AGRICULTURE'S CLEAN WATER ALLIANCE

CURRENT PROJECTS

Each year provides new and exciting challenges and project opportunities — 2014 was no exception. Throughout the year, Agriculture's Clean Water Alliance (ACWA) had the opportunity to host a farm tour, participate in nationwide dialogues about water quality, continue all-important water monitoring efforts and complete the Cooperative Conservation Partnership Initiative.

SMELTZER FARM TOUR

The need to raise awareness and educate farmers and key stakeholders on conservation practices is of paramount importance. In light of this need, ACWA partnered with the Webster County Conservation Board to host a field day at the Smeltzer Farm in early August. The Smeltzer Farm was selected because it provided a physical example of key conservation practices, including water monitoring, a restored oxbow and a bioreactor. ACWA invited local farmers, media, politicians, partners and stakeholders to take part in the field day highlighting these practices. About 50 people, including Iowa Rep. Helen Miller of Fort Dodge, gathered for the event and engaged in an informative program. Many questions were asked and new approaches were discussed at the event. Farm-News and Wallace's Farmer printed stories and photos detailing the tour and conservation practices. KWMT also conducted on-site interviews at the event.

ONE WATER: MISSISSIPPI RIVER NUTRIENT DIALOGUES

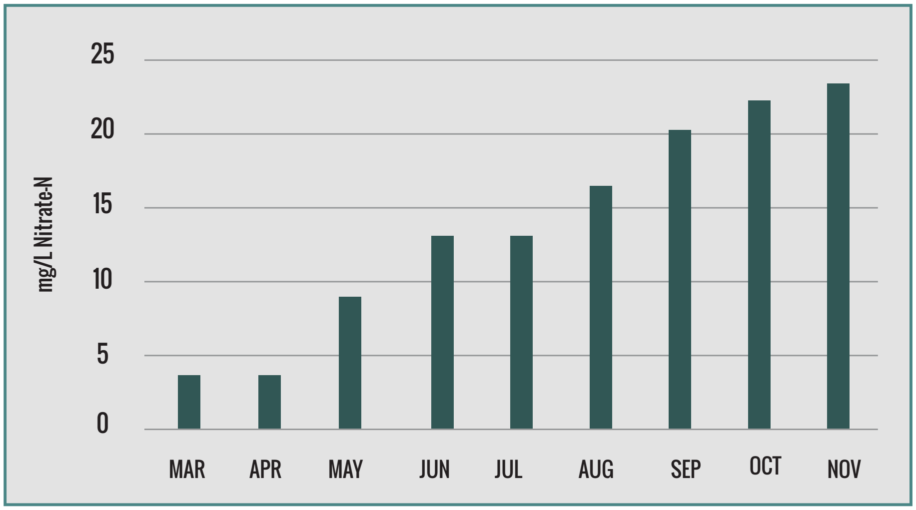
In the water quality conversation, municipal utilities are a key audience for communication and engagement. It often can be difficult for agriculture to connect with this audience and unfortunately sometimes the two end up on opposing sides. This is disappointing because fundamentally both groups want clean water and are dedicated to taking action required to protect and improve the water vital to everyone. The Mississippi River Nutrient Dialogues brought together representatives from these key stakeholder groups and fostered an environment where conversations essential to success could occur. The dialogues took place throughout two years and culminated at the One Water conference in Kansas City in September where participants — including Harry Ahrenholtz and Roger Wolf of ACWA — presented the idea of Watershed Protection Utilities. The idea would create organizations focused on cost-effective results that bring together farmers upstream and water consumers downstream in order to identify infrastructure

and conservation practices that would holistically address the issue of protecting and maintaining a clean and sustainable water source, and ultimately create a funding source to support the implementation of needed actions. The idea was well received by conference attendees and the discussion resulted in the development of a working group to advance the idea into a real-world trial. Progress from the workgroup is on-going.

WATER MONITORING

Water monitoring, a core ACWA principal, helps determine the current condition of rivers and streams and evaluate results of applied conservation practices. ACWA completed its fifteenth year of water monitoring in 2014. A total of 1,621 samples were analyzed for nitrate-nitrogen and turbidity, and several hundred more were analyzed for coliform bacteria, alkalinity and total organic carbon.

Figure 1. Average Nitrate-N of All ACWA Samples



This past year was quite unusual in the record. In the course of a year, nitrate concentrations tend to oscillate from low (winter) to high (spring) to low (summer) to high (autumn) as the calendar progresses. Deviating from the norm, nitrate concentrations started low in 2014 and steadily climbed as the year progressed (Figure 1). This is a reflection of the year starting out relatively dry, followed by heavy rains in June, August and September. This kept tiles flowing through the summer and fall, and we know the proportion of river flow that is tile flow controls the concentration of stream nitrate.

COOPERATIVE CONSERVATION PARTNERSHIP INITIATIVE WRAPS UP

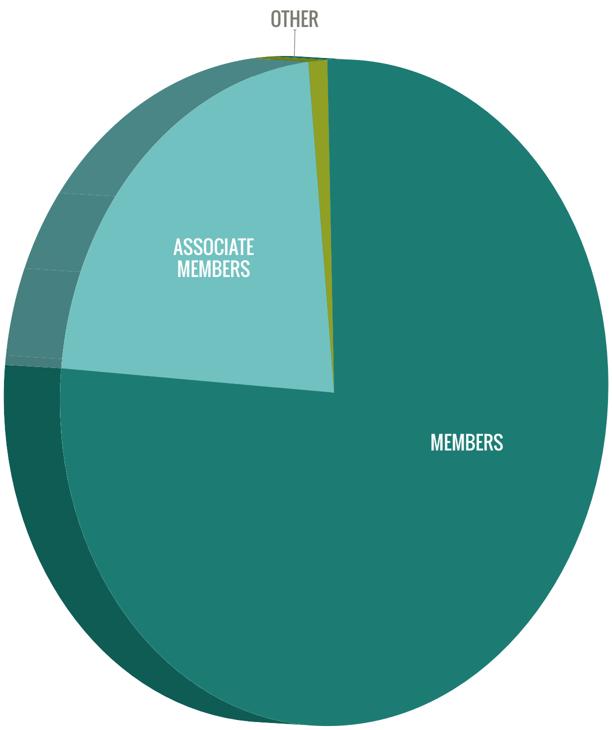
2014 marked the end of the four-year Cooperative Conservation Partnership Initiative (CCPI) titled “Adoption of Nutrient Management Technology Enhancements in Targeted Iowa Watersheds” that ACWA administered as part of the USDA Natural Resources Conservation Service’s (NRCS) Mississippi River Basin Initiative (MRBI). The project encouraged farmers to implement nutrient management technology enhancements that help avoid, control, trap and treat nutrient runoff from agricultural land. Through the project, farmers were encouraged to apply nitrogen stabilizers in the fall and spring to maximize nutrient efficiency and protect surface and ground water, provided tools and information needed to complete nutrient management plans and assisted with documenting the use of nutrient applications and stabilizer use.

Altogether the ACWA CCPI project brought almost $400,000 to work on more than 5,000 acres in the Boone and North Raccoon River basins, thanks in large part to ACWA efforts. ACWA members in the project area were actively involved in communicating and promoting the project to their agronomic staff and farmer customers. ACWA members shared project information and encouraged farmers to participate via sales teams, informational meetings and area NRCS staff. Water monitoring data provided by ACWA played a key role by identifying areas within the larger watersheds to focus project efforts.

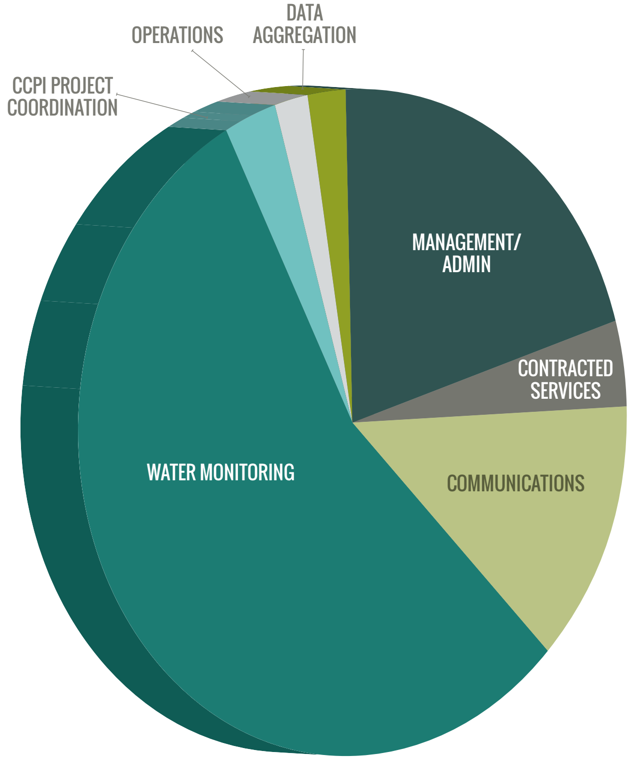
ACWA TOTAL REVENUE				
TYPE	2001-2014	2001-2014	2015	2015
MEMBERS	$2,493,053.00	91.27%	$273,569.00	77%
ASSOCIATE MEMBERS	$155,000.00	5.67%	$80,000.00	22%
GRANTS	$80,000.00	2.93%	$-	0%
OTHER	$3,600.00	0.13%	$3,600.00	1%
TOTAL REVENUE	$2,731,653.00	100.00%	$357,169.00	100%

ACWA TOTAL EXPENSES				
TYPE	2001-2014	2001-2014	2015	2015
MANAGEMENT/ADMIN	$559,767.00	21.53%	$56,700.00	21%
CONTRACTED SERVICES	$61,363.00	2.36%	$9,809.00	4%
COMMUNICATIONS	$278,652.00	10.72%	$36,450.00	13%
WATER MONITORING	$1,294,418.00	49.80%	$149,000.00	55%
WAGES	$51,376.00	1.98%	$-	0%
MCKNIGHT SCIENCE TEAM	$80,000.00	3.08%	$-	0%
CCPI PROJECT COORDINATION	$87,500.00	3.37%	$7,500.00	3%
AMORITIZATION/ DEPRECIATION	$49,599.00	1.91%	$-	0%
BIOREACTOR	$54,441.00	2.09%	$-	0%
OPERATIONS	$82,268.00	3.16%	$5,492.00	2%
DATA AGGREGATION	$-	0.00%	$4,634.00	2%
TOTAL EXPENSES	$2,599,384.00	100.00%	$269,585.00	100%

ACWA TOTAL REVENUE



ACWA TOTAL EXPENSES



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The Iowa Soybean Association

TARGETED WATERSHED PROJECTS

In 2014, ACWA supported four targeted watershed projects — Boone River Water Quality Initiative, Lyons Creek Watershed Project, Lizard Creek Watershed Planning Project and Black Hawk Lake Watershed Project — through water monitoring activities as well as education and outreach.

BOONE RIVER WQI

State funded Water Quality Initiative (WQI) project supporting implementation of the Iowa Nutrient Reduction Strategy. ACWA supports water monitoring throughout the Boone River Watershed going back to 2007. Historical water monitoring data helps local partners prioritize focus in specific subwatersheds as well as determine how agricultural practices influence water quality at various scales including field, subwatershed and basin scale. This WQI supports farmers' implementation of nutrient reduction practices on working farms including in-field nutrient management and edge-of-field practices such as bioreactors.

LYONS CREEK WATERSHED

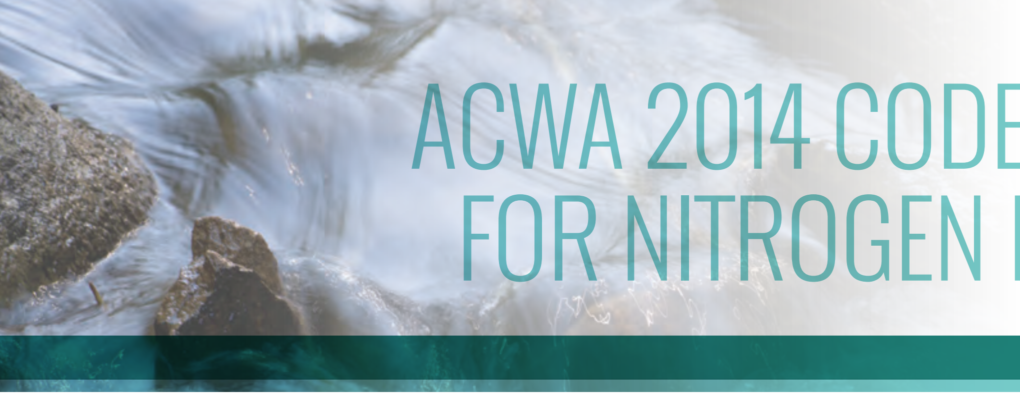
Long-term targeted watershed project located within the Boone River. An Iowa Department of Natural Resources/Environmental Protection Agency approved watershed management plan was completed for this watershed. Several grants and projects have been awarded to the watershed, including Clean Water Act Section 319 and Mississippi River Basin Initiative funding. ACWA along with other partners support ongoing water quality monitoring throughout the watershed, providing a baseline profile of water quality and hydrology within three microwatersheds and at the mouth of Lyons Creek.

LIZARD CREEK WATERSHED

The Webster County Soil and Water Conservation District utilizes ACWA monitoring support in the Lizard Creek Watershed Planning Project, including analysis for nitrate and ortho-phosphorus. Local leaders are working to advance a targeted project for the Lizard Creek Watershed.

BLACK HAWK LAKE WATERSHED

Historical ACWA water monitoring data documented blue-green algae flowing into the Raccoon River from discharge of Black Hawk Lake. As a state owned and managed recreational lake, Black Hawk Lake and its watershed are state and local priorities with a history of water quality challenges primarily due to sedimentation and phosphorus. A watershed plan was developed and various state and federal water quality programs are used by farmers in the watershed to improve runoff conditions. Practices include soil conservation through reduced tillage or no-till, cover cropping systems, grassed waterways, nutrient management and edge-of-field or landscape treatment practices like constructed treatment wetlands.



ACWA 2014 CODE OF PRACTICE FOR NITROGEN FERTILIZATION

PURPOSE:

To establish reasonable and practicable guidelines for nitrogen fertilization applications to reduce nitrate loss from farm fields.

WHY:

Effective management of nutrients on farms in the watershed is one of the keys to enhancing both environmental quality and profitable crop production. Consistent with the Iowa Nutrient Reduction Strategy, this Code of Practice provides information about guidelines adopted by the ACWA members as a condition of membership.

APPLICATION GUIDELINES:

1. A nutrient budget for N, P and K shall be developed that considers all potential sources of nutrients including manure, legumes, etc. Nutrient recommendations shall be based on current soil test results, realistic yield goals, environmental impact and producer management capabilities.
2. Use the standardized county temperature and forecast maps found at http://extension.agron.iastate.edu/NPKnowledge/ as part of the decision-making process for fall fertilizer application.
3. Delay fall anhydrous applications without a nitrification inhibitor until soil temperatures are:
   - 50° F, trending lower
   - Notify Association office of start of application for accountability documentation - email record to mwhitcomb@isamanagementsolutions.com.
4. Encourage use of other nutrient management technologies such as stabilizers, slow release fertilizers, incorporation or injection, soil nitrate testing and other technologies that minimize loss to surface or ground water resources.
5. If producer is participating with USDA Conservation Programs additional considerations for producer conformance with NRCS 590 Nutrient Management Standard shall be followed. For guidance and requirements see standard: Iowa Nutrient Management Conservation Practice Standard Fact Sheet - What's New That Affects You in the Iowa 590 Standard?
6. Encourage use of other supporting practices where feasible:
   - Tile line denitrification bioreactor
   - Constructed wetland
   - Conservation stream buffer
   - Fall cover cropping system

IOWA NUTRIENT REDUCTION STRATEGY

In 2013, the Iowa Nutrient Reduction Strategy was adopted to move the state toward an overall 45 percent reduction in nitrogen and phosphorous loss. The plan, which was spurred by the 2008 Gulf Hypoxia Action Plan, set the goal of reducing nitrogen loss by 41 percent and phosphorous loss by 29 percent for nonpoint sources — including agriculture.

In order to achieve this goal, a variety of approaches and practices were identified for implementation across Iowa's farmland. Practices outlined in the plan include cover crops, land use changes, edge-of-field practices and nutrient management to help make the goal a reality.

As Iowa agriculture works to accelerate the pace and scale of voluntary practice implementation and adoption, an understanding of the impact of these practices is critical for all involved.

A valuable first step is to understand the categories individual practices fall into:

- **Management practices** are any activity that changes the approach to management of crop production including the timing and method of nutrient application and the use of cover crops or reduced tillage.
- **Land use practices** include ways agriculture is adjusting the utilization of specific types or plots of land in order to better fit the environment including perennial energy crops, extended rotations, grazed pastures and land retirement.
- **Edge-of-field practices** are those activities that can be placed next to or on the field border to mitigate unwanted affects and include drainage water management, wetlands, bioreactors, buffers, terraces and sediment control.

A science assessment was conducted during the development of the strategy to identify effective nutrient reduction practices in these three categories — nitrogen and phosphorus management, land use and edge-of-field. See the charts originally provided in the Iowa Nutrient Reduction Strategy on the following pages to gain an understanding of the ability of specific practices to reduce nitrogen and phosphorous loss.

Knowledge of the projected reduction can be a key factor to helping farmers identify the practices that will ultimately help them reach their individual goals for reduction.

IOWA STRATEGY TO REDUCE NUTRIENT LOSS: NITROGEN PRACTICES[1]

	PRACTICE	COMMENTS	% NITRATE-N REDUCTION +
			AVERAGE (SD*)
EDGE-OF-FIELD	**Drainage Water Mgmt.**	No impact on concentration	33 (32)
	Shallow Drainage	No impact on concentration	32 (15)
	Wetlands	Targeted water quality	52
	Bioreactors		43 (21)
	Buffers	Only for water that interacts with the active zone below the buffer. This would only be a fraction of all water that makes it to a stream.	91 (20)
	Saturated Buffers	Divert fraction of tile drainage into riparian buffer to remove Nitrate-N by denitrification.	50 (13)
LAND USE	**Perennial**	Energy Crops – Compared to spring-applied fertilizer	72 (23)
		Land Retirement (CRP) – Compared to spring-applied fertilizer	85 (9)
	Extended Rotations	At least 2 years of alfalfa in a 4 or 5 year rotation	42 (12)
	Grazed Pastures	No pertinent information from Iowa – assume similar to CRP	85
NITROGEN MANAGEMENT	**Timing**	Moving from fall to spring pre-plant application	6 (25)
		Spring pre-plant/sidedress 40-60 split compared to fall-applied	5 (28)
		Sidedress – Compared to pre-plant application	7 (37)
		Sidedress – Soil test based compared to pre-plant	4 (20)
	Source	Liquid swine manure compared to spring-applied fertilizer	4 (11)
		Poultry manure compared to spring-applied fertilizer	-3 (20)
	Nitrogen Application Rate	Nitrogen rate at the MRTN (0.10 N:corn price ratio) compared to current estimated application rate. (ISU Corn Nitrogen Rate Calculator – http://extension.agron.iastate.edu/soilfertility/nrate.aspx can be used to estimate MRTN but this would change Nitrate-N concentration reduction)	10
	Nitrification Inhibitor	Nitrapyrin in fall – Compared to fall-applied without Nitrapyrin	9 (19)
	Cover Crops	Rye	31 (29)
		Oat	28 (2)
	Living Mulches	e.g. Kura clover – Nitrate-N reduction from one site	41 (16)

+A positive number is nitrate concentration or load reduction and a negative number is an increase.
*SD = standard deviation. Large SD relative to the average indicates highly variable results.
[1]Source: Iowa Nutrient Reduction Strategy Nitrogen Practices Assessment https://store.extension.iastate.edu/Product/Reducing-Nutrient-Loss-Science-Shows-What-Works

IOWA STRATEGY TO REDUCE NUTRIENT LOSS: PHOSPHORUS PRACTICES[1]

	PRACTICE	COMMENTS	% P LOAD REDUCTION[+]
			AVERAGE (SD*)
EROSION CONTROL PRACTICES	**Terraces**		77 (19)
EROSION CONTROL PRACTICES	**Buffers**		58 (32)
EROSION CONTROL PRACTICES	**Control**	Sedimentation basins or ponds	85
LAND USE CHANGE	**Perennial Vegetation**	Energy Crops	34 (34)
LAND USE CHANGE	**Perennial Vegetation**	Land Retirement (CRP)	75
LAND USE CHANGE	**Perennial Vegetation**	Grazed pastures	59 (42)
PHOSPHORUS MANAGEMENT PRACTICES	**Phosphorus Application**	Applying P based on crop removal – Assuming optimal STP level and P incorporation	0.6[a]
PHOSPHORUS MANAGEMENT PRACTICES	**Phosphorus Application**	Soil-Test P – No P applied until STP drops to optimum or, when manure is applied, to levels indicated by the P Index[b]	17[c]
PHOSPHORUS MANAGEMENT PRACTICES	**Source of Phosphorus**	Liquid swine, dairy, and poultry manure compared to commercial fertilizer – Runoff shortly after application	46 (45)
PHOSPHORUS MANAGEMENT PRACTICES	**Source of Phosphorus**	Beef manure compared to commercial fertilizer – Runoff shortly after application	46 (96)
PHOSPHORUS MANAGEMENT PRACTICES	**Placement of Phosphorus**	Broadcast incorporated within 1 week compared to no incorporation, same tillage	36 (27)
PHOSPHORUS MANAGEMENT PRACTICES	**Placement of Phosphorus**	With seed or knifed bands compared to surface application, no incorporation	24 (46)
PHOSPHORUS MANAGEMENT PRACTICES	**Cover Crops**	Winter rye	90 (17)
PHOSPHORUS MANAGEMENT PRACTICES	**Tillage**	Conservation till – Chisel plowing compared to moldboard plowing	33 (49)
PHOSPHORUS MANAGEMENT PRACTICES	**Tillage**	No till compared to chisel plowing	90 (17)

[+]A positive number is P load reduction and a negative number is increased P load.
[*]SD = standard deviation. Large SD relative to the average indicates highly variable results.
[a]Maximum and average estimated by comparing application of 200 and 125 kg P_2O_5/ha, respectively, to 58 kg P_2O_5 /ha (corn-soybean rotation requirements) (Mallarino et al., 2002).
[b]ISU Extension and Outreach Publication (PM 1688)
[c]Maximum and average estimates based on reducing the average STP (Bray-1) of the two highest counties in Iowa and the statewide average STP (Mallarino et al., 2011a), respectively, to an optimum level of 20 ppm (Mallarino et al., 2002). Minimum value assumes soil is at the optimum level.
[1]Source: Iowa Nutrient Reduction Strategy Phosphorus Practices Assessment https://store.extension.iastate.edu/Product/Reducing-Nutrient-Loss-Science-Shows-What-Works

EDGE-OF-FIELD PRACTICES

The Iowa Nutrient Reduction Strategy sets an aggressive goal for agriculture to reduce its nitrogen loss by 41 percent to meet the overall reduction of 45 percent. Nutrient management, cover crops, land use changes and edge-of-field practices are listed as ways to achieve this reduction.

While working with current production methods, edge-of-field practices show the biggest impact potential with more consistent performance in terms of nitrogen reduction. Edge-of-field practices targeted to reduce nitrogen from field tiles reaching streams often include bioreactors, Conservation Reserve Enhancement Program (CREP) wetlands, drainage water management and saturated buffers. Table 1 describes potential locations and impacts of conservation drainage practices and three edge-of-field practices.

TABLE 1. CONSERVATION DRAINAGE OPTIONS.

PRACTICE	LOCATION PRACTICE APPLIES	N REMOVAL % AVERAGE CONCENTRATION (SD*)[+]	CHALLENGES
Drainage Water Management (DWM)	Flat fields with 0.5%-1% grades. Can be installed on new tile or retrofitted to existing systems.	33 (32)	Difficult to retrofit unless previous tile was installed along field contours.
Shallow Drainage	New tile installations or when splitting lateral spacing.	32 (15)	Requires closer lateral spacing, increasing the cost compared to conventional.
Bioreactor	30-100 acre drainage areas with 6 in.-10 in. tiles. Not recommended for smaller drainages.	43 (21)	No economic benefit and requires periodic management.
Saturated Buffer	Non-incised channel and 30 ft. buffer minimum.	50 (13)	Site specific and minimal performance data.
CREP Wetlands	0.5%-2% wetland to drainage area and minimum 500 acre drainage area.	52	Large footprint and design time.

[*] SD = standard deviation
[+] Iowa Nutrient Reduction Strategy Nitrogen Reduction Practices Assessment

BIOREACTORS

Nitrogen in the form of nitrate is highly water-soluble and can be lost from the farm landscape as water moves through the soil profile and into tile systems.

A bioreactor is constructed to remove nitrate from tile systems, and is essentially an underground pit of woodchips. Water flowing through the tile line is redirected into the bioreactor's woodchips. Microorganisms colonize the woodchips and use them as a food source, convert the nitrate and expel it as nitrogen gas. Since the nitrogen is released as a gas, a bioreactor functions without becoming a sink for nitrogen.

Bioreactor systems are easy to construct, cost effective, take little or no land out of production and require minimal maintenance. When managed correctly, there are no adverse effects on crop production, and they are designed to avoid unwanted drainage restriction.

Iowa State University research estimates that 50-70 percent of total annual tile flow can be directed through a bioreactor. Iowa Soybean Association research has documented nitrate removal efficiency between 20-60 percent from on-farm bioreactors.

SATURATED BUFFERS

A saturated buffer removes nitrate from field tiles by intercepting the tile at the edge of the field and redistributes the water through the carbon-rich soil profile of the buffer or filter strip where denitrification occurs. A control structure is used to raise the water table and force the water through the lateral distribution lines, but allows water to bypass if the saturated buffer is at capacity.

Initial results indicate saturated buffers can remove nearly all of the tile water nitrate distributed through the system, and is only limited by the amount of water that bypasses. Annual nitrate load reductions of more than 60 percent have been reported.

OXBOWS

Oxbows are a meander of a river that has been cut off from present flow of water either by the process of a river's natural movement or as a result of channel straightening. Most oxbows are well suited to restoration because the land is usually marginal and not conducive for crop production.

Functioning oxbows provide numerous benefits to people including water filtration and flood storage. Oxbows also create habitat for wildlife, particularly birds, fish and amphibians. The slow-moving water found in oxbows is critically important for the endangered Topeka shiner, a minnow that requires off-channel habitat to complete its life cycle.

DRAINAGE WATER MANAGEMENT

The purpose of drainage water management (DWM) is to manage the water table with control structures to reduce drainage during periods when it is not needed. Water may be stored in the soil profile to be made available to the crop during portions of the year when water is scarce. Research by Skaggs et al. 2012 has reported 18-75 percent nitrate load reduction, based on system design, location, soil and site conditions. DWM nitrate load reductions are a result of reduced flow volumes.

CONSERVATION RESERVE ENHANCEMENT PROGRAM WETLANDS

The Conservation Reserve Enhancement Program (CREP) is a coordinated state and federal government financial assistance program available for farmers to establish constructed nutrient treatment wetlands. Iowa CREP wetlands collect tile water in a vegetated shallow pool to promote denitrification and vegetative assimilation of nitrogen as well as provide wildlife habitat. Nitrogen reduction varies based upon the size of wetland relative to its drainage or watershed area. According to the Iowa Nutrient Reduction Strategy, constructed nutrient treatment wetlands in Iowa have averaged 52 percent nitrate concentration reduction. CREP wetlands are strategically placed to provide the most water quality benefit — typically lower in the watershed landscape where the watershed feeds into the receiving stream or river. Through this positioning, wetlands receive a larger volume of tile water and correspondingly trap and treat more nitrate before the water moves downstream. CREP wetlands are placed in a position to not impede upslope drainage, but the wetland itself may remove land from production.

In order for the Iowa Nutrient Reduction Strategy to be successful, edge-of-field practices need to play a vital role. Research and dissemination of information regarding the effectiveness of both proven and innovative practices will be essential to future success.