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December 30, 2014

Dr. Kirk Havens, Chair
CBP Scientific and Technical Advisory Committee
645 Contees Wharf Road
P.O. Box 28
Edgewater, Maryland 21037

Dear Dr. ~~Havens~~ ^{Kirk}:

Thank you for the opportunity to respond to the Scientific and Technical Advisory Committee (STAC) workshop report on *Exploring the Environmental Effects of Shale Gas Development in the Chesapeake Bay Watershed*. The report contains nine recommendations addressed to the Chesapeake Bay Program partnership (CBP).

CBP appreciates STAC's push for overall improvement in our scientific understanding of the effects of the rapid expansion of the hydraulic fracturing industry in the Chesapeake watershed. The CBP needs to understand the potential for Marcellus Shale development, as well as other unconventional oil and gas development, in the watershed to impact water quality in the Chesapeake Bay and, where such potential exists, determine how any identified impacts will be addressed in the context of the Chesapeake Total Maximum Daily Load (TMDL) accountability framework. To this end, the STAC report has helped the CBP make considerable progress. The issues raised in the report of land use and land cover change, cumulative impact assessment, water quality and quantity impacts, efficacy of BMPs, sedimentation, etc. are all very relevant to CBP's restoration work.

The CBP recognizes STAC's work to improve understanding of the environmental influences the emerging shale gas industry has in the Chesapeake. In particular, the CBP is appreciative of STAC's role and initiative in insisting that we "lead with the science" in this, as well as in all Chesapeake restoration issues. As you are aware, some state and federal agencies, as well as non-governmental organizations, are already conducting or planning research related to unconventional oil and gas development. Pursuant to Executive Order (E.O.) 13605, *Supporting Safe and Responsible Development of Unconventional Domestic Natural Gas Resources*, and a memorandum of agreement between the U.S. Environmental Protection Agency, the U.S. Department of Energy, and the U.S. Department of the Interior, these federal agencies are developing a research plan to address the highest research needs associated with safely and

prudently developing unconventional oil and gas resources, including research regarding potential environmental impacts. More information about this multi-agency research is available at: http://www2.epa.gov/sites/production/files/2013-12/documents/plans_for_federal_multiagency_collaboration_on_unconventional_oil_and_gas.pdf.

This and other research efforts may be relevant to concerns identified by the STAC and help inform CBP efforts to account for impacts from unconventional oil and gas development. The STAC recommended that CBP undertake a number of actions related to improving scientific understanding of Marcellus Shale drilling and its associated impacts. CBP has not made any determination regarding implementation or resource allocation for such activities, but does generally agree that the types of information identified would enhance our ability to fulfill Program objectives. Specific responses to the workshop recommendations to CBP follow.

Workshop Recommendation 1. Evaluate existing monitoring data to begin to assess the impact that Marcellus Shale drilling, production, and transport activities may have on sediment loading to the Bay.

The CBP agrees that local effects, particularly with sediment, have the potential to be substantial. These effects can best be accessed through monitoring. Cumulatively, the effects are the loads from the sum of all the land use changes and associated construction of drilling pads, access roads, and pipelines. The cumulative effects could affect the Chesapeake Bay or particular state/basins of the Chesapeake TMDL, particularly for sediment. Phosphorus associated with sediment, changes in hydrology, and nitrogen oxide (NO_x) emissions are other potential impacts. STAC encourages a system-wide analysis of impacts for shale gas development, particularly through monitoring, and the CBP concurs.

Workshop Recommendation 2. Implement monitoring of nitrogen deposition which may be very high locally near gas rigs, compressor stations, and processing plants.

This is an important point and the CBP agrees. While nitrogen *deposition* monitoring is not currently conducted by states at shale gas development areas under any Clean Air Act requirement, states do report Marcellus Shale emissions to EPA as required under the Air Emissions Reporting Requirement (AERR). These emissions are incorporated into EPA's National Emissions Inventory (NEI). In Region 3, the emissions from the Marcellus Shale activities are primarily reported as nonpoint sources grouped at the county level. Emission inventories required under State Implementation Plans (SIP) would need to account for Marcellus Shale emissions in non-attainment areas where Marcellus Shale activity occurs or where it is expected to occur in the years covered by the SIP. Practically speaking, all states must achieve the national ambient air quality standards (NAAQS), and this is a motivation for accurate monitoring of the shale gas emissions. This emissions data may be useful to inform future nitrogen deposition monitoring.

Workshop Recommendation 3. Add infrastructure associated with Marcellus Shale gas drilling, production, and transport into Chesapeake Bay land cover/land use maps.

The Chesapeake Bay Program agrees that the land use of Marcellus Shale infrastructure including drilling, production, and transport be incorporated into the Chesapeake Bay land cover/land use estimates to the fullest extent possible.

The Chesapeake Bay TMDL accountability framework requires that new loads to the Chesapeake Bay be accounted for and offset. The development of State Phase III Watershed Implementation Plans (WIPs) for Best Management Practices (BMPs) and management actions between 2018 and 2025 provides an opportunity to consider, during the 2017 Midpoint Assessment, the impacts and implications of potential changes to land use due to unconventional oil and gas development.

Currently, the CBP Land Use Workgroup has not explicitly addressed land uses associated with unconventional oil and gas development. Adding infrastructure to land cover/land use maps would be helpful if an appropriate level of detail is applied. For example, it might be adequate to plot the projected average well density of a given area rather than plot each individual well in that area. Some organizations have developed projections of landscape changes resulting from Marcellus Shale development. For example, the U.S. Geological Survey has published results of research of landscape disturbance from gas exploration in certain Pennsylvania counties within the Chesapeake Bay drainage, and The Nature Conservancy has developed maps showing projected development scenarios in Tioga County, New York. State partners may be able to provide access to information regarding location and extent of existing and planned well pads, roads, and pipelines if such information is needed to refine such forecasts. The Chesapeake Bay Program may find opportunities to use such information resources to enhance the Phase 6 Watershed Model land use dataset and land use forecast for 2025. The incorporation of Marcellus shale development land uses is planned in the late-fall 2014 timeframe.

Workshop Recommendation 4. Investigate if any existing CBWM (Chesapeake Bay Watershed Model) land uses may be appropriate for simulating the land uses associated with these Marcellus Shale gas play activities by undertaking simulations with a range of parameter values.

When oil and gas development land use information or data on shale gas drilling/production pads and rights-of-way for roads and pipelines is made available, an assessment could be made for Phase 6 Watershed Model application if appropriate. The first step would be to determine if unconventional oil and gas development land uses identified can translate into one of the designated Phase 6 land use classes such as impervious surfaces, open space, and roads. Development of unique land uses for unconventional oil and gas development areas might be necessary for adequate characterization.

Workshop Recommendation 5. Investigate if the sediment loss from dirt and gravel roads used for gas development and production are effectively simulated in the CBWM.

The CBP fully agrees. A dirt and gravel road land use is under development and management practices for dirt and gravel roads have been described. Reference: (http://archive.chesapeakebay.net/pubs/calendar/NSC_01-21-09_Handout_13_9968.pdf).

Workshop Recommendation 6. Provide a framework to centralize the data for well pads, pipelines, road ways, and rapid land use/cover changes.

The CBP agrees that the collection of data in a centralized repository could be helpful to partners and other stakeholders. CBP could use this resource to verify and refine land use projections. The repository might also be of use to stakeholders with interest in coordinating co-location of infrastructure and/or minimization of forest or habitat fragmentation.

Workshop Recommendation 7. 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.

CBP agrees that it would be helpful to account for cumulative effects of all aspects of shale gas infrastructure in the Phase 6 Watershed Model, and in guiding WIP III development.

Workshop Recommendation 8. Investigate how the Marcellus Shale gas play may affect land use/land cover future projections, and in turn, how those adjusted projections affect nutrient and sediment loads to the Bay.

Future projections of a highly dynamic industry are difficult, but as noted in the response to *Recommendation 4*, the Nature Conservancy and USGS, and others have developed maps and forecasts of land cover change. If appropriate, the various forecasts available could be reviewed by the Chesapeake Bay Program partners during the Phase 6 Watershed Model application to the WIP III development to see which would be best suited for projections of Marcellus shale development.

Reference:

Evans, J. and J. Kiesecker 2014. Shale Gas, Wind and Water: Assessing the Potential Cumulative Impacts of Energy Development on Ecosystem Services within the Marcellus Play. PLoS One

Workshop Recommendation 9. Implement real-time monitoring at headwaters where shale gas development is taking place or proposed.

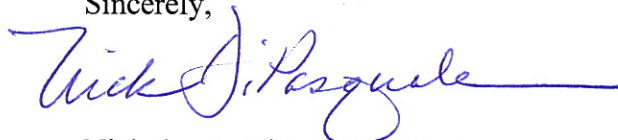
The CBP agrees that real-time monitoring at headwaters where shale gas development is taking place is needed. Enhanced monitoring, including real-time monitoring, should focus on the local near-field influences of shale gas development. The CBP agrees with the report's authors that local near field influences are likely to have the greatest impacts and be the first monitoring

stations to observe potential impacts. In particular, local monitoring data could be effective in evaluating the efficacy of existing erosion and sediment controls shale gas development.

The Susquehanna River Basin Commission (SRBC) has established a Remote Water Quality Monitoring Network (RWQMN) to support evaluation of water quality in areas of the Susquehanna River basin undergoing shale gas development before and during development activities. The network of 58 monitoring stations provides continuous measurements of temperature, pH, conductance, dissolved oxygen, and turbidity. SRBC is also periodically collecting grab samples at monitoring sites and analyzing them to determine water quality parameters. Data resulting from the implementation of SRBC's RWQMN may be helpful in estimating potential impacts of development to water quality, and can be accessed online at <http://mdw.srbc.net/remotewaterquality/>.

In closing, the CBP Management Board wishes to extend its thanks to the workshop steering committee and participants for their time and effort. The rapid and extensive Marcellus shale gas development raises the question of the need to organize regionally for more efficient approaches for examining and mitigating potential impacts. The STAC report is a significant aid to CBP's understanding of the issues of local and regional impacts of Marcellus Shale development.

Sincerely,

A handwritten signature in blue ink that reads "Nick DiPasquale". The signature is fluid and cursive, with a long horizontal line extending to the right.

Nicholas A. DiPasquale, Chair
Management Board
Chesapeake Bay Program Partnership

cc: Management Board
Water Quality Goal Implementation Team

