

Appendix B. Interview Summaries

Water Quality Trading Research
Summary of Findings
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Introduction and Purpose

The Washington Department of Ecology (Ecology) has contracted with a team led by PG Environmental (the PG Team) to conduct research on water quality trading programs throughout the U.S. to gather relevant information that might inform recommendations and considerations for developing a water quality trading program for wastewater treatment plants (WWTPs) covered under the Puget Sound Nutrient General Permit. This document summarizes the results of the research that inform the program recommendations.

The PG Team and Ecology initially identified more than 40 trading approaches to consider for research. Of those, seven programs were selected for in-depth research.¹ The selection criteria prioritized programs that have had recent, successful trades between WWTPs, those that facilitate trading through a general permit, and those that involve trading for nutrients.

The PG Team reviewed all publicly available documentation prior to conducting interviews with state agency staff. The results of both the online research and the interviews have been summarized in this document, which includes a profile for each researched program. Table B-1 identifies the programs selected for detailed research, along with the name of the state staff who participated in interviews to provide details and answer questions about each program.

Table B-1. Researched Programs

State	Program Name	State Representative(s)
Connecticut	The Connecticut Nitrogen Credit Exchange Program and General Permit for Nitrogen Discharges	Iliana Raffa, CT Department of Energy and Environmental Protection (CT DEEP)
Maryland	Water Quality Trading Program	Gregorio Sandi and Nicole Christ, Maryland Department of the Environment (MDE)
Minnesota	Statewide Water Quality Trading Program and Minnesota River Basin: General Phosphorus Permit Phase I	Bruce Henningsgaard and Marco Graziani, Minnesota Pollution Control Agency (MPCA)
North Carolina	Nutrient Strategies and Water Quality Trading Program	Joey Hester and Rich Gannon, North Carolina Department of Environment and Natural Resources (NC DENR)
Pennsylvania	Nutrient Credit Trading Program	Rachel Colyer, Pennsylvania Department of Environmental Protection (PADEP)
Virginia	Nutrient Credit Exchange Program	Allan Brockenbrough, Virginia Department of Environmental Quality (Virginia DEQ)
Wisconsin	Water Quality Trading Program	Kevin Kirsch, Matthew Claucherty, and Sean Spencer, Wisconsin Department of Natural Resources (WI DNR)

¹ The initial list of candidate programs included trading efforts in neighboring states including Oregon and Idaho. These programs ultimately were not included in the detailed research phase because of their dissimilarity with the Ecology's needs for information on programs where water quality trading for nutrients is conducted under a general permit framework. However, the project team is aware of and has studied Pacific Northwest trading programs and their understanding of trading programs and subsequent recommendations for Ecology are informed by that understanding.

Program Profiles: Processes, Structure, and Content

The program profiles are based on two phases of research. First, the PG Team conducted foundational research using publicly available information (e.g., websites, program policies and documents, regulations) to better understand the basic structure and implementation status of each program. The PG Team used this foundational research to inform a set of detailed research questions tailored to each program. These questions served as the basis for program-specific interviews intended to gather more information on the specific program elements most relevant to a potential trading program under the Puget Sound Nutrient General Permit. Specific program elements are those that inform considerations for trading between WWTPs, trading for nutrients, trading under a general permit, pre-Total Maximum Daily Load (TMDL) trading, and trading involving estuarine discharges.

Upon completion of the foundational research and development of the program-specific research questions, the PG Team conducted interviews with representatives of each of the seven selected programs. The foundational research (and associated publicly available resources) and information provided through the interviews comprise the primary source material for the program profiles in this document. In addition, several programs provided follow-up materials to provide more details on specific program elements and one state provided written responses to the research questions in addition to participating in the interview.

The program profiles in this document follow a standardized structure but differ in the specific types of information provided. The profiles are not intended to be comprehensive program descriptions but rather focus on the specific program elements that appear to be most relevant to Ecology's needs and priority areas of interest (as described above). Therefore, the amount and specific types of information summarized in each profile varies. The general structure of each profile is:

- **Introduction:** Provides a brief overview of the program structure and key characteristics.
- **Program Details:** Summarizes research findings on relevant details pertaining to:
 - Program Structure: How the program was developed, who administers and participates in the program, etc.
 - Operational Processes: Program implementation, permitting considerations, trading ratios and risk mitigation measures, reporting and tracking requirements, etc.
 - Funding and Resources: Number of Full Time Equivalents (FTEs) needed to administer the program, funding sources critical to program success, etc.
 - Statutory and Regulatory Considerations: Legal framework for trading.
 - Program Successes and Outcomes: How states define success, major accomplishments, challenges, and modifications to the program.
- **Relevant Program Highlights:** This section is intended to highlight the program aspects that appear to be most useful or relevant to inform recommendations for nitrogen trading in Puget Sound. This section also presents relevant lessons learned and program development recommendations if those were provided by state agency staff who participated in the research phase. The PG Team anticipates the relevant program highlights will form the basis for developing the recommendations.

Note that not all of these sections are included in every profile; if research did not reveal relevant information on one of these topics for a specific program, that section is omitted. In addition, Program Details sections for some profiles are organized into topic-specific subsections which are included for readability and vary from program to program depending on the information presented.

Common Considerations

In conducting the program research and developing relevant program profiles, the PG Team identified several themes that were common among program highlights and lessons learned. The items listed below are relevant program development considerations that arose from the research on multiple state programs. This section is not meant to be a comprehensive list of all lessons learned or the PG Team's recommendations for Ecology. Rather, this section identifies program development considerations that were common to multiple programs.

- **Geographic extent.** Several state agency representatives highlighted the importance of the geographic extent of trading. Many of the programs had to consider trading within subbasins and how to modify ratios for interbasin trading. Several states mentioned that environmental groups and the public were concerned about trading and the creation of hot spots and impacts to local water quality. In the case of Virginia, interbasin trading is needed when the market for a particular subbasin (e.g., Eastern Shore) is small and eligible sources do not provide adequate credit supply and demand within the subbasin. The trading boundaries both in Maryland and Wisconsin have been some of the most challenging aspects of the trading programs.
- **Early stakeholder involvement.** Many of the state agency representatives highlighted the criticality of early engagement with stakeholders, including the dischargers, environmental groups, and public. In the case of Maryland, a technical advisory committee of 40-50 stakeholders participated in the design of the nutrient credit trading program. While this group included non-government organizations (NGOs) who were vocal in their opposition to trading, Maryland Department of the Environment (MDE) staff responsible for administering the trading program attribute the lack of legal challenges to early stakeholder engagement. Connecticut began public engagement and outreach to stakeholders regarding nutrient control during the 1980s. By the time the Nutrient Credit Exchange Program was established dischargers were eager to identify a collaborative solution to restoring the Long Island Sound.

For Virginia's nutrient trading program and general permit, dischargers significantly drove the development process codified in regulation. Discharger involvement initially led Virginia to a trading program design that was not envisioned by Virginia Department of Environmental Quality (DEQ). However, the discharger-driven framework has given dischargers ownership over the program and Virginia DEQ now cites this as an element of the program's overall success. Similarly, Wisconsin found that it was critical to bring stakeholders to the table during the beginning of the trading program to think creatively about collecting meeting permit requirements.

Although none of the programs were initially developed with significant participation from tribal entities, many of the state agency representatives suggested that it would have been beneficial to include tribes in the trading program early on. Minnesota specifically mentioned that two tribal entities are located within the Minnesota River Basin (with a general permit for nutrient

trading), one of which wants to participate in the trading program and another that wishes not to be involved.

- **Scope and structure of rules at program outset.** While the Chesapeake Bay watershed jurisdictions researched for this effort (PA, VA, MD) are subject to the same 2010 Chesapeake Bay TMDL requirements, each jurisdiction took a different regulatory approach to nutrient credit trading. Pennsylvania’s regulations provide flexibility by using broad language that allows PADEP to make changes through guidance. For Virginia, the regulatory language was discharger-driven, very prescriptive, and, thus, is regularly amended to reflect general permit reissuance and changes to waste load allocations (WLAs). A suite of regulations work together in Virginia to authorize the nutrient exchange association, the general permit, and technology-based effluent limitation requirements for facility upgrades in the Chesapeake Bay. In Maryland, the regulation authorizing cross-sector trading does not support WWTP-to-WWTP trading, affecting market demand. Connecticut and Wisconsin both felt that establishing simple statewide program rules that are supplemented with more detailed guidance or permit requirements can provide flexibility to adapt to changing conditions. In contrast, North Carolina promulgated basin-specific trading rules.
- **Registry/information technology for tracking.** Maryland and Pennsylvania are working together to adapt the U.S. Army Corps of Engineers Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS) to support nutrient credit trading for point source and nonpoint sources. This registry tool will streamline credit approval and tracking processes for state agency staff and provide transparency for all stakeholders. Pennsylvania highlighted the necessity of a tracking tool at the beginning of the program. Connecticut also emphasized the benefit of early investment in systems that can automate data reporting, verification, and analysis and can be adapted to accommodate program changes.
- **Factors that could influence supply/demand.** While several of states did not conduct supply and demand analysis prior to developing their trading programs, many state agencies cited factors that influence credit supply and demand in their states. Several states suggested that understanding the factors that influence supply and demand at the program design phase can help a state develop a resilient program that adapts to changing market conditions over time.
 - **Climate/weather.** Based on the climate projections and changes to weather patterns, many of the states are expected to have more frequent storms of increasing intensity and may also be impacted by changing trade boundaries due to sea level rise. A representative from Connecticut mentioned that weather impacts nitrogen removal efficiency, meaning that in years with more precipitation, there will be a greater demand and lower supply of available credits.
 - **Funding for upgrades (such that trading is unnecessary).** In Maryland, state grant-funded facility enhanced nutrient removal (ENR) upgrades for major WWTPs has affected supply and demand. The grant-funded upgrades require WWTPs to meet their WLAs through ENR technology as opposed to nutrient credit purchases. As a result, the nutrient trading regulations do not allow WWTP-to-WWTP trading. Through the facility upgrades, WWTPs generate a significant number of nutrient credits, but there is not a significant demand for this credit supply by other sectors eligible to trade. One reason for the limited demand by

other sectors is the availability of other funding programs to finance nutrient reduction activities (e.g., best management practices for nonpoint sources). MDE assumes that these other sources would rather secure grant funding than purchase credits from WWTPs on the open market.

Through the Water Quality Improvement Fund, Virginia provided resources for up to 50 percent of the cost of upgrades for significant dischargers. Being able to fund the plant upgrades helped the dischargers to generate credits for the market. Connecticut funds all plant upgrades under its Nitrogen Credit Exchange Program through the State's Clean Water Revolving Fund; without this funding mechanism, Connecticut dischargers would not have accepted the non-voluntary exchange concept.

Minnesota noted that trading programs generally will experience decreased demand over time as regulated facilities upgrade their treatment; the state is currently trying to determine how to transition their program to alleviate the burden of trading-related reporting and other requirements for facilities that no longer need to trade while maintaining a compliance option for those that do.

Connecticut's Nitrogen Credit Exchange Program and General Permit for Nitrogen Discharges

Background

To address seasonal hypoxia related to nitrogen pollution in Long Island Sound, the Connecticut Department of Energy and Environmental Protection (CTDEEP) and the New York State Department of Environmental Conservation collaborated to develop a multi-state total maximum daily load (TMDL) for dissolved oxygen in December 2000. The TMDL established a wasteload allocation (WLA) for the State of Connecticut requiring a 64 percent reduction of total nitrogen by 2014 from 79 publicly owned treatment works (POTWs) discharging nitrogen to Connecticut's portion of the Long Island Sound watershed (CTDEEP n.d.(a), CTDEEP and NYSDEC 2000). In July 2001, the Connecticut General Assembly passed *Public Act 01-180: An Act Concerning Nitrogen Reduction in Long Island Sound*, requiring the CTDEEP to issue a general permit with effluent limits for total nitrogen and to establish a Nitrogen Credit Advisory Board to assist and advise the CTDEEP with administration of a Nitrogen Credit Exchange Program (State of Connecticut, 2001).

When established, the goal of the Nitrogen Credit Exchange Program was to cost-effectively meet the TMDL by encouraging upgrades to nitrification treatment systems with State grants, spreading upgrades over 13 years to reduce the financial impact to the State, and providing fiscal alternatives to the immediate expenditure of capital funds (CTDEEP 2018a).

Program Details

Program Structure

Permitting Framework

CTDEEP issued the *General Permit for Nitrogen Discharges* in 2002 and most recently renewed the permit in 2018 with an effective date of January 1, 2019 (CTDEEP 2018b). The General Permit is the primary mechanism for implementation of the Nitrogen Credit Exchange Program (CTDEEP 2019). Each facility also maintains coverage under an individual permit issued under the National Pollutant Discharge Elimination System (NPDES). The General Permit is a non-NPDES overlay permit that regulates nitrogen and implements the credit exchange program; the individual NPDES permits address other discharges from each POTW.

The General Permit includes facility-specific "discharge limits" for each POTW based on the TMDL WLAs. The limits are expressed as maximum pounds per day of total nitrogen. If a POTW cannot comply with its discharge limit, it can purchase State-owned equivalent total nitrogen credits through the Nitrogen Credit Exchange Program to comply with the effluent limitation. In contrast, POTWs that reduce nitrogen loads below the limit can sell credits to the State (CTDEEP 2019).

The nitrogen credit exchange program established in the General Permit is similar to water quality trading but is not market-based or voluntary. Instead, credit prices through the exchange are legislated, and the program framework creates the supply of, and demand for, credits (I. Raffa, personal communication, December 19, 2022).

Eligibility for Participation

The 79 POTWs covered under the General Permit are eligible to participate in the Nitrogen Credit Exchange Program.

Operational Processes

Facility-specific discharge limits are revised each permit term based on monitoring data and the CTDEEP's understanding of which facilities need to upgrade (based on availability and cost of credits) and which still need to buy credits (I. Raffa, personal communication, December 19, 2022). The discharge limits are meant to incentivize upgrades for those facilities that need to upgrade sooner.

A POTW generates credits to sell through the exchange if it undertakes a nitrogen removal project and removes more nitrogen than is required by its annual mass loading limit. Equivalent credits are calculated by multiplying the total nitrogen credit (i.e., the difference between the annual limit and the annual load discharged) by an assigned equivalency factor (i.e., trade ratio). The equivalency factor accounts for geographic location of the POTW and its impact on dissolved oxygen levels in the hypoxic areas of the Long Island Sound (CTDEEP 2018b). The equivalency factors do not account for the impacts of trades on nitrogen levels in tributaries of Long Island Sound. In general, the equivalency factors are higher for POTWs closer to the hypoxic areas (I. Raffa, personal communication, December 19, 2022). Facilities with a relatively high equivalency factor may find it more economical to undertake nitrogen removal projects, whereas it may be more economical for those with lower equivalency factors to purchase credits.

Weather can pose a challenge for trading between POTWs. In 2014 and 2018, unanticipated wet and cold weather affected the facilities' nitrogen removal efficiency. In 2018, 45 POTWs were required to purchase credits for 2024.57 equalized pounds of nitrogen to remain in compliance with the General Permit (CTDEEP 2018a). However, the 34 facilities able to sell credits that year only had 1319.31 equalized pounds of nitrogen available (CTDEEP 2018a). Therefore, as a whole, facilities were not in compliance with their General Permit limit in 2018 because of the extreme weather conditions.

Funding and Resources

Connecticut provides financial assistance to POTWs to undertake nitrogen removal projects through the State Clean Water Fund (I. Raffa, personal communication, December 19, 2022). The Clean Water Fund also finances other types of water infrastructure projects across the state and is independent of the credit exchange program, though the existence of the fund is key to the structure of the exchange program. Primary sources of funding for the Clean Water Fund are State revolving fund revenue bonds and State general obligation bonds, and federal capitalization grants through the Clean Water Act with annual appropriations through the U.S. Environmental Protection Agency (EPA) (CTDEEP and Office of the Treasurer 2022). The State matches the annual federal appropriation. The Clean Water Fund provides 100 percent of financing for nitrogen removal projects through a combination of grants covering a percentage of project costs (30 percent) and low interest rate (2 percent) loans for the balance of the project costs. Facilities request Clean Water Fund financing through the CTDEEP annually with funds allocated based on need through a point system. The Clean Water Fund is critical to the success of the General Permit and Nitrogen Credit Exchange Program as it allows CTDEEP to look at the watershed holistically, funding the upgrades that will be most beneficial earlier in the process and

ensuring that enough credits will be generated for the remaining demand (I. Raffa, personal communication, December 19, 2022).

Initially, the state subsidized the credit exchange program by paying sellers for all credits generated, regardless of demand. However, the CTDEEP and the Nitrogen Credit Advisory Board determined that the state subsidization of the Nitrogen Credit Exchange Program was unsustainable long-term, with projections for 2018 estimated at over \$5 million (CTDEEP 2014). Therefore, the Connecticut General Assembly passed *Public Act 15-38: An Act Concerning the Sustainability of the Nitrogen Credit Exchange Program* to move the program toward self-sufficiency by 2016 by no longer providing subsidies (State of Connecticut 2015). As a result, POTWs generating credits now divide the funds paid by buyers proportionally based on the seller's relative performance, and most sellers receive reduced payments for their credits (I. Raffa, personal communication, December 19, 2022).

Establishing the Nitrogen Credit Exchange Program involved years of collaboration between the State and municipalities. The initial program set-up involved approximately five CTDEEP staff.

Currently, various elements of General Permit and Nitrogen Credit Exchange are implemented by multiple staff across CTDEEP, including program directors, lawyers, engineers, treasury staff, and inspectors. One FTE is dedicated to program administration. Other program functions are distributed across CTDEEP staff in various clean water and TMDL programs. These staff roles include informing priorities for upgrades through the Clean Water Fund, conducting quality control checks for discharge data, and ensuring nutrient removal projects are implemented and maintained as needed to achieve the necessary nutrient reductions (I. Raffa, personal communication, December 19, 2022).

Program Successes and Outcomes

The Nitrogen Credit Exchange Program was successful in cost-effectively achieving the TMDL wasteload allocation by 2014, saving an estimated \$300–\$400 million in state-funded upgrades by 2018 (CTDEEP 2018a). In addition, 63 of the 79 POTWs are currently achieving their nitrogen limits through on-site treatment upgrades (I. Raffa, personal communication, December 19, 2022).

Relevant Program Highlights

Several aspects and lessons learned from the Connecticut Nitrogen Credit Exchange and general permit approach may be beneficial for Ecology's consideration during development of a trading program for Puget Sound.

- **Stakeholder engagement.** Early communication and stakeholder involvement were key to the success of Connecticut's program. CTDEEP had been working with dischargers since the mid-1980s on ways to control nutrient discharges to protect Long Island Sound. By the time the TMDL was adopted, dischargers were well informed on the issues surrounding nitrogen discharges and wanted to engage with CTDEEP and the legislature on a cooperative solution.
- **Accounting for information technology needs.** CTDEEP has had to revise and adapt several different electronic systems for program tracking and administration over the course of implementing Nitrogen Credit Exchange. Early in the program, discharge data had to be entered and quality control reviews conducted by hand, which was very labor intensive, and mistakes could have real economic impacts on the POTWs required to buy.

- **Distribution of roles across program staff.** Staff at multiple levels (e.g., directors, engineers, inspectors) and different groups at CTDEEP coordinate to implement the program. This coordination facilitates communication and a common understanding of exchange program requirements as well as the discharger's needs and capabilities throughout the water programs. Ensuring that all sections of a program can communicate simply and effectively is also important for effective program administration.
- **State-level funding for facility upgrades.** The Clean Water Fund enables CTDEEP to coordinate funding of nitrogen removal upgrades in the context of the Nitrogen Credit Exchange Program. The dischargers would not have accepted the non-voluntary exchange concept without the assurance that funds would be available for upgrades and upgrades would be coordinated to ensure credits would be available to meet the demand.
- **Weather and climate impacts on market demand.** Weather affects nitrogen removal efficiency meaning that there will be more demand for credits and less supply in years with colder, wetter weather. This could be compounded in areas where a changing climate increases the frequency of colder, wetter weather. CTDEEP is considering how future phases of their program might better account for weather and climate change.

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Maryland's Water Quality Trading Program

Background

The Maryland Department of the Environment (MDE) developed its initial nutrient water quality trading program in 2008 through the “Maryland Policy for Nutrient Cap Management and Trading in Maryland’s Chesapeake Bay Watershed” (Phase I 2008 Cap Management Policy), which authorized point source trading, and Phase II A and B: Guidelines for the Generation and for the Exchange of Agricultural Nonpoint Source Credits, which regulates the NPS trading program administered by MDE and the Maryland Department of Agriculture (MDA). These caps were based on Chesapeake Bay tributary strategy loads. Finalization of the Chesapeake Bay TMDL in 2010 then became the focus of Maryland’s trading program.

The key driver for Maryland’s program was to provide a method for point source and non-point sources to achieve nutrient and sediment reductions for the main stem of the Chesapeake Bay. Maryland developed a cross-sector trading program allows trading between regulated stormwater and wastewater point sources in addition to point source-to-non-point source trading by wastewater, stormwater, septic systems, agricultural, and oyster aquaculture sectors to comply with permitted limits for total phosphorus (TP), total nitrogen (TN), and sediment (MDE 2017). However, MDE regulations do not currently support trading between wastewater treatment plants (WWTPs) due to state-funded facility upgrades of major facilities. WWTPs generating credits sell to municipal separate storm sewer systems (MS4s) and smaller industrial facilities (G. Sandi and N. Christ, personal communication, December 16, 2022). Although Maryland doesn’t allow WWTP-to-WWTP trading under the 2015 policy and 2018 regulations, this profile describes MDE’s experience with administering their trading program, mainly between WWTP and MS4 dischargers.

Program Details

Program Structure

Eligibility for Participation

To achieve water quality standards for the Chesapeake Bay, Maryland required significant wastewater facilities (with a design capacity of 500,000 gpd or greater) to upgrade to enhanced nutrient removal (ENR) technologies and maintain the nutrient load caps for all point sources (MDE 2017). Through Maryland’s Bay Restoration Fund Act, MDE was able to provide 100 percent grant funding for ENR upgrades to significant WWTPs. As a result, WWTPs cannot purchase credits from other WWTPs to achieve compliance. WWTPs can generate credits to sell to other sectors (e.g., MS4s, industrial facilities). WWTPs can purchase credits from other sectors to offset growth, as the state cannot permit new WWTP discharges unless WLA capacity is available.

WWTPs must be granted authority to trade in their individual permit and must discharge below 3.25 mg/L for TN, 0.3 mg/L for TP, and 30 mg/L Total Suspended Solids (TSS) to be able to generate credits (G. Sandi and N. Christ, personal communication, December 16, 2022). Other location-specific regulations between buyers and sellers apply to protect local water quality.

Characteristics of Typical Trades

Most of the nutrient credits available in Maryland market are currently generated by WWTPs and are purchased by MS4 programs. MDE issues MS4 permits on a county-wide level to provide flexibility with implementation, thus, the WWTPs within a county that are generating credits are often selling these credits to the same county's MS4 program. MDE sees the trading program as a bridge to compliance, in which trading provides an option for MS4 permittees to comply with their WLAs as they complete nutrient reduction activities and would largely not need to participate in trading after projects are complete (G. Sandi and N. Christ, personal communication, December 16, 2022).

Operational Processes

Verification, Registration, Documentation, and Trading Processes

If an entity is interested in trading, MDE must review and approve the request which culminates in MDE modifying a discharger's individual permit to allow for trading. Once trading is allowed through the permit, dischargers may find available credits on MDE's Water Quality Trading (WQT) Market Board. The information on the WQT Market Board has not yet been certified by MDE while the list of certified credits is posted on MDE's WQT Register. Permittees may also work independently, or with brokers or aggregators to find available credits (MDE n.d.).

If generating credits, the discharger completes a credit estimation spreadsheet to evaluate the number of credits generated and then completes a credit certification form, which the discharger submits to MDE for credit certification. MDE reviews the information and evaluates accuracy with information submitted through the discharge monitoring reports (DMRs). After certifying the credit, MDE places it on the WQT Register to be sold. The WQT Register provides a ledger of certified credits, their status, who has purchased and sold credits, and where trades have occurred. Credit buyers are required to secure certified credits, which are generated on an annual basis (MDE n.d.). The MDE then generates an annual report with a summary of the number of credits generated, number of trades and other information, such as successes and challenges with the trading program, among others. MDE will automate this process through the use of a registry tool; MDE is working with Pennsylvania to adapt and adopt U.S. Army Corps of Engineers registry tool (see "Funding" section below).

The MDE is not involved with setting the price structure and allows for market-based credit pricing.

Trading Ratios, Risk Mitigation, and Minimum Control Measures

The MDE adopted the delivery factors established under the Phase 6 Chesapeake Bay Model. MDE allows trading to occur upstream of the targeted water body in the Potomac, Patuxent, Eastern Shore and Western Shore River Basins (including the Susquehanna River basin) within the state of Maryland. Credits used within an impaired water must be generated within such impaired waters or upstream of the credit user's discharge (MDE 2017). The MDE also uses delivery, reserve, and uncertainty trading ratios in its program, as well as an edge of tide ratio. The MDE defines the edge of tide ratio as "A numeric adjustment to compensate for process through which pollutants are reduced through natural processes before reaching the Bay." This ratio is used as a method to make loading contributions consistent across all regions of the state.

The MDE has developed a GIS map that identifies the various edge of tide factors and shows the geographic locations where trades can potentially occur after the credits are certified and verified by MDE. Credits cannot be used to meet permit requirements outside of the trading regions in which they are generated (MDE 2017). The MDE has also identified trading regions and purchasing regions, which largely applies to trades between MS4 and industrial stormwater dischargers.

Funding and Resources

The MDE has two employees who are primarily responsible for overseeing trading, with approximately 20 percent of their time spent on managing the trading program. These staff are typically busy during the first quarter of the year when credits are generated. These individuals collaborate with MDA on the NPS program and the Maryland Department of Natural Resources (MDNR) on the oyster aquaculture program. The MDE is relying on Pennsylvania's grant-funded efforts to adapt U.S. Army Corps of Engineers' Regulatory In-lieu Fee and Bank Information Tracking System (RIBITS) for use as a trading registry. The RIBITS will help to reduce manual tracking processes for credits, increasing the overall efficiency of the trading program administration and level of transparency.

Statutory and Regulatory Considerations

In 2015, MDE released the *Maryland Nutrient Trading Policy Statement* with a focus on cross-sector trading in Maryland's portion of the Chesapeake Bay watershed. In 2018, Maryland finalized and adopted the nutrient credit regulations into its state code that authorize the Maryland Water Quality Trading Program ([COMAR 26.08.11](#)). Maryland's trading regulations provide clarity on processes and definitions for stakeholders. In the initial phase of the program, prior to the regulations, MDE staff had to interpret too much about the program. The regulations not only provide clarity to avoid interpretation, but also serve as a mechanism for continuity and institutional knowledge (G. Sandi and N. Christ, personal communication, December 16, 2022).

Program Successes and Outcomes

Overall, the Maryland's nutrient credit market has maintained a high level of available credits from WWTPs, as there are many sources generating credits. The supply of credits is more significant than demand. Demand could be faltering where the regulations are too restrictive (e.g., no WWTP-to-WWTP trading) and where state grant funding is available, incentivizing sources to pursue grant funding for nutrient reduction activities rather than pursue nutrient credits on the open market (G. Sandi and N. Christ, personal communication, December 16, 2022). The MDE is looking at innovative ways to expand the trading program and increase demand, including event-based trading and an oyster aquaculture program.

Relevant Program Highlights

While MDE does not allow in WWTP-to-WWTP credit trading, there are other aspects of MDE's nutrient credit trading efforts may be beneficial to the development of recommendations for nutrient trading in Puget Sound. The following highlights are presented for Ecology's consideration.

- **Stakeholder involvement in program design.** Maryland's use of a technical advisory committee to develop the trading policy and regulations included 40-50 representatives. While the process may have been challenging, this type of extensive engagement allow stakeholders to share

reservations about trading early in the process. Ultimately, there have been no legal challenges to Maryland's trading program, even from the most vocal non-government organizations who stated opposition to the program. MDE credits the lack of legal challenges to a robust stakeholder engagement process.

- **State funding sources may affect market demand.** The MDE pointed out that state funding sources for nutrient reduction projects affects credit demand. Evaluating the sources of funding for facilities can help predict if it is more likely facilities will choose to apply for grant funding rather than pursue purchase of credits to achieve compliance. There may be a need to expand participating sources to increase demand for credits.

References

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Minnesota's Statewide Water Quality Trading Program and Minnesota River Basin: General Phosphorus Permit Phase I

Background

The Minnesota Pollution Control Agency (MPCA) was one of the first states to allow trading to support nutrient reductions, beginning in 1997. Initially, the state allowed point source dischargers to offset new discharges of nutrients using nonpoint source projects to prevent additional impacts from eutrophication in impaired waterbodies. The state's nutrient trading program evolved to allow pre-Total Maximum Daily Load (TMDL) offsets for new dischargers from other point sources as well.

In addition to pre-TMDL trading, MPCA also developed a general permit for point source-to-point source trading of total phosphorus (TP) in the Lower Minnesota River Basin following the finalization of the *Lower Minnesota River Basin TMDL* to address dissolved oxygen impairments. The first trades began in 2008 and the market hit its peak number of buyers and sellers in 2010. As a result of trading, many dischargers upgraded their plants and no longer needed to generate or purchase credits. By 2016 there were only two sellers and seven buyers within the watershed, and those numbers have remained largely unchanged (B. Henningsgaard and M. Graziani, personal communication, December 9, 2022).

In 2022, the state released its *Water Quality Trading Guidance* which describes, in general terms, what is necessary when trading partners wish to use trading to comply with water quality-based requirements. The guidance addresses trading between point source dischargers and between point source and nonpoint source dischargers. The MPCA's program drivers and structures have evolved over the past decade to adapt to changing water quality, standards, and trade boundaries. Although MPCA still administers the Lower Minnesota River Basin trading program, its focus is shifting toward agricultural and nonpoint source trading. This profile focuses on the framework established in the general permit as it is the most relevant part of Minnesota's program to Puget Sound characteristics and challenges.

Program Details

Program Structure

History and Drivers for Trading

In 2007 an environmental group took legal action against MPCA for issuing a permit to a new facility discharging to an impaired water body. MPCA issued the permit because another facility within the same HUC-8 had upgraded their plant, creating assimilative capacity in the receiving water so that there would be no net increase in TP loading to the watershed. The MPCA lost the case in the Court of Appeals, causing MPCA to re-evaluate its approach to nutrient control. Realizing that no new permits could be issued for discharges to an impaired water until a TMDL was in place, MPCA began developing the framework for pre-TMDL individual point source-to-point source trades. When a new facility was permitted in a watershed, the discharger would need to offset their permitted load until a TMDL was completed and a WLA was available for those discharges.

In 2004, a TMDL was developed for the Lower Minnesota River. Subsequently, MPCA issued the Minnesota River Basin General Phosphorus Permit, Phase I on December 1, 2005. The general permit provided a framework for a more sustained and organized trading program.

Eligibility for Participation

The general permit regulates TP trading between 40 point source dischargers within the Minnesota River Basin, and includes specific calculations to determine credits that can be bought and sold based on the amount of TP discharged and the location of the discharger (MPCA 2005).

The baseline for point source sellers is the most stringent numeric effluent limit, a WQBEL, which is equivalent to the WLA in the general permit. Dischargers can generate credits if they reduce their discharge below the WQBEL. The entities that were not in compliance with the WQBELs could purchase credits to meet those limits.

Operational Processes

Under the general permit, permittees within the Basin are allowed to trade with each other and are responsible for finding and proposing trading partners. The MPCA has to approve trading partners, but does not oversee the trades and is not involved with setting the price of credits or recording financial information. Trading proposals must demonstrate that the offset credit is being generated during the same seasonal period that the credit is needed. The permit includes a 5-month (May 1 – September 30) mass-based TP limit and requires permittees to submit monthly influent and effluent data through the Minnesota River Basin Discharge Monitoring Report in addition to a pre-season implementation plan and annual compliance report (MPCA 2005).

Permittees have the option to develop trade associations, which refers to a group of permittees who have registered their trade association with MPCA. Depending on the type of trade, permittees are required to submit either an Internal Legal Contract to Trade Form (trades within the association) or the Legal Contract to Trade Form (used for all other trades). Dischargers then submit the forms to MPCA for review and approval. At the end of the season (May – September), the buyers and sellers reconcile any trades and submit the required annual compliance report to MPCA. The agency then conducts a final review of the information to verify and certify the trades (MPCA 2022).

The currency for trading developed under the general permit is referred to as “Jordan Trading Units (JTUs),” which consider watershed assimilation factors, including the Jordan Biochemical Oxygen Demand Factor, to compensate for changes in loading impacts related to spatial differences throughout the basin. During the initial development of the general permit, MPCA incorporated different trade ratios depending on the type of facility and geographic location, including:

- Existing dischargers were subject to a minimum trade ratio of 1.1 to 1.
- New dischargers were subject to a minimum trade ratio of 1.2 to 1.

Over the past decade, MPCA has modified its trading program to accommodate changes in local water quality and incorporate additional data and information. The MPCA adopted new river eutrophication standards in 2014, which helped MPCA to develop more accurate delivery ratios and has highlighted the impact of hot spots to local water quality, causing the initial trade boundaries to shrink. Henningsgaard and M. Graziani, personal communication, December 9, 2022).

Funding and Resources

The MPCA representatives indicated that the most resource-intensive period of the program occurred during the program development and initial implementation stages. The MPCA provided extensive outreach and stakeholder engagement while writing the general permit to address significant public concern that trading would not protect water quality. The MPCA held numerous public meetings and responded to public comments and questions received during the permit development stage. The level of effort associated with the program decreased after the general permit was issued and dischargers began trading. The MPCA has two staff who primarily spend time on trading, but are also involved with other work, there isn't a dedicated group for facilitating and managing trading (B. Henningsgaard and M. Graziani, personal communication, December 9, 2022).

Statutory and Regulatory Considerations

The MPCA first incorporated trading into state statute in 2007 as a result of a lawsuit. The MPCA has modified the statutory requirements of the trading program since then to include various pollutants and to increase flexibility. The MPCA currently has general language within the state code, which helps to provide the necessary legal authority but reduces complexity. The authority is present in the statute and the state provides guidance through the forms, information, and the 2022 *Water Quality Trading Guidance* posted on MPCA's website.

Program Successes and Outcomes

The MPCA considers water quality trading within the general permit successful based on achievement of the TP reduction goal for the Basin. Specifically, over a seven-year period the Minnesota River Watershed was able to meet the TMDL goal of reduced TP loading by 26,891 kg/season. The MPCA conducted trend analysis, comparing TP loads and concentrations based on DMR data throughout the watershed. The MPCA also defines success based on the number of plants that have upgraded and no longer need the trading program to reach their permitted limits. The MPCA representatives explained that trading helped the state achieve reductions much more quickly than if trading hadn't been an option. Without trading, it would have taken multiple permit cycles for dischargers to upgrade their plants and reduce their TP loading (Henningsgaard and M. Graziani, personal communication, December 9, 2022).

Relevant Program Highlights

Several aspects and lessons learned from MPCA's program may be beneficial for Ecology's consideration during development of a point source-to-point source trading program. The following highlights are presented for Ecology's consideration.

- **Early stakeholder engagement.** The MPCA involved stakeholders early in the program development process. Discharger and environmental groups were instrumental in the development of the general permit and the trading program.
- **Planning for program phase-out.** Since many plants within the Basin have upgraded and phosphorus discharges have decreased, MPCA is now looking at how to relieve permittees who no longer need to trade from the trading-related reporting requirements under the general permit. The MPCA did not consider how to phase out trading when the program was developed, and therefore recently authored an exclusion memo explaining which permittees are no longer

required to follow the reporting requirements included in the general permit and is thinking through ways to move the program forward for those who still need to trade while protecting local water quality.

- **Understanding credit prices.** The MPCA is not engaged in the financial aspects of the trades, but indicated that it would be helpful to be generally aware of the price of the trades to understand if the economic benefit of trading is worth the cost of administering the program.
- **Simple systems.** The MPCA set up a simple system that facilitates direct contact between permittees and credit verification so that the parties know credits are legitimate. Provide guidance and oversight, but allow the dischargers to handle the trading details amongst themselves.
- **Simple regulations.** Initially, MPCA thought they would need complex state regulations to govern the trading program but determined that having simple regulations increased flexibility and allowed the program to evolve more easily.

References

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North Carolina's Nutrient Strategies and Water Quality Trading Program

Background

In the 1980s, waterbodies in North Carolina were plagued by high-profile harmful algal blooms and fish kills caused by excessive nutrients. This issue led to the development of Nutrient Sensitive Waters Management Strategies (nutrient strategies). Nutrient strategies are regulatory approaches to reducing nutrients from multiple sectors (wastewater, agriculture, and stormwater from new and existing developments) that are specific to a particular estuary or reservoir (NCDEQ 2019). The first attempt at implementing a trading program occurred in the Tar-Pamlico River Basin (NCDEQ 2018a) and was based on goals in the associated nutrient strategy. The program is currently implemented through a set of rules that allow dischargers to participate in trading activities, either individually or through compliance associations, to meet collective allocations within the basin area outlined in the strategy. The currently established nutrient strategies and trading options available to dischargers are codified in the state rules at 15A NCAC 02B (State of North Carolina 2020). As of 2022, rules for implementing nutrient strategies, including trading, have been adopted by the Environmental Management Commission (EMC) for the Neuse River Estuary, Tar-Pamlico Estuary, Jordan Lake, and Falls Lake.

Much of the program infrastructure, and trading activity, in North Carolina is focused on nonpoint source participation. This profile highlights the aspects of the statewide and basin-specific programs that are most relevant to Puget Sound characteristics and challenges.

Program Details

Program Structure

Point source dischargers may comply with the nutrient allocations assigned through their nutrient strategy using the following point source to point source trading methods:

- **Joint Compliance:** Joint compliance allows a group of regulated entities within the same basin to form an association with bylaws governing internal contractual trading (NCDEQ 2019). Typically, through this option a permit is issued to the association with nutrient allocations for each member and a group (or “bubble”) load allocation for the association. If the association is in compliance with the group allocation, members are considered to be in compliance with their individual allocations. However, if the group allocation is exceeded, the association must purchase credits from the Division of Mitigation Services at a rate consistent with the Nutrient Offset Payment Rule at 15A NCAC 2B .0703 (State of North Carolina 2020), and members exceeding their individual allocations are in violation as well (NCDEQ 2018b). In addition, there are rules within the association. Individual members who exceed their individual allocation must pay a fine to the association regardless of compliance with the group limit. Members of the association also pay annual membership dues. Since compliance is demonstrated through the “bubble” limit, members are able to purchase, lease, or sell allocations (credits) from other members of the association without the need for State oversight or permit modifications (NCDEQ 2019). Historically, prices for these informal allocation purchases through the Neuse River Compliance Association (NRCA) have ranged from \$4 to \$9 per pound (NCDEQ 2019).

- **Allocation Trades:** Allocation trades are enacted between facilities within the same basin through a bilateral contractual trading agreement and permanent major permit modifications (NCDEQ 2019). Through this type of trade, a seller agrees to permanently transfer part of their individual permit allocation to the buyer. Historically, prices for allocation trades in the NRCA have ranged from \$275 to \$491 per pound of nitrogen (NCDEQ 2019). Less than ten permanent allocation trades have occurred since the start of the State allocation trading program. Transport factors (i.e., trade ratios) are only applied if required by the nutrient strategy applicable to the basin (NCDEQ 2019).

Joint compliance between point sources within a watershed that have a collective nutrient allocation (“bubble”) permit is the most common type of point source-to-point source trading option currently utilized. One example of this option is the NRCA group permit. The permit, first issued in 2002, authorizes the NRCA and its 23 co-permittee members to discharge total nitrogen from the members’ facilities to waters of the Neuse River Basin (NCDEQ 2018b). Since members are located throughout the basin and are subject to a variety of transport factors, group limits are expressed as delivered loads (end-of-pipe load × transport factor).

Relevant Program Highlights

Several aspects and lessons learned from North Carolina’s program may be beneficial for Ecology’s consideration during development of a point source-to-point source trading program. The following highlights are presented for Ecology’s consideration.

- **Basin-specific rules.** The State has promulgated specific trading requirements in legislative rules, including the Nutrient Offset Rule, and nutrient strategies applicable to specific basins. There are currently four nutrient strategies codified in the rules.
- **Trade associations.** The most common type of trades occur within trade associations, which have the ability to trade amongst members without State oversight or permit modifications.
- **Accounting for climate change.** The NCDEQ indicated that trying to account for climate change impacts is important when setting up the program. Initial tributary goals that formed the basis of discharger allocations may not be adequate to protect water quality due to changes in precipitation patterns in the watersheds (e.g., longer duration, higher frequency storms are causing the discharge of more nutrients from nonpoint sources).
- **Accurate allocations.** In the State’s experience dischargers are fiercely protective of their allocations and reluctant to trade or lease. This is likely due to the prospect of future growth and industry potentially determining the need for additional nutrient allocation, which would need to be purchased if the discharger traded the allocation too early. This has led to relatively few trades (seven to date) within the Neuse basin (R. Gannon and J. Hester, personal communication, December 14, 2022), and highlights the importance of careful planning to determine the initial allocations.

References

NCDEQ. 2018a. *North Carolina's Nutrient Trading and Joint Compliance Framework: Discussion Draft #2*. North Carolina Department of Environmental Quality, Nonpoint Source Planning Branch, Raleigh, NC. <https://deq.nc.gov/media/10684/download>

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Pennsylvania's Nutrient Credit Trading Program

Background

The Pennsylvania Department of the Environment (PADEP) developed its nutrient water quality trading policy in 2005 policy to achieve nutrient reductions required by the Chesapeake Bay Tributary Strategies. In 2010, PADEP adopted nutrient credit trading requirements into its state code of regulations (Pennsylvania Code n.d.) to meet subsequent nutrient wasteload allocations (WLAs) in the Chesapeake Bay Nutrient total maximum daily load (TMDL). Together the policy and regulations provide a framework for the state's trading program. This profile focuses on the aspects of point source-to-point source trading under PADEP's program that may be most relevant to establishment of a point source trading program in the Puget Sound watershed.

Program Details

Program Structure

Context for Trading

The PADEP's nutrient trading program is intended to help point sources and nonpoint sources achieve their allocations under the 2010 Chesapeake Bay TMDL. The PADEP's program was developed with substantial input from stakeholders, including dischargers.

Eligibility for Participation

The Phase III Watershed Implementation Plan (WIP) Wastewater Supplement contains an updated listing of WLAs for regulated wastewater dischargers, including significant sewage dischargers (wastewater treatment plants [WWTPs]) with a design flow of at least 0.4 MGD, significant industrial waste dischargers, combined sewer overflows, and nonsignificant dischargers. The WWTPs that meet the significant sewage dischargers definition are eligible to participate in trading to meet their total phosphorus (TP) and total nitrogen (TN) water quality-based permit limits.

Operational Processes

All significant sewage point source discharges with assigned cap loads as listed in the Phase III WIP Wastewater Supplement must demonstrate effluent concentrations below 6.0 mg/L TN and 0.8 mg/L TP, as well as general permit compliance, to be eligible to generate credits (PADEP 2022). The total amount of credits cannot exceed the facility's permitted cap load.

The PADEP's main responsibilities in administering the trading program include permitting, tracking and verifying credits, and generating reports to document trades. The dischargers are responsible for trading individually amongst each other and the market determines the price of credits. PADEP does not rely on a trade association or broker to administer point-source trades, but entities may utilize a third party, as desired. The PADEP is not directly involved in facilitating trades between entities or setting prices (R. Colyer December 9, 2022, personal communication).

Pennsylvania's nutrient credit trading program involves three steps: certification, verification, and registration.

PADEP must verify that activities generate credits before they can be registered for trading. Therefore, credit generators complete a Verification Request Form, including the certification ID, location, number of credits generated, and supporting DMR data for review and approval by PADEP. The PADEP then posts the credits on a verified credit list on their website. Credit generators and buyers work together to negotiate the number of credits needed, cost, and other details, which is documented through a signed contract. The credit generator then submits a Nutrient Credit Registration Request Form (with a copy of the signed contract) to PADEP. After PADEP updates information on the website to reflect the registered credits, they are available for trade. The generators and sellers then update the Annual Chesapeake Bay Spreadsheets to identify the number of credits purchased, sold, registry number, loading, effective date, and other information, and submits the documentation to PADEP. Through the development of the Regulatory In-lieu Fee and Bank information Tracking System (RIBITS) registry tool, PADEP will streamline the process used to approve and track trades. The RIBITS will allow real-time tracking that will reduce staff time to administer the trading program and increase overall transparency of the trading process.

The PADEP's program allows for a truing period following each compliance year (October 1 – September 30) for a discharger to comply with cap loads through the application of credits and offsets (PADEP 2022). Point source dischargers submit their electronic discharge monitoring reports (e-DMRs) to PADEP by September 30. The truing period occurs from October 1 – November 28 each year, providing a 60-day period for dischargers to find buyers, calculate trades, trade registered credits generated during the compliance year, and submit information to PADEP for review and certification. The PADEP maintains additional information internally, including historic supply and demand information, number of credits and trades, trade sources, and average cost of credits based on the information supplied by trading partners.

Trading Ratios, Risk Mitigation, and Minimum Control Measures

The PADEP uses a 1:1 trading ratio for both nitrogen and phosphorus, which must only be traded as comparable credits (e.g., nitrogen traded for nitrogen and phosphorus for phosphorus).

The PADEP originally used approximately 30 delivery ratios for trading in the Chesapeake Bay. With the Phase 6 Chesapeake Bay model, PADEP refined the delivery ratios to be more granular and accurate. The PADEP utilizes a 10 percent credit reserve ratio for point sources to address potential uncertainties and mitigate risk. The PADEP allows trades within and between the Susquehanna and Potomac River basins, with an interbasin trading requirement of an additional 5 percent credit purchase to address uncertainties.

Program Successes and Outcomes

The PADEP defines the success of its program the number of compliant facilities. Of the 274 dischargers regulated in Pennsylvania's portion of the Chesapeake Bay, only five facilities have been noncompliant. There were enough credits for these five noncompliant facilities, but sometimes a facility chooses to take the violation rather than participate in the program or misses a trading deadline (R. Colyer, December 9, 2022, personal communication).

Historical supply and demand data are a surrogate metric for the rate of facility upgrades and resulting credit generation by WWTPs. At one point, the market had been flooded with credits. The supply of

credits resulted from WWTP credit generation; NPS participation was low in 2021 and no NPS trades occurred this year. This year, there were approximately 500,970 verified credits with approximately 450,000 traded credits.

Funding and Resources

The costs associated with program administration are mainly labor costs, which are covered by state funding. The PADEP has also received grant funds from USDA, the National Environmental Information Exchange Network (NEIEN) and Chesapeake Bay Implementation Grant to support the development and set up of the RIBITS registry. The PADEP's trading program is primarily administered by one staff person, with some managerial assistance. The PADEP representative estimated that 90 percent of their time is dedicated to administering the trading program, and of that, 50 percent of time is spent on the NPS trading. The PADEP representative stated that the point source-to-point source trading program is straightforward, but the NPS portion is more involved as it is more complex, with larger data sets, and thus, more resource intensive. The PADEP representative anticipates that the point source-to-point source trading will become even more streamlined with the implementation of the RIBITS registry (R. Colyer December 9, 2022, personal communication).

Statutory and Regulatory Considerations

The PADEP has not been involved with legal cases regarding program implementation. The current state regulations provide flexibility so the program can move forward without regulatory backlog. For example, the regulatory language includes phrases such as "the most current modeling tools" help to ensure current information is incorporated.

Relevant Program Highlights

The following program elements and lessons learned from PADEP's program may be beneficial for Ecology's consideration during development of a point source-to-point source trading program.

- **Online registry.** The PADEP believes that the use of RIBITS as the trading program registry will provide process efficiencies and increase transparency through real-time data tracking.
- **Regulatory flexibility.** The state's flexible regulations have been helpful in ensuring that the program has structure but can also move forward without requiring updated rules.
- **Limited state involvement in trades.** The PADEP has benefited from not playing a role in trading partner negotiations and financial transactions. A bilateral trading structure where permittees are responsible for negotiating trades streamlines the state's role, which is limited to permitting, tracking and verifying credits, and documenting trades.
- **Pre-TMDL loading caps.** Point source trading in Pennsylvania has been driven by point source cap loads to first meet Chesapeake Bay tributary strategy goals and then to meet approved WLAs by river basin with a focus on achieving water quality improvements in the Chesapeake Bay, reflected in delivery ratios supported by the Chesapeake Bay model.
- **Documenting program decisions and procedures.** Staff turnover within the state agency can leave gaps in institutional knowledge. The current PADEP staff person responsible for administering the trading program learned the operational processes from one person who no longer works for PADEP. While historical documentation is available about credit supply and

demand, some of the basis for programmatic decisions has not been transferred to new staff. Documenting key program decisions to preserve institutional knowledge can be beneficial for information sharing to new staff over time.

References

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Virginia's Nutrient Credit Exchange Program

Background

Virginia's General Assembly passed legislation in 2005 that authorized the development of the Virginia Nutrient Credit Exchange Program ([Va. Code § 62.1-44.19:12 et seq](#)) to provide regulated wastewater treatment plants (WWTPs) with a flexible approach to meet nutrient allocations first through Chesapeake Bay tributary strategy goals and then the 2010 Chesapeake Bay total maximum daily load (TMDL). This legislation directed the Virginia Department of Environmental Quality (DEQ) to issue a Watershed General Virginia Pollutant Discharge Elimination System (VPDES) Permit. In 2006, the Virginia General Assembly adopted the General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed in Virginia ([9 VAC 25-820-70](#)). Virginia DEQ has reissued this general permit four times, in 2012, 2017, and 2021. Under the general permit, Virginia DEQ allows WWTPs to purchase total phosphorus (TP) and total nitrogen (TN) credits within its five Chesapeake Bay tributary river basins: Eastern Shore, James, Potomac, Rappahannock, and York. Virginia's Nutrient Credit Exchange Association (the Exchange) plays a significant role in coordinating credit transactions and compliance planning for most of the regulated point source dischargers in Virginia's five Chesapeake Bay river basins. Trading to meeting nutrient waste load allocations (WLAs) is part of Virginia's two-pronged approach to addressing nutrients in the Chesapeake Bay watershed; the second prong of the approach is the inclusion of technology-based effluent concentration limitations (expressed as annual average concentrations) in the individual permits for WWTPs that have installed technology for the control of nitrogen and phosphorus whether by new construction, expansion, or upgrade per Virginia's 2005 Regulation for Nutrient Enriched Waters and Dischargers within the Chesapeake Bay Watershed (Virginia Administrative Code n.d.).

This document focuses on the aspects of point source-to-point source trading under Virginia DEQ's general permit for WWTPs in the Chesapeake Bay watershed that may be most relevant to establishment of a point source trading program in the Puget Sound watershed.

Program Details

Program Structure

History and Drivers for Trading

The 2000 Chesapeake Bay tributary strategy goals served as the initial driver for nutrient trading in Virginia's portion of the Chesapeake Bay watershed. Although this was technically pre-TMDL, the tributary strategy goals set TMDL-like nutrient allocations codified in Virginia's Water Quality Management Planning Regulation (9 VAC 25-720) (VDEQ n.d.).

Regulated dischargers provided significant input into Virginia's nutrient trading program design, including the concept of the Exchange and a watershed nutrient general permit (A. Brockenbrough, personal communication, December 12, 2022). Between 2004 and 2005, Virginia's governor called for state action as controlling the point source discharges of nutrients to the Bay would be the most dependable and initially effective way to reduce nutrient discharges. The dischargers held meetings with the Secretary of Natural Resources, Virginia DEQ, and non-governmental organizations like the Chesapeake Bay Foundation to work on legislation for a trading program and associated general permit

(A. Brockenbrough, personal communication, December 12, 2022). This gave WWTP owners/operators the ability to choose one of two paths to permit compliance: upgrading facilities through Virginia's Water Quality Improvement Fund or trading. Many of the larger WWTPs began making upgrades to their plants to generate credits to sell, which were largely purchased by smaller municipalities that couldn't finance upgrades.

Eligibility for Participation

The general permit authorizes nutrient trading for new or existing VPDES permittees that discharge nutrients to the Chesapeake Bay or its tributaries. Three categories of permittees are covered by the general permit based on the volume of discharge, the type of discharge (including sewage treatment and industrial discharges), and the type of receiving water (tidal or non-tidal) (VDEQ n.d).

Permit Framework and Credit Generation

Virginia DEQ maintains a registry of the facilities covered under the general permit that contains the load limits for each facility. The 2010 Chesapeake Bay TMDL included WLAs for two river basins that were more restrictive than the tributary strategy WLAs codified in the 2005 Water Quality Management Planning Regulation (9 VAC 25-720). Virginia DEQ has modified the load limits when WLAs change through new phases of Virginia's watershed implementation plans (WIPs) to implement the Chesapeake Bay TMDL.

The general permit sets forth the options for facilities to comply with their assigned load limits, including purchase of credits. Per the general permit, credits are the difference in pounds between the facility's limit and the mass actually discharged. Per the general permit, credits purchased to comply with a facility's assigned WLA must meet the following criteria:

- Credits must be generated and applied to a compliance obligation in the same calendar year and acquired no later than June 1 immediately following the calendar year in which the credits are applied.
- Credits must be generated by one or more permitted facilities in the same tributary as the purchasing facility, although facilities in the Eastern Shore Basin have authorization to acquire credits from permitted facilities in the Potomac and Rappahannock tributaries using applicable equivalency factors (see "Trading Ratios, Risk Mitigation, and Minimum Control Measures" below) due to the small market size of the Eastern Shore Basin.
- Credits must be generated by a facility that has discharged from treatment works whose design flow or equivalent industrial activity is the basis for the facility's WLA.

The general permit recognizes that some WWTP owners may have more than one facility discharging to a tributary covered under the general permit and allows an owner of two or more facilities to apply for an aggregated mass load limit for TN and TP. Permittees with these aggregated mass load limits are eligible to generate credits if the aggregate mass load discharged by the facilities is less than the total of the wasteload allocations assigned to any of the affected facilities.

The general permit also includes provisions to allow trading for new and expanding dischargers.

Operational Processes

Virginia DEQ's current primary role in nutrient trading is issuing the general permit and ensuring compliance with the general permit, as well as fulfilling annual reporting under existing regulations authorizing nutrient trading and the general permit.

Virginia DEQ cites the Exchange as a key to the success of Virginia's nutrient trading program. The Exchange serves as a credit clearinghouse and conducts compliance planning and other functions on behalf of its member regulated point source dischargers (approximately 105 facilities/73 owners) (U.S. EPA Region 3 2021). The Exchange is a non-stock corporation authorized through regulation to create bylaws, develop processes for trading, and establish credit pricing. The Exchange is responsible for tracking the credit exchanges, including the entities trading, number of trades, amounts traded, and other associated information. The Exchange compiles a single compliance plan on behalf of its regulated members and submits the annual compliance plan to Virginia DEQ for review and approval (Virginia Nutrient Credit Exchange Association 2022). Bi-lateral trading outside of the Exchange is authorized.

The Exchange initially set the price of credits low to encourage trading at the onset of the program and will move to a more market-based approach over time. The Exchange developed a Class A credit and Class B credit approach, with Class A credits defined by the Exchange credit policy as "credits for which an agreement for sale and purchase in a specific quantity is made in advance in accordance with" the Credit Exchange Policy. Class B credits are those that are pledged to the Exchange, but have not been included in a specific agreement for sale and purchase; the number of Class B credits that will be transferred to the exchange in a given year is estimated, but not guaranteed. (Virginia Nutrient Credit Exchange Association 2022). Providing Class A credits that guarantee a specific quantity over a specific period of time has helped to provide the market and participating dischargers with some assurances for compliance (A. Brockenbrough, personal communication, December 12, 2022).

Registration, Verification, Documentation, and Trading Processes

The general permit requires WWTPs covered under the general permit to submit an annual registration statement to Virginia DEQ.

Facilities covered under the general permit must submit to Virginia DEQ monthly discharge monitoring reports (DMRs) that include TN and TP average concentration, flows, and monthly loading. The final yearly DMR is due on January 10 to Virginia DEQ. All DMRs are subject to Virginia DEQ review. Virginia DEQ posts loading reports for each basin by April 1 on its website; the report summarizes the amount of credits available and which entities need to trade. Dischargers then work together, either through the Exchange or independently, to purchase the necessary credits to comply with WLAs. Dischargers must then provide a certification form to the Exchange Association by June 1. During the same timeframe (April – June 15), the Exchange conducts a data review process, generates credit certificates for its members, and prepares the final reconciliation report (Virginia Nutrient Credit Exchange Association 2022).

Trading Ratios, Risk Mitigation, and Minimum Control Measures

Virginia DEQ applies new TN and TP delivery factors established using EPA's Phase 6.0 Chesapeake Bay Watershed Model. These delivery factors apply to discharges west of the fall line (the transition from the Piedmont region to the Coastal Plain region) for each river basin. Discharges located east of the fall

line for each river basin are assigned a delivery factor of 1.0. Dischargers can identify their specific delivery factors on the Registration List that Virginia DEQ generates for each basin. Virginia DEQ acknowledges that the Exchange's compliance plan applies the previous TN and TP delivery factors to trade agreements that end in 2025; therefore, the new TN and TP delivery factors will not go into effect until 2026.

The general permit acknowledges the small market in the Eastern Shore Basin and allows for interbasin trading between Eastern Shore Basin and the Rappahannock or Potomac River Basins at trade ratios of 1.3:1 and 1:1, respectively (Virginia DEQ 2022).

Virginia DEQ identified a hot spot in a tidal area of the James River Basin and now has a split trade area on the James River to address the hot spot (A. Brockenbrough, personal communication, December 12, 2022).

Another risk mitigation approach is the use of the Nutrient Offset Fund. If a facility covered under the general permit cannot purchase credits from another facility to meet the assigned WLA, the general permit authorizes the facility to acquire sufficient nitrogen or phosphorus credits through payments made into the Nutrient Offset Fund for nonpoint source nutrient control projects.

As previously mentioned, any facility that has installed technology for the control of nitrogen and phosphorus whether by new construction, expansion, or upgrade is subject to technology-based effluent concentration limitations (expressed as annual average concentrations) in their individual permit per Virginia's 2005 Regulation for Nutrient Enriched Waters and Dischargers within the Chesapeake Bay Watershed (9 VAC 25-40).

Funding and Resources

VDEQ provided seed funding for the Exchange to become operational. This funding included approximately \$200,000 per year for two years. With this funding, the Virginia Nutrient Credit Exchange organized its membership, hired an engineer and a lawyer, and developed bylaws and procedures. After this initial two-year period, the Exchange operated on its own based on revenue generated through membership dues.

Virginia DEQ primarily has one full-time employee responsible for overseeing the Chesapeake Bay watershed nutrient general permit; this employee is also responsible for Virginia's industrial stormwater general permit. The most significant use of resources occurred during program development and when issuing the general permit. Other responsibilities include general permit reissuance, DMR review, and report preparation. Ultimately, issuing the general permit has been a cost savings for Virginia DEQ rather than having to issue and reissue individual permits. The level of effort associated with administering the nutrient trading program decreased after issuance of the general permit and dischargers began trading, due to the operational activities conducted through the Exchange (A. Brockenbrough, personal communication, December 12, 2022).

Statutory and Regulatory Considerations

Virginia's state code authorizes Virginia DEQ to implement nutrient trading through the general permit. Virginia DEQ has modified General VPDES Watershed Permit Regulation for Total Nitrogen and Total Phosphorus Discharges and Nutrient Trading in the Chesapeake Bay Watershed in Virginia, 9 VAC 25-

820-70, to reissue the general permit. Incorporating the nutrient credit exchange program into state code helped to establish the trading framework but has in some instances limited Virginia DEQ's flexibility to administer the program (A. Brockenbrough, personal communication, December 12, 2022).

Recent amendments to the Water Quality Management Planning Regulation require new facility upgrade projects through the Enhanced Nutrient Removal Certainty (ENRC) Program for a specific list of facilities. The regulation establishes a schedule for these upgrade projects with more stringent WLAs. Many of these facilities are operating under capacity, resulting in a surplus of credits; the reduced WLAs for facilities will likely tighten the supply of available credits (A. Brockenbrough, personal communication, December 12, 2022).

Program Successes and Outcomes

Virginia DEQ considers Virginia's nutrient trading program successful in facilitating discharger compliance with cap loads. Through this approach, Virginia has been able to achieve the nutrient reductions in the five basins tributary to the Chesapeake Bay much more quickly and efficiently than if all the individual permits within the Chesapeake Bay watershed had to be negotiated and updated. Regulated dischargers able to meet their discharge requirements as efficiently, effectively, and as cheaply as possible is a measure of program success. The fact that the nutrient credit exchange and general permit framework was driven by dischargers has likely contributed to the fact there have been no legal challenges to the overall approach (A. Brockenbrough, personal communication, December 12, 2022).

Relevant Program Highlights

Several aspects and lessons learned from Virginia DEQ's nutrient credit trading program and general permit approach may be beneficial for Ecology's consideration during development of a WWTP-to-WWTP trading program for Puget Sound.

- **Discharger participation in program design.** Virginia's dischargers in the Chesapeake Bay watershed played an influential role in the design of the nutrient credit trading program. Virginia DEQ views discharger involvement in the program design and ownership over the program as a factor that has contributed to success.
- **Use of a third party to oversee trades, with buy-in from dischargers.** Virginia DEQ cites the Exchange as essential to operating a nutrient credit trading program. Given the membership nature of the Exchange, the structure has increased discharger buy-in. The Exchange has given the dischargers ownership of the market, and provided the dischargers with a way to organize and to develop their own bylaws. While Virginia DEQ believes the Exchange has been essential to Virginia's efforts, they suggest that Washington Ecology should consider leaving the decision up to dischargers about whether a discharger-based association as the third-party entity to administer trading would meet their needs in Puget Sound.
- **State support to help establish third-party trade administration infrastructure.** Virginia DEQ states that the seed money provided to the Exchange over a two-year period was a solid use of resources. While Virginia DEQ did not directly get involved in how the Exchange established its bylaws and processes, the seed funding ensured that this association had the foundation to function effectively from the outset.

- **Use of a general permit provides efficiencies.** Virginia DEQ feels that the nutrient general permit has also contributed to the success of nutrient reductions to achieve the Chesapeake Bay TMDL loads. Use of a general permit has created consistency for dischargers and facilitated the dischargers working together to make trades and reduce loading. Flexibility is important in the program, particularly for the dischargers. The goal of the program was to provide the dischargers with an opportunity to choose a path to compliance—either upgrade their plants or purchase credits to meet their WLAs. The general permit also reduced the time needed for permit negotiations and reissuance.
- **Two-pronged approach involving both TBELs and WLAs works well.** While the focus of the general permit and the nutrient credit trading program is providing flexibility to meet WLAs, Virginia does have a regulatory mechanism to also require facilities to comply with nutrient TBELs in the Chesapeake Bay. Virginia DEQ incorporate TBELs into a facility’s individual permit when a facility undergoes an upgrade. This approach gives Virginia another tool to address nutrient loads to the Chesapeake Bay while maintaining flexibility for facilities to achieve compliance.
- **Early engagement with the state legislature on statutory language to authorize trading.** Virginia DEQ acknowledges the need for statutory language to support the trading framework, but did not initially envision the direction and scope of the final regulation, which was heavily influenced by dischargers. Early involvement in the statutory language stipulating design elements of a trading program will ensure the language has the necessary level of flexibility. Bringing all stakeholders together in the statutory development process will promote a collaborative approach and buy-in, which is much more efficient than dealing with legal challenges.

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Wisconsin Statewide Water Quality Trading Program

Background

Wisconsin's statewide water quality trading program has been in place since 2011. The trading program was authorized to assist wastewater treatment plants (WWTPs) in complying with stringent statewide numeric water quality criteria for total phosphorus (TP). The statewide program establishes rules and guidelines that allow point sources to use water quality trading to comply with Wisconsin Pollutant Discharge Elimination System (WPDES) permit limits, but the specific trades are identified, developed, and proposed by permittees. Wisconsin Department of Natural Resources (WDNR) reviews the submittals, and if approved, revises WPDES permits to reflect the proposed trade(s). While trading can be used for all pollutants except bioaccumulative chemicals of concern, to date, most trades and guidance have focused on TP and total suspended solids (TSS). In addition, only two of all the trades that have occurred were between point sources; all other trades have been between point sources and nonpoint sources. Trading occurs statewide in watersheds with and without total maximum daily loads (TMDLs) and must result in a net reduction of the pollutant(s) traded. Long-term monitoring shows continued small, but significant, TP load reductions in rivers and streams across the state (WDNR 2020b).

Program Details

Program Structure

Pilot Study

The formation of Wisconsin's water quality trading program started in 1997 when legislative action created three pilot areas for phosphorus water quality trades: the Red Cedar River Watershed, the Fox and Wolf River Basin, and the Rock River Basin. At the time, none of the areas had TMDLs. The Red Cedar River Watershed had a successful pilot trading program. However, most facilities within the watershed determined that on-site upgrades to comply with technology-based phosphorus limits were more cost effective than trading (WDNR nd). One point source facility, a wastewater treatment plant, successfully traded with a nonpoint source, with the County Conservation Department serving as a broker. The major lesson from the pilot was that water quality trading was not economically viable in most cases, unless a facility needed to reduce its TP effluent below 1 mg/L (K. Kirsch, personal communication, December 9, 2022).

Statutory History

In December 2010, the Wisconsin legislature adopted statewide numeric water quality criteria for TP (Wisconsin Administrative Code Chapter NR 102). As water quality-based effluent limits were incorporated into permits, water quality trading became an economically viable compliance option, and an economically preferable action compared to facility upgrades or other compliance options (WDNR n.d.). In 2011, additional legislative action moved water quality trading from the pilot phase to a statewide program and established the framework for the current water quality trading program (Wisconsin Administrative Code Chapter NR 283.84). The WDNR followed in 2013 with the release of guidance documents for water quality trading. Program coordinators note that development of the guidance required substantial negotiation with EPA to establish flexibility around TMDLs, especially with

nonpoint source trades (K. Kirsch, personal communication, December 12, 2022). In 2020, the Wisconsin legislature authorized water quality trading through a central clearinghouse (Act 151). The request for proposal (RFP) process to identify a third party to run the clearinghouse is ongoing. The goals of the clearinghouse effort are to facilitate a statewide credit marketplace, to engage more parties to reduce water pollution, and to provide compliance solutions for WPDES permittees (DOA 2021).

In 2020, WDNR released updated guidance documents that made program adjustments based on the previous seven years of trading projects. This guidance included flexibility around TMDL credit thresholds (including interim floors, interim credit timeframes, and site-specific baselines), accounting for lack of precision in nonpoint source modeling (including rounding and rotational averaging), expansion of interim credits to 10 years, further clarification of downstream trading policy, and additional guidance on other credit generating nonpoint activities.

Statutory Framework

The 2011 statutory framework (s. 283.84, Wisc. Stats) that established statewide water quality trading includes the following key provisions. The WDNR “shall administer a program for the trading of water pollution credits which allows a person required to obtain a permit to increase the discharge of pollutants above levels that would otherwise be authorized in the permit” when:

- A binding written agreement is reached;
- Trading results in improvement of water quality;
- Involves the same pollutant or same water quality standard;
- Trading occurs within the same basin;
- Terms and conditions of the trade are included in the permits; and
- Only load reductions below permit limits for point sources and below loadings at the time the agreement is reached for nonpoint sources can generate credits.

Program Administration

The Wisconsin water quality trading program administration has no fully dedicated full-time equivalents (FTEs) for program administration. Rather, program duties are divided among three existing state-level staff positions that span three related programs: Nonpoint Source, Point Source, and Water Quality Standards/TMDLs. In addition, five regional coordinators support the program at the local level through educating and working with permittees and reviewing permit submittals. Program coordinators note that staffing was the most substantial cost with developing the trading program (K. Kirsch, personal communication, December 12, 2022). Initial program development included attorneys, policy makers, and engineers.

Eligibility for Participation

All facilities in the state with Wisconsin Pollutant Discharge Elimination System (WPDES) permits are eligible to participate in water quality trading. Participants must meet the statutory requirements (e.g., binding agreement, demonstrate trades will improve water quality) detailed above. Trading must be used to meet water quality-based effluent limitations (WQBELs), not technology-based effluent limitations (TBELs).

Market Feasibility Study

After the authorization of the water quality trading program in 2011 and development of the trading framework, a three-year assessment of the economic feasibility of trading was initiated in the Lower Fox River Basin (Great Lakes Commission 2016). The initiative was commissioned by the Great Lakes Commission, the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the Wisconsin DNR, and focused specifically on trades of TP and TSS between point sources (WWTPs and municipal separate storm sewer systems (MS4s)) and nonpoint sources (e.g., agricultural best management practices). The study did not result in any significant changes to the framework or implementation of the water quality trading program (K. Kirsch, personal communication, December 12, 2022).

Characteristics of Trades to Date

To date, only two trades in the history of the Wisconsin program have been between point sources, and the credits generated for both of these trades resulted from treatment upgrades at a single WWTP (M. Claucherty, personal communication, December 12, 2022). These trades between WWTPs in a basin with an approved TMDL occurred because the WWTP generating the credits had achievable phosphorus limits and wastewater that responded well to chemical removal without the need for tertiary filtration (Claucherty 2022, personal communication). Program coordinators noted that other WWTPs are looking to add tertiary treatment to then give credits to their permitted MS4s (M. Claucherty, personal communication, December 12, 2022). However, trades between point sources remain challenging because one of the permittees must go below their permitted effluent limits to generate credits, which may not be economically feasible (K. Kirsch, personal communication, December 9, 2022). Almost all trades have been point source-to-nonpoint source because of these economic reasons and because landscape change projects targeting nonpoint sources, including agricultural projects, often reduce more pounds of phosphorus per dollar spent (M. Claucherty, personal communication, December 12, 2022).

Operational Processes

Permit Compliance

The WPDES permits include minimum control levels, computed compliance limits, and compliance schedules. The minimum control level, which is established to prevent backsliding, could be a TBEL, a limit based on discharges, or for TP, an interim WQBEL developed in accordance with state standards (WDNR 2020a). Computed compliance limits establish the maximum allowable difference between the amount of P discharged and the number of credits used. However, these are not used in point source-to-point source trades. Rather, the WQBELs are increased based on the amount of credit to be applied (M. Claucherty, personal communication, December 12, 2022). Permits also include compliance schedules that build in a 7- to 9-year planning process for facilities before they must comply with the set pollutant limit (M. Claucherty, personal communication, December 12, 2022). During the planning process, the facilities must investigate options to meet permit limits. Water quality trading is one option for compliance. Adaptive management and the statewide Multi-Discharger Variance for phosphorus are other options. Typically by the time facilities are ready to trade, they have improved effluent quality and WDNR will set interim limits at achievable levels based on those improvements (M. Claucherty, personal communication, December 12, 2022).

Verification and Certification of Trades

Currently the WDNR approves trades as part of the permit compliance provisions. Trades can be “bi-lateral” agreements or through a third party (WDNR 2020a). A statewide third-party clearinghouse (see below) is in development. Program coordinators note that much of the trading work is done through county conservation departments, environmental consultants, and wastewater consultants (M. Claucherty, personal communication, December 12, 2022). The WDNR verifies point source compliance with trading using effluent monitoring. The permits of the credit generator and credit user specifies the frequency and sampling protocols, as well as reporting requirements.

State Clearinghouse Development

Wisconsin’s 2020 statute authorizes the development of a central clearinghouse. A third-party vendor will develop and implement the clearinghouse. The WDNR released an RFP in 2021 to select this third-party vendor. The clearinghouse is not expected to change the fundamental structure of the program. The RFP anticipates improving risk mitigation for nonpoint source trades through the clearinghouse by requiring the third party vendor to enter into agreements with credit generators and to establish and maintain a bank of certified credits for sale (DOA 2021). The WDNR will work with the third party to approve the initial methods, then annually the clearinghouse will report to WDNR and the Department of Administration (DOA). The clearinghouse will be self-funded.

Trade Ratios

To ensure a net reduction of pollutants, WDNR established formulas for four different factors that are used to calculate trade ratios (WDNR 2020a):

- **Delivery Factor:** accounts for distance between credit generator and credit user
- **Downstream Factor:** accounts for local water quality impacts if credit user is upstream of credit generator
- **Equivalency Factor:** accounts for when trading partners discharge different forms of a pollutant
- **Uncertainty Factor:** accounts for uncertainty with the effectiveness of nonpoint source management practices; not used in point source to point source trades

Trading in TMDL Basins

Trades can occur in basins with and without TMDLs. When a TMDL is in place, a nonpoint source credit generator must reduce their pollutant load below their TMDL load allocation. When a new TMDL is implemented, there may be cases where previously generated credits are no longer valid because the credit generator becomes subject to new or more stringent credit thresholds from the TMDL load allocations. In these cases, the WDNR gives the regulated credit purchaser 5 – 10 years to find new credits (M. Claucherty, personal communication, December 12, 2022).

Risk Mitigation

If a permittee is unable to purchase sufficient credits (e.g., if the anticipated credits are not generated), the permittee is in violation of the permit. The WDNR encourages permittees to mitigate risk, especially with point source-to-nonpoint source trades, by generating excess credits through management measures that are independent of each other. The WDNR checks that trading partners have a binding

legal agreement, but any disputes between a credit generator and user are worked out between the two parties.

Funding

The Wisconsin water quality trading program does not have a dedicated funding source. The three primary program coordinators and five regional coordinators are funded under different programs for which they hold primary job responsibilities. Funding for information technology has been acquired on a per project basis. There is interest in exploring the use of Clean Water State Revolving Funds (CWSRF) to finance water quality trading projects.

Program Successes and Outcomes

The program coordinators consider the program to be successful because it provides flexibility for facilities to meet more stringent effluent limits in the way that is most economical or that provides “greater overall environmental impact than a traditional upgrade” (K. Kirsch, personal communication, December 9, 2022). While there has not been specific monitoring related to the water quality trading program, most long-term water quality monitoring sites for rivers and streams throughout the state continue to show declines for TP (WDNR 2020b). At some sites, rapid decreases in TP loads have been detected and correspond with the implementation of stricter TP regulations (K. Kirsch, personal communication, December 12, 2022). Another form of success has been increased awareness and understanding of pollution sources among permittees and the general public. The program coordinators described the importance of bringing relevant stakeholders to the table to think more creatively about collectively meeting permit requirements (M. Claucherty, personal communication, December 12, 2022).

Relevant Program Highlights

The following program elements and lessons learned from Wisconsin’s statewide program may be beneficial for Ecology’s consideration in developing a point source-to-point source water quality trading program for WWTPs under the Puget Sound Nutrient General Permit.

- **Staff integration across programs.** Wisconsin’s water quality trading program does not have any FTEs that are fully dedicated to program implementation. Instead, water quality trading roles and responsibilities are distributed across three state-level coordinators who are housed in different, related programs: Nonpoint Source, Point Source, and Water Quality Standards/TMDLs. In addition, five regional coordinators support the program at the local level. While program coordinators estimate the program could be run with 2 dedicated FTEs, they believe their integrated approach results in a stronger program. Water quality trading impacts many programs and having staff that support all those programs be part of water quality trading coordination efforts has led to better program integration with more people who are knowledgeable of the program requirements and responsibilities (M. Claucherty, personal communication, December 12, 2022).
- **Online registry for trades.** While Wisconsin does not have an online registry for water quality trades, program coordinators noted that such a system could work well for point source – point source trading. Wisconsin has similar registries for an air monitoring program and a wetland

mitigation program. An online registry would allow permittees to advertise available credits to facilitate connections and trades between credit generators and credit buyers.

- **Clear guidance around geographic extent.** The geographic extent of specific trades (trading boundaries) has been one of the most controversial and challenging parts of Wisconsin's water quality trading program. Some permittees push to apply credits more broadly than standards are set up to achieve while some local governments are not amenable to spending money outside of their jurisdictional boundary. Program coordinators point to the importance of clear guidance around trading boundaries and geographic extent of trades.
- **Trade ratios.** Wisconsin's program offers detailed guidance around calculating trade ratios. This guidance facilitates development of approvable water quality trading plans that result in a net water quality improvement.
- **Alternative compliance options.** Wisconsin permittees have several options for complying with effluent limitations, in addition to upgrading on-site treatment. These options include water quality trading, adaptive management, and a multi-discharger variance for phosphorus. Staff note that offering that flexibility for permittees to identify the most economical compliance option and time to come into compliance was critical to initial implementation and acceptance of the statewide phosphorus criteria by both permittees and the state legislature.

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