

Advancing Agricultural Performance™

Environmental Programs

HOME

ENVIRONMENTAL
PROGRAMS

CEMSA

WATERSHED
PROGRAM

WATER QUALITY
MONITORING NETWORK

NEWSROOM

CONTACT US



ACWA Tile Line Bioreactor Installed

Agriculture's Clean Water Alliance (ACWA) has completed the installation of its first tile line bioreactor pilot project in Greene County in the Raccoon River watershed in central Iowa. The scope and scale of this bioreactor make it the largest known installation in the United States.

The ACWA bioreactor is constructed to remove nitrogen from the water flowing through the tile line. While there are mitigation practices that capture and filter surface water (e.g. wetlands and retention ponds), those practices can be costly and require taking land out of production. Bioreactor systems are easy to construct, relatively inexpensive, take little or no land out of production and are believed to require little maintenance over time. There are no adverse effects on crop production, and they can be designed to not restrict drainage.

Matt Helmers, an ag systems engineer with Iowa State University says the design is simple. "Nitrogen is highly water-soluble, so as water moves off the farm landscape, it carries nitrogen from the soil and fertilizer with it. This tile line bioreactor is essentially an underground trench or pit filled with a carbon source — in this case, wood chips. Water flowing through the tile line is redirected into the bioreactor's wood chips. Microorganisms colonize the wood chips and use them as a food source, break down the nitrate in the water, and expel it as a gas. Since the nitrogen is released as a gas, a bioreactor functions without becoming a sink for nitrogen."

Helmers estimates that 50 percent to 70 percent of total annual tile flow can be directed through this bioreactor. "It's a new enough technology that there are no design standards. Early research has found nitrogen removal efficiency averaging between 25 to 35 percent. That's one of our primary research questions — how to maximize the performance of the system and amount of water treated."

It's also a new enough technology that the process of nitrate removal in bioreactors remains a mystery. Scientists have not yet identified the specific identity and community dynamics of the microorganisms that participate in the denitrification in the bioreactors. Preliminary findings show that both bacterial and fungal species are important to the process. It is thought that the fungi break the cellulose in the wood into smaller organic molecules, which the bacteria then use in their metabolic processes. Part of the study of the ACWA bioreactor will include research to gain a better understanding of these details.

A satellite system will monitor the depth of water entering and leaving the structure. There will also be water samples pulled every week in the tile line, above and below the bioreactor itself in order to determine what nitrate reduction is occurring as water moves through the system.

ACWA will also observe nitrate levels in its water monitoring network above and below the site to evaluate the performance of the bioreactor and the impact it has on water in the stream. If the bioreactor shows potential to be a beneficial practice in the Raccoon River watershed, this site could become one of several integrated solutions and practices for improved water quality. Further study could help establish a bioreactor practice standard for public cost-share programs.

Dave Coppess of Heartland Co-op is president of ACWA, a group of ag retailers organized to reduce nutrient loss from farm fields in the Raccoon and Des Moines River watersheds. Coppess says ACWA is providing a share of the funding for the bioreactor project as a natural extension of the ACWA mission. "The installation of the bioreactor here signals an exciting transition for ACWA. With this project, we're moving from collecting data and investigating solutions to doing actual project implementation and scientific research.

"Those of us who work in agriculture want others to know that we are focused on finding solutions to water quality issues, taking those solutions to farmers and implementing them," says Coppess. "We recognize there is a lot more to do, and we feel that it's going to take a commitment to total watershed management to get the job done. But that's our ultimate objective — to keep nutrients from getting into the water."

Roger Wolf is director of Environmental Programs for the Iowa Soybean Association, and serves as executive director for ACWA. Wolf says the successful installation of the ACWA bioreactor is the result in a broad partnership effort. "There are many people involved, but ACWA and Sand County Foundation have led the way by sharing the cost of this project. Iowa's crop production system is highly dependent on organically rich soils and drainage, so addressing tile drainage is a critical element of addressing water quality, especially in regard to nitrates."

"It's important that we acknowledge all of our partners who have worked so hard on making this a reality — from our contractor John Pemble of Pemble Digging & Drainage Service Inc., and his crew, who did a great job working on a different kind of project, to the Sand County Foundation, who shared the cost of installation with ACWA. We also want to thank Greene Soil and Water Conservation District, Iowa State University, the City of Perry (donation of wood chips), but especially Mike Bravard, the farmer who provided us the opportunity to put this project on a working farm landscape.

Joe Britt, Sand County Foundation, says the Sand County Foundation works on agricultural conservation projects worldwide. "Our goal is to help people everywhere improve environmental management of privately-owned land. We can only meet our goal if we concurrently keep those lands productive and profitable for agriculture. That's why we jumped at the opportunity to partner with ACWA and the Iowa Soybean Association to install this working demonstration of a bioreactor. This kind of project puts ACWA and the Iowa Soybean Association far, far

ahead of anyone in the country in terms of action taken to improve the environment around ag and it's our hope that it sets an example that other farm organizations will follow."

Kevin Kordick, Greene County district conservationist, helped with site selection and helped coordinate its installation. Kordick said that reducing nitrate has been a priority for the district for a long time. "Most of the projects we have done emphasize improving water quality. One of the things we we hope for is that enough research data comes out of this project to establish an NRCS interim standard and specification so that this practice can be cost-shared in the future," says Kordick.

This is the first ACWA bioreactor installation. There are several more installations funded and planned for the Raccoon River and Des Moines River watersheds.

