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Time to target

WATER CHECKUP: Kevin Kuehner (left) with MDA and conservation consultant Ron Meiners monitor a watershed outlet to Crystal Creek as part of the Root River Field to Stream Partnership.

THE numbers are in, the data have been crunched, and it's time to target conservation.

The Root River Field to Stream Partnership, led by Minnesota Department of Agriculture staff in Preston, is beginning Phase 2 of its program.

This second phase involves working one on one with local farmers who are considering adding conservation practices to critical areas, and in portions of fields that might need some practices tweaked to perform better. Fifty-two of the 53 farmers in the program area, representing 8,400 crop acres, have had field walk-overs.

Phase 1, which began in spring 2010 with edge-of-field and in-stream monitoring, involved collecting data in three subwatersheds of the Root River: the south branch of the Root River headwaters, Crystal Creek and Bridge Creek.

The partnership came together eight years ago in an effort to answer questions about how farming practices affect the health of local rivers and streams in a watershed. The Root River watershed was chosen for its diversity, which includes glacial till, karst topography and bluff land.

To learn more about the program, its data and current work, see Pages 4-5.

Small watersheds tell big story

Varying fertilizer rates, timing

On the 60-acre tiled field of Wayne DeWall, Grand Meadow, Field to Stream staff, — in collaboration with CHS of Grand Meadow and funding from Minnesota Corn Growers — are monitoring various levels of nitrogen fertilizer to see if overall nitrate levels leaving the field will decrease.

During the wet growing season of 2013, nearly 50 pounds per acre of nitrate-nitrogen were lost from the tile monitoring station. In a normal year, that amount would be closer to 30 pounds.

The goal? To see if it is possible to reduce long-term N losses in DeWall's tile water by 20% through nitrogen application rate adjustment and split applications — all while maintaining yields and lowering input costs.

"I am learning that we can apply less, maybe 10% to 30% less, and still get really good yields," DeWall says. He appreciates being involved on the ground floor of watershed research. "We're already proving it's not as bad as some think," he adds.

To further reduce water pollution, DeWall may install edge-of-field grass strips to trap sediment and associated nutrients leaving his field in surface runoff.

BY **PAULA MOHR**

AROUND 80 miles as the crow flies, west to east, over the three most southeastern counties of Minnesota — Mower, Fillmore and Houston — farmers, state agency staff and others in tune with water quality efforts have been working together to better understand how farming practices affect local waters.

With six years of baseline field and stream monitoring data now in hand, those involved with the Root River Field to Stream Partnership can target conservation efforts to areas where the most sediment, nitrogen and phosphorus have been leaving the landscape. Ongoing monitoring will help scientists evaluate the effectiveness of conservation practices before and after the practices are installed.

The partnership came about eight years ago as ag water quality discussions became heated, recalls Kevin Kuehner, the Minnesota Department of Agriculture lead for the Field to Stream program.

"Comments kept coming up about how we needed better numbers and better science to understand how agricultural practices affect the health of local rivers and streams, and what's feasible with respect to obtaining clean water goals," Kuehner says. "To get those answers, we first needed detailed measurements from actual farm fields and small watersheds."

The Root River watershed came up in early discussions as a possible area for research, due to its size and geologic diversity. Encompassing around 1.06 million acres — a little smaller than the state of Delaware — the watershed contains glacial till, karst topography and bluff land.

Several entities came alongside MDA to work together, thus creating the Root River Field to Stream Partnership. Partners include the Minnesota Agricultural Water Resources Center, The Nature Conservancy and Monsanto. Clean Water, Land and Legacy Amendment funding and technical support are provided by Mower, Fillmore and Houston County Soil and Water Conservation District staffs.

The project was designed in two phases: the first, to accumulate data from edge-of-field and in-stream monitors; and second, to work with farmers in the watershed to install additional and/or update existing conservation practices.

Due to the diversity of farming practices and landscape, three small sub-

Looks deceiving

The Field to Stream cooperator who owns this field worked with Houston County SWCD and other agencies to enroll the field in the Conservation Reserve Program and plant it to pollinator habitat. That will happen after this growing season.

The field has challenging slopes ranging from 10% to 14% that direct flow into ravines that go directly to Bridge Creek. This field was assessed to be one of the highest runoff risks in the watershed, according to USDA conservation planning tools used by MDA.

New grass waterways will be shaped, and new water and sediment control structures will be installed this fall so the field will be ready for production after it comes out of CRP.

Goodbye, gully
This 26-acre field, planted to continuous corn grain and silage at Johnson Rolling Acres farm near Rushford, saw some serious erosion in 2013 and 2014 following heavy rains. The field averaged soil loss of 24 pounds per acre before a gully formed along the outside edge of an existing grass waterway.

After the gully formed, losses averaged more than 5,000 pounds per acre and highlighted the importance of maintaining existing conservation practices. This site emphasized the importance of grassed waterways in concentrated flow areas, and is why the partnership has focused so much time on this particular practice, explains Kevin Kuehner, MDA.

The field walk-over process found that more than 30% of the existing grass waterways in the study watersheds had similar gully features to the one that is being monitoring here. Owner Richard Johnson invested his own money in this grassed waterway that he had rehabilitated last fall. He also had another 6,000 feet of waterways built in other fields on his farm. Monitoring will continue for the next four years to measure the effectiveness of the new waterway.

Minnesota **NewsWatch**

Early adopter
Kent Dornink, Preston, who was one of the first farmers to participate in the Field to Stream project, serves on the stakeholder committee and farms in the Crystal Creek Watershed. He followed through on the suggestion to install an edge-of-field flume to learn what sediment and nutrients might be leaving his 96-acre field.

"I thought there wasn't anything leaving because the soil erosion isn't that bad," he says. However, with six years of monitoring data, he learned that there were times when his field was vulnerable to high sediment losses, especially when transitioning from hay to corn.

Through stalk nitrate testing, Dornink learned where to improve N management on his hog manure acres. He is back to split N applications, putting on less hog manure in the fall and supplementing with in-season N only if the field needs it. He also installed nearly 1,000 feet of new waterway in April on a high-priority field.

watersheds were selected for the study: the south branch of the Root River headwaters, located in glacial till in the western portion of the watershed, encompassing 2,778 acres with 14 farms; Crystal Creek, covering 3,728 acres in the center of the watershed, dominated by rolling hills and karst features, with 23 farms; and Bridge Creek, with 4,665 acres in the bluff land in the east region of the watershed, with 16 farms.

Water movement through the watershed is interesting. The Root River starts as a drainage ditch in Mower County and empties into the Mississippi River near Hokah. Near Forestville State Park, the river disappears underground and resurfaces at Mystery Cave near Preston.

"Surface water can become groundwater and groundwater can become surface water, all within a matter of hours," Kuehner says. "We've got [drainage] tile to the west, karst in the middle and steep bluff land in the east. Plus, there is sandy soil in the floodplain of the Root, and we have the highest annual precipitation in the state here."

The data collection phase wrapped up last year. Since this spring, Kuehner and project consultant Ron Meiners with Fillmore SWCD have been focusing efforts on working with landowners. Meiners, who recently retired after 25 years with the Root River SWCD, is responsible for doing field walk-overs and assessments on farms in the watershed. However, this time it's different for him.

"Before, landowners came through the office door when they needed help," Meiners says. "Here, with this program, we're going out to them, asking permission to walk their land and offering suggestions of things to install."

Fifty-two of the 53 farmers in the program's subwatersheds allowed Meiners to conduct field walk-overs on 8,400 crop acres. Walk-overs are a visual assessment of existing conservation practices, erosion and erosion potential. When Meiners visits with farmers, he takes detailed maps that show runoff risks based on land slope and where field runoff tends to flow and concentrate. Maps were developed by MDA staff using high-resolution elevation information and conservation planning tools developed by USDA's Agricultural Research Service.

During follow-up farm visits, Meiners offers a simple report, showing options for improving prioritized areas. Since starting, Meiners has helped identify more than 400 potential conservation practices, of which 88 projects are considered a high priority. In the first year of implementing practices, nearly 20 projects were completed in two of the three study watersheds, with an additional 20 planned for this fall and next spring.

"Some farmers received cost-share money, and some installed them on their own," Meiners adds. There have been challenges for some farmers with getting paperwork and cost-share lined up. Sometimes local soil and water office staffs have been overwhelmed by the increasing paperwork.

Still, it is well worth the time for farmers to seek some conservation financial assistance. "We've been offering up to 90% cost-share rates on most practices, which is pretty much a 'gimme,'" Meiners says.

Kuehner says recently awarded state Clean Water Legacy funding from the Board of Soil and Water Resources and the federal Environmental Quality Incentives Program will be available for the next three to four years.

"Our goal is to continue monitoring for an additional four to five years after practices are installed to measure how low we can practically cut our losses from these agricultural watersheds," Kuehner says. "This information will be valuable to farmers and watershed managers in the region. Just as important will be the lessons learned from the delivery phase of the project and the approach the partnership has taken."

Kuehner adds that overall, farmers in the watershed have a lot of practices on the land and are doing a good job.

"There is always room for improvement, though," he adds. "Let's address those most critical areas on farms now."

Having data in hand helps move the conservation discussion to the next level.

"All this local data elevates the conversation, and we can talk facts about what is actually happening," Kuehner says.

"I tell cooperating farmers that you need to know your runoff numbers like you do your crop yields, so you can share the information with other farm neighbors and non-farmers," he says. "Now more than ever is the time to have these conversations, and be proactive about practices for clean water."

Watershed outlet monitoring
Drainage to the Bridge Creek watershed outlet is 4,665 acres. The monitoring station is on a productive trout stream near Houston. Producers have installed many practices on their own, with 42 water/sediment storage structures and 16 miles of grass waterways.

With the rolling topography, sediment control basins are very popular, but many are more than 50 years old. Other water quality challenges in this watershed include high sediment and phosphorus concentrations during storm events, and there has been a 35% decrease in contour strip farming since 1991.

Goals for new conservation include rehabilitating about one-third of those existing waterways and structures, and adding 10 miles of new waterways and 10 new water/sediment structures.

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Crops

Observations from Root River Watershed

BY **PAULA MOHR**

DATA on rainfall and runoff were collected from field edges and in streams in each of the three subwatersheds in the Root River watershed from 2010-2015 under the Field to Stream Project (see pages 4-5).

Here are some of the numbers gathered during that time.

Rainfall and runoff

Rain in the region averaged 2% above the 30-year normal, with 36.2 inches of rain. The study has had a good mix of dry, normal and wet years. 2013 was the wettest year, with 47.6 inches of rain. Field runoff was six times higher in 2013, too, mainly due to high rainfall hitting early in the growing season.

On average, 7% of the annual precipitation ran off the study fields. Most rain soaked into the ground, was used by the crop or evaporated into the air. The amount was highly variable by site and year. For instance, in 2013, 15% to 23% of the precipitation received ran off the fields, while in 2012, the amount was less than 2%. Nearly 50% of the annual water volume occurred when the soil was frozen, typically in March.

More than 90% of the annual runoff water and associated sediments/nutrient losses occurred during just four months: March, April, May and June.

Field sediment loss

Average sediment loss was 1,288 pounds per acre, with loss ranging from 2 pounds to 8,457 pounds per acre per year. Eighty-seven percent of annual field loss occurred during certain storms in May and June.

Losing soil at a rate of more than 1,000 pounds per acre is a faster quantity than can be naturally replenished, says Kevin Kuehner, Minnesota Department of Agriculture soil scientist. Keeping it closer to 500 to 1,000 pounds per acre would be a good goal, especially if phosphorus is a concern for local receiving waters.

CHANGING TOPOGRAPHY: Here in the Bridge Creek subwatershed in eastern Fillmore County, the stream drops 380 feet in a little over 5 miles—similar to mountain stream gradients. Recent sediment fingerprinting studies indicate that 30% of the Bridge Creek watershed sediment comes from forested hillslopes and streambanks.

Field phosphorus loss

The average total P loss was 1.4 pounds per acre. Sixteen percent of P was lost in its dissolved form (not attached to sediment). Nearly 50% of the dissolved loss occurred when the ground was frozen.

Seventy percent P loss occurred in May and June, and was strongly correlated with sediment loss. With good soil conservation practices, P losses could be held at or below 1 pound per acre, Kuehner says.

Field nitrogen loss

The average total nitrogen loss was 10 pounds per acre in field surface runoff. When substantial soil loss occurred, total N loss exceeded 34 pounds per acre at one site in 2013.

However, most nitrogen was not detected in surface runoff, but detected as nitrate-nitrogen in tile drainage, springs, streams, river and groundwater — averaging 29 pounds per acre from a tile-drained field in Mower County, and as high as 41 pounds per acre during a wet year.

Stream/watershed loss

Annual nitrate-N losses measured in the stream ranged from nearly 50 pounds in the headwaters to less than 5 pounds per acre in Bridge Creek. Geology and land use explain some of the large differences. Statewide watershed goals are to cut total nitrogen loading by 20% by 2025, and have no more than 10% of the groundwater wells test about 10 mg/L of nitrate-N.

Stream sediment and P loss averaged about 40% of that observed from field edges. This indicates that existing downstream practices, such as grass waterways, sediment basins and other natural features, are likely trapping these materials, Kuehner adds.

During the six-year study, it was found that most soil loss occurred during a few days in May and June of each year, with only one or two years accounting for the vast majority of the loss. For instance, in the headwaters and Bridge Creek watersheds, up to 70% of the six-year sediment loss occurred during a very wet 39-day period in May and June 2013. By targeting critical source areas in these watersheds, the study will determine how much lower losses can be cut, Kuehner says.

Crystal Creek watershed had the lowest soil loss over the six-year monitoring period. That could be attributed to the large amount of existing practices, and one large sediment retention structure installed in the 1950s that treats more than 50% of the watershed land area, he adds.