

Background Information: Prepared for Trading Ratio Study October 2012

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1. Enactment Clause (SB 77 and HB 176)

“2. That by July 1, 2013, the State Water Control Board shall reevaluate its trading ratio for nutrient allocation acquisition pursuant to subdivision B 1 b of § 62.1-44.19:15 of the Code of Virginia, giving full consideration to similar trading ratios established by § 10.1-603.8:1 of the Code of Virginia, § 10.1-603.15:2 as added by this act, and trading programs in other Chesapeake Bay watershed states. The Board shall establish an advisory group of interested stakeholders for the purpose of receiving recommendations during the reevaluation regarding an appropriate ratio. If warranted based on the outcome of the reevaluation, the Board shall adopt a revised trading ratio for purposes of subdivision B 1 b of § 62.1-44.19:15 as soon as practicable following the completion of the reevaluation.”

2. Watershed General Permit Provisions

Note: The permit was amended by the State Water Control Board to conform to changes made by the General Assembly. The excerpts below reflect the new language. The amendments will appear in the Virginia Register on 10/22 with an effective date of 11/21.

B. Acquisition of waste load allocations. Waste load allocations required by this section to offset new or increased delivered total nitrogen and delivered total phosphorus loads shall be acquired in accordance with this section.

1. Such allocations may be acquired from one or a combination of the following:

a. Acquisition of all or a portion of the waste load allocations or point source nitrogen or point source phosphorus credits from one or more permitted facilities, based on delivered pounds by the respective trading parties as listed by the department;

b. Acquisition of credits certified by the Board pursuant to §62.1-44.19:20 or certified by the Soil and Water Conservation Board pursuant to § 10.1-603.15:2. Credits used to offset new or increased nutrient loads under this paragraph shall be:

- (1) Subject to a trading ratio of two pounds reduced for every pound to be discharged if certified by the Soil and Water Board pursuant to § 10.1-603.15:2;
- (2) Calculated using best management practices efficiency rates and attenuation rates, as established by the latest science and relevant technical information, and approved by the board;
- (3) Based on appropriate delivery factors, as established by the latest science and relevant technical information, and approved by the board;
- (4) Demonstrated to have achieved reductions beyond those already required by or funded under federal or state law, or by Virginia's Chesapeake Bay TMDL Watershed Implementation Plan;
- (5) Included as conditions of the facility's individual Virginia Pollutant Discharge Elimination System permit; and
- (6) In the case of allocations generated by land use conversions and urban source reduction controls (BMPs), beyond those in place as of July 1, 2005.

3. Code of Virginia – Relevant Code Sections

Code of Virginia Provisions Related to Ratios

§ 62.1-44.19:15. New or expanded facilities.

C. Until such time as the Director finds that no allocations are reasonably available in an individual tributary, the general permit shall provide for the acquisition of allocations through payments into the Nutrient Offset Fund established in § 10.1-2128.2. Such payments shall be promptly applied by the Department to achieve equivalent point or nonpoint source reductions in the same tributary beyond those reductions already required by or funded under federal or state law or the Virginia tributaries strategies plans. The general permit shall base the cost of each pound of allocation on (i) the estimated cost of achieving a reduction of one pound of nitrogen or phosphorus at the facility that is securing the allocation, or comparable facility, for each pound of allocation acquired; or (ii) the average cost of reducing two pounds of nitrogen or phosphorus from nonpoint sources in the same tributary for each pound of allocation acquired, whichever is higher. Upon each reissuance of the general permit, the Board may adjust the cost of each pound of allocation based on current costs and cost estimates.

D. The acquisition of nutrient allocations, credits, or offsets from animal waste-to-energy or animal waste reduction facilities, or the acquisition of such nutrient allocations, credits, or offsets from entities acting on behalf of such facilities pursuant to subdivision B 1, shall be considered point source allocations, credits, or offsets for all nutrient trading purposes and shall not be subject to a two-for-one trading ratio if the best management practice being used to generate such nutrient allocations, credits, or offsets is a point source nutrient removal technology. Point source nutrient removal technology shall include animal waste gasification in which lab analysis of the animal waste reveals the concentration of nutrients in the animal waste being fed into the gasifier, and the fate of the nutrients during the animal waste gasification process, is known and documented using studies such as air emissions tests and ash analyses.

§ 10.1-603.8:1. Stormwater nonpoint nutrient offsets

G. For that portion of a site's compliance with stormwater nonpoint nutrient runoff water quality criteria being obtained through nutrient credits, the applicant shall (i) comply with a 1:1 ratio of the nutrient credits to the site's remaining postdevelopment nonpoint nutrient runoff compliance requirement being met by credit use and (ii) use credits certified as perpetual credits pursuant to Article 1.1:1 (§ 10.1-603.15:1 et seq.).

§ 10.1-603.15:2. Nutrient credit certification.

8. Establish a credit retirement requirement whereby five percent of credits in the Chesapeake Bay Watershed are permanently retired at the time of certification pursuant to this section for the purposes of offsetting growth in unregulated nutrient loads;

4. Chesapeake Bay Basin States Ratios

West Virginia

From: West Virginia Water Quality Nutrient Credit Trading Program Guidance – West Virginia Department of Environmental Protection available at <http://www.wri.nrcce.wvu.edu/programs/pwqb/index.cfm>

Definitions (page 6):

“Trading Ratios” or “Trading Calculation Factors”- *Discount factors applied to nutrient reductions, to account for uncertainty, delivery, credit reserve or special need concerns.*

• **“Delivery Ratio” or “Delivery Factor”-** *The factor that compensates for the natural attenuation or loss of nutrients as they travel in water.*

- **“Reserve Ratio”**- *The proportion of the credits generated by a nutrient reduction set aside in the credit reserve for the purposes of insurance against risk of nutrient reduction project failure for natural or unexpected causes.*
- **“Special Concerns Ratio”**- *Additional ratios applied to credits generated in watersheds of impaired streams (303d-listed) and otherwise as the Department deems necessary in areas of special water quality concern.*
- **“Uncertainty Ratio”**- *Ratio applied to point-to-nonpoint trades to account for uncertainty in modeling and BMP performance.*

2. Calculation of Credits (page 9)

b) Application of trading ratios or credit calculation factors. Nutrient reductions must be calculated in a manner that accounts for factors such as location, reserve/risk, uncertainty, and/or other special needs. Trading ratios need to be considered and used as appropriate to ensure that trading provides the desired level of nutrient reductions and water quality benefits. Examples of ratios that would apply to trades are provided below and their specific application to the Potomac program is explained in Appendix A. ***Delivery Ratio*** is a function of the distance from the location where the nutrient reduction activities are carried out, to the compliance point and the related estimated diminution of the effect of the nutrient reductions between upstream and downstream points. ***Reserve Ratio*** is applied where the Department determines that it is necessary to provide for possible failures in nutrient reduction efforts. ***Uncertainty Ratio*** can be applied to point-to-nonpoint trades to account for uncertainty in modeling and variation in BMP performance. ***Special Concerns Ratio*** – Additional ratios may be applied to credits generated in watersheds which the Department deems to be of special water quality concern such as those with impaired streams (303d-listed) and otherwise as the Department deems necessary.

b) Conservative assumptions. The Department will use conservative assumptions and methodologies for calculating credits. In the Potomac, these assumptions have been employed within NutrientNet credit calculation methodologies (see Appendix A). The Department will continue to confer with experts in agronomics and other specialized areas in order to employ the best available science when applying its credit calculation protocols.

Where appropriate, trading ratios will be applied to account for uncertainties inherent in estimating the delivered loads and reductions in the absence of daily site or stream monitoring and other cost-prohibitive measures. Despite 17 conservative estimation methodologies, remaining uncertainty can include but is not limited to estimating the effect of temporal, spatial, and water quality factors specific to reductions that cannot be captured by models and methodologies - these uncertainties can include the variation in annual/seasonal weather, in the fields and crops, in human practices, in receiving streams, in the estimation of past loadings, and in the equivalency of various forms of pollutants (e.g. bound vs. biologically available phosphorous).

c) Reserve Ratio. The Department will adjust all load reductions available for credit generation to populate an annual risk reserve of credits to be used in the event of natural or otherwise unforeseeable/uncontrollable causes of project failures.

B. Application of Ratios

1. Credits generated by non-point sources that either measure reductions or implement Chesapeake Bay Program peer-reviewed practices will be used by NPDES permittees at a ratio of 1.2:1 – that is, for each pound of nutrient discharged above permit levels, the permittee must purchase 1.2 credits of non-point source reductions. This accounts for the risk reserve factor (0.2). An additional uncertainty factor may be applied on a case-by-case basis to non-point nutrient reduction practices that are not measured or have not been peer reviewed and approved by the Chesapeake Bay Program.
2. Credits generated by *nutrient-limited point sources* must be purchased or secured by other NPDES point sources at a ratio of 1.1:1 – for each pound of nutrient discharged above permit levels, the permittee will be required to purchase 1.1 credit pounds of point source reductions. This accounts for the risk reserve (0.1).
3. 3. Credits available from regulated point sources without nutrient limitations can be secured by other NPDES point sources at a ratio of 1.1:1 – for each pound of nutrient discharged above permit levels, the permittee is required to purchase 1.1 credits of point source reductions to account for risk (0.1 risk reserve factor). An example of the latter is that a nutrient limited point source may take measures to reduce or eliminate discharge from an unregulated wastewater point source in order to increase its own nutrient allocation. A PSD may choose to control the discharge from an existing package treatment plant or on-lot sewage disposal system. The PSD could claim credits from absorbing an unregulated point source or on-lot system at a ratio of 1 pound credit to every 1.1 pound load eliminated.

Maryland

<http://www.mde.maryland.gov/programs/water/pages/water/nutrientcap.aspx>

<http://www.mdnutrienttrading.com/>

From: “Producing and Selling Credits in Maryland’s Nutrient Trading Market: Guidance for Agricultural Producers and Landowners in the Chesapeake Bay Watershed”

Applying Trading Ratios

A trading ratio is a mathematical adjustment made to the number of pounds of nitrogen or phosphorus leaving a farm (edge of field) or being discharged by a wastewater treatment plant. Different types of trading ratios are imposed for different reasons, and one or more may be required in a given trade. The types of trading ratios that are used in the Maryland trading program are explained in Box 2.

For nonpoint sources, two types of delivery ratios are applied: the edge of stream ratio and the in-stream delivery ratio (see Box 2 for more information). In addition, a 10 percent retirement ratio will also be applied to credits at the time of trade. If you use the online credit estimation

tool or spreadsheets to estimate your credit generation potential, it will automatically apply the appropriate delivery ratios and the retirement ratio. If you do these calculations yourself, Appendix A provides information on how to determine the appropriate delivery ratio to use.

If you intend to use BMPs in Categories 2 or 3 (see below), an uncertainty ratio may also be applied. MDA and the technical panel will set this ratio in the review of your credit certification request. Unlike delivery or retirement ratios that are expressed as fractions, uncertainty ratios are expressed as actual ratios. For example, an uncertainty ratio of 2:1 means that 2 pounds of edge-of-field reductions are required to generate 1 credit.

Box 2. Trading Ratios Used in Maryland's Nutrient Trading Program

Delivery Ratio

When a pound of nitrogen or phosphorus from your farm enters the nearest stream, not all of it reaches the mainstem of the Chesapeake Bay, i.e., is “delivered.” How much of that pound actually reaches the Bay depends on many factors, with distance being the most important one. Tributary Strategy goals are expressed in terms of delivered loads, and the delivery ratio is used to simulate the physical and biological processes that affect nutrient loads as they travel downstream. Thus, a pound of nitrogen or phosphorus released in an upper watershed has less impact than a pound of either released at the mouth.

The delivery ratio that is applied is based on location in the watershed, and it is actually comprised of two types of ratios derived from the Chesapeake Bay Watershed Model:

- Edge of Segment Delivery Factor (EOS) – The EOS is the amount of land-applied nutrients expected to reach the surface waters at the boundary of the watershed model segment through surface runoff, groundwater flows, or atmospheric deposition.
- In-Stream Delivery Factor (DF) – The DF represents the pollutant effect of the nutrient reductions between upstream and downstream points and is largely the function of the distance from the edge of the watershed model segment to the Bay.

Uncertainty Ratio

Uncertainty ratios are used to compensate for possible discrepancies in the relationship between credit generation models and actual pollution reductions resulting from various BMPs. They are needed when sufficient data do not yet exist to determine BMP efficiency or actual nutrient loads or reductions cannot be accurately measured. The application of an uncertainty ratio essentially provides a margin of safety to ensure that water quality goals are being met.

Retirement Ratio

A retirement ratio represents a percentage of the total amount of credits sold that cannot be used by the buyer. These credits are considered to be “retired” and, thereby, create a greater reduction in nutrient loads than that which would have occurred without the trade. In the Maryland trading policy, the retirement ratio has been set at 10 percent and will apply to all credit sales.

Box 3 illustrates how the delivery and retirement ratios are included in the credit calculations. Two scenarios are shown to demonstrate the ways in which differences between the buyer's and seller's delivery ratios can dramatically alter the number of credits sold. Note that credits determined by the retirement ratio will be retired by the buyer after the transaction has occurred.

Box 3. Illustration of the Application of Trading Ratios

This example of applying delivery and retirement ratios shows two scenarios, one where the seller has a delivery ratio of 0.58 and one where he has a delivery ratio of 0.80. A higher delivery ratio means the seller is closer to the mainstem of the Bay. A substantially different number of credits is generated under the two scenarios.

Delivery ratio example		
	Scenario 1	Scenario 2
Eligible Reductions	1000	1000
Delivery ratio	(x) 0.58	(x) 0.80
Credits available to sell	(=) 580	(=) 800

An additional factor also affects the number of credits that can be sold to a buyer. Assume that the buyer requires 500 credits. A 10 percent retirement ratio requires 550 credits to be exchanged in the transaction. The extra 50 credits will be retired by the buyer after the transaction occurs. This determination should be spelled out in the sales contract.

Retirement ratio example

Credits sold	500
Retirement ratio (10%)	50
Total credits needed	550

BMPs

For many BMPs and other agronomic practices (collectively referred to as BMPs in the remainder of this document), the nitrogen and phosphorous load reductions they achieve (i.e., their nutrient-removal efficiencies) have been scientifically assessed, peer reviewed, and incorporated into the Bay models. Thus, the credit generation capability has already been established for these BMPs. The Phase II Policy incorporates this work and divides possible BMPs into three categories:

- *Category 1 – BMPs with Approved Load Reduction Efficiencies.* These are BMPs that are currently in widespread use in the Chesapeake Bay watershed. They have well-documented installation and maintenance specifications, and well-established and

understood nutrient removal efficiencies. They have recently been put through a rigorous scientific peer review by the Chesapeake Bay Program and their efficiencies have been incorporated into the Bay Program nutrient loading and water quality models. Since the efficiencies are long-term averages, you do not need to consider seasonal or annual variability in BMP performance in estimating your credits.

- *Category 2 – BMPs Requiring Technical Review.* These are BMPs that are also currently in use in the Chesapeake Bay watershed but they may still require additional scientific analysis and technical review before standardized performance efficiencies can be assigned.
- *Category 3 – Other BMPs.* These are new technologies or innovative practices that are not yet in widespread use. Since reliable estimates of their nutrient removal performance capabilities may not exist, they will be subject to scientific analysis and technical review to evaluate and determine efficiencies and load rates before any credits can be assigned.

BMPs currently contained in these three categories are shown in Table 2.

The use of BMPs in Category 1 can greatly simplify credit generation calculations. The approved load reduction efficiencies are built into the Maryland Nutrient Trading Program's credit estimation tool on the website (www.mdnutrienttrading.com) so you can evaluate different scenarios by simply selecting a BMP or set of BMPs. The estimation tool will automatically apply the appropriate efficiencies and tell you the number of credits generated in that scenario.

Category 1 BMPs have an added advantage in that you do not need to apply an “uncertainty” ratio to your trade (trading ratios are described in the following section). Any uncertainty associated with the BMP has already been taken into account by the Chesapeake Bay Program in the adoption of the stipulated efficiency.

Category 2 BMPs do not have well-established nutrient reduction efficiencies and are under peer review and awaiting approval by the Chesapeake Bay Program. Credit generation or trade proposals involving them will require review by an independent technical panel established by MDA. The panel will set the efficiency and loading rates to be used in the trade, along with an appropriate uncertainty ratio.

Category 3 BMPs are largely new or untested and lack even estimated nutrient reduction efficiencies. Credit generation proposals involving these practices will be examined by MDA and the technical panel. Appropriate specifications for project installation, operation, maintenance, and monitoring will be developed as needed, and an appropriate uncertainty ratio will be applied. The approval process for these credits will likely take longer than that for proposals involving Category 2 credits.

Table 2. BMPs by Chesapeake Bay Program Category

Category 1 BMPs with Approved Load Reduction Efficiencies	Category 2 BMPs Requiring Technical Review	Category 3 Other BMPs
Riparian/Conservation Forest Buffers	Prescribed Grazing	Algal Turf Scrubber
Riparian/Conservation Grass Buffers	Stream Access Control with Fencing*	Oyster Aquaculture
Wetland Restoration	Alternative Watering Facility	Other Innovations
Tree Planting*	Horse Pasture Management	
Carbon Sequestration/ Alternative Crops*	Decision Agriculture	
Cover Crops	Continuous No-till	
Commodity Cover Crops	Enhanced Nutrient Management [†]	
Conservation Plans	Ammonia Emissions Reduction [†]	
Barnyard Runoff Control		
Loafing Lot Management		
Water Control Structures		
Erosion and Sediment Control [†]		
Conservation Tillage*		
Animal Waste Management Livestock		
Animal Waste Management Poultry		
Mortality Composters		
Stream Restoration		
Dairy Precision Feeding and Forage Management [†]		
Nutrient Management Applications [†]		
Poultry and Swine Phytase [†]		
Poultry Litter Transport [†]		

*Credited as a land use change

[†]Credited as an application reduction

PENNSYLVANIA

<http://www.pacode.com/secure/data/025/chapter96/s96.8.html>

<http://www.dep.state.pa.us/river/nutrienttrading/calculations/index.htm>

<http://www.pabulletin.com/secure/data/vol40/40-41/1927.html>

From: Pennsylvania Code § 96.8. Use of offsets and tradable credits from pollution reduction activities in the Chesapeake Bay Watershed.

Delivery ratio — A ratio that compensates for the natural attenuation of a pollutant as it travels in water before it reaches a defined compliance point.

Edge of segment ratio — A ratio that identifies the amount of a pollutant expected to reach the surface waters at the boundary of a Chesapeake Bay Watershed Model segment through surface runoff and groundwater flows from a pollutant source within a watershed segment.

Trading ratio — A ratio applied to adjust a pollutant reduction when calculating credits for a pollutant reduction activity. A trading ratio is used to address uncertainty, water quality, reduction failures or other considerations. The term will include a delivery ratio, an edge of segment ratio and a reserve ratio.

(3) *Calculation requirements.* The following credit calculation requirements apply:

(i) The calculations must demonstrate how the pollutant reductions will be achieved from the proposed pollutant reduction activity to generate credits for the applicable period of time.

(ii) The pollutant reductions must be expressed in pounds per year.

(iii) The calculations used must be based on methodologies that the Department determines are appropriate under subsection (c).

(iv) The calculation for a point source may include excess load capacity attributable to activities such as effluent controls or the use of offsets.

(v) The calculation must include a 10% set aside for the Department's credit reserve.

The Department may establish other calculation requirements necessary to ensure that the use of credits is effective in meeting water quality requirements, and to address uncertainty for reasons such as unforeseen events that may disrupt pollutant reduction activities. The calculation requirements may include the need to use trading ratios, risk-spreading mechanisms and credit reserves. These calculation requirements may reduce the amount of credits the Department may certify for a pollutant reduction activity.