ACWA

AGRICULTURE'S CLEAN WATER ALLIANCE

Land use, data and the future

Raccoon River Water Quality How we got here — and where to look in the future

This article is based on a research paper by ACWA members Dr. L.D. McMullen of the Des Moines Water Works, Chris Jones of the Des Moines Water Works, and Dr. Jerry Hatfield of the National Soil Tilth Laboratory.

Improved water quality — a shared goal

Stakeholders from all sides of the issue agree that water quality in Iowa must improve. For example, in the Raccoon River, nitrate-N (NO3-N) concentrations have increased since the early 1970's, often rising above the federal drinking water standard. Because the Raccoon River is the predominant water supply for the city of Des Moines, there is concern about a broad spectrum of potential impacts from NO3-N concentrations above the federal drinking water standard. It has also raised questions about the potential sources of nitrogen (N) and the impact of agricultural practices on the river.

The search for solutions

Ultimately — in order to link action to results — it's important to learn what the problems are and what factors affect water quality in the Raccoon River watershed. Further, from the point of view of agriculture, if there are factors within the control of farmers that can improve water quality, they need to be discovered, quantified and proven effective before ag is asked to implement them.

(continued)

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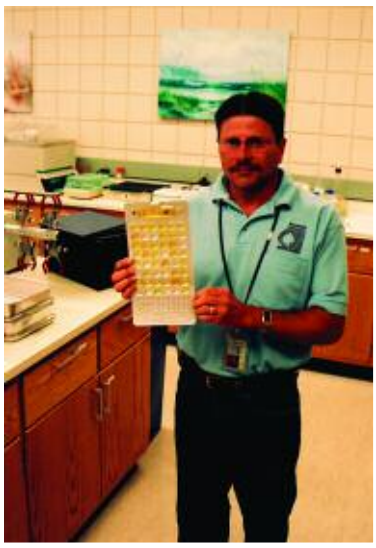
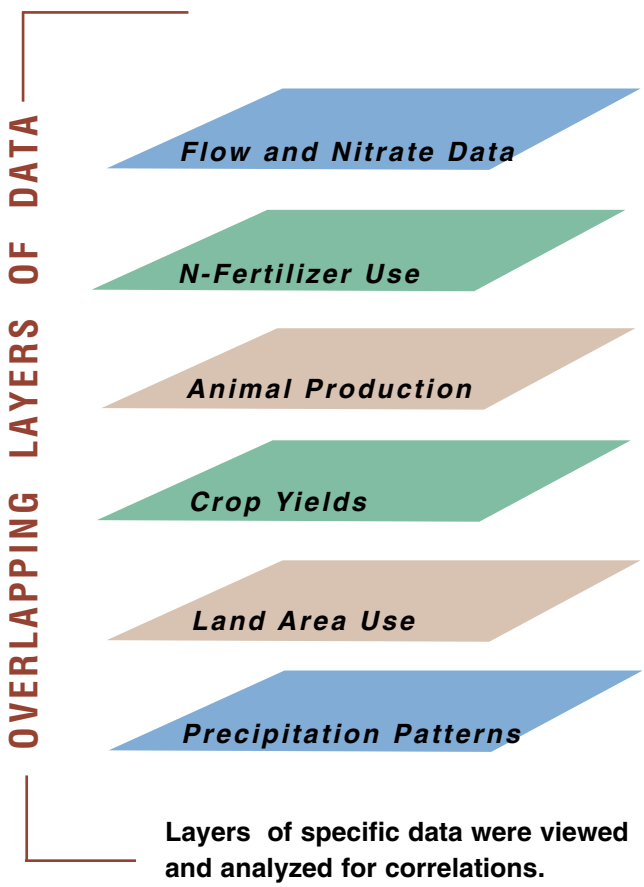
Toward that end, researchers at the Des Moines Water Works (DMWW) and the National Soil Tilth Laboratory (NSTL) studied historical and current NO3-N, flow and other data on the Raccoon River. Understanding the interactions between nitrogen in agricultural production systems and NO3-N levels in surface waters should provide insights into efforts to reduce N levels in drinking water.

DMWW staff extensively reviewed long-term flow and nitrate data for the Raccoon River, using the historical data base of NO3-N concentrations sampled at the DMWW facility and United States Geological Survey (USGS) flow data dating back to 1919. Then they overlapped that data with observations on N fertilizer use, animal production, crop yields, land use changes, and precipitation patterns (see Summary of Findings next page).





Layers of specific data were viewed and analyzed for correlations.

Summary of findings

What researchers found is that **there has been a large increase in average annual NO3-N concentrations since 1970 in spite of no significant change in N fertilizer use for the past 15 years.** The study also revealed that there have been **significant variations in NO3-N concentrations in the Raccoon River watershed over the past 70 years — and they have occurred alongside considerable variations in annual loading from year-to-year.**

For example, there have been three years with maximum concentrations above 18 mg L^{-1}. However, these concentration levels have occurred throughout the past 30 years and are not isolated to the recent record. **In fact, NO3-N loads from the watershed have shown a slight decrease in the past 10 years because of increased crop yields and increased removal of N in the grain.**

That means that **variations in annual NO3-N loading are probably related to annual precipitation,** since leaching into subsurface drains is the primary path that NO3-N takes from the field into streams and rivers.

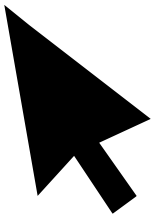
Another interesting piece of the puzzle seems to be the movement into a period of extremely variable rainfall — less frequency, yet higher intensity.

But more than anything else revealed by the research, **the increased average annual NO3-N concentration since the 1970's seems likely related to decreased planting of small grains, cover crops or hay crops, since there is a correlation between the land area used for these crops and the average annual NO3-N concentration.**

March rains recharge the groundwater supply — anything that falls after that is usually flushing the system. **That's why high levels of NO3-N occur consistently from April to June each year. Small grains, cover crops or hay crops are at their peak water use up until May, during spring rains, providing 'water tension.'** Row crops simply cannot use as much water at that time of year — they provide no water tension. **The result is that rainfall is more likely to drain off from a row crop landscape, taking N along with it.**

When viewed from that perspective, **NO3-N loading becomes more of a water management issue than a nutrient management issue. The implications of the research are that we'll probably have to look at solutions that include land use change in order to find a solution.** Perhaps it's possible to target land use practices (reintroduce small grains, cover crops or hay) in 'hot spots' to change the water balance. It definitely points to the need to experiment with new systems.

But at the end, the key issue is this: making changes in the watershed will not be easy — if we decide to do so, how are we going to manage the basin to achieve our goals?



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LEARNING FROM THE DATA | RACCOON RIVER

Flow and Nitrate-N Loading

Annual Average	1997	1998	1999	2000	2001
Flow (cfs)	19,000	36,000	31,000	4,000	19,000
Nitrate-N load (Metric Ton)	12,000	29,000	32,000	1,000	14,000
Nitrate-N concentration (ppm)	13	27	31	1	14

Interpretation: Total nitrate-N loads leaving the watershed are affected by precipitation and

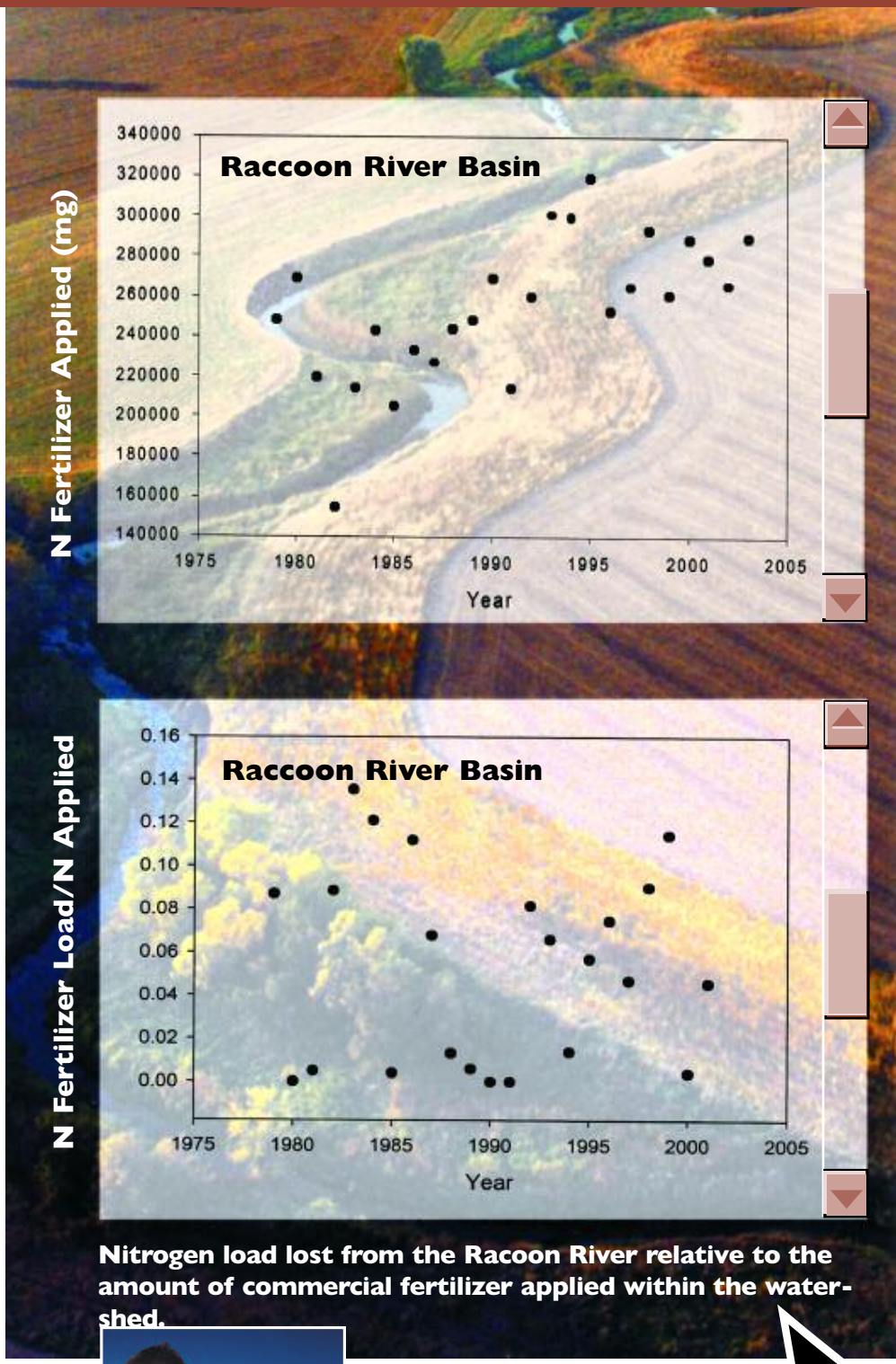
Do increased yields mean increased NO3-N issues?

In the ongoing public discourse, an assumption persists that if we stopped applying fall anhydrous, then our water quality problems would go away. But since 1990, the total amount of fertilizer applied has been relatively flat —there's not more fertilizer going into the system, and researchers found a decrease in NO3-N loading in the Raccoon River when compared to the amount of N applied within the watershed over the last 30 years. Cattle and hog numbers have decreased as well, so the manure pool has diminished, too (this doesn't apply in all Iowa watersheds, but is true of the Raccoon).

The change could be attributed to increased crop production, which has increased N removal from the soil profile. The annual rate of yield increase translates to an annual increase of over 1000 Mg of N removed by corn and 750 Mg from soybean production.

Also, there is relatively small amount of the N that is applied as fertilizer that is lost via transport down the Raccoon River. Agronomically-speaking, the most N lost is up to 17 pounds per acre — 10% or less of what is commonly applied. That is a relatively small amount of N to manage to achieve reductions in NO3-N. In the end, it may not be reasonable to expect monumental change because we're dealing with a small fraction of N — under 10%. But even that small nitrogen loss is enough to cause high concentrations.

Development of ag management practices that affect water quality will have to be more inclusive than just changes in fertilizer rate and timing.



Nitrogen load lost from the Racoon River relative to the amount of commercial fertilizer applied within the watershed.

The chart above shows Nitrogen fertlizer applied in the Raccoon River Basin from 1975 to 2005 in mg. There is little to no correlation between N application levels and nitrate levels in water.

The Raccoon River Watershed

The Raccoon River begins in Buena Vista County, Iowa, traveling approximately 300 km to its confluence with the Des Moines River in the city of Des Moines. The watershed drains 17 counties and 3600 square miles, 6.4% of Iowa's total area. Agriculture predominates with over 80% of the land area in agriculture production. The soils are formed from Wisconsin till under a native prairie grass vegetation. The river basin is predominantly in the Des Moines Lobe — and can be characterized as a prairie pothole structure with extensive drainage systems that move water from the landscape into nearby streams. It has been estimated that over 40% of the agricultural land area in this region of Iowa has subsurface drainage. The installation of subsurface drainage has greatly altered the hydrology of the watershed by providing a conduit from fields into adjacent surface water streams.

Harvesting water from the Raccoon River

The Raccoon River, and shallow groundwater influenced by it, are the primary sources of water for the Des Moines Water Works (DMWW). From 1884 until 1948, DMWW used water exclusively from an underground collection system called the

infiltration gallery — a 91-cm wide underground pipe that runs parallel to the Raccoon River for 5-km, at a depth of 10-meters.

River water is also diverted to a series of constructed ponds that lie above the gallery. These ponds help saturate the surrounding soil structure, increasing water yield. By the late 1940's water demand had increased to the point where yield from the gallery was not sufficient and DMWW constructed a permanent intake on the Raccoon River to supplement the supply from the infiltration gallery.

Water quality in the infiltration gallery is highly influenced by the river, but it does benefit from bankside filtration, which removes many of the solids and suspended matter that is present in

The Raccoon River watershed is one of North America's largest surface water sources of drinking water.

DATA | SOURCES

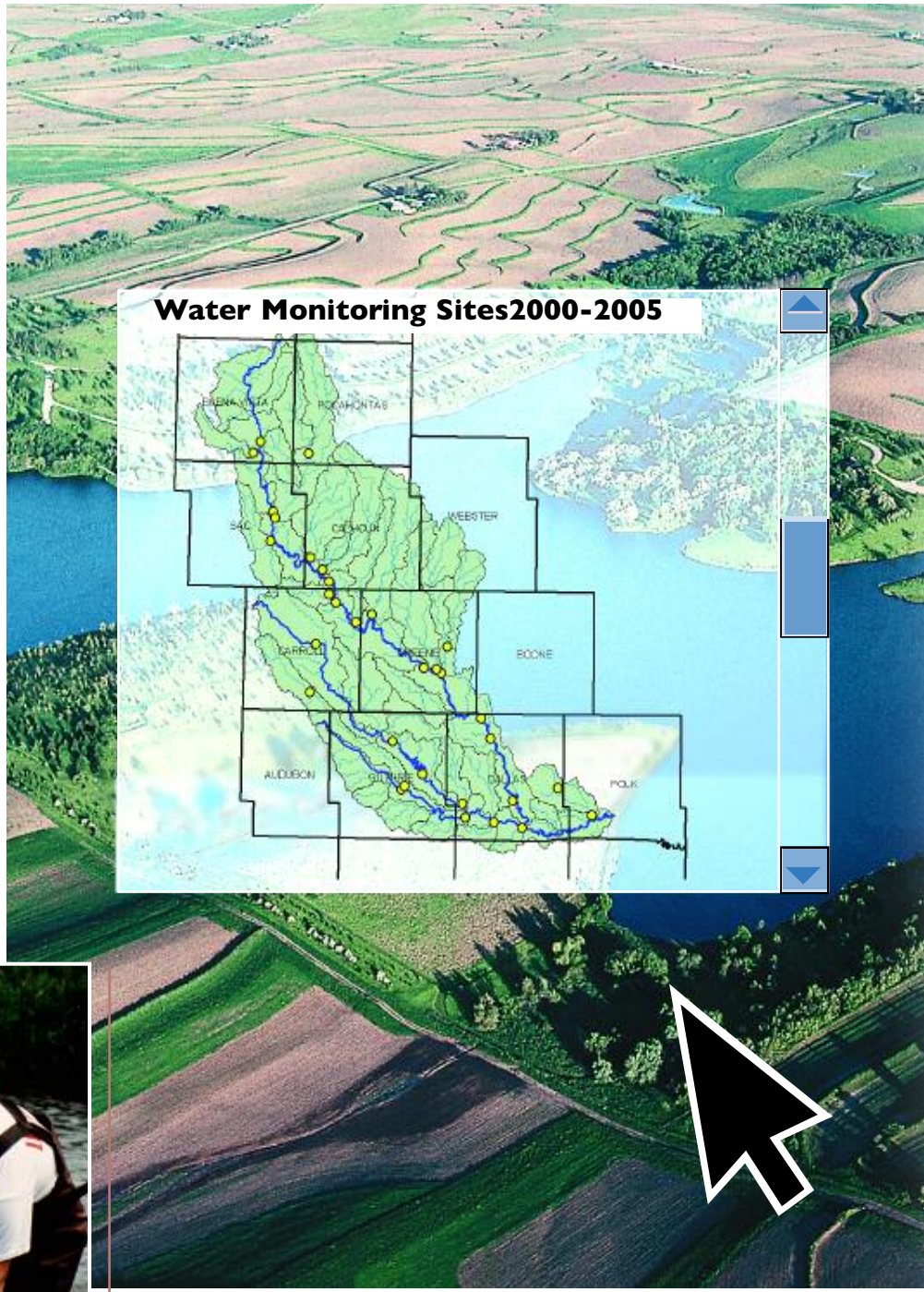
Crop Acreage — National Agriculture Statistics Service (NASS)
Crop Yield — Iowa Department of Agriculture and Land Stewardship
Fertilizer use — Iowa Department of Agriculture and Land Stewardship
Animal production — USDA-NASS agricultural inventory data
Meteorological data — National Climate Data Center
Water data — Des Moines Water Works, U.S. Geological Survey

ACWA — a leading private sector sponsor of water quality monitoring

ACWA members have invested a great deal in water quality monitoring in an effort to examine the issues and to begin to establish a trail of scientific data. From that data, it can be determined what approaches are going to be most effective for farmers and the environment.

In 2005 ACWA purchased and placed four automated samplers in the Raccoon River watershed to enhance the collection of data. These machines complemented the placement of four automated samplers in the Raccoon River watershed by the Iowa Department of Natural Resources.

ACWA has also managed a volunteer water monitoring project for several years, with 32 volunteer collection sites now managed by the organization. The organization of volunteers has become remarkably effective — in the ten sampling periods from April to August, 96% of the slated samples were collected.



ACWA manges 32 volunteer collection sites on the Raccoon River.

The ACWA water quality monitors are measuring flow rate and nitrate parameters. Although the automated samplers were not installed in time to capture a significant rainfall event (2005 was a very dry year once June started), we have collected data, including rainfall and stage information. The DNR machines are also collecting information about dissolved oxygen and temperature in the water.

Once a sample is collected, either by automated sampler or volunteer, the Des Moines Water Works runs an initial analysis on it. The ACWA research partners — organizations like the National Soil Tilth Laboratory — also look at the data, to see if trends and other relationships in the data can be established. As the process moves forward, ACWA is committed to communicating the results of the sampling to the public and to the watershed stakeholders.

New Water Monitoring Equipment

In the automated system, a collection hose is positioned in the creek, along with a sensing device. When water levels in the creek rise, the sensing device triggers a sampler to collect a series of samples at specific time intervals, in a number of bottles.

Mechanized water monitoring provides a more reliable and more robust sampling capability that will lead to the collection of a higher level of data. And putting this new set of equipment in place makes the Raccoon River watershed one of the most-heavily monitored watershed in Iowa.

ACWA | MEMBERS

Farmers Cooperative Company | Farnhamville, Iowa
Ag Partners, LLC | Albert City, Iowa
New Coop, Inc. | Fort Dodge, Iowa
UAP | Kasota, Minnesota
Heartland Coop | West Des Moines, Iowa
Dedham Cooperative Association | Dedham, Iowa
Van Diest Supply | Webster City, Iowa
West Central | Ralston, Iowa
First Coop Association | Cherokee, Iowa
Pro Coop | Gilmore City, Iowa

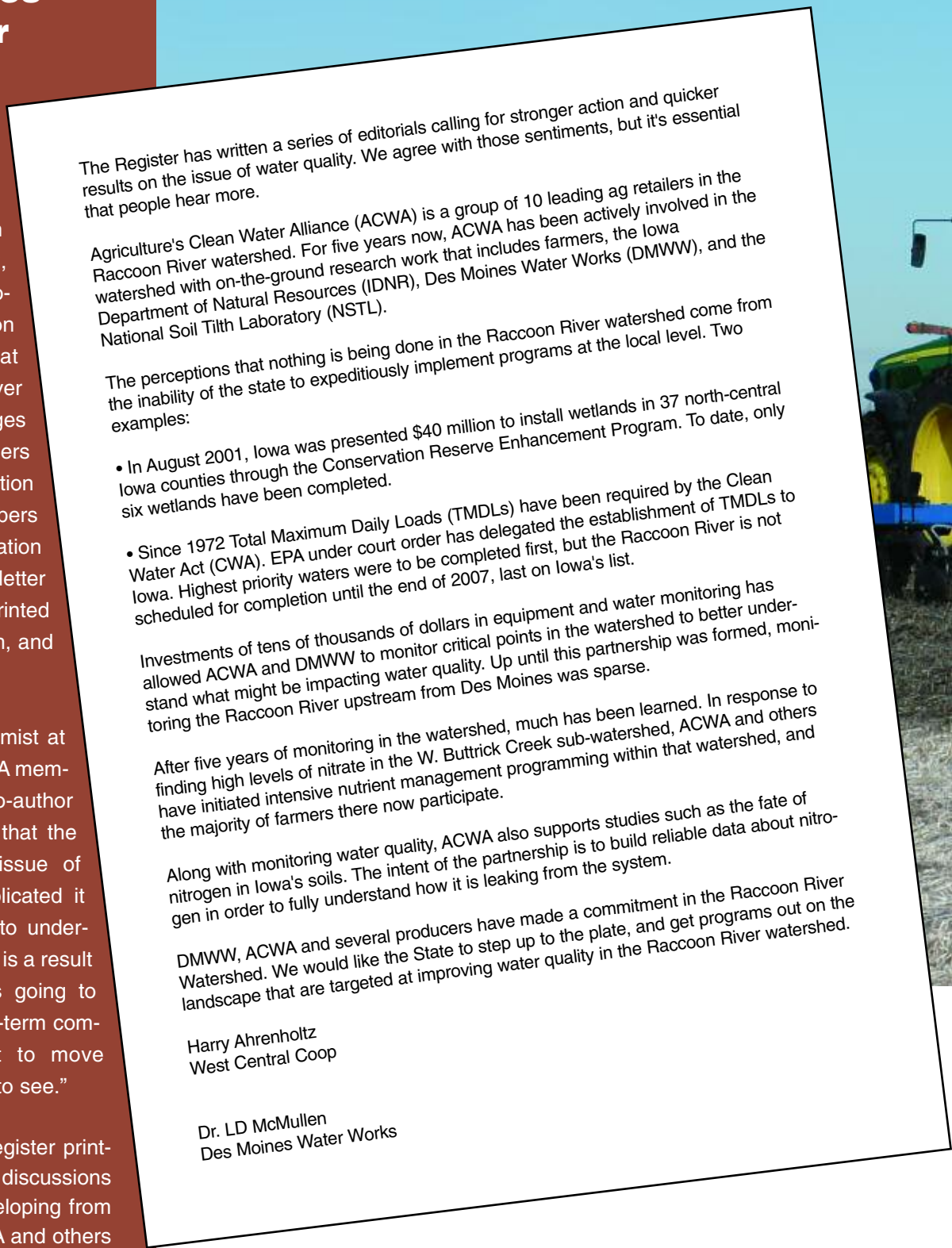
Letter to Editor — Des Moines Register

Joint ACWA/DMWW Letter to Editor printed in the Des Moines Register

One of the predominant issues covered by the Des Moines Register in 2005 has been the issue of water quality, with a focus on the Raccoon River watershed. On October 2, 2005, the Register ran an editorial entitled “Pick up pace on cleaning Iowa’s waters’ that talked about the Raccoon River and the water quality challenges facing it and charged stakeholders and agencies with stronger action in the watershed. ACWA members chose to add to the information printed in the Register with a letter to the editor. The letter was printed in the paper on November 10th, and is shown here.

Harry Ahrenholtz is an agronomist at West Central Coop — an ACWA member cooperative — and was co-author of the letter. Ahrenholtz says that the more ACWA examines the issue of water quality, the more complicated it becomes. “We ask everyone to understand that water quality in Iowa is a result of many complex factors. It's going to take time, patience and a long-term commitment on everyone's part to move toward the results we all want to see.”

ACWA appreciates that the Register printed this letter. The feedback, discussions and relationships that are developing from this publicity are helping ACWA and others gain momentum and work together to find solutions to the water quality challenges



The Register has written a series of editorials calling for stronger action and quicker results on the issue of water quality. We agree with those sentiments, but it's essential that people hear more.

Agriculture's Clean Water Alliance (ACWA) is a group of 10 leading ag retailers in the Raccoon River watershed. For five years now, ACWA has been actively involved in the watershed with on-the-ground research work that includes farmers, the Iowa Department of Natural Resources (IDNR), Des Moines Water Works (DMWW), and the National Soil Tilth Laboratory (NSTL).

The perceptions that nothing is being done in the Raccoon River watershed come from the inability of the state to expeditiously implement programs at the local level. Two examples:

• In August 2001, Iowa was presented $40 million to install wetlands in 37 north-central Iowa counties through the Conservation Reserve Enhancement Program. To date, only six wetlands have been completed.

• Since 1972 Total Maximum Daily Loads (TMDLs) have been required by the Clean Water Act (CWA). EPA under court order has delegated the establishment of TMDLs to Iowa. Highest priority waters were to be completed first, but the Raccoon River is not scheduled for completion until the end of 2007, last on Iowa's list.

Investments of tens of thousands of dollars in equipment and water monitoring has allowed ACWA and DMWW to monitor critical points in the watershed to better understand what might be impacting water quality. Up until this partnership was formed, monitoring the Raccoon River upstream from Des Moines was sparse.

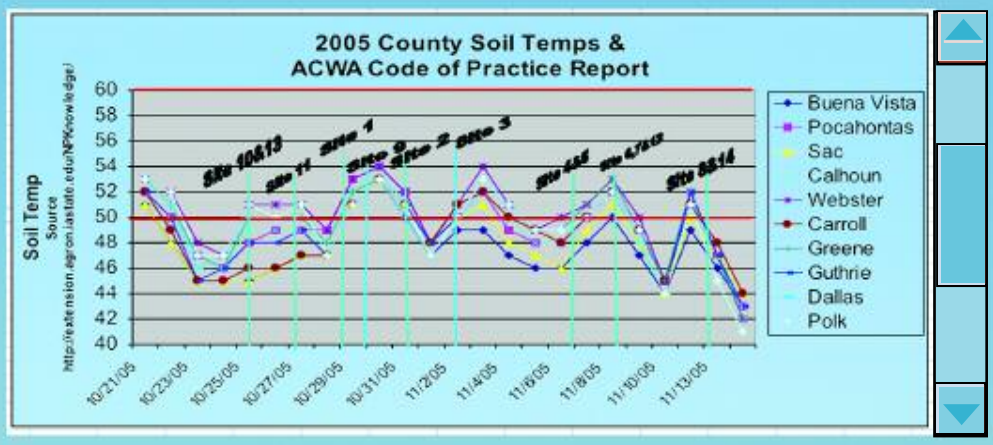
After five years of monitoring in the watershed, much has been learned. In response to finding high levels of nitrate in the W. Buttrick Creek sub-watershed, ACWA and others have initiated intensive nutrient management programming within that watershed, and the majority of farmers there now participate.

Along with monitoring water quality, ACWA also supports studies such as the fate of nitrogen in Iowa's soils. The intent of the partnership is to build reliable data about nitrogen in order to fully understand how it is leaking from the system.

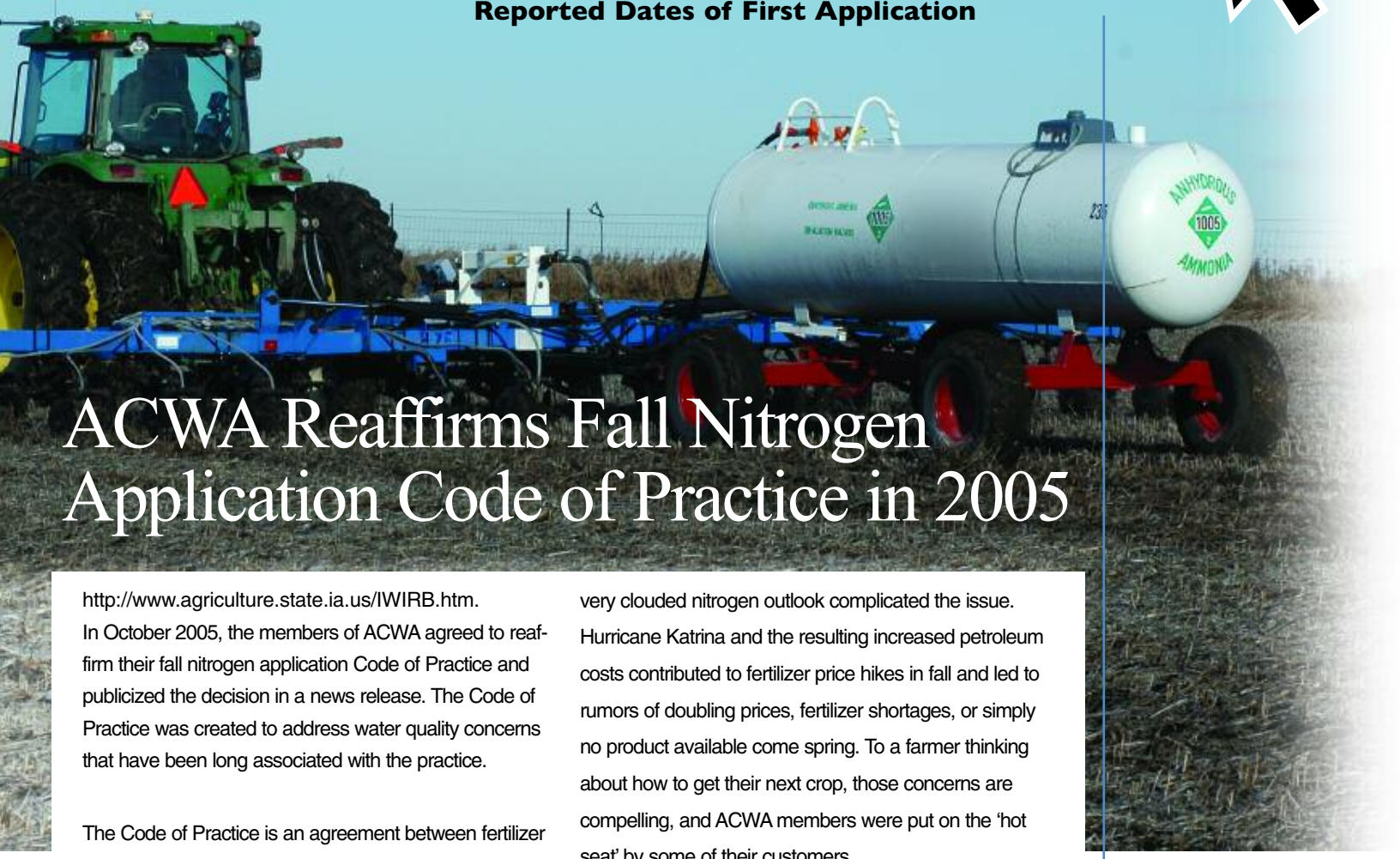
DMWW, ACWA and several producers have made a commitment in the Raccoon River Watershed. We would like the State to step up to the plate, and get programs out on the landscape that are targeted at improving water quality in the Raccoon River watershed.

Harry Ahrenholtz
West Central Coop

Dr. LD McMullen
Des Moines Water Works



Reported Dates of First Application



ACWA Reaffirms Fall Nitrogen Application Code of Practice in 2005

http://www.agriculture.state.ia.us/IWIRB.htm.
In October 2005, 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 in and around the Raccoon River watershed area 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.

Over the years, the ACWA Code of Practice has received good reviews from the public, regulators, farmers and dealers alike. But in 2005, a quick harvest and a very clouded nitrogen outlook complicated the issue. Hurricane Katrina and the resulting increased petroleum costs contributed to fertilizer price hikes in fall and led to rumors of doubling prices, fertilizer shortages, or simply no product available come spring. To a farmer thinking about how to get their next crop, those concerns are compelling, and ACWA members were put on the 'hot seat' by some of their customers.

It's important for all stakeholders in the watershed to understand that ACWA members made and kept their commitment, even in the face of extreme market conditions and many unknowns. ACWA members maintained their pledge to not sell nitrogen fertilizer in the area until soil temperatures went down.

Legislature Approves Watershed Improvement Fund

First round approved to use new watershed projects resources

During the 2005 session, the Iowa legislature created a new $5 million Watershed Improvement Fund to award grants to local organizations that are working to improve water quality. At the same time, the legislature also established a Watershed Improvement Review Board to administer the funds.

The two groups eligible to receive funds are Soil and Water Conservation Districts and local watershed improvement committees. Anyone who is affected by water quality or who may be affecting water quality, might be eligible to establish their own watershed improvement committee — a formally organized, nonprofit entity. Additional specific requirements for forming a local watershed improvement committee are found in the Request for Applications.

The Watershed Improvement Review Board — a 15-member board composed of representatives of environmental, agricultural, commodity, and water-related organizations and agencies — will review all applications. The board will then grant awards to projects that address water quality impairments from at least one of the following:

- agricultural runoff and drainage
- stream bank erosion
- municipal discharge
- stormwater runoff
- unsewered communities
- industrial discharge; and
- livestock runoff

Many types of water quality improvement projects may be eligible. Specific ranking criteria for projects are detailed in the Request For Applications, found at http://www.agriculture.state.ia.us/IWIRB.htm.

The maximum amount requested per application is limited to 10% of the annual appropriation to the fund from the legislature. For example, if $5 million

is appropriated to the Watershed Improvement Fund, the maximum allocation for an individual application would be $500,000 that year.

However, projects can be funded on a single application for up to three years. If a multi-year project is funded, the WIRB will set aside funds for the length of the entire project in order to ensure the project can be completed as proposed, and eliminating repeat funding requests.

This is a tremendous new resource for Iowans to fund the kind of projects that make a difference.

Contact

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Jerry.neppel@idals.state.ia.us

The RFA documents, other information regarding the WIRB, and contact information for questions can be found on the WIRB website at:

MEMBERSHIP | WATERSHED IMPROVEMENT REVIEW BOARD

Agribusiness Association of Iowa — Mark Rosenbury, Sioux City
Iowa Association of Water Agencies — Jolee Belzung, Ankeny
Iowa Environmental Council — Susan Heathcote, Des Moines
Iowa Farm Bureau — Leah Maass, Ellsworth
Iowa Pork Producers — Marcia Dudden, Reinbeck
Iowa Rural Water Association — Kevin Jacobson, Story City
Iowa Soybean Association — John Hoffman, Waterloo
Soil and Water Conservation Districts of Iowa — Deb Ryan, Chariton
Iowa Association of County Conservation Boards — Jeff Bergman, Burlington
Representative of IDALS — Jim Gillespie, Earlham
Representative of DNR — Bernie Hoyer, Des Moines
State Senator — Dennis Black, Grinnell
State Senator — David Johnson, Ocheyedan
State Representative — Sandra Greiner, Keota
State Representataive — Dolores Mertz, Ottoson

PROJECT FIRST ROUND | 2005 WIRB APPROVED PROJECTS

The Watershed Improvement Review Board approved 17 applications in 24 counties with a total of $4,745,200 for watershed improvement funding, addressing issues of bacteria, sedimentation, nutrient run-off, urban storm water, drainage well closures, feedlot run-off, and stream bank erosion.

- **Yellow River Watershed** — Allamakee, Clayton and Winneshiek
- **Rathbun Lake Watershed** — Appanoose, Clarke, Decatur, Lucas, Monroe & Wayne
- **Upper Miller Creek and Dry Run Creek** — Black Hawk
- **Storm Lake Watershed** — Buena Vista
- **Elk River** — Clinton and Jackson
- **Urban Watershed of Dickinson County Lakes**
- **Hewitt Creek Watershed** — Dubuque
- **Clear Creek Watershed** - Hancock and Cerro Gordo
- **Joint Drainage District Number One** — Humboldt and Webster
- **Clear Creek Watershed** — Iowa
- **Farmers Creek** — Jackson
- **Muchakinock Creek Watershed** — Mahaska
- **Viking Lake Watershed** — Montgomery
- **Little Pony Creek Watershed** — Pottawattamie
- **Mill-Picayune project** — Shelby county

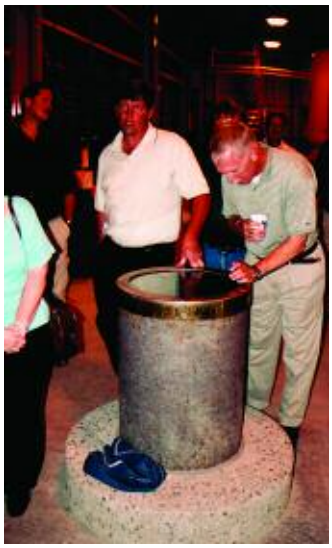
ACWA tours Des Moines Water Works

In July, 2005, ACWA members and their key staff were invited to come to the Des Moines Water Works operations center in order to learn more about the challenges that DMWW faces as it processes Raccoon River water for distribution to 350,000 Iowans.

Also on the agenda was an opportunity to hear from USDA about NRCS Technical and Financial Assistance in the Raccoon River Watershed through EQIP and CSP, Raccoon River TMDLs, and a group discussion at the end of the day.

20 people attended the meeting and toured plant, laboratory and water distribution facilities. They were given the opportunity to talk with people in lab who do the analysis on samples — work that is collected by volunteers and ACWA automated samplers that were supported by ACWA.

ACWA members tour the microbiology lab, and learn more about how DMWW evaluates water quality.



ACWA members look into a holding tank — the water here is ready for distribution.

DMWW senior chemist talks about what he has seen from sample analysis.

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