Interpreting The Metric

Water Quality

Why It Matters

When water leaves the farm field it takes the soil and residual crop inputs with it resulting in lost investments, reduced yields and negative impacts on water quality. Protecting water quality is beneficial for the economic health of the farm and the health of the local and downstream communities and industries that rely on clean water.

Crop protectants and nutrients can runoff directly into surface waters, leach through the soil profile and enter either tile lines that discharge to surface water or leach into groundwater. This is especially true when the quantity, type, time, and placement of the inputs are not in-line with what the crops need. Groundwater supplies approximately 95% of people living in agricultural communities with drinking water1. Agricultural chemicals can give drinking water a foul odor and flavor. More importantly, there are known negative health effects of nitrates in drinking water, particularly for infants and children2. Excess nutrients from fertilizer and manure that run off of fields into surface water are also known to stimulate rapid expansion of algae populations. The massive algal "blooms" cause hypoxic, or oxygen-scarce zones in ecologically and economically important bodies of water. Wildlife and fishing industries have been negatively impacted by hypoxia.

To reduce the amount of crop nutrients in watersheds, some states have created laws regulating nutrient application and manure management. These states may require nutrient plans to be filed by growers with their state department of agriculture.

Field management practice that can enhance the aggregate stability, water holding capacity, or microbiological life in the soil may prevent or decrease the chances of runoff by increasing the soil's ability to hold water and nutrients. Using cover crops, installing water buffers and greenways, maintaining crop residue on the soil surface, or reducing tillage are practices that may work on some fields to reduce runoff potential.

How It Is Measured In The Fieldprint® Platform

The Water Quality Metric uses the Stewardship Tool for Environmental Performance (STEP), developed by NRCS to assess how likely a field is to lose nutrients to waterways. Based on soil properties and local climate characteristics, STEP assigns a Field Sensitivity Score (FSS) to each field that represents the potential for nutrient losses, either by runoff beyond the edge of the field (surface loss) or leaching below the rootzone (subsurface loss), for each of four loss pathways: Surface P (Phosphorus), Subsurface P, Surface N (Nitrogen), and Subsurface N. STEP then assigns mitigation points, the Risk Mitigation Score (RMS), for management practices that impact nutrient loss.

The goal is to mitigate all four nutrient loss pathways. A pathway is considered to be mitigated if the pathway ratio, assessing overall risk mitigation against a given field's potential for nutrient loss is equal to or greater than 1. Higher pathway ratios are desirable as scores less than 1 indicate risk of nutrient loss.

Factors That Affect The Fieldprint Score

- STEP calculations are dependent on the crop being grown.
- The Field Sensitivity Score is assessed using the location of the field, the soil type, rainfall amounts, tile drainage and the amount of irrigation water applied (if relevant).
- The Risk Mitigation Score is determined by nutrient management techniques, such as the use of nitrification inhibitors and precision application, presence of a cover crop, tillage type, 4R nutrient management techniques and the implementation of NRCS conservation practices.

Strategies to Improve Water Quality Outcomes

Farmers should work with trusted advisers to develop the right combination of practices that work best for their cropping system and location. In-stream water quality measurement can be time- and cost- restrictive. Farmers may need support to access the tools and equipment needed to implement management practices that reduce potential water and nutrient runoff. The right practice(s) for a farmer to adopt will be unique to the farmer and their field, but there are several practices generally recommended to improve water quality such as:

- Adopting NRCS edge of field conservation practices like installing bioreactors, riparian buffers or grassed waterways (see Edge of Field Roadmap).
- Keeping water and soil on the field with low-output irrigation delivery. If tile drainage is used, implementing in-field drainage water management or end of pipe treatment practices. Reduce soil erosion (see Interpreting the Metric: Soil Conservation) by minimizing soil disturbance using the least aggressive tillage tools available and keeping soil covered with vegetation throughout the year.
- Optimize fertilizer and crop protection applications using 4R Nutrient Stewardship (right time, right rate, rate source, right place) and integrated pest management to maximize plant uptake and keep inputs on the field.

Farmers face agronomic and financial risks when adopting new conservation practices. While some practices that reduce input and energy use can lead to immediate cost savings, many practices require up-front investment. An essential component to driving improvements in water quality is designing effective incentive strategies to support farmers and help share in the agronomic and financial risk inherent in transitioning to new practices. Please note more detailed strategies for improving water quality outcomes by crop will be available Fall 2021.

[1] *Pesticides in Groundwater, https://water.usgs.gov/edu/pesticidesgw.html*
[2] *Nitrates in Drinking Water, https://extension.psu.edu/nitrates-in-drinking-water*