

Phase 2 Watershed Implementation Plan Nutrient Trading Supplement

Revised, October 14, 2016

Section 9 of Pennsylvania’s Phase 2 Chesapeake Bay Watershed Implementation Plan (“Phase 2 WIP”) describes the use of Pennsylvania’s Nutrient Trading Program to implement the Phase 2 WIP. This supplement to Section 9 (“Nutrient Trading Supplement”) provides an update on policy and program enhancements to the Nutrient Trading Program.

I. Background

Since 2005, the Pennsylvania Department of Environmental Protection (DEP) has been leading the way nationally in developing its nutrient trading program. The program is one of the first programs in the country to have both agricultural operations (nonpoint sources) and wastewater treatment facilities (point sources) participating in a nutrient credit trading program. Pennsylvania built its program with significant input from stakeholders – and those very stakeholders are now participants in the program. Pennsylvania built its program to meet Pennsylvania’s needs with regard to the Chesapeake Bay. The key to the program’s success is that it is voluntary and follows these principles:

- A trade must involve comparable credits (for example, nitrogen may only be traded for nitrogen) that are expressed as mass per unit time (pounds per year);
- Credits generated by trading cannot be used to comply with existing technology- based effluent limits except as expressly authorized by regulation;
- Trading may only occur in a PA DEP defined watershed;
- Trading may take place between any combination of eligible point sources, non- point sources and third party aggregators; and,
- Each trading entity must meet applicable eligibility criteria established under the Nutrient Trading Program regulations, 25 Pa. Code Section 96.8.

The Phase 2 WIP identified the success of the existing program and a plan of action to move forward to address a number of recommendations the U.S. Environmental Protection Agency (EPA) made in 2012. These recommendations were divided into two tiers, with the first tier being those recommendations specific to Pennsylvania. As stated in the Phase 2 WIP, DEP has been working with stakeholders and EPA to define the details for the plan of action to address these recommendations since 2012.

In April 2014, EPA began objecting to the issuance of National Pollutant Discharge Elimination System (NPDES) permits prepared by DEP that contained Cap Loads and permit language that enabled the use of credits to achieve compliance with those Cap Loads. The objections were based on EPA’s concerns with the nonpoint source agricultural baseline requirements in the nutrient trading regulations. EPA asserted that DEP had not made a quantitative demonstration that these requirements achieve the load allocations for agricultural sources in the Chesapeake Bay Total Maximum Daily Load (TMDL). Unlike point source discharges with NPDES permits, agricultural operations cannot quantitatively measure the potential nonpoint source loading of nutrients from their fields. To resolve EPA’s objections and retain the ability to issue the NPDES permits in question, DEP has established additional eligibility and credit calculation requirements to ensure the effectiveness of the use of credits to meet legal requirements of the Chesapeake Bay TMDL as authorized by its regulations (25 Pa. Code §§ 96.8(d)(5) & (e)(3)(vi)).

This supplement describes those additional requirements. This plan of action is divided into the four key components of the program: Eligibility, Certification, Verification and Registration.

II. Definitions

Annual Net Mass Load (lbs): The Annual Total Mass Load, as defined below, adjusted for credits sold and applied and offsets applied. Annual Net Mass Loads are compared to Cap Loads to determine compliance.

Baseline: The compliance activities and performance standards that must be implemented to meet current environmental laws and regulations related to the pollutant for which credits or offsets are generated. The term includes allocations established under 25 Pa. Code Chapter 96 (relating to Water Quality Standards Implementation), in a TMDL, or in a similar allocation for the pollutant.

Cap Load (lbs): The mass load of a pollutant authorized by an NPDES permit. Cap Loads for Total Nitrogen (TN) and Total Phosphorus (TP) are implemented in NPDES permits by the establishment of Annual Net Mass Load limits. The term "Net" is used to recognize that Credits and Offsets may be used to comply with the limits. The Annual Net Mass Load must be less than or equal to the Cap Load to achieve compliance.

Certification: Written approval by DEP of a proposed pollutant reduction activity to generate credits before the credits are verified and registered to be used to comply with NPDES permit effluent limitations.

Compliance Year: The year-long period starting October 1st and ending September 30th. The Compliance Year will be named for the year in which it ends. For example, the period of October 1, 2015 through September 30, 2016 is Compliance Year 2016.

Credit: The tradable unit of compliance that corresponds with a unit of reduction of a pollutant as recognized by DEP which, when certified, verified and registered, may be used to comply with NPDES permit effluent limitations.

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.

Offset: The pollutant load reduction measured in pounds (lbs) that is created by an action, activity or technology which when approved by DEP may be used to comply with NPDES permit effluent limitations, conditions and stipulations under 25 Pa. Code Chapter 92a (relating to NPDES permitting, monitoring and compliance.) The offset may only be used by the NPDES permittee that DEP determines is associated with the load reduction achieved by the action, activity or technology.

Registration: An accounting mechanism used by DEP to track certified and verified credits before they may be used to comply with NPDES permit effluent limitations.

Threshold: Activities and performance standards beyond baseline compliance which are required under 25 Pa. Code Chapter 96.8(d)(3) (relating to threshold requirement to generate credits) before credits may be certified.

Total Mass Load (lbs):

Monthly Total Mass Load = The sum of the actual daily discharge loads for TN and TP (lbs/day) divided by the number of samples per month, multiplied by the number of days in the month in which there was a discharge. The daily discharge load for TN and TP (lbs/day) equals the average daily flow (MGD) on the day of sampling, multiplied by that day's sample concentration for TN and TP (mg/l), multiplied by 8.34.

Annual Total Mass Load = The sum of the actual daily discharge loads for TN and TP (lbs/day) divided by the number of samples per year (beginning October 1st and ending September 30th), multiplied by the number of days in the year in which there was a discharge.

Total Nitrogen: For concentration and load, Total Nitrogen is the sum of Total Kjeldahl-N (TKN) plus Nitrite-Nitrate as N ($\text{NO}_2+\text{NO}_3\text{-N}$), where TKN and $\text{NO}_2+\text{NO}_3\text{-N}$ are measured in the same sample.

Truing Period: The time provided following each Compliance Year for a permittee to comply with Cap Loads through the application of Credits and Offsets. The Truing Period will start on October 1st and end on November 28th of the same calendar year, unless DEP extends this period. During this period, compliance for the specified year may be achieved by using registered Credits that were generated during that Compliance Year. For example, Credits that are used to achieve compliance in Compliance Year 2016 must have been generated during Compliance Year 2016. Approved Offsets that have been generated may also be applied during the Truing Period.

Verification: Assurance that the verification plan contained in a certification, permit or other approval issued by DEP has been implemented. Verification is required prior to registration of the credits for use in an NPDES permit to comply with NPDES permit effluent limitations.

III. Eligibility/ Requirements for Certification

For a point source or nonpoint source to be eligible to generate and trade credits, it must meet baseline and threshold eligibility requirements as defined in 25 Pa. Code §96.8(d). In addition, to address concerns expressed by EPA, the eligibility requirements summarized below must be satisfied to generate credits to meet the legal requirements of the Chesapeake Bay TMDL.

A. Point Sources

Effective October 1, 2015, to be eligible to generate credits for sale, all Significant Sewage point sources with an assigned Cap Load (see Table 7-1 of the [Phase 2 WIP Wastewater Supplement](#)) must demonstrate treated yearly effluent concentrations below 6.0 mg/L TN and 0.8 mg/L TP (i.e., "baseline" concentrations) in accordance with the procedures described below. Guidance on how to apply for verification and the registration of credits from a point source can also be found on the nutrient trading website, www.dep.pa.gov/nutrient_trading.

DEP's procedures for point sources to generate and trade credits consist of the following:

- To generate credits, facilities must be able to demonstrate they are in compliance with their NPDES permit.
- The total amount of credits the facility is certified to generate cannot exceed its permitted Cap Load.
- DEP final approval of this point source certification was published in the Pennsylvania Bulletin on October 3, 2015 and will expire on September 30, 2017.
- Beginning October 1, 2015 (Compliance Year 2016), the calculation of credits will be made using new formulas. The formulas and an example are below.

Point Source Credit Calculations

The calculation of TN and TP credits will be made using the following formulas after the end of a Compliance Year:

$$\text{TN Credits: } [(Q * (6.0 - \text{TNConc}) * 8.34) / n] * y * \text{TNdr} * 0.9$$
$$\text{TP Credits: } [(Q * (0.8 - \text{TPConc}) * 8.34) / n] * y * \text{TPdr} * 0.9$$

Where:

- Q = Average Daily Flow on day of sampling (MGD)
- TNConc = TN Effluent Concentration in sample (mg/L)
- TPConc = TP Effluent Concentration in sample (mg/L)
- 6.0 = TN concentration baseline value for credit generation (mg/L)
- 0.8 = TP concentration baseline value for credit generation (mg/L)
- n = Number of samples taken during the year
- y = Days in the year (365 or 366)
- TNdr = TN Chesapeake Bay delivery ratio
- TPdr = TP Chesapeake Bay delivery ratio
- 0.9 = 10% Reserve ratio
- 8.34 = Gallons to pounds conversion factor

The average daily flow on the day of sampling in million gallons per day (MGD) is multiplied by the conversion factor of 8.34 and the difference between the actual TN and TP effluent concentrations in the sample collected and 6.0 mg/L and 0.8 mg/L, respectively. The sum of these values is divided by the number of samples taken during the Compliance Year, and then multiplied by the number of days in the Compliance Year, the TN/TP Delivery Ratio, and 0.9 (to account for a 10% reserve).

Example 1 Credit Calculation

This example assumes only one sample is collected per month for TP. The actual number of samples will generally be greater. Assume the TP delivery ratio is 0.436 and there is no local TP limit.

Effluent sampling at a sewage treatment facility produces the following TP data for a Compliance Year:

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Sampling Date	Effluent TP (mg/L)	Average Daily Flow on Day of Sampling (MGD)
10/1/2015	0.7	2.2
11/1/2015	0.5	2.5
12/1/2015	0.4	2.0
1/1/2016	0.3	1.9
2/1/2016	0.6	2.0
3/1/2016	1.0	2.3
4/1/2016	0.4	2.6
5/1/2016	0.6	2.1
6/1/2016	0.5	2.0
7/1/2016	0.4	1.9
8/1/2016	0.3	1.8
9/1/2016	0.4	1.9

Step 1: Determine Total Daily Load Below Baseline

Subtract each Effluent TP concentration result from the nutrient trading baseline TP concentration (0.8 mg/L). (Note that for TN, the same step is performed using the nutrient trading TN baseline concentration of 6.0 mg/L). The difference is then multiplied by the Average Daily Flow on Day of Sampling and the conversion factor of 8.34. If the Effluent TP concentration exceeds 0.8 mg/L, the values will be negative. Sum the Daily Loads Below Baseline (i.e., find the sum of both positive and negative daily load values).

Calculations and rounding should be completed in accordance with DEP’s guidance document, [Discharge Monitoring Reports Overview and Summary](#) (3800-BK-DEP3047). If there are non-detect values (e.g., < 1); ignore the less than symbol and use the reported value (laboratory quantitation limit) to calculate credits.

Sampling Date	Effluent TP (mg/L)	Baseline TP (mg/L)	Difference (mg/L)	Average Daily Flow on Day of Sampling (MGD)	Daily Load Below Baseline (lbs/day)
10/1/2015	0.7	0.8	0.1	2.2	1.83
11/1/2015	0.5	0.8	0.3	2.5	6.26
12/1/2015	0.4	0.8	0.4	2.0	6.67
1/1/2016	0.3	0.8	0.5	1.9	7.92
2/1/2016	0.6	0.8	0.2	2.0	3.34
3/1/2016	1.0	0.8	- 0.2	2.3	- 3.84
4/1/2016	0.4	0.8	0.4	2.6	8.67
5/1/2016	0.6	0.8	0.2	2.1	3.5
6/1/2016	0.5	0.8	0.3	2.0	5.0
7/1/2016	0.4	0.8	0.4	1.9	6.34
8/1/2016	0.3	0.8	0.5	1.8	7.51
9/1/2016	0.4	0.8	0.4	1.9	6.34
TOTAL:					59.55

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Step 2: Divide Total Daily Load Below Baseline by the number of samples collected during the Compliance Year:

$$59.55 / 12 = 4.96$$

Step 3: Multiply by the number of days in the Compliance Year, the TP Delivery Ratio and 0.9:

$$4.96 \times 366 \times 0.436 \times 0.9 = \mathbf{713 \text{ TP Credits}}$$

NOTE – 713 TP Credits will be generated only IF the Annual Total Mass Load for TP is less than the Cap Load for TP. If the Cap Load is exceeded, no Credits will be generated.

Example 2 Credit Calculation

This example illustrates how a facility with a local nutrient limit that is above the baseline concentrations for trading can purchase credits to comply with a Cap Load. In this example, the Cap Load of 6,000 lbs/year TP is in effect with a TP delivery ratio of 0.436:

Sampling Date	Effluent TP (mg/L)	Average Daily Flow on Day of Sampling	Daily Load (lbs/day)
10/1/2015	2.1	2.2	38.5
11/1/2015	1.2	2.5	25.0
12/1/2015	1.6	2.0	26.7
1/1/2016	1.9	1.9	30.1
2/1/2016	2.0	2.0	33.4
3/1/2016	1.8	2.3	34.5
4/1/2016	1.4	2.6	30.4
5/1/2016	1.5	2.1	26.3
6/1/2016	1.2	2.0	20.0
7/1/2016	1.7	1.9	26.9
8/1/2016	2.0	1.8	30.0
9/1/2016	1.9	1.9	30.1
TOTAL:			352

$$\text{Annual Total Mass TP Load: } (352 / 12) \times 366 = 10,736 \text{ lbs TP/year}$$

The facility is over its TP Cap Load by 4,736 lbs-TP (10,736 – 6,000). The facility may purchase credits to come into compliance. The amount of TP Credits the facility would need to purchase is calculated as follows:

$$(\text{Annual Total Mass Load} - \text{Cap Load}) \times \text{delivery ratio}$$

$$(10,736 - 6,000) \times 0.436 = 2,065 \text{ TP Credits}$$

DEP's [Annual Chesapeake Bay Spreadsheet](#) provides automated calculations of nutrient credits generated on an annual basis using raw (daily) self-monitoring data. Use of this spreadsheet is required for wastewater facilities that wish to register credits with DEP.

NOTE – A mechanism that recognizes the generation of nutrient credits by Significant Industrial Waste facilities has not been developed by the Nutrient Trading Program at this time.

B. Nonpoint Sources (NPS)

As a result of EPA's concerns and objections to NPDES permits related to the baseline and threshold eligibility requirements for the generation of credits by agricultural operations, DEP has not approved any requests for credit certification for nonpoint sources since October 1, 2013. To address EPA's concern and ensure consistency with the Chesapeake Bay TMDL, DEP is implementing a 3:1 trading ratio as an interim step until DEP can develop a performance-based or other approved method-based tool to use to establish baseline eligibility for nonpoint sources. DEP plans to implement this approach as described below.

1. Credit Certifications Using Practice Based Approach Through September 30, 2017

For nonpoint sources, baseline eligibility requirements include compliance with the following regulations, as applicable:

- 25 Pa. Code Chapter 102, Erosion and Sedimentation Control Regulations – All plowing and tilling activities must implement and maintain BMPs to minimize the potential for accelerated erosion and sedimentation. Written erosion and sedimentation control plans are required for agricultural plowing or tilling or animal heavy use areas that disturb 5,000 square feet or more.
- 25 Pa. Code Section 91.36 – these regulations define pollution control and prevention requirements at agricultural operations, including requirements related to land application of animal manure.
- 25 Pa. Code Section 92a.29 – these regulations define the requirements for Concentrated Animal Feeding Operations (CAFOs) with NPDES permits.
- 25 Pa. Code Chapter 83, Subchapter D – these regulations promulgated by the State Conservation Commission define and regulate Concentrated Animal Operations (CAOs) through the development and implementation of Nutrient Management Plans.

The additional threshold eligibility requirements that must be met before an agricultural operation can generate credits include implementation of one of the following:

- Manure is not mechanically applied within 100 feet of a perennial or intermittent stream with a defined bed or bank, a lake or a pond, and commercial fertilizer is applied at or below appropriate agronomic rates.
- A minimum of 35 feet of permanent vegetation is established and maintained between the field and any perennial or intermittent stream with a defined bed or bank, a lake, or a pond. No mechanical application of manure may occur within the 35 foot vegetative buffer.
- A downward adjustment of at least 20% to the overall amount of pollution reduction generated by the pollution reduction activity.

An additional 3:1 trading ratio will be applied to the number of credits generated once the

defined baseline compliance and threshold is reached, as authorized by the regulations (25 Pa. Code § 96.8(e)(3)(vi)). The credit calculation tools that must be used to calculate the number of Credits to be certified are the [TN](#) and [TP](#) practice-based spreadsheets created by DEP and the World Resource Institute (WRI) for the Nutrient Trading Program in 2007.

These Credit certifications approved by DEP will expire September 30, 2017, regardless of when DEP receives the credit certification application.

In addition to the regulatory and threshold requirements identified above, in order to be able to generate credits from the hauling of poultry manure, the poultry manure must be applied to a site outside of the Chesapeake Bay watershed that is nutrient deficient in accordance with a nutrient management plan or nutrient balance sheet completed by a certified nutrient planner. The application of commercial fertilizer to the site where the poultry manure is being removed must be tracked and documented. The additional 3:1 trading ratio will be applied to the final number of credits generated.

The eligibility of manure destruction and conversion technologies will be determined based upon a thorough review of the individual technology and, at a minimum, compliance with all local, state, and federal requirements. If the number of credits generated will be verified using a comprehensive sampling and monitoring protocol where actual reductions in nutrients can be measured and verified; no additional adjustment may be necessary. However, if it is determined during the technical review of the verification plan that the sampling and monitoring protocols are not sufficient to ensure consistency with the defined Chesapeake Bay Program (CBP) protocols¹, then an additional ratio of up to 3:1 may be applied to the generated credits. These approved certifications will expire September 30, 2017, regardless of when DEP receives the credit certification application.

2. Approval of Credit Certifications After October 1, 2017, or when the approved WRI Multi-State Trading Tool or other approved tool is finalized and calibrated to Phase 6 of the Chesapeake Bay Watershed Model, whichever is earlier.

DEP is in the process of refining the WRI Multi-State Trading Tool being developed in partnership with the Chesapeake Bay Foundation and the Chesapeake Bay Program to calculate credits from agricultural nonpoint sources using a performance based approach. When this tool is developed and calibrated to Phase 6 of the Chesapeake Bay Watershed Model, eligibility to generate credits will be determined by compliance with the previously mentioned regulations in Section 1 above as applicable, and use of this new performance-based tool to establishing the baseline nutrient loading.

DEP will approve credit certification requests that calculate credits using the performance-based trading tool approved by DEP where the pollution reduction activity exceeds the nutrient baseline loading rate² (lbs TN or TP/acre) as determined by the Chesapeake Bay Watershed TMDL model run. These credit certifications will be approved for five years.

In addition to the regulatory requirements identified above, in order to be able generate

¹ The Chesapeake Bay Program has formed an Expert Panel to determine pollution control performance measure estimates, specifically N, P, and sediment, for several BMPs that fall under a broad umbrella of practices termed "manure technologies." Approximate completion of these BMP protocols is the end of 2015.

² The scale of the definition of this loading rate requirement will be defined when the credit calculation tool is finalized and calibrated. The final loading rates that must be met will be posted on the DEP website at www.dep.pa.gov/nutrient_trading.

credits from the hauling of poultry manure, the poultry manure must be applied to a site outside of the Chesapeake Bay watershed that is nutrient deficient in accordance with a nutrient management plan or nutrient balance sheet completed by a certified nutrient planner. Demonstration of the baseline loading rate at the site from where the manure is hauled and the calculation of any adjustments due to the application of replacement fertilizer will be made using the performance-based trading tool. These credit certification applications will be approved for five years.

The eligibility for manure destruction and conversion technologies will be determined based upon a thorough review of the individual technology and, at a minimum, compliance with all local, state, and federal requirements. If the number of credits generated will be verified using a comprehensive sampling and monitoring protocol where actual reductions in nutrients can be measured and verified, no additional adjustment may be necessary. However, if it is determined during the technical review of the verification plan that the sampling and monitoring protocols are not sufficient to ensure consistency with defined CBP protocols, then an additional adjustment may be made using the performance-based modeling tool and/or other technology specific CBP approved modeling/calculation tools to calculate the final number of generated nutrient credits. These certification applications will be approved for five years.

Should this performance-based modeling tool not be available by September 30, 2017, DEP will continue to review requests for credit certification using the practice-based approach with the 3:1 trading ratio as described above until the performance-based modeling tool becomes available. Credit certification applications previously approved under the practice-based approach that expire on September 30, 2017, may be administratively extended for a total term of not more than five years until the performance-based modeling tool becomes available on an annual basis (25 Pa. Code § 96.8(e)(8)).

IV. Certification Review Process

Certification is a written approval by DEP of a proposed pollutant reduction activity to generate credits before the credits are verified and registered for compliance with a NPDES permitted facility.

Nonpoint Sources

A general overview of DEP's certification process for nonpoint sources follows:

- All credit certification applications must be submitted using DEP form, [Certification of Nutrient Credits Nonpoint Source, Document #3800-FM-BPNPSM0503](#).
- All credit calculations must be made using the appropriate [Nitrogen](#) or [Phosphorus](#) spreadsheet found on the DEP Nutrient Trading website at http://www.dep.pa.gov/nutrient_trading.
- Within several weeks of receipt of the request for certification, an administrative completeness review will be performed.
- Administratively complete credit certification applications will be published in the PA Bulletin for public comment. The Bulletin Notice will allow 30 days for public comment.
- During the public comment period, DEP will complete the technical review of the credit certification application.
- After the 30 day time period given for public comments AND successful completion of a technical review, DEP may approve the request for certification.

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- A Verification Plan is also required to be submitted as part of the Certification request. The template for this plan should be the Natural Resource Conservation Service (NRCS) Job Sheet(s) for the practice(s) to be verified; however, variations from this standard will be considered. This Verification Plan is reviewed and approved by DEP before certification is approved.
- The currently approved spreadsheets for both point and nonpoint source generators are located on DEP's Nutrient Trading Website at http://www.dep.pa.gov/nutrient_trading.

The generators of existing approved nonpoint source credits will need to re-apply for credit generation six months before expiration of their current certification where the adjustments described above to the credit calculation methodology will be made. Generators should check DEP's Nutrient Trading Website at http://www.dep.pa.gov/nutrient_trading for any changes in the application process relative to re-application.

Point Sources

As noted above, to be eligible to generate credits for sale, all Significant Sewage point source discharges with Annual Net Mass Load effluent limitations ("Cap Loads") in an NPDES permit (see the [Point Source Generators Table](#), Table 7-1 of the [Phase 2 WIP Wastewater Supplement](#)) must demonstrate effluent concentrations below 6.0 mg/L TN and 0.8 mg/L TP, as well as general compliance with the permit. This point source certification expires on September 30, 2017, so point sources will not be required to submit requests for certification of credits to DEP prior to that time. However, requests for the verification and registration of credits for compliance purposes will still be required.

V. Verification Process

Verification is a written approval by DEP that the pollutant reduction activity(s) generated nutrient credits based upon the approved verification plan in the certification application. The following explains the verification process:

- Nonpoint source credit generators must follow their approved verification plan to generate and have DEP approval of credits before they can sell them.
- Point sources must submit their Discharge Monitoring Report (DMR) information using the Annual Chesapeake Bay Spreadsheet, available on [DEP's website](#).
- Verified credits may only be used in the Compliance Year in which they were generated.
- Nonpoint source credit generators will use the [Nitrogen Spreadsheet](#) and [Phosphorus Spreadsheet](#) to calculate nutrient credits in addition to all other conditions set forth in their approved certification.
- Point source credit generators will use the [Annual Chesapeake Bay Spreadsheet](#) to calculate credits in addition to all other conditions set forth in their approved certification.
- The appropriate Chesapeake Bay Model Delivery ratio is applied to all verified pollution reduction activities. The delivery ratios for sewage treatment facilities are defined in Table 7.1 of the [Phase 2 WIP Wastewater Supplement](#). The delivery ratios for nonpoint sources are summarized below by Chesapeake Bay Watershed Model Segment.
- A 10% reserve factor is applied to all verified pollution reduction activities.

VI. Registration Process

- Registration is the sale of credits and assignment of those credits to an NPDES permit.
- Buyers and Sellers must fill out the [Registration Form, 3800-FM-BPNPSM0504](#), attach a valid contract, and send these documents to DEP to start the registration process.

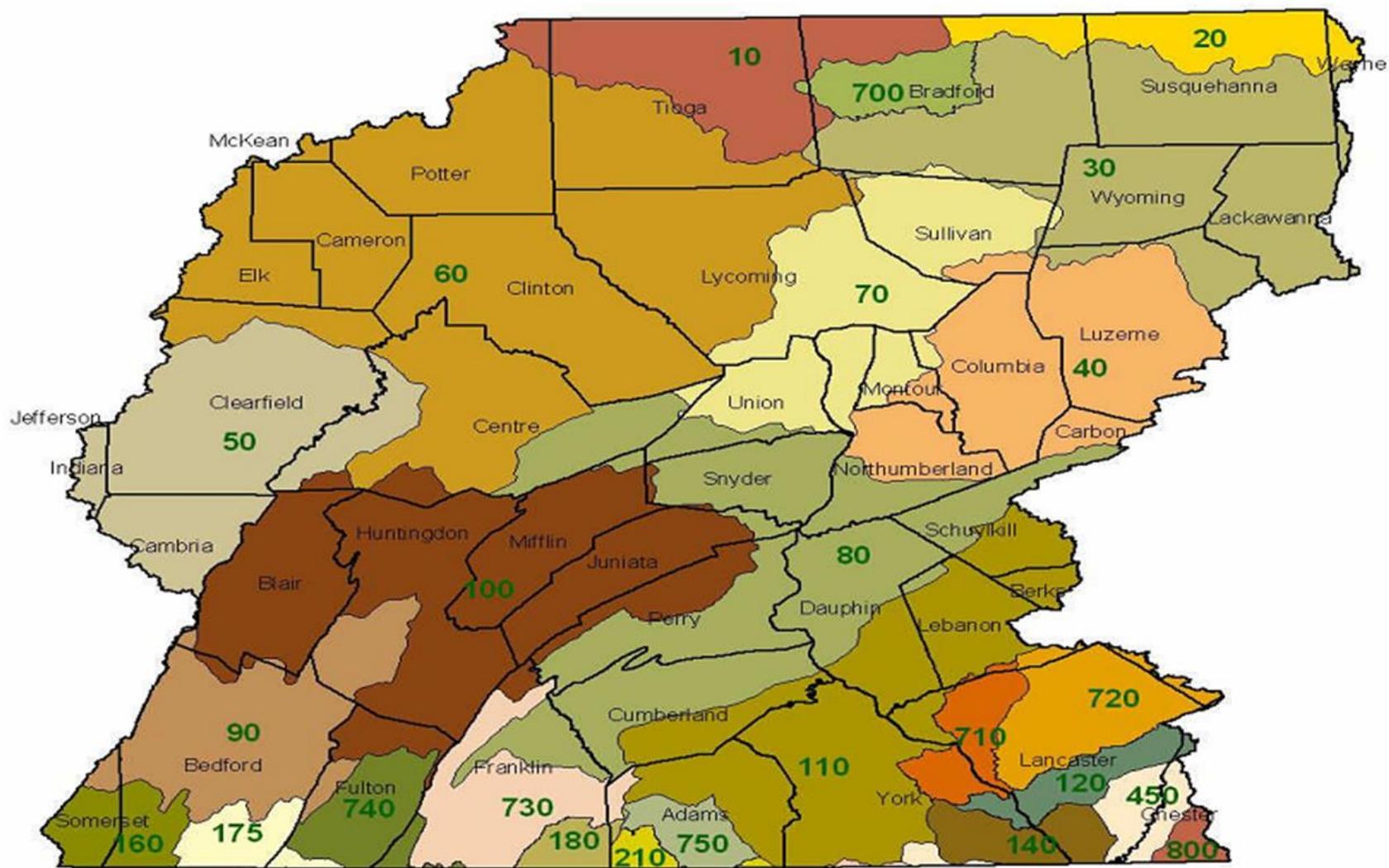
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- After review, DEP will issue a Registration letter to the seller and buyer listing the number of credits applied to the NPDES permit and a registry number.

Data on Certification, Verification, and Registration is tracked in the DEP Nutrient Trading Database and posted on the DEP website at http://www.dep.pa.gov/nutrient_trading.

Watershed Segment Map

This map is coded by colors and each color corresponds to a segment (the number in green). This segment number will then allow you to choose the appropriate nitrogen or phosphorous delivery ratio and appropriate nitrogen or phosphorous edge of segment ratio from the table listed on the second page. For example, if your property is in Bedford, you would be in segment 90 which would give a nitrogen delivery ratio of 0.897 and a nitrogen edge of segment ratio of 15 % to 45% depending on the tillage practice.



Delivery and EOS Ratios

Watershed Segment	Nitrogen Delivery Ratio	Nitrogen EOS Ratio (see Notes 1 & 2)				Watershed Segment	Phosphorus Delivery Ratio	Phosphorus EOS Ratio (see Notes 1 & 2)			
		Conventional Till	Conservation Till	Hay	Pasture			Conventional Till	Conservation Till	Hay	Pasture
10	0.474	36%	29%	89%	15%	10	0.436	10%	4%	4%	15%
20	0.495	38%	31%	34%	16%	20	0.436	13%	7%	5%	16%
30	0.733	43%	31%	78%	16%	30	0.436	11%	6%	7%	16%
40	0.871	42%	38%	60%	12%	40	0.436	12%	10%	7%	12%
50	0.836	50%	38%	97%	18%	50	0.436	15%	6%	14%	18%
60	0.93	55%	31%	78%	15%	60	0.436	11%	4%	16%	15%
70	0.941	45%	45%	86%	13%	70	0.436	27%	7%	12%	13%
80	0.951	32%	25%	75%	10%	80	0.436	12%	7%	7%	10%
90	0.897	45%	34%	49%	15%	90	0.436	11%	4%	12%	15%
100	0.88	35%	29%	32%	12%	100	0.436	8%	3%	5%	12%
110	0.961	31%	22%	27%	10%	110	0.436	9%	5%	5%	10%
120	0.98	29%	21%	20%	9%	120	0.436	8%	3%	4%	9%
140	0.99	30%	22%	22%	9%	140	0.436	25%	10%	7%	9%
160	0.583	33%	28%	59%	23%	160	0.67	32%	27%	7%	23%
175	0.7	33%	22%	29%	20%	175	0.67	5%	5%	6%	20%
180	0.819	34%	38%	58%	9%	180	0.67	9%	7%	4%	9%
210	0.72	46%	33%	40%	10%	210	0.669	11%	7%	7%	10%
450	1	30%	22%	16%	9%	450	1	5%	2%	2%	9%
470	1	25%	17%	23%	6%	470	1	22%	3%	3%	6%
700	0.7	40%	35%	37%	13%	700	0.436	7%	6%	5%	13%
710	0.97	28%	21%	15%	9%	710	0.436	6%	2%	2%	9%
720	0.891	27%	21%	16%	9%	720	0.436	6%	3%	3%	9%
730	0.683	23%	22%	43%	11%	730	0.67	15%	8%	6%	11%
740	0.749	21%	17%	50%	12%	740	0.67	12%	8%	8%	12%
750	0.627	47%	33%	38%	10%	750	0.67	13%	7%	5%	10%
800	1	48%	34%	34%	9%	800	1	15%	8%	11%	9%

Notes:

1. The portion of nutrient loads leaving a watershed were estimated by adding the manure, fertilizer, air deposition and mineral/residual nutrient inputs for each watershed and subtracting the estimated crop uptake from the total nutrient inputs. The remaining nutrient loads after crop uptake were then divided by the estimated loads leaving the watershed to calculate the edge of watershed percents.
2. All calculations based on watershed simulations completed by EPA's Chesapeake Bay Program Office.