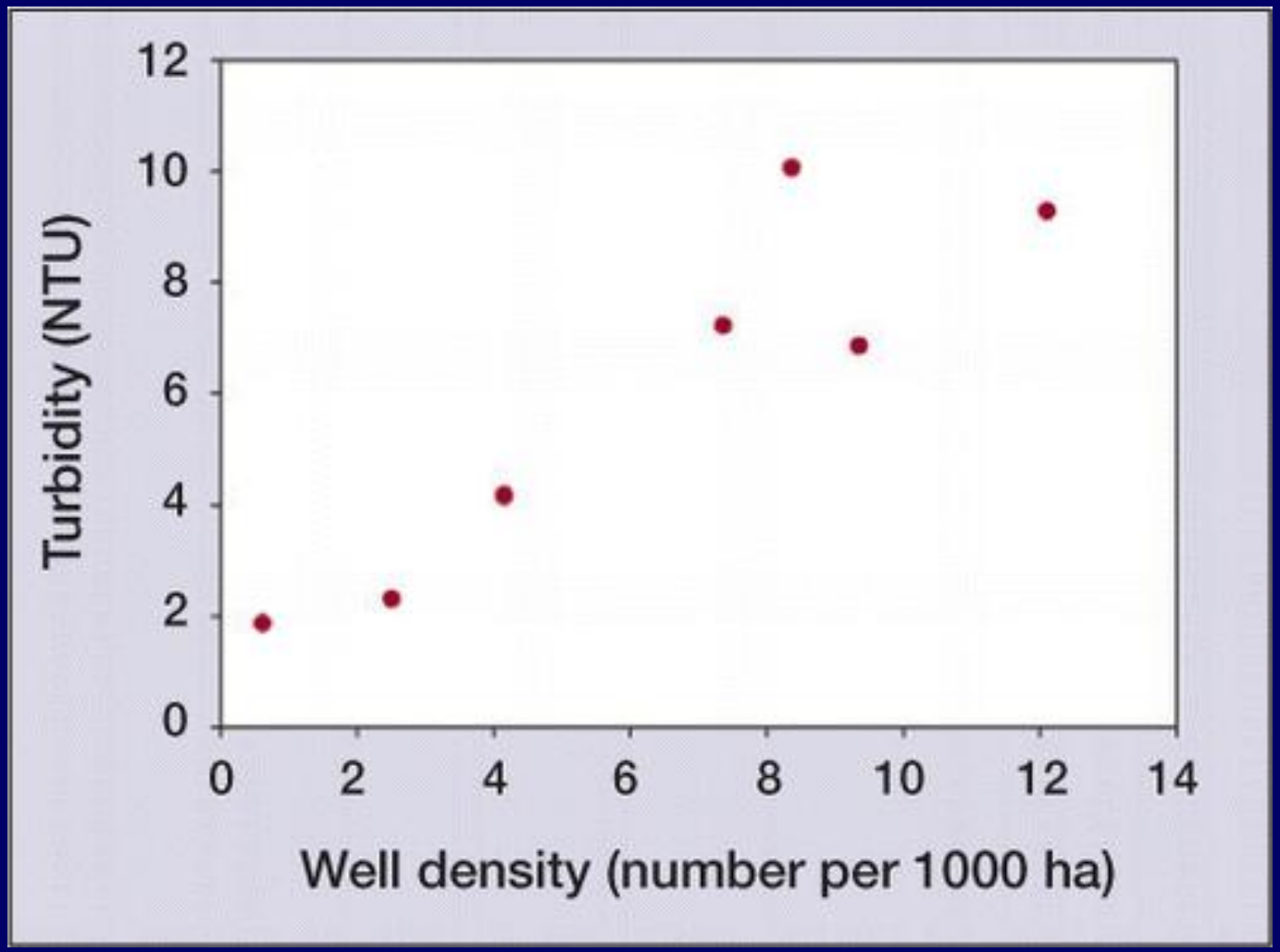
Information courtesy of Nels Johnson, The Nature Conservancy

Water Quality and Quantity Effects

Image from Sally Entrekin, University of Central Arkansas

Photo by Doug Mazer, used with permission via Daniel Soeder, DOE NETL

Water Quality Effects



From Entrekin et al. 2011 Frontiers in Ecology and Environment

Water Quantity Effects

Marcellus Water Withdrawals in the Broader Energy Context

- Projected maximum daily consumptive use by entire gas industry: 30 MGD.
- Measured daily consumptive use by one nuclear power plant: 30 MGD
- This is 10% of the measured daily use for water supplies

Information from Jim Richenderfer, Susquehanna River Basin Commission

Workshop Objectives

- To review and synthesize the research available regarding shale gas development's environmental effects
- To identify the environmental effects that shale gas development will pose to the Chesapeake Bay Watershed relative to Chesapeake Bay water quality
- To identify and prioritize future research needs relative to shale gas development and Chesapeake Bay water quality

Agenda

- Summary presentations to help the group have some common knowledge
- Two breakout groups to discuss questions and prepare reports to group
  - Land based effects group
  - Water quantity and quality effects group
- Breakout groups report to whole group with discussion
- 39 total workshop attendees

Water Quantity and Quality Questions

- What are the potential effects on Chesapeake Bay TMDL pollution reduction efforts?
- How effective are BMPs at reducing water quality and quantity effects?
- What are the high priority research needs for quantifying shale gas development effects on Chesapeake Bay water quality?

Land Based Effects Questions

- How does the shale gas development infrastructure affect land cover/use and indirectly water quality and quantity via cumulative effects?
- What are the potential effects on Chesapeake Bay TMDL pollution reduction efforts?
- How effective are BMPS at reducing those effects?
- What are the high priority research needs for quantifying shale gas development effects on Chesapeake Bay water quality?

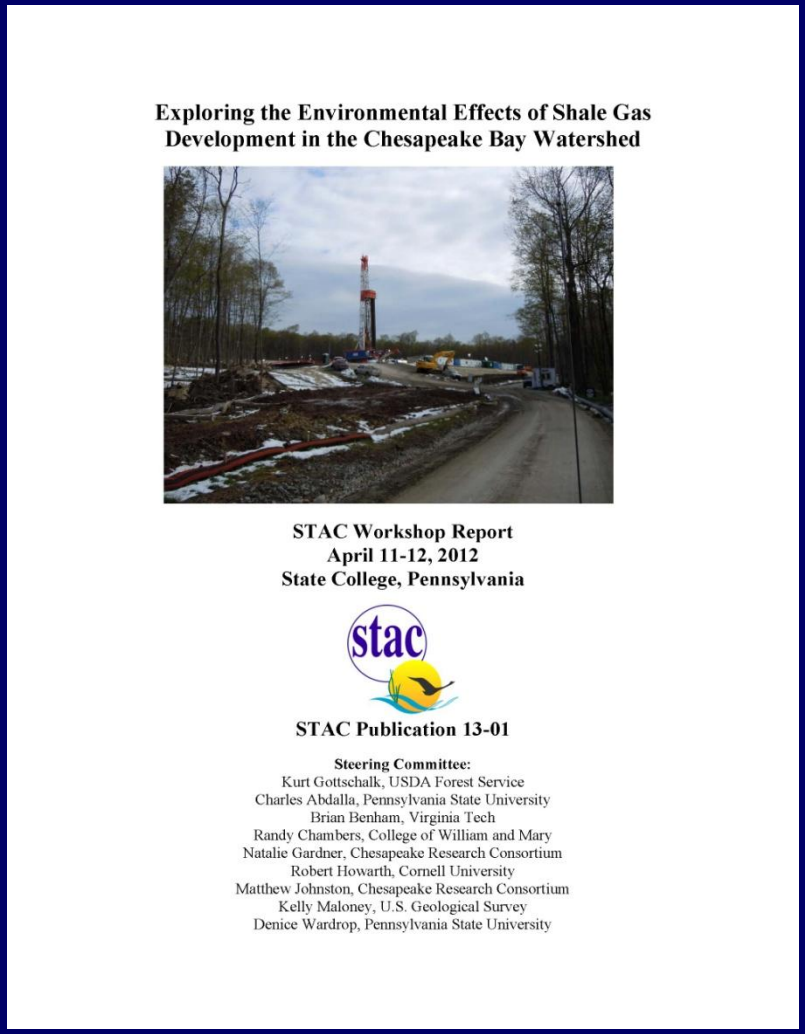
Effects versus Impacts

- Effects = changes due to an action (increase, decrease, no change), objective measureable changes in status (i.e. structure, function) of some environmental or socioeconomic factor in response to an activity or other cause

- Impacts = strong influence of effects, applying some type of value system to the status change to provide an interpretation of those changes (i.e. positive, negative, neutral), or using socioeconomic analysis (i.e. cost-benefit, willingness to pay) to provide information for value judgments

Workshop Products

- The workshop report summarizes the state-of-the-science regarding environmental effects of shale gas development
- The report makes recommendations
- The report identifies specific research gaps



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STAC Workshop Report
April 11-12, 2012
State College, Pennsylvania

STAC Publication 13-01

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Research Needs

- What are the sediment loads coming from well pads, pipelines, and access roads and how do they change through the development and restoration cycle?
- What is the trend in current BMP use and the pattern of enforcement for incorrect or non-use of BMPs and how effective are BMPs?
- How will the Chesapeake Bay watershed model use the data from gas drilling to make changes?
- How adequate are the monitoring systems to evaluate gas drilling effects?

Recommendations to the Chesapeake Bay Program and its partners:

- Evaluate existing monitoring data to assess the effects that Marcellus Shale drilling, production, and transport activities may have on sediment loading to the Bay

- Where data does not exist, the CBP should work with Bay Program partners to design monitoring programs that will enable the CBP to collect data that will be useful in fostering any needed adjustments to the CBWM

- Assess the CBWM's ability to simulate sediment loads coming from Marcellus Shale drilling, production, and transport activities

Recommendations to the Chesapeake Bay Program and its partners:

- Add infrastructure associated with Marcellus Shale gas drilling, production, and transport into Chesapeake Bay land cover/land use maps

- Endeavor to modify the CBWM such that nutrient and sediment loads associated with Marcellus Shale gas drilling, production, and transport related land disturbing activities can be simulated

- Investigate if any existing CBWM land uses may be appropriate for simulating the land uses associated with these Marcellus Shale gas play activities by doing simulations with a range of parameter values.

Recommendations to the Chesapeake Bay Program and its partners:

- The CBP should investigate if the sediment loss from dirt and gravel roads used for gas development and production are effectively simulated in the CBWM.

- The CBP should provide a framework for centralized GIS data for well pads, pipelines, road ways, and rapid land use/cover changes.

Recommendations to the Chesapeake Bay Program and its partners:

- Investigate any scale-effects (cumulative effects) associated with using the CBWM to effectively simulate the sediment loading from Marcellus Shale drilling, production, and transport activities.

- Consider developing/using smaller-scale, companion watershed models that are capable of accurately simulating the sediment loading and using output from those models as inputs to the CBWM.

Recommendations to the Chesapeake Bay Program and its partners:

- The CBP should investigate how the Marcellus Shale gas play may affect future land use/land cover projections, and in turn, how those adjusted projections affect nutrient and sediment loads to the Bay.

Recommendations to Industry, Scientific, and Policy-Making Communities:

- We recommend that Federal agencies take the initiative to monitor and conduct research on shale gas development
- We also recognize that funding and coordinating such activities will be a challenge
- Research and monitoring funding could come from a variety of sources including federal and state agencies, industry contributions, a portion of impact fees, and requiring research funding as part of permitting process

Recommendations to Industry, Scientific, and Policy-Making Communities:

- We recommend that there be a local focus for monitoring and research because we cannot wait for the lag time to observe a larger Bay-wide impact.

- We further recommend that researchers team up with local conservation districts, industry, and other entities that are permitting, funding, and conducting on the ground activities so those areas can be used to monitor and collect data.

Recommendations to Industry, Scientific, and Policy-Making Communities:

- We recommend more research be done on metals and other pollutants that are not included in the TMDL as they are extremely important and will become an issue in the future.

- The industry should implement set back distances for pads from water bodies, maintain riparian buffers, prevent spills, and implement all mandatory and voluntary BMPs in order to lessen the cumulative impact to the Chesapeake Bay.

Recommendations to Industry, Scientific, and Policy-Making Communities:

- PA DEP should encourage that BMPs are used in Chapter 102. There is a need for a large project review process with PA DEP to better evaluate the potential cumulative effects within a watershed, but we know that politically it might be difficult to implement.

- We recommend that states change the permitting process to be project-based rather than individual site-based and to have permits provide potential build-out scenarios to provide better potential cumulative effects information.

Recommendations to Industry, Scientific, and Policy-Making Communities:

- We recommend that industry personnel signing permits and state regulators be required to have BMP certification training. Continuing education credits could be required to maintain certification.

- We recommend better state-to-state sharing of information via an ad-hoc group and that the information gathered (data and research results) be synthesized, centralized and shared with the public, including a regional conference to look at BMPs, lessons learned, etc.

Questions?

Images courtesy of Kelly Maloney, USGS