



EMERGING ISSUES IN NUTRIENT CREDIT TRADING IN THE CHESAPEAKE BAY WATERSHED

Joseph H. Maroon

Prepared for and funded by the Keith Campbell Foundation

Updated Version September 2, 2011

The following analysis of nutrient credit trading programs in the Chesapeake Bay watershed was conducted during the spring and summer months of 2011. The focus of this analysis is on the trading programs in the three main Bay states: Virginia, Maryland, and Pennsylvania, as well as on the related EPA and regional efforts.

Much of the information and analysis was derived from interviews with several federal officials, state program administrators, recognized trading experts, and key stakeholders, as well as from reviewing state policy and regulatory documents and research articles. Additional information was obtained by participating in related regional and state level meetings, related webinars and Bay work group phone meetings.

This assessment was prepared for the interested public and Bay funders as well as decision-makers with the hopes that they will benefit from the information and perspectives contained herein on the policy considerations and status of nutrient credit trading in the Chesapeake Region. The information presented highlights the strengths, weaknesses, opportunities and challenges in the Bay states' current nutrient trading frameworks. While there is a wide range of opinions regarding the value and role of trading as a tool to reach the nutrient reduction goals outlined in the Bay TMDL and state watershed implementation plans, there is widespread agreement that trading must be done in a manner that includes accountability, transparency, verifiability, and that it achieves real pollution reductions.

This white paper is organized into three sections: General Observations, State Program Comparisons, and Gauging Demand and Supply for Nutrient Trading in the Bay watershed. The terms "nutrient credits" and "offsets" are used interchangeably unless otherwise noted. The author wishes to acknowledge the cooperation and assistance of Bay trading officials and stakeholders in providing their perspectives and information. Special thanks to the Keith Campbell Foundation for its support of this project.

SUMMARY OF FINDINGS AND RECOMMENDATIONS

- *Trading in the Chesapeake Bay offers the possibility of reducing costs for meeting TMDL nutrient reduction targets, assisting in permit compliance, and accommodating future growth. It is a tool that can supplement other nutrient reduction strategies and practices.*
- *Nutrient Credit Trading can promote much needed innovation and stimulate private sector investment in the water quality arena and may incentivize and accelerate nonpoint source projects that otherwise would not be undertaken. Some of these nonpoint projects may have added ecosystem benefits such as watershed resiliency and habitat protection. In addition, point to nonpoint source trading may accelerate improvements in BMP verification that are otherwise unlikely to occur in these tight budgetary times.*
- *While market actions and innovations will push the next round of Bay state nutrient trading, in order for decision-makers and the public to be confident of the outcomes and the requirements of the Bay TMDL to be met, water quality protections that exist in certain aspects of each Bay state trading program must be maintained and strengthened as program changes are considered by the states and EPA. In addition, point source permit holders who engage in trading retain the liability of meeting water quality targets and must have assurances that waste load reductions purchased actually occur.*
- *Nutrient Credit Trading should not be viewed as a water quality improvement program. That is, trading changes where the pollution reduction occurs but not the amount of reductions. However, states can choose to include design features (such as retiring a percentage of credits in every trade) that will result in additional nutrient reductions.*
- *The challenges of meeting the Bay TMDL adopted in December 2010 will have a profound impact on the likelihood that more trading will occur in the future. Bay states, in general, have placed a heavy reliance on nutrient trading in their state Watershed Implementation Plans as a means of achieving reductions, offsetting new growth and lowering the cost of compliance. It is too early to tell whether the demand for trading will meet the expectations.*
- *A second potential “driver” of nutrient trading will be compliance with new or enhanced federal and state stormwater requirements relating to construction activities or compliance with Municipal Separate Storm Sewer (MS4) permits. Stormwater retrofit requirements can be especially costly to implement and trading offers an opportunity for reducing costs. The TMDL will help drive stormwater requirements and new rules are expected to clarify what is expected of stormwater sources.*

- *State nutrient trading programs in the Bay region vary considerably in several key areas. Because the nutrient reduction baseline (which is used to determine practices and reductions that the TMDL or WIPs ascribe to the entities such as farms and other land uses and the threshold necessary for potential credit opportunities) is fundamentally important to successful trading, EPA should take a close look at the sufficiency of state baselines during its reviews of state nutrient trading programs.*
- *Dealing with the uncertainty of outcome in trades involving nonpoint sources is another critical element to a successful trading scheme. There are currently a variety of ways that the Bay states are approaching this important matter. The recently released National Academy of Sciences report, entitled “Achieving Nutrient and Sediment Reductions Goals in the Chesapeake Bay”, raises broad Bay program issues, several of which should be considered in the context of nutrient trading. EPA and the Bay states should review existing and proposed programs along the lines of the following questions:*
 - *Exactly what agricultural BMP efficiencies are being used by the Bay states in determining nutrient credits in their jurisdiction? Are they consistently applied across the watershed? Do the state trading calculators include the revised BMP coefficients used in the Bay Partnership’s Watershed Model?*
 - *Are the shortcomings in the tracking and verification of BMP practices pointed out by the National Academy of Sciences report adequately addressed in the various states’ nutrient trading programs? What are the implications for expanded nutrient trading in light of that report?*
 - *Given the uncertainties involved in nonpoint trading (including lag time for results, the effect of weather events, proper installation and maintenance), is a 1 to 1 trading ratio involving nonpoint or nontraditional sources sufficient for meeting the reasonable assurance standard under the Bay TMDL requirements? Should a trading ratio of greater than 1 to 1 be the norm for every trade involving nonpoint or nontraditional sources unless the individual project can demonstrate sufficient safeguards and assurances that the projected outcomes have a high degree of success?*
 - *Should more credit be given to longer term structural farm BMPs (such as riparian buffers and stream fencing) that are more durable than to annual practices such as cover crops?*
 - *Should retiring credits be part of every nutrient credit exchange made under the Bay TMDL in order to produce additional water quality improvements from a state trading program? This may require federal rule-making but states could also establish such provisions as part of their revised programs. This is an area where states should work towards a common approach.*

- *Although some states prohibit the conversion of land from generating nutrient credits, recent preliminary discussions within the Bay Program about crediting land conservation within the TMDL suggest that conversion of farmland to forests or other less intensive land uses has long-term water quality benefits and deserves more consideration as an allowable trading option.*
- *Nontraditional nutrient trading sources (such as constructed wetlands, algal production, and oyster aquaculture) are increasingly proposed as deserving of nutrient credits. These more innovative sources pose a challenge to state trading officials who may have limited expertise to evaluate their creditworthiness. It appears that states would benefit by having the opportunity to call upon either a state or regional body of technical experts who could offer important expertise and advice on the nutrient creditworthiness of these practices. Maryland has established such a committee. EPA and the other states should consider establishing such panels. Perhaps the Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) or another Watershed Implementation Team could serve this role or EPA and the states could establish a dedicated panel. In addition, states should carefully consider the trading ratios in such nontraditional cases and build in sufficient uncertainty allowances based on the best available science.*
- *While the opportunities presented by nutrient credit trading are promising, the expectations for trading should be tempered with the recognition that aggressive actions on a number of fronts will be needed to meet the Bay nutrient reduction goals. Reliance on trading prospects has not produced the expected results in other parts of the country and has even slowed needed reductions in nonpoint sources. In addition, the administrative transaction costs to ensure accountability, transparency and verifiability could be relatively high and present a barrier to widespread trading.*
- *The merits of allowing nutrient trading across state boundaries continue to be debated. Proponents suggest that the wider the trading area, the more buyers and the better chance trading will work and result in lower cost reductions. There is also concern that meeting the reductions called for in the Potomac River may necessitate some level of interstate trading. Not everyone agrees with these arguments. There is resistance or reluctance for a state to give up credits to a neighboring jurisdiction when the level of reductions needed to meet its own allocations is so demanding. Should there continue to be interest in cross-jurisdictional trading in the Bay region, additional study such as is currently ongoing would appear useful in determining if nutrient trading across state boundaries or across river basins can be done in a manner that contributes to nutrient reductions overall and in local situations, and on the economics of such trades. Otherwise, it may be prudent for the Bay states to engage in interstate trading or intra-basin trading on a case-by-case basis only. If trading across boundaries is pursued in the future, it is important that key state provisions relating to nonpoint and nontraditional sources such as baseline requirements and BMP efficiencies be more consistent than they are today and that assurances be given that there will be no increase in local water quality degradation. Further, EPA will need to have a leadership role (for example, in certifying and*

verifying) in any trade across state lines. In any event, interstate trading should not be used as a justification for weakening state provisions such as those that deal with trading uncertainties (trading ratios). Rather, the more stringent trading provisions of the states involved should prevail.

- *It is difficult to know what amount of actual nutrient credit trading is likely to occur in the Bay region over the next 15 years. Because there is considerable reliance on trading and offset credits in WIPs, the recent request made by the Chesapeake Bay Commission (May 2011, Federal Agency Request to EPA) that EPA take the lead in conducting a nutrient trading market analysis as part of its review of state trading programs could provide valuable information for decision-making and adaptive management under the state WIPs.*
- *Expansion of nutrient trading in the watershed, especially as more nonpoint and nontraditional sources become involved, must be done with water quality as the paramount objective. While the next era of nutrient trading offers possibilities for much needed innovation and private sector opportunities, changes to existing state programs should not sacrifice water quality benefits in order to create increased trading opportunities. Improperly designed trading programs can result in further degradation or increased uncertainty of pollution reductions.*
- *Although EPA reviews of state programs would have been preferable before the state WIPS were accepted, EPA's current round of program evaluations is a welcome occurrence. EPA should make its reviews of state Nutrient Credit Trading Programs available for public review and be prepared to assist the states in making needed changes to their programs or to EPA's own policies and toolkit, as warranted, in 2012. Additionally, EPA should be supportive of state measures that provide greater assurance of credit achievements (such as Maryland's retirement of credits and Virginia's 2 to 1 trading ratio for nonpoint sources). Because the WIPs generally rely heavily on trading, EPA should also commit in partnership with the Bay states, stakeholders and the public to another round of state trading program reviews in conjunction with the 2017 reevaluation.*

GENERAL OBSERVATIONS

Nutrient Credit Trading Expected to Increase In The Bay Watershed. Nutrient Credit Trading (NCT) is occurring here in the Bay watershed, incorporated into a state by state framework, on a limited basis and seemingly poised to substantially increase as part of the Bay states' Watershed Implementation Plans (WIPs) under the Bay TMDL.

- Nutrient trading, which may include generating, selling and buying credits, as well as generating credits to offset new or increased loadings, began in the Chesapeake region about mid-way through the past decade. The state programs were established to address reductions associated with the Bay Tributary Strategies, which preceded the Bay TMDL.

- While trading of point source credits was already recognized as a viable alternative to wastewater treatment plant upgrades, the newly adopted Bay TMDL and state WIPs will likely become the primary “driver” along with stormwater compliance for many more trades involving agricultural nonpoint sources and nontraditional sources.
- EPA has stated that the presence of a TMDL is a basic requirement for water quality trading to occur. In 2010, EPA reported that nationwide there are nearly 50 water quality trading programs in various stages of development.
- NCT is expected to grow as a means of reducing costs associated with compliance, offsetting new and increased sources, and allowing for anticipated and unanticipated growth to occur even after the Bay region reaches the TMDL nutrient load caps.
- New growth and its associated pollution will occur in the region. The Bay watershed’s population of 17 million is expected to grow to 20 million by 2030. States and EPA have allowed for the allocation of loadings associated with future growth for existing wastewater treatment plants in the Bay watershed. Some wastewater treatment facilities have already exceeded their TMDL wasteload allocations (perhaps because they have not finished planned facility upgrades, are delaying upgrades or are seeking less costly alternatives) and are involved in purchasing credits. Many think this will become more commonplace in the future.
- Some have suggested that NCT is a means for getting more nonpoint source reductions paid for by point sources and as a means for lowering permit compliance costs. However, not everyone agrees that this is likely. While it called for innovative funding models to better address the costs of meeting Bay goals, the recently released National Academy of Sciences report on the Bay nutrient and sediment goals states that, “(a)lthough nutrient trading among point and nonpoint sources is often cited as a mechanism to reach nutrient reduction goals at lower cost, its potential for reducing costs is limited.”
- Barriers to trades involving nonpoint sources include social and political considerations such as reluctance to exchange credits between rural farm areas and urban areas, as well as institutional resistance by wastewater treatment operators. Also, uncertainty as to the credibility, accountability, and ultimately the acceptance of nonpoint source-generated credits by states and EPA is a factor contributing to this reluctance.
- Several observers have noted that some of the Bay states’ WIPs are relying heavily on trading to achieve or lower the cost of achieving their nutrient reduction strategies. One proclaimed that, “Without trading, the TMDL is doomed.” While one can agree that the states are perhaps overly optimistically counting on trading, there is little evidence to suggest that the TMDL is doomed without trading. More trades will, in all likelihood, be made under the TMDL especially if substantial new public funding for related Bay restoration (e.g., wastewater treatment plant upgrades, agricultural cost-share funds,

stormwater retrofits) is unavailable. Whereas, the point-to-point source trading programs to date have been especially important to wastewater treatment operators, nutrient trading in general will potentially take on a much more significant role in the Chesapeake's restoration in the near future. Indeed, the main areas of interest have broadened to include urban and rural nonpoint source credits. However, few believe that trading will be the panacea for fixing the Bay's nutrient problems.

- A fundamental question that remains unanswered is whether the expanded reliance on trading within the state WIPs will lessen the Bay community's ability to meet reduction targets particularly for nonpoint sources OR whether it will accelerate the reduction pace and prove to be beneficial. At this point, it is too soon to say as there are examples from across the nation where very little trading has occurred even under a TMDL. Whether or not nutrient reductions from nonpoint sources are realized through the expansion of trading programs will be largely determined by how successfully improvements in consistency and reliability can be incorporated into all Bay trading programs. This will be especially important if the number of trades increases exponentially as some hope.

Trades Involving Nonpoint Sources Raises Concerns. The major concerns with expanded nutrient trading in the Bay region are not over point source to point source trading, which involves "like" pounds of nutrients and "like" kinds of permitted facilities. Rather, it is the increasing reliance on purchasing or selling nonpoint source credits which have a much less certain outcome than point source upgrades that raises the most questions. The involvement of unpermitted nonpoint sources raises legitimate issues such as consistency of credit determination, proper BMP implementation, permanence of practices, trading ratios, accounting, tracking, and compliance. Several of these issues are examined below.

NAS Report Identifies Issues that Need Addressing. The recently released National Academy of Sciences report, *Achieving Nutrient and Sediment Reduction Goals in the Chesapeake Bay*, offers valuable insights into key aspects of the Bay restoration efforts. While the report's findings and recommendations are aimed at improving the overall efforts, several of the findings regarding shortcomings in the tracking and accounting of BMPs have particular relevance for state trading programs and should be considered during EPA and the states' own reviews of their trading programs. For example:

- i. BMP estimates contain significant uncertainties caused by site-specific factors, practice design, extent of maintenance, and challenges in scaling up the data from the plot or field scale;
- ii. In contrast to load reduction efficiencies of municipal and industrial wastewater nutrient control technologies which are well understood, BMP efficiencies for diffuse sources (e.g., suburban, urban and agricultural nonpoint sources) are less predictable and vary widely with local site conditions;

- iii. Bay states report that they vary as to how often and if they conduct field verifications of BMPs, whether they have a process for removing BMPs from databases when expired or not functioning, and whether they have a process to prevent double-counting.
- iv. Past experience has shown that, when evaluated in light of new field information, credited BMP efficiencies have more commonly been decreased rather than increased.

EPA's Oversight Role Vital. In order to provide greater accountability and consistency in NCT programs within the Bay watershed, EPA must take on a greater oversight and leadership role.

- To date, EPA's leadership on nutrient credit trading has been both notable and lacking. The agency has published some useful policy statements, guiding principles and a Water Quality Trading Toolkit. On the other hand, it is surprising that more EPA guidance or direction was not offered on trading during the WIP approval process last year.
- Because the three main Bay states all had their own trading programs in place at the time of the WIP development, EPA chose not to evaluate the nutrient credit trading strategies that the states incorporated into their Phase I WIPs last fall. In contrast, EPA did willingly comment on shortcomings in other state programs that were included in the state WIPs. In the final TMDL, EPA did, however, commit to review all of the states' trading programs as part of the Phase II WIP process.
- The guidance EPA did provide on trading was contained in Section 10.1 and Appendix S of the Bay TMDL. Appendix S presents definitions and "Common Elements" which are more like design criteria or "performance standards." Appendix S is notably long on policy and short on specific methodology and leaves questions unanswered as to what constitutes an acceptable state nutrient trading program in light of the new TMDL.
- To its credit, EPA has begun a review of state NCT programs that will be completed this year. Meetings with state nutrient trading officials have been completed and EPA recommendations are expected by fall 2011. While it would have been beneficial for EPA to do so before states completed their Phase I WIPs, EPA should be applauded for conducting these reviews now. The agency should make their reviews of state NCT programs available to the public and be prepared to assist the states in making needed changes to their programs or to EPA's own policies and toolkit, as warranted, by 2012. Because the WIPs are relying so heavily on trading, EPA should also commit in partnership with the Bay states, stakeholders and the public to another round of program reviews in conjunction with the 2017 reevaluation.

STATE COMPARISONS

One key to understanding the role that NCT may play throughout the Bay watershed is recognizing the notable and significant differences that exist across the region's nutrient trading programs as they are currently designed. Several important highlights are listed below. For a more comprehensive review, see the recently released comparison by the World Resources Institute.

- ***Expansion of Virginia's Program.*** Virginia is generally recognized as having a strong program from a water quality protection standpoint. Virginia's Nutrient Credit Exchange Association, while limited to wastewater treatment plant credit exchanges, is generally viewed as a model for facilitating trades among point sources. Virginia's WIP has placed considerable reliance on expanding its trading options and the Commonwealth may consider instituting additional programmatic and legislative changes that will be beyond anything allowed in any other state. According to some trading specialists, the proposed expansion of Virginia's nutrient credit exchange program will potentially put the Commonwealth in the national forefront for credit opportunities. A key question for Virginia will be whether the Commonwealth can successfully expand its nutrient trading program while retaining its strong water quality protections. Success in its expansion will depend upon establishing a structure that ensures credibility and sustainability of nonpoint and nontraditional credits that are certified and traded. A second key area of the Virginia study is what role the state itself should play in accounting for and facilitating trades. The stakeholder process was initiated in the spring of 2011 and is scheduled to be completed in time for recommendations to be proposed to the 2012 General Assembly which convenes in January. State law already allows for stormwater management offsets and consideration is being given to requiring offsets of new loads from onsite (septic tank) systems.
- ***Maryland's ENR Requirements.*** Maryland officials stress that nutrient trading in that state is for new growth and development, and is not intended to be used to meet permit compliance or the TMDL obligations. With regard to who can buy credits, Maryland requires their major sewage treatment plants to upgrade to meet ENR (Enhanced Nutrient Removal) levels before they can purchase credits. Specifically, Maryland wastewater treatment facilities must reduce their discharge to below the current 4 mg/l for nitrogen in order to consider trading. Maryland's approach is aggressive from a water quality standpoint and lessens the need for point sources to be able to trade, at least in the short term. Maryland's flush tax has been a major funding source for the upgrades. Some observers are concerned that should there be more pressure on that fund in the future, there may also be pressure to relax the ENR requirement.
- The Maryland stipulation that point sources must first upgrade to meet ENR treatment levels is significantly different than the approach taken by Virginia and Pennsylvania, both of which allow point source dischargers to purchase credits to comply with their annual permit limits without first reaching

ENR or similar treatment levels. Virginia allows existing point sources to purchase credits from other point sources to meet their annual compliance requirements, and limits the purchase of nonpoint source credits to only new and expanding facilities with no load allocation. Pennsylvania allows existing point sources to buy credits from both nonpoint and point sources.

- ***Pennsylvania's Program Concerns.*** Several knowledgeable observers view Pennsylvania's trading program as being both the most aggressive in allowing trades involving nonpoint sources and having the most lenient baseline that must be met before a nonpoint source is eligible to generate credits. It has been noted that the Keystone State recognized that it initiated trading involving non-point sources before working out all of the measurement, oversight and enforcement issues involved and that it would be evaluating its program as it evolved. Questions remain as to whether Pennsylvania has an adequate monitoring program to determine if nonpoint trading is actually achieving the water quality improvements the state is assuming. Additional questions exist over the validity of credits given by Pennsylvania for moving poultry manure out of the watershed and whether there is appropriate monitoring of replacement fertilizers that may have taken its place. Many trading observers believe that the questions concerning Pennsylvania's program need to be addressed soon if trading in the Bay region is to gain greater public acceptance. In its defense, Pennsylvania is the first of the Bay state partners to engage in nonpoint source trading and is dealing with issues that the entire region will need to wrestle with if trading involving nonpoint sources becomes more widespread. Nevertheless, there appear to be significant issues that need to be addressed in the Pennsylvania program including credit baseline, use of cost share dollars to fund credits, and credit allowances for certain projects.

Differing Baselines and Trading Ratios in the Bay Region. Currently, agriculture is the predominate nonpoint trading partner. Established baselines for generating and selling farm credits vary in the watershed. A baseline represents the extent to which a source is expected to reduce under the TMDL. The TMDL and state WIPs assign certain reductions to nonpoint sources. Appendix S defines baseline as "the amount of pollutant loading allowed by wasteload allocation (WLA) or load allocation (LA) that applies to individual credit generators in the absence of offsets. Sources generating credits are expected to first achieve their applicable offset baselines before credits may be generated." If the baseline is not properly tied to these reduction levels, it means credits may be sold without achieving the needed pollution reductions to help restore the Bay and lessens the chances of meeting basic load allocations.

- Maryland uses what has been called a "performance approach" to determining baseline loads and calculating additional reductions beyond the baseline that may qualify as nutrient credits that exceed the baseline. Pennsylvania uses a combination approach that requires farms to be in "regulatory compliance" with applicable environmental requirements (which they are already required to do) plus a threshold of either a 100 foot setback or a 35 foot buffer. If the setback or buffer are not in place, the Commonwealth reduces the amount of credit generated by 20 percent. Both of these states have a

nutrient credit calculator, an online trading tool (“Nutrient Net” which was established by the World Resources Institute or a derivation of it) which is available for helping farmers and landowners estimate their nutrient load and potential credits. In contrast, Virginia uses a minimum “practice approach” which establishes as its nonpoint trading baseline the implementation of five priority BMPs applicable to the farm operation (Nutrient Management Plan, Cover Crops, Soil Conservation Plan, Livestock Stream Exclusion, and Riparian Buffers). Both approaches have certain advantages. Virginia’s practice approach offers a clear set of practices that must be considered, and is therefore, easier to understand, administer and enforce. The performance approach of the other two states potentially may more accurately identify the suite of practices needed for an individual farm field but may be more difficult to track and enforce. (Virginia may be moving towards a more performance based approach since the legislature recently directed the Virginia Department of Conservation and Recreation to develop farm Resource Management Plans.) *Because the credit baseline is so important to successful trading, EPA should take a close look at this area during its program reviews.*

- A trade in Pennsylvania involving nonpoint credits raises some issues regarding baseline that need greater scrutiny and discussion. Although not obligated to use the annual practice, a farm that has already been using no-till farming for many years was given nutrient credit by the Commonwealth for the practice which, in turn, offset reductions required at a sewage treatment facility. While the progressive farmer should not be penalized for being ahead of the environmental curve, it is questionable as to whether water quality benefited in this case. It also raises concerns that individuals can get paid for what they are already doing. In addition, although it does not appear to be the case in this example, states would need to check to see if the farming practice has already been credited in earlier Bay model reporting. In any event, the past practice would have been reflected in actual water quality monitoring and would have likely been considered in the development of loading calculations. This scenario could become more commonplace in the future. One might argue that given the definition of “baseline” in Appendix S cited above, the key question would appear to be whether the no-till practice is something that the TMDL called upon the farmer to do. If yes, then it should not have been the basis for a credit; if not, then the credit would be acceptable. *In any event, the states and EPA should come to a clear agreement about how to handle such cases in the future.*

- All three primary Bay states allow for agricultural BMP cost-share dollars to be used for farmers to meet baseline requirements. Pennsylvania also allows for cost-share funds to be used to generate credits and offsets. This is not allowed in Maryland or Virginia because it can result in selling credits essentially paid for by taxpayers. *Pennsylvania should review its current practice of allowing cost-share funds to be used to generate credits in order to better maximize limited cost share dollars.*

- The issue of trading ratios is another key aspect of point to nonpoint nutrient trading. Again, this matter is handled differently across the region and is an area worthy of serious review by EPA and the

states. EPA's Trading Policy acknowledges that "the diffuse nature of nonpoint source pollutants along with the variability in precipitation; land management practices; and the effect of soil type, slope and cover on pollutant loadings to receiving waters creates a great degree of uncertainty in determining loading from nonpoint sources and measuring the effectiveness of BMPs used to reduce nonpoint source pollutant loads."

EPA's Water Quality Trading Toolkit states that "Uncertainty ratios are particularly important to account for potential inaccuracies in the estimation methodology when credits from nonpoint source BMPs are estimated or calculated." It does go on to say that uncertainty ratios can be reduced "by enhancing the level of confidence in BMP effectiveness" through means such as edge-of-field monitoring, better modeling of BMP effectiveness, and possibly estimating BMP effectiveness through such activities as field testing. While these means are employed in the Bay Program, uncertainty still exists.

The Watershed Model developed by the Chesapeake Bay Program Partnership uses a kind of "common currency" (likened to a EURO) that basically adjusts BMPs applied anywhere in the watershed to a pound of nutrients delivered to the tidal waters. While this approach is helpful, officials acknowledge that the modeling is not foolproof when it comes to accounting for nonpoint source nutrient reductions and does not account for factors such as "lag time" (the actual time it takes for BMPs like streamside filters to reach their pollution reduction potential), severe weather events and improper installation and maintenance. Therefore, even with the approach used in the Bay Watershed Model, the uncertainty of nonpoint source reductions raises issues of how to address them within a state trading program, where permit liability and actual reductions are paramount. Furthermore, the recently released National Academy of Sciences report should receive considerable attention from EPA and state trading officials as it points out shortcomings in the current BMP tracking and accounting systems used in the Bay region that could seriously impact the effectiveness of state trading programs. *EPA and the Bay states should agree on a common approach and high standard for BMP verification in the context of trading.*

Similar to many wetlands mitigation programs, Virginia uses a conservative trading ratio of 2-to-1 for nearly all point to nonpoint nutrient trades. By doing so, the Commonwealth has incorporated a measure of safety and recognition that BMPs can be affected by several factors. The Virginia approach offers better certainty that the level of reductions being credited will occur. (For stormwater management offsets, the Virginia legislature passed a requirement that calls for a 1-to-1 ratio for the site's remaining post-development nutrient runoff compliance and assurance that the nonpoint nutrient offsets are secured in perpetuity, which should help provide more certainty that pollution reductions are actually achieved and continued. Practices such as nutrient management, no-till, and cover crops are short term, and not held "in perpetuity" as converted land covered by an easement.)

Maryland and Pennsylvania have a stated 1-to-1 trading ratio policy. They may assume that the Bay computer model or their own methodology sufficiently takes into account placement in the watershed, delivered load and pollution reduction coefficients of various agricultural practices. According to this view, a 2-to-1 ratio may be redundant and unnecessary. (Some familiar with the Pennsylvania trading system indicate that the reserves built into the credit calculations essentially make the tradable credit ratio greater than 1-to-1.)

A Pennsylvania trade involving a wastewater treatment facility that purchased credits provides an example of how the economics of a 2-to-1 can work. A municipality estimated the cost of upgrading their facility to meet nutrient reduction standards to be \$ 1.45 million. The facility managers were reportedly able to instead purchase nutrient credits for \$ 157,000 over 20 years, resulting in a savings of \$ 1.29 million. If a 2-to-1 ratio was in place, the municipality's costs would have been \$ 314,000 and would have still resulted in a substantial savings of over \$ 1.1 million, while at the same time providing better assurances for water quality reductions and possible achieving additional reductions. Clearly, the lower cost of credits contributes to this outcome and not every example will experience the same result under a higher trading ratio.

However, the significance of dealing with uncertainty must not be understated. It is fundamental to achieving the TMDL standard of "reasonable assurance". *EPA and the states should review current policies and practices dealing with uncertainty to better address trades involving nonpoint and nontraditional sources.*

- Only Pennsylvania currently reserves 10 percent of the credits it approves as sort of an insurance policy for point source dischargers which buy credits in the event that nonpoint credits do not fully perform. This form of "credit insurance" is a recognition that uncertainty exists in the nonpoint credit arena. At the end of each "water year", the reserve credits are eliminated from the books, which make this aspect of the Pennsylvania program similar to "credit retirement".

Some states across the nation retire credits as part of each trade. Here in the Bay region, only Maryland's policy calls for retiring 10 percent of every trade involving nonpoint sources and five percent of point source credits as a way to improve water quality through trading. A point source that needs 100 lbs of reduction, for example, must buy 10% more and those credits are retired by the state. Doing so, results in a *net improvement* to the Bay. (As mentioned above, Nutrient Credit Trading in general is not a water quality improvement tool unless it includes design features like these.)

- *Dealing with uncertainty in trades involving nonpoint sources and achieving actual water quality improvements are critical elements that should be reviewed in order to improve existing state*

trading programs. During reviews of state trading programs, EPA and the states should look into the following questions:

- What agricultural BMP efficiencies are being used by the states in determining nutrient credits in their jurisdiction? Are they consistently applied across the watershed? Do the state trading calculators include the revised BMP coefficients in the Bay Watershed Model?

- Are the shortcomings in the tracking and accounting of BMP practices pointed out by the National Academy of Sciences report adequately addressed in the various states' nutrient trading programs? What are the implications for expanded nutrient trading in light of that report?

- Given the uncertainties involved in nonpoint trading (including lag time, weather events, proper installation and maintenance), is a 1 to 1 trading ratio involving nonpoint or nontraditional sources sufficient for meeting the reasonable assurance standard under the Bay TMDL requirements? Should a trading ratio of greater than 1 to 1 be the norm for every trade involving nonpoint or nontraditional sources unless the individual project can demonstrate sufficient safeguards and assurances that the projected outcomes have a high degree of success?

- Should more credit be given to longer term, more durable, structural farm BMPs (such as riparian buffers and stream fencing) than to annual practices such as cover crops?

- Should retiring credits be part of every nutrient credit exchange made under the Bay TMDL in order to produce additional water quality improvements from a state trading program?

Limited Sediment Trading Occurring. In Maryland and Pennsylvania, sediment can be traded in addition to nutrients which is not the case in Virginia. Sewage treatment plants have been given limits for TSS (total suspended solids), even though their sediment discharges are negligible. Sediment trading may be more relevant for construction sites and stormwater, and representatives of the homebuilding industry have expressed interest in sediment credit trading. To date the Bay watershed's experience with sediment credits has been very limited.

Farmland Conversion. Of the three main Bay states, only Virginia allows farm land conversion to qualify as a nutrient credit, while the other two states do not, in part out of deference to state goals to preserve farmland acreage and out of concern that a conversion of farmland to more intensive development could seek such credit. Recent preliminary discussions within the Bay Program about crediting land conservation within the TMDL suggest that conversion of farmland to forests is generally viewed as a beneficial water quality practice and deserves more consideration as a possible trading option.

Cost of Trading Oversight. There has been relatively little discussion of the full costs to the states associated with providing adequate oversight of a robust trading program. Permit reviews, field inspections, and ongoing monitoring at some additional level are elements of adequate state oversight and in providing "reasonable assurance". While aspects of the oversight may be accomplished by independent third parties and private interests, states should take these costs into consideration when

reviewing changes to their programs. *States should avoid having the credit broker or generator serve as the only oversight.*

CREDIT DEMAND AND SUPPLY

Nonpoint Source Trading Demand. As of May 2011, there have been only a small number of nutrient trades in the Bay watershed involving point to nonpoint sources. There have been 69 proposals submitted in Pennsylvania; only nine trades involving nonpoint sources have occurred. All but one involved manure transport. (NOTE: As of August 2011, Pennsylvania reports over 100 proposals submitted; 10 trades have been approved.) There have also been three failed applications for trading credits involving nonpoint sources in Maryland, and no trades involving nonpoint sources yet in Virginia. Again, trading is expected to increase with the adoption of the Bay TMDL and state WIPs. Most of the demand for nonpoint credits in Pennsylvania has been for nitrogen.

Dealing with Nontraditional Source Crediting. Not all nonpoint source trading involves farming operations. More innovative technologies and practices such as oyster aquaculture, constructed wetlands, algal production, waste-to-energy projects, biofuels, etc, are also possibilities and requests for such credit opportunities are likely to increase in the future. While such nontraditional approaches to nutrient reduction may prove beneficial, the matter of granting credits to such sources raises separate issues (such as what trading ratios would apply and some potential legal questions) and deserves greater research and scrutiny before states and the public will be assured of their creditworthiness.

States trading officials would benefit by having the opportunity to call upon either an independent state or regional body of technical experts who could offer important scientific and legal expertise and advice on the nutrient creditworthiness of these practices. Maryland has already established such a technical review committee that includes university and Bay Program staff. *EPA and the remaining states should consider establishing similar panels. Perhaps the Chesapeake Bay Program's Scientific and Technical Advisory Committee (STAC) or another Watershed Implementation Team could serve this role or EPA and the states could establish a dedicated panel. States should also carefully consider the trading ratios in such nontraditional cases and build in sufficient uncertainty allowances based on the best available science.*

Stormwater and Septics. Offsetting stormwater and on-site disposal systems (septics) is also being considered as part of an expanded Virginia program and new development offsets will be considered in Maryland. Stormwater compliance credits have the potential to become a very significant part of state nutrient trading schemes in the Bay region and nationwide. The principal benefit for stormwater offsets is similar to that for point sources in that it can significantly reduce the costs of achieving full compliance onsite, especially given that the last few pounds of reduction are often the most costly.

Issues such as those relating to properly crediting localities under their MS4 permits for improvements made elsewhere due to nutrient trades, anti-backsliding provisions, and grandfathering will need to be properly addressed as states move forward in this area.

- Localities that manage their own Municipal Separate Storm Sewer Systems under a MS4 permit could potentially benefit greatly by nutrient credit trading. MS4 localities may find trading among its own facilities to be a means of avoiding or at least reducing the need for costly retrofits.
- One area of further inquiry might be to investigate whether, in the future, it should be possible for a MS4 locality in the Bay watershed to receive a single load reduction number under a permitting process similar to a “bubble permit” that incorporates all of its sources - sewage treatment plants, construction runoff, stormwater retrofits, etc.- and gives localities the flexibility for determining which combination of sources offers the best mix of reductions to reach its loading target in the most cost effective manner. This approach was envisioned by EPA in its 2003 Watershed Permitting Implementation Guidance and could have relevance for dealing with the Bay TMDL requirements.
- With regard to on-site disposal systems, the hooking up of septic systems to a municipal wastewater treatment facility is the most accepted means to generate nutrient credits. In Maryland, sewage treatment plants are given additional wasteload allocation depending upon whether the septic systems that are hooked up are located in the designated “Critical Areas” or not.

Interstate and Inter-basin Trading. Interstate trading is attracting considerable attention, but is not receiving universal acceptance. Among the reasons given for promoting interstate trading are that it would open up the potential supply of credits and keep prices down. Authorization for an interstate trading program in the Bay watershed was proposed in the Cardin bill during the last Congress (and is likely to come forward again).

- Even without the passage of federal legislation, some interstate trading is occurring. Reportedly, there is a trade in the works between a wastewater treatment plant in West Virginia and farm credits produced in Pennsylvania. EPA Region III reviewed and did not object to the trade in the context of the NPDES permit issued by the West Virginia Department of Environmental Protection, and the Interstate Commission on the Potomac River certified the credits. Pennsylvania officials indicate that the trade occurred because West Virginia does not yet have a formal trading program. This example raises questions about the authorization, accounting and verification of such future interstate trades.
- While interstate trading may have a place over the long term or in shared river basins like the Potomac, additional study may be needed to more fully determine its usefulness. This is especially true given the considerable amount of reductions that each state needs to achieve in order to meet its WIPs; most will need all the offsets and credits that can be generated within their own borders.

- Inter-basin trading within states is also on the horizon as concern exists that some river basins will be unable to generate enough offsets to accommodate growth. A modest provision for inter-basin trading was recently allowed through a change to Virginia law for the Eastern Shore point sources which have limited trading options so that they can now obtain credits in the Potomac or Rappahannock river basins. One example that was provided as justification of the potential need for inter-basin trading is the unanticipated growth in some localities due to the BRAC process where certain military bases are now looking to add hundreds of new residents and businesses and associated sewage that the receiving localities had not planned for and did not have load allocation to accommodate the new growth. While it has similar issues as interstate trading, inter-basin trades may be more useful as all transactions would fall under a single state's program and purview. States may want to consider it on a case-by-case basis.
- Additional study appears to be needed to determine if nutrient trading across state boundaries or across river basins can be done in a manner that also contributes to nutrient reductions overall and under what framework it would reduce the cost of implementation. The World Resources Institute, EPA and the Bay state trading programs are currently part of a workgroup exploring opportunities for interstate and inter-basin trading. Until additional work is completed, it may be prudent to pursue interstate trading or inter-basin trading only on a case-by-case basis. Should such trading across boundaries be pursued in the future, key state protections relating to nonpoint and nontraditional sources must be more consistent than they are today, assurances must be given that there will be no increase in local water quality degradation, and EPA should take a leadership role (for example, in certifying and verifying) in any trade across state lines. Interstate trading should not be a reason for reducing state provisions that deal with trading uncertainties (trading ratios). Rather, the more stringent trading provisions of the states involved should prevail.

Determining "Success". While virtually every trading publication acknowledges that protection of water quality must be the overriding goal, there are differences about how to determine whether a specific trading program is "working". One measure of success would be to determine if a reduction in the cost of compliance in achieving reductions occurs. Another viewpoint suggests that the primary objective of a trading program is to ensure that trades – particularly those involving nonpoint sources – are made. Whether credits are being bought and sold, however, should not be the overriding judge of a successful program. Ensuring that needed nutrient reductions are actually occurring must be the main objective of trading. If trading can ultimately result in lower cost nutrient reductions and greater verifiable pollution reductions than in the absence of trading, then all the better.

Within the Bay TMDL context, trading programs should, at a minimum, ensure that there is no net increase in Bay pollution, no increase in degradation of local waters, and, if possible, be designed to contribute to the improvement in water quality.

As the Bay community moves into the next round of trading expansion, it will be important for states to resist pressure to redesign their programs primarily to increase the number of trades, especially those involving nonpoint and nontraditional sources. There is already pressure to do this. For example, the 2011 Virginia General Assembly passed a bill to reduce trading ratios from 2-to-1 to 1-to-1 to favor credits purchased from new waste-to-energy companies. (To acquire credits from them, one would need to purchase an equal amount of pounds compared to other nonpoint sources where one would need to purchase twice as many pounds.)

The informed Bay public and conservation interests may wish to reaffirm their support to Bay leaders for maintaining water quality protection as the highest goal in any changes made to state nutrient credit trading programs.

Differing Viewpoints on Trading Demand. There is a robust debate going on among academicians, policy advocates and government agencies as to whether water quality trading, including nutrient trading, is really an effective and efficient means for achieving water quality improvement. The following is reflective of the variety of viewpoints here in the Bay region:

- Some research shows that expectations for many trading programs are “often unrealized” and can divert attention from the challenge of successfully addressing nonpoint source pollution which is the largest source of water quality problems in the Bay and elsewhere.
- A second viewpoint holds that point source dischargers will be reluctant to buy or sell credits in order to protect their own long-term growth under the Bay nutrient caps or because they fear the uncertainty of legal liability from nonpoint credits that do not achieve or maintain pollution reductions. In addition, there is concern that sewage treatment plant operators are often reluctant to negotiate contracts directly with farmers or other sources of nonpoint credits.
- Some have expressed the viewpoint that many farmers, potentially the primary source of nonpoint credits, may find meeting baselines so challenging that they are reluctant or unable to participate.
- Trading advocates view the low number of trades to date as largely due to the fact that the regulatory “drivers” were not so great until now. This view acknowledges that the new Bay TMDL, the state WIPs, and enhanced stormwater requirements have changed the regulatory environment and made the Bay partnership more accountable for achieving nutrient reductions. Because of this, they expect many more trades in the future.

- It is difficult to know what amount of actual nutrient credit trading is likely to occur in the Bay region over the next 15 years. Because there is considerable reliance on trading and offset credits in WIPs, the recent request made by the Chesapeake Bay Commission (May 2011, Federal Agency Request to EPA) that EPA take the lead in conducting a nutrient trading market analysis as part of its review of state trading programs could provide valuable information for decision-making and adaptive management under the state WIPs.

Accountability, transparency and verifiability. How the Bay region deals with these three key concepts will ultimately determine whether trading efforts serve as an effective tool or not in the Chesapeake TMDL implementation. To determine if “reasonable assurance” is achieved, EPA and the states will need to know whether each trade is achieving what it is represented to offset. While states have varying degrees of compliance provisions and public transparency in their programs, it remains to be seen in this era of state budget reductions if they are capable of conducting the requisite inspections, oversight and monitoring or whether the permit holder or a third party can provide adequate safeguards. Building greater accountability and certainty into the program will also be critically important if the public is to become more accepting of nutrient credit trading, especially of those trades involving nonpoint and nontraditional credits.



Joseph H. Maroon is the Principal/Owner of Maroon Consulting LLC, which assists businesses, nonprofits and public organizations in areas relating to natural resources, Chesapeake Bay, land conservation, and environmental protection and policy. Maroon formerly served in two gubernatorial administrations as the Agency Director of the Virginia Department of Conservation and Recreation (2002-2010). Prior positions include serving as the Virginia Executive Director of the Chesapeake Bay Foundation (1985-2002) and as a senior legislative analyst/project team director for the Virginia Joint Legislative Audit and Review Commission (1978-1985). Maroon is an adjunct faculty member at VCU where he teaches a graduate course in Chesapeake Bay Policy. He has received numerous awards including the 2000 Outstanding Environmental Leader Award in Virginia, the 2009 Gerald McCarthy Award for Environmental Conflict Resolution and the Virginia Water Resources Leadership Award in 2006. For further information, contact: joseph.maroon@verizon.net or 804.379.3591.