WATER MATTERS

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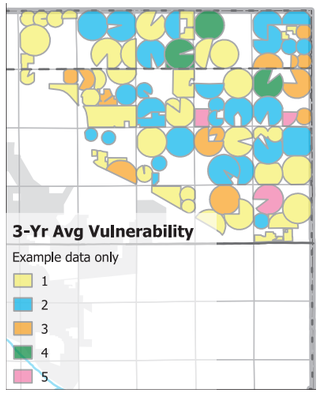
Nitrate Vulnerability Model Aids Producers with Better Nutrient Management

In February 2023, the Lower Loup Natural Resources District Board of Directors passed a rule to allow the Lower Loup NRD to assess all the fields in the District's three groundwater quality management areas on an annual basis with the purpose of locating potentially problematic sites. Individual fields are ranked after reviewing reported parameters including soil nitrates, water nitrates, organic matter, historic yields, and continued low nitrogen use efficiency. Fields found by the assessment to be high-impact fields must have both the operator and owner collaborate with District personnel to develop a nutrient management plan.

Each plan will evaluate historical fertilizer recommendations to determine potential improvements including better scheduling, fertilizer application rates, and fertilizer types. The LLNRD will also look at other potential conservation measures to improve overall efficiency. Other practices could include implementing soil moisture sensors, installation of Variable Rate Irrigation (VRI), and better soil sampling practices to more accurately represent the field and provide more reliable fertilizer recommendations.

The nutrient management plan could also include changes to tillage or cover crop practices to improve soil health. Those fields found by the modeling effort to be approaching a high-impact status will not require a plan but the operator and owner will receive notice of this status and be provided with options for improving total nitrogen use efficiency and conservation measures that could be implemented.

With this improved outreach and assessment of the groundwater quality management areas, the LLNRD will help address the ongoing water nitrate problem that continues to impact drinking water in parts of the District.



Fictitious representation of high impact fields within Water Quality Management Area 30.

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Vadose Sampling Update

Staff at the Lower Loup Natural Resources District (LLNRD) have been working in the field collecting soil samples to a depth of 30 feet. This is part of a project that began back in April 2023 in response to the continuing trend of increasing groundwater nitrate levels in parts of the District. A greater emphasis must be placed on reducing the amount of nitrate that is making it to the aquifer, so the LLNRD is collecting samples to determine how much is getting past the root zone.

Hand operated soil sampler.

Nitrogen fertilizers are an important resource for the agricultural community, but in some areas, the fertilizer is not entirely used up by the growing crop. When this happens, nitrate continues to migrate through the soil profile and ultimately ends up in the water table. The LLNRD has partnered with the United States Geological Survey, (USGS), to study the movement of nitrate and leaching in Platte, Nance, and Boone counties.

Three primary fertilizer application practices including fall fertilizer, manure application, and sidedress application will be studied. To do this, soil samples will be collected to a depth of 8 feet throughout the growing season. Deeper soil samples will then be collected post-harvest to a depth of 30 feet to see how much nitrogen has escaped the root zone and is no longer available to the crop. By sampling continually throughout the entire season, more understanding will be gained on how quickly nitrogen leaches through the soil profile.

A study focused in Groundwater Quality Management Area 30, northeast of Columbus, will also investigate nitrate accumulation in the vadose zone, the area between the land surface and the aquifer. This project aims to create a leaching model that can simulate how nitrate moves in the soil and can estimate loading to vadose zone based on the specific farm management practices used.

Both projects are multi-year projects, so stay tuned for future articles and updates from the Lower Loup NRD.

Technicians from the Lower Loup NRD collect vadose zone samples near St. Edward.

Inside this issue:

The segment of the vadose zone inhabited by fungi, roots, and microbial life, is often referred to as the "soil carbon sponge."

Visit the Nebraska Vadose Zone Project at nebraskavadose.unl.edu/

Cover Crop Impact Study

The effect of cover crops on potential groundwater recharge and nitrate movement through the soil profile

The planting of cover crops is utilized for many soil health benefits, and it is widely accepted that cover crops reduce erosion by anchoring the soil. One thing not often discussed is how cover crops might affect potential groundwater recharge and if there is the possibility of negative impacts to water quantity and to the producer's water budget. To explore these possibilities further, the Lower Loup NRD and the Central Platte NRD partnered with EA Engineering, Science, and Technology, Inc, PBC to study the impacts of growing cover crops in southern Buffalo County where the aquifer is limited, and the water levels have declined in recent years. The study area is between the Wood River and South Loup River.

Within this area, three irrigated row crop fields were selected and monitored for a period of three growing seasons.

The project aimed to gain a better understanding of the general influence of cover crops on soil moisture and potential groundwater recharge. Soil samples to a depth of 15 feet were also collected to study the movement of nitrate vertically through and below the root zone.

The study design was to select fields where, after harvest, the grower would then plant half the field with a cover crop and maintain the other half with no cover crop. This would allow for a comparison between Cover Crop and No Cover Crop in the same field.

Soil moisture probes were installed at depths of 18, 72, and 84 inches to monitor the movement of water through the root zone and into the unsaturated zone, also known as the vadose zone. Water not utilized by the growing crop would be accounted for by the deeper sensors and would be considered groundwater recharge. A cellular gateway allowed for the collection of data throughout the entire calendar year. Equipment was only removed for the planting and harvesting of crops.

At the completion of the project, the annual potential groundwater recharge was averaged together across the three fields for the entire study duration. Results showed no statistical difference between Cover Crop and No Cover Crop areas.

Since individual seasons and years can vary greatly, longer duration data may be needed to determine if a consistent trend is observed and allow for developing long-term conclusions.

For additional information, please contact Jason Moudry at the Lower Loup NRD at (308) 728-3221.

Each field in the study was half planted with cereal rye, while the other part was left unplanted.

LLNRD Flow Meter Requirements

Just like farm machinery, automobiles, appliances, and furniture, not all flow meters are created the same. The Lower Loup Natural Resources District (LLNRD) offers the following requirements to help ag producers:

The water user shall select the proper size, pressure rating, and operating range (minimum and maximum GPM) for his/her water flow meter installation and properly install the meter in accordance with the LLNRD's requirements and the manufacturer's instructions.

1. All meters shall be warranted to register not less than 98% nor more than 102% of the actual volume of water passing the meter for all flow rates within the meter size's range of flow.

Example of a flow meter that records in gallons per minute.

2. The meter shall be equipped with a direct reading rate-of-flow indicator showing instantaneous flow in gallons per minute, or a sweep hand indicator for which rate-of flow can be determined by timing. The meter registry shall have a visual, volume-recording totalizer which shall record in acre-inches.

3. The meter shall be located in such a manner as to measure the entire flow from the well, except when a single meter is installed in such a manner as to measure the combined flow from two or more wells, the meter shall then be installed to measure the combined flow prior to entering the distribution system.

4. The meter must be installed in such a manner that there shall always be a full pipe flow of water while water is being pumped. Full pipe flow can be achieved by elevating a downstream section of pipe, constructing a "gooseneck" in the downstream pipe, or installing a control valve downstream of the meter to create back pressure. If your system is pressurized, you will normally have full pipe flow.

5. Pipe flow is influenced by valves, elbows, check valves or other obstructions or conditions which create turbulent or jetting flow. Minimums of unobstructed straight run of pipe upstream and downstream of the meter installation are needed to correct these flow problems. This straight run of pipe must be sufficient for turbulent water to settle down to smooth flow conditions.

6. Turbulent flows: Non-jetting flows occur downstream of turbine pump discharges, pipe elbows, cooling coils, etc. Jetting flows typically occur downstream of check valves but also develop from pressure regulating valves and other in-pipe restrictions. Use of straightening vanes immediately upstream of a propeller meter (within 5 pipe diameters of the propeller) is recommended. The installation of vanes can be used to lessen the amount of straight pipe required. Piping requirements discussed below are in "pipe diameters"; for example, if the meter is installed in an 8-inch pipe, 10 pipe diameters equals 80 inches.

7. All meters must be equipped with an anti-reverse feature and an overrun bearing assembly. The LLNRD maintains a listing of flow meters that meet District specifications. This list is compiled based on the manufacturer's provided specifications.

Lower Loup NRD technician Ed Drozd inspects a flow meter near Genoa

This list does not represent an endorsement of the product(s). A meter not being on the list does not necessarily indicate that it doesn't meet specifications. If the meter a producer wishes to use is not on this list, please contact the Lower Loup NRD. After a review of manufacturer's specifications, any meter which meets LLNRD guidelines may be added.

Following these guidelines will keep ag producers in compliance, reduce the possibility of installing a substandard flow meter, and help to protect our water resources.