Rahr Malting Company Permit

Minnesota

Overview

Type of Trading

Point Source–Nonpoint Source

Pollutant(s) Traded

Carbonaceous biochemical oxygen demand

Basis for Trading

Fully allocated wasteload with no reserve capacity in TMDL for new discharges

Participants

NPDES permitted industry (malting plant), upstream nonpoint source discharges

Rahr Malting Company produces and distributes malt that is mainly used for beer brewing or making whiskey. The malting process steeps grains such as barley, sorghum, or wheat and creates a wastewater that is high in carbonaceous biochemical oxygen demand (CBOD)[1]. One of Rahr's malt production plants is in Shakopee, Minnesota. Wastewater from this plant was originally treated at a regional wastewater treatment plant (WWTP). When Rahr wanted to expand production at the plant, they determined they could reduce costs if they constructed their own WWTP with a discharge to the Minnesota River. However, the total maximum daily load (TMDL) for CBOD for the Minnesota River did not include reserve capacity for new discharges. Rahr proposed a solution to the Minnesota Pollution Control Agency (MPCA) to include special conditions in their National Pollutant Discharge Elimination System (NPDES) permit that allowed for multiparameter nonpoint source trading offsets for phosphorus, nitrogen, CBOD, and sediment to address the dissolved oxygen impact of the new discharge from the proposed WWTP.

In 1997, Rahr was issued a permit for the discharge from the new WWTP (MN0031917). The permit established both mass-based and concentration-based average and maximum monthly effluent limits, as well as permit conditions that required trading with nonpoint sources to provide equivalent reductions to fully offset the CBOD load from the new discharge.

[1] CBOD measures dissolved oxygen depletion from only carbonaceous sources. Biochemical oxygen demand sampling results are based on dissolved oxygen depletion from both carbonaceous and nitrogenous sources in a wastewater sample.

The permit required Rahr to provide 150 pounds per day (lbs/day) of CBOD equivalent credits.[2] Within the first five years of implementing the trading effort, Rahr obtained 212.8 lbs/day worth of credits (MPCA, 2019), which is more nonpoint source reductions than were required in the permit.

Market Driver

A TMDL with no reserve capacity for new discharges.

Trading Mechanisms

Trading is authorized and implemented through the NPDES permit for discharges from the Rahr WWTP.

1997 NPDES Permit

The initial permit to Rahr established phosphorus and CBOD concentration- and mass-based effluent limits. In addition, the permit required 150 nonpoint source load reduction units to be accumulated through nonpoint source offsets during the five-year permit term. The nonpoint source load reduction units could be generated through reductions in CBOD (1 lb = 1 unit), phosphorus (1 lb = 8 units), nitrogen (1 lb = 4 units), or sediment (1 ton = 0.5 units). The permit specified an interim schedule beginning in year two for these units to be acquired (i.e., 30 units per year every year except the final year, when the final 60 additional units were required).

The initial permit required that Rahr establish a $250,000 trust fund to pay for nonpoint source projects that would reduce CBOD loadings by at least 150 lbs/day. The initial permit required that the trust fund be administered by a board of citizens concerned with water quality conservation, including people from grassroots organizations, state offices, and Rahr representatives, to oversee the final selection of BMP sites. The MPCA gave final approval for each nonpoint source project and determined the amount of CBOD credits generated. Rahr ultimately spent $300,000 during the first permit term to achieve this goal (Fang and Easter, 2003).

The credits were granted in a schedule to give Rahr greater flexibility in meeting the permit requirements: 45 percent were granted when the contractual agreements were reached, 45 percent when the nonpoint source controls were implemented, and 10 percent when vegetation establishment criteria were reached.

2019 Permit

Rahr's 2019 permit provides concentration- and mass-based effluent limits for CBOD and phosphorus in addition to a requirement to offset 150 lbs/day of CBOD. The permit requires the company to maintain the existing nonpoint source controls.

Trading requirements are described in three separate attachments to the 2019 permit. Attachment 3 (entitled Rahr Malting Permit Trading Language) authorizes trading of nitrogen, phosphorus, and CBOD, as well as sediment to generate CBOD credits, using the same nonpoint source load reduction unit conversion rates as described above. Rahr may not trade to meet its phosphorus effluent limitations.

[2] Based on dissolved oxygen stressor impacts from CBOD, ammonia-nitrogen, total phosphorus, and sediment reductions.

The Point–Nonpoint Source Trading Summary (Attachment 2 of the 2019 permit) explains the premise for Rahr's point–nonpoint source trading process, the concepts involved in developing the trading program, and how the trading agreement and administration of the trades occurs.

Replacement credits, if proposed and approved, will be granted in a schedule. Based on a history of successful implementation of the nonpoint source trading requirements, the permit no longer requires Rahr to maintain a trust fund.

Credit Generation

Trade-eligible nonpoint source BMPs are:

- Soil erosion BMPs;
- Livestock exclusion;
- Rotational grazing with livestock exclusion;
- Critical area set aside;
- Wetland treatment systems;
- Alternative surface tile inlets;
- Cover cropping; and
- BMPs installed to reduce CBOD (this category covers BMPs that directly reduce CBOD, in contrast with the categories listed above that also reduce nutrients and sediment).

Attachment 1 of the permit details how pollutant reductions are calculated for the different types of approved BMPs. Attachment 2 details the various calculations necessary to determine Pollutant Equivalency Credits for the pollutants reduced by these BMPs. These credits are calculated to show how many pounds per day of phosphorus, CBOD, and total Kjeldahl nitrogen reduction, as well as how many tons per day of sediment reduction, are necessary to equate to a specified number of CBOD units in each of three areas of the Minnesota River: the reach of the river covered by the TMDL (the TMDL zone), the portion of the river upstream of this zone to river mile 107 (the BOD zone) and then the portion of the river upstream of river mile 107.

The calculations for determining Pollutant Equivalency Credits account for safety and delivery (i.e., channel assimilation and field loss) to minimize associated risks specific to each pollutant.

- The relationship between phosphorus and BOD varies depending on the nutrient needs of the biological life forms, flows, turbidity impacts on photosynthetic activity, and the bioavailability of phosphorus. For phosphorus, the Pollutant Equivalency Credits calculation assumes an upstream reduction of 1 pound of phosphorus results in a reduction of 8 pounds of CBOD.[3]

- Nitrogen is less persistent in the river because of loss to the atmosphere, and it exerts its demand on oxygen more rapidly than phosphorus. So, a reduction of 4 pounds of CBOD is assumed for every pound of nitrogen removed in the TMDL zone, and a reduction of 1 pound is assumed in the BOD zone. Calculation of load reductions from livestock management BMPs includes a 50 percent field loss factor to account for atmospheric nitrogen losses prior to transport into the water column.

[3] MPCA estimated the pollutant equivalency factors based on a review of literature documenting the association of nutrients with chlorophyll concentrations in rivers and the relationship between chlorophyll and BOD.

- Controlling sediment loss reduces oxygen demand associated with turbidity. The permit presumes that a reduction of one ton of sediment is necessary for 0.5 pounds of CBOD within both the TMDL and BOD zones.

For CBOD, presumed reductions within the BOD zone are based on the river mile distance from the TMDL zone, as described in the 2019 Permit, Table 2 of Attachment 2. The further away the credit is generated from the TMDL zone, the less CBOD persists. Discharges of CBOD directly into the TMDL zone experience no assimilation reduction. BOD zone assimilation rates are also provided. Minimal credit—1 percent of the pounds removed—is given for pollutant reductions that occurs upstream of the BOD zone beyond mile 107 (MPCA, 2019).

Pollutant Trading Ratios

In addition to accounting for delivery and assimilation as described above, the permit applies a trade ratio of 1.2:1 for all point source–point source trades and 2.6:1 for point source–nonpoint source trades (e.g., if a point source needs 10 pounds of reduction, it would have to purchase 26 pounds of nonpoint source generated credits). The nonpoint source trade ratio includes three different components: a base of 1:1 to offset the discharge, +0.6 to account for uncertainty and variations among sites, and +1 to provide additional water quality improvements (i.e., retirement) (MPCA, 2019).

Monitoring and Assessment

The estimated reductions from BMPs are determined by calculations described in Attachment 3 of the permit. Some data were collected on initial phosphorus concentrations in the soil and used in the reduction calculations. Prior to MPCA's approval of a BMP, Rahr is responsible for submitting to MPCA technical and engineering reports detailing the design and installation of the BMP as confirmed by an independent auditor, including structural specifications, operation plans, and detailed photographs after BMP completion. The permit requires Rahr to submit an annual CBOD Nonpoint Source Load Reduction Monitoring Report accounting for nonpoint source credits. MPCA monitors the status of BMPs with annual site inspections. For the initial trades, MPCA did not verify pollutant reduction with systematic monitoring (MPCA, 2019). Rahr does not conduct water quality monitoring at the BMP credit generation sites.

Summary of Trading Activity

Rahr implemented trades at four sites using nonpoint source BMPs to generate credits to offset CBOD loadings from the WWTP. The BMP sites had to be upstream of the Rahr plant in the Minnesota River basin and flow from the BMPs could not flow through large water impoundments before reaching the lower Minnesota River.

Two of the BMP sites, located at the junction of the Cottonwood and Minnesota rivers, restored riparian vegetation to offset 28.9 and 71.8 lbs/day of CBOD, respectively. Rahr bought the land for these sites from the landowner, the city of New Ulm. The contracts included landowner obligations. One site was then sold back to the city for a dollar. The other site was donated to an environmental organization, which has since sold the property to a private individual (Henningsgaard, 2022). The sales were contingent on the property becoming wildlife areas and the resulting easement agreements include provisions and restrictions needed for preservation and upkeep of the properties (MPCA, 2019).

The other two BMP sites were bank stabilization projects located on the Rush River and Eight Mile Creek. Prior to project implementation, the landowners for the sites had concerns about the effects of

bank erosion on their land and buildings and were eager to participate in the trading arrangement with Rahr to reduce bank erosion (Klang, 2006a; Sparks and Wallace, 2006). For the Eight Mile Creek site, Rahr installed bluff/channel stabilization BMPs on the landowner's property in return for the landowner excluding livestock from the Creek and maintaining the BMPs. These BMPs offset 13.4 lbs/day of CBOD. At the Rush River site, a bench terrace was constructed, and rock J-hooks were installed to deflect the channel away from the river bluff to limit erosion of the 60-foot-high bluff face. The BMPs at the Rush River site offset 98.7 lbs/day of CBOD. Together, the projects provide an offset of 212.8 lbs/day of CBOD, which exceeds the permit requirement to offset 150 lbs/day of CBOD.

The most recent 2019 permit does not require additional credit generation from other projects, only "replacement trades"—new BMPs that reduce loading in order to take other BMPs out of service—for existing reductions (MPCA, 2019).

Benefits

A 2003 study by Fang and Easter, suggested it is likely that Rahr achieved cost savings through trading. The researchers estimated that the capital and operation costs for a WWTP with comparable design flow to treat to 1 milligram per liter (mg/L) of phosphorus[4] range between $4 and $18 per pound of phosphorus reduced, based on a 20-year investment life and an 8 percent annual interest rate. The cost of phosphorus removal through Rahr's nonpoint source projects was approximately $1.56 per pound (including engineering, construction, materials, design, transaction costs, and maintenance costs) when annualized in the same way.

Ancillary environmental benefits were realized by implementing nonpoint source BMPs. Two bank stabilization projects that improved land stability provided benefits to landowners experiencing property loss. One of those projects also provide deeper pools in the river for fish habitat. Two other projects created wildlife areas to prevent erosion of crop land flood plain areas (Henningsgaard, 2022).

The trading program raised watershed awareness, provided an example of community cooperation, and supported a local company's economic growth (Klang, 2006b).

Challenges

Deciding how to determine the relationship between upstream nonpoint source phosphorus loadings and CBOD discharges from Rahr's WWTP was a significant challenge. MPCA conducting studies relating phosphorus to chlorophyll-a and relating chlorophyll-a to CBOD to determine that an upstream reduction of 1 pound of phosphorus results in a reduction of 8 pounds of CBOD.

Local environmentalists initially objected to the trading program, but Rahr gained their support by cooperatively working with and accepting input from environmental organizations.

The initial permit required approximately 25–50 percent of a full-time MPCA staff person for permit trade calculation development. Now, MPCA spends only a few days a year managing the program (Henningsgaard, 2022).

[4] Because costs cannot be estimated for getting to zero phosphorus discharge, which would have been required of Rahr if they had discharged without trading, Rahr's costs were compared to that of WWTPs with comparable design flow that have to reduce to one mg/L of phosphorus.

Resources

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