Minnesota NPDES Wastewater Permit Nitrogen Monitoring Implementation Plan

Wastewater implementation strategy to achieve the first milestone established in the Minnesota's draft nutrient reduction strategy

Approved April 17, 2014 by Minnesota Pollution Control Agency (MPCA) Water Quality Policy Forum.

The frequency of nitrogen series monitoring requirements in Minnesota's industrial and municipal wastewater NPDES permits is being increased in order to develop a more complete understanding of the magnitude and dynamics of nitrogen sources and discharges from wastewater sources. A better understanding of nitrogen concentrations and loadings received by and discharged from municipal and industrial wastewater sources is necessary in order to assess the accuracy of current nitrogen loading estimates and to develop realistic nitrogen reduction alternatives from wastewater sources.

The following synopsis of the MPCA's Nitrogen in Minnesota Surface Waters study and Minnesota's draft Nutrient Reduction Strategy establishes the basis for the increase in total nitrogen monitoring requirements in industrial and municipal wastewater NPDES permits. The MPCA's legal authority to implement this monitoring strategy is derived from Minnesota Statutes Chapter 115 and Minnesota Rules Chapter 7050.

Background

Nitrogen in Minnesota surface waters

The MPCA's 2013 Nitrogen In Minnesota Surface Waters study (study) was conducted to better understand the Nitrogen (N) conditions in Minnesota's surface waters, along with the sources, pathways, trends and potential ways to reduce N in waters. Concern about N in Minnesota's surface waters has grown in recent decades due to: 1) increasing studies showing toxic effects of nitrite+nitrate-N (nitrate) on aquatic life, 2) increasing N concentrations and loads in the Mississippi River combined with N's role in causing a large oxygen-depleted zone in the Gulf of Mexico and 3) the discovery that some Minnesota streams exceed the 10 milligrams per liter (mg/l) standard established to protect potential drinking water sources.

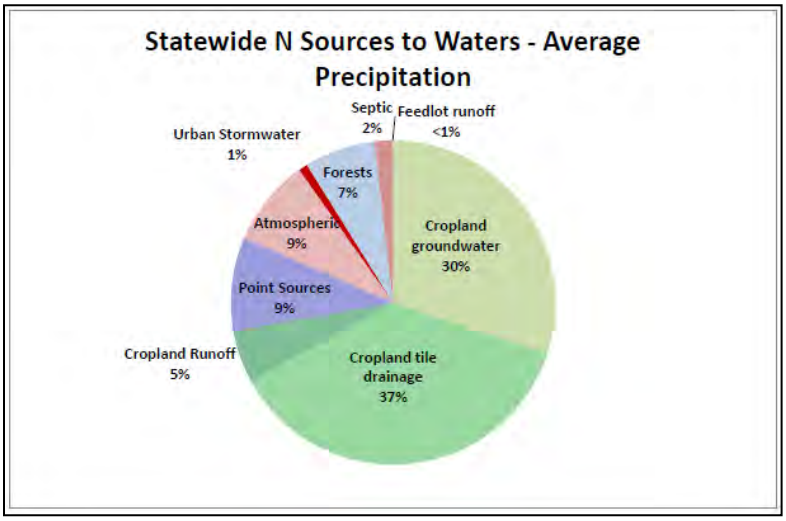
The study found that maximum nitrate levels in Minnesota rivers and streams (years 2000-2010) exceeded 5 mg/l at 297 of 728 (41%) monitored sites across Minnesota, and exceeded 10 mg/l in 197 (27%) of the monitoring sites. In addition, the study evaluated flow-adjusted nitrate concentration trends at 51 mainstem river and major tributary river monitoring sites throughout the state over a timeframe beginning during the mid-1970s and ending between 2008 and 2011. Overall most sites showed increasing nitrate concentrations.

Sources

The study estimates that wastewater point sources discharge an average annual N load of 28.7 million pounds statewide, an estimated 9% of the statewide N load during an average precipitation year.

Due to the lack of detailed N monitoring data from most Minnesota wastewater point source dischargers, N loads have been estimated from known effluent flows and estimates of effluent concentrations based on facility type

Minnesota has over 900 wastewater point sources that actively discharge to surface waters. Of these point sources, 64% are domestic wastewater treatment plants (WWTPs) and 36% are industrial WWTPs. In total, it is estimated that wastewater point sources discharge an average annual N load of 28,671,429 pounds statewide. Most of this load is from municipal dischargers (24,929,970 pounds/year N, 87%); the remainder is from industrial facilities (3,741,459 pounds/year N, 13%). Within most basins, municipal facilities account for over 90% of the point source load. The few exceptions include basins like the Rainy River and St. Croix River which have large, water-using industrial facilities.



Despite the large number of individual permits in Minnesota, the majority of wastewater point source N loading comes from a small number of large facilities. The 10 largest point sources, as measured by the average annual N load, collectively amount to 67% of the point source N load. The monitoring frequency discussed later in this document is weighted based on facility type and design flow due to the fact that the majority of wastewater nitrogen is believed to be discharged by relatively few large municipal WWTPs.

Current state level efforts

Minnesota recently initiated two state-level efforts related to N in surface waters; the development of water quality standards and the Minnesota Nutrient Reduction Strategy.

Water quality standards

The MPCA is developing water quality standards to protect aquatic life from the toxic effects of high nitrate concentrations. The standards development effort, which is required under a 2010 Legislative directive, draws upon recent scientific studies that identify the concentrations of nitrate harmful to fish and other aquatic life.

Draft Minnesota nutrient reduction strategy

Minnesota is one of 12 states along the Mississippi River developing a cleanup plan for the excess nutrients (phosphorus and nitrogen) impairing waters within the states and causing a hypoxic "dead zone" in the Gulf of Mexico where aquatic life can't live. Ultimately, the goal set by the US Environmental Protection Agency and other states is a 45% reduction in nutrient loading to the Gulf of Mexico.

To address the nutrient issue, 10 Minnesota agencies have proposed a strategy that looks at the main causes, solutions and how best to track our progress. The draft Minnesota Nutrient Reduction Strategy (Strategy) guides state-level programs to achieve nitrogen and phosphorus reductions within Minnesota water bodies to enhance the health of aquatic life, improve public health and safety and increase the recreational potential of Minnesota's numerous lakes, rivers, and streams, as well as the health of the groundwater supply. In addition, nutrient reductions will also benefit the Gulf of Mexico hypoxia problem and other waters downstream of Minnesota, including Lake Winnipeg and Lake Superior.

The Strategy includes goals and milestones for nutrient reduction at multiple scales including basin (e.g., Mississippi River Basin at the state line) and watershed (e.g., 8-digit hydrologic unit code [HUC 8] watersheds). The Nitrogen milestone for the Mississippi River Basin is a 20% reduction and the Red River Basin is a 13% reduction by 2025.

The document recommends five strategies for addressing nitrogen contributions from wastewater sources. All of the strategies require the collection of N data. This Implementation Plan addresses the data collection strategy for N and provides the foundation for development and implementation of the remaining strategies.

Influent and effluent nitrogen monitoring at WWTPs.

Increase N series monitoring frequencies for all dischargers, including industrial facilities, starting with permits issued in 2014. There are limited available data in Minnesota on influent and effluent nitrogen concentrations.

Monitoring has been limited to ammonia primarily due to permit requirements. Those facilities with ammonia concentration or load requirements are providing treatment to convert ammonia to nitrate-nitrite nitrogen, but are not reducing nitrogen loads in the effluent. Monitoring additional forms of N beyond ammonia is needed to more fully understand loading from WWTPs.

Nitrogen series (nitrate, total Kjeldahl nitrogen [TKN], ammonia) effluent monitoring is currently required twice per year for all dischargers with design flows over 0.1 million gallons per day per CFR 122.21j. Influent monitoring will be added for municipal WWTPs and the effluent monitoring frequency will be increased based on discharge type and size to obtain more data about point source N dynamics. More frequent data collection will help establish a better understanding of the variability in point source N discharges, and the comparison of influent and effluent N concentrations will allow for the development of nitrogen management plans and identification of dischargers with unusual (high or low) influent and effluent N concentrations. After one full permit cycle of N monitoring is completed nitrogen management plans will be required to be completed by Permittees 180 days after issuance of the next permit. By having 5 years of influent and effluent N data the Permittee will have the information necessary to complete source reduction and management, and process optimization work at their WWTP.

Once the nitrate water quality standards are final, requiring nitrogen management plans for certain Permittees might not be enough. Therefore, as permits are re-issued the Permittees available nitrate data will be reviewed to determine if the discharge has a reasonable potential to violate the approved nitrate standard applicable to the receiving water. If it is found that a Permittee has a reasonable potential to violate a nitrate water quality standard a limit will be assigned to the discharge. If the Permittee cannot meet the nitrate limit at the time of permit issuance a compliance schedule will be included in the permit that will outline a series of actions that the Permittee must complete to come into compliance with the final nitrate limit. The actions are developed on a case-by-case basis but can include nitrogen management and reduction work and/or facility planning and construction for nitrogen treatment.

Basin	Pollutant	Phase 1 Milestone	Phase 2 Milestone	Phase 3 Milestone
Mississippi River (Includes the Cedar, Des Moines, and Missouri Rivers)	Phosphorus	Achieve 35% reduction from baseline by 2025 [a]	Achieve 45% reduction goal	Meeting goals, no net increase
	Nitrogen	Achieve 20% reduction from baseline by 2025 [b]	Achieve 30% reduction from baseline	Achieve 45% reduction goal
Lake Winnipeg [c] (Red River Only)	Phosphorus	Achieve 10% reduction goal by 2025	Adapt goals, if necessary, based on international joint efforts with Canada	
	Nitrogen	Achieve 13% reduction goal by 2025	Adapt goals, if necessary, based on international joint efforts with Canada	
Lake Superior	Phosphorus	Achieve 3% reduction goal by 2025	Meeting goals, no net increase	
	Nitrogen	Maintain Protection		
Statewide Groundwater/ Source Water	Nitrogen	Meet Goals of 1989 Groundwater Protection Act		

a. It is important to note that active phosphorus reduction began with the completion of the *Detailed Assessment of Phosphorus Sources to Minnesota Watersheds* (Barr Engineering 2004) and Phosphorus Strategy adopted by MPCA's Citizens' Board in 2000.
b. While the baseline for nitrogen reduction is established as prior to 2000, no active strategy has been established since that time to coordinate actions.
c. Milestones to be revised upon completion of the Red River/Lake Winnipeg strategy.

Monitoring also allows for information exchange among MPCA, operators, and consultants. Data could be used as background data for developing performance standards for various facility types.

In order to develop a more complete understanding of wastewater N dynamics and in accordance with the draft Minnesota's Nutrient Reduction Strategy, the following Nitrate + Nitrite and TKN monitoring requirements will be included in industrial and municipal wastewater permits upon reissuance or modification (starting in May 2014). Data collected during the initial 5-year permit cycle will be used to develop and implement the Nitrogen Management Plans during the second permit cycle. It is expected that gathering sufficient N data and

completing Nitrogen Management Plans through two permit cycles will successfully achieve the municipal and industrial wastewater sectors N reduction goals by 2025.

Monitoring frequencies

NPDES permit N monitoring frequencies are detailed in the table below. Both Nitrite-Nitrate-N and TKN sampling is required in order to obtain Total Nitrogen data. Monitoring requirements are less frequent for smaller municipal wastewater treatment facilities and industrial dischargers whose effluents are not expected to represent large sources of nitrogen. Monitoring requirements are more frequent for larger municipal wastewater facilities and industrial process effluents that are expected to be more significant sources of nitrogen.

Monitoring frequencies for all wastewater dischargers

Sector	Flow Type	Design Flow	Influent/ Effluent	Major/ Minor	Parameters	Sample Frequency	Sample Type
Domestic	Continuous	< 0.1 mgd	Both	Minor	Nitrate + Nitrite, TKN	2/year (March & September)	24-Hour Flow Composite
Domestic	Continuous	0.1 - 0.99 mgd	Both	Minor	Nitrate + Nitrite, TKN	1/quarter	24-Hour Flow Composite
Domestic	Continuous	1.0 – 9.99 mgd	Both	Major	Nitrate + Nitrite, TKN	1/month	24-Hour Flow Composite
Domestic	Continuous	> 10.0 mgd	Both	Major	Nitrate + Nitrite, TKN	2/month	24-Hour Flow Composite
Domestic	Controlled	< 0.1 mgd	Influent	Both	Nitrate + Nitrite, TKN	2/year (March & September)	Consistent with current permit (grab or composite)
Domestic	Controlled	< 0.1 mgd	Effluent	Minor	Nitrate + Nitrite, TKN	2/year (1/half year)	Grab
Domestic	Controlled	>0.1 mgd	Influent	Both	Nitrate + Nitrite, TKN	1/quarter	Consistent with current permit (grab or composite)
Domestic	Controlled	>0.1 mgd	Effluent	Both	Nitrate + Nitrite, TKN	1/discharge	Grab
Industrial	Any	Water Treatment Plants (WTPs)	Effluent	Both	Nitrate + Nitrite, TKN	2/year	Consistent with current permit (grab or composite)
Industrial	Any	RO Reject	Effluent	Both	Nitrate + Nitrite, TKN	2/year	Consistent with current permit (grab or composite)
Industrial	Any	Untreated NCCW	Effluent	Both	Nitrate + Nitrite, TKN	1/year	Consistent with current permit (grab or composite)
Industrial	Any	Treated NCCW	Effluent	Both	Nitrate + Nitrite, TKN	2/year	Consistent with current permit (grab or composite)
Industrial	Any	NCCW using surface water as source water	Both	Both	Nitrate + Nitrite, TKN	1/year	Consistent with current permit (grab or composite)
Industrial	Any	Process wastewater/ contact cooling water	Effluent	Both	Nitrate + Nitrite, TKN	1/month	24-Hour Flow Composite
Industrial	Any	Dewatering MNG49	Effluent	Both	Nitrate + Nitrite, TKN	1/year	Consistent with current permit (grab or composite)