The Nature Conservancy biologist Maria Lemke (right) and tenant Tim Lindenbaum look at one of a series of three constructed wetlands being studied on the Franklin Demonstration Farm, in McLean County, Ill.

FIELD Filters

These six ideas can help treat tile water before it leaves the farm.

STORY AND PHOTOS BY LYNN BETTS

Keeping nutrients in the field is an issue garnering more attention from regulators. So far, efforts have centered on voluntary actions by farmers to reduce the amount of phosphorus (P) and nitrogen (N) reaching the Gulf of Mexico. In a 2008 Action Plan, a task force of 12 states along the Mississippi River recommended an overall goal to reduce N and P in the water by 45% in order to shrink the severity of hypoxia in the Gulf, and encouraged states to set goals and develop strategies. While states have been slow to respond, they are progressing. Four states—Iowa, Minnesota, Ohio and Wisconsin—have set strategies or adopted goals. Minnesota's goal is to reduce N and P by 20 and 35%, respectively, by 2025. Iowa has a 45% N and P reduction goal with no timeline set. Officials agree achieving such a high goal requires a majority of farmers in the affected watershed to use a combination of practices. Conservation tillage, split-N applications, nitrogen inhibitors, eliminating fall fertilization and other in-field nutrient strategies will help, but Iowa State University specialists point out each of these practices cuts nitrate-N concentrations by only single digits. Winter cover crops can have a bigger impact than all the other in-field N reduction practices combined, trimming potential N concentrations by as much as 30%.

TREAT TILE WATER. Several agencies, conservationists and other groups are working with farmers who want to go the extra mile to remove N from tile water before it leaves the farm.

For instance, The Nature Conservancy (TNC) has secured about $5 million from groups like the World Wildlife Fund and The Coca-Cola Foundation to test various practices. "What we do is work in partnerships that help local people craft solutions to national problems, and we're interested in helping farmers increase productivity and avoid regulation," says Dave DeGeus, sustainable agriculture lead for TNC.

"Farmers probably don't know much about us or our goals unless we're involved in a local project, and then they see we have mutual goals," he adds.

There are several options for treating tile water before it leaves the farm. Here's a summary of some of the most common practices:

▶ Constructed Wetlands

Scientists in Illinois are finding that running tile water through small, constructed wetlands helps considerably.

"We've found a wetland that's 5 to 6% of the area being drained by tiles removes about 50% of the nitrates from tile water," says University of Illinois researcher David Kovacic. "Wetlands with that ratio give you the most bang for the buck; larger wetlands have diminishing returns."

Research at the Franklin Demonstration Farm, in McLean County, Ill., demonstrates that the wetlands work, explains Maria Lemke, aquatic ecologist with TNC. "We think we've got the answer to the question of how large wetlands need to be to effectively reduce nutrients from tile water. Now, we have to figure out how to expand their use to a watershed scale."

USDA's Farmable Wetlands Program began offering a practice called CP39 in 2009 as part of USDA's Conservation Reserve Program (CRP). Its purpose is to clean nitrates from tile water and enhance wildlife habitat.

CP39 wetlands can be built and enrolled in CRP at any time. Up-front signing incentive payments have been up to $100 per acre, with a practice incentive payment equal to 40% of the installation cost. Cost-share for construction is 50%. Annual rental payments are made by the Farm Service Agency on the wetland area and associated buffer for up to 15 years.

Estimated cost of a 1-acre wetland is $8,000 to $12,000.

▶ Bioreactors

Tile water is filtered through an underground bed of wood chips at the edge of a field. The wood chips denitrify the water as it moves slowly through the bed. One water-control structure directs water into the ▶

A bioreactor intercepts tile water and runs it through a bed of underground wood chips before it reaches a stream and leaves the farm.

bioreactor—with bypass capabilities. Another at the bioreactor outlet controls the rate of flow and release of treated water to a nearby stream.

A bioreactor can handle tile from a 30- to 100-acre drainage area with 6- to 10-inch tile. Expect a reduction in nitrates of between 40 and 100%. The Iowa Soybean Association has helped install and is monitoring 22 bioreactors.

Conservationist Bruce Voigts inserts a panel into a water-control structure that intercepts field tile water and backs at least some of that water into a perforated tile within a grass and tree buffer along a stream in north-central Iowa. The perforated, underground tile releases the water into the buffer's soils, where roots of the grasses and trees filter and remove nitrates from the water.

The cost of a bioreactor varies with the size of the drainage area and how much tile water will be filtered. Estimated cost for a bioreactor that treats 40 to 100 acres of drainage is $8,000 to $10,000.

▶ Saturated Riparian Buffers

Riparian buffers, strips of grass and trees along streams, have long been known for their ability to cut sediment, phosphorus and nitrates from surface waters that flow from fields to streams.

A new practice called a saturated riparian buffer uses a water-control structure to intercept and redirect some of the tile water into shallow, perforated tile that is installed in the buffer, which runs parallel to the stream. The perforated tile releases the water into the soil profile in the buffer. Denitrification and uptake by the buffer's grasses, shrubs and trees then remove nitrates from the water.

Initial tests in Iowa show as much as a 60% reduction of nitrates coming to the stream from tile water. The USDA Agricultural Research Service is installing and monitoring nine new saturated buffers, thanks to a Conservation Innovation Grant, in Minnesota, Iowa, Illinois and Indiana. This new, relatively inexpensive practice takes no land out of production. However, it's not yet an approved practice through the Natural Resources Conservation Service (NRCS) in all areas.

Estimated cost of a saturated buffer, including the tile and water-control structure, is $3 per lineal foot of buffer.

▶ Drainage Water Management

This practice uses water-control structures and water gates within tile lines to raise and lower the water table in a crop field. Most often the structures are used to close the drains in the fall after harvest, open them in the spring before field operations, close them again after planting to varying heights to make water available to crops, as needed, then close them again before fall field operations.

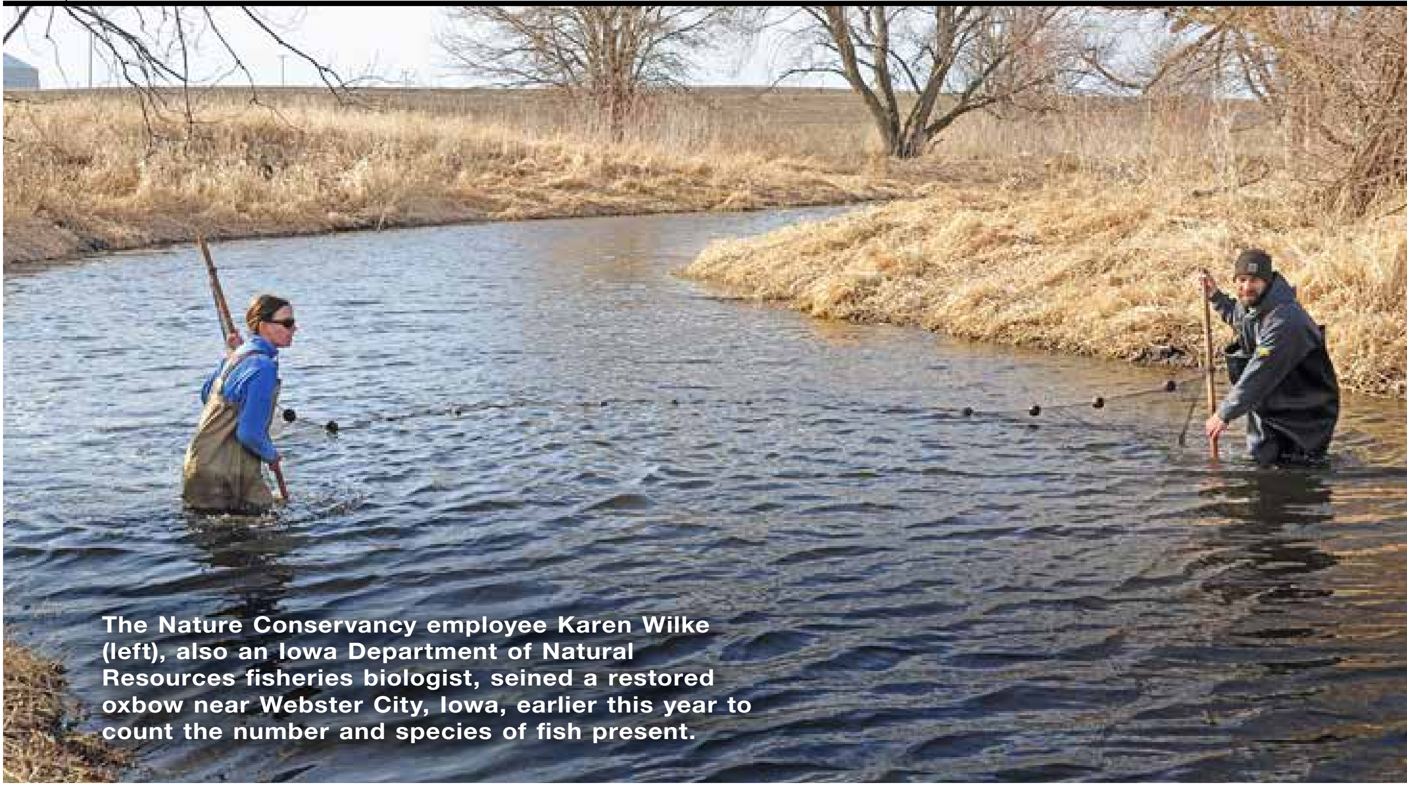
North-central Iowa farmer Arliss Nielsen is using drainage-water management—temporarily backing tile water into his fields when the plants need it—to reduce the amount of nitrates leaving his farm.

Called smart drainage by some farmers, turning drainage on and off reduces overall nitrates leaving the farm by keeping more water in the soil profile longer during the year.

The estimated cost for the structures required for drainage-water management is $2,000 to $3,000 per structure, which may account for drainage on 10 to 20 acres.

▶ Restored Oxbows

In the Boone River Watershed, in north-central Iowa, a handful of farmers have cleaned sediment out of oxbows to reconnect them to stream channels. Part of the ▶



The Nature Conservancy employee Karen Wilke (left), also an Iowa Department of Natural Resources fisheries biologist, seined a restored oxbow near Webster City, Iowa, earlier this year to count the number and species of fish present.

restoration of the oxbows is to redirect field tile lines into the oxbow.

"Some people call them oxbow wetlands," says TNC project director Karen Wilke, based in Webster City. "We're sampling the water every two weeks, and the Iowa Soybean Association is monitoring the water in and out to find out how well the restored oxbows will filter nutrients from the tile water. Monitoring data so far show an average of 45% of nitrates are removed from water that enters the oxbow."

The Iowa Department of Natural Resources is also monitoring how restored oxbows will function to restore spawning for the endangered Topeka shiner and other fish species that need this off-stream habitat.

A half-acre restored oxbow is estimated to cost $12,000 to $15,000.

▶ Two-Stage Drainage Ditches

Vegetated, elevated benches on each side of major drainage-ditch channels partially filter tile water from side inlets before it runs into the center channel below. The benches slow the flow to the channel and allow some infiltration versus being dumped directly and quickly into the flowing center of the channel.

The University of Minnesota is researching the long-term stability of the new two-stage ditches, as well as their ability to remove nitrates. "We're estimating the two-stage design is removing about 20% of the nitrates in the water from 3,500 acres of tile draining into that part of the ditch," says Rich Biske, TNC conservation coordinator. TNC secured funds from Cargill and General Mills to match funds from a USDA NRCS Conservation Innovation Grant for the $200,000 project.

A two-stage drainage ditch is usually part of a larger project to improve a drainage ditch; the cost will vary by project.

Federal, state and local governments, along with private organizations, may offer financial incentives for these water-improvement practices. See your local USDA NRCS or soil and water conservation district for technical assistance and information on any incentives that may be offered. ●

Rich Biske (left) of The Nature Conservancy and drainage ditch inspector Cody Fox say the two-stage design of the Mullenbach drainage ditch, in southern Minnesota, will remove nitrates and allow for efficient drainage.