

Case Studies of Water Quality Trading Being Used for Compliance with National Pollutant Discharge Elimination System Permit Limits

2013 TECHNICAL REPORT

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Abstract

While there is a great deal of published work describing and analyzing water quality trading and explaining how to engage in it, research is lacking regarding permits that use water quality trading to meet compliance obligations. This report aims to provide transparency on National Pollutant Discharge Elimination System (NPDES) permits that incorporate water quality trading through a series of 18 case studies. The research does not attempt to provide comprehensive coverage of every NPDES permit that uses water quality trading. Rather, case studies of 18 NPDES permits are provided as a sample of permits known to allow water quality trading to meet compliance obligations. The case studies focus on the language within the permit itself, supplemented with external information that provides a context for water quality trading in the permit.

Keywords

National Pollutant Discharge Elimination System (NPDES)
Nutrient trading
Regulatory compliance
Temperature trading
Water quality trading



Executive Summary

While there is a great deal of published work describing, instructing and analyzing water quality trading (WQT), there lacks research regarding the permits in which water quality trading is operationalized to meet compliance obligations. This report aims to provide transparency to National Pollutant Discharge Elimination System (NPDES) permits that incorporate water quality trading through a series of 18 case studies. Case studies of 18 NPDES permits are provided as a sample of permits known to allow water quality trading to meet compliance obligations. The case studies focus on the language within the permit itself, supplemented with external information to inform the context of WQT in the permit.

Within the 18 confirmed case studies, the majority (10) of permittees were wastewater treatment plants. The case studies also included regulatory authorities, food or beverage companies, an electric power plant, and an agricultural cooperative. The incorporation of WQT towards a permit obligation varied widely among the case studies. EPRI confirmed that eleven permittees had used water quality trading to comply with the permits. The remaining seven permits lacked a regulatory driver to apply credits towards the permit obligation, were too recently permitted to have completed a trade, or for other reasons did not execute trades towards the permit.

The case studies showed a dichotomy in the means of stipulating the details of how WQT was to be executed: 1) provide limited details of WQT within the permit and refer to a separate trading plan document, or 2) provide details of WQT within the permit. This is reflected in the amount of text written into the permits regarding WQT, which ranges from one sentence to five pages. Eight of the cases referenced trading plans or similar detailed guidance, while the others included descriptions directly in the permits.

While this research did not attempt to provide comprehensive coverage of every NPDES permit using water quality trading, this is the only known report to consolidate this type of information. As interest and applicability of WQT builds in the United States, this report highlights the value of developing consolidated resources of related information. Clarity that develops from this and similar analysis can illuminate otherwise hypothetical discussions regarding the status, details, and frequency of applying WQT credits towards permit compliance obligations in the United States.

Acronyms

BMP	Best Management Practice
CBOD ₅	Five-day carbonaceous oxygen demand
CWS	Clean Water Services
DEEP	Connecticut Department of Energy and Environmental Protection
EPA	U.S. Environmental Protection Agency
MPCA	Minnesota Pollution Control Agency
N	Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint source
NRCA	Neuse River Compliance Association
NRCS	U.S. Department of Agriculture Natural Resources Conservation Service
P	Phosphorus
PS	Point source
PS/NPS	Point source to nonpoint source trading
PS/PS	Point source to point source trading
SMBSC	Southern Minnesota Beet Sugar Cooperative
SWCD	Soil and Water Conservation District
TMDL	Total Maximum Daily Load
TN	Total nitrogen
TP	Total phosphorus
WQBELs	Water quality-based effluent limits
WQT	Water quality trading
WWTP	Wastewater treatment plant

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Section 1: Introduction

Water quality trading is an innovative market-based approach to achieving water quality goals for nutrients such as phosphorus and nitrogen through programs that allow permitted emitters to purchase nutrient reductions from another source (Figure 1-1). Control costs for any one nutrient can differ from one emitter to another, and water quality trading provides an option for meeting discharge requirements in a cost-effective manner.

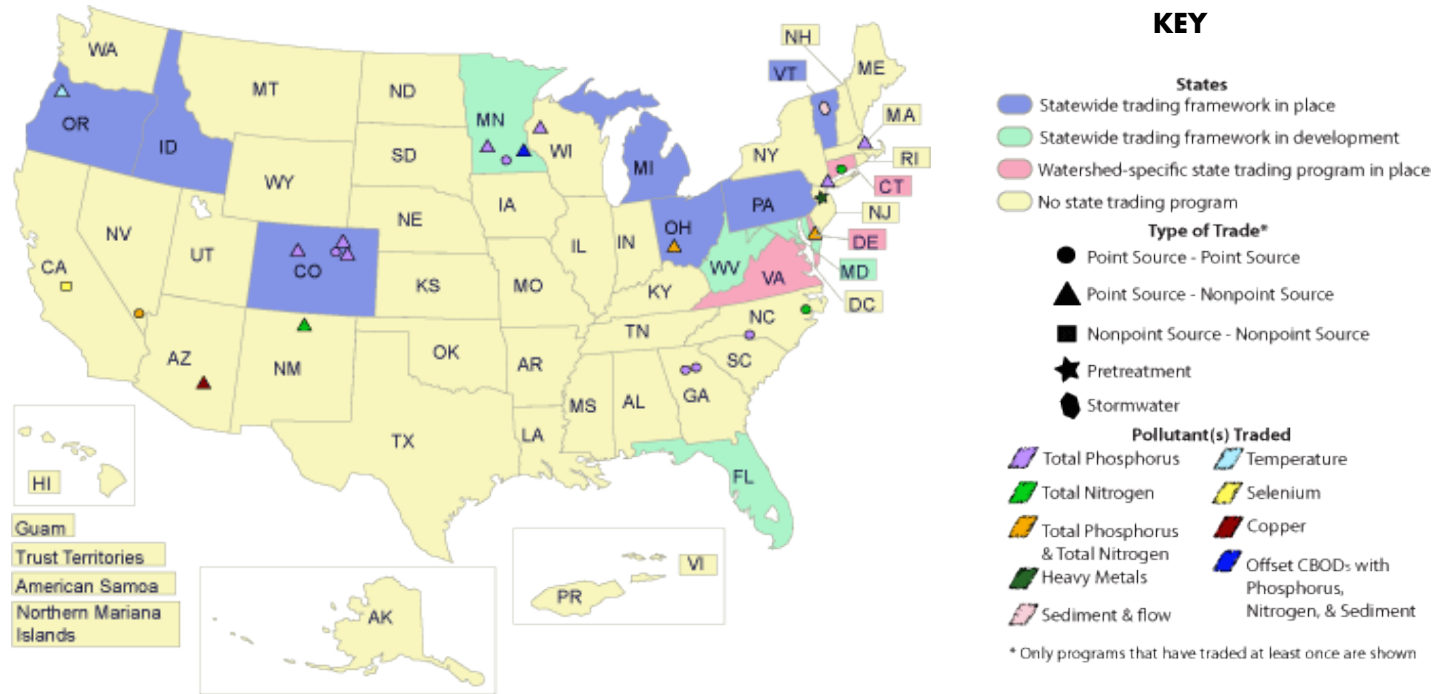


Nutrient Reduction at Lower Cost

Figure 1-1
Trading of Water Quality Credits between Farmer and Permitted Discharger


In 2007, the U.S. Environmental Protection Agency (EPA) developed a “Water Quality Trading Toolkit for Permit Writers” that provided guidance for implementing the 2003 National Water Quality Trading Policy [1, 2]. There is solid published work describing, instructing and analyzing water quality trading at a framework level —meaning the level that describes policy, approaches, and infrastructure [3, 4, 5, 6, 7, 8]. For example, the U.S. EPA provides a map of state and individual water quality trading programs across the United States (Figure 1-2). However, not all of these programs include active trading to meet NPDES permit compliance, and in some cases no trades have occurred whether for compliance or otherwise.

Further, there lacks detailed analysis on the permits in which water quality trading is operationalized to meet compliance obligations. This report aims to narrow this gap by summarizing case studies on how water quality trading has been incorporated in National Pollutant Discharge Elimination System (NPDES) permits.



[9]

Figure 1-2
EPA Map of State and Individual Water Quality Trading Programs



Section 2: Methods

The research did not attempt to provide comprehensive coverage of every NPDES permit using water quality trading. Rather, EPRI researchers reviewed 35 leads of NPDES permits suspected to allow water quality trading, which were obtained from subject matter experts and discovered during the course of online research on water quality trading programs, guidance and reports. Of the initial leads, a total of 18 NPDES permits were found online or were provided by subject matter experts and case studies were compiled. The case studies were then verified, as possible, with the permit holders themselves, WQT program administrators, agency staff, and/or consultants knowledgeable about the projects. The case studies focus on providing information from the permit language itself, supplemented by external information to inform the context of trading in the permit.

Section 3: Results

EPRI identified 35 possible NPDES permit case studies. However, of these 35, only 18 of these could be confirmed via location of the permits. The leads that EPRI did not include are summarized in Table 3-1 below.

*Table 3-1
Leads NOT Included as Case Studies*

Name of WQT program or NPDES permit holder	Reason for not including
Antrim Township Municipal Authority	Known to have purchased nutrient credits on Pennvest auction, but could not obtain NPDES permit online [10]
City of Cumberland / Red Cedar River trading program	Determined not to be WQT. The city's participation in the Red Cedar River trading program "is not handled within the trading framework, since the trading program is authorized by a letter from the DNR to Cumberland." [4, page 277]
City of Harrisburg	Known to have purchased nutrient credits on Pennvest auction, but could not obtain NPDES permit online [10]
City of Missoula	Could not obtain NPDES permit online
City of Union	NPDES permit did not mention water quality trading
Delaware Inland Bays	Could not obtain NPDES permit online
Forest Hills Metropolitan District WWTP / Bear Creek Watershed, Colorado	Could not obtain NPDES permit online
Guilford Mills, Inc.	Known to have purchased nutrient credits on Pennvest auction, but could not obtain NPDES permit online [10]
Illinois-American Water Company's Alton water treatment facility / Piasa Creek Watershed, Illinois	Could not obtain NPDES permit online
Las Vegas Wash	Determined not to be WQT. In a 2008 EPA report, the program's coordinator declined to be interviewed saying that he did not believe the program was 'water quality trading' [5]
Mountaintop Area Joint Sanitary Authority	Known to have purchased nutrient credits on Pennvest auction, but could not obtain NPDES permit online [10]
Municipal Authority of the Town of Bloomsburg, County of Columbia	Known to have purchased nutrient credits on Pennvest auction, but could not obtain NPDES permit online [10]

Table 3-1 (continued)
Leads NOT Included as Case Studies

Name of WQT program or NPDES permit holder	Reason for not including
Panda Power’s Brandywine, Maryland power plant	Could not obtain NPDES permit online
Ponderosa Wastewater Treatment Plant / Chatfield Reservoir, Colorado	Could not obtain NPDES permit online
Raven Power’s Brandon Shores, Maryland power plant	Could not obtain NPDES permit online
Tar Pamlico Basin Association	Could not obtain NPDES permit online
Towanda Municipal Authority	Known to have purchased nutrient credits on Pennvest auction, but could not obtain NPDES permit online [10]

The 18 case studies for which EPRI could obtain permits are summarized in Table 3-2, and a detailed review of each follows. Each case study in this analysis contains the following information (as available):

- Name of facility
- State
- Permit number and time period
- Was trading used to comply with permit
- Pollutant
- Amount traded (as applicable)
- Point source to point source trading (PS/PS) or point source to nonpoint source trade (PS/NPS trade)
- Buyer and seller
- Best Management Practices (BMPs, as applicable)
- Narrative summary
- Description of what is in the permit
- Additional information from sources other than the permit
- Authorization for water quality trading
- References

The case studies focus on water quality trading in the text of the permit itself, supplemented by external information to inform the context of trading in the permit. The case studies do not attempt to provide a detailed summary of the water quality program within which the NPDES permit operates (as applicable). The case studies are named by the permittee name.

Table 3-2
Summary of NPDES Permits Incorporating Water Quality Trading

Permittee name	State	Permit time period	Was trading used to comply with permit?	Pollutant	PS/PS or PS/NPS	Buyer, seller
1. Alpine Cheese Company, Inc.	OH	Jan 2007 - Dec 2011	Yes	P	PS/NPS	Alpine Cheese Company was the buyer, Holmes County SWCD was seller/aggregator of credits from farmers
2. Butler County Board of Commissioners	OH	Feb 2011 – Feb 2015	No*	TN and TP	PS/NPS	Butler County was the buyer and the Miami Conservancy District was the aggregator of credits from farmers
3. Carolina Power and Light Company d/b/a/ Progress Energy Carolinas, Inc	NC	Nov 2009 – May 2013	Yes	TN	PS/PS and PS/NPS	Progress Energy was the lessor and lessee of credits with the Neuse River Compliance Association (NRCA); sellers could also be individual point sources, and the State’s Ecosystem Enhancement Program.
4. City of Dayton	OH	Aug 2009 – Jan 2014	No*	TN and TP	PS/NPS	City of Dayton was the buyer and the Miami Conservancy District was the aggregator of credits from farmers
5. City of Englewood	OH	July 2012 – July 2016	No*	TN and TP	PS/NPS	City of Englewood was the buyer and the Miami Conservancy District was the aggregator of credits from farmers
6. City of Kalamazoo	MI	Circa 2002 – 2005**	No	P	PS/NPS	City of Kalamazoo would be the buyer
7. City of Medford	OR	Dec 2011 – Nov 2016	Yes	Temperature	PS/NPS	City of Medford was the buyer and The Freshwater Trust was the seller/aggregator of credits from riparian projects primarily on agricultural land
8. Clean Water Services	OR	July 2005 – Jan 2009	Yes	CBOD ₅ , ammonia, temperature	PS/PS and PS/NPS	Clean Water Services was the buyer, sellers were individual landowners; PS/PS trading was allowed between two Clean Water Services facilities: Durham and Rock Creek

Table 3-2 (continued)
Summary of NPDES Permits Incorporating Water Quality Trading

Permittee name	State	Permit time period	Was trading used to comply with permit?	Pollutant	PS/PS or PS/NPS	Buyer, seller
9. Lakeland Sanitary District #1	WI	July 2013 – June 2018	No	TP	Unspecified	Lakeland Sanitary District #1 would be the buyer, permit does not specify whether trading would be anticipated to be PS/PS or PS/NPS
10. Minnesota Pollution Control Agency***	MN	Dec 2005 – Nov 2010	Yes	P	PS/PS	WWTP permittees within the general permit would be both buyers and sellers. Trade associations would also be buyers or sellers.
11. Neuse River Compliance Association***	NC	Jan 2004 – Dec 2007	Yes	TN	PS/PS and PS/NPS	Members of the Neuse River Compliance Association were buyers and sellers; sellers could also be point sources outside the NRCA, and the State's Wetland Restoration Program
12. Rahr Malting Company	MN	July 2012 – July 2017	Yes	CBOD ₅ ****	PS/NPS	Rahr Malting Company was the buyer, sellers were landowners
13. Southern Minnesota Beet Sugar Cooperative	MN	April 1999 – March 2004	Yes	P	PS/NPS	Southern Minnesota Beet Sugar Cooperative was the buyer, sellers were beet sugar growers in the cooperative
14. State of Connecticut***	CT	Jan 2011 – Dec 2015	Yes	N	PS/PS	The State of Connecticut's Nitrogen Credit Exchange was the buyer of credits from facilities who discharge less than their annual limit (sellers); facilities that exceeded their limit would have to buy credits from the State

Table 3-2 (continued)
Summary of NPDES Permits Incorporating Water Quality Trading

Permittee name	State	Permit time period	Was trading used to comply with permit?	Pollutant	PS/PS or PS/NPS	Buyer, seller
15. State of Virginia***	VA	Jan 2012 – Dec 2016	Yes	TN and TP	PS/PS and PS/NPS	Facilities in the Virginia Nutrient Credit Exchange Association &/or facilities covered by the permit were the buyers and sellers; sellers could also be farmers, landowners, a nutrient land trust and a nutrient bank, and the State’s Water Quality Improvement Fund
16. Tri-Cities North Regional Wastewater Authority	OH	Aug 2009 – Jan 2014	No*	TN and TP	PS/NPS	Tri-Cities was the buyer and the Miami Conservancy District was the aggregator of credits from farmers
17. Truckee Meadows Reclamation Facility	NV	Unknown, circa 2012	Unknown	TN, TP, and TDS	PS/NPS	The Truckee Meadows Water Reclamation Facility would be the buyer
18. West Branch Regional Authority	PA	July 2013 – June 2018	Yes	TN and TP	PS/NPS and PS/PS	West Branch Regional Authority was the buyer, sellers were Mercuria America Inc. and Muncy Borough Wastewater Treatment Plant (owned by West Branch Regional Authority)

* The permit notes that pre-compliance credits were funded but have not been applied towards permit due to an absence or regulatory need (i.e. permittee is in compliance with current requirements) [11]

** “Water quality trading” was in the template of the permit in 2002 and the permit expired in 2005 [12]

***This is a permit under which multiple point source facilities participate (see case studies)

****CBOD₅ with equivalency ratios between CBOD₅, phosphorus, nitrogen, or sediment loads

Case 1: Alpine Cheese Company, Inc.

Name of facility: Alpine Cheese Company's industrial wastewater treatment works located at 1658 Township Road 660, Paint Township, Holmes County, Ohio

State: Ohio

Permit number and time period: 3IH00100*FD, permit effective January 1, 2007; expiration December 31, 2011 [13]

Was trading used to comply with permit: Yes

Pollutant: P [14]

Amount traded: The facility was required to use 5,500 P credits for a reduction of 16,500 lbs P (7,484 kg) over the five year permit [15]. As of year four of the five year permit, the facility had used 5,581 credits (reduced 16,743 lbs or 7,594 kg P) and was projected to use 7,156 credits (reduce 21,486 lbs or 9,746 kg P) by the end of the permit [15].

PS/PS or PS/NPS: PS/NPS

Buyer and seller: Alpine Cheese Company was the buyer and the Holmes County SWCD was the seller/aggregator of credits from farmers

BMPs: There are two sets of BMPs referenced in "A Plan to Reduce Phosphorus Loading and Improve Stream Ecological Function in the Middle Fort and Adjoining Watersheds of the Sugar Creek Watershed: Joint Recommendations for the Alpine Cheese Phosphorous Nutrient Trading Plan"(2006 Alpine Cheese Nutrient Trading Plan). The first set includes the following traditional USDA Natural Resources Conservation Service BMPs: "Residue Management No-Till or Strip Till, Conservation Crop Rotation, Cover-Green Manure Crop, Nutrient Management, Soil Tests, Manure Analysis, Waste Utilization, Waste Storage Facility, Manure, Milkhouse and Waste Water, Roof Runoff Structures, Prescribed Grazing, Fencing, Watering Facility, Stream Crossing, Use Exclusion, Access Road, Livestock Use Area Protection, Filter Strip Area, Composting Facility, Wetland Creation" [14]. The second set of BMPs were included "because a large portion of farms in the watersheds are Amish and do not participate in traditional conservation programs" due to cultural reasons. The second BMP set includes: calculating appropriate manure application rates, education to reduce over-application of P, promotion of fencing, giving preference to cost-sharing based on P remediation, filter strips, controlled grazing in riparian zones, three types of prioritized incentives [14, page 12].

Narrative summary: The Alpine Cheese facility discharges into Sugar Creek, which is impaired due to "sediments/siltation, habitat alteration and nutrient enrichment" [14]. The cheese factory wanted to expand Jarlsburg cheese production, but an upgrade in wastewater treatment to meet P limits under a

TMDL would be expensive, so they worked with farmers to reduce nonpoint source P loadings [15]. Alpine Cheese’s five year permit renewal requires implementation of the 2006 Alpine Cheese Nutrient Trading Plan [13]. If the plan is not implemented, the permit reverts back to a TMDL limitation of 1 mg/l P for the facility. The facility is allowed a higher limit than is stipulated in the TMDL by reducing P from “nonpoint and other sources” [14, page 12]. Nonpoint source P reductions were generated from BMPs on small dairy farms [15]. These farmers, due to cultural reasons, do not utilize federal cost-share programs, but are willing and interested in collaborating with private funders to implement conservation practices [16].

What is in the permit: The 2007 permit contains a three-paragraph section titled “Nutrient Trading Plan,” which states “The permittee shall immediately implement the January 1, 2006 Nutrient Trading Plan... to meet the conditions of the Sugar Creek TMDL.” The permit notes that credits created prior to the permit effective date “shall be considered for final credit by Ohio EPA” [13].

Additional information: The majority of information regarding nutrient trading for the permit renewal is in the 49-page 2006 Alpine Cheese Nutrient Trading Plan [14, page 12]. The 2006 Alpine Cheese Nutrient Trading Plan includes the TMDL limits, reduction targets (expressed in lbs/d and kg/d), and allows trading to address discrepancy between the loading from the facility and the reductions required in the TMDL:

“The total amount of P pollution that will be reduced... will be at least the 2.51 lbs/d (1.14 kg/d) needed to account for the difference between the proposed 3.74 lbs/d (1.7 kg/d) permitted P and the 1.23 lbs/d (0.56 kg/d) that would be allowed for a flow of 0.140 MGD at 1 ppm P as per the TMDL target for point source P for the Middle Fork... If all reductions are from NPS BMPs, it would result in phosphorus loading reductions ranging from 5.02 lbs/d (2.28 kg/d) to 30.10 lbs/d (13.68 kg/d) P at the NPS sites dependent upon the location of the selected sites for implementation” [14, page 4, 17].

Trading ratios are between 1:1 and 12:1, depending on “source of P loading and its [farm] location in the watershed relative to the Alpine Cheese discharge location” [14, page 16]. A 20% credit set-aside is required. Credit stacking is allowed: “The broker also has the right to gain carbon, sediment, and nitrogen credits from the same conservation measures being installed if a buyer and documentation can be arranged” [14, page 16]. Holmes County SWCD acts as administrator of the water quality trading program (verifier, broker, aggregator); and Ohio State University provides research, monitoring, and facilitation.

A 2011 article written by the Holmes County Soil and Water Conservation District (SWCD) program administrator provides a good description of trading under this permit [15].

Authorization: “Water quality nutrient trading credit [sic] is based on the 2003 EPA nutrient trading policy. The Clean Water Act (CWA), 33 U.S.C. § 1251, et seq. and its implementing regulations establish a legal bases and authority for trading to achieve and maintain water quality standards. The legal framework of water quality credit trading is two fold [sic]. First, it is based on water quality standards (Section 303 (c)) that establish a level of water quality must be attained and protected. The second criterion is the CWA requirement that NPDES permits contain water quality-based effluent limits as stringent as necessary to meet water quality standards (CWA Section 201 (b)(1)(C))” [14, page 9].

References:

13. Alpine Dairy LLC NPDES permit 3IH00100*FD. Ohio EPA: 2007. Accessed July 2013, <http://web.epa.ohio.gov/dsw/permits/doc/3IH00100.pdf>.
14. *A Plan to Reduce Phosphorus Loading and Improve Stream Ecological Function in the Middle Fort and Adjoining Watersheds of the Sugar Creek Watershed: Joint Recommendations for the Alpine Cheese Phosphorous Nutrient Trading Plan* [aka 2006 Alpine Cheese Nutrient Trading Plan]. Ohio EPA: 2006. Accessed June 2013, http://www.epa.ohio.gov/Portals/35/wq_trading/alpine%20cheese%20trading%20plan%201%201%2006.pdf.
15. Michelle Wood, “Holmes Co., Alpine Cheese water quality trading project proves successful,” Farm and Dairy, January 13, 2011, accessed June 2013, <http://www.farmanddairy.com/columns/holmes-co-alpine-cheese-water-quality-trading-project-proves-successful/19895.html>.
16. Holmes County Soil and Water Conservation District, 2013. Personal communication, October 18, 2013.
17. *Total Maximum Daily Loads for the Sugar Creek Basin Final Report*. [aka 2002 TMDL] Ohio Environmental Protection Agency Division of Surface Water: 2002. Accessed June 2013, <http://www.epa.state.oh.us/portals/35/tmdl/SugarTMDLtitleandTOC.pdf>.

Case 2: Butler County Board of Commissioners

Name of facility: New Miami Water Reclamation Facility wastewater treatment works located at 1000 Sipps Lane, New Miami, Ohio, Butler County

State: Ohio

Permit number and time period: 1PB00023*HD; permit modification effective February 1, 2011; expiration February 28, 2015

Was trading used to comply with permit: No. Pre-compliance credits were funded but have not been applied towards the permit due to an absence of regulatory need (i.e. permittee is in compliance with current requirements) [11].

Pollutant: TN and TP [18]

Amount traded: Not specified in either the permit or the Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program (2005 Great Miami Operations Manual) [19]

PS/PS or PS/NPS: PS/NPS

Buyer and seller: Butler County was the buyer and the Miami Conservancy District was the aggregator of credits from farmers

BMPs:

- Grade stabilization structure
- Grassed waterway
- Critical area planting in areas with gullies
- Water and sediment control basins
- Animal trails and walkways
- Stream channel stabilization
- Streambank protection
- Prescribed grazing
- Residue management, mulch till
- Conservation crop rotation
- Conservation cover
- Cover and green manure
- Critical area planting
- Stripcropping, contour
- Stripcropping, field
- Filter strips
- Animal waste systems
- Septic system pumping or rehabilitation
- Restoration of natural stream function
- Vegetated filter strips
- Grass swales
- Infiltration devices
- Extended wet detention
- Wetland detention
- Dry detention
- Settling basin
- Sand filters
- WQ inlets
- Weekly street sweeping
- Infiltration basin
- Infiltration trench
- Porous pavement
- Concrete grid pavement
- Sand filter / infiltration basin
- WQ inlet w/ sand filter
- Oil / grit separator
- Wet pond [18]

Narrative summary: Butler County funded a watershed trading program (the Great Miami River Watershed Water Quality Credit Trading Program, or Great Miami Trading Program) to create pre-compliance water quality credits, but nutrient limits have not yet come into force so credits have not been applied to

the permit [11, 19]. Neither the permit nor the 2005 Great Miami Operations Manual mention specific amount of credits available to the County or load reductions that the County intended to meet with WQT. This permit is substantially the same as the City of Dayton permit (Case 3), the City of Englewood permit (Case 4), and the Tri-Cities permit (Case 16).

What is in the permit: The permit contains a four-paragraph “Section S. Water Quality Trading.” Butler County New Miami WWTP is acknowledged as a “Investor” in the Great Miami Trading Program, having participated prior to their 2011 NPDES permit, and “At the time nutrient limits are included in this NPDES permit, water quality credits accrued through its participation in the trading program will be available to the permittee to use for permit compliance consistent with provisions of the Operations Manual and the effective NPDES permit” [19]. The permit references detailed information about the Great Miami Trading Program that is not specific to Butler County, but rather describes a broader program in which the County and other point sources participated. The language in the permit mirrors some (but not all) of the language of the “Model Draft Language for Inclusion in NPDES Permits” in Appendix C of the 2005 Great Miami Operations Manual [18, page 31].

Additional information: The 39-page Operations Manual for the Great Miami River Watershed Water Quality Credit Trading Program (2005 Great Miami Operations Manual) is not specific to the County but rather provides details on the broad GM Trading Program. “[The] Operations Manual addresses all aspects of the Trading Program including program development, implementation, evaluation, and adaptation” [18]. One subwatershed in the Great Miami River had a TMDL as of 2005, and “nearly all subwatersheds... are scheduled for TMDL development” for nutrients and sediments [18].

Eligible buyers in the GM Trading Program are NPDES permit holders who have funded the Great Miami Trading Program and have had permit modifications to reflect their participation in the Trading Program. Permit holders who have funded the program prior to NPDES compliance requirements are called “Investors” which “earns them the right to trade at more favorable water quality credit trading ratios [than those who fund the WQT program after compliance, or “Contributors”] for all subsequent permits where credits are applied to achieve compliance” [19].

The range of trading ratios are 1:1 to 3:1, depending on status of participation (Investor versus Contributor) as well as whether the discharge is to an impaired watershed or not [18, page 12]. The 2005 Operations Manual has both a “Management Practice Contingency Plan” and an “Insurance Pool of credits.” The Water Conservation Subdistrict of the Miami Conservancy District is the third party broker and monitor; and Soil and Water Conservation Districts are verifiers.

Authorization: In addition to underlying authority under the Clean Water Act, the 2005 Great Miami Operations Manual includes Appendix B providing Ohio EPA correspondence confirming State acceptance of the program [18, page 29].

References:

11. A. Bachman, 2013. Personal communication. October 25, 2013.
18. *Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program*. Ohio EPA: 2005. Accessed July 2013, <http://www.miamiconservancy.org/water/documents/tradingprogramoperationmanualfeb8b2005secondversion.pdf>.
19. Butler County NPDES permit 1PF00000*ND. Ohio EPA: 2009. Accessed July 2013, <http://web.epa.ohio.gov/dsw/permits/doc/1PB00023.pdf>.

Case 3: Carolina Power and Light Company d/b/a Progress Energy Carolinas, Inc.

Name of facility: H.F. Lee Steam Electric Plant, located at 1677 Old Smithfield Road, Goldsboro, North Carolina, Wayne County

State: North Carolina

Permit number and time period: NC0003417; permit effective date November 1, 2009; expiration May 31, 2013

Was trading used to comply with permit: Yes

Pollutant: TN

Amount traded: 9,000 lbs (4,082 kg) TN

PS/PS or PS/NPS: PS/PS and PS/NPS

Buyer and seller: Carolina Power and Light Company (Progress Energy) leased annual point source credits from other facilities in the Neuse River Basin through the Neuse River Compliance Association (NRCA). In 2009, Progress Energy leased 9,000 lbs (4,082 kg) of TN allocation to the NRCA. Then in 2010, NRCA leased 9,000 lbs (4,082 kg) TN to Progress Energy [20]. The permit also allows purchase of point source credits from individual facilities and payment to the North Carolina Ecosystem Enhancement Program.

BMPs: None specified

Narrative summary: Progress Energy's Lee Steam Plant is one of the co-permittees of the Neuse River Compliance Association (see Case #11). This permit says the facility is in compliance with its annual TN Load limit if it is "a Co-Permittee Member of a compliance association" and notes that the facility's TN discharge is governed through NRCA's NPDES permit [21]. Progress Energy has both leased TN *to* and *from* NRCA (see Case #11).

What is in the permit: The permit contains about two pages related to water quality trading in sections “A. (6) Annual Limits for Total Nitrogen” and “A. (8) Total Nitrogen Reopener Clause” [21].

The permit states that Progress Energy will be in compliance with annual limits for TN if “the Permittee is a Co-Permittee Member of a compliance association,” and then notes that their discharge is governed under NRCA’s NPDES permit [21]. The “Total Nitrogen Reopener Clause” states that the regulator can re-open the permit and establish enforceable TN limits if Progress Energy “fails to maintain sufficient allocation to cover its excess TN load” [21].

Additional information: NRCA publishes an annual Nitrogen Sales and Leases report, which shows Progress Energy’s leases to and from NRCA [20].

Authorization: The permit language notes: “For any given calendar year, the Permittee shall be in compliance with the annual TN Load limit in this Permit if: i. the Permittee's annual TN Load is less than or equal to said limit, or ii. the Permittee is a Co-Permittee Member of a compliance association” [21].

References:

20. “NRCA Nitrogen Sales and Leases: 3/25/2012,” Neuse River Compliance Association: 2012. Accessed September 2013, <http://lnba.net/sites/default/files/NRCA%20Nitrogen%20Trades%202011.pdf>.
21. Progress Energy NPDES permit NC0003417. North Carolina DEQ: 2009. Accessed October 2013, http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=1333482&name=DLFE-65241.pdf.

Case 4: City of Dayton

Name of facility: City of Dayton wastewater treatment works located at 2800 Guthrie Road, Dayton, Ohio, Montgomery County [22]

State: Ohio

Permit number and time period: 1PF00000*ND; permit effective August 1, 2009; expiration January 31, 2014

Was trading used to comply with permit: No. Pre-compliance credits were funded but have not been applied towards the permit due to an absence of regulatory need (i.e. permittee is in compliance with current requirements) [11].

Pollutant: TN and TP [18]

Amount traded: Not specified in either the permit or the Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program (2005 Great Miami Operations Manual)

PS/PS or PS/NPS: PS/NPS

Buyer and seller: City of Dayton was the buyer and the Miami Conservancy District was the aggregator of credits from farmers

BMPs: BMPs for this permit are the same as those for Case 2

Narrative summary: This permit is substantially the same as the Butler County permit (Case 2), the City of Englewood permit (Case 5), and the Tri-Cities permit (Case 16). All of the information in the 'Narrative summary' section of Case 2 applies to this case.

What is in the permit: All of the information in the 'What is in the permit' summary of Case 2 applies to this case.

Additional information: All of the information in the 'Additional information' section of Case 2 applies to this case.

Authorization: All of the information in the 'Authorization' section of Case 2 applies to this case.

References:

11. A. Bachman, 2013. Personal communication. October 25, 2013.
18. *Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program*. Ohio EPA: 2005. Accessed July 2013,
<http://www.miamiconservancy.org/water/documents/tradingprogramoperationmanualfeb8b2005secondversion.pdf>.
22. City of Dayton NPDES permit 1PF00000*ND. Ohio EPA: 2009. Accessed August 2013,
<http://web.epa.ohio.gov/dsw/permits/doc/1PF00000.pdf>.

Case 5: City of Englewood

Name of facility: Englewood wastewater treatment works located at 800 Englewood Drive, Englewood, Ohio Montgomery County [23]

State: Ohio

Permit number and time period: 1PD00001*OD; permit effective July 1, 2012; expiration July 31, 2016

Was trading used to comply with permit: No. Pre-compliance credits were funded but have not been applied towards the permit due to an absence of regulatory need (i.e. permittee is in compliance with current requirements) [11].

Pollutant: TN and TP [18]

Amount traded: Not specified in either the permit or the Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program (2005 Great Miami Operations Manual)

PS/PS or PS/NPS: PS/NPS

Buyer and seller: City of Englewood was the buyer and the Miami Conservancy District was the aggregator of credits from farmers

BMPs: BMPs for this permit are the same as those for Case 2

Narrative summary: This permit is substantially the same as the Butler County permit (Case 2), the City of Dayton permit (Case 4), and the Tri-Cities permit (Case 16). All of the information in the 'Narrative summary' section of Case 2 applies to this case.

What is in the permit: All of the information in the 'What is in the permit' summary of Case 2 applies to this case.

Additional information: All of the information in the 'Additional information' section of Case 2 applies to this case.

Authorization: All of the information in the 'Authorization' section of Case 2 applies to this case.

References:

11. A. Bachman, 2013. Personal communication. October 25, 2013.
18. *Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program*. Ohio EPA: 2005. Accessed July 2013,
<http://www.miamiconservancy.org/water/documents/tradingprogramoperationmanualfeb8b2005secondversion.pdf>.
23. City of Englewood NPDES permit 1PD00001*OD. Ohio EPA: 2012. Accessed October 2013,
<http://web.epa.ohio.gov/dsw/permits/doc/1PD00001.pdf>.

Case 6: City of Kalamazoo

Name of facility: Kalamazoo Water Reclamation Plant located at 1415 Harrison Street, Kalamazoo, Michigan

State: Michigan

Permit number and time period: MI0023299; permit effective circa 2002; expiration 2005 (the information EPRI obtained was an excerpt of the NPDES permit and the time period was not included, but Michigan Department of Environmental Quality confirmed that “water quality trading” was in the template of the permit in 2002 and the permit expired in 2005) [12]

Was trading used to comply with permit: No

Pollutant: P

Amount traded: Unknown

PS/PS or PS/NPS: PS/NPS

Buyer and seller: City of Kalamazoo would have been the buyer

BMPs: Unknown

Narrative summary: The City of Kalamazoo’s circa 2002 permit included one sentence which authorizes participation in the Michigan Water Quality Trading Program that was codified in 2002, but WQT was not used for compliance for the permit [24, 25, 26].

What is in the permit: The circa 2002 permit includes the following sentence on WQT: “5. Water Quality Trading: The permittee may participate in Michigan Water Quality Trading Program in accordance with applicable laws and rules” [24].

Additional information: The state of Michigan codified a state WQT program in 2002 [25]. The 27-page Michigan WQT program documentation within the state code includes general requirements, prohibitions and restrictions, baseline and reduction calculations, uncertainty factors, discount factors, and other information.

Language allowing trading has not appeared in the City of Kalamazoo’s last two NPDES permits [12, 26, 27].

Authorization: Michigan developed a state water quality trading program, codified in 2002: “DEPARTMENT OF ENVIRONMENTAL QUALITY, SURFACE WATER QUALITY DIVISION, WATER RESOURCES PROTECTION (by authority conferred on the department of environmental quality by sections 3103 and 3106 of 1994 PA 451, MCL 324.3103 and 324.3106) Part 30. Water Quality Trading” [25].

References:

12. D. Quinn, 2013. Personal communication. October 15, 2013.
24. City of Kalamazoo NPDES permit MI0023299. Michigan DEQ; circa 2002.
25. *State of Michigan Water Quality Trading Rules: Part 30 - Water Quality Trading Rules*. Michigan Office of Regulatory Reform (MI-ORR): 2002. Accessed August 2013, http://www7.dleg.state.mi.us/orr/Files/AdminCode/102_91_AdminCode.pdf.
26. M. Kieser, 2013. Personal communication. October 25, 2013.
27. City of Kalamazoo NPDES permit renewal MI0023299. Michigan DEQ; 2011. Accessed October 2013, <http://www.deq.state.mi.us/owis/Page/Utility/GeneratePDF.aspx?type=.pdf>.

Case 7: City of Medford

Name of facility: City of Medford, Medford Regional Water Reclamation Facility, Trickling Filter—Activated Sludge [WWTP], located at 110 Kirtland Road, Central Point, OR 97502

State: Oregon

Permit number and time period: 100985; permit issue date December 31, 2011; expiration November 30, 2016

Was trading used to comply with permit: Yes

Pollutant: Temperature

Amount traded: The permit requires the City of Medford to obtain at least 300 million kilocalories per day in thermal credits by 2022. This amount is subject to a trading ratio so the actual obligation is 600 million kilocalories [28, 29].

PS/PS or PS/NPS: PS/NPS

Buyer and seller: City of Medford was the buyer and The Freshwater Trust was the developer and seller of credits from riparian projects primarily on private land

BMPs: Riparian planting for shading

Narrative summary: “To meet these new [Rogue Basin TMDL] thermal limits at the Medford Regional Water Reclamation Facility, the City of Medford is proposing to use streamside re-vegetation projects that will reduce stream warming caused by radiant heating” [30].

What is in the permit: The permit contains a three-page section specifically on WQT and makes reference to WQT in other sections of the permit. “Section 7. Water Quality Credit Trading in the Rogue Basin” authorizes the permittee to use WQT to comply with its waste discharge limitation, and has three pages of details. The trading ratio is 2:1, “that is, to generate credit for one unit of thermal load, two units of solar radiation thermal load must be blocked by the planting” [28]. The permittee cannot use credits until site planting is complete. The permit requires an ecologically-appropriate planting strategy and a long-term financial plan.

“Schedule B: Minimum Monitoring and Reporting Requirements” requires the permittee to calculate thermal parameters including thermal credits, “per the procedures in the [2011 Medford Thermal Credit] trading program” [28]. This section also requires that the permittee submit an annual report of its credit trading activities for the previous year, although this was not found on Oregon Department of Environmental Quality’s (OR DEQ) water quality trading website. “Schedule C: Compliance Schedule,” has a BMP implementation and credit timeline [28].

Additional information: OR DEQ’s water quality trading website has the 2011 Medford Thermal Credit Trading Plan (11 pages), which “provides an explanation of the plan to offset thermal impacts and includes the solar load reduction calculation methodology, site selection and location criteria, landowner recruitment and contracting requirements, maintenance and monitoring, remediation measures to address underperforming sites, and third party verification and registration procedures” [30].

The 2008 Rogue River TMDL states that point sources may use WQT: “Sources that may be required to upgrade their facilities to comply with their WLAs may wish to consider water quality trading” [30]. The TMDL also specifically notes that “Medford WWTP could trade with nonpoint sources within the Bear Creek watershed to help meet its WLA” [31].

Oregon DEQ has an Internal Directive (2012) on “Water Quality Trading in NPDES” that “define[s] concepts, explain[s] eligibility, and describe[s] specific trading scenarios that DEQ anticipates and generally supports” WQT but “The recommendations contained in this internal management directive should not be construed as requirements of rule or statute” [32].

Authorization: The permit states that “The permittee is authorized to use water quality credit trading to comply with the waste discharge limitations in Schedule A provided its credit trading activities comply with the requirements of this section” and “The DEQ-approved credit trading program is incorporated into this permit by reference” [28].

References:

28. City of Medford NPDES permit 100985. Oregon DEQ; 2011. Accessed August 2013, http://www.deq.state.or.us/wqpr/3526_2011121400a25CS01.PDF.

29. D. Primozych, 2013. Personal communication, October 10, 2013.
30. *Proposal: Medford Regional Water Reclamation Facility Thermal Credit Trading Program*. Oregon DEQ; 2011. Accessed August 2013, <http://www.deq.state.or.us/wq/trading/docs/MedfordThermalTrading.pdf>.
31. *Rogue River Basin TMDL, Chapter 2: Temperature*. Oregon DEQ; 2008. Accessed September 2013, <http://www.deq.state.or.us/wq/tmdls/docs/roguebasin/Rogue/Chapter2Temperature.pdf>.
32. *Water Quality Trading in NPDES Permits Internal Management Directive*. Oregon DEQ; 2012. Accessed September 2013, <http://www.deq.state.or.us/wq/pubs/imds/wqtrading.pdf>.

Case 8: Clean Water Services

Name of facility: The permit combines four individual permits but only two facilities discharge during the summer months, and thus utilized WQT: Durham Advanced Wastewater Treatment Facility, located at 16580 SW 85th, Tigard, Oregon 97224; and Rock Creek Advanced Wastewater Treatment Facility, located at 3235 SW River Road, Hillsboro, Oregon 97123.

State: Oregon

Permit number and time period: 101141, 101142, 101143, 101144 and MS4; permit issue date July 7, 2005; expiration January 31, 2009. Clean Water Services is currently negotiating its permit renewal and trading will likely be included in the renewed permit [33].

Was trading used to comply with permit: Yes

Pollutants: CBOD₅, ammonia, temperature

Amount traded: The shade credit goal was 35 miles of restoration planting for the five year permit (2005 Temperature Management Plan) [34]. Trades were conducted during the five-year permit period and reported on an annual basis. The 2009 annual report indicated that cumulatively between 2004 and 2009, “the District’s riparian planting projects generated 295 million kilocalories per day of shade credits... using a combination of flow augmentation and riparian planting projects” [35]. Clean Water Services did not use PS/PS trading for oxygen demanding substances during the permit period [36]. EPRI could not find annual reports for years 2006 or 2007 online.

PS/PS or PS/NPS: PS/PS and PS/NPS

Buyer and seller: Clean Water Services was the buyer, sellers are individual landowners; PS/PS trading for CBOD₅ and ammonia allowed between two Clean Water Services facilities: Durham and Rock Creek [37]

BMPs: Riparian planting for shading, and flow augmentation – “the release of stored water from Scoggins and Barney Reservoirs into the Tualatin River during the summer months” [34]

Narrative summary: This was the first permit in Oregon to incorporate WQT, and the first permit in the country to conduct temperature trading. Clean Water Service mentioned that trading “will eliminate the need for more burdensome alternatives, such as the installation of refrigeration equipment at wastewater treatment facilities, or piping treatment facility effluent to another river basin” [34].

What is in the permit: The permit contains a three-page section specifically on WQT and makes reference to WQT in other sections of the permit [37].

“Section 7. Water Quality Trading Plans” authorizes the permittee to develop and implement WQT plans to comply with waste discharge limitations for TMDL limits for oxygen demanding parameters and temperature. Thermal NPS trading is authorized, subject to Clean Water Services revising their Temperature Management Plan (TMP) and a Thermal Load Credit Trading Plan. While a draft Temperature Management Plan was developed in 2003, EPA and CWS were still negotiating WQT during permitting (per 2005 TMP). The Temperature Management Plan was completed after the permit was issued [33].

“Schedule C Compliance Conditions and Schedules” of the permit reviews thirteen elements that OR DEQ required for the final Temperature Management Plan, including “an explanation of how an increase in stream shade that will result from riparian re-vegetation will offset thermal load discharges from the permittee’s facilities;” a planting plan, a monitoring plan, plant selection criteria, etc [37]. OR DEQ also required a Thermal Load Credit Trading Plan (which was later rolled into the Temperature Management Plan) describing the mechanisms of WQT, including the thermal load to be offset, “a discussion of how the permittee will create, purchase, or otherwise arrange for thermal credits,” the methodology for calculating thermal credits, etc [37].

The permit requires an annual report of credit trading, and a report of PS/PS trading in the permittee’s monthly discharge monitoring report.

In Schedule A, the permit allows point to point source trading for “oxygen demanding parameters (CBOD₅ and ammonia) between the Durham and Rock Creek Advanced Wastewater Treatment Facilities” [37].

Additional information: Clean Water Service’s 2005 Temperature Management Plan “...contains a summary of the applicable water quality criteria, TMDL allocations, a list of methods for reducing stream temperatures that were considered but not selected, and a list of such methods that were selected... flow augmentation and the creation of stream shade” [34]. Clean Water Services estimated “that about 35 miles of stream restoration will be required” to create the required amount of shade via riparian restoration (called the Shade Credit Goal) [34]. The Temperature Management Plan does not mention a specific

total thermal load reduction, but mentions that Shade Credit projects will be converted from a square foot basis to a kilocalorie reduction to determine credit. There is a “2:1 trading ratio... [which] ensures that within 20 years, the solar radiation that is offset will exceed CWS’ excess thermal load” [34].

Regarding the time period in which thermal loads were based: “Excess thermal load (i.e. thermal load to offset) is based on average daily temperature and flow conditions from July 1 through August 31” [37, 38].

Annual reports describe the activities implemented to date [35, 39, 40]. EPRI could not find annual reports for 2006 or 2007 online. Generation of credits is noted in ‘Amount Traded’ section above.

Oregon DEQ has an Internal Directive (2012) on “Water Quality Trading in NPDES” that “define[s] concepts, explain[s] eligibility, and describe[s] specific trading scenarios that DEQ anticipates and generally supports” WQT but, “[t]he recommendations contained in this internal management directive should not be construed as requirements of rule or statute” [32].

Authorization: “The permittee is authorized to develop and implement water quality credit trading plans... This authority for the trading plan is derived from: ORS 468B.030, 468B.035 and 468B.048; Section 402 of the Federal Clean Water Act 33 U.S.C. § 1342; and the U.S. Environmental Protection Agency’s policies on Water Quality Trading (1/13/03) and Watershed-Based NPDES Permitting (1/7/03) endorse water quality credit trading. Additionally the TMDL authorizes water quality trading as a means of achieving the allocations established by the TMDL” [37].

References:

32. *Water Quality Trading in NPDES Permits Internal Management Directive*. Oregon DEQ; 2012. Accessed September 2013, <http://www.deq.state.or.us/wq/pubs/imds/wqtrading.pdf>.
33. B. Cochran, 2013. Personal communication, October 10, 2013.
34. *Clean Water Services Revised Clean Water Services Temperature Management Plan*. Oregon DEQ; February 2005. Accessed September 2013, <http://www.deq.state.or.us/wq/wqpermit/docs/individual/npdes/ph1ms4/cws/tmp/plan.pdf>.
35. “Temperature Management Plan Activities & Credit Trading Activities: 2009 Annual Report,” Clean Water Services: February 2010. Accessed September 2013, <http://www.cleanwaterservices.org/content/Documents/Projects%20and%20Plans/Temperature%20Management%20Plan%20Annual%20Report%2009.pdf>.
36. R. Kapur, 2013. Personal communication, October 15, 2013.

37. Clean Water Services NPDES combined permit for 101141, 101142, 101143, 101144. Oregon DEQ: 2005. Accessed September 2013, <http://www.deq.state.or.us/wq/wqpermit/docs/individual/npdes/ph1ms4/cws/permit.pdf>.
38. *Tualatin Subbasin Total Maximum Daily Load (TMDL)*. Oregon DEQ: 2001. Accessed September 2013, http://www.epa.gov/waters/tmdldocs/Tualatin_TMDL.pdf.
39. “Temperature Management Plan Credit Trading Activities” [2005 Annual Report], Clean Water Services: 2005. Accessed September 2013, <http://www.cleanwaterservices.org/content/documents/Projects%20and%20Plans/Temperature%20Mgt%20Plan%20Annual%20Report%202005-06.pdf>.
40. “Temperature Management Plan & Credit Trading Activities: 2008 Annual Report,” Clean Water Services: March 2009. Accessed September 2013, <http://www.cleanwaterservices.org/content/Documents/Projects%20and%20Plans/Temperature%20Management%20Plan%20Annual%20Report%202008.pdf>.

Case 9: Lakeland Sanitary District #1

Name of facility: NEQNWQ SEC 4 T36N R13W, located on County Line Road, Barronett, Wisconsin

State: Wisconsin

Permit number and time period: WPDES Permit No. WI-0061387-09-0; permit effective July 1, 2013; expiration June 30, 2018

Was trading used to comply with permit: No. Trading is authorized in permit, but water quality-based effluent limits (WQBELs) that may drive trading will not be in force until 2019.

Pollutant: TP

Amount traded: NA

PS/PS or PS/NPS: Unspecified

Buyer and seller: Lakeland Sanitary District #1 would be the buyer. The permit does not specify whether trading is anticipated to be PS/PS or PS/NPS.

BMPs: Wisconsin’s WQT How-To Guidance includes “Table 16. Management practices with preapproved credit generation and use information” with the following BMPs [41, see detailed info starting on page 57]:

Agricultural Practices

- Whole Field Management
- Companion Crops
- Conservation Easement
- Nutrient Management and support practices
- Production area practices
- Streambank Stabilization and Shoreline Protection
- Streambank Stabilization and Shoreline Protection accompanied by aquatic habitat restoration
- Dredging and removal of in-situ sediment and nutrients
- Dredging or treatment of in-situ sediment and nutrients accompanied by aquatic habitat restoration
- Wetland Restoration
- Sediment Control Basin

Urban Practices

- Bioretention for Infiltration
- Infiltration Basin
- Infiltration Trench
- Proprietary Storm Water Sedimentation
- Devices
- Vegetated Infiltration Swales
- Wet Detention Pond

Narrative summary: Wisconsin state water-quality based effluent limits (WQBELs) for TP will come into force in 2019 [42]. Lakeland Sanitary District #1's permit allows the use of WQT to comply with WQBELs [42]. The language in the permit requires the facility to decide by July 2016 whether they want to use WQT as an alternative to facility upgrades [42]. EPRI could find no information to verify whether the permittee was planning on using WQT during the permit period.

What is in the permit: The permit contains approximately two paragraphs relating to WQT. Additionally, the language referring to WQT in the permit is not specific to the permit facility, but rather written broadly for all facilities that will be affected by WQBELs.

Under "2 Surface Water Requirements" there is a two-paragraph subsection "2.2.1.3 Alternative Approaches to Phosphorus WQBEL Compliance. Rather than upgrading its wastewater treatment facility to comply with WQBELs for total phosphorus, the permittee may use Water Quality Trading or the

Watershed Adaptive Management Option, to achieve compliance under ch. NR 217, Wis. Adm. Code, provided that the permit is [modified to say the facility is going to do that]” [42].

Section 4 of the permit describes the WQBEL, a schedule of required actions, and options to meet the WQBEL, one of which is WQT. If a wastewater treatment plant (WWTP) wants to use WQT, it must notify the Wisconsin Department of Natural Resources (WI DNR) by July 1, 2016 and get its permit modified. Facilities that choose to use WQT must also submit a “Final Compliance Alternatives Plan” to WI DNR by July 1, 2018 which includes identifying potential trading partners. If a facility does not choose WQT or “the Watershed Adaptive Management Option,” it has to start constructing upgrades by late 2019 [42].

Additional information: Wisconsin Department of Natural Resources (WI DNR) has “Guidance for Implementing Water Quality Trading in WPDES Permits” (2013 Wisconsin Guidance) and also a draft “WQT How-To Manual” [43, 41]. The 2013 Wisconsin Guidance sets minimum trade ratios for PS/NPS at 1.2:1, and a minimum trade ratio for PS/PS at no less than 1.1:1, “as required by s. 283.89 (1m)(a), Wis. Stats.” [43].

Authorization: The permit notes that “the permittee may use Water Quality Trading or the Watershed Adaptive Management Option, to achieve compliance under ch. NR 217, Wis. Adm. Code” [42].

The 2013 Wisconsin Guidance notes the following: “Pursuant to s. 283.84, Wis. Stats. [Trading of water pollution credits], water quality trading may occur between two or more point sources and between point sources and nonpoint sources... Water quality trading may also occur between a point source and a credit exchange or broker pursuant to s. 283.84 (1)(c), Wis. Stats.” [43]. The guidance also notes: “NR 217.13 (8), Wis. Adm. Code, identifies trading as one of three options that must be met before a new discharger may discharge TP to phosphorus-impaired surface waters” [43].

References:

41. *[Wisconsin Draft] Water Quality Trading How-To Manual*. Wisconsin DNR: March 2013. Accessed August 2013, <http://dnr.wi.gov/news/input/documents/guidance/WQTHowToGuidance.pdf>.
42. Lakeland Sanitary District #1 WPDES Permit No. WI-0061387-09-0. Wisconsin DNR: 2013.
43. *[Wisconsin] Guidance for Implementing Water Quality Trading in WPDES Permits*. Wisconsin DNR: August 2013. Accessed August 2013, <http://dnr.wi.gov/topic/SurfaceWater/waterqualitytrading.html>.

Case 10: Minnesota Pollution Control Agency

Name of facility: There were 40 facilities on the original 2005 permit and seven were added in 2009 (see Appendix B of the 2009 permit modification) [44]

State: Minnesota

Permit number and time period: Minnesota River Basin General Phosphorus Permit Phase I MNG420000; permit issue date December 1, 2005 (modification date December 1, 2009); expiration November 30, 2010

Was trading used to comply with permit: Yes

Pollutant: P

Amount traded: Unknown

PS/PS or PS/NPS: PS/PS

Buyer and seller: Wastewater treatment plant (WWTP) permittees within this general permit could be both buyers and sellers. Trade associations could also be buyers or sellers.

BMPs: N/A

Narrative summary: The Minnesota River Basin General Phosphorus Permit Phase I “establishes a [PS/PS] phosphorus trading program for Permittees in the Minnesota River Basin” for compliance with the Lower Minnesota River Dissolved Oxygen TMDL which requires P reductions [44]. The permit covers multiple facilities: Appendix B of the permit lists 47 WWTP permittees as of 2009 [44]. The TMDL sets a P loading baseline at 2006-2007 levels and requires P reductions that increase each year for existing facilities, while new or expanded facilities are required to offset discharge completely through PS/PS trading [44]. Minnesota Pollution Control Agency noted that the program aided point sources in meeting the TMDL waste load allocation three years ahead of the expected timeframe [45].

What is in the permit: The permit references WQT throughout the permit, and contains about five pages relating specifically to trading. Specifically, “Chapter 7. Trading Conditions” (1.5 pages) details trading requirements and trade associations. WWTPs apply to the Minnesota Pollution Control Agency to become permittees under this general permit. The permit allows the formation of trade associations and PS/PS trading within or between associations. The permit requires that permittees use specific contracts for trades. The permit contains the following language about property rights: “This Permit does not convey a property right or an exclusive privilege. Minn. R. 7001.0150, Subp. 3C (2005). The authorization to discharge up to a permitted level is nontransferable” [44].

Appendix B lists the 47 WWTPs covered under the Minnesota River Basin General Phosphorus Permit Phase I, their individual NPDES permit numbers, a

trading baseline set in 2006 and 2007, and effluent limits for 2008, 2009, 2010, and 2015. “Limits are based on aggregate phosphorus reduction milestones of 15% (2008), 25% (2009) and 35% (2010) from the baseline mass” [44]. The discharge limit is in effect during summer months (“5-Month Mass Phosphorus Limit” is from May 1 – September 30).

Appendix H (1.5 page) provides definitions and details of terms referenced in Chapter 7. Included in these definitions is the term ‘Jordan Trading Unit’ (JTU), a standardized trading unit between buyers and sellers that includes ‘JBOD Factor,’ a Jordan Biochemical Oxygen Demand that takes into account location in the watershed to ensure that “a JTU discharges by one facility has the same impact at Jordan, Minnesota, as a JTU discharges by another facility” [44].

Appendix I (1 page) has permit equations, including for adjusted P limits, and JTU calculations that include trade ratios of 1.1 to 1 for existing WWTPs and 1.2 to 1 for new or expanded facilities.

Additional information: Individual facilities report on trading activity in monthly discharge monitoring reports, but the information is not summarized across all permittees covered by the general permit [45].

Authorization: “This Permit is issued under the authority of Minn. Stat. Chs. 115 and 116 and Minn. R. Chs. 7001 and 7050 and Section 401 of the Clean Water Act, Title 33 Part 1341” [44].

References:

- 44. Minnesota River Basin General Phosphorus Permit Phase I NPDES general permit MNG420000. Minnesota Pollution Control Agency: 2009. Accessed September 2013, <http://www.pca.state.mn.us/index.php/view-document.html?gid=5997>.
- 45. L. McCormick, 2013. Personal communication, October 22, 2013.

Case 11: Neuse River Compliance Association

Name of facility: 22 co-permittees in the Neuse River Compliance Association [46]

State: North Carolina

Permit number and time period: Permit No. NCC000001 for the Neuse River Compliance Association (NRCA); permit effective January 1, 2004; expiration December 31, 2007

Was trading used to comply with permit: Yes

Pollutant: TN

Amount traded: >119,953 lbs (54,410 kg) TN sold or leased cumulatively between 2004 and 2011 [20]

PS/PS or PS/NPS: PS/PS and PS/NPS

Buyer and seller: Buyers are co-permittees (point sources) in the Neuse River Compliance Association (NRCA); sellers can be facilities within the NRCA, point sources outside the NRCA, or if the NRCA exceeds its collective TN allocation it can pay \$11/lb TN to North Carolina Division of Water Quality's Wetland Restoration Program [47]

BMPs: None specified

Narrative summary: The Neuse River Compliance Association (NRCA), with its 22 point source co-permittees, “is issued a single, collective NPDES permit for nitrogen based on the sum of the members’ individual nitrogen allocations” under a TMDL for the Neuse Estuary [5]. The NRCA can reapportion loads within its members or members can purchase/sell/trade/lease allocation from another member or non-member dischargers which is akin to PS/PS WQT [47]. As of 2012, the load allocation for the NRCA was approximately 1.2 million lbs (544,311 kg) TN or 75% of the total point source load under the TMDL [48].

What is in the permit: The permit does not mention “water quality trading,” but instead contains about four paragraphs on the total allocation for the NRCA and provides the following flexibility in meeting a waste load allocation: “(ii.) For the purposes of this Permit, allowable changes in TN Allocations include... purchase, sale, trade, or lease of allocation among the Association, its members, and non-member dischargers... (iii.) The Association may reapportion its TN Allocation among its Co-Permittee Members” [47]. The permit also discusses offset payments: “In the event that the Association exceeds its Estuary TN Allocation in a given calendar year, the Association shall make offset payments for the excess TN for that year at a rate of \$11 per pound (15A NCAC 2B .0240)” [47]. A 2008 EPA report noted that the payments funded nonpoint source offsets [5].

The permit requires NRCA to keep track of each member’s discharge reports, provide an annual summary of all purchases, sales, and leases. Appendix A of the permit lists all co-permittee members of the NRCA, transport factors and the load allocations for each.

Additional information: The Association held 1.18 million lbs (535,239 kg) of allocation as of 2011, and used around half of its allocation of TN [46]. As of March 25, 2012; the Association had 24 sales or leases [20].

Authorization: In addition to federal authorization from US EPA, the following is noted in “Neuse River Basin – Nutrient Sensitive Waters Management Strategy: Wastewater Discharge Requirements” (15A NCAC 02B .0234 (9)(a)):

“Any or all facilities within the basin may form a group compliance association to meet nitrogen estuary allocations collectively. Any such association must apply for and shall be subject to an NPDES permit that establishes the effective total nitrogen allocations for the association and for its members” [49].

References:

5. U.S. EPA. *Water Quality Trading Policy Evaluation: Final Report*. Washington, DC. October 2008. Accessed September 2013, <http://www.epa.gov/evaluate/pdf/water/epa-water-quality-trading-evaluation.pdf>.
20. “NRCA Nitrogen Sales and Leases: 3/25/2012,” Neuse River Compliance Association: 2012. Accessed September 2013, <http://lnba.net/sites/default/files/NRCA%20Nitrogen%20Trades%202011.pdf>.
46. “Neuse River Compliance Association: Total Nitrogen Monitoring Report for 2011,” Neuse River Compliance Association: 2011. Accessed September 2013, <http://lnba.net/sites/default/files/2011%20NRCA%20Annual%20Report%20-%20Data%20File.pdf>.
47. Neuse River Compliance Association permit NCC000001. North Carolina DEQ: 2004.
48. Lower Neuse Basin Association[®] and Neuse River Compliance Association[®], “Point Source Perspective Progress of Neuse Nutrient Management Strategy.” Online presentation, January 12, 2012, EMC Meeting. Accessed September 2013, http://portal.ncdenr.org/c/document_library/get_file?uuid=515d4ab5-c996-4b0d-952c-9abc9fc98edc&groupId=61581.
49. *Neuse River Basin – Nutrient Sensitive Waters Management Strategy: Wastewater Discharge Requirements [aka Neuse Rules] (15A NCAC 02B .0234 (9)(a))*. North Carolina DENR: 1997. Accessed September 2013, <http://reports.oah.state.nc.us/ncac/title%2015a%20-%20environment%20and%20natural%20resources/chapter%2002%20-%20environmental%20management/subchapter%20b/15a%20ncac%2002b%20.0234.pdf>.

Case 12: Rahr Malting Company

Name of facility: Rahr Malting Company, located at 800 W 1st Avenue, T115N, R23W, Section 1, Shakopee, Scott County, Minnesota

State: Minnesota

Permit number and time period: MN0031917; permit issue date around July 2012; expiration around July 2017. Time period is an estimate because the permit available online is in draft form, and dates were estimated from a 2012 public notice of permit renewal [50, 51].

Was trading used to comply with permit: Yes

Pollutant: CBOD₅ with equivalency ratios between CBOD₅, phosphorus, nitrogen, or sediment loads [52]

Amount traded: “The Permittee has obtained 212.8 nonpoint source load reduction units during the terms of the previous permits... One unit of trading credit is the equivalent of one pound per day of CBOD₅ discharged” [50]. The date of “previous permits” is unspecified, but the first permit for Rahr that mentions trading is a 1997-2002 permit [53].

PS/PS or PS/NPS: PS/NPS

Buyer and seller: Rahr Malting Company was the buyer, sellers were landowners

BMPs: “Projects subject to (1) land purchase or (2) easement(s) or other contractual obligation(s) in place for the duration of CBOD₅ discharge. Projects shall be Soil Erosion BMPs, Livestock Exclusion, Rotational Grazing With Livestock Exclusion, Critical Area Set Aside or Wetland Treatment Systems” [50]. A 2013 summary of Rahr WQT Project noted that “Offsetting activities have included acquiring and replanting flood-prone agricultural lands and streambank stabilization projects on private land” [52].

Narrative summary: The 2012 permit does not allow new trading for the facility, but it requires maintenance of existing trades through “replacement trades.” The permit also allows generation of credits for sale to other entities, or generation of credits for potential future use [51].

“Rahr Malting Company was issued a NPDES permit incorporating trading in 1997. The permit imposed concentration-based effluent limits as well as nonpoint source trading requirements to offset [new] pollutant loading. In five years, Rahr achieved the needed nonpoint source loading reductions through four nonpoint source offsets... The Minnesota Pollution Control Agency established equivalency ratios between five-day carbonaceous oxygen demand (CBOD₅), phosphorus, nitrogen, or sediment loads, giving Rahr Malting further flexibility in meeting regulatory requirements. For example, the company ultimately met its CBOD₅ reductions via phosphorus offsets” [52].

What is in the permit: The permit contains approximately three pages on WQT, with one of those pages referring to details of trading that occurred in previous permits, and the remainder on “Replacement Trade Requirements for Existing Trades” [50].

Regarding replacement trades, the permit states: “The permittee currently has 212.8 nonpoint source load reduction units. This permit does not authorize the permittee to obtain additional nonpoint source load reduction units above 212.8 pounds CBOD₅ per day. The following section applies to replacement trades that may be necessary should one of the previous trades no longer exist, or are no longer available. No additional nonpoint source load reduction units shall be credited to the permittee should future trades, required for replacement purposes, exceed the current 212.8 nonpoint source load reduction units” [50].

The permit requires maintenance of existing credits for the life of the point source discharge: “It is the intent of this permit that the Permittee shall achieve and maintain MPCA-approved trade reduction active credits for the life of the wastewater treatment plant discharge to surface waters” [50].

The permit does allow generation of credits “in excess of those required by this permit” for transfer to other permittees. As well, the permit allows partial use (45% of credits generated) “in the event that additional trades are required in the future” [50].

The permit specifically does not allow credit stacking: “Trade credits shall not be proposed or approved for sites which simultaneously track benefits for other environmental programs, including but not limited to wetland mitigation under the Wetland Conservation Act,” and further, “The Permittee shall not receive credits for those portions of a project financed by public funding sources” [50].

Additional information: A narrative case study of the Rahr Malting company and Southern Minnesota Beet Sugar Cooperatives’ water quality trading programs (see Case Study 13) can be found in a 2011 case study published by EcoAgriculture Partners [54].

Authorization: There is no specific reference to legal or policy authority in the permit, but permit language notes: “The Permittee shall comply with the cumulative CBOD₅ nonpoint load reduction specified in the table below [which stipulates a nonpoint load reduction requirement for each year in the five-year permit] or obtain CBOD₅ nonpoint load reduction equal to or greater than its actual CBOD₅ discharge” [50].

References:

50. Rahr Malting Company NPDES permit MN003191. Minnesota Pollution Control Agency: 2012. Accessed August 2013, http://www.pca.state.mn.us/index.php?option=com_k2&id=715_1248a1315a91e0ead67f851640883724&task=download&view=item.
51. “Public Notice of Intent to Reissue National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) Permit MN0031917,” Minnesota Pollution Control Agency: 2012. Accessed August 2013, http://www.pca.state.mn.us/index.php?option=com_k2&id=714_62f9136ed1ebf7c46715d84c855c5d0f&task=download&view=item.

52. “Rahr Malting Co” [summary], Forest Trends’ Watershed Connect: 2013. Accessed August 2013, http://www.watershedconnect.com/projects/rahr_malting_co#sthash.h9fYR0Se.dpuf.
53. Rahr Malting Company NPDES permit MN003191. Minnesota Pollution Control Agency: 1997. Accessed August 2013, <http://archive.nacwa.org/getfile2071-2.pdf?fn=Minnesota%20Trading%20Permit.pdf>.
54. A. Birr, 2011. “Farm of the Future: The Watson Partners and the Southern Minnesota Sugar Beet Cooperative,” EcoagriculturePartners. Accessed October 2013, http://www.ecoagriculture.org/documents/files/doc_349.pdf.

Case 13: Southern Minnesota Beet Sugar Cooperative

Name of facility: Southern Minnesota Beet Sugar Cooperative Processing Plant, Renville, Minnesota

State: Minnesota

Permit number and time period: MN0040665; permit issue date April 7, 1999; expiration March 31, 2004

Was trading used to comply with permit: Yes

Pollutant: P

Amount traded: The permit requires that the permittee cumulatively generate over 10,400 lbs (4,717 kg) P reduction credits by the end of 2003, and to maintain those credits for the life of the point source discharge (1999 permit). A 2011 case study notes that “In 2009, [Southern Minnesota Beet Sugar Cooperative] achieved 10,633 phosphorus trade reduction credits... acquired through two trades” [54]. A 2012 article noted that the cooperative had reduced 18,000 pounds of P from cover crop installation [55].

PS/PS or PS/NPS: PS/NPS

Buyer and seller: Southern Minnesota Beet Sugar Cooperative was the buyer, and the sellers were beet sugar growers in the cooperative

BMPs: The 1999 permit notes that “Projects shall be Soil Erosion Best Management Practices (BMPs), Cattle Exclusion, Rotational Grazing With Cattle Exclusion, Critical Area Set Aside, Constructed Wetland Treatment Systems, Alternative Surface Tile Inlets, or Cover Cropping” [56]. A 2011 case study notes “These credits were acquired through two trades: cover crops accounted for 86 percent of the total credits and stream bank stabilization accounted for 14 percent” [54].

Narrative summary: The Southern Minnesota Beet Sugar Cooperative (SMBSC) could not build a new WWTP on the phosphorous-impaired lower Minnesota River unless it “offset all discharges with nonpoint source phosphorus reductions” [5]. The permit requires the P credits to be maintained for the life of the point source discharge [56].

What is in the permit: The permit contains approximately five pages relating to water quality trading, under Chapter 12 (“Total Facility Requirements”), section 20 “Special Requirements” [56]. There is an appendix “Phosphorus Trade Crediting Calculations” that was not included in the permit document EPRI obtained. A trade ratio is mentioned: 2.6 credits are needed per pound of P discharged [56, sections 20.4 and 20.5].

The permit specifies the credits required per year:

- 1999: 2,600 lbs (1,179 kg) P
- 2000: 5,200 lbs (2,359 kg) P
- 2001: 7,800 lbs (3,538 kg) P
- 2002: 7,800-10,400 lbs (3,538-4,717 kg) P
- 2003: 10,400 lbs (4,717 kg) up to 2.6 * mean lbs P discharged, with no maximum stipulated [56, page 79]

The permit requires maintenance of existing credits for the life of the point source discharge: “It is the intent of this permit that the Permittee shall achieve and maintain MPCA-approved trade reduction active credits for the life of discharge SD005” [56]. This language mirrors that of the Rahr Malting company permit (Case 12).

The permit specifically does not allow credit stacking: “Trade credits shall not be proposed or approved for sites which simultaneously track benefits for other environmental programs, including but not limited to wetland mitigation under the Wetland Conservation Act” [56]. Although the Rahr permit (Case 12) prohibits credits from “portions of a project financed by public funding sources,” this permit states that “For projects that involve landowner cost-sharing with public financing, the total financing by the Permittee plus public sources shall not exceed 75 percent of the total project costs” [56]. The permit is silent on generating and transferring excess credits, unlike the Rahr permit.

The permit requires establishment of a “Phosphorus Trading Trust Fund of at least \$300,000 before proposing sites to the MPCA for phosphorus trade credits under this permit” [56].

Additional information: A narrative case study of the Southern Minnesota Beet Sugar Cooperatives’ water quality trading programs can be found in a 2011 case study published by EcoAgriculture Partners [54]. The case study notes that “Every year SMBSC generates phosphorus trade reduction credits almost two-fold greater than what is required in its permit. Meanwhile, every year SMBSC receives calls from municipal WWTFs and other point sources throughout the

region seeking to purchase credits; there is clearly a market for phosphorus and other nutrients within the region and state” [54].

A 2012 article noted that “The cooperative reported success in its cover crop program that reduces phosphorus run off to the Minnesota River. Last year, participation increased to 80 percent representing 105,351 acres. The cover crop kept 18,000 pounds of phosphorus from the river, said [Louis Knieper, environmental director for the Cooperative]” [55].

Authorization: There is no reference to legal or policy authority in the permit, but the permit language notes that: “The Permittee shall achieve and maintain MPCA-approved phosphorus trade reduction active credits” [56].

References:

5. U.S. EPA. *Water Quality Trading Policy Evaluation: Final Report*. Washington, DC. October 2008. Accessed September 2013, <http://www.epa.gov/evaluate/pdf/water/epa-water-quality-trading-evaluation.pdf>.
54. A. Birr, 2011. “Farm of the Future: The Watson Partners and the Southern Minnesota Sugar Beet Cooperative,” EcoagriculturePartners. Accessed October 2013, http://www.ecoagriculture.org/documents/files/doc_349.pdf.
55. T. Cherveney, “Sugar beet co-op in Renville, Minn., talks of progress with water standards,” *AgWeek*, May 16, 2012, accessed October 2013, http://www.agweek.com/event/article/id/93597/publisher_ID/22/#sthash.c8M3Mi5p.dpuf.
56. Southern Minnesota Beet Sugar Cooperative NPDES permit MN0040665. Minnesota Pollution Control Agency: 1999.

Case 14: State of Connecticut

Name of facility: 79 facilities (see Appendix 1 of the 2011 permit) [57]

State: Connecticut

Permit number and time period: State of Connecticut General Permit for Nitrogen Dischargers; permit issue date January 1, 2011; expiration December 31, 2015

Was trading used to comply with permit: Yes

Pollutant: N

Amount traded: “In 2011, fifty-two facilities were required to purchase credits in order to remain in compliance with the Nitrogen General Permit (Attachment

D). Municipalities purchased 811,610 equalized credits at a total cost of \$4,398,929 and the value of those sold was \$2,435,958 from the sale of 449,438 equalized nitrogen credits” [58]. Trading began in 2002 [59].

PS/PS or PS/NPS: PS/PS

Buyer and seller: The State of Connecticut’s Nitrogen Credit Exchange is the buyer of excess nitrogen credits from facilities who discharge less than their annual limit (sellers). As well, facilities that exceed their limit must buy credits from the State to remain in compliance with their permit

BMPs: NA

Narrative summary: This is a permit that covers 79 facilities and coordinates PS/PS WQT of TN through a centralized, state-run Nitrogen Credit Exchange Program. If a facility exceeds its permit limit, it buys credits from the Nitrogen Credit Exchange Program. Likewise, if a facility comes under its permit limit, it sells the excess credits to the Nitrogen Credit Exchange Program. The Connecticut Department of Energy and Environmental Protection developed the nitrogen trading program to address a 2001 TMDL for the Long Island Sound [60]. “The initial Nitrogen General Permit was issued in 2002 and marked the first year of nitrogen trading. As of 2009 after 8 years of trading, wastewater treatment plants in Connecticut have already attained 84% of the final 2014 nitrogen reduction goal. The [2011] General Permit sets the final goal of 100% attainment by 2014, with "step down" limits set for 2011, 2012 and 2013” [59].

What is in the permit: The permit contains one paragraph referring to nitrogen credits, noting that a permittee will be in compliance with annual discharge limits if it either is below its discharge limits, or if: “(b) the permittee has secured state-owned equivalent nitrogen credits equal to the amount the POTW exceeded the annual discharge limit set forth in Appendix 1 in accordance with the Nitrogen Credit Exchange Program and Sections 22a-521 through 527 of the Connecticut General Statutes” (Section 4 “Conditions of this General Permit”, section (b) Compliance During Term of Permit) [57].

Additional information: “An Act Concerning Nitrogen Reduction in Long Island Sound,” was passed by the Connecticut General Assembly in 2001 [61, 62]. The seven-page act authorized issuance of a Nitrogen General Permit, established a Nitrogen Credit Exchange overseen by a Nitrogen Credit Advisory Board, and provides other details of the trading program [62].

The DEEP index website on the Nitrogen Control Program for Long Island Sound contains annual reports of the Nitrogen Credit Exchange published from 2003-2012 [60].

The Connecticut Department of Energy and Environmental Protection (DEEP) wrote up a narrative case study of the program in 2010 [59].

Authorization: The permit states that: “This general permit is issued under the authority of Sections 22a-521 through 527 and Chapter 446k of the Connecticut General Statutes” [57].

“An Act Concerning Nitrogen Reduction in Long Island Sound,” Public Act No. 01-180 was codified in the Connecticut General Statutes in Sections 22a-521 through 527 in 2001 [62]. The act notes:

“Sec. 2. . . .the Commissioner of Environmental Protection shall issue a general permit specifying effluent limits for nitrogen in accordance with the total maximum daily load... Publicly-owned treatment works may participate in the nitrogen credit exchange program in order to comply with effluent limits for nitrogen specified in the general permit” [62].

References:

57. Connecticut General Permit for Nitrogen Dischargers. Connecticut DEEP: 2011. Accessed September 2013, http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/2011_2015_nitrogen_gp.pdf.
58. “Report of the Nitrogen Credit Advisory Board for Calendar Year 2011 to the Joint Standing Environment Committee of the General Assembly,” Connecticut Department of Energy and Environmental Protection: September 2012. Accessed September 2013, http://www.ct.gov/deep/lib/deep/water/municipal_wastewater/nitrogen_report_2011.pdf.
59. “DEP Initiates Process to Reissue General Permit for Nitrogen Discharges in Wastewater from Treatment Plants,” Connecticut Department of Energy and Environmental Protection: June 2010. Accessed September 2013, <http://www.ct.gov/deep/cwp/view.asp?A=3847&Q=462550>.
60. “Nitrogen Control Program for Long Island Sound” webpage, Connecticut Department of Energy and Environmental Protection, accessed September, 2013, http://www.ct.gov/deep/cwp/view.asp?a=2719&q=325572&deepNav_GID=1635%20.
61. “Connecticut’s Nitrogen Credit Exchange – An Incentive-based Water Quality Trading Program,” Connecticut Department of Energy and Environmental Protection: June 2010. Accessed September 2013, http://www.ct.gov/deep/lib/deep/water/lis_water_quality/nitrogen_control_program/water_quality_trading_summary_2010.pdf.
62. *Public Act 01-180 - An Act Concerning Nitrogen Reduction in Long Island Sound*. State of Connecticut: 2001. Accessed September 2013, <http://www.cga.ct.gov/2001/act/Pa/2001PA-00180-R00SB-01012-PA.htm>.

Case 15: State of Virginia

Name of facility: 211 NPDES facilities are covered by the general permit and are eligible to trade [63]. In 2012, 26 facilities traded to meet their waste load allocation [64].

State: Virginia

Permit number and time period: State of Virginia General Permit for Nutrient Discharges to the Chesapeake Bay, VAN000000; permit effective January 1, 2012; expiration December 31, 2016 [65]

Was trading used to comply with permit: Yes

Pollutant: TN and TP

Amount traded: 288,613 lbs (130,913 kg) TN and 37,806 lbs (17,149 kg) TP in 2012 [64]

PS/PS or PS/NPS: PS/PS and PS/NPS

Buyer and seller: Buyers and sellers can be facilities (point sources) covered by the general permit. The Virginia Nutrient Credit Exchange Association can facilitate trades within their Association as well as act as a buyer and seller. Farmers, landowners and a registered nutrient bank are listed as nonpoint sellers. Finally, the state allows payment into a Water Quality Improvement Fund if credits are unavailable in a tributary [63, 64]. A 2012 Nutrient Trading Report shows credit transfers from the Nutrient Credit Exchange Association and individual point source permittees [63]. A 2013 Nonpoint Source Nutrient Credit Registry shows NPS credit sales, but not the buyer of those credits nor whether they were used for NPDES compliance or for storm water permit compliance [64].

BMPs: There is only brief mention in the permit of “land use conversions and urban source reduction controls (BMPs)” in the context of offsetting new discharges (Part II. A, general permit) [65]. A Virginia Department of Environmental Quality report, “Trading Nutrient Reductions from Nonpoint Source Best Management Practices in the Chesapeake Bay Watershed: Guidance for Agricultural Landowners and Your Potential Trading Partners,” includes an Appendix A with the following BMPs: early planted cover crops, 15% nitrogen reduction on corn, continuous no-till, and land conversion (cropland to forest, cropland to hay, cropland to mixed open, hay to forest, hay to mixed open, pasture to forest) [66].

Narrative summary: This general permit was developed to meet the Chesapeake Bay TMDL for Nitrogen, Phosphorus and Sediment (December 2010) which established waste load allocations for dischargers. The general permit requires that all facilities under the permit meet effluent limitations, sets out monitoring requirements, and allows trading of TN and TP between facilities. New or expanding facilities have to offset all new nutrient loads [67]. PS/NPS trading is

only allowed for offsetting new discharges. Existing point sources (permitted before July 2005) can only trade PS/PS [65].

What is in the permit: The general permit contains about four pages relating to water quality trading. “Part I. J. Compliance with waste load allocations” provides additional details on WQT for existing facilities [65]. The section notes the Water Quality Improvement Fund (WQIF) prices of credits: “\$6.04 for each pound of nitrogen and \$15.08 for each pound of phosphorus” [65]. The WQIF can only be used if “the [existing PS] permittee certifies on a form supplied by the department that it has diligently sought, but has been unable to acquire, sufficient credits to satisfy his compliance obligations through the acquisition of point source nitrogen or phosphorus credits with other permitted facilities” [65].

“Part II. A. Offsetting mass loads discharged by new and expanded facilities” states new discharges have to be completely offset by purchasing credits from a point source, nonpoint source credits which are “certified by the [State Water Control] board ... or certified by the Soil and Water Conservation Board [now the Department of Environmental Quality],” or from the Water Quality Improvement Fund if no credits are available, or another option that would be approved on a case-by-case basis [65,68]. Nonpoint source “credits certified by the board” have a 2:1 ratio, delivery factors, and have to show additionality to the Chesapeake Bay TMDL implementation plan [65].

Part I. B. 2. allows a “bubble permit” for an owner of two or more facilities covered by the general permit if the facilities are in the same tributary [65].

Additional information: The Virginia Department of Environmental Quality publishes a nonpoint source nutrient credit registry, annual nutrient trades reports, nutrient trading registration lists, and annual reports from the Virginia Nutrient Credit Exchange Association on their main webpage for VPDES Watershed General Permit for Nutrient Discharges to the Chesapeake Bay [69].

The Water Quality Improvement Fund uses funds “to design and installation of nutrient reduction technology at Chesapeake Bay watershed publicly owned wastewater treatment plants” [70].

Authorization: The general permit is codified in the State’s administrative code: “The State Water Control Board (Board) has approved the modification of a general VPDES watershed permit for total nitrogen and total phosphorus discharges and nutrient trading in the Chesapeake Bay watershed in Virginia. These modifications were made in response to changes to § 62.1-44.19:13, § 62.1-44.19:15 and § 62.1-44.19:18 of the Code of Virginia as approved by the 2012 session of the General Assembly” [67].

References:

63. “[2013] Nutrient Registration Trading Lists,” Virginia Department of Environmental Quality: 2013. Accessed September 2013, <http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/NutrientTrading.aspx>.
64. “2012 Nutrient Trades Report,” Virginia Department of Environmental Quality: 2013. Accessed September 2013, <http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/NutrientTradesReport2012.pdf>.
65. Virginia General Permit for Total Nitrogen and Total Phosphorus and Nutrient Trading in the Chesapeake Watershed in Virginia. State of Virginia: 2012. Accessed September 2013, <http://lis.virginia.gov/cgi-bin/legp604.exe?000+reg+9VAC25-820-70>.
66. “Trading Nutrient Reductions from Nonpoint Source Best Management Practices in the Chesapeake Bay Watershed: Guidance for Agricultural Landowners and Your Potential Trading Partners,” Virginia Department of Environmental Quality: Unknown date. Accessed October 2013, http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/VANPSTradingManual_2-5-08.pdf.
67. “Fact Sheet: Modification of a General VPDES Permit to Discharge to State Waters and State Certification under the State Water Control Law,” Virginia Department of Environmental Quality: 2012. Accessed October 2013, <http://www.deq.virginia.gov/Portals/0/DEQ/Water/PollutionDischargeElimination/VAN00FactSheet2012.pdf>.
68. B. Fults and S. Reed, 2013. Personal communication. October 10, 2013.
69. “VPDES Watershed General Permit for Nutrient Discharges to the Chesapeake Bay” index webpage, Virginia Department of Environmental Quality: 2012. Accessed October, 2013, <http://www.deq.virginia.gov/Programs/Water/PermittingCompliance/PollutionDischargeElimination/NutrientTrading.aspx>.
70. “Water Quality Improvement Fund” webpage, Virginia Department of Environmental Quality: 2013. Accessed October, 2013, <http://www.deq.virginia.gov/Programs/Water/CleanWaterFinancingAssistance/WaterQualityImprovementFund.aspx>.

Case 16: Tri-Cities North Regional Wastewater Authority

Name of facility: Tri-Cities North Regional Wastewater Authority wastewater treatment works located at 3777 Old Needmore Road, Dayton, Ohio, Montgomery County

State: Ohio

Permit number and time period: 1PD00020*ID; permit effective August 1, 2009; expiration January 31, 2014

Was trading used to comply with permit: No. Pre-compliance credits were funded but have not been applied towards the permit due to an absence of regulatory need (i.e. permittee is in compliance with current requirements) [11, 71].

Pollutant: TN and TP

Amount traded: Not specified in either the permit or the Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program [18]

PS/PS or PS/NPS: PS/NPS

Buyer and seller: Tri-Cities was the buyer and the Miami Conservancy District was the aggregator of credits from farmers

BMPs: BMPs for this permit are the same as those for Case 2

Narrative summary: This permit is substantially the same as the Butler County permit (Case 2), the City of Dayton permit (Case 4), and the City of Englewood permit (Case 5). All of the information in the 'Narrative summary' section of Case 2 applies to this case.

What is in the permit: All of the information in the 'What is in the permit' summary of Case 2 applies to this case [71].

Additional information: All of the information in the 'Additional information' section of Case 2 applies to this case.

Authorization: All of the information in the 'Authorization' section of Case 2 applies to this case.

References:

11. A. Bachman, 2013. Personal communication. October 25, 2013.
18. *Operations Manual (February 8, 2005) for the Great Miami River Watershed Water Quality Credit Trading Program*. Ohio EPA: 2005. Accessed July 2013, <http://www.miamiconservancy.org/water/documents/tradingprogramoperationmanualfeb8b2005secondversion.pdf>.
71. Tri-Cities North Regional Wastewater Authority NPDES permit 1PD00020*ID. Ohio Environmental Protection Agency: 2009. Accessed September 2013, <http://web.epa.ohio.gov/dsw/permits/doc/1PD00020.pdf>.

Case 17: Truckee Meadows Reclamation Facility

Name of facility: Truckee Meadows Water Reclamation Facility, located at 8500 Clean Water Way, Reno, NV 89502

State: Nevada

Permit number and time period: NV0020150; official permit date unknown, circa 2012 (permit renewal factsheet was prepared in March 2012)

Was trading used to comply with permit: Unknown. Trading is authorized in permit after certain steps have been taken, but EPRI could find no information to indicate that the facility had taken steps to use water quality offset projects.

Pollutant: The permit allows water quality offsets in relation to TMDL waste load allocations for TP, TN, TDS [72]

Amount traded: Unknown

PS/PS or PS/NPS: PS/NPS

Buyer and seller: The Truckee Meadows Water Reclamation Facility would be the buyer

BMPs: “Potential water quality offset opportunities include, but are not limited to: water augmentation, river restoration, septic system conversion, and stormwater management practices” [72]

Narrative summary: Information contained herein is based on a 2012 permit renewal application factsheet and other information, as EPRI was unable to find the final NPDES permit online.

A 2008 EPA report on water quality trading noted that the City of Sparks had been exploring “creative solutions” including water quality trading to “solve water quality and flow issues in the Truckee River,” which has TMDL limits for TN, TP and TDS [5]. The 2012 permit renewal factsheet for Truckee Meadows indicates that “water quality trading offset projects” are an option for meeting permit compliance on a case-by-case basis, provided several testing, modeling steps, and program implementation steps are completed [72]. EPRI could find no information to confirm that water quality trading is currently being tested or implemented.

What is in the permit: Information contained herein is based on a 2012 permit renewal application factsheet and other information, but not the final permit itself. The permit factsheet contains a one-page section on “Water Quality Offset Projects – Part I.A.5” which authorizes use of WQT: “The Division may modify the permit, without further public notice, to include specific water quality offset projects based upon review of the results of scientific studies” [72]. The steps that must be taken for water quality to be used for permit compliance are:

- “Development of proposals to evaluate demonstration projects to substantiate the benefits of specific water quality offset project proposals,” and details of this step, and
- “Full implementation of the water quality management project, and the development of the final trade ratio” [72].

Additional information: There is a The Truckee River TMDL for TN, TP, and TDS [73].

Authorization: Because EPRI was unable to find the final permit online or otherwise, authorization is unknown. However the following language is in the 2012 permit renewal factsheet, “The Division may modify the permit, without further public notice, to include specific water quality offset projects based upon review of the results of scientific studies” [72].

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Case 18: West Branch Regional Authority

Name of facility: Montgomery Borough Wastewater Treatment Plant, located in Montgomery Borough, Lycoming County, Pennsylvania

State: Pennsylvania

Permit number and time period: PA0020699; permit effective July 1 2013; expiration June 30, 2018

Was trading used to comply with permit: Yes

Pollutant: TN and TP

Amount traded: West Branch Regional Authority purchased 25,000 nutrient credits in 2013 on the Pennvest nutrient auction [74].

PS/PS or PS/NPS: PS/NPS and PS/PS

Buyer and seller: West Branch Regional Authority is the buyer. The permit allows West Branch Regional Authority to use PS offsets from Muncy Borough Wastewater Treatment Plant (also owned by West Branch Regional Authority). One specific NPS credit seller shown on Pennvest nutrient auction results is Mercuria America Inc. The permit defines both credits and offsets as pollutant load reductions, but distinguishes that offsets “may only be used by the NPDES permittee that DEP determines is associated with the load reduction... Offsets may be applied to meet compliance with Cap Loads, but may not be treated as Credits, and are not eligible for sale or trading” [75].

BMPs: The 2013 permit does not provide a full list of activities for either credits or offsets. While the permit notes “Offsets that are approved under this permit are listed in Part A, Footnotes,” it does not list offsets there. Section C of the 2013 permit describes offsets as “created by an action, activity or technology... approved by DEP” and further mentions the following two specific types of offsets:

- “Offsets may be approved for the connection of on-lot sewage disposal systems that existed prior to January 1, 2003 to public sewers,” and
- “Offsets may be approved for the transfer of load between facilities owned by the same entity [PS/PS] if (1) the facility receiving Offsets does not discharge to waters classified as impaired for nutrients and (2) the Delivery Ratios for TN or TP, as applicable, are the same” [75].

Narrative summary: West Branch Regional Authority purchased 25,000 nutrient credits in 2013 on the Pennvest nutrient auction [74]. The 2013 permit authorizes use of credit or offsets for compliance [74]. In regards to the broader Pennsylvania Nutrient Credit Trading Program, “The primary purpose of the... Program is to provide for more efficient ways for National Pollutant Discharge Elimination System (NPDES) permittees to meet their effluent limits for nutrients. Currently, the focus of the program is on the Chesapeake Bay Watershed” [76].

What is in the permit: The permit contains a three-page section “I. Chesapeake Bay Nutrient Requirements” that contains details about meeting downstream State of Maryland water quality standards, with the option of using credits or offsets (only created by the permittee for its own use) for compliance. The section provides definitions (1.5 pages), details on how credits and offsets need to be approved and when they need to be applied, and stipulates requirements for monitoring and reporting. The permit also specifically notes that “This permit authorizes the receipt of Offsets from Muncy Borough Wastewater Treatment Plant, NPDES Permit No. PA0024325,” which is also owned by the permittee [75].

“Credits used have to be certified, verified, and registered for the year in which they are used for compliance with this permit... The Compliance Year is the year-long period starting October 1st and ending September 30th” [75].

Additional information: Pennvest auction results can be found on the Markit “Pennvest Nutrient Credit Trading” webpage [74].

Authorization: The permit notes that “The permittee is authorized to apply TN and TP Credits to achieve compliance with Cap Loads when the Credits are certified, verified and registered in accordance with 25 Pa. Code 96.8” [75].

A 2013 Pennsylvania Department of Environmental Protection webpage on Nutrient Trading Regulation notes that: “On October 9, 2010, the Department published its nutrient trading regulation, 25 Pa. Code § 96.8, entitled ‘Use of offsets and tradable credits from pollution reduction activities in the Chesapeake Bay Watershed,’ in the Pennsylvania Bulletin. See, 40 Pa. B. 5790. The regulation became effective that day. The regulation codifies, with some revisions, the Department's former guidance entitled ‘Final Trading of Nutrient and Sediment Reduction Credits—Policy and Guidelines’ (No. 392-0900-001, December 2006) as it relates to the Chesapeake Bay” [76, 77].

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Section 4: Electric Power Companies Engaged in Trading

Progress Energy (Lee Plant, North Carolina) was a co-permittee member of the Neuse River Compliance Association (NRCA) and traded within the NRCA's bubble permit [46]. In 2009, Progress Energy leased 9,000 lbs (4,082 kg) of TN allocation to the NRCA. Then in 2010, NRCA leased 9,000 lbs (4,082 kg) TN to Progress Energy [20]. See Case #3 for full case study of Progress Energy's NPDES permit.

Additionally, public results documents from Pennvest auctions of nutrient credits show several energy sector participants [74]. **EnergyPlus LLC** is the only energy sector buyer, and it has been the single largest buyer of credits in the Pennvest auctions, often being the only buyer during auctions. EnergyPlus LLC is an energy supply company and an unregulated subsidiary of PPL Corporation, which also owns PPL Electric Utilities [78, 79]. From October 2010-June 2013, EnergyPlus LLC has purchased a total of 258,650 credits for a total of \$790,841, with credit prices ranging from \$2.15-\$4.00 per credit [74].

EPRI also researched the two energy sector sellers in Pennvest auctions: Mercuria Energy America, Inc. and Gettysburg Energy and Nutrient Recovery Facility. **Mercuria** describes itself as transacting energy and commodity credits on a global scale, and recently trading nutrient credits in Pennsylvania [80]. In a 2011 legal white paper on WQT developments, Mercuria was described as "...purchasing what are essentially water quality credit futures." Mercuria approached point source facilities to buy anticipated nutrient reduction credits and then aggregate and sell them on Pennvest [81]. The white paper also noted that Pennvest has not seen much activity, "as the vast majority of credits have been traded... in the private contract market" [81].

Gettysburg Energy and Nutrient Recovery Facility is a manure-to-energy project that began operations in 2012 and generates 3.24 megawatts along with "over 1 million Nitrogen credits/year and over 53,000 Phosphorus credits/year" [82]. The \$30-million facility received \$11 million in a low-interest loan through Pennvest and claims to be the largest credit generator certified in Pennsylvania's WQT program [82, 83].

Section 5: Summary

Table 3-2 provided a summary of the 18 case studies of NPDES permits incorporating water quality trading. Both the permittee types and the incorporation of WQT in permits varied widely. Of the permittees: ten were wastewater treatment plants or authorities, four covered multiple individual facilities, two were food or beverage companies, one was an electric power plant, and one was an agricultural cooperative. Figure 5-1 below shows the approximate locations of the 18 case studies.



Figure 5-1
Approximate Location of Case Studies

Some overall observations of implementation of WQT in NPDES in the case studies are as follows:

- There are two general approaches to incorporating WQT in the NPDES permits that EPRI reviewed: 1) provide limited details of WQT within the permit and refer to a separate trading plan document, or 2) provide details of WQT within the permit. This is reflected in the amount of text written into the permit regarding WQT, which ranges from one sentence to five pages.
- Eight of the cases (Cases #1, #2, #4, #5, #7, #8, #9, and #15) referenced trading plans or similar detailed guidance, while the others included descriptions directly in the permits.
- Seven of the permits (Cases #2, #4, #5, #6, #9, #16, and #17) have language that allows WQT, but to the best of our knowledge, credits have not been applied towards a permit obligation. There are various reasons for this including a lack of regulatory need for applying the credits (as is the case in #2, #4, #5, and #16), not having had time to execute trades due to relative nascence of the permit (#9, #17), or the WQT program not maturing to the point of trading (#6).
- Fifteen of the permits allowed trading for nutrients (nitrogen &/or phosphorus), two for temperature reduction, two for CBOD₅ (five-day carbonaceous oxygen demand), one for ammonia, and one for total dissolved solids (TDS).
- The main categories of sellers were agricultural landowners, individual point source facilities, and credit exchange associations.
- Several of the cases allowed trading to occur between multiple NPDES permittees. Three states – Connecticut, Minnesota, and Virginia – created general permits which incorporated WQT as a means to meet TMDL waste load allocation. These permits all gave an option of paying a fee or buying a WQT credit from the State when discharges exceeded waste load allocations. The Neuse River Compliance Association also allowed trading between point sources within the association.
- One permit specifically allows credit stacking¹ (Case #1) and two permits specifically disallow credit stacking (Case #12 and Case #13).
- The earliest permit in the case studies was from 1999 (#13). The newest permits date from July of 2013 (#9 and #18). The other 15 case studies were initiated between 2002 and 2012.

¹ Credit stacking is defined as establishing more than one credit on spatially overlapping areas. Credit types include carbon, endangered species, water quality, and wetlands [82]. EPRI has conducted extensive research of credit stacking [83, 84, 85].



Section 6: Conclusion

While previous authors have summarized programmatic and implementation aspects of WQT, EPRI could not locate a reference summarizing the application of WQT credits towards NPDES permit obligations. This report summarizes research results based on NPDES permits obtained online or from subject matter experts. EPRI is not aware of a similar effort to summarize NPDES permit examples that have referenced WQT and/or actually applied credits towards compliance obligations. At the time of report writing, the EPRI Ohio River Basin Trading Project had not resulted in application of credits towards permit obligations, and therefore is not included as a case study in this report.

While this research did not attempt to provide comprehensive coverage of every NPDES permit using water quality trading, this is the only known report that attempts to consolidate this type of information. Of note, this research confirms several examples of permits acknowledging WQT that have not yet purchased credits, and other cases where credits were purchased and recognized in the permits, but have not been applied towards permit obligations. These are important distinctions that can inform discussions regarding the status of WQT programs in the United States, the extent to which transactions have occurred, and when those transactions have been used toward permit obligations. As interest and applicability of WQT builds in the United States, this report highlights the value of developing consolidated resources of related information. Clarity that develops from this and similar analysis can illuminate otherwise hypothetical discussions regarding the status, details, and frequency of applying WQT credits towards permit compliance obligations in the United States.



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