ACWA

Agriculture's Clean Water Alliance

MONITORING

NO_3

DATA ANALYSIS

Leadership Through Partnership and Science

2006 Progress Report

The ACWA mission: **To reduce the nutrient loss – specifically nitrate – from farm fields and to keep the nutrients from entering the Raccoon River and its tributaries.**

ACWA – investing in data; science

Brent Bunte
President ACWA,
New Coop, Inc.

Just as data has always been at the foundation of proving agronomic performance, so will it be the foundation of proving environmental performance.

As ACWA members, we see every day how our industry is working hard to meet environmental standards. One of the things we've done as an organization is recognize the importance of water quality monitoring and the collection of agronomic and environmental data. Without data, you cannot measure agronomic and environmental performance.

So, over the past couple years, ACWA has voluntarily invested in the gathering of data to evaluate the environmental condition of the Raccoon River Watershed.

We did it because we felt that these efforts would be a critical first step in addressing environmental issues. Without scientifically-sound linkages between changed management practices on the field, we're taking shots in the dark at improving water quality for Iowans.

Just as data has always been at the foundation of proving agronomic performance, so will it be the foundation of proving environmental performance.

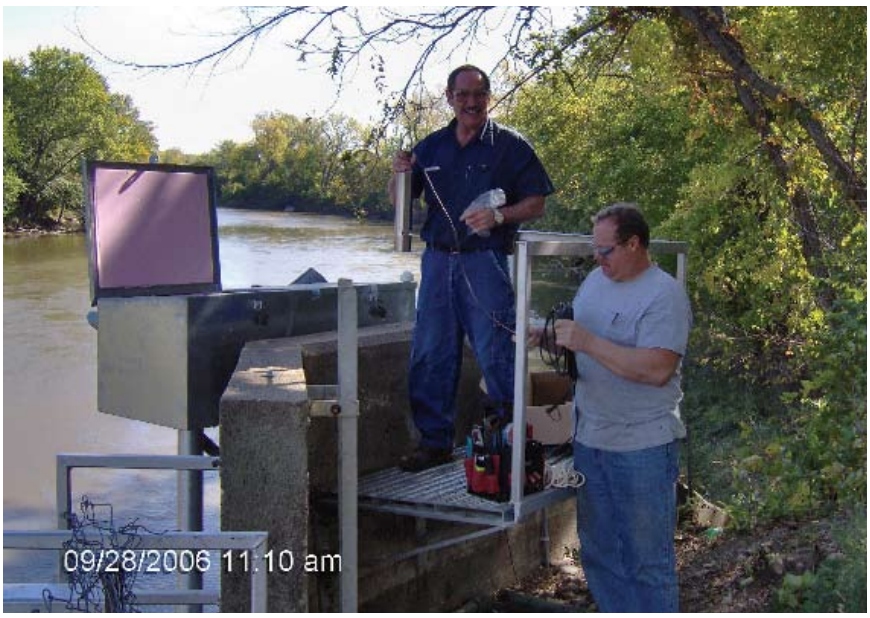
As we collect this information, we also think it is important to reach out to the people in our communities and in our watersheds, and tell them what we've learned about the complex relationships between agronomy, hydrology, economics and the environment. The entire story is not easy to understand.

We're learning a lot as experts begin to stitch together the complex relationships of agriculture, soil and water. We're generating a large quantity of data and offering new ideas about the issue of water quality as we move forward.

What ACWA has accomplished in water monitoring as a private-sector, smaller scale project has had tremendous impact. We're leading the way in our watershed, and we're growing our expertise in understanding what it's going to take to achieve environmental performance.

We've done this work because we believe that it's our responsibility to help facilitate comprehensive watershed planning as part of the services we offer.

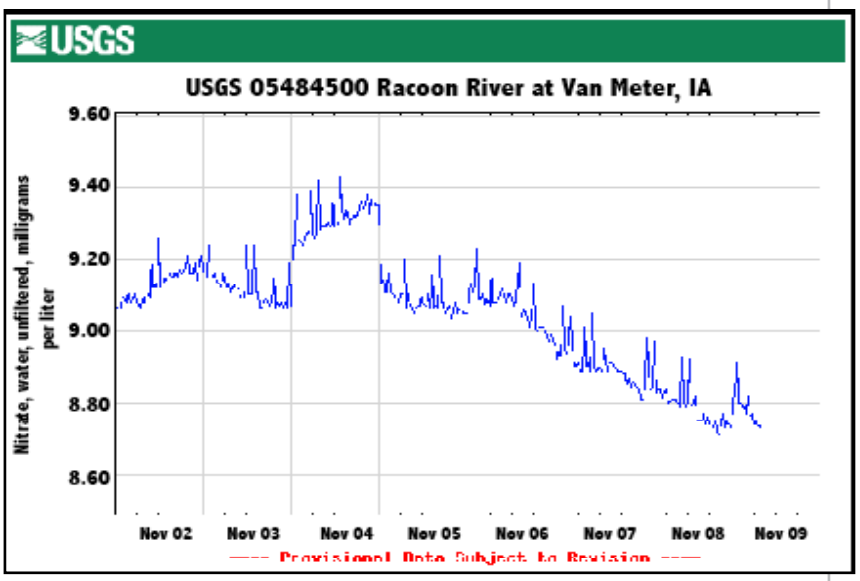
Brent Bunte,
President, ACWA



ACWA, partners monitor nitrate levels in Raccoon River

Thanks to a cooperative project between Des Moines Water Works, the Iowa Department of Natural Resources, the U.S. Geological Survey and ACWA, a remote monitoring device has been installed near the Van Meter bridge, just downstream from the confluence of the North, Middle and South branches of the Raccoon. Below you will find an Internet link to the 24/7 nitrate monitor. This monitor provides up-to-the-minute nitrate readings in the Raccoon River. This location has scientific importance because nitrate readings can be evaluated along with USGS flow data, for which there is nearly a 100-year record. This is also the beginning of the stretch of the river defined as “impaired” for nitrate. ACWA purchased the device for $10,000; IDNR has pledged $2,000 toward its operation and maintenance, and the Des Moines Water Works lab and maintenance staff will maintain and calibrate the device periodically. The device should work through the winter as long as flow in the the river stays high enough. You can see the current readings at:

http://waterdata.usgs.gov/ia/nwis/uv?05484500



Real time data graph from the Van Meter Monitoring site

Making our water drinkable

Chris Jones
Des Moines Water Works

At the Des Moines Water Works, nitrate means more to us than meets the eye. When nitrate levels in the Raccoon get very high, it causes us to use the Des Moines River more than we would like. For various reasons, water from the Des Moines is more expensive to treat from an energy and chemical perspective. Nitrate also causes green and blue-green algae blooms which cause taste and odor problems. In fact, we had a very bad taste and odor event the beginning of June, the worst in my tenure at DMWW.

In 2006, we saw extremely high wintertime nitrate levels in the Des Moines River, followed by some very high numbers in April and May in the Raccoon River, when it topped out at 18.7 mg/L — the highest reading measured at Fleur Drive since 1979. But with the dry weather, nitrate levels dropped earlier than usual this summer. Because of the dry weather, I suspect that 2006 will not be an extraordinary year for average nitrate levels when all is said and done.

Data from the main-stem river shows the proportion of river flow from tile lines continues to increase. Average nitrate concentrations are steady to inching up, but the loads seem to be trending downward. To me, that says more tile water and less runoff. I really think the shallow groundwater throughout the watershed has about 10 mg/L of nitrate year-round, which would explain the high wintertime nitrate levels. There has been a tendency to blame high wintertime nitrate on fall application of nitrogen (N), but I believe it is due to high groundwater nitrate, a condition that has evolved over several decades.

How does that all fit into historical terms or what would be considered 'normal?' And how do we get to a place where we all agree we've succeeded? I'm sure pre-settlement nitrate levels may have averaged below 1 mg/L. Now we see over 8 mg/L. Prior to World War II and application of chemical N, it's pretty clear we had episodes of around 8 mg/L, and I suspect annual averages were in the 3-4 mg/L range.

So, knowing that, what's acceptable? Frankly, I think that's a political question. From a drinking water perspective, I guess we would be pleased if nitrate levels never exceeded 10 mg/L. But from the hypoxia perspective, I think you are talking about levels much lower, probably in the 3-4 mg/L range.

For our purposes, what happens upstream in the watershed is critical to water quality here, and critical to our customers — 1/6 of Iowa's population. Our water customers depend on agriculture for jobs too. Many of them work for companies like Pioneer, John Deere, Farm Bureau, etc. So they recognize that it is in the best interest for everyone involved to improve water quality in the watershed while at the same time doing everything it takes to maintain a vigorous farm economy.

So from our perspective, what does the issue of water quality mean for farmers in the watershed?

People in agriculture are no different than anybody else. They want to earn an honest living, and have their work leave behind a legacy of some sort. I think most people want that legacy to be something they can be proud of.

Farmers and those who depend on them are going to have to face the facts. To be a viable, long-term enterprise that looks to operate well into the 21st century, the industry is going to have to demonstrate that it is operating in an environmentally-responsible manner — they're going to have to demonstrate environmental performance.

Organizations like DMWW face many of the same challenges as farmers, and we've learned that, environmental considerations aside, pollution means waste and lost profits — it's that plain and simple.

In light of that, ACWA is more important than ever, both for farmers and for urban communities. Consumers increasingly demand a 'high quality' product. And more than ever, people are informed – they can access information and look at data. Frankly, I think many people are going to move beyond just nitrate, as they do that, they will want to know what else is there.

Increasing awareness is going to be job one. So I think we're going to have to continue monitoring and measuring, so that we have some information to talk about. And we're going to have to find ways to make the system perform environmentally, so we have successes to talk about. And along the way, we're going to have to communicate with the public about the complexities of the system.

We're also going to have to work at making people aware of the problem from a 'watershed perspective.' We need to make sure that people know that the little creek in the back yard (and everything in it), goes somewhere and that it can really affect people. That little creek is where it all starts.

To be a viable, long-term enterprise that looks to operate well into the 21st century, the industry is going to have to demonstrate that it is operating in an environmentally responsible manner — they're going to have to demonstrate environmental performance. In light of that, ACWA is more important than ever, both for farmers and for urban communities.

Water quality monitoring data in 2006

Dr. Jerry Hatfield
National Soil Tilth Laboratory

The 2006 ACWA water quality monitoring data confirms what everyone else is seeing — that a lot of nitrate is moving down the river with a seasonal peak in the spring. This routine of early season flow is typical of upper Midwest river watersheds.

There's also a lot of confirmatory data showing N movement as being tightly-coupled with water movement. One of the reasons we see a lot of N movement in spring is probably because we don't yet have a lot of crop uptake of water and nutrients.

What is unique about the Raccoon River Watershed is the amount and intensity of water quality monitoring taking place across several small watersheds. Because of that monitoring, we're beginning to recognize that there is a lot variance from one small area to the next within the watershed. We're seeing some 'hot spots,' and developing ideas about the unique characteristics of some of these 'micro-watersheds.' So now that we have the data, we have to ask why this uniqueness is occurring.

One of the possibilities we can look at is differences in land use. When we see a 'hot spot,' we can examine it for more information by researching cropping intensity, land use patterns, soil patterns and drainage characteristics. The database we're building is becoming very rich, and it shows us there's a lot of snooping that needs to be done.

ACWA has been very proactive in getting out front and saying that these are some of the things we need to get out and look at. This water quality monitoring data is essential to making progress, and it bears repeating that ACWA is a major player in making it happen.

Farmers and others are probably wondering what it means to be sitting in the middle of one of these 'hot spots.' I don't think it means anything yet. We have to be very careful about indicting ag practices. It could simply be that the make up of their part of the watershed has organic matter that is mineralizing a great deal of nitrogen — it could be something out of their control.

The public assumes that the N in an agricultural watershed is primarily man-made and man-applied. That is simply not true. In fact, the bulk of N comes from what is in the soil resource itself. Most people don't realize that there's an incredible amount of N in the soil — from 4,000 to 6,000 pounds total in the top foot of soil in each acre of land in the Raccoon River Watershed. That N is constantly being mineralized into forms that can travel with groundwater. It's a leaky system.

And with our organically-rich soils, it quickly becomes very challenging to talk about managing N and keeping it on the landscape. The reality is that we're probably losing less than 10 percent of applied N (between 10 and 20 pounds an acre) from

farm fields. So when people start talking about managing that specific fraction of applied N — that ten and twenty pounds per acre — and looking for impact when there's 4,000 - 6,000 existing pounds per acre, you're not looking at a variable that's going to be easy to manage for impact.

So I think that the public needs to understand that agricultural systems and Iowa's hydrological systems are extremely complex. There is a tremendous variety of interactivity. If we could reach over and turn off the N spigot so that no more N could make its way to Des Moines and beyond, we'd have done it a long time ago.

Every single farm field, farming operation and watershed is unique. None of them are going to react to changes in management in the same way. The agricultural system is complex, and includes processes that are biological, chemical, physical and even social in nature. Again, we're dealing with complexity. It's going to take time and investment to understand it.

Up until recently our knowledge base came only from the test plot. The work done by ACWA in the Raccoon River Watershed is helping us move into watershed scale interactions in real time. The work is giving us real indicators of what to start looking at for on-the-ground solutions. So even though we haven't figured out the recipe, we're on our way.

What we have to do is find a balance — it's not a system where 'zero' is a possibility. But we can reduce loss. Will it be a pristine watershed? Can we intentionally alter the dynamics of the system? To what degree and at what cost? Those are all questions that have to be answered, but in my mind, our ultimate success will be a sociological model where people understand the system, achieve broad acceptance, and begin moving toward the objectives.

When we focus on N, it seems we may have lost sight of the principles of what causes the responses to be the way they are. We tend to think of only input responses, but you look at data, and that increase in base flow that occurs in spring is a hydrologic change not related to fertilizer application. It's my guess that we can achieve some part of the solution through better water management instead of tinkering with nutrient management. Better water management could solve many problems – starting with N, but also including phosphorus and sediment. So let's start with a different principal, and manage water in the watershed and lay our other pieces on top of that.

In the end, I think we can intensify the cropping system and still achieve broad environmental goals. But it will require a different way of managing.

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Application rates trend down; nitrate loads trend up

Dave Coppess
ACWA member
Heartland Coop

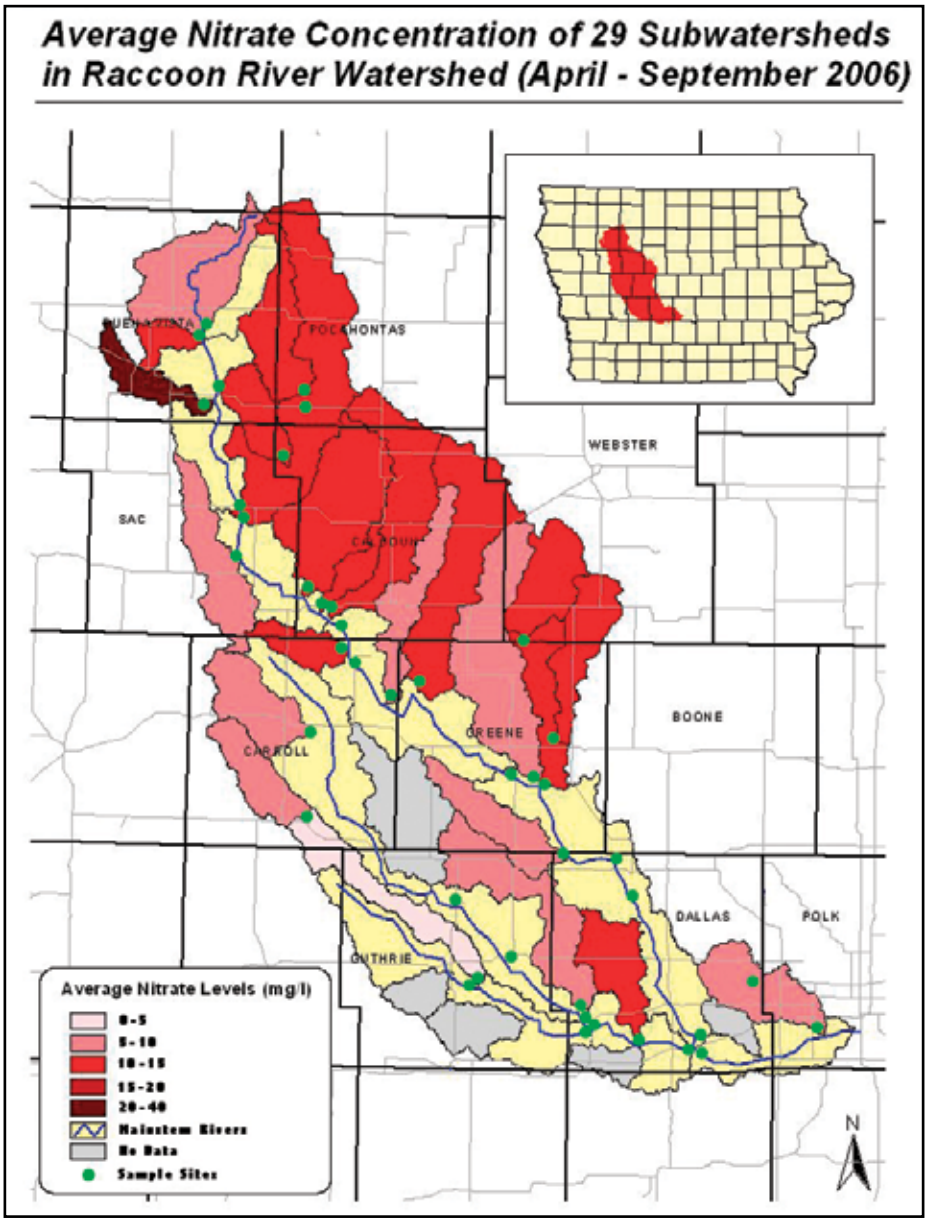
Why is it that we're putting less N into the ground, yet we're seeing nitrate N levels spiking to all-time highs?

We're gathering a lot of information about nitrate concentrations in the Raccoon River. We know that in April and May 2006, the Raccoon had very high average nitrate concentrations — with the month of April being the highest ever. In comparison, April 2006 showed the second-highest nitrate concentrations for the Des Moines River for the month of April.

But the most interesting facet of the puzzle is that our nitrogen sales for the 2006 crop year — for both fall and spring applied — were down 10 percent on NH_3 and 24 percent on our UAN, due to more side-dressing and lower application rates than previous years. A lot of these cultural practices are being driven by high nitrogen costs, but also by some efforts for better nitrogen management for environmental reasons.

Yet, nitrate levels in the Raccoon remained high this fall. Why is it that we're putting less N into the ground, yet we're seeing nitrate N levels spiking to all-time highs?

What the researchers are telling us is that the warm, wet weather during the end of the growing season probably contributed to a relatively high mineralization rate, which added to the nitrate pool. We also saw faster crop maturation, so the water use by crops declined early — limiting water uptake and increasing drainage. As flow rates are high, a lot of N starts moving through the system.



What is unique about the Raccoon River Watershed is the amount and intensity of water quality monitoring taking place across several small watersheds. Nitrate sampling in the Raccoon River Watershed has been taking place since 1999. In 2006, eight volunteers collected water samples every two weeks from April to September from 42 sites. In addition to the volunteer network, four automated samplers are now in place in the watershed providing both stage measurement for loading calculations and rain event sampling. All of these samples are coupled with a bacteria study targeting priority watersheds and additional sampling to provide a comprehensive picture of the watershed.

ACWA contracts water quality technician

Tony Seeman has joined ACWA as a watershed water quality technician. Tony grew up in Woodward, Iowa, and has lived the last 10 years in Des Moines. His primary responsibilities include implementation of water monitoring work plans, water sample collection, site characterization and assistance with various field activities. Tony is working to gain an intimate knowledge of the Raccoon watershed to identify specific sites of concern.

He graduated this spring with a degree in Environmental Policy from Drake University. Prior to graduation, Tony worked several years for the Polk County Conservation Board at Jester Park.

2006 Code of Practice for fall nitrogen application

ACWA members have agreed to continue their fall nitrogen application Code of Practice in 2006. The Code of Practice is a standing agreement among ACWA member fertilizer dealers who supply farmers in and around the Raccoon River Watershed. The agreement states that each entity will suspend fall application of nitrogen (N) until soil temperatures reach 50 degrees F at a depth of 4 inches, with a forecast of cooling soil temperatures (or 60 degrees F if a nitrification inhibitor is used).

The Code of Practice was established in response to water quality concerns associated with the practice of applying nitrogen in the fall for the following crop year. Over the years, this voluntary approach to fall N application by the industry and the farmers they serve has received good reviews from the public, regulators, producers and dealers alike.

ACWA uses the county soil temperature and forecast maps compiled by Iowa State University that are available at http://extension.agron.iastate.edu/NPKnowledge as a reference point for soil temperatures. According to past Iowa State University observations, soil temperatures cooled to below 50 degrees F at varying dates during the past few years. In 2005, state-wide soil temperatures cooled to below 50F on Nov. 14; it was November 21 in 2004; October 28 in 2003 (however, areas south of Highway 20 did not remain consistently below 50F until Nov. 21 in 2003); October 22 in 2002; November 21 in 2001; and November 3 in 2000.

ACWA members have held to their commitment to the ACWA Code of Practice in the past, even in the face of unfavorable market conditions, projected equipment shortages in spring, and many other unknowns shared by dealers and their farming customers.

Environmental Code of Practic

Purpose

To establish reasonable and practice guidelines for fall nitrogen fertilization to reduce nitrate loss from farm fields entering the Raccoon River and its tributaries.

Why

1. Effective management of nutrients on farms in the watershed is one of the keys to enhancing both environmental quality and profitable crop production in the Raccoon River watershed.
2. The impact from agricultural application of nitrogen on receiving water resources is gaining increased attention from local, regional and national levels.
3. This Environmental Code of Practice (ECOP) provides information about practice guidelines adopted by ACWA members.
4. Adherence to this practice enables agriculture to demonstrate management commitment without the need of regulations.

Application Guidelines

1. Review and use information regarding the fate of applied nitrogen. Use Iowa State University Extension Web site link: http://extension.agron.iastate.edu/NPKnowledge/
2. Use the standardized county temperature and forecast maps found at http://extension.agron.iastate.edu/NPKnowledge/

e for Fall Nitrogen Fertilization

3. Delay anhydrous ammonia applications until soil temperatures are:
    - 50° F, trending lower, without a nitrification inhibitor
    - 60° F, trending lower, with use of a nitrification inhibitor in a manner consistent with manufacturer's label directions

Management Factors

1. Establish agronomically sound recommendations considering all N sources.
2. Confirm that soil moisture conditions are conducive for application and sealing.
3. Use and maintain application equipment to proper standards.

Conformance with ECOP

1. Conformance to this standard is a requirement of ACWA membership.
2. Members are required to notify the ACWA office by e-mail or by phone their intention to start application of all applied nitrogen.
3. ACWA will compile a report for review.

ACWA Supports Governor's 2006 Iowa High School Water Summit

ACWA was proud to be part of the Governor's 2006 Iowa High School Water Summit in November 2006, at the State Capitol in Des Moines. The Summit is a one-day competition designed to encourage student leaders to understand the importance of protecting Iowa's water resources and promote awareness of the broad array of challenges facing the state.

The Governor's Iowa High School Water Summit is an opportunity for students to research water quality and its relationship to quality of life, economic viability of communities, recreation and public health and recommend changes. The goal is to give the students an opportunity to voice their perspectives; strategize on actions to be taken and develop solutions to protect water resources in their own communities. Young people can also network with each other and environmental, educational, governmental and private professionals, and gain a better understanding of other viewpoints while gaining pride in and respect for Iowa's natural resources.

Students participating will learn more about water quality and its relationship to quality of life, the economic viability of communities, and recreation and public health, as well as voice their perspectives, strategize on actions to be taken and develop solutions for protecting Iowa's water resources. Juniors and seniors begin their participation by researching and preparing a paper on one of three scenarios provided. If selected for the Iowa High School Water Summit, the student presents their paper in November. Participants will be judged on their paper and presentation. Scholarships are awarded to the top three students: 1st place, $5,000; 2nd place, $3,000; 3rd place, $2,000.

After the summit, each student is asked to complete a follow-up report or project with others in their community. Projects might include, giving a presentation to elementary students, business groups, etc., writing an article for the local newspaper, making educational fliers or posters to distribute in the community, starting a program for water monitoring, stream clean-up day or a recycling program.

For additional information, please contact Iowa Association of Water Agencies at (515) 283-8706, or go to the following Web sites: www.iowadnr.com, www.governor.state.ia.us, www.iaenvironment.org.

ACWA Members

Farmers Cooperative Company | Farnhamville, Iowa

Ag Partners, LLC | Albert City, Iowa

New Co-op, Inc. | Fort Dodge, Iowa

UAP | Kasota, Minnesota

Heartland Co-op | West Des Moines, Iowa

Dedham Cooperative Association | Dedham, Iowa

Van Diest Supply | Webster City, Iowa

West Central | Ralston, Iowa

First Co-op Association | Cherokee, Iowa

Pro Co-op | Gilmore City, Iowa

Data

ANALYSIS

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