A Water Quality Trading Framework for Wisconsin

A Report to the Natural Resources Board
July 1, 2011

Prepared By:
Wisconsin Department of Natural Resources

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Abbreviators and Acronyms

BCC	bioaccumulative chemical of concern
DNR	Wisconsin Department of Natural Resources
EPA	U.S. Environmental Protection Agency
LA	load allocation
MS4	municipal separate storm sewer system
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
PI	phosphorus index
PS	point source
POTW	publicly owned treatment works
TBEL	technology based effluent limitation
TMDL	total maximum daily load
TSS	total suspended solids
USGS	United States Geological Survey
WLA	wasteload allocation
WQT	water quality trading
WQBEL	water quality based effluent limitation
WPDES	Wisconsin Pollutant Discharge Elimination System

Executive Summary

This report is in response to the Natural Resources Board's June 2010 resolution to develop a water quality trading framework for Wisconsin. The development of the framework is in response to the promulgation of Wisconsin's phosphorus rules.

The framework was developed in conjunction with stakeholders and is built on a philosophy of encouraging water quality trading in a way that maximizes environmental benefits in the most efficient and cost-effective manner. Both internal and external stakeholder groups were consulted in the drafting of the framework. In cases where consensus was not reached, this report provides a summary of views.

A major goal of the framework is to encourage water quality trading. As written, the framework includes information on how trading fits into the regulatory permit program; it does not envision the DNR filling the role of broker or facilitator of trades. Two U.S. Environmental Protection Agency (EPA) policies regarding water quality trading also helped to shape the framework. Trades should never result in violations of water quality criteria, and trades must result in an overall improvement of water quality, not just maintenance of the status quo.

It is an important distinction that many of EPA's policies concerning water quality trading are guidance based on the federal Clean Water Act and not on actual administrative rule. Where possible, the proposed framework encourages flexibility based on guidance but holds firm to requirements set forth in specific federal or state administrative rules.

It is recommended that the Natural Resource Board support the DNR in implementing the water quality trading framework. This includes supporting necessary statutory changes and development of guidance as identified in Part 3 of the report. In addition, continued stakeholder involvement will be sought as guidance is developed.

The first step in moving the water quality trading framework forward is holding discussions with EPA regarding location of trades and the generation of pollutant reduction credits. These two issues are the primary concern of external stakeholders who seek greater flexibility than implied in current EPA policy.

Introduction and Background

Wisconsin Natural Resources Board Resolution: In June, 2010 the Natural Resources Board (Board) approved a comprehensive rule package aimed at improving the water quality of Wisconsin's lakes, rivers and streams. The approved rule package addresses both point (end-of-pipe) and nonpoint (runoff) sources of phosphorus and other pollutants. Point sources are addressed by ch. NR 217, Wis. Adm. Code, and nonpoint sources are addressed by ch. NR 151, Wis. Adm. Code. Also included in the rule package are numeric water quality criteria for phosphorus for rivers, streams and lakes (ch. NR 102, Wis. Adm. Code).

The Department of Natural Resources (DNR) also drafted a first of its kind watershed adaptive management option that promotes cooperation among point and nonpoint pollution sources to find the most cost-effective means to reduce phosphorus and other pollutants. This adaptive management option is outlined in s. NR 217.18, Wis. Adm. Code.

To further promote flexibility and provide options to maximize environmental benefits in the most cost-effective manner possible the Board passed a resolution instructing the DNR to create a framework for water quality trading.

> *Board Resolution: Mr. Cole MOVED, seconded by Mr. Welter, to direct the Department to immediately assemble a stakeholder group of those interested parties in watershed based trading issues to develop a trading framework including any recommended rules or guidance to facilitate watershed based trading, and report back to the Board no later than July 1, 2011. The motion carried unanimously.*

This report contains the Board requested water quality trading framework. This framework outlines an approach and recommends the actions needed to create a viable water quality trading program.

The purpose of the water quality trading framework is to promote a voluntary statewide water quality trading program with the following goals:

- Optimize the costs necessary for maintaining and improving water quality in Wisconsin's lakes, rivers, and streams.

- Create economic incentives for nonpoint source pollution reductions and facilitate implementation of Total Maximum Daily Load (TMDL) allocations.

- Provide greater flexibility and promote watershed based approaches and dialogue between different pollutant sources within a watershed.

This framework is drafted with a philosophy of encouraging water quality trading; however, the framework emphasizes how trading fits into regulatory permit programs and does not promote DNR filling the role of a broker or facilitator of trades.

Two U.S. Environmental Protection Agency (EPA) policies regarding water quality trading significantly shaped the framework: (1) trades should not result in violations of water quality criteria; and (2) trades must result in an overall improvement of water quality, not just maintain the status quo.

The water quality trading framework is drafted to work with a variety of pollutants; however, more detail is provided for phosphorus. This was done because of the December 2010 promulgation of ch. NR 102, Wis. Adm. Code, and the numeric phosphorus criteria contained therein.

Water Quality Trading Framework Development: The development of the framework was sponsored by Russ Rasmussen, Water Division Deputy Administrator, Bruce Baker, former Water Division Administrator, and Susan Sylvester, Acting Director, Bureau of Watershed Management. The development of the framework was co-lead by DNR staff, Mike Hammers and Kevin Kirsch, PE, representing both the point source and nonpoint source sections of the DNR, respectively. As directed by the Board, an external stakeholder committee made up of representatives from point sources, nonpoint sources, and environmental groups was formed to assist in the development of the framework. An internal workgroup was formed as well. Information pertaining to the external stakeholder committee, meeting process, and minutes can be found in Appendix A.

At their first meetings, both the internal workgroup and external stakeholder committee performed an analysis of the forces working for and against water quality trading in Wisconsin. A summary of the external stakeholder's analysis can be found in Appendix A. The purpose of this analysis was to determine points of common ground to start the creation of a water quality trading framework and to provide a feedback tool to evaluate the applicability of the trading framework. A successful framework should leverage the existing forces working for trading and adequately address forces working against trading such that they do not prevent an overall trading program.

University of Wisconsin-Extension staff facilitated meetings, drafted meeting minutes and summary reports, and assisted in communication efforts by creating and maintaining a webpage (http://fyi.uwex.edu/wqtrading/). In addition, a webinar was conducted with technical support provided by UW-Extension staff on February 10, 2011. The webinar outlined the framework for a larger audience and allowed feedback from stakeholders beyond the external stakeholder committee and internal workgroup. A complete copy of the presentation can be found on the UW-Extension webpage (http://fyi.uwex.edu/wqtrading/resources//).

Implementation of the water quality trading framework will require approval from EPA. Therefore, in addition to working with stakeholder committees, the DNR has discussed the trading framework with EPA. Interaction occurred with EPA through both their participation in external stakeholder committee meetings and discussions between DNR and EPA. The DNR anticipates additional input from EPA when EPA reviews this final draft of the framework.

Part 1: Summary of Water Quality Trading Efforts

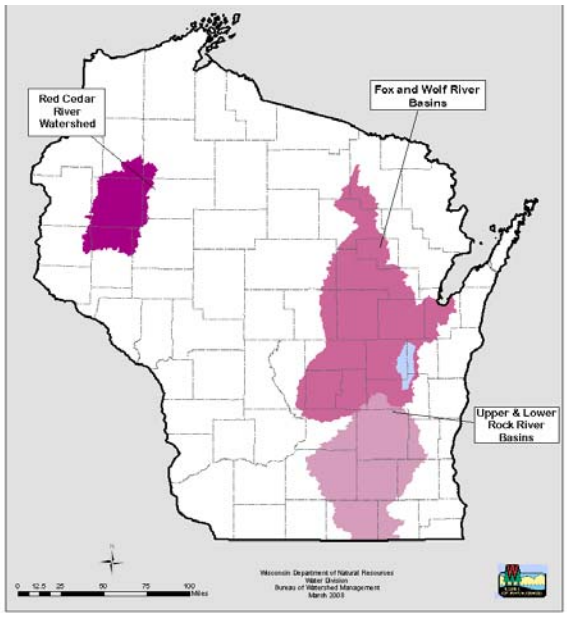
Part 1 of this report provides a summary of water quality trading programs that Wisconsin and other states have undertaken. In its *Water Quality Trading Assessment Handbook* (US EPA 2004), EPA describes water quality trading as follows:

> Generally, water quality trading (WQT) involves a party facing relatively high pollutant reduction costs compensating another party to achieve less costly pollutant reduction with the same or greater water quality benefit.
>
> Economic benefits can include: allowing dischargers to take advantage of economies of scale and treatment efficiencies that vary from source to source; reducing the overall costs of achieving water quality objectives in a watershed; and providing the means to manage growth while protecting the environment. Environmental benefits can include: achieving water quality objectives more quickly; encouraging further adoption of pollutant prevention and innovative technologies; engaging more nonpoint sources in solving water quality problems; and providing collateral benefits such as improved habitat and ecosystem protection. From a social standpoint, trading efforts have helped foster productive dialog among watershed stakeholders and helped create incentives for water quality improvement activity from a full range of dischargers.

1.1 Wisconsin's Experience with Water Quality Trading

Wisconsin has three water quality trading study areas: the Red Cedar River Watershed, Fox-Wolf Basin, and Rock River Basin. These three study areas were designated in 1997 in response to a technology based phosphorus effluent limit of 1 mg/L (ch. NR 217, Wis. Adm. Code). The location and extent of the study areas is shown in Figure 1.

Figure 1. Pilot trading study areas.



In 1997, the DNR was directed by s. 283.84, Wis. Stats., to "administer at least one pilot project to evaluate the trading of water pollution credits." Under this law, a permitted point source of water pollution may discharge pollutants at levels above what would otherwise be authorized in the WPDES discharge permit when another entity removes an equal or greater pollutant load. The greater discharge levels are allowed provided certain agreements are reached with the other dischargers and the DNR or with other units of government if necessary.

In response to s. 283.84, Wis. Stats., DNR staff worked with a variety of stakeholders to address the issues associated with watershed based trading. Significant progress was made on developing local participation, creating a framework with associated sideboards for the trading process, evaluating the costs and associated phosphorus loading reductions of best management practices, and distributing funding.

The Red Cedar River Watershed is in west central Wisconsin and within the Lower Chippewa River Basin. In the mid-nineties, the Red Cedar Steering Committee explored new ways of addressing water pollution issues in the watershed. This partnership group completed a monitoring and modeling effort that is the basis for the development of a conceptual phosphorus management plan for the basin. The overall watershed goal was to remove enough phosphorus from the surface water to make a significant difference in the occurrence of algae blooms in impoundments within the watershed. The City of Cumberland actively pursued phosphorus trading options with the assistance of the Barron County Land Conservation Department.

The Village of Colfax, as a requirement of their application for an alternative effluent limit due to economic hardship, evaluated the feasibility of trading to meet their economic liability. Their analysis showed that trading was feasible and they plan to implement trading similar to Cumberland to meet the requirements of their current permit, which includes a 9.9 mg/L alternative phosphorus limit. If Dunn County is still not interested in brokering trades, Colfax likely will work through Barron County.

The Fox-Wolf Basin covers a large area in the northeast part of the state and includes watersheds that drain to Lake Winnebago and the Fox River at Green Bay. In this area, the Fox-Wolf Basin Watershed Alliance (formerly Fox-Wolf Basin 2000) convened partners from the public and private sector interested in the use of watershed based trading to address some of the water quality problems in the basin. Fox-Wolf Basin Watershed Alliance is a not-for-profit organization dedicated to achieving high-quality surface waters in Wisconsin's Fox-Wolf River Basin through cost-effective public policy and private action. While phosphorus is still a pollutant of concern, many of the point source dischargers have already installed the necessary equipment to remove phosphorus to a limit of not greater than 1 mg/L.

However, still greater reductions in phosphorus are needed to achieve water quality standards as determined by the Lower Fox River TMDL analysis. Watershed based trading is a potential tool to use when identifying the most cost-effective means of achieving that goal. Under the direction of Fox-Wolf Basin Watershed Alliance, an aggressive information and education effort, including workshops on trading tools such as NutrientNet, was undertaken to elicit interest. The economic times and the lack of regulatory drivers have resulted in no trading activity in this basin to date. Fox-Wolf Basin Watershed Alliance continues to work on projects that may ultimately lead to the development of a TMDL for phosphorus for the entire Fox-Wolf Basin.

The Rock River Basin is located in south central Wisconsin. Nutrient trading has been under discussion in this basin since 1996. The development of technology base effluent limits for

phosphorus, pursuant to ch. NR 217, Wis. Adm. Code, encouraged dischargers to look at a basin approach for phosphorus management. The Rock River Watershed Partnership was formed and funding was collected to implement a detailed work plan. The Partnership completed a modeling and monitoring effort, the drafting of a trading framework, a literature review of best management practices (costs and effectiveness), and an analysis of in-stream results from implementing phosphorus management. Ten of the over 60 original participants in the Partnership pursued trading to the point of completing feasibility analyses to meet their permit effluent limits. No trades have resulted, primarily for economic reasons.

From these three study areas, only one trade occurred between a point source, the City of Cumberland, and agricultural nonpoint sources. Cumberland's WPDES permit requires removal of 4,400 pounds of phosphorus within the Hay River Watershed each year (see Figure 2). In this situation, Cumberland pays $3.85 for each pound of phosphorus removed by credits generated by converting conventional tillage to no-till systems. Cost includes soil testing fees. The total phosphorus saving purchased in 2010 trades ranged from 0.7 to 16 pounds/acre/year. Implementation of tillage methods are easily verified by the Barron County Land Conservation Department.

Figure 2. Hay River Watershed.

Even though trades have yet to occur in the Rock River and Fox-Wolf Basins, much was learned about the trading process as summarized below:

- Most wastewater treatment plants can more economically meet an effluent limit of 1 mg/L phosphorus through plant upgrades than through trading. As such, the effluent limit of 1 mg/L phosphorus is generally not an adequate driver to support trading in most instances. A lower limit obtained through a TMDL or a water quality based effluent limit is needed to elicit interest based primarily on cost considerations.
- Trading is more likely to be economical if the phosphorus load to be traded is relatively small.
- For trading to be effective, a broker such as the County Land Conservation Department or the DNR may need to assume administrative costs and roll these costs in the price of pollution reduction credits. The broker may need a source of funds to function in this capacity.
- Brokerage and administrative costs can be minimized by selecting management practices in which implementation benefits are easily calculated and verified.

Conversion to no-till cultivation fit these requirements in the Cumberland / Barron County situation because verification could be conducted by visual examination; nutrient management alone was not funded due to the labor intensive process that is required to track compliance.

- An agreed-upon set of tools is needed to quantify phosphorus reduction loads from nonpoint sources with a single application of an established model (e.g., phosphorus index via Snap-Plus).

Given the change in phosphorus regulations with the promulgation of numeric phosphorus criteria and the development of TMDLs, additional drivers will be in place allowing greater emphasis on using trading as a tool for achieving cost-effective pollution reductions.

1.2 Summary of Other State Programs

Many states have water quality trading programs in place. These programs were evaluated as part of the development of Wisconsin's water quality trading framework (see Figure 3). The review of existing trading programs was conducted by both DNR staff and UW-Extension staff. A summary bibliography prepared by UW-Extension can be found in Appendix C. A summary table of other applicable state programs can be found in Appendix B.

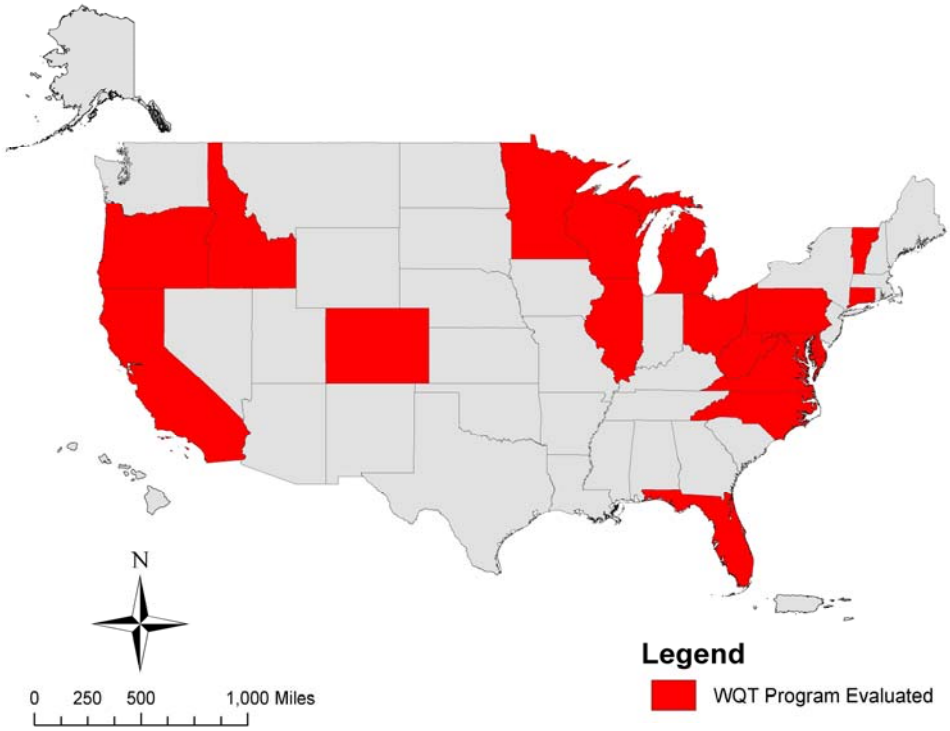


Figure 3. States with water quality trading programs evaluated by UW Extension.

In reviewing other state programs it was found that most had several common elements. These elements include location and geographic extent of trades, the pollutants eligible for

trading, procedures for determination and generation of pollutant reduction credits, trade ratios, and mechanisms for compliance and enforcement.

1.3 EPA Guidance

EPA guidance and policy documents were also reviewed to develop this framework including:

- *Water Quality Trading Policy* (US EPA 2003);
- *Water Quality Trading Toolkit for Permit Writers* (US EPA 2007); and
- *Water Quality Trading Assessment Handbook* (US EPA 2004) with an erratum sheet issued in October 2005.

Part 2: Draft Framework

Part 2 of this report addresses the components of the water quality trading framework. In general, Part 2 specifies how pollutant reduction credits can be generated and identifies how they may be used by WPDES permittees to demonstrate compliance with permit effluent limits.

2.1 Pollutant Parameters Acceptable for Water Quality Trading

Not withstanding the restrictions presented in Section 2.2 of this report and excluding bioaccumulative chemicals of concern (BCCs) as identified in ch. NR 105, Wis. Adm. Code, the DNR will consider any pollutant parameter including bacteria for water quality trading. Excluding BCCs from water quality trading is consistent with U.S. Environmental Protection Agency's policy of not supporting trades of persistent, bioaccumulative, toxic substances (US EPA 2003).

Cross-pollutant trading, which is the use of pollutant reduction credits for one pollutant parameter to demonstrate compliance with permit effluent limits for a second parameter, is acceptable when there is adequate information to establish and correlate impacts between the two pollutant parameters. An example would be trading pollutant reduction credits for phosphorus to allow a discharger to demonstrate compliance with water quality based effluent limits for 5-day biochemical oxygen demand (BOD_5) when the limits are based on preventing oxygen depletion in the receiving water.

Due to increased interest in water quality trading for phosphorus caused by the recent promulgation of phosphorus water quality criteria (ch. NR 102, Wis. Adm. Code) and methods for deriving water quality based phosphorus limits (ch. NR 217, Wis. Adm. Code), the water quality trading framework will highlight phosphorus trading.

2.2 Appropriate Circumstances for Water Quality Trading

The water quality trading framework addresses pollutant reduction credit trading to meet water quality based effluent limits. Permittees including those covered by a general permit or a stormwater permit can use water quality trading to demonstrate compliance with water quality based effluent limits. Water quality trading shall not result in exceedances of water quality criteria, which are listed in chs. NR 102 and NR 105, Wis. Adm. Code, and shall not result in the exceedance of water quality based effluent limits for acute toxicity as derived pursuant to ch. NR 106, Wis. Adm. Code, including limits for acute whole effluent toxicity and limits based on acute criteria for temperature. Such restrictions are consistent with EPA policy and guidance (US EPA 2003 and 2007).

The use of water quality trading to demonstrate compliance with technology based effluent limits (TBELs) established pursuant to ss. 283.13 (1) through (4), Wis. Stats., is prohibited unless authorized by the administrative rule that establishes the TBEL. Such a prohibition is consistent with EPA policy (US EPA 2003).

The use of water quality trading to demonstrate compliance with runoff pollution performance standards is prohibited with the exception of agreements between adjacent municipalities under a long-term stormwater management plan pursuant to ss. NR 151.13 (2)(b)3 and NR 216.07 (6), Wis. Adm. Code.

The use of water quality trading to demonstrate compliance with phosphorus effluent standards and limitations as derived pursuant to Subchapter II of ch. NR 217, Wis. Adm. Code, is prohibited with the following exception. Those water quality trades established under the pilot programs of s. 283.84, Wis. Stats., are allowed to continue. No new trading for technology-based phosphorus limits will be allowed once s. 283.84, Wis. Stats., is modified as discussed in Part 3 of this report.

Note: In this report, phosphorus effluent limits derived pursuant to Subchapter II of ch. NR 217, Wis. Adm. Code, are frequently referred to as technology based effluent limits.

Water quality trading can be used to demonstrate compliance with interim phosphorus limits for direct discharges to the Great Lakes, schedules of compliance, and the watershed adaptive management option addressed in ss. NR 217.13 (4), NR 217.17 (3), NR 217.18 (3)(e), Wis. Adm. Code, respectively. It is the DNR's intent, however, to encourage actions such as optimization of current wastewater treatment systems and installation and operation of reasonably affordable removal technologies be undertaken before water quality trading is allowed to meet interim phosphorus limits.

This water quality framework is applicable to trading when used to offset an increasing pollutant load from an existing discharge or the entire load of a new discharger. Section NR 217.13 (8), Wis. Adm. Code, identifies trading as one of three options that must be met before a new discharge of phosphorus to an impaired surface water is allowed. A finding that water quality is not being lowered, as addressed by s. NR 207.04 (1)(c), Wis. Adm. Code, can be supported by water quality trading to offset an increasing pollutant load or a new discharge.

Partnerships between point sources and nonpoint sources to reduce phosphorus loading as part of a watershed adaptive management plan pursuant to s. NR 217.18, Wis; Adm. Code, are not considered trades and are not subject to the water quality trading framework. As discussed above, however, water quality trading is applicable to demonstrate compliance with adaptive management interim phosphorus limits.

The water quality trading framework is not applicable to pollutant trading undertaken as part of any voluntary agreement or plan when the trading is not used to demonstrate compliance with permit effluent limits. Trading under a voluntary agreement or plan occurs outside of the WPDES permitting program.

It is the DNR's intent that water quality trading may occur between two or more point sources, between point sources and nonpoint sources, and between two or more nonpoint sources. If one permittee holds more than one WPDES permit, such as a municipality with a permit for its wastewater treatment system discharge and a permit for municipal stormwater

discharge, water quality trading may occur between the points sources identified in the permits when the permits allow trading. Nonpoint sources may trade pollutant reduction credits to meet load allocations set by a TMDL.

2.3 Location and Geographic Extent of Trade

This section of the report outlines the location and geographic requirements for water quality trading. The DNR proposes having two categories for defining the geographic extent of trades depending on whether water quality trading is conducted under a TMDL or to meet to water quality based effluent standards in a non-TMDL watershed. The critical requirement in setting the location and geographic scope for water quality trading is the potential for local violation of water quality standards. Often referred to as "hot spots"; local violations of water quality standards should be avoided.

2.3.1 Trading to Meet TMDL Requirements

EPA requires that TMDLs be created for water bodies listed on Wisconsin's impaired waters list, which is often referred to as the 303(d) list. TMDLs assign wasteload allocations (WLAs) and load allocations (LAs) to point and nonpoint sources, respectively, such that the impaired water will meet water quality standards. These allocations are assigned to pollutant sources that drain to or contribute to the impaired segment. This contributory area shall be referred to as the drainage area.

A pollutant credit generator can trade with other dischargers within the drainage area for the impaired segment that resulted in the allocation being assigned to it. Trades can occur both upstream and downstream of the generator's discharge point provided that the potential for localized water quality exceedances is adequately addressed. The ultimate extent of the area available for trading is limited to the drainage area contributing to the impaired segment.

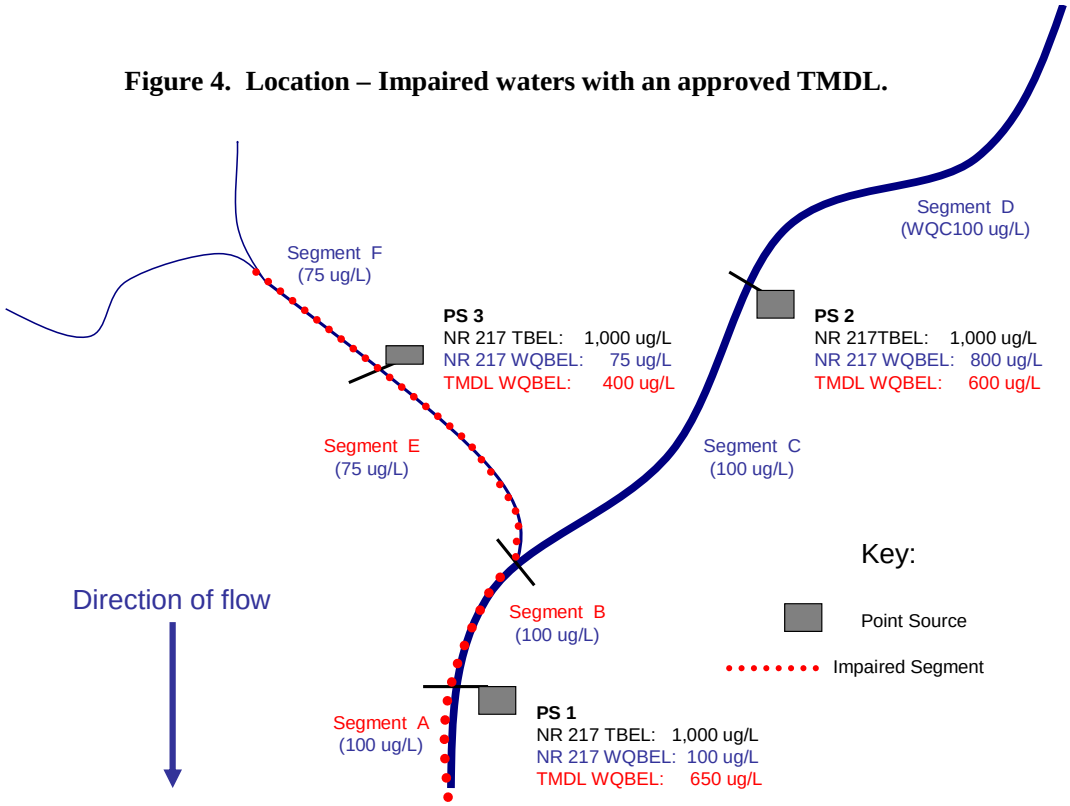
In cases where impoundments, lakes, or other features impact the flow of pollutants through the drainage area, water quality trading with credit generators above such features may need to be adjusted to account for the delivery of pollutants as discussed later in Subsection 2.5.1 of this report.

Figure 4 provides an illustration of the proposed location for a trade under an approved TMDL. Figure 4 shows impaired segments with TMDLs for segments A, B, E, and F. Based on the water quality trading framework, the point sources can trade as follows:

Point Source 1 (PS1) is located at the top of segment A and can trade with sources in the contributory drainage area for segment A, which includes segments A, B, E, F, C, and D.

Assuming in this example that Point Source 2 (PS2) received a TMDL allocation based on meeting water quality standards for segment B, PS2 can trade with the contributory drainage area to segment B, which also includes segments, E, F, C, and D provided the discharge from PS2 does not result in a violation of water quality standards in segment C.

Figure 4. Location – Impaired waters with an approved TMDL.



Assuming in this example that the WLA for Point Source 3 (PS3) is because of segment E, PS3 can trade within the drainage area for segment E, which also includes segment F.

2.3.2 Trading to Meet Non-TMDL WQBELs

If a facility desires to trade to meet the effluent requirements stemming from a non-TMDL WQBEL (for phosphorus see s. NR 217.13, Wis. Adm. Code), in most cases the trade will need to occur upstream of the discharge point to prevent the violation of water quality criteria outside the mixing zone. This is because derivation of the WQBEL includes consideration of upstream concentrations. In cases where a discharger is a small percentage of the relative load at the point of discharge, the point source may have the option to trade with downstream sources within the reach without creating local violations of the water quality criteria. This requires evaluation on a case-by-case basis.

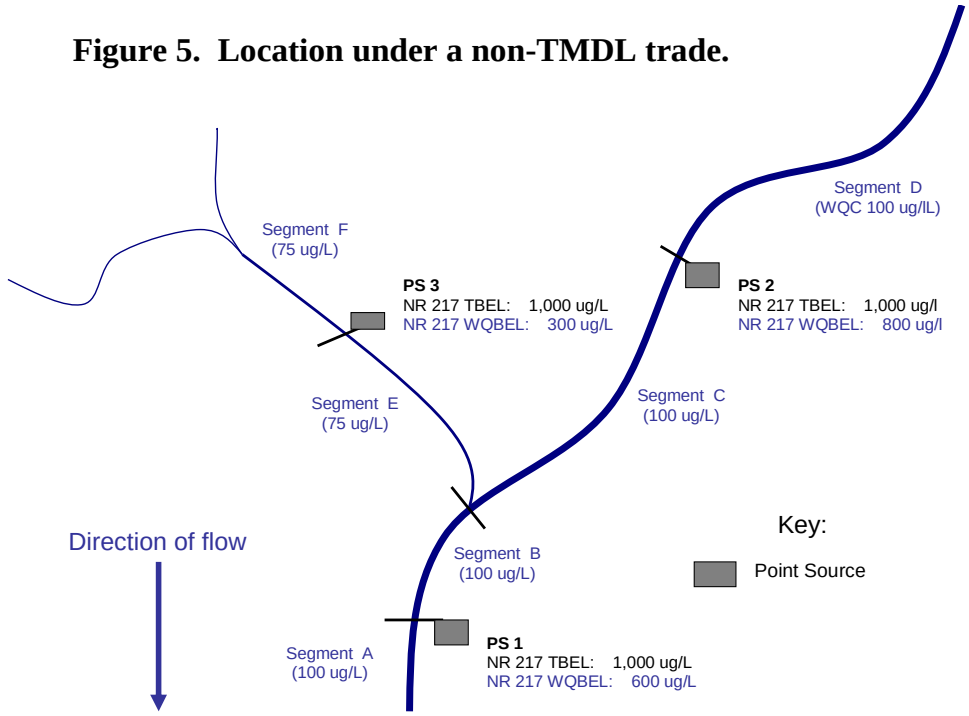
Figure 5 shows TBELs and WQBELs based on water quality criteria. Trades can occur as follows:

Point Source 1 (PS1) may trade with sources in segments B, C, D, E, and F.

Assuming that Point Source 2 (PS2) is an insignificant source of the pollutant load to segment C (calculated through a quantification of phosphorus loads), PS2 can trade with

sources in segment D and could likely trade with downstream source in segment C since PS2 is not a significant contributor to segment C.

Figure 5. Location under a non-TMDL trade.



Point Source 3 (PS3) should trade with sources draining to segment F and not sources downstream of its discharge point assuming that PS3 is a significant source of the pollutant load for segment E.

2.3.3 Additional Information

A summary of EPA's position on water quality trading, as presented in their guidance, is provided below.

To comply with the goals of the Clean Water Act, trading must not create localized exceedances of water quality standards. In other words, trades cannot clean-up one body or segment of water at the expense of another nor can a trade create the potential for exceedances of water quality standards. Because of this general requirement to maintain water quality standards, it is unlikely that a trading scenario involving an upstream credit buyer and downstream credit seller will be viable.

The proper geographic scope for water quality trading will depend on specific circumstances. If the area has been issued a TMDL, trading should occur within the drainage area addressed by the TMDL. When there is no TMDL in place, trading should occur "within a watershed." What "trading within a watershed" will mean depends on a number of factors. In general, the geographic scope of a trade should be no larger than necessary to encompass the universe of sources that contribute to a specific water quality problem that is to be addressed through

trading. Beyond this, EPA encourages regulatory authorities to consider the following factors in the determination of the appropriate geographic scope of a trade:

- Trading should occur only within a hydrologic unit that is appropriately defined to ensure that trades will maintain water quality standards within that unit, as well as within downstream and contiguous waters.

- The parties to the trade must discharge, either directly or indirectly, to the same water body where water quality improvement is necessary.

Additional factors that should be taken into account, depending on the characteristics of the site and the trade, include:

- Where are the dischargers located relative to the water body for which reductions are needed?

- What is the distance between the potential trading partners' discharges, either along a shared receiving stream, or to the point where the receiving streams converge?

- If the credit generator is a nonpoint source, where is its loading released?

- Are there diversions, tributaries, impoundments, drinking water intakes, or other water withdrawals between the potential trading partners' discharges?

- What are the water quality impacts and fate and transport (e.g., decay) characteristics of the pollutant(s) to be traded?

- Are other water quality trades being conducted in the waterbody, and how might they affect the water quality impacts of the trade being considered?

Some stakeholder groups desire increased flexibility in determining location and geographic extent of trades beyond that recommended by this report and implied in current EPA policy.

2.4 Credit Threshold and Pollutant Reduction Credits

As part of the water quality trading framework, the term "credit threshold" is used to denote the pollutant loading level below which reductions must be made to generate a credit. With the exceptions presented below, credit threshold is similar to "baseline" as used by EPA in its water quality trading guidance.

The credit threshold can vary depending on the pollutant and the basis of the limit. For example, phosphorus WQBELs may be derived under s. NR 217.13, Wis. Adm. Code, (non-TMDL WQBEL) and from TMDL wasteload allocations (TMDL WQBEL). Under a TMDL trade, the credit threshold is based on the allocation of the source generating the pollutant reduction credits. Under a non-TMDL WQBEL trade, the credit threshold is set at the statewide nonpoint performance standards; however, consideration is given to cost share

requirements often needed to bring nonpoint sources into initial compliance with statewide performance standards.

2.4.1 Credit Threshold

Generally, the credit threshold for pollutant reduction credits generated by a nonpoint source is set equal to either the applicable statewide performance standard or the TMDL load allocation, whichever is lower. For credits generated by a point source, the credit threshold is set equal to the TBEL or the WQBEL, whichever is lower.

Credit thresholds for nonpoint sources can vary as outlined below.

Non-TMDL Agricultural Sources: The credit threshold for an agricultural area that is not addressed by a TMDL is set at applicable statewide performance standards. For example, for phosphorus runoff from agricultural fields the credit threshold is set to a phosphorus index (PI) of 6 (s. NR 151.04, Wis. Adm. Code). For total suspended solids (TSS) or sediment from agricultural fields the credit threshold is set equal to tolerable soil loss or "T" (s. NR 151.02, Wis. Adm. Code).

For agricultural sources that do not have numeric statewide performance standards, such as barnyard runoff and stream bank erosion, the credit threshold shall be set using a method approved by the DNR.

Non-TMDL Permitted Urban Sources: In the absence of a TMDL, permitted urban areas (MS4s) shall have a credit threshold set to the load corresponding to the calculated 20 percent TSS reduction in accordance with chs. NR 216 and NR 151, Wis. Adm. Code, and applicable DNR guidance. The trading of TSS shall follow the requirements outlined in ss. NR 216.07 and NR 151.13(2)(b)3, Wis. Adm. Code.

Non-TMDL Non-permitted Urban Sources: In the absence of a TMDL, non-permitted urban areas, those not covered by s. NR 151.13, Wis. Adm. Code, shall have a credit threshold set equal to the existing pollutant load calculated by a method approved by the DNR.

TMDL Agricultural Sources: For agricultural areas addressed by a TMDL, the credit threshold is set equal to the load allocation calculated in the TMDL. If the TMDL expresses the load allocation in relationship to the state-wide performance standards contained in ch. NR 151, Wis. Adm. Code, (i.e., PI=4 or T=0.5 tons/acre/yr) than those values shall serve as the credit threshold. If the TMDL does not express allocations in terms of the state-wide performance standards, for example a PI less than 6, the credit threshold will be expressed by taking the load allocation and dividing it by the total area of the agricultural land in the watershed (note: adjustments may need to be made to differentiate between edge of field measurements, instead of the delivered loads typically expressed in a TMDL load allocation).

Unless specifically assigned an allocation, barnyard runoff, stream bank erosion, and other nonpoint sources that do not have numeric performance standards or allocations shall have a credit threshold set by a method prescribed in the TMDL implementation plan or by a method approved by the DNR.

TMDL Non-permitted Urban Sources: Non-permitted urban areas shall have a credit threshold set equal to the non-permitted load allocation identified in the TMDL divided by the non-permitted urban area (acres) used in the TMDL calculations.

TMDL Permitted Urban Sources: Permitted urban areas (MS4s) shall have a credit threshold set equal to the assigned WLA divided by the area (acres) used in the TMDL analysis for the urban area.

TMDL Other Sources: Under a TMDL, if sources other than agricultural and urban areas are assigned allocations or reductions, such as a reduction in septic field discharges, the credit threshold shall be set at the load allocation or specified percent reduction.

2.4.2 Pollutant Reduction Credits

As part of the water quality trading framework, two types of credits can be generated: (1) interim pollutant reduction credits and (2) long-term pollutant reduction credits. Both types of credits have a lifespan, referred to as their credit duration.

- Interim pollutant reduction credits are generated for reductions that achieve the credit threshold. For example, if the performance standard for phosphorus is a PI=6, a reduction from the existing PI (e.g., PI=10) down to PI=6 are interim pollutant reduction credits. Interim pollutant reduction credits are available for a maximum of 5 years after which point they are lost and need to be replaced with new interim pollutant reduction credits or final pollutant reduction credits. Specifically, the credit duration for interim pollutant reduction credits is the lifespan of the management practice employed but cannot exceed 5 years, the typical length of a permit.

- Long-term pollutant reduction credits are generated for reductions obtained at or below the credit threshold. Long-term pollutant reduction credits have a credit duration based on the trade duration defined in Section 2.7 of this report.

A point source is not required to use interim pollutant reduction credits. The permittee may collect enough long-term pollutant reduction credits in the very first trade to meet WQBELs or may choose to collect long-term credits over a longer period. The time period that interim credits can be generated is a function of the amount of pollutant reduction credits needed by a facility and the amount of nonpoint pollution available for trading in the watershed.

Interim pollutant reduction credits will be given to initially bring agricultural sources into compliance with the performance standards. This allowance is made because a cost-share rate of 70 percent of the cost of the management practices is required to make the performance standard a regulatory requirement. Once an agricultural source is brought into compliance with statewide performance standards it has to stay in compliance without additional cost share dollars. At this point, since the nonpoint performance standard has been enforced, EPA would not approve the use of interim credits for trading.

2.4.3 Example Trading Scenarios

Example Non-TMDL WQBEL Trade Scenario: A point source decides to trade with a nonpoint source (farm) to generate phosphorus credits to count toward the point source's WQBEL requirement. The farm fields average a PI=10 and the point source pays for the installation of management practices that bring the fields down to a PI=1. The lifespan of the management practice in this example is 10 years. In the absence of a TMDL, the point source gets the full credit of 9 pounds/acre/year (calculated from a P=10 down to PI=1; 10-1=9) for the first 5 years. During the first five years, 4 pounds/acre/year are considered interim pollutant reduction credits (calculated from a PI of 10, minus PI of 6, the credit threshold set equal to the performance standard; 10-6 = 4) and 5 pounds/acre/year are long-term pollutant reduction credits providing a total of 9 pounds/acre/year of credits. For the next 5 years, the point source can claim 5 pounds/acre/year as long-term reduction credits because the useful life of the management practice is 10 years. The interim credits are no longer available because after the first 5-year period, the farm was brought into compliance with the statewide performance standard (s. NR 151.04 Wis. Adm. Code). Other interim credits or long-term credits will be required as replacement.

At the end of the 10-year period, the point source can decide to renew its agreement with the farm. Without the renewal of the agreement the farm is required to maintain its fields at a PI no greater than 6. If the point source chooses to renew the trade, the pollutant credits generated must be below the credit threshold. In this case only 5 pounds/acre/year are generated; the different of PI=6 to the PI=1 as established by the management practices.

Example TMDL WQBEL Trade Scenario: A point source decides to trade with a nonpoint source (farm) to generate phosphorus credits to count toward the point source's TMDL WQBEL. The TMDL sets a nonpoint load allocation equivalent to a PI=4. The farm field selected for a trade averages a PI=10 and the point source pays for the installation of management practices that bring the fields down to a PI=1. The lifespan of the management practice is 10 years. For the first 5 years, the point source gets the full credit of 9 pounds/acre/year (calculated from a P=10 down to PI=1; 10-1=9). During the first five years, 6 pounds/acre/year are interim pollutant reduction credits and 3 pounds/acre/year are long-term pollutant reduction credits providing a total of 9 pounds/acre/year of credits. For the subsequent 5 years, the point source can claim 3 pounds/per/acre/year as long-term reduction credits. This is because the useful life of the management practice is 10 years and the TMDL set the load allocation as a PI=4, the credit threshold. The interim credits are no longer available after the first 5-year period. For the subsequent 5-year period the lost interim pollutant reduction credits need to be replaced with either new interim or long-term pollutant reduction credits from a second trade.

At the end of the 10-year period, the point source can decide to renew its agreement with the farm. If the point source chooses to renew the trade, the pollutant credits generated must be below the credit threshold.

2.4.4 Additional Information and Considerations

According to EPA guidance, pollutant reduction credits can only be generated below the credit threshold. It is the DNR's position that use of interim credits can result in a greater reduction of load overall and accelerate attainment of water quality.

If a point source initiates water quality trading, more pollutant load could be reduced from nonpoint sources if trading of interim credits is allowed. The same nonpoint load reduction could occur if interim credits are not allowed, but this is unlikely because the point source would not select nonpoint sources that are above the credit threshold. Some stakeholders believe that it is more cost effective to seek nonpoint sources at or near the credit threshold. Point sources do not want to pay to bring the nonpoint source down to the credit threshold without receiving credit. As a consequence, nonpoint sources with high pollutant loads would be passed over when the point source selects a trading partner. This would be unfortunate because research indicates that a disproportionate amount of agricultural fields are responsible for the majority of the pollutant load (UW-Madison, 2005). These agricultural fields, vulnerable to runoff and carrying high pollutant loads, likely would not be addressed if trading of interim credits is not allowed.

Some stakeholders are concerned that even the use of interim credits will make water quality trading uneconomical for point sources. They generally believe that EPA's position, that no pollutant reduction credits are generated until after a source has reached a credit threshold, is overly severe in that it does not provide for permanent reduction credits. They maintain that a reduction from existing nonpoint loads, regardless of a credit threshold, can result in water quality improvements and the credit user should receive credit for the entire reduction in pollutant load. These stakeholders strongly believe that the credit threshold, even with the allowance of interim credits, means that a very limited number of trades will be viable, and the opportunities for nonpoint reductions will be lost.

The subject of credit threshold likely needs further discussion with EPA that may include a review of a broader range of options than just the concept of interim credits. Specifically in TMDL situations in which nonpoint sources are given aggregate load allocations, stakeholders are seeking greater flexibility in working with particular nonpoint sources without having to determine loads for the entire contributory drainage area.

2.5 Trade Ratio

EPA's *Water Quality Trading Toolkit for Permit Writers* (US EPA 2007) states that in many cases, pollutant credits are not generated on a "one pollutant pound-to-one pollutant credit" basis. Rather, some type of a trade ratio is used to either discount or normalize the value of pollutant credits. For example, a trade ratio of 2:1 means two pounds of a pollutant credit generated is equivalent to one pound of pollutant credit used. Factors such as delivery, equivalency, retirement, and uncertainty are commonly represented in the trade ratio.

While combining factors into a single trade ratio may make implementation easier, it often results in an oversimplification of the pollutant delivery process and creates a lack of

transparency for what is taken into account in the trade ratio. To address these concerns, the water quality trading framework has the trade ratio factors separated to provide better transparency and simplicity of use. The factors outlined below are calculated separately and independently of each other and are combined to give a final trade ratio.

2.5.1 Delivery

The delivery factor accounts for the distance between the pollutant credit generator and the credit user and the impact that this distance can have on fate and transport of the pollutant. An almost infinite number of situations can arise in the calculation of a delivery factor including, but not limited to, the size of water bodies, gradient of flow, travel distance, and presence of impoundments. To accurately account for delivery, two approaches are proposed depending on the type of effluent limit, non-TMDL WQBEL or TMDL WQBEL.

TMDL WQBEL Delivery Factor: In a TMDL, allocations are assigned to pollutant sources so receiving waters meet water quality standards. The TMDL report outlines the methods used to calculate the allocations including any processes used to account for delivery and transport of pollutants. For trades occurring to meet a TMDL WQBEL, the delivery factors used in the TMDL must also be used to calculate the delivery factor of the trade. If the TMDL assumes no delivery factors or does not simulate fate and transport phenomena than the trade also does not have to account for delivery. This is because WLAs calculated without delivery factors are already restrictive with the delivery factor already implicit in the WLA.

Non-TMDL WQBEL Delivery Factor: The calculation of delivery factors can be extremely complex and costly. Often, no modeling or analysis will be available without a TMDL. The DNR has explored several options; however, many are dependent on pollutant type. At this time, the DNR concludes that the best method to determine delivery factors for phosphorus, nitrogen, and sediment is using the SPARROW model (http://water.usgs.gov/nawqa/sparrow/). The SPARROW model was developed by United States Geological Survey (USGS) and relies on regression equations from monitoring data to create a delivery routine between two points in a watershed. The DNR will attempt to develop default delivery factors for phosphorus using the SPARROW model. The DNR will work with Wisconsin USGS staff to make this model available for use. For other pollutants, please contact the DNR to discuss possible options.

2.5.2 Equivalency

The equivalency factor accounts for situations where two sources may discharge the same pollutant, but the composition of the discharges may differ with respect to the forms of the pollutant. An equivalency factor is appropriate when water quality criteria or TMDLs differentiate between the various forms of a pollutant in the allocation. As such, equivalency factors will vary based on the pollutant. For phosphorus, ch. NR 102, Wis. Adm. Code, does not differentiate the form of phosphorus and regulates total phosphorus so no equivalency factor is required. As numeric criteria are developed for nitrogen and sediment, equivalency factors maybe warranted especially given the speciation of nitrogen.

Note: Soluble and sediment bound phosphorus have different transport capacities that are accounted for in the delivery factor.

2.5.3 Retirement

A retirement factor can be applied if a goal of the trading program is to accelerate achievement of water quality standards. Retirement factors retire a percentage of all credits generated and these credits cannot be sold. A retirement factor is not used in the water quality trading framework with the exception of interim reduction credits described earlier in Section 2.4 of this report.

2.5.4 Uncertainty

The uncertainty factor accounts for the multiple types of uncertainty that normally occur in nonpoint source generation of pollutant reduction credits. Uncertainties originate from climatic variability, potential inaccuracies in field testing or modeling of the amount of pollutant controlled by a management practice, and the reliability of the management practice to perform.

Nonpoint Source to Point Source Uncertainty Ratios: This application of an uncertainty factor addresses trades between nonpoint sources and point sources and trades between permitted urban areas (MS4s) and point sources. For the purpose of this trade ratio factor, MS4s and other permitted stormwater sources are considered nonpoint because the pollutant source is diffuse and dependent on climatic factors. Generally, the trade ratio will be calculated based on the effectiveness of the management practices employed by the nonpoint source. Table 1 illustrates the ordering of effectiveness of a few management practices.

Table 1. Order of effectiveness of management practices.

Lower Ratio	2:1 Ratio	Higher Ratio
Companion Crops	Buffer with upland practices	Tillage Practices
	Fall cover crops	Buffer without supporting practices

The DNR will provide, maintain and update a list of nonpoint source management practices that may be used to generate credits for water quality trading. The list should specify for each practice, the anticipated lifespan of the practice, the credits available from application of the practice (e.g., a default value and an approved method for site-specific modeling), the uncertainty trade ratio applicable to the practice, and any restrictions on the use of credits generated by the practice. An example of the list is provided in Table 2.

Pollutant credit generators are not restricted to the management practices covered by the DNR's list, but if not present in the list a proposed management practice will likely require an evaluation by the DNR before credits generated by the practice are approved for use by a second source to demonstrated compliance with permit limits.

Table 2. Management practices with preapproved credit generation and use information.

Management Practice	Available Credits (Approved Method)	Uncertainty Trading Ratio	Schedule for Credit Use	Credit Availability Date	Credit Use Restrictions
Companion Crops	x lbs P/acre•PI^{-1}•in. precipitation (SWAT)	1.2	Credits may be banked and used over the entire year.	First month second cover crop established	Credits may not be carried over from year to year.
Conservation Tillage					
Nutrient Management					
Buffer Strips					
Vegetative Filter Strips					
Livestock Exclusion					
Rotational Grazing					
Land Set-asides					

Point Source to Point Source Uncertainty Ratio: Under a point to point trade, between two wastewater treatment plants for example, the trade ratio will be set to 1:1. Measurement of credits is relatively straightforward because both sources are required to perform effluent monitoring in accordance with the terms of their permits. A trade ratio of 1:1 does not apply when one point source is an MS4, since discharge monitoring is not performed by the MS4.

2.6 Timing of Credit Generation and Use

The timing of pollutant reduction credit availability and use of credits to offset a pollutant discharge is addressed in this section of the water quality trading framework. At times the following discussion does not distinguish between interim and long-term credits, but the lack of such a distinction does not imply that interim credits may be used beyond the deadlines discussed in Section 2.4 of this report.

2.6.1 Timing of Pollutant Reduction Credit Availability

Pollutant reduction credits may not be used before they are generated. For point sources, the means for generating credits, such as wastewater treatment, production process modifications or other controls, must be in place and reductions in pollutant loads must be measurable before pollutant reduction credits become available for trading. For nonpoint sources, the conservation practice or management practice must be in place and effective before credits become available for trading. Since the reduction of pollutant load may not occur immediately after implementation of a management practice, credits may not be immediately available. Examples include those practices that require vegetation to be established before phosphorus runoff is reduced and nutrient management plans where phosphorus levels are gradually reduced year by year. As discussed earlier, the DNR's management practices list as recommended by this framework (see Table 2) will specify the point in time when pollutant load reductions are anticipated to occur and credits become available for each management practice that is listed.

Pollutant reduction credits, with the exception of interim credits, remain available for trade as long as the generator and user agree to continue trading credits and the practice or control that generates the credit remains effective. For nonpoint sources that generate credits, credits remain available for trading through the design life of the management practice as long as the practice remains in place and is properly maintained. For point sources that generate credits, credits remain available as long as the point source properly operates and maintains the pollutant reduction control and reductions are measurable.

2.6.2 Timing of Credit Use

When pollutant reduction credits are available, the timing of credit use depends on the source of the credits. When a point source other than an MS$ generates credits, only those credits generated during the time period used by the trading partner to demonstrate compliance with the WQBEL may be used. For example, the demonstration of compliance with the monthly total WQBEL for a specific month and year may take into consideration only those credits that are generated during that month and year.

When a nonpoint source generates credits, it is much more difficult to establish the timing of credit generation since many of the management practices employed produce credits only during periods of runoff. Further, management practice modeling is limited in its ability to predict the actual periods when credit generation occurs and normally provides pollutant load reductions in annual or seasonal time periods; e.g., pounds of total phosphorus per acre per year. This is because many models rely on average annual data sets rather than actual recorded daily values. Therefore, the credit user may bank the credits generated by a nonpoint source management practice for the calendar year and use any portion of the banked credits to demonstrate compliance with WQBELs that are expressed in averaging periods less than one year at any time during the year. An exception may have to be made for highly variable discharges which would require prorating the use of credits over the entire year.

Note: DNR's management practice list as recommended by this framework will specify allowable schedules of credit use for each management practice listed (see Table 2).

2.7 Trade Duration

The duration or term of a water quality trade is limited by either trading partner ending the agreement, to the conclusion of the design life of the pollutant reduction practice or control that generates the credits, or to the DNR's withdrawal of its approval of the water quality trade, whichever results in the shorter trade term. Expiration of interim credits may occur during the term of a trade agreement without ending the agreement.

Note: Section 283.84 (1m)(c), Wis. Stats., limits the term of trade agreements to five years. The statute conflicts with framework recommends provided above. The full trade duration suggested by this framework may not be used until the statute is changed.

2.8 Quantifying Pollutant Reduction Credits

Pollutant reduction credits are specified through either monitoring or modeling depending on the type of water quality trade. Credits are generated based on the credit threshold and procedures outlined in Section 2.4 of this report. Required credits may also need to be adjusted based on the trade ratio outlined in Section 2.5 of this report. Additional guidance on modeling procedures specific to water quality trading will need to be developed.

2.8.1 Point to Point Credit Quantification

The quantification of credits for point to point trades requires the use of monitoring. The credit generator must verify the generation of credits through monitoring reported to the DNR on monthly discharge monitoring reports. Pollutant reduction credits must be generated and used in the same time period; generally monthly for non-TMDL WQBELS and the time period specified in the TMDL for TMDL WQBELs.

For the purpose of quantifying credits, MS4s and other permitted stormwater sources are considered nonpoint because the pollutant source is diffuse and dependent on precipitation and climatic factors.

2.8.2 Nonpoint Credit Quantification

Because of the diffuse nature of nonpoint sources, it can be extremely difficult to monitor for the generation of credits. Monitoring nonpoint to quantify credits requires long-term monitoring of both the before and after condition to quantify the impact of management practices. Monitoring just after the installation of management practices is not sufficient to quantify pollutant reduction credits.

A viable alternative to monitoring is the use of field scale modeling to quantify pollutant reduction credits. Currently, models are available to quantify credits for the two most pressing pollutants, phosphorus and sediment. Methodologies for other pollutants still need to be evaluated and explored.

Urban Sediment and Phosphorus Nonpoint Trades: For the quantification of pollutant reduction credits for sediment and phosphorus resulting from the implementation of urban management practices, the most current version of SLAMM (http://www.winslamm.com/), P-8 (http://www.wwwalker.net/p8/), or an equivalent methodology approved by the DNR shall be used. For implementation of practices that are not simulated by the models, the process outlined in ch. NR 151, Subchapter V, Wis. Adm. Code, shall be used.

Agricultural Sediment and Phosphorus Nonpoint Trades: For trades involving agricultural sources pollutant reduction credits shall be determined using RUSLE2 for sediment (http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm) and SNAP-Plus for phosphorus (http://www.snapplus.net/). SNAP-Plus can also be used for sediment predictions; however, RUSLE2 may provide more options. For implementation of practices that are not simulated by the models, the process outlined in ch. NR 151, Subchapter V, Wis. Adm. Code, shall be used.

2.9 Compliance and Enforcement

The compliance and enforcement component of the water quality trading framework is based on the concept that the WPDES permit is the DNR's compliance and enforcement tool for implementing water quality trading. Aspects of the permitting process applicable to water quality trading are addressed below.

2.9.1 Application for Water Quality Trading

To initiate trading, the credit user, usually a point-source permittee, must submit an application for water quality trading to the DNR. The application for trading provides the DNR with the information necessary to verify the amount of pollutant reduction credits that will be generated. The application for trading is not the contract that will likely be drawn up

between trading partners. Nor is the application for trading the trade agreement addressed by s. 283.84 (1), Wis. Stats.

Content of the application for water quality trading includes:

- Notification that trading will be used to demonstrate compliance with WQBELs;
- Identification of credit generator;
- Identification of method for generating credits (e.g., the management practice to be employed);
- Location where credits will be generated (e.g., field location or site where management practice will be applied);
- Duration of the agreement (e.g., the design life of the management practice);
- Date when credits become available (i.e., credits may not be available immediately after a management practice is installed);
- Applicable trade ratio; and
- Amount of pollutant reduction credits being made available.

The DNR will develop an application form for water quality trading that the permittee may submit electronically.

2.9.2 Credit User's WPDES Permit

To allow trading of pollutant reduction credits between a point source (credit user) and a nonpoint source (credit generator), the point source's WPDES permit must include conditions that allow trading. Example permit conditions are presented below.

- The permit will include the WQBELs for which water quality trading will be used to demonstrate compliance.

  Note: The permittee must comply with these WQBELs whether water quality trading occurs or not.

- If water quality trading is being used to offset a new or increased discharge, the permit must acknowledge the trade, require the continuation of the trade throughout the permit term, and specify the amount of the trade.

- When already present in a WPDES permit, TBELs for the parameter being traded must be retained in the permit. While trading may be used to demonstrate compliance with WQBELs, it may not be used to demonstrate compliance with

TBELs, with the exception explained in Section 2.2 of this report. That is, effluent quality must comply with TBELs.

- The permit should include language that allows the use of pollutant reduction credits, identifies the WQBELs for which credits may be applied, and establishes how credits are used to demonstrate compliance with WQBELs.

- The permit should include a requirement that pollutant reduction credits used to demonstrate compliance with WQBELs must be generated under an approved application for water quality trading (see Subsection 2.9.1 of this report).

- The permit should include effluent monitoring and reporting requirements for the parameter addressed by the WQBELs.

- The permit should include reporting requirements for the amount and source of credits used to demonstrate compliance with WQBELs including the cumulative amount of credits used during the year up to the reporting date. Such a report may be provided on the monthly discharge monitoring reports required by the permit.

- The permit should require the permittee to certify that the management practice is being appropriately operated and adequately maintained when credits are generated by a nonpoint source management practice. At a minimum, the certification must identify the management practice and the location of its application.

- The permit should require the permittee or the permittee's agent to inspect on a specified frequency the location of the management practice to confirm the installation or implementation of the management practice and its appropriate operation and adequate maintenance.

- The permit should require the permittee to notify the DNR when becoming aware that credits become unavailable or the trading agreement must be amended, modified or concluded. The notification of changes to the trading agreement should include details of the changes.

- Other terms determined to be appropriate may be included in the permit as the DNR gins experience with trading and on a case by case basis.

To allow trading of water quality credits between two point sources, the credit users WPDES permit should include all of the conditions listed above with the exception of the management practice certification and inspection requirements. Verification of credit generation will be provided by the credit generator on monthly discharge monitoring reports.

2.9.3 Credit Generator's WPDES Permit

To allow trading of pollutant reduction credits between two point sources, the credit generator's WPDES permit must include the conditions that allow trading. Example permit conditions are listed below.

- The permit must include a requirement that any credits generated may be traded only under an approved application for water quality trading (see Subsection 2.9.1 of this report)

- The permit must include language that allows the generation of credits.

- When the traded pollutant is also limited by the credit generator's permit, the permit must specify how compliance with effluent limits is demonstrated by the credit generator given that credits are being provided to the credit user.

- The permit must include effluent monitoring and reporting requirements for the parameter being traded.

- The permit must include reporting requirements for the amount of credits generated. Such a report may be provided on the monthly discharge monitoring report required by the permit.

2.9.4 Public Notice of Applications for Water Quality Trading

To allow public participation and input, permit conditions that allow water quality trading will be public noticed. The DNR will state in the public notice that it will finalize its review of the application for trading upon consideration of comments received during the 30-day public comment period. When the DNR receives and reviews an application for trading during the term of the permit, the DNR will public notice a permit modification or reissuance to include water quality trading conditions in the permit. Section 283.84, Wis. Stats., both current and modified versions as discussed in Part 3 of this report, require the terms and conditions related to water quality trading to be included in a new, reissued or modified WPDES permit. Section 283.39, Wis. Stats., and ch. NR 203, Wis. Adm. Code, require permit issuances, reissuances and modifications to be public noticed.

2.9.5 WPDES Permit Timeline

Figure 6 provides a timeline that depicts the use of water quality trading over three terms of a hypothetical WPDES discharge permit. Assumptions used to construct the timeline include:

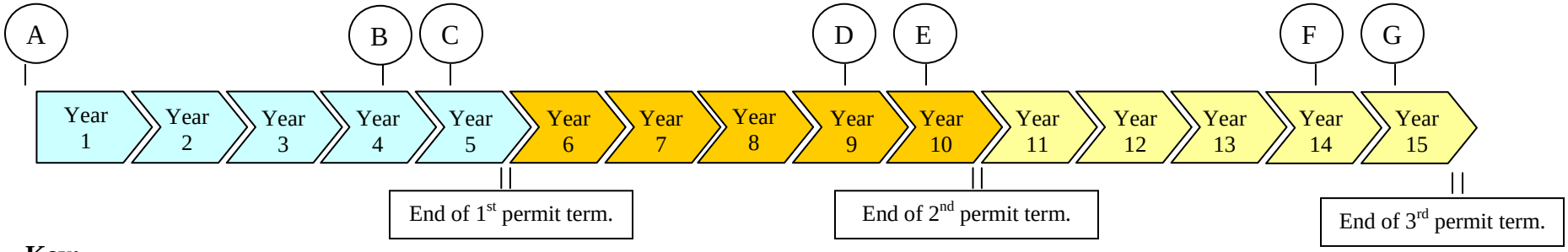
- The first-term permit contains a WQBEL for phosphorus with an effective date of four and one-half years after issuance of the permit. The phosphorus WQBEL remains unchanged over the three terms of the permit.

Note: Section NR 217.17, Wis. Adm. Code, allows schedules of compliance in excess of five years.

- The first-term permit contains terms and conditions for water quality trading since the permittee submitted an application for water quality trading prior to issuance of the permit. The public notice for the first-term permit indicates that the permittee will use water quality trading to help meet the phosphorus WQBEL and that the DNR will consider public comments prior to approving the water quality trading application.

- The first application for water quality trading, as submitted by the permittee prior to permit issuance, identifies management practices to generate phosphorus credits that have design lives in excess of fifteen years.

Figure 6. WPDES permit timeline.



Key:

<u>Prior to Issuance of First Permit:</u>

A — In anticipation of receiving a WQBEL for phosphorus, the permittee submits an application for water quality trading. The public notice for the first permit includes a statement that the DNR will consider public comments prior to approving the application for water quality trading.

<u>First Permit Term (years 1 through 5)</u>:

B — After four and one-half years when the schedule of compliance ends, the phosphorus WQBEL becomes effective. The permittee may use pollutant reduction credits including interim credits as addressed by the initial application for water quality trading to demonstrate compliance with the WQBEL. If credits are being generated by a nonpoint source, management practices must be in place and effective before traded credits may be used to demonstrate compliance with the WQBEL.

C — Approximately six months prior to permit expiration, the permittee submits a permit reissuance application. The permittee must include a new application for water quality trading to replace any interim pollutant reduction credits from the first water quality trading application that expire during the term of the second permit. Expiration of interim credits from the first application for water quality trading occurs five years after the WQBEL becomes effective or the credits are first used. The second application for water quality trading may also include interim credits. The public notice for permit reissuance includes a statement that the DNR will consider public comments prior to approving the second application for water quality trading.

Second Permit Term (years 6 through 10):

D Interim pollutant reduction credits from the first water quality trading application expire five years following the effective date of the WQBEL. The expired credits are replaced with those from the second application for water quality trading.

E Approximately six months prior to permit expiration, the permittee submits a permit reissuance application. The permittee must include a new application for water quality trading, the third application, for replacement of interim pollutant reduction credits from the second application for water quality trading that expire during the permit term (i.e., ten years after the WQBEL becomes effective). The third application for water quality trading may also include interim credits. The public notice for permit reissuance includes a statement that the DNR will consider public comments prior to approving the third application for water quality trading.

Third Permit Term (years 11 through 15):

F Interim pollutant reduction credits from the second application for water quality trading expire. The expired credits are replaced with those from the third application.

G Approximately six months prior to permit expiration, the permittee submits a permit reissuance application. The permittee must include a new application for water quality trading, the fourth application, for replacement of interim pollutant reduction credits from the third application that expire during the permit term (i.e., 15 years after the WQBEL becomes effective). The fourth application for water quality trading may also include interim credits.

2.9.6 Additional Information

In its *Water Quality Trading Policy* (US EPA 2003), EPA expressed support for including general conditions in a National Pollutant Discharge Elimination System (NPDES) permit that authorizes trading and describes appropriate conditions and restrictions for trading to occur. EPA does not expect NPDES permits "…to be modified to incorporate an individual trade if the permit contains authorization and provisions for trading to occur and the public was given notice and an opportunity to comment and/or attend a public hearing at the time the permit was issued."

The recommendations made in Section 2.9 of this report do not preclude the use of a general or watershed permit that contains an aggregate WQBEL. However, such a permit must also include individual point source WQBELs should the aggregate limit be exceeded and must include procedures that ensure localized exceedances of water quality standards do not occur and methods for tracking implementation of such procedures.

The DNR will develop procedures that it will use to audit water quality trading when it performs a compliance inspection.

2.10 Trade Administration

As discussed in Section 2.9 of this report, water quality trades addressed by the water quality trading framework are implemented as a component of WPDES permitting. The WPDES permit identifies those effluent limits for which trading may be used when demonstrating compliance and contains enforceable provisions under which trading may occur. The DNR is responsible for issuing WPDES permits that allow trading, evaluating and approving applications for water quality trading, tracking the use of pollutant reduction credits to demonstrate compliance with permit effluent limits, enforcing noncompliance, and, on occasion, inspecting sites that generate credits.

The DNR will also develop and maintain a list of acceptable management practices. The menu will identify the management practice, specify the amount of pollutant reduction credits (pounds per acre per year) generated by the management practice and/or the approved model for calculating credits, specify trade ratios for each management practice, identify the period of time each year that credits are generated and may be traded, identify any lag periods from the point of practice installation up to the point when the practice is capable of reducing pollutant load, and list any restrictions for the use of credits. An example list is included in Table 2, page 21.

The DNR will also track the trading of pollutant reduction credits within a watershed. Tracking is necessary to prevent duplication of credit use, to ensure that the capacity of a watershed to generate credits is not exceeded by the number of credits used to demonstrate compliance with permit limits within the watershed, and to gauge the progress of TMDL implementation. Note that s. NR 217.16 (2), Wis. Adm. Code, allows the DNR to replace permit limits derived from TMDL wasteload allocations with more stringent WQBELs for

phosphorus should a significant reduction in nonpoint source load fail to occur under the TMDL.

It is the responsibility of the permittee to locate trading partners, prepare and submit an application for water quality trading to the DNR, comply with permit limits, report credit use, and verify credit generation.

The water quality trading framework does not preclude a third party, an entity other than the user or generator of pollution reduction credits, from facilitating credit exchanges. The third party may be a state agency, conservation district, private entity, other organization or person, or even a website (e.g., NutrientNet at http://www.nutrientnet.org/).

Brokers are third parties who help trading partners make contact with one another and may facilitate negotiations between partners. For example, as part of the Red Cedar River trading pilot the Barren County Land Conservation Department serves as a third-party facilitator. The Barren County LCD negotiates with farmers, verifies management practice installation and operation, and establishes trading contracts between participating farmers and the City of Cumberland.

Use of a broker would not alter framework specifications including WPDES permit conditions for trading as discussed in Section 2.9 of this report. The broker could also be the permittee's agent to provide the permit-required annual inspection of management practice installations that generated the traded credits.

Another type of third party is a nonpoint-source credit exchange which would pool nonpoint source pollutant reduction credits and make them available to point sources. Point sources would purchase credits from the exchange rather than dealing directly with nonpoint source credit generators.

In addition to buying and selling credits, a credit exchange may perform several other functions including:

- Promoting management practice implementation to generate credits;
- Establishing standards for trading;
- Determining eligible credits;
- Establishing trade ratios including accounting for delivery and location;
- Verifying the operation and maintenance of management practices; and
- Tracking trade information for all participants.

If not operated by the DNR, a credit exchange will likely have to be approved and monitored by the DNR. Establishing criteria for approving a credit exchange exceeds the scope of this framework and will have to be developed at a later time.

Part 3: Action

3.1 Recommendations

It is recommended that the Natural Resource Board support the DNR in implementing the water quality trading framework. This includes supporting necessary statutory changes and development of guidance as identified below. In addition, continued stakeholder involvement will be sought as guidance is developed.

While it appears that implementation of the framework may increase the DNR's workload, this increase is offset by potential improvements in water quality and increased flexibility for the regulated community. The increase is divided into two categories, a startup workload and ongoing workload. Startup workload involves guidance development outlined in Section 3.2.2 below and training. Ongoing workload stems from more complex permit issuance and potential permit modifications, tracking of trades, and verification of credit generation.

3.2 Implementation Steps

Water quality trading framework implementation steps are provided below.

3.2.1 Necessary Statutory and Administrative Rule Changes

Statutory Changes: State law currently authorizes the trading of water pollution credits in Wis. Stat. s. 283.84. However, the statute is designed to be a pilot program which limits the use of trading. For example, the statute limits the term of trade agreements to 5 years. The following changes to s. 283.84, Wis. Stats., are recommended to eliminate the pilot program status and streamline water quality trading:

- Eliminate references to a pilot program;
- Clarify that any trading agreement must be written and binding;
- Allow trades between permit when a person holds more than one permit (such as a municipality with a POTW and an MS4 permit);
- Clarify that a trade could consist of providing cost share dollars under s. 281.16, Wis. Stats.;
- Provide that a trade must occur within a basin or other subset of a basin as approved by the DNR instead of the "pilot project area";
- Eliminate the requirement that a trade is limited to 5 years;

- Provide that the DNR has authority to include the terms and conditions related to a trade into a new, modified, or reissued WPDES permit;

- Eliminate the annual pilot reporting requirement; and

- Provide that the DNR has the authority to promulgate rules.

Rulemaking: While recommended statutory changes would provide the DNR with the authority to promulgate rules for water quality trading, the consensus of the external stakeholder committee when this report was prepared was that the DNR should not immediately proceed with rulemaking. Instead, the DNR should proceed with additional guidance to implement a water quality trading program. If necessary, rules could be developed at a later point after the DNR gains more experience with trading and additional issues are identified.

3.2.2 Guidance Development

The following list of guidance is not ranked in order of significance because all are required for a successful water quality trading program. For a successful water quality trading program, the DNR will need to be allocated the resources to implement the recommendations listed below.

List of Management Practices: Table 2 of this report, representing the DNR's list of approved management practices, is anticipated to be a key component in the implementation of water quality trading. The table provides a list of management practices with a preapproved trade ratio, credit schedule and duration, method for calculating credits, timing of credits, and any special restrictions. This table currently is a concept that needs to be further developed. A procedure for updating and maintaining the table also needs to be developed. The DNR will work with stakeholders to complete this table and provide guidance for the addition of new practices in the future.

Credit Threshold Analysis: While the basic concepts of credit threshold and generation of pollutant reduction credits are addressed in Section 2.4 of this report, guidance will need to be developed to address nonpoint performance standards that do not have numeric targets that can be readily adapted to a credit threshold. Also, many effective management measures such as stream bank stabilization and control of barnyard runoff lack adequate tools to quantify the pollutant reduction credits generated. The DNR should, in consultation with stakeholder groups, develop guidance detailing procedures. While some specific procedures may be watershed or trade dependent, the DNR should develop statewide guidance outlining minimum requirements and procedures.

Liability and Risk Management: Water quality trading may introduce more risk and liability for a credit user. This is especially true when the credit user is a point source and the credit generator is a nonpoint source. We have identified four major sources of risk:

1. The risk that nonpoint management practices are purchased but not installed.

2. The risk that nonpoint management practices will not be maintained. This can result from a variety of reasons including simple lack of needed maintenance or elimination of management practices when commodity prices become higher than the payments for a management practice. For example, the price of corn may become high enough that a farmer can generate a higher profit by returning a buffer to corn rather than maintaining a perennial vegetative cover and plows under and plants the buffer.

3. The risk that management practices will not generate the pollutant reduction credits anticipated either for a predetermined duration, at a specific time, or in the anticipated quantity.

4. A major rainfall event resulting in flooding or other climatic factors such as a drought may damage or destroy the management practice and render it useless.

The management of risk can be accomplished through a variety of methods. The first two sources of risk, and to a lesser extent the third, can be addressed through strong contract language between trade partners with clear remedies outlined and liable parties identified. The third and fourth sources of risk can also be addressed through contractual documents. Since climatic factors can be the dominant source of the risk, however, it can be hard to assign the burden to one of the parties involved.

The trade ratio outlined in Section 2.5 of this report partially addresses the impact of climate; however, the trade ratio assumes that the management practice is functioning. Management practices that become nonfunctional during the year because of climatic factors may leave a credit user struggling to find a new source of credits and potentially be in violation of permit requirements. This framework and the stakeholder committee that helped develop it have not yet addressed this concept. Options that could be explored include an insurance program for pollutant reduction credits or a system that allows the credit user to use future credits to make up for lost credits due to climatic factors. These concepts are likely best addressed in the contract language between the parties involved in the water quality trade.

Permit Writing Guidance: As discussed in Sections 2.9 and 2.10 of this report, water quality trades addressed by this framework are implemented by way of WPDES permits. To facilitate drafting and issuance of permits that allow water quality trading, the DNR will prepare guidance for drafting such permits; train its permit drafters, limits calculators and field staff, and make necessary changes to its permit supporting software, System for Wastewater Applications, Monitoring and Permits (SWAMP).

Water Quality Trading Application Form: As discussed in Subsection 2.9.1 of this report, the permittee must submit an application for water quality trading for DNR approval prior to using pollutant reduction credits to demonstrate compliance with effluent limits. The DNR will prepare an application form that the permittee can complete and submit electronically.

Guidance for Compliance Inspections: As discussed in Section 2.10 of this report, the DNR will include a review of a permittee's use of pollutant reduction credits when performing a compliance inspection and will occasionally inspect sites that generate pollutant reduction credits. The DNR will prepare guidance to aid its compliance inspectors to complete these tasks.

Pollutant Reduction Credit Tracking: The DNR will develop a tool to track the use of pollutant reduction credits within a watershed. Tracking is necessary to prevent duplication of credit use, to ensure that the capacity of a watershed to generate credits is not exceeded by the number of credits used to demonstrate compliance with permit limits within the watershed, and to gauge the progress of TMDL implementation.

Glossary

"**303(d) list**" means a list of impaired waters established by the DNR and approved by US EPA pursuant to 33 USC 1313 (d) (1) (A) and 40 CFR 130.7.

"**Adaptive management**" as defined in s. NR 217.11 (2), Wis. Adm. Code, means the use of monitoring data and other information at the time of permit reissuance to reassess management decisions and permit requirements.

"**Adaptive management option**" is a strategy to achieve the phosphorus water quality criteria in s. NR 102.06, Wis. Adm. Code, in the most economically efficient manner, and as soon as possible, taking into consideration the contributions of phosphorus from point and nonpoint sources in a watershed as specified by s. NR 217.18, Wis. Adm. Code.

"**Calendar year**" means the time period from January 1 through December 31 inclusive for a given year.

"**Clean Water Act**" or "**CWA**" means the Federal Water Pollution Control Act (33 U.S.C. 1251).

"**Conservation practice**" means a best management practice designed to reduce or prevent soil or sediment loss to the waters of the state.

"**Credit threshold**" means the pollutant loading level below which reductions must be made to generate pollutant reduction credits.

"**Cross-pollutant trading**" means the use of discharge or load reductions generated for one pollutant to be used to compensate for an increase in the discharge or loading of a different pollutant.

"**Load allocation**" means the portion of a receiving water's loading capacity that is allocated to a nonpoint source or group of nonpoint sources under a TMDL.

"M**anagement practices**" as defined by s. NR 151.002 (4), Wis. Adm. Code, means structural or non-structural measures, practices, techniques or devices employed to avoid or minimize soil, sediment or pollutants carried in runoff to waters of the state.

"**New discharger**" means a point source which was not authorized by a WPDES permit as of the effective date of the rule that covers said point source. A new discharger often includes a relocation of an outfall to a different receiving water. Pursuant to s.NR 217.11 (3), Wis. Adm. Code, "new discharger" means a point source which was not authorized by a WPDES permit as of December 1, 2010.

"**Nonpoint source**" means a source of pollutant loading to surface waters of the State other than a source defined as a point source.

"**Performance standard**" as defined by s. NR 151.002 (33), Wis. Adm. Code, means a narrative or measurable number specifying the minimum acceptable outcome for a facility or practice.

"**Phosphorus Index**" or "**PI**" as defined by s. NR 151.015 (15s), Wis. Adm. Code, means Wisconsin's agricultural land management planning tool for assessing the potential of a cropped or grazed field to contribute phosphorus to the surface water.

"**Point source**" means a discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel or tunnel from which pollutants may be discharged into waters of the State. A discernible, confined and discrete conveyance of stormwater for which a permit is required under s. 283.33 (1), Wis. Stats., is also defined as a point source.

"**Pollutant reduction credit**" or "credit" means the amount (mass) of pollutant reduced over a specified time period (day, month, year) that is in excess of the required reduction for a certain source.

"**Surface waters**" means all natural and artificial named and unnamed lakes and all naturally flowing streams within the boundaries of the state, but not including cooling lakes, farm ponds and facilities constructed for the treatment of wastewaters.

"**Technology based effluent limitation**" or "**TBEL**" means an effluent limitation established pursuant to ss 283.13 (1) through (4), Wis, Stats. Effluent limitations established for phosphorus pursuant to Subchapter II of ch. NR 217, Wis. Adm. Code, are included in the definition of TBELs by this report.

"**Total maximum daily load**" or "**TMDL**" means the maximum amount of a pollutant a waterbody can receive and still meet applicable water quality standards. In this report, TMDL is also used when referring to not only the derivation of the total assimilative capacity of a waterbody, but also the allocation of capacity to point and nonpoint sources.

"**US EPA**" or "**EPA**" means the United States Environmental Protection Agency.

"**Water quality based effluent limitation**" or "**WQBEL**" means an effluent limitation determined by using applicable water quality criteria (e.g., aquatic life, human health, wildlife, translation of narrative criteria) for a specific point source to a specific receiving water for a given pollutant or based on the facility's wasteload allocation from a TMDL.

"**Water quality standards**" means standards established by the DNR pursuant to s. 281.15, Stats., of the physical, chemical or biological characteristics or both of a water which must be maintained to make it suitable for specified uses. Water quality standards consist of the designated uses of the waters or portions thereof and the water quality criteria for those waters based upon the designated use.

"**Wasteload allocation**" means the pollutant-specific allocation for an individual point source, which ensures that the level of water quality to be achieved by the point source complies with all applicable water quality standards.

"**Watershed**" means an area of the land that drains to a common lake, pond, river, stream, or other surface waters of the State that is delineated for the purpose of instituting water quality management activities.

"**WPDES permit**" means a Wisconsin Pollutant Discharge Elimination System discharge permit issued under ch. 283, Wis. Stats.

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US EPA (U.S. Environmental Protection Agency). 2003. *Water Quality Trading Policy*. U.S. Environmental Protection Agency, Office of Water. Washington, DC. www.epa.gov/owow/watershed/trading/finalpolicy2003.pdf.

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Appendix A. Water Quality Trading Committee

Committee Members: **Denny Caneff**, River Alliance of Wisconsin
Paul Kent, Municipal Environmental Group
Betsy Lawton, Midwest Environmental Advocates
Melissa Malott, Clean Wisconsin
Kevin Schafer, Milwaukee Metropolitan Sewerage District
Tom Sigmund, Green Bay Metropolitan Sewerage District
Pat Sutter, Dane County Land & Water Conservation Department
Dave Taylor, Madison Metropolitan Sewerage District
John Umhoefer, Wisconsin Cheese Makers Association
Paul Zimmerman, Wisconsin Farm Bureau

In the event a committee member was unable to attend a particular meeting, a substitute was permitted to attend in their absence.

DNR Participants: **Susan Sylvester**, Bureau of Watershed Management, Acting Director
Kevin Kirsch, Bureau of Watershed Management
Mike Hammers, Bureau of Watershed Management
Robin Nyffeler, Bureau of Legal Services

UW Extension Facilitators: **Chad Cook**
Gail Overholt
Andrew Yencha
Daniel Zerr

Committee Meeting Summaries: The Water Quality Trading Committee met six times during the period from October 27, 2010 through July 1, 2011. Meeting summaries are available at http://fyi.uwex.edu/wqtrading/advisory-committee/meeting-summaries/ .

Summary of Forces Working For and Against Trading: During the first committee meeting on October 27, 2010, UW-Extension staff facilitated an exercise looking at the forces working for or against water quality trading in Wisconsin. The purpose of this exercise was to help anticipate and address potential implementation problems associated with a statewide water quality trading framework, weigh the relative importance of forces for or against, and allow a feedback tool to evaluate the framework developed by the committee. The exercise also promoted a better understanding and awareness of issues surrounding water quality trading from the perspective of all the different stakeholder groups. A summary of the exercise is provided below.

Table 3. Summary of major forces working to promote water quality trading.

Regulatory and Political Support	EPA supports development of trading programs within the legal constraints of the Clean Water Act.
	Natural Resources Board support for trading
	Political support for trading, "the time is right"
	Unlike previous trading efforts, the phosphorus rules (chs. NR 102 and NR 217, Wis. Adm. Code) provide a driver.
Cost Efficiency and Economic Benefits Associated with Trading	Trading may provide the most cost-effective way to achieve water quality standards.
	Provide and alternative to the considerable capital and O&M cost for point sources
	All costs associated with trading may be less than a technology investment by the dischargers.
Control of Nonpoint Pollution	National examples of trading successes
	trading provides an opportunity to fund and control nonpoint sources in watersheds by providing cost share to farmers to meet requirements of ch. NR 151, Wis Adm. Code. Cost share is likely necessary to require compliance.
	We have developed tools to quantify nonpoint loads and credits from trades.
Potential for increased water quality improvements and ancillary habitat benefits	In watershed where agriculture is a significant source of phosphorus, water quality trading permits costs to be offset through trading.
	Potential for agriculture operations to realize cost savings through reduced fertilizer and input costs while promoting water quality
	If trading works and water quality improves, we might see economic benefits like more boating, fishing, recreation, tourism, jobs, and increased property values coupled with lower water treatment costs and reduced restoration costs.
	Addressing nonpoint sources may reduce multiple pollutants stemming from pesticides, fertilizers, and other chemicals.
Public Involvement	Trading requires a watershed approach that promotes dialogue between stakeholders in the watershed.

Table 4. Summary of forces working against water quality trading.

Trading requires a watershed approach that can be challenging and time intensive to organize.	Difficulty of organizing disparate group of stakeholders with often conflicting views to come together for solving a watershed problem
	Can be difficult to reach consensus on how to implement framework.
	Rate payers may not want to spend point-source-collected funds for activities not in the service area or to fund practices outside the service area.
	No real driver for farmers to accept management practices on their property
Regulatory Challenges	Historic inflexibility of regulatory programs to allow creative solutions
	Lack of resources at state or county level to implement and administer a trading program
The uncertainty of nonpoint models and the complexity of calculating nonpoint pollution	Need accurate models for measuring nonpoint loads and reductions obtained from trades.
	Getting consensus about using models/tools to quantify phosphorus reductions - balancing the role of models and monitoring
	Lack of data on agricultural management practice effectiveness for some practices and challenge quantifying sources such as barnyards
Potential for too narrow a geographic focus or length of trade	Too narrow definition of geographic area for trading will limit opportunities for trading.
	Uncertainty about duration of trade leading to difficulty estimating economic variables
Administration Costs and Contract Issues	Building a trade agreement requires a third party (legal, consultant, and engineer) to determine credits or balance in a trade. Assumes a significant cost
	Minimum cost savings as a result of program costs (monitoring, etc)
	For some industries a cooperative, contracted relationship between producer (credit generator) and processor (credit user) is unprecedented.
	Will trades/contracts extend to new farm owners? The durability of the contract is a question. What happens if a farm ceases operation?
	The complexity of a trade implementation may exceed the cost of the technology to solve phosphorus reduction.
	Permits for end-of-pipe point source control versus the complexity in implementation of trade contracts, permit language, and enforcement for nonpoint sources
Unintended Consequences	Could move pollutants around and cause problems elsewhere
	Belief that nutrients from a POTW are different than nutrients from non-point

Table 4. Summary of forces working against water quality trading.

Performance Tracking	Challenging and expensive to monitor and measure water quality 'improvements Need to establish baseline and impact on annual weather on the monitoring
	Testing and tracking at farms must be defined and enforced.
	Challenges associated with quantifying the cause/effect of water quality improvements
Baseline (credit threshold)	Restriction on credits that can be generated from nonpoint sources due to the determination of the baseline level
Uncertainty Associated with NPS Control	Lack of guidance on how to identify and properly locate management practices for trades
	Variable effectiveness over different flow conditions and maintenance issues associated with nonpoint management practices
	Long-term uncertainty in credits generated from a nonpoint trade
	Non-point effectiveness of nonpoint controls verses the know effectiveness of POTW upgrades and discharge
	Vast number of nonpoint sources of pollution requiring different types of control
Risk	Legal liabilities in a trading contract are unclear and without precedent
	Reducing risk to both the buyer and the seller of phosphorus credits over time
	Risk to the permit holder in trading for nonpoint pollution that has inherent risk and lack of certainty
	Lack of real-world historical success of trading examples
	Uncertainty and risk of maintaining non-structural improvements such as nutrient management for agriculture
	Potential for 3rd party lawsuits

Appendix B. Summary of State Water Quality Trading Efforts

California - Grassland Area Farmers Tradable Loads Program

Pollutants Traded: Selenium

Regulatory Drivers: A maximum cap was established on the total amount of selenium that the Grassland Area Farmers could discharge; voluntary effort to protect ecosystem and wildlife.

Types of Trades Allowed: PS-PS, PS-NPS, NPS-NPS

Other Information/Website:
http://water.epa.gov/polwaste/nps/success319/Section319III_CA.cfm

Colorado

Pollutants Traded: Non-toxic Pollutants

Determination of Credit: Pollution prevention at the source, treatment technologies and practices, in relation to baselines, determined case-by-case

Trading Ratios: May use equivalence ratios or similar mechanisms to adjust for the amount of pollutant reduction needed to assure that trades result in environmentally equivalent outcomes at the point(s) of concern in the receiving water. Trading ratios can be determined on a case-by-case basis.

Liability for Noncompliance: The point source will be granted a period of time, not to exceed three years, in which to rehabilitate the nonpoint source project, develop a new project, or find another means to obtain the credits provided that all effluent limitations necessary to ensure compliance with water quality standards are met in the interim.
Each party to a trade may include in their contracts private remedies that would address the failure of one party to achieve appropriate reductions and removals.

Types of Trades Allowed: PS-PS, PS-NPS, and NPS-NPS

Other Information/Website:
http://www.cdphe.state.co.us/wq/permitsunit/POLICYGUIDANCEFACTSHEETS/PolicyandGuidance/TradingPolicy.pdf

Colorado - Chatfield Reservoir

Pollutants Traded: Phosphorus

Types of Trades Allowed: NPS-NPS

Colorado: Cherry Creek

Pollutants Traded: Phosphorus

Trading Ratios: 2:1 or greater

Types of Trades Allowed: PS-NPS

Connecticut - Long Island Sound

Pollutants Traded: Nitrogen

Regulatory Drivers: Long Island Sound TMDL

Types of Trades Allowed: Multiple PS

Other Information/Website:
http://www.ct.gov/dep/lib/dep/water/lis_water_quality/nitrogen_control_program/water_quality_trading_summary_2010.pdf

Delaware - Delaware Inland Bays

Determination of Credit: BMP Nutrient Reduction Calculations

Types of Trades Allowed: PS-NPS

Other Information/Website:
http://www.dnrec.state.de.us/water2000/Sections/Watershed/ws/ib_pcs.htm

Florida (under development)

Other Information/Website: http://www.dep.state.fl.us/water/tmdl/index.htm

Idaho

Other Information/Website:
http://www.deq.idaho.gov/water/prog_issues/surface_water/pollutant_trading/water_quality_pollutant_trading_guidance_0710.pdf

Idaho - Lower Boise River

Pollutants Traded: Phosphorus

Regulatory Drivers: TMDL

Determination of Credit: Phosphorus loading reductions for a nonpoint source seller are calculated by first multiplying the nonpoint source's baseline load (estimated using the Surface Irrigation Soil Loss (SISL) model applying a conversion factor of 2 lbs phosphorus per ton of soil loss) by a 'water quality contribution percentage' that represents the individual nonpoint source's share of the reduction amount needed to achieve the load allocation assigned in the TMDL. This 'water quality contribution' represents the amount of reductions the nonpoint source must exceed to generate credits to sell. The amount of reductions created by a BMP is estimated by multiplying the nonpoint source's baseline load by a BMP effectiveness ratio. The number of credits that can be sold is calculated as the difference between the amount of reductions generated by the BMP and the 'water quality contribution' reduction amount. These remaining reductions are multiplied by three ratios to determine the number of tradable credits: 1. a "river location ratio" to calculate credits in "Parma pounds" (Parma is the small town near the mouth of the Boise River where the TMDL's reduction target is measured; this conversion reflects how phosphorus reductions throughout the watershed will have differential impacts on the water quality at Parma); 2. a "drainage delivery ratio" to account for transmission losses within a drainage channel; and 3. a "site location factor" to account for transmission losses between cropland and drainage channels.

Trading Ratios: the formula for credits includes an uncertainty discount. Additional trading ratios reflect river location, site location, and drainage delivery

Liability for Noncompliance: The State will ultimately hold the point source liable for securing sufficient credits, but the trading parties sign a private contract that includes the amount of credits in Parma pounds, a description of the practices that will generate credits, monitoring requirements and assignment of responsibility, payment terms, and penalties for failure to deliver credits.

Approval Process: A Reduction Credit Certificate, signed by the point source purchasing the credit and containing information provided by the nonpoint source, is submitted every month to the Idaho Clean Water Cooperative

Verification of Trades: Point sources must submit a monthly Discharge Monitoring Report, and purchased credits will be checked against these discharge reports in audits of NPDES permits. For measurable nonpoint reductions, water quality monitoring of inflow and outflow verifies the exact amount of reduction. For calculated nonpoint sources reductions, BMP installation is monitored by the point source prior to the creation of credit, and maintenance inspections are conducted by the point source to document monthly credits.

Types of Trades Allowed: PS-NPS

Program Obstacles: The delay associated with TMDL approval.

Incentives to Trade/NPS Involvement: The primary incentive for farmers to participate is that they are partially compensated financially for BMPs.

Illinois - Piasa Creek Watershed Project

Pollutants Traded: Sediment

Regulatory Drivers: None; facilitated by a local, not-for-profit organization, Great Rivers Land Trust (GRLT), and funded by the Illinois-American Water Company (IL-AWC) to reduce sediments in the Mississippi River.

Determination of Credit: Streambank stabilization calculations performed quarterly (determination of erosion rates) and estimated sediment accumulations taken for silt basins. Physical measurements are also taken at maintenance time.

Trading Ratios: 2:1

Liability for Noncompliance: Landowners are responsible for the maintenance of sediment control structures built on their land. If, at the halfway review point, the Illinois EPA determines the program is not effective in achieving sediment reductions, the contract will be terminated.

Approval Process: Approval for the contractual agreement between Great Rivers Land Trust and Illinois-American Water Company came from the Illinois Pollution Control Board and Illinois EPA.

Verification of Trades: Great Rivers Land Trust is responsible for monitoring and provides quarterly and annual reports to Illinois EPA and Illinois-American Water Company. Maintenance of sediment control structures is performed by landowners.

Types of Trades Allowed: PS-NPS

Incentives to Trade/NPS Involvement: Financial incentives encourage farmers and landowners to participate in the Project and implement conservation practices; loss of acreage [as caused by erosion] means loss of income.

Maryland

Pollutants Traded: Nitrogen and Phosphorus

Regulatory Drivers: Nitrogen and phosphorus discharges were lowered by the state legislature to levels approaching the limit of current technology; Chesapeake Bay Agreement.

Trading Ratios: Suggested 2:1 trading ratio for point/nonpoint (1999)

Types of Trades Allowed: PS-PS, PS-NPS, and NPS-NPS

Program Obstacles: The potential available credits for trading are limited, therefore reducing the economic driver for trades to occur.

Michigan

Pollutants Traded: Nitrogen, Phosphorus, potentially sediments

Regulatory Drivers: Address unregulated nonpoint source runoff that is a major source of pollution to the Great Lakes.

Determination of Credit: Point source baselines are established by actual loading levels (rather than discharge limits) over a 3-year period. The baseline is calculated as the product of flow, concentration, and a unit conversion constant. Nonpoint source baselines are set by a TMDL, remedial action plan, lake wide management plan, or a watershed management plan in closed trading. In open trading, agricultural baselines are set by a certified nutrient management plan, while streambank erosion and unregulated stormwater runoff baselines are derived from pollutant-specific loading estimates for different land uses or management practices.

Trading Ratios: To guarantee environmental improvement, each point source must retire 10 percent of the credits it generates (effectively a 1.1:1 trading ratio) and each nonpoint source must retire 50 percent of the credits it generates (effectively a 2:1 trading ratio). Additional site-specific discount factors may be applied to provide greater equivalence where there is an impoundment between sources and greater net reduction in impaired waters pre-TMDL.

Liability for Noncompliance: Holds both credit sellers and purchasers liable in each trade. Generators of credits must obtain three times the number of registered but insufficient credits, which are retired to promote water quality. Purchasers of credits are solely responsible for complying with their permits and showing due diligence. If they provide notice of insufficient credits without having received previous notice from the Department of Environmental Quality, or if purchasers use credits that are later discovered to be insufficient (and the Department of Environmental Quality determines that they had no way of knowing), they are given a reconciliation period to true-up insufficient credits.

Approval Process: Sources intending to sell credits must submit a notice of credit generation or use, which are reviewed for completeness and certified within 30 days. The changes specified by the notice become legally enforceable once the DEQ has certified them. For point sources, the generation or use of credits constitutes a permit modification by rule.

Verification of Trades: Individuals farmers must submit annual reports to verify that the BMPs are successfully installed. Point sources already must submit discharge monitoring reports, which will be used to monitor compliance with trading requirements. The Department of Environmental Quality conducts ambient water quality monitoring and cost calculations as well as more comprehensive program evaluations every five years.

Types of Trades Allowed: PS-PS, PS-NPS, and NPS-NPS

Program Obstacles: Information gaps, misperceptions about trading, and federal-state disputes about legality

Other Information/Website: http://www.state.mi.us/orr/emi/admincode.asp?AdminCode=Single&Admin_Num=32303001&Dpt=EQ&RngHigh=

Michigan: Kalamazoo River

Pollutants Traded: Phosphorus

Regulatory Drivers: The demonstration project preceded a TMDL, although the fact that a TMDL was in the pipeline was hoped to be a driver for farmers' participation.

Determination of Credit: Six-step process: 1. Monitor to determine baseline conditions and annual reductions; 2. Apply trading ratios to calculate available credits for trading; 3. Calculate total costs, including design, construction, and monitoring; 4. Assess the life span of installed BMPs; 5. Calculate the annual cost per pound of phosphorus reductions; 6. Calculate the value of each credit based on the trading ratio and per pound costs, amortizing for the BMP life span. The minimum eligibility requirement for a baseline for agricultural credits was set by Generally Accepted Agricultural Management Practices. Improvements to achieve Generally Accepted Agricultural Management Practices were discounted 50 percent

Trading Ratios: The trading ratio for point-nonpoint trades was 2:1 (4:1 for BMPs to achieve Generally Accepted Agricultural Management Practices). Any point-point trades would have had a 1.1:1 trading ratio. Further trading ratios and restrictions could also be used to address distance, seasonality, and equivalence.

Liability for Noncompliance: Correct deficiencies within 60 days. If the nonpoint source partner failed to respond, payments would need to be refunded within 90 days.

Approval Process: Once a nonpoint source project was identified, the landowner submitted a Service Agreement to the Steering Committee for approval.

Verification of Trades: Follow up monitoring and technical assistance are conducted by the **Natural Resources Conservation Service**. Kieser & Associates also conducted follow-up water quality monitoring where possible.

Types of Trades Allowed: PS-NPS

Program Obstacles: Lack of existing partnerships and interagency coordination, conflicting perceptions of various stakeholders, clashes with the personal interests of several individuals on the Steering Committee, and unexpected resistance from local environmental groups that had declined earlier involvement. A broad-based community education and participation initiative eventually built consensus around the local trading framework. Farmers did not trust regulators, were afraid of being targeted as polluters, and were reluctant to make voluntary changes that might later become required

Minnesota - Rahr Malting Co.

Pollutants Traded: Phosphorus, nitrogen, 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), and sediment

Regulatory Drivers: TMDL

Determination of Credit: Acceptable projects include soil erosion BMPs, livestock exclusion, rotational grazing, wetland restoration, and land set-asides. BMPs that are already being widely adopted, such as reduced tillage, would not be considered additional and are therefore not eligible for trading. The credits are granted in a schedule to give the point source greater flexibility in meeting the permit requirements: 45 percent are granted when the contractual agreements are reached, 45 percent when the nonpoint source controls have been implemented, and 10 percent when vegetation establishment criteria are reached.

Trading Ratios: In addition to the ratios correlating nutrients, a 2:1 trading ratio is applied to trades.

Liability for Noncompliance: The NPDES permit specifies that Rahr is liable for securing nonpoint source credits, and noncompliance is subject to enforcement. If a nonpoint source seller defaults, then Rahr is responsible for finding another project.

Approval Process: The Commissioner of the Minnesota Pollution Control Agency gives final approval for each nonpoint source project and determines the amount of credits generated.

Verification of Trades: The point source is responsible for submitting technical and engineering reports, including structural specification, operation plans, and detailed photographs, to the Minnesota Pollution Control Agency before and after each trade. The permit also requires annual reports accounting for nonpoint source credits . The Minnesota Pollution Control Agency monitors the implementation of BMPs with period site inspections.

Types of Trades Allowed: PS-NPS

Program Obstacles: Defining the appropriate trade ratio between upstream nonpoint source phosphorus loading; used studies to determine a 1:8 ratio. Local environmentalists initially objected to the trading program, but Rahr gained their support by cooperatively working with and accepting input from environmental organizations.

Incentives to Trade/NPS Involvement: NPS were financially compensated, and the BMPs provided ancillary benefits by improving land stability. In the case of two agricultural sites, the farmers were very concerned about the severe riverbank erosion that threatened their agricultural land, fences and buildings, and for years they had been searching unsuccessfully for financial assistance. Landowners' participation also had a strong social component. Farmers were recognized for their good stewardship of the land, and newspaper coverage helped build community support. The trading program may also have been well-received in the agricultural community because it was seen as a private initiative, as opposed to corporate, governmental, or environmental.

Minnesota - Southern Minnesota Beet Sugar Cooperative

Pollutants Traded: Phosphorus

Regulatory Drivers: TMDL

Determination of Credit: The Southern Minnesota Beet Sugar Cooperative NPDES permit specifies the formulas used to calculate phosphorus credits from each BMP. For soil erosion and cover cropping BMPs, the Revised Universal Soil Loss Equation (RUSLE) was used to estimate the soil erosion reduction (tons/acre/year), which was subsequently multiplied by area, a delivery ratio, and a soil phosphorus content factor to determine phosphorus reductions. For cattle exclusion and rotational grazing, the phosphorus load is calculated from the manure deposited in each pasture area and the associated phosphorus content and

delivery ratio. The permit also specifies phosphorus reduction calculations for critical area set-asides, constructed wetland treatment systems, and alternative surface tile inlets.

Trading Ratios: The trading ratio is 2.6:1, which reflects 1 lb for the offset, 1 lb for environmental improvement, and 0.6 lb as an "engineering safety factor."

Liability for Noncompliance: Southern Minnesota Beet Sugar Cooperative is liable for ensuring nonpoint source phosphorus reductions. If BMPs are not properly implemented or maintained, then the Southern Minnesota Beet Sugar Cooperative will be responsible for identifying another project.

Approval Process: After a trade has been approved by the trade board, it must receive final approval from the Minnesota Pollution Control Agency. Compared to the Rahr Malting Company's permit, Southern Minnesota Beet Sugar Cooperative's permit had many more prescriptive elements for documenting BMPs to submit for approval.

Verification of Trades: The point source is responsible for submitting technical and engineering reports, including structural specification, operation plans, and detailed photographs, to the Minnesota Pollution Control Agency before and after each trade (Fang and Easter 2003). The permit also requires annual reports accounting for nonpoint source credits (MPCA 1997). The Minnesota Pollution Control Agency monitors the implementation of BMPs with periodic site inspections, randomly auditing 10 percent of the contract sites.

Types of Trades Allowed: PS-NPS

Program Obstacles: The environmental community was initially uneasy with the trading program because Southern Minnesota Beet Sugar Cooperative had a history of environmental compliance problems. Southern Minnesota Beet Sugar Cooperative entered into a Compliance Agreement with the Minnesota Pollution Control Agency that contained a schedule of corrective actions, including the implementation of an environmental management system.

Incentives to Trade/NPS Involvement: Although farmers were compensated at $2/acre for implementing BMPs, it actually cost farmers $6/acre. The spring cover crops provide additional benefits to farmers, however, by protecting young sugar beet plants. Southern Minnesota Beet Sugar Cooperative tried to engage cattle farmers for the trade, and they did have one contract for cattle exclusion and bank stabilization. Three other cattle farmers turned them down, most likely because of tensions between cattle farmers and sugar beet growers. The cattle farmers thought that the beet growers drove up land prices, and they did not want to do business with the beet growers even if it made financial sense.

North Carolina: Catawba Watershed

Pollutants Traded: Phosphorus

Types of Trades Allowed: Multiple PS

North Carolina: Neuse River Basin

Pollutants Traded: Nitrogen

Regulatory Drivers: Group compliance association must meet overall cap of Nitrogen discharge into the Neuse River by meeting their allocations.

Liability for Noncompliance: Each Co-Permittee Member shall continue to monitor its discharge(s) and report the results to the Division as specified in its individual NPDES permit.

Other Information/Website: http://www.water.rutgers.edu/Projects/trading/00001nrcapermit-pt1mod200401.pdf

North Carolina: Tar-Pamlico Basin Association

Pollutants Traded: Nutrients

Regulatory Drivers: Voluntary establishment of a group compliance association to reduce instream discharges.

Types of Trades Allowed: PS-NPS

Incentives to Trade/NPS Involvement: Individual Association members' nutrient limits are waived since they are subject to a collective cap.

Other Information/Website: http://portal.ncdenr.org/web/wq/ps/nps/tarpamns

Ohio

Other Information/Website: http://epa.ohio.gov/dsw/rules/3745_5.aspx

Ohio: Great Miami River Watershed

Pollutants Traded: Nitrogen and Phosphorus
Regulatory Drivers: Pre-TMDL water quality improvement
Types of Trades Allowed: PS-NPS
Incentives to Trade/NPS Involvement: Trading Program provides funds to agricultural producers who voluntarily implement nutrient reduction practices on their land. Up to 100 percent cost share.
Other Information/Website: http://www.miamiconservancy.org/water/quality_credit.asp

Oregon

Pollutants Traded: Temperature and oxygen demanding substances, which include BOD, ammonia, nutrients, sediment, and total suspended solids.

Regulatory Drivers:

Determination of Credit: Credit can only be given for actions that are not currently required by existing regulation or are above and beyond the minimum regulatory requirement.

Trading Ratios: Depending on circumstances of a particular trade, use of delivery/location ratios, equivalency ratios, and/or retirement ratios may be used.

Liability for Noncompliance: The permittee is responsible for complying with its permit conditions. If the permittee's anticipated credits, either self-generated or purchased, are not available to comply with permit conditions the permittee will need to respond by acquiring

other available credits, taking appropriate operational actions to maintain compliance (e.g., the permittee may reduce its discharge by increasing land irrigation), or other action (e.g., permit modification).

Approval Process: Trades will be incorporated into NPDES permits.

Verification of Trades: Permit evaluation reports

Types of Trades Allowed: PS-PS, PS-NPS, and NPS-NPS

Other Information/Website: http://www.deq.state.or.us/wq/pubs/imds/wqtrading.pdf

Pennsylvania

Pollutants Traded: Multiple (potentially nutrients, habitat, carbon, etc.)

Regulatory Drivers: TMDLs and Chesapeake Bay tributary strategies

Types of Trades Allowed: PS-PS, PS-NPS, and NPS-NPS

Program Obstacles: The scope of the trading registry

Other Information/Website:
http://www.dep.state.pa.us/river/Nutrient%20Trading%20Documents/Additions%2012-29-2006/Final%20Policy%2012-28.pdf

Vermont

Pollutants Traded: Sediments/ stormwater offsets.

Regulatory Drivers: Used to meet state requirements.

Virginia

Pollutants Traded: Nitrogen and Phosphorus

Regulatory Drivers: Chesapeake Bay Agreement Tributary Strategies

Determination of Credit: Used as a baseline the nutrient reductions specified by Water Quality Improvement Fund grant agreements. A point source that discharges below annual performance requirements would earn nutrient credits that could be banked for one year or traded to other Water Quality Improvement Fund grantees or the State.
Trading Ratios: 1:1 trading ratio likely for point/point trades.

Liability for Noncompliance: Point sources that fail to meet their nutrient reduction goals as called for by their Water Quality Improvement Fund grant would likely be required to repay a portion of the cost-share funds with interest or secure credits from grantees that had exceeded their performance requirements

Types of Trades Allowed: PS-PS and PS-NPS

Program Obstacles: No support from either the environmental community or the municipal and industrial dischargers.

Other Information/Website: http://www.deq.virginia.gov/vpdes/nutrienttrade.html

West Virginia (in development)

Regulatory Drivers: In order to restore the water quality and aquatic habitat of the Chesapeake Bay, all political jurisdictions within the watershed have agreed to achieve voluntary load reductions in nitrogen, phosphorus, and sediment; avoiding an EPA TMDL

Other Information/Website: http://wvwri.nrcce.wvu.edu/programs/pwqb/index.cfm

Appendix C. UW-Extension Bibliography

A review of existing water quality trading programs was conducted by UW-Extension staff. A summary bibliography prepared by UW-Extension follows.

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