ACWA

Agriculture's Clean Water Alliance (ACWA)

A Report of Our Progress | 2008

The ACWA mission is to reduce nutrient loss - specifically nitrate - from farm fields and keep them from entering the Raccoon and Des Moines Rivers and their tributaries.


"The ACWA model is unique. We are flourishing and having significant impact. The process of adding new members has led to some consideration about how our work translates to larger scales — statewide, regionally and nationally. We are giving some thought to how we might start networking on a larger scale."
"ACWA is generating a strategy for dealing with water quality issues credibly and successfully — from collecting information to developing practices that have measurable results."

President's report | Dave Coppess

"As we look back in the past year, we see many accomplishments signaling that ACWA has evolved into a robust and relevant organization."

ACWA Expands | *new territory; new memberships*
We doubled the scope of the organization's influence when Des Moines River Watershed retailers Gold-Eagle Cooperative, Helena Chemical Company, Heart of Iowa Cooperative joined ACWA this year. We intend to continue building membership in the Des Moines River watershed, and we're offering membership in ACWA to other organizations that support the mission of ACWA. The process of adding new members has also lead to some consideration about how our work translates to larger scales — statewide, regionally and nationally. We are giving some thought to how we might start networking projects ongoing in Iowa, Minnesota, Wisconsin and Illinois. Growth is exciting and we feel it's a reflection on the accomplishments of the organization.

Bioreactor Installation | *adding project implementation*
In August, 2008, we installed the largest known tile line bioreactor in the United States, and we've been observing its performance since. You can read more about the project in the pages that follow, but this is an exciting step for ACWA, in that it signals a launch for ACWA into a project implementation phase. Of course, we have a lot of partners and people to thank for their assistance, including Sand County Foundation for providing funding partnership in this research demonstration.

Water Sampling | *building credible, solution-oriented data*
A total of 1,423 water monitoring samples were collected and analyzed by ACWA in 2008. Those samples came from 44 sites in the Raccoon River watershed and 50 sites in the Des Moines. Staff and certified samplers collected 1,352 of 1,364 scheduled samples — a success rate of over 99%. Another 59 samples were collected by ISCO automated samplers. The ACWA water monitoring program was instrumental in better understanding two major water quality issues in 2009 — an ammonia issue at snowmelt in spring 2008 and cyanobacteria issues in late fall 2008.

Code of Practice | *an industry stand*
All ACWA members also continued to follow our annual Code of Practice, with members calling in and complying. The ACWA Fall Nitrogen Code of Practice is a formal agreement among the retailers that they will not distribute anhydrous ammonia for fall application until soil temperatures reach 50 degrees F at a depth of four inches (60 degrees F with use of a nitrification inhibitor) with a forecast of cooling soil temperatures.

Building a Foundation for Change
ACWA is generating a strategy for dealing with water quality issues credibly and successfully — from collecting information to developing practices that have measurable results. This approach continues to generate positive feedback from other ag retailers, farmers and our suppliers — it seems that everyone has good things to say about what we're doing. The ACWA model is unique, and we're flourishing and having significant impact, and we feel we've been an essential part of the work ag is doing. We hope you enjoy reading our report on 2008.

Dave Coppess

ACWA member organizations are dedicated to promoting good environmental stewardship with and through their customers.

The ACWA Code of Practice is an agreement between fertilizer dealers in and around the Raccoon and Des Moines River watersheds. They will wait to apply nitrogen until soil temperatures reach 50 degrees F at a depth of 4 inches (or 60 degrees F with use of a nitrification inhibitor) with a forecast of cooling soil temperatures.

ACWA Expands | now includes Des Moines River watershed

ACWA has expanded membership and activities into the Des Moines River watershed. ACWA President Dave Coppess of Heartland Coop says the organization's presence in the Des Moines River watershed makes sense for a couple reasons.

"Our partnership with the Des Moines Water Works (DMWW) is an important one. The DMWW relies on both the Raccoon and the Des Moines Rivers for source water and we thought it was appropriate to duplicate the ACWA model there. Our objective is the same — to establish a comprehensive database of water quality monitoring information and keep learning as much as we can as quickly as we can. As we find ways to bring partnerships like this together and build ACWA, we hope the ACWA model can be used by other ag retailers throughout Iowa and the Midwest as agriculture works on its part to achieve environmental balance."

Jim Penney is general manager of Heart of Iowa Co-op, one of the new Des Moines River watershed ACWA members. Penney says joining ACWA is part of their mission of benefiting the environment and their customers.

"Heart of Iowa Co-op is dedicated to promoting good environmental stewardship with our customers. Being part of ACWA is going to help us do that. We've built an elite production system in Iowa," says Penney. "We need to do everything we can to preserve it and improve on it for our grand kids. It's important that we keep our eyes open and manage our precious natural resources in the best way possible. Farmers trust our relationship, and we can use that connection to inform them about new ideas in environmental performance and to foster environmentally-responsible decision making. As time goes on, we're going to need to become more and more knowledgeable. Being part of ACWA is going to help us do that."

ACWA Installs Tile Line Bioreactor | largest known implementation

ACWA has completed the installation of its first tile line bioreactor project. The bioreactor was installed on Mike Bravard's farm in Greene County in the Raccoon River watershed. The scope and scale of this bioreactor make it the largest known bioreactor installation in the United States. ACWA and Sand County Foundation shared the cost of the installation.

The ACWA bioreactor is designed to remove nitrogen from the water flowing through the tile line. While mitigation practices that capture and filter surface water exist (wetlands, retention ponds, etc.), 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 so that they do not restrict drainage.

Matt Helmers, an ag systems engineer with Iowa State University, is providing technical assistance in the project. He 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. The tile line bioreactor constructed by ACWA is essentially an underground pit filled with wood chips as its carbon source. Water flowing down the tile line from the field is redirected into the wood chips. Microorganisms colonize the wood chips and use them as a food source, while breaking down the nitrate in the water, and expelling 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 we can maximize the performance of the system and amount of water treated."

Bioreactors are a new enough technology that 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.

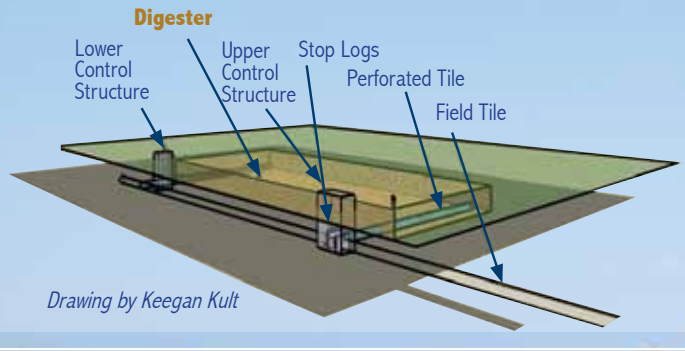
A satellite system will monitor the depth of water entering and leaving the structure. There will also be water samples pulled every week in the tile line above and below the bioreactor itself in order to determine what nitrate reduction is occurring as water moves through the system.

This photo looks from south to north and upslope is from right-to-left. The lower control structure is in place at the right, with a tile line installed to collect the bioreactor output (extending into the bottom of the photo). Excavation is beginning for placement of the upper control structure at the left by the backhoe.

This view looks from southeast to northwest with upslope generally from right to left. Both control structures are visible and excavation has now started on the processing section of the bioreactor. The processing section of this bioreactor site measures 25 feet by 50 feet, making it the largest known tile line bioreactor in the U.S.

BIOREACTOR

This schematic details the major components of the bioreactor including both upper and lower control structures. These structures contain a series of baffles that allow the water table to be raised slightly.



Drawing by Keegan Kult

With this project, ACWA is moving from collecting data and investigating solutions to doing actual project implementation and scientific research.

▲ This view looks up slope from east to west. Excavation of the processing section of the bioreactor is complete. The sides have been lined with plastic to limit seepage of groundwater into the bioreactor system, and the organic media — in this case, wood chips — are being put in the bioreactor's processing section. At the top of the pit, the input tile line from the upper control structure is still visible.

◀ This view looks upslope from east to west. After being filled with organic media, the bioreactor is covered with landscape fabric (to prevent dirt from filling the processing section) and covered with dirt to allow grasses to grow over the top of the system.

◀ John Jordison of Agri-Drain installs automated monitoring and sensing equipment for the bioreactor.

Joe Britt of Sand County Foundation says improving environmental quality in the Midwest is inextricably linked to water. "Keeping land productive while exploring projects like bioreactors will benefit both farmers and the people who live downstream. It sets an example I hope others will follow."

Chris Jones of the Des Moines Water Works says, "We're happy to work with ACWA because they are not afraid to have an honest relationship with us. That's the only way we are going to make progress."

Microorganisms colonize the wood chips and use them as a food source, while breaking down the nitrate in the water, and expelling it as a gas.

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.

Todd Sutphin is leading the monitoring effort for the ACWA bioreactor project. He says the first couple months after the installation were dry and the system had no water flowing through it. "Once we had water flowing through it, the system had to prime itself — to get inoculated with microbes, for example. Since then, the water looked visibly better every time we sampled it. And the equipment is working as designed. We're seeing an average processing time of 15 hours — time that the water spends moving from the upper structure until it flows through to the lower control structure. We don't know if that's right, so we need to find a balance between retention time and moving water through the system. At any rate, so far, we're very pleased with the effectiveness — the bioreactor has settled down and is removing most of the measurable nitrate from the water flowing through the system. The real test will come with spring flow, though."

ACWA President Dave Coppess of Heartland Coop says ACWA is providing a share of the funding for the bioreactor project as a natural extension of the ACWA mission. "The installation of this bioreactor 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.

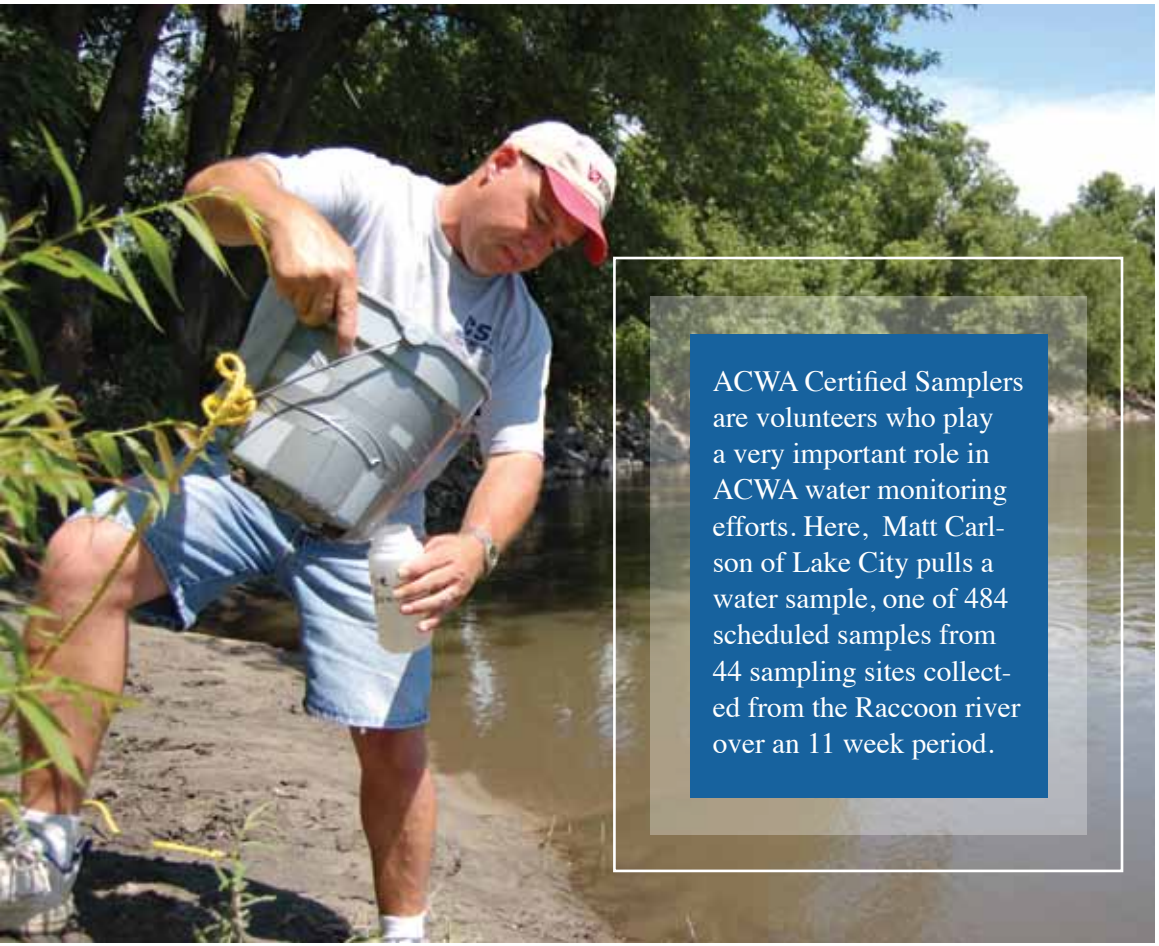
"Those of us who work in agriculture want people to know that we are focused on finding solutions to water quality issues, taking those solutions to farmers and implementing them," says Coppess. "We recognize there is a lot to do, and we feel that it's going to take a commitment to total watershed management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

Roger Wolf 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, with ACWA and Sand County Foundation leading the way by sharing the cost of this project. We have had a number of partners who worked hard on making this a reality and we need to thank them all — 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, Greene County 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.

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

Certified Samplers | a critical part of the ACWA effort

ACWA is working to establish a comprehensive database of water quality monitoring information. ACWA Water Quality Technician Anthony Seeman oversees the water sampling activities and says the data is helping prioritize subwatersheds for further investigation.



ACWA Certified Samplers are volunteers who play a very important role in ACWA water monitoring efforts. Here, Matt Carlson of Lake City pulls a water sample, one of 484 scheduled samples from 44 sampling sites collected from the Raccoon river over an 11 week period.

"Some of what we are doing is zeroing in on what we believe may be hotspots. We've already been able to identify problems and change some individual operator management practices upstream. That's where the water monitoring program is having real impact."

"But aside from those immediate benefits, ACWA water monitoring is adding a lot to the general body of knowledge about agricultural non-point source water pollution science. Learning and sharing information is part of ACWA's collaborative nature."

Matt Carlson of Lake City teaches ag at the local high school and has volunteered a great deal of his time as a Certified Sampler for the ACWA water monitoring program. Carlson says he wants to be part of the effort because he wants to know what's in the water.

"Iowa is a good place to live, so we have to be mindful of what is going into ours streams and rivers. We are all aware of the demands on ag, and we know people are focused on production. But I don't want us to overlook the safety of our water. Since farmers are the number one users of chemicals and fertilizers, they play an important environmental role in our community."

"I help with monitoring water quality because we need to have an idea of what and how much is going into our rivers for our health and other reasons. My hope is that the people who live here have the information found in these tests made available to them in layman's terms. I want to make sure we use it."

Seeman says the Certified Samplers did great work in keeping the sampling regime going through 2008's unusual weather cycle. "During all the flooding and bad weather, we only missed 2 out of 94 scheduled samples. Those are outstanding results, and we'd like to thank the Certified Samplers for doing a great job."

ACWA — with staff assistance at the Iowa Soybean Association — collected 1,352 of 1,364 scheduled samples for a success rate of more than 99 percent.

ACWA Water Monitoring | by the numbers

Water Monitoring Report | *2008 year-end wrap-up*

Between the expansion of ACWA into the Des Moines River watershed and the unusual weather, our water monitoring capacity was tested in 2008. ACWA with staff assistance at the Iowa Soybean Association together collected 1,352 of 1,364 scheduled samples — for an over 99% success rate. With event samples and a couple extra samples collected in response to a special request, a grand total of 1,423 samples were analyzed. Of the 1,423, 59 were collected by ISCOs, 307 by ISA and DMWW staff, and 1057 by 29 Certified Samplers.

Raccoon River watershed

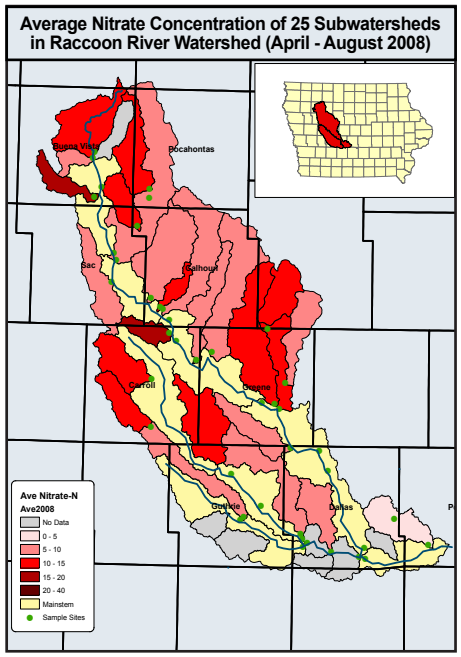
The Raccoon River sampling route remained mostly unchanged from 2007, with 44 sites sampled over 11 weeks for a total of 484 scheduled samples. We missed one sample that was inaccessible during the heaviest flooding so we collected 483. An additional 59 event samples gave us a total of 548 samples collected in the Raccoon in 2008.

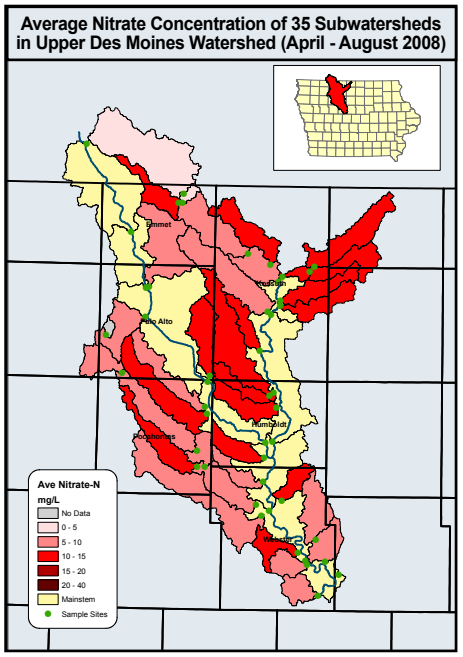
Des Moines River watershed

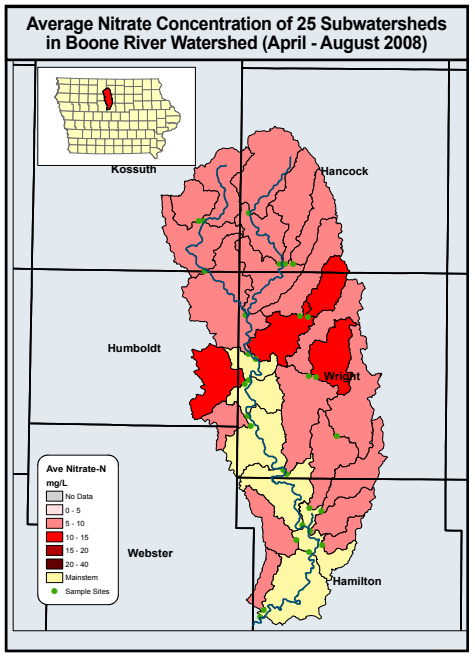
The Des Moines route had 50 sites, extending well into Minnesota, for a total of 496 scheduled samples. We missed two samples because of time and road construction, one because of flooding, five that were pulled but didn't get to the drop off in time, and two that were not collected. We did collect an extra site the first week, a site of interest one week, and assisted Webster County Conservation Board with their beach monitoring for a total of 492 grab samples in the Des Moines.

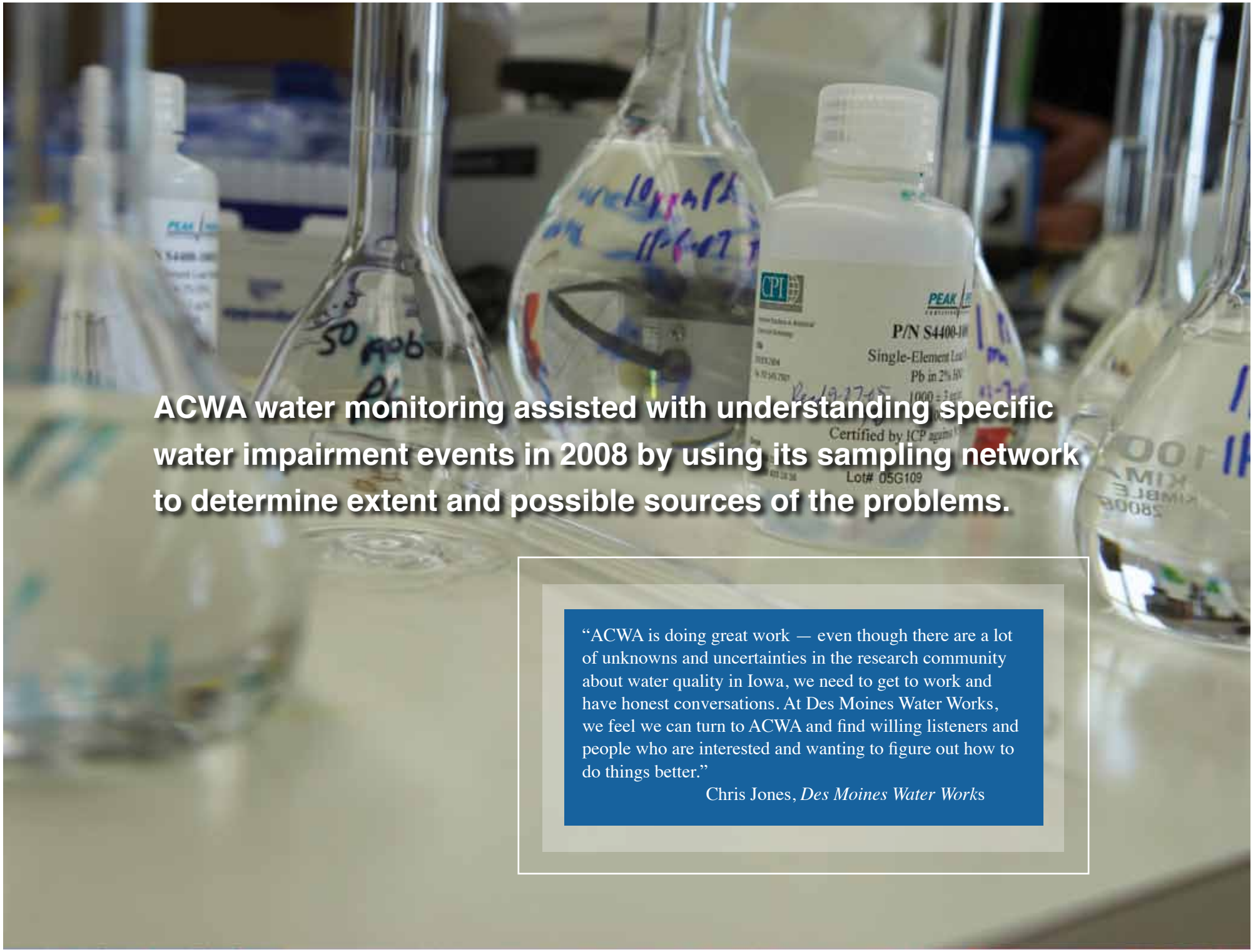
Boone River watershed

Thirty-five samples were collected over 11 weeks for a total of 385 scheduled samples. We missed 2 samples because of flooding for a total of 383 grab samples.









ACWA water monitoring assisted with understanding specific water impairment events in 2008 by using its sampling network to determine extent and possible sources of the problems.

"ACWA is doing great work — even though there are a lot of unknowns and uncertainties in the research community about water quality in Iowa, we need to get to work and have honest conversations. At Des Moines Water Works, we feel we can turn to ACWA and find willing listeners and people who are interested and wanting to figure out how to do things better."

Chris Jones, *Des Moines Water Works*

Acute Water Quality Events | ACWA positioned in leadership role

ACWA assisted with understanding specific water impairment events in 2008 by using its sampling network to determine the extent and possible sources of the problems.

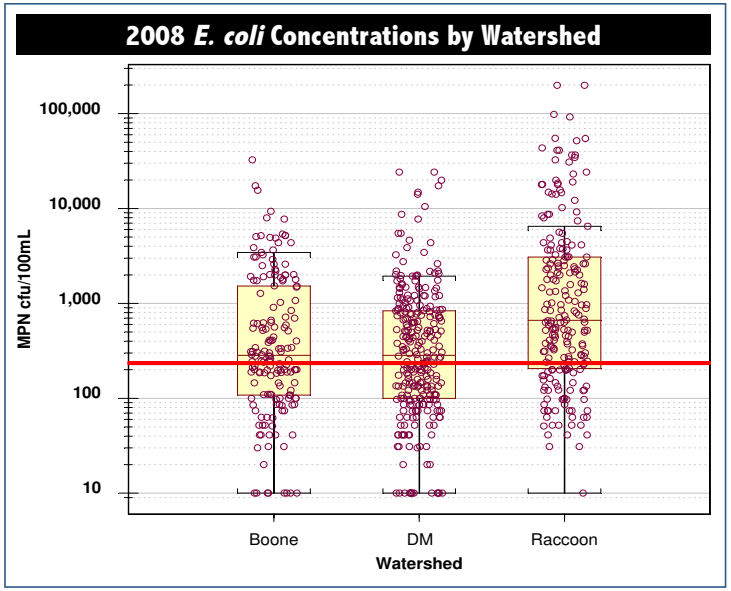
Ammonia — As the snow melted in Spring 2008, The Des Moines Water Works reported elevated ammonia levels in both of its surface water sources — the Raccoon and Des Moines Rivers. Ammonia values in the Raccoon River at Van Meter on 3/4/08 were 2.52 mg/l, the second highest reading ever recorded (with records dating back to 1972). The ammonia measured in the Des Moines River on 3/7/08 was 2.7 mg/l. At a site on the Boone River on 3/11/08 the ammonia level was 5.08 mg/l. These levels topped or were among the highest values ever recorded for those water bodies.

The generally-accepted origin of ammonia in surface water is the decomposition of animal and human waste and the remains of plants and animals. Examples of sources of this type of pollution include wastewater treatment plants, failing septic tank systems, and runoff from livestock farms or applied manure that has not infiltrated the soil profile. Volatilization of fertilizer also thought to be a major source of ammonia.

Cyanobacteria — The prevalence of cyanobacteria in the Raccoon River watershed became an issue in late 2008. Cyanobacteria are unique among bacteria in that they are capable of photosynthesis and they are capable of out-competing typical algae in nutrient rich waters. Cyanobacteria cause taste and odor problems and cloudy drinking water, and some species can make it through water works plant filtration systems. Many cyanobacteria produce toxins that can be harmful to humans and livestock.

Cyanobacteria blooms are typically found in stagnant water in lakes, but it's not well understood what causes them to bloom excessively. It's thought that the source of the bloom in the Raccoon in 2008 was Black Hawk Lake in Sac County. What was unusual was that the cyanobacteria survived the three to four day trip along the Raccoon River, affecting water quality all the way to Des Moines and beyond.

2008 *E. coli* results — *E. coli* is an intestinal bacteria in animals and humans and is used as an indicator of fecal contamination in water. *E. coli* concentrations are highly variable and are affected by things like runoff from rainfall and streambed sediment disturbances. The graph shows *E. coli* concentrations grouped by major watershed. Note that the data is plotted on a logarithmic scale because it is positively skewed and varies by several orders of magnitude. The red line represents the EPA single sample standard of 235 colony forming units per 100mL for swimmable waters. In 2008, 399 of 658 grab samples (60%) exceeded the EPA standard. Tributary sites exceeded the standard in 64% of the samples while mainstem sites exceeded it in 52% of the samples. Due to the high variability in E. coli sampling, care must be taken interpreting these results as a daily averages or as describing typical conditions.

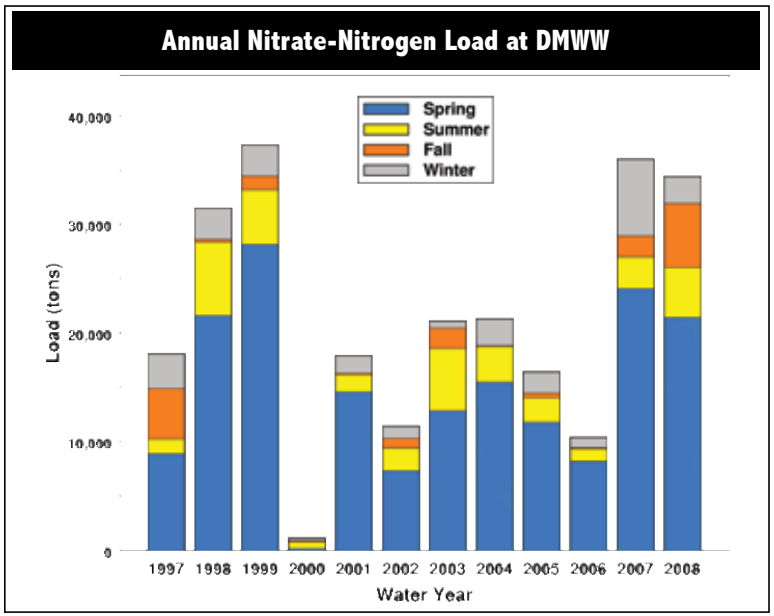


Nutrients in water | understanding the movement of nitrate-N

People who work in agriculture, environmentalists, and those who work from agencies charged with protecting water quality are all beginning to accept that collecting, understanding, and processing data is the only way our watershed communities are going to be able improve and protect water quality.

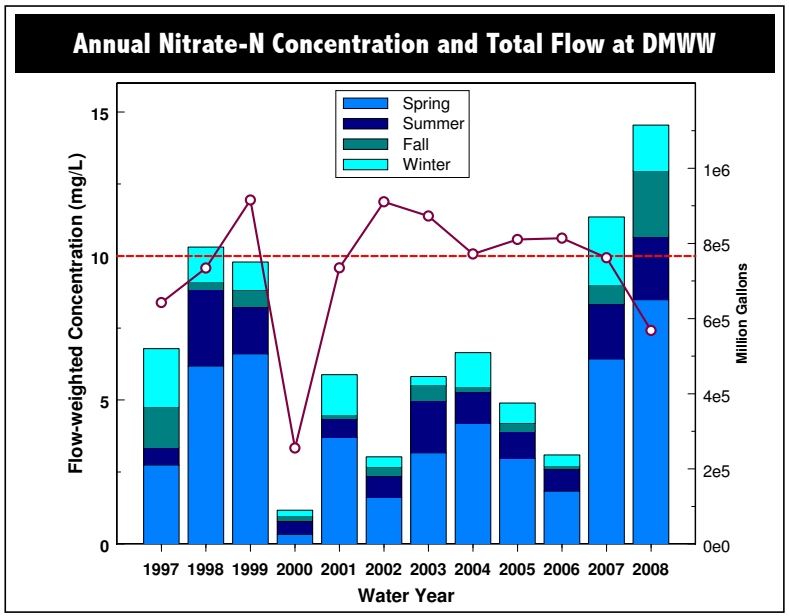
ACWA's water monitoring of nitrate-N in water helps the scientific community assess what is occurring on the landscape. We evaluate the presence of nutrients like nitrate-N in water because they are easy to track and because microorganism contamination usually depends on nutrients in the water to survive. Farmers are also interested in keeping nutrients on the landscape for crops, instead of losing it to the environment. Gathering data also helps us better understand the impact of weather on water quality.

Working from the watershed perspective and knowing when, how, and where nitrate-N is moving through the hydrologic systems of the Raccoon and Des Moines River watersheds will help scientists understand how to improve agricultural management of nitrogen, improve water quality, and boost farmer profitability.



Annual Nitrate-Nitrogen Load:

The annual load is the total weight of nitrate-nitrogen for the year in the Raccoon River. Load is more related to the amount of water than the concentration of nitrate. Water year is a hydrologic term referring to the period from October 1 of the previous year to September 30th and is used to account for the effect of snow and ice in the winter. The total load in water year 2008 was similar to 2007, however a wet fall and high flow lingering into summer this year contrasted with the warm winter of 2007.



Flow-weighted Nitrate-N concentrations:

Nitrate-N concentrations are measured almost daily at DMWW and represent the weight of nitrate-nitrogen per liter of water. The flow-weighted concentration (solid red line) represents the weight of nitrate-nitrogen if all the water for the year was mixed and sampled. Although the total load was similar between 2007 and 2008, more water in 2008 means a lower nitrate-N concentration than 2007. The dotted red line shows the EPA drinking water maximum concentration of 10 mg/L of nitrate-N.

ACWA Reaffirms Fall Nitrogen Application Code of Practice in 2008

The members of ACWA agreed to reaffirm their fall nitrogen application Code of Practice and publicized the decision in a news release. The Code of Practice was created to address water quality concerns that have been long associated with the practice.

The Code of Practice is an agreement between fertilizer dealers that they will wait to apply nitrogen until soil temperatures reach 50 degrees F at a depth of 4 inches (or 60 degrees F with use of a nitrification inhibitor), with a forecast of cooling soil temperatures.

ACWA Membership

ag organizations working for better water quality

Ag Partners LLC (Des Moines River & Raccoon River)
Albert City, Iowa | www.agpartners.com

Dedham Cooperative Association (Raccoon River)
Dedham, Iowa

Farmers Cooperative Company (Des Moines River & Raccoon River) Ames, Iowa | www.fccoop.com

First Coop Assoc. (Raccoon River)
Cherokee, Iowa | www.first.coop

Gold-Eagle Cooperative (Des Moines River)
Goldfield, Iowa | www.goldeaglecoop.com

Heartland Co-op (Des Moines River & Raccoon River)
West Des Moines, Iowa | www.heartlandcoop.com

Heart of Iowa Cooperative (Des Moines River)
Roland, Iowa | www.hoic.com

Helena Chemical Company-Midwest Division (Raccoon River)
West Des Moines, Iowa | www.helenachemical.com

New Coop, Inc. (Des Moines River and Raccoon River)
Fort Dodge, Iowa | www.newcoop.com

Pro Coop (Des Moines River & Raccoon River)
Gilmore City, Iowa | www.procooperative.com

Crop Production Services (Raccoon River)
Wall Lake, Iowa | www.cropproductionservices.com

Van Diest Supply (Des Moines River & Raccoon River)
Webster City, Iowa | www.vdsc.com

West Central (Des Moines River & Raccoon River)
Ralston, Iowa | www.westcentral.coop

Agriculture's Clean Water Alliance (ACWA)

ACWA
Agriculture's Clean Water Alliance

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