

# A Primer on Water Quality Credit Trading in the Mid-Atlantic Region



The Mid-Atlantic Regional Water Quality program is a coordinated effort among: Delaware State University; University of Delaware; University of Maryland; University of Maryland, Eastern Shore; The Pennsylvania State University; Virginia State University; Virginia Tech; West Virginia University; West Virginia State University

## Water Quality Credit Trading—An Overview

Water quality credit trading is a tool for reducing the cost of meeting the environmental goal of controlling nutrients and sediments that severely affect streams, rivers, lakes, and estuaries. Some states in the Mid-Atlantic have begun to encourage trading through legislation and rulemaking.

All those involved in making or shaping policies must understand that water quality credit trading presents opportunities, such as lowered costs for pollution reduction, but is accompanied by challenges. These challenges include gaps in knowledge and resultant uncertainty about the outcomes. How can citizens influence the process as trading programs emerge? For starters, become familiar with what trading is and what it offers, the terms associated with trading, and the key questions for evaluating the potential of a trading program to reach water quality goals at the lowest cost to society.

Trading has gained interest as a potential tool in large part due to the severity of aquatic conditions in the Chesapeake Bay. Traditional environmental policies, such as technology-based permits for industrial and municipal wastewater facilities, have not solved the problem. The nutrients (nitrogen and phosphorus) and sediments entering the bay from a variety of sources have caused the depletion of dissolved oxygen, threatening the health of plant and animal life in the Chesapeake Bay, the area's biodiversity, and bay-dependent economic sectors such as commercial fisheries.

As trading is discussed, it is essential to keep in mind that the end goal of trading is water quality improvement at lower costs, which are achieved by providing polluters flexibility in how they reduce pollutants like nutrients and sediments. One form of water quality trading is based on the generation of "credits." Credits are the "goods" used in

trades and are defined as a unit of pollution reduction beyond levels required by federal or state rules. Credits can be purchased by polluters with higher pollution-abatement costs and used to comply with their pollution-reduction requirements.

Market-based programs to reduce pollution are not new. In the United States, successful air emissions trading programs have removed sulfur dioxide air plumes and saved billions of dollars over several decades. However, air and water are very different environmental media—air pollution will disperse at the source and is not contained the way a stream, river, or watershed contains water and its pollutants.

While there is interest in trading as a tool for cost-effective reductions in water pollution, the success of water quality credit trading will depend on watershed-specific factors, which include the number and location of pollution sources and their relative costs of pollution reduction, as well as specific trading rules such as the ratio of exchange of pollution reductions between sources upstream and downstream.

### Should I Be Informed about Water Quality Credit Trading?

- Are you a farmer?
- Do you manage a wastewater discharge?
- Are you involved in local watershed activities—monitoring or management?
- Do you work with or serve on a board, commission, or authority?
- Are you concerned about the costs of water pollution control?
- Are you concerned about the well-being of the Chesapeake Bay and local water quality?

If any of these apply to you, then water quality credit trading may be a topic worth researching.

Who has a stake in trading? Key stakeholders in trading include prospective buyers or sellers—the entities that will have the ability to reduce pollution and create credits—as well as residents vested in the condition of the watershed.

## Varied Focus of State Trading Programs

### Types of Trades

- **Point source–point source (PS/PS):** Point-source dischargers, such as a municipal and industrial wastewater treatment plants, are legally bound by a National Pollution Discharge Elimination System (NPDES) permit that sets specific limits for the pollutants in their discharge. Some point sources can reduce pollutants in their discharges below the NPDES limits, thereby generating credits. Other point sources can purchase these credits to substitute for their own more costly pollution reductions required to meet their NPDES permit limits.
- **Point source–nonpoint source (PS/NPS):** Credits are generated by a nonpoint-source discharger—pollution sources that do not have a discharge pipe and are unlikely to have an NPDES permit—like farm. The credits will likely be purchased by a point source that needs to meet its NPDES permit limits.

### Pollutants

Pollutants that can be removed to generate credits to trade in some Mid-Atlantic states include nitrogen, phosphorus, and sediment. However, trading programs can be designed to address other water quality conditions or pollutants such as temperature and metals.

## How Does Water Quality Credit Trading Work?

Water quality credit trading is a market-based approach for reducing the costs of removing pollution. Pollution-control costs can differ from source to source. The traditional approach of uniform, technology-based standards does not permit trading, so sources are required to remove pollutants to meet the standards regardless of costs. However, costs can be minimized by allowing sources to reallocate reductions according to their pollution-abatement costs. Well-designed trading programs can achieve this allocation by harnessing the forces of the market. This flexibility creates incentives to discover cheaper and more efficient methods for pollution abatement. Economists predict that society will be better off through trading because overall pollution reduction costs are lower than if trading were not allowed.

### Simplified Example of a Trade

Two separate entities within a watershed each have a water discharge that has a pollutant of interest in it. For this example, the pollutant is phosphorus (P).

#### Scenario 1: No Trading Allowed

Municipal Wastewater Treatment Plant (WWTP)	Farmer
\$30 to remove one unit of P from this discharge using best available technology (BAT).  (Example of BAT for removal of P: Enhanced biological phosphorus removal applied to activated sludge systems)	\$20 to remove one unit of P from this discharge using best management practice (BMP).  (Example of BMP for removal of P: Establishment of a forested riparian buffer adjacent to the stream)
What are the total costs of removing one unit of P from each discharge (two units total)?	
Pollution Reduction Expenditure = WWTP \$30 + Farmer \$20	
Total costs for removal of two units of P = \$50	

In a trading scenario between these two dischargers, the WWTP, who has a higher cost for removing one unit of phosphorus, would pay the farmer to remove an extra unit of phosphorus at the lower cost. The payment that the WWTP makes to the farmer is negotiated between them.

#### Scenario 2: Trading Allowed

WWTP	Farmer
\$30 to remove one unit of P from this discharge using BAT	\$20 to remove one unit of P from this discharge using BMP
Farmer generates one "credit" by removing an extra unit of P from the farm discharge, and sells this credit to the WWTP	
Pollution Reduction Expenditure = WWTP \$0 + Farmer \$40	
Total costs for removal of two units of P = \$40	

The overall result is that two units of P were removed from this discharge with a potential savings of \$10 in expenditures.

## Why the Increased Interest in Water Quality Credit Trading?

Point sources (dischargers with a pipe, such as municipal or industrial wastewater treatment plants) are currently regulated using command and control technologies and discharge permit limits. Most nonpoint sources such as farms and urban areas—places where the rainwater and terrain contribute to movement of pollutants into streams and rivers—cannot be controlled in this manner. The variability and disperse nature of nonpoint-source pollution create a challenge to all types of environmental policies, including trading. However, trading programs are flexible and can be designed to address these issues.

Under the Clean Water Act, regulators can impose total maximum daily loads (TMDLs), which essentially are a budget for the amount of allowable pollutants for a particular water body. By establishing a pollutant cap on a watershed, the TMDLs serve as a driver for creating a market for water quality credit trading. Trading creates the possibility that point sources may meet their pollutant allotments by buying credits from other point sources and nonpoint sources, provided that the overall amount of pollutant in the water body is within the TMDL pollutant cap.

## Components of a Trading Program

The following table defines the key components and examples for establishing a state trading program.

Key Component	Example
<b>Public water quality goals</b> are set by federal, state, or local authorities based on public input and can be defined in terms of ecosystem restoration, improvement of fish population or public safety, or as pounds of pollution load reduced.	The Clean Water Act's "fishable and swimmable" waters and the Chesapeake Bay Agreement's "restoring and protecting the ecosystem and the living resources of the Chesapeake Bay."
<b>Pollution cap for a watershed</b> is a limit on the total pollution load from all sources to a water body. Usually the cap is set for an annual load of specific pollutants. The size of the cap is based on the public's water quality goals.	TMDLs and tributary strategies (i.e., regional and state designated pollution reduction goals that serve as caps).
<b>Regulated baseline for point sources</b> is the numeric level of pollutant load allowed at a particular point in time.	An NPDES permit provides an allowable pollution limit for industrial and municipal point sources. Group or watershed permits that cover several point sources also provide this limit.
<b>Regulated baseline for nonpoint sources</b> is the numeric level of pollutant load allowed at a particular point in time.	A TMDL may set allowable pollution limits for nonpoint sources.
<b>Unregulated baseline for agricultural nonpoint sources</b> is the minimum level of pollution abatement an agricultural operation must achieve before it can participate in a trading program.	A set of BMPs that create a minimum level of pollution abatement required by a specific trading program.
<b>Credits</b> are units of goods (pollution reduction) to be traded in the water quality market. Credits are generated for every unit of pollution reduction beyond the baseline level.	Implementation of agricultural BMPs beyond the baseline may generate credits. Point sources, both industrial and municipal, that implement new treatment technologies and reduce pollutants beyond their baseline may also generate credits.
<b>Sellers (credit suppliers)</b> are the dischargers that reduce pollution below the baseline and generate credits for sale in the market. Credits can also be sold by intermediaries, if allowed by program rules.	Farmers who implement BMPs; industrial point sources that install new abatement technologies; intermediaries such as credit banks or aggregators.
<b>Buyers (demanders for credits)</b> are the dischargers with regulated baselines for whom pollution reduction is expensive. For these sources, it is less costly to buy pollution credits from other parties and use these credits to help achieve their baseline loads. Credits can also be purchased by intermediaries and third parties, if allowed by program rules.	Wastewater treatment plants with a regulated baseline and high abatement costs; third-party buyers, like watershed groups, aiming at reduction of pollution by purchasing and retiring credits from the market; intermediaries, such as credit banks or aggregators.
<b>Credit price</b> can be determined from negotiations between the credit buyer and seller. Usually, the price cannot be lower than the costs of load reductions incurred by the seller, and it cannot be higher than the cost that of an abatement alternative for the buyer.	The lower the price of the credits offered by the seller (e.g., farmer), the more willing the credit buyer (e.g., wastewater treatment plant) is to purchase the credits. The break-even credit price for a farmer equals the ratio of the BMP implementation cost to the number of credits generated by the BMP. If the sale price is above the break-even level, the farmer would profit from the sale. If the sale price is below the break-even level, the farmer would not receive enough revenue to cover the costs of implementing the BMP.
<b>Trading ratio</b> is the number of load-reduction credits from one source can be used to compensate excessive loads from another source.	A delivery trading ratio is set to ensure that trading among distant sources (e.g., upstream and downstream) does not violate an overall watershed pollution cap. Uncertainty trading ratio specifies the number of pollution reduction credits generated by the nonpoint source that should be purchased by the point source to offset one unit of their own discharge. The ratio is set to account for seasonal and daily changes in nonpoint source loading, and can be set greater, equal, or less than one.
<b>Regulator</b> is the entity that determines the water quality goals, establishes caps for pollutants in a watershed, approves and administers the trading program, and monitors and enforces the rules.	State, regional, and federal agencies and local authorities.

## Challenges for Water Quality Credit Trading Programs

Even with the necessary components for a trading program in place, certain challenges must be addressed to set up a water quality credit trading program. Many of the challenges relate to point source–nonpoint source trades, in which the regulated community (NPDES permit holders) meets the unregulated community (agriculture and other nonpoint sources). The following are some of these challenges.

**Setting pollution caps.** In order to create demand for trades, a maximum load, or “cap,” must be set for a watershed and enforced by the regulatory agency. While public water quality goals are often linked to services a water body provides (e.g., fish habitat), trading requires that a cap be defined for specific pollutants. This presents a challenge for accurately estimating the amount of pollution reduction necessary to achieve the public’s goals. In addition, consistent enforcement of the cap is necessary for trading to occur.

**Establishing baselines for pollution load.** A nonpoint-source pollution load is spread over large areas and varies by site-specific factors and weather, which complicates the selection of the baseline. For both point and nonpoint sources, establishing baselines often raises questions about responsibility for pollution cleanup, property rights of landowners, fairness, and related issues.

**Complexities in establishing credits.** For nonpoint sources, accurately measuring pollution reduction for a BMP is difficult. The effectiveness of a BMP depends on site-specific conditions, its age, its implementation, and how well it has been maintained. Scientific models are often used to estimate load reduction from BMPs. Due to imperfections that exist in almost all models, the estimated reductions from a BMP will likely differ from actual loadings. This creates uncertainty about the magnitude

of water quality improvement from a trade. Finally, many current nonpoint BMPs have been funded with public cost-share money. A debate exists in many states about whether BMPs installed using public funds should be eligible for trades.

**Transaction costs.** The degree of difficulty in finding a buyer or seller and negotiating and implementing a trade are all examples of transaction costs. A beginning point for a market exchange is that buyers and sellers can easily locate one another and negotiate a trade. Because nonpoint sources are widely distributed across a watershed, the transaction costs of making trades involving nonpoint sources will almost always be higher than the costs for point source–point source trades. A mechanism that can help buyers and sellers find each other (e.g., through a credit bank or a clearinghouse) may be a way to reduce some transactions costs and increase the potential for trades.

**Enforcing contracts and liability issues.** For the benefits of trading to be realized, there must be a mechanism to ensure that agreements arrived at in a trade are met (i.e., the contract is enforced). When sources with a regulated baseline (such as point sources) buy credits from polluters with an unregulated baseline (such as nonpoint sources), the buyers are legally liable for achieving pollution reductions. In contrast, the only document binding the sellers is the private contract with the buyer. As a result, the buyer is responsible for monitoring the seller and enforcing the trade agreement. One possible approach to help alleviate liability issues is to use a mediating body that can monitor and enforce the trading contract. Another possible approach is to place a share of purchased credits in an “insurance pool” to guarantee that the buyer’s regulated baseline is met even if one seller fails to deliver the credits.

## Emerging State Water Quality Credit Trading Programs—How Will Trading Advance Water Quality Goals?

Currently, the Mid-Atlantic states are in different stages of trading program development. Below are important questions about trading that citizens should consider:

- How will the state evaluate whether its trading program is successful in meeting its goal of reducing water pollution and improving water quality?
- Will the state’s program have unintended consequences (e.g., creation of “hotspots”—concentrated areas of pollutants)?
- Is a monitoring program in place that will assess the effectiveness of the BMPs, the reduction of the overall pollution load, and the water quality of the receiving streams or rivers?
- Has the state assessed the costs of a trading program versus the benefits of improved water quality?
- Is trading the best tool for helping to reach the state’s water quality goals?
- Is the trading program coordinated with other programs that are addressing the same or other pollutants?

Citizens interested in trading and how to cost-effectively achieve water quality in their state may wish to ask their administering agency these questions. Because trading is a tool of interest to the states, formulating a plan for evaluating the success of the tool is essential. Citizen interest and inquiry about evaluation can help states ensure that the goal of water quality improvement remains the end result of its trading program.

## Web-Based Resources on Water Quality Credit Trading

### State Activities

Agency Web sites are good sources for determining the level of state activity in water quality credit trading. For states that do not have pages dedicated to trading programs, check the home page and search using keywords such as “nutrient trading” or “water quality credit trading.”

#### Delaware

[www.dnrec.state.de.us/water2000/index.asp](http://www.dnrec.state.de.us/water2000/index.asp)

#### Maryland

[www.mde.state.md.us/water/nutrientcap.asp](http://www.mde.state.md.us/water/nutrientcap.asp)

#### Pennsylvania

[www.dep.state.pa.us/river/nutrient%20trading.htm](http://www.dep.state.pa.us/river/nutrient%20trading.htm)

#### Virginia

[www.deq.state.va.us/vpdes](http://www.deq.state.va.us/vpdes)

#### West Virginia

[www.wri.nrcce.wvu.edu/programs/pwqb/index.cfm](http://www.wri.nrcce.wvu.edu/programs/pwqb/index.cfm)

### Other Educational Resources

**“Environmental Credit Trading: Can Farming Benefit?” Amber Waves, USDA Economic Research Service**  
[www.ers.usda.gov/AmberWaves/July06SpecialIssue/Features/Trading.htm](http://www.ers.usda.gov/AmberWaves/July06SpecialIssue/Features/Trading.htm)

**“Getting Paid for Stewardship: An Agricultural Community Water Quality Trading Guide,” Conservation Technology Information Center**  
[www.conservationinformation.org](http://www.conservationinformation.org)

### Mid-Atlantic Regional Water Quality Program

[mawaterquality.org/Publications/Trading\\_resources\\_directory.doc](http://mawaterquality.org/Publications/Trading_resources_directory.doc)

### Nutrient and Water Policy Update

[nutrientwaterpolicy.aers.psu.edu](http://nutrientwaterpolicy.aers.psu.edu)

### “Putting the ‘Market’ in Market-Based Water Quality Management,” Virginia Water Resources Research Center

[www.vwrrc.vt.edu/pdfs/newsletter/027aug2003onecol.pdf](http://www.vwrrc.vt.edu/pdfs/newsletter/027aug2003onecol.pdf)

### U.S. Department of Agriculture

[www.nal.usda.gov/wqic/trading.shtml](http://www.nal.usda.gov/wqic/trading.shtml)

### U.S. Environmental Protection Agency

[www.epa.gov/waterqualitytrading](http://www.epa.gov/waterqualitytrading)

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To learn more about the Mid-Atlantic Regional Water Quality Program visit our Web site at: <http://www.mawaterquality.org/>.

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