Water: We need it, but we can get too much of it; Iowa's engineers examine summer's flooding and its aftermath

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Summer program provides challenge, mental elbow room for some promising young students

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College welcomes new professors

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Researchers' work results in singular honors from NSF

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Colleagues' kudos go to these alumni, faculty, and staff

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Man of the Hour  L.D. McMullen, general manager of the Des Moines Water Works, stands in the plant he resurrected this summer from the devastation of way too much water. McMullen, a University of Iowa College of Engineering alumnus, is profiled beginning on page 10.
Over the summer, Iowa received unprecedented amounts of rainfall. The effects of the resulting flood on Iowa and other midwestern states were well publicized by the national media. Due to the natural public interest generated by this event and the well-known research strength of our Iowa Institute of Hydraulic Research, much of this issue of Iowa Engineer is devoted to flood-related research and activities in the College.

Although the University campus suffered several million dollars in damage to facilities (mostly from basement flooding on the arts campus and in Mayflower dormitory), the facilities in the College of Engineering received very minor damage. Fall classes began on schedule, and except for the silt-covered gray areas in Iowa City's flood plane (mostly near City Park), the appearance of the campus and Iowa City has returned to normal.

One of the effects of natural disasters is that they tend to test man's ability to adapt and survive the unexpected. An outstanding example is provided by the profile included in this issue of L.D. McMullen, CEO and general manager of the Des Moines Water Works (see pages 10-12). McMullen was seen almost daily on national television this past summer as he directed the remarkable recovery of the drinking water supply to the city of Des Moines.

McMullen says that his engineering education at Iowa played a major role in preparing him for the broad challenges he faced during the flooding, particularly in dealing with people and the unexpected. His remarks point up the college's long-standing emphasis on a broad liberal education that encourages graduates to respond in open-minded and flexible ways.

Also in this issue is news of three alumni who have been honored by their colleagues—Timothy Lafond, Mark French, and Timothy Hughes (see story on page 19).

Our college has produced many alumni who have achieved distinction, largely as a result of the outstanding quality of its student body and its curricular emphasis on liberal education and leadership. It is important to document these alumni accomplishments for several reasons, and I am asking that you help by providing us with appropriate information on your career. This issue contains a new postage-paid tear-out card for you to report such news, some of which we plan to publish regularly as part of expanded alumni coverage in future issues of Iowa Engineer.

The quality of our student body has become recognized as a hallmark of the college in recent years. I suspect that alumni achievement is a less well-known hallmark that deserves equal attention and acclaim.

Richard K. Miller, Dean
The Great Flood of '93—Iowa Scientists Pose Questions, Seek Out Answers

"I'm told the Chinese character for 'disaster' is a combination of characters meaning 'danger' and 'opportunity.' That's the way we tried to look at the great flood of the past summer."
—Robert Ettema

The effects of the summer 1993 flood have been staggering throughout the Midwest. Damage estimates for Iowa alone soared to $5 billion, and the entire state was declared a disaster area by the federal government.

In some areas, river flow rates rose to almost four times the average for comparable historical periods. Several cities lost their tap water, thousands of people lost property, and dozens lost their lives.

University of Iowa researchers are just beginning to investigate the causes, effects, and recovery from three months of flooding that swept through every midwestern state during summer 1993, says Robert Ettema, professor of civil and environmental engineering and acting director of the Institute of Hydraulic Research.

"Engineers at the College of Engineering's Institute of Hydraulic Research intend to be actively involved in gathering and analyzing data," Ettema says.

"Through a variety of efforts," Ettema says, "we hope to answer questions about why so much rain fell and in what kinds of patterns, the extent of riverbed scouring, and the significance of damage sustained by bridges, river walls, and other structures."

Improved long-term weather prediction and enhanced warnings of flood events also are critical areas for future research, Ettema adds.
New Methods to Study and Predict Flooding:

From his office at the Hydraulics Laboratory, high above the Iowa River, Fred Ogden can gaze through his window at the rain falling in Iowa City, and at the same time, watch rainfall in Oklahoma on his computer screen.

Ogden, adjunct assistant professor of civil and environmental engineering and postdoctoral research associate at the Institute of Hydraulic Research, and Witold Krajewski, associate professor of civil and environmental engineering, are exploring better ways to model watersheds through the use of distributed hydrologic models.

And of course, rainfall—with its effect on the physical properties of watersheds—figures significantly in their work.

“Traditionally, watersheds were treated as single, very large units,” Ogden says. “With distributed hydrologic models, we can break watershed systems into very small units and study the physics of flow in smaller areas.”

A watershed of 2,300 square kilometers, for instance, can be resolved into units of 200 square meters, for which some 58,000 pieces of data can be gathered and calculated.

In his own research, Ogden gathers rainfall data from 12 gauges on and around the Bird Creek basin in Oklahoma. Every fifteen minutes, his computer uses the rainfall data to simulate the runoff, depth of water on the soil surface, and depth of rainfall infiltrating the soil (sub-soil moisture).

By preserving these measurements, Ogden is able to determine spatial characteristics of particular rainfall events in the basin over long periods of time. With this information, he can continue to fine-tune his mathematical models based on physics—models that he hopes will soon be used in a larger study of the Mississippi River basin.

“Once the model is developed, calibrated, and verified with previous data,” Ogden says, “then current rainfall data from rain gauges, weather radars, and satellites, coupled with information about the actual amounts of water going through rivers and fine-tuned rainfall forecasts, could provide much more accurate predictions about where flash floods on larger rivers are about to occur.

“The predictions could be made at least four hours before the onset of flooding, and the percentage of false alarms would be decreased.”

Ogden’s computer model is one of several developed or refined by University researchers that may be applied to study the recent Midwest floods.

Tatsuaki Nakato, acting associate director and research scientist at the Institute of Hydraulic Research, has been monitoring the 1993 flood’s
These Researchers Create, Apply Their Own

Tatsuaki Nakato

effects on several midwestern rivers, including the Mississippi. Nakato, whose interests focus on the sedimentary features of rivers, says the summer floods did more than affect the amount of water flowing in rivers—they changed the actual physical properties of the rivers, as well.

"The elevations of midwestern riverbeds were significantly affected by the massive transportation of sediment during this flood," Nakato says. "As the river stages slowly dropped, we began to see navigational problems all over. Sediment deposition tends to be particularly excessive where river currents slow down at mid-channel 'cross-over' points, which occur between two bends in a river."

Nakato, who spoke on the midwestern floods to the 25th congress of The International Association for Hydraulic Research, held in Tokyo this September, hopes to expand his study of the characteristics of some midwestern river systems, perhaps even modeling the upper Mississippi River basin through sophisticated techniques of photography and photo imaging.

In addition to Nakato and Ogden, Forrest Holly, professor of civil and environmental engineering, also has been interested in studying flooding and related phenomena. Using a computer model he developed before the 1993 flood, Holly can use information about channel properties gathered at cross sections along a river's length to calculate flood velocities and levels, as well as channel changes. Holly's model is widely used by researchers across the country.

Over the coming months, Nakato and his colleagues will use data gathered before, during, and after the flood to investigate flood-related issues such as hypotheses concerning the directional relationships between rivers and storm courses, hydrometeorological causes of the sustained rainfall, and long-term effects of flooding on riverbed shape and location.

Nakato says that one of the researchers' main goals is to develop better ways to predict floods. "We have never seen such a persistent, lingering, and widespread flood," he says. "Although it was not a happy event, it has provided us with a unique opportunity to study a rare phenomenon and try to improve both our techniques of predicting flooding and our methods of protecting people and property."

Clogging the Mighty Mississippi

Mississippi River transportation was severely affected this year by both high flood waters and sediment deposition. As late as October, shipping along the river remained at a standstill in places like Guttenberg, Iowa, where so much sediment had washed into the river channel that barges—although able to travel north or south of the town—could not pass that point in the river.

Out with the New, In with the Old

The Iowa River cascaded over the Coralville Dam spillway (upper left) this July. When the waters finally receded late in the summer, an entire campground had been washed away, right down to the very last bush, tree, and speck of soil. Miraculously, what was left in the bare rocks was an extensive fossil bed—a slice of Iowa's prehistoric life, exposed for all to see. The site, recently featured on network television evening news, will provide treasures for the minds of scientists and the public for years to come. (Photo by Rodney White, Iowa City Press Citizen)
From Disaster Spring Answers, New Questions

Even before the soil is dry, researchers are making some surprising discoveries about the effects of recent floodwaters on natural and human-made environments.

For A. Jacob Odgaard, one of the most interesting questions about the flood concerns the structural failure of soil masses and levees. "Answering that question then opens up a whole series of others about how levees should be designed, how close they should be to the main river channel, and what kind of soil should be used to build them," says Odgaard, professor of civil and environmental engineering and associate dean for research and graduate studies.

"We're interested in how sediment—especially nonuniform soil—is transported from fields and eroded from riverbanks," Odgaard says. "Different types of soils erode differently, according to their various characteristics. Soil stratification is a key factor in determining rates of erosion."

Traditional erosion models have been based on theories of failure that assumed uniform soil particle size. Based on observations of the effects of the summer's flood, Odgaard says, it is very clear that these models were inadequate.

"Stream banks and levees don't fail the way we have always thought they did," he says. "First, most levees and stream banks are not composed of uniform soils.

"In addition, we used to think that failure was caused by the sheering action of fluid in the channel with a direct relationship between failure and the speed of the fluid. Now we are finding that several other factors are probably equally important."

Among those factors are processes that involve wetting and drying of the soil and seepage of groundwater out of and back into the riverbank.

"We've always had our suspicions about how these interactive processes work," Odgaard says, "but now we have the opportunity to study them in detail, because soil in the Midwest has been so thoroughly saturated."

Odgaard also is interested in examining the relationship between river flow characteristics and the amount of sediment transported through river channels.

"The sediment transport formulas we use now," he says, "have been developed using data from annual, biennial, or five-year floods. Nothing has been developed using data from infrequent flooding of the past summer's magnitude."

The 1993 flood, whose severity made it characteristic of the class of floods that are said to happen, on average, no more than once every 500 years, will serve as an excellent "far side of the graph" calibration point for the study of sediment transport relationships. These relationships are used to estimate soil degradation, the life of reservoirs, sediment deposit rates in river channels, and soil loss in given areas.

Finally, Odgaard says, the events of the past summer give researchers an opportunity to determine the effects of flooding on the fate of chemicals in the soil—in particular, the pesticides that have been banned from use but that remain in midwestern soil.
College's Facilities Escape Serious Damage

The University of Iowa was not spared by the summer's relentless waters. Several arts campus buildings and the Mayflower residence hall were closed for several weeks. In Coralville, flash floods along Clear Creek caused serious damage to the University's printing plant and softball fields.

Fortunately, the College of Engineering was largely untouched by the flooding, except for the basement of the Hydraulics Laboratories, where researchers had front-row seats for the spectacle of water slowly rising at the Burlington Street dam.

As the water began piling up below the dam, the normal 25-foot drop near the University Power Plant became virtually nonexistent. Eventually, the basement of the Hydraulics Laboratory was 20 feet below water level.

"At one point fish were swimming by the basement windows," says Fred Ogden, adjunct assistant professor of civil and environmental engineering and postdoctoral research associate at the Institute of Hydraulic Research.

Sump pumps working around the clock kept the building's laboratories and other rooms dry, but for safety reasons, research in the basement labs was suspended, says Robert Ettema, professor of civil and environmental engineering and acting director of the institute.

"Of course, the flood was particularly frustrating for people like Fred Stern [associate professor of mechanical engineering], who was forced to delay his ship tank projects," Ettema says. "But we were fortunate that there was no significant damage to people, research, or property at the institute."

Historical Perspective

Sustained heavy rainfall and the Iowa River's large scale of catchment proved to be a volatile combination this past summer. The peak discharge at the Coralville dam during the 1993 flood hovered around 26,000 cubic feet per second.

Despite the devastation in some areas along the Iowa River and its Clear Creek tributary, however, the magnitude of flow during the summer's floods has been surpassed by several prior floods since the mid-nineteenth century. During a flood on June 8, 1918, peak discharge at the Burlington Street dam near the UI Hydraulics Laboratory reached 42,500 cfs; discharge in May 1944 topped 31,000 cfs.

"Flood control at Coralville Dam was a tremendous help in reducing peak flows over the summer," says Robert Ettema, professor of civil and environmental engineering and acting director of the Institute of Hydraulic Research. "The dam and the Corps of Engineers proved their worth."
Flood’s Toll on Groundwater is Assessed . . .

Rising water levels were the most immediate and dramatic threat to homes, businesses, and farmland during the summer floods. But another concern soon developed: How is the flood affecting the very quality of water?

“Water quality was a secondary concern for midwestern residents who were busy saving their lives and homes,” says R. Rajagopal, professor and head of geography and professor of civil and environmental engineering. “Only later could they think about water quality, and even then, most people worried chiefly about bacterial pollution. They thought there wasn’t much danger of herbicide contamination because of the sheer volume of floodwater.”

Several reports in the news media underscored this perception, stating that the tremendous quantity of water actually decreased the level of herbicides being transported.

“The conventional wisdom,” Rajagopal says, “was that with the large volume of water during floods, concentration of agrichemicals would be small due to the dilution effect.”

But as often happens, the conventional wisdom was not the best reflection of reality.

In one of the most detailed studies of its kind, Rajagopal and postdoctoral researcher Ping-Chi Li found that during the recent floods, the amounts of herbicides in Iowa River water and drinking water were higher than expected.

Rajagopal and Li, with the assistance of University of Iowa graduate students Kevin Pape and Grace Chen and Council Bluffs high school student Danita Voss, collected more than 200 water samples from puddles on farms, ditches, ponds, tile drains, creeks, groundwater, and the Iowa, Cedar, Des Moines, and Mississippi Rivers. During ten weeks of research, more than 3,500 individual analyses of the samples were performed at The University of Iowa and EPA-certified commercial laboratories using immunoassay and gas chromatographic analyses to detect three classes of herbicides and a suite of other compounds.

From these analyses, Rajagopal estimated that between July 15 and August 23, the Iowa River at Iowa City transported 1,000 pounds of alachlor, an agricultural chemical commonly used to control weeds. Iowa City drinking water contained 0.26 parts per billion. Although Environmental Protection Agency standards call for a maximum contaminant level of 2 ppb, Rajagopal points out, normally there is so little alachlor in Iowa City drinking water that conventional testing cannot detect it.

Levels of atrazine, another herbicide, also were estimated to be higher than normal during peak flooding. Rajagopal estimates that 7,500 pounds of that chemical flowed down the river past Iowa City during the 40-day period. Atrazine concentrations were as high as 3-4 ppb in Iowa River water and 2.8 ppb in Iowa City tap water. EPA standards set a maximum contaminant level of 3 ppb in drinking water.

The third chemical found in the farm samples was 2,4-D, one of the most commonly used lawn-care herbicides and the fourth most popular agricultural chemical, with an EPA maximum contaminant level of 70 ppb. Rajagopal says 2,4-D was rarely detected in drinking water or in the Iowa River during the flood, perhaps because the chemical effectively binds to the soil.

The levels of the chemicals during the flood did not pose a threat to drinking water and declined rapidly after the flooding’s onset. But, Rajagopal estimates, during a flood period of 30 to 40 days, the total load of agrichemicals—particularly atrazine and alachlor—delivered to the Mississippi River and eventually to the Gulf of Mexico was as great as that normally delivered during an entire year.

“The concentrations of agrichemicals in water during the peak flood-flow period were near historical highs,” he says.

by Gary Galluzzo and Jean Florman

The circled “X’s” mark the location of samples taken by R. Rajagopal to ascertain levels of agricultural chemicals in three Eastern Iowa watersheds during the summer flooding.
Visitors at the International Farm Progress Show, held this past September at Amana, Iowa, got a first-hand look at how stands of poplar trees purified groundwater and reduced soil erosion during the summer flooding.

Louis Licht, associate research scientist in civil and environmental engineering, spoke and answered questions at an exhibit detailing his research with poplars. Licht and his research team planted 15,000 trees in 30-foot-wide strips between Amana crops and streams. The poplars, Licht says, dramatically improved water quality.

“We got incredibly good results,” Licht says. “Between July 22 and 26, about three inches of rain fell on two adjacent Amana watersheds—one buffered by rows of poplar trees and the other unbuffered.

“The run-off water from the buffered watershed had about one-fifth the sediment and less than half the nitrate-nitrogen per cropped acre than did the run-off from the unbuffered watershed,” he says. “The sediment would silt up nearby Lily Lake and the Coralville reservoir, while the nitrates could end up in Iowa City drinking water.”

Licht’s project got started several years ago, well before the 1993 floods. It now includes some 250,000 trees planted at diverse sites, such as a South Dakota gold mine, where they remove heavy metals leaching from mine tailings, and Ljubljana, Slovenia, where they serve as cover for a landfill.

The Amana trees, whose roots grow down to the water table, have reduced nitrate concentrations from 150 to less than 2 parts per million—well below the 45 parts per million drinking water standard set by the Environmental Protection Agency.

Licht notes that in addition to acting as a buffer for watersheds, the poplar trees provide pellets or chips that can be substituted for propane in drying corn and soybeans or for wood in wood-burning furnaces. They also have potential for use as livestock feed, building materials, or paper pulp.

The poplar tree demonstration was one of some 350 at the Farm Progress Show. Licht’s research is conducted in collaboration with The University of Iowa and Iowa State University, state and federal agencies, and private concerns such as the Izaac Walton League and the Amana Forestry Society.

by Gary Galluzzo and Linda Ferry

Corps of Engineers

During the summer, the U.S. Army Corps of Engineers had its hands full monitoring flooding and collecting data for research. Jacob Odgaard, professor of civil and environmental engineering and associate dean for research and graduate studies, notes that the types of research carried out by the corps and those conducted by the University often complement one another.

“The corps performs very applied types of research,” he says, “while we have the techniques and equipment to look at basic research questions about the mechanics of soil erosion, the interaction between soil and water, and fracture analysis.”

Odgaard adds that the Corps of Engineers “has done a fantastic job of handling and channeling minor floods through the years and was as prepared as it possibly could have been for this unprecedented event.

“I have a lot of respect for the people who work in the corps,” Odgaard says. “Like us, they are now trying to learn from this disaster, to design better structures and procedures for the future.”
On the windowsill of his downtown Des Moines office, L.D. McMullen, CEO and General Manager of the Des Moines Water Works, has placed a striking reminder of the 1993 Iowa flood. The memento is a white car on which is painted “Des Moines Water Works 1993—Pulling Together,” along with the signature of every member of McMullen’s administrative team.

McMullen and five other water works engineers are graduates of The University of Iowa College of Engineering. In 1978 McMullen was the first—and for some time the only—engineer to be hired by the water works’ engineering department. Since becoming the head of the utility in 1986, he has employed 12 engineers.

With innovative engineering, hard work, and adrenalin on overdrive, McMullen’s entire staff responded swiftly and effectively last July when flooding temporarily crippled the water plant and left 250,000 Des Moines residents without water for 12 days and without drinkable water for another week.

“There are two philosophies of engineering design,” McMullen says. “One is to teach solutions to problems. The other is to teach problem solving—how to break down a problem to its fundamentals and then build back a solution.

“It was that type of thinking—the kind that I learned at The University of Iowa—that is critical when solving a problem that no one has ever experienced before.”

Water works personnel found themselves confronted with just such a problem on the morning of July 11. With the level of the nearby Raccoon River rising a foot every hour, McMullen got word from the National Weather Service that the water was expected to crest at 25 feet—exactly the height of the levee system surrounding the water works.

McMullen realized that normal flood emergency procedures were not going to suffice and told his staff that “this is going to be a big one.” Shortly after, the river overtopped the levee system.

"It eventually crested at 26.75 feet," McMullen says. "We had 20 feet of water in the lower levels of the pumping station. Water on the lawn was six feet and flowing."

At midnight Saturday, McMullen and a core of his administrators sat on a dry curb and decided to try to pump enough of the river water back over the levee to control flooding of the plant.

"An hour later, it was clear that the pumps would not be able to keep up," he says. "I notified the public and the media that we were going to lose the plant.

"It was a terrible feeling, a feeling of defeat."

By 6 o’clock Sunday morning, McMullen had banished those emotions and had begun to plot the recovery process.

When he and his crew had left the plant Sunday morning, the only thing they had to help them start up the water works again was the utility’s computer system, which was stowed in a panel truck. That was all they needed.

“At 9 a.m. I met at the Altoona City Hall with the people on that oar—" he points toward his windowsill “—and we laid out our strategy for recovery. Our goal was to be pumping water in seven days, and we did. We would have made it in six, but the first pump we used burned out."

The banner headline of the July 23 Des Moines Register said, “And On The Twelfth Day, We Flushed." By the 19th day after the water works shut down, Des Moines had drinkable water, beating McMullen’s hopes for a 30-day recovery by a considerable margin.

Creative engineering and crews working in 16-hour shifts around the clock combined to rectify the situation. The most critical and immediate challenge was to devise and build a water works within a water works.

"It’s one of the things we had always taken for granted," McMullen says, “but once the plant shut down, we couldn’t even begin the normal operations of providing water for the city until we had built a water treatment operation and a water distribution system inside the plant itself. Until the water works inside the plant was in operation, we couldn’t control valves, backwash filters, or use chemical feeds."

With some remarkable engineering, some makeshift devices, and donated materials, McMullen’s staff created an in-house water

With water everywhere and Iowa grad rallies staff and volunteers to restore

“It was that type of thinking—the kind that I learned at The University of Iowa—that is critical when solving a problem that no one has ever experienced before.”

—L.D. McMullen
treatment operation, a water distribution system
that could maintain normal water pressure, and a
piping network throughout the plant.

"All that engineering was done on pieces of
yellow paper," he says. "We implemented some
really innovative ideas."

In a mere two days, water works personnel
and volunteers had designed and built a unique
gallery system that collected alluvial groundwater
and pumped it through microfiltration units into
large plastic storage tanks, booster stations, and
finally through the plastic piping that crisscrossed
the entire plant.

Early in the recovery process it became clear
that clean water to backwash filters was a critical
necessity. The staff couldn't use muddy river
water, and there was not enough clean water left
in the plant to both run the water works and
clean the filters.

"Then someone said, 'We really don't need
the water in the plant—we have plenty of clean
water in the underground storage tanks,' "
McMullen says. "So we put in a pump and, with
the help of the National Guard, suspended a
pipeline on ropes from the tanks to the top of
the six-story wash-water tank. What a neat idea—
it worked slick as a whistle."

McMullen describes the three-week ordeal as
a roller coaster of despair and euphoria. He says
the real key to the plant's now-world renowned
success is the people who work there.

"This is much more than a technical achieve­
ment; it's a triumph of hardworking, creative
people and the team concept of management," he says. "We've successfully implemented the
team approach at the Des Moines Water Works
for six years, and when this crisis hit, we just
continued the teamwork.

"That's the real success story." McMullen became manager of the Des
Moiines Water Works during a difficult time.

"I had been director of engineering services
for five years before becoming assistant general
manager in June 1985," he says. "Six months
later, the board of directors relieved the general
manager and said to me, 'Here's this utility for
you to run.'

"At that point, forming teams sounded like a
good idea."

Although the work situation during the flood

Back at Work McMullen (far right) talks with engineers at the Des Moines
Water Works. Along with restoring the city's water supply after the flood,
McMullen's staff has continued to maintain the plant's nitrate removal
facility. Des Moines is the largest city in the world to have such a facility.
his eyes glow. “There was just something great that happened when you threw that switch and there would be a rumble and whine and then everything would kick into gear.”

After earning his M.S. (’72) and Ph.D. (’75) degrees at the University, McMullen joined the faculty as an assistant professor of civil and environmental engineering. Although he loved working with students, when he was asked in 1978 to work as a design engineer at the Des Moines Water Works McMullen couldn’t resist the opportunity to return to operations.

Long before the flood made him a familiar name and face to thousands of Midwesterners, the Des Moines CEO had achieved prominence in his field. He is chair of the management division of the American Water Works Association, on the board of trustees of the American Water Works Association Research Foundation, and president of the Association of Metropolitan Water Agencies, an organization of the 100 largest municipal water systems in the country.

His achievements within the Des Moines operation include not only building a skilled and loyal staff, but building the largest, most efficient nitrate removal facility in the world. He has served as a member of the College of Engineering Advisory Board since 1990, chairing the group since 1992, and as a ten-year member and two-term president of the Urbandale, Iowa, school board.

McMullen attributes his new-found fame to the efforts of his dedicated, talented staff in responding to a fluke of nature. During the months since the mid-July flood, the quiet, energetic engineer has been nicknamed “The Flood Stud,” has received hundreds of pieces of fan mail, and has shown a steer named Atta Boy, Water-Boy in his honor at the Iowa State Fair.

Typically self-effacing, McMullen claims he had no idea what he was doing with the steer, then adds that it was fun to beat his competition, including University of Iowa President Hunter Rawlings.

Emblems of McMullen’s achievements are scattered around his temporary office, set up in downtown Des Moines after the administrative building at the water works was flooded. One, from the American Institute of Architects, calls him one of “today’s heroes,” silently serving his neighbors and standing tall. Another cites his sustained efforts in ending the water crisis.

Clearly, though, the chief water man’s favorite emblems are two objects salvaged from his water-logged office: a lamp made by a friend from a brass water meter, and a clock made for him by his employees from a pressure gauge. And the white oar, symbol of survival.

Other University of Iowa graduates currently employed by the Des Moines Water Works also worked as operators at The University of Iowa water plant during their college days. McMullen describes Randy Beavers (B.S.C.E., M.S. in environmental engineering), Gary Benjamin (B.S.C.E., M.S. in environmental engineering), and Dennis McAllister (B.S.C.E.) as “old hands at water works operations who gained a superb engineering design philosophy as well as practical experience during their college years at Iowa.”

Two other UI graduates, Theresa Wu (B.S.C.E.) and Don Staley (B.S.C.E.), round out the Iowa crew working at the Des Moines utility.
Rivers and Change

Once considered monsters to be tamed, rivers have been the object of shifting attitudes during recent decades, says Robert Ettema, professor of civil and environmental engineering and acting director of The University of Iowa Institute of Hydraulic Research. For instance, one prominent nineteenth-century engineer maintained that no river deserved more than one channel. Today, Ettema says, rivers are seen as more complex entities.

"With the rise of industrial society, rivers were regarded as both resource and hazard to be trained and controlled," Ettema says. "So river engineers designed projects that eliminated impediments to progress, such as backwaters and braided channels.

"Over time, as we have better understood the structural complexities of rivers and river behavior and have gained a better appreciation for the role of rivers in the larger environment, we have come to see rivers in a different light. It's not that floods shouldn't be controlled, but engineers now are asking whether the location of people shouldn't also be controlled in some way."

No single attitude predominates in the approach to river research and engineering, Ettema says. Rather, a layering of attitudes and approaches has benefited both the engineering field and the public.
With a Chance to Spread Their Wings, Talented Students Use Creativity and Untested Ideas to Solve Real Problems

Engineering = creativity in practice.
High school students who attended Iowa's "engineering summer camp" last summer had a unique opportunity to learn first-hand the meaning and significance of that equation. The 60 students—40 from Iowa and 20 from surrounding states—spent three weeks studying, researching, and thinking at the University's Summer Institute for Creative Engineering and Inventiveness. Sponsored by the National Science Foundation, the institute encourages students to explore specific research questions and experience engineering as a profession.

"It's a think tank and more," says Forrest Holly, professor of civil and environmental engineering and one of the program's directors. "We provide gifted high school students with a chance to become educated in a particular problem area, to come up with possible solutions for real-world problems, and to prepare a feasibility study for their solutions."

Now in its fourth year, the program is a joint effort of the College of Engineering and the Connie Belin National Center for Gifted Education, which is directed by Nicholas Colangelo, professor of counselor education and codirector of the summer institute.

Students working on the hydropower project had an excellent chance to see how important creativity can be in solving problems; as the summer's flood waters rose, they were forced to alter their project goals. But students and instructors kept their heads above water and managed to visit the Palo nuclear power plant, the University's power plant, and the Coralville Dam. Individually and together, they explored environmental, financial, and structural engineering implications of creating power production capabilities at the Coralville Dam.

The students applying technology to improve the mobility of the aged visited nursing homes and farms operated by individuals with physical disabilities.

In addition to having prepared project feasibility statements during the summer, all of the students will continue to work on some facet of engineering research during this school year. Next spring they and their parents will return to Iowa City to submit written reports and make oral presentations detailing their efforts. The program will honor 20 students—10 each for oral and written presentations—for excellence, and each honoree who decides to enroll at the College of Engineering will be guaranteed a scholarship.

"Last summer," Holly says, "we had three graduate students and six undergraduate students who were busy more than full time living and working with the students in the program. Two of the undergraduates had attended the institute themselves during their own high school years."

Susan Assouline, adjunct assistant professor of psychological and quantitative foundations, in the College of Education, and associate director of the Belin Center, says the institute was designed to provide structure and content to the creativity that talented students bring to their work.

"They have a lot of opportunity to think about and express their ideas, and to test them in an atmosphere where they won't immediately be 'shot down.' "

—Susan Assouline

Students who attend the institute receive financial support for travel, room and board, and spending money for the three-week session. Because parental support and encouragement is deemed important for the students' success, parents are provided travel money to attend the summer opening and closing ceremonies and the final project presentations and reports, which are held the following May.

Students at the 1993 institute worked on a problem in one of two areas: technology for increased mobility of the aged, and hydropower as an energy alternative for Iowa City.
New Faculty Members Join Two Departments

The recent addition of two new faculty members strengthens the teaching and research abilities of two departments in the college.

From his position as assistant professor of ocean engineering at Florida Atlantic University, Associate Professor Jeffrey Marshall brings expertise in fluid and environmental mechanics to the Department of Mechanical Engineering and the Iowa Institute of Hydraulic Research.

Marshall earned his Ph.D. in mechanical engineering in 1987 from the University of California–Berkeley and his M.S. in mechanical, aerospace, and nuclear engineering in 1984 from the University of California–Los Angeles. In 1983 that institution also awarded Marshall a B.S. degree in mechanical engineering summa cum laude.

Marshall’s research focus has been three-dimensional vortex dynamics, coherent structure in turbulent flows, and geophysical flows. He has chaired technical sessions at meetings of the American Physical Society and has served as a reviewer for the National Science Foundation and a number of professional journals, including the Journal of Fluid Mechanics.

Colby Swan, Jr., joins the Department of Civil and Environmental Engineering as assistant professor.

Swan comes to Iowa from Princeton University, where he earned a Ph.D. in 1993 in civil engineering. He earned an M.S. in ocean engineering in 1985 at the University of Miami and a B.S. with high distinction in 1983 from the University of Maine.

For his dissertation research, Swan developed a computer model for measuring optimum plasticity of composite materials, then tested the model on the Hagia Sophia, a fourteenth-century Byzantine structure in Istanbul, Turkey. Having determined the response of the structure to gravity and seismic loading, Swan proposed measures to protect the structure from future earthquakes.

Swan has a strong interest in promoting research collaborations between academic and industrial institutions.

Receptions Help Dean, College Alumni Get Acquainted

When Dean Richard K. Miller assumed leadership of the College of Engineering last fall, he set as one of his top priorities establishment of a closer relationship between the college and its alumni.

To that end, Miller has met with College of Engineering graduates at receptions throughout Iowa and across the nation. In October and November, he traveled to Chicago, Minneapolis, Dallas, Houston, Los Angeles, and San Francisco for receptions in those cities. Last spring he met with alumni in Iowa City, Cedar Rapids, the Quad Cities, and Des Moines, and plans are being made for future events in western Iowa.

In addition to talking informally with individual alumni, the new dean has made a formal presentation at each reception, speaking to alumni about his thoughts on the college and his plans for the future and answering questions from audience members.

Miller says he has enjoyed sharing his pride in the College of Engineering and his appreciation for Iowa’s engineering alumni.

“During my first year in the college,” Miller says, “I’ve become more impressed with our students, faculty, and especially our alumni.

“Our graduates have distinguished themselves and are a very dedicated group,” Miller says. “They’re extremely loyal to the college and have been very supportive. I look forward to working with them in the future.”
Researchers Win Prestigious NSF Awards

The National Science Foundation last spring recognized the achievements and potential of two members of the Department of Electrical and Computer Engineering.

Assistant Professor Irith Pomeranz was awarded a prestigious NSF National Young Investigator Award. Pomeranz was one of some 150 recipients out of the 1,700 scholars nominated for the award by their departments.

Intended for beginning investigators, the peer-review award provides $25,000 per year for five years. In addition, up to $37,000 per year is also provided to match funds received from nonfederal sources.

The funds can be applied to support faculty members and graduate assistants and to provide equipment and travel. Pomeranz will study a scalable approach to the design and testing of very-large-scale integrated electronic circuits.

Soura Dasgupta, associate professor of electrical and computer engineering, received an NSF Presidential Faculty Fellow Award. Of some 330 scholars nominated nationally, only 30 received the prestigious honor; 15 were engineers, and only two were from Big Ten universities.

The award provides $100,000 annually for five years to support the faculty member, postdoctoral fellows, graduate research assistants, travel, and equipment. Dasgupta will study various problems in the areas of control systems and signal processing.

"It is a tremendous honor for members of our department to have received not just one, but two of these awards in one year," says Sudhakar Reddy, professor and chair of electrical and computer engineering. "It is very unusual and a recognition by peers of our electrical engineering faculty's high quality and national leadership."

Giving Clubs Recognize Contributors for Their Generosity

In 1991, the College of Engineering established annual giving recognition clubs to make appropriate acknowledgment of the college's leading contributors. Individuals and corporations who make up the membership of these groups are the college's most generous supporters. Their annual unrestricted gifts benefit the entire college.

The highest level, the Dean's Club, recognizes benefactors who contribute $1,000 or more each year to the College of Engineering Development Fund and other unrestricted engineering funds. All contributors of $500 to $999 annually to college-wide funds are recognized as members of the Transit Club. The MECCA Club recognizes individuals who contribute $250 to $499 each year to the funds.

Membership in the three clubs has risen over the past two years. In 1990, prior to formal establishment of the three giving levels, there were 46 contributors at what is now the Dean's Club level, 38 at the Transit Club level, and 42 at the MECCA Club level. For calendar year 1992, corresponding numbers were 57 at the Dean's Club level, 52 at the Transit Club level, and 69 at the MECCA Club level.

"We have been encouraged by the results after two years of the College of Engineering recognition clubs," says Rich Wretman, the college's director of development. "This is a wonderful way for the college to say 'thank you' to its most generous and loyal alumni and friends."

Members of the recognition clubs receive a lapel pin designed specifically for the College of Engineering and special recognition in the college's annual honor roll of contributors. They also receive periodic mailings from the college that keep them abreast of current activities. Members of the Dean's Club receive invitations to special college events, as well.

For more information on the College of Engineering annual recognition clubs, contact Rich Wretman at The University of Iowa Foundation, 500 Alumni Center, P.O. Box 4550, Iowa City, Iowa, 52244-4550; phone 800-648-6973.
Looking for a Job? Or, Have Time to Mentor a Student? Engineering Career Services' Door Swings Both Ways

Remember those frantic days before graduation when you were looking for that perfect engineering job, writing resumes, and interviewing for positions? Chances are, the people who work in Engineering Career Services helped you discover your opportunities, plan your future, and just calm down.

Now that you're out in "the real world," Sharon Kurtt and her staff are still eager to help.

"Résumés, referrals, and resources—that's what we're here for," says Kurtt, director of Engineering Career Services since 1989.

Besides advising current College of Engineering students, Kurtt says, the office helps alumni design job-search materials, find career opportunities, or set up on-campus interviews. It also publishes a weekly job bulletin that lists engineering positions available nationwide.

"At any time," Kurtt says, "our office helps more than 150 engineering students participating in summer internships, 200 graduating students, and 60 alumni. We keep in touch with as many as 150 companies across the country, and that makes for a lot of potential contacts between employers and job seekers."

Kurtt gets help in establishing those contacts from her staff members, the newest of whom is Assistant Director Andrea Wagner.

"Never before have we had more than one professional on staff," Kurtt says. "Hiring Andrea was a quantum leap forward for us."

Wagner, who has an M.A. degree in counselor education from The University of Iowa, focuses her work on two programs that draw on the help of college alumni: summer internships and semester-long cooperative education positions, in which students take a leave from studying to gain practical work experience.

"The more in-the-field experience students have," Kurtt says, "the better their chances to land and succeed in a first job."

Alumni also benefit the Career Services office and its clients by mentoring students and providing information about job openings.

Kurtt is especially involved in the mentoring program, which provides an opportunity for students—particularly women and minorities—to talk with people who have succeeded in their chosen engineering professions.

"Mentoring is just one way to help students discover the realities of engineering professions during their undergraduate years," she says.

Alumni participation in career activities has benefited engineering students since the college opened its first "career planning" office prior to World War II. Today, alumni continue to play a vital role in career planning for current students, Kurtt says, just as they are welcomed as clients themselves.

"Our job," Kurtt says, "is to help individuals decide the best match between their skills, abilities, and interests and a particular field of engineering. We're here to help everyone, both students and alumni, and we try to make the discovery of career interests as personalized an experience as possible.

"We're not an employment agency—we don't try to plug a person into a job. But we do try to help people discover and weigh their options. Our real goal is to help people know more about themselves as engineers."

"Our job is to help individuals decide the best match between their skills, abilities, and interests and a particular field of engineering."—Sharon Kurtt
Three Honored with New Collegiate Awards

The winners of three new engineering faculty awards were announced May 5 at the college’s annual faculty awards luncheon. The awards—one each for teaching, research, and service—were instituted following suggestions by the faculty that recognition of excellence in these areas of academe should be enhanced.

The winner of the 1993 Teaching Award needs no introduction—at least not to hundreds of current and former students at the college. Wayne L. Paulson, professor of civil and environmental engineering, has devoted himself to teaching and serving as a mentor to University of Iowa engineering students for more than three decades. Paulson’s many classroom accomplishments were detailed in the spring issue of Iowa Engineer.

At the spring awards banquet, Dean Richard K. Miller added another anecdote to the stock of stories about Paulson’s commitment to students. “To insure smooth handling of a recent professional seminar that he had planned in Chicago,” Miller said, “Wayne did a ‘dry run’ for the session, driving into the city a week early just to time the traffic, find the parking lot and building, and so forth.”

The college’s 1993 Faculty Service Award was bestowed upon another long-time faculty member, Steve M. Collins, professor of electrical and computer engineering and of biomedical engineering.

In addition to his many achievements in research, Collins also maintains a long history of service to the college. He has served three terms on the Engineering Faculty Council and one year as council chair, and he played a central role in helping to articulate the strengths of the college when its programs came under close scrutiny during the 1989 Peat Marwick Main audit of the University. When engineering student Tony Pham was stricken with cancer, Collins helped organize a series of fundraising events to assist Pham and his family.

Collins also has served as chair of the University’s strategic planning committee and spent three years as an officer, including one as president, of the University’s Faculty Senate.

At the awards presentation Dean Miller noted with some incredulity that Collins seems to consider serving in such roles as “a hobby.” Miller then added that, “when the job absolutely, positively must get done,” Collins is the person to call.

“He has an incredible grasp of ‘big picture’ issues,” Miller said, “and routinely provides essential advice to me, to Provost Peter Nathan, President Hunter Rawlings, and many others.”

Rounding out the recognition of faculty achievement was presentation of the 1993 Faculty Research Award to Edward J. Haug, professor of mechanical and of civil and environmental engineering, and director of the Center for Computer-Aided Design. Before presenting the award, Dean Miller cited Haug’s research vision, prolific work product, amazing funding record, and ability not only to contribute to his field but also to mold the very direction of computer-aided design research.

“Ed Haug’s published work is held in extremely high regard internationally,” Miller said, “and he is definitely on the cutting edge of new fields. Ed is able to get to the heart of the matter quickly and simply, and he is known as an energetic, enthusiastic, focused, and demanding researcher.”

Paulson, Collins, and Haug were among a group of faculty and staff members honored at the University Convocation, held September 27 at the Iowa Memorial Union. The program opened with a musical prelude by the Iowa Brass Quintet and introductory remarks by Jerald Schnoor, professor of civil and environmental engineering and president of the University Faculty Senate. University President Hunter R. Rawlings presented awards after speaking on the creative imagination that informs the work of the University’s faculty and staff members and their contributions to society. The evening program concluded with a reception.
Engineering Alumni Win Professional Recognition from Their Colleagues

Three College of Engineering graduates have recently won professional recognition.

Timothy J. Lafond (M.S.E. in CEE, 1982), environmental operations manager at S.C. Johnson & Son, Inc., in Racine, Wisconsin, was awarded the 1993 North American Samuel C. Johnson Environmental Stewardship Award at a June 7 reception for his “impressive efforts in behalf of environmental causes without pay or company sponsorship.”

A conservationist since childhood, Lafond applies his concern for the environment to his professional work as well as his free time. He helped establish a successful and attractive recycling drop-off facility in southeastern Wisconsin and a town compost site. As a volunteer engineering consultant, he reviews permit requirements and advises the town of Mount Pleasant, Wisconsin, on controversial environmental issues.

In monthly speaking engagements at local schools, Lafond has helped students learn about environmental careers and issues. He mentors three students pursuing degrees in environmental science and has helped high school students organize a highway cleanup day.

“It’s fun to challenge grade school children, to help them open their horizons,” Lafond says.

Lafond donated four-fifths of his $2,500 award to the Department of Civil and Environmental Engineering to meet a critical need for laboratory equipment and supplies.

Mark N. French (Ph.D. in CEE, 1992) was selected by the Universities Council on Water Resources (UCOWR) as first place winner in the dissertation/thesis competition for the Outstanding Water Resources Thesis in the Field of Engineering and Physical Sciences. French, who is an assistant professor of civil engineering at the University of Louisville, was a guest at the August 5 UCOWR annual meeting in San Francisco, where he received the award.

Timothy Hughes (B.S.E. in ECE, 1993) recently was chosen one of four 1993 Tau Beta Pi Laureate award winners. The laureate program recognizes gifted engineering students across the nation who excel in nontechnical areas. Tim, an award-winning professional jazz musician, earned a music degree at The University of Iowa in 1991. He currently is a Ph.D. candidate in cellular and molecular biology at Baylor College of Medicine. Only 32 laureates have been chosen in the program’s 11 years.

Exceptional Achievement

Rebecca Rowe, secretary in the dean’s office at the College of Engineering for the past eleven years, received a University of Iowa Staff Achievement Award for 1993 at the University Convocation, held September 27 at the Iowa Memorial Union. Rowe was one of only seven people chosen this year to receive the award, which recognizes exceptional service by the University’s non-faculty staff members. Each staff award winner was presented with a certificate and an Amana clock.

In nominations submitted on her behalf, Rowe was lauded for her efficiency and effectiveness and her ability to maintain consistent, high quality work on regular duties while carrying out a variety of special projects. Faculty members praised her for maintaining professional and positive working relationships through demanding times at the college. Rowe was especially lauded for her work with students and her participation in the college’s search for a new dean.

The University holds a convocation each fall. Faculty and staff members upon whom major University honors have been bestowed during the year are recognized at the ceremony (see story on page 18).
Correction

The story about establishment of the Donald and Jeanne Tweed Trust Fund for the College of Engineering that was published in the spring issue of Iowa Engineer stated that Donald Tweed holds 18 patents on the Touchtone dial. Tweed actually holds a total of 18 foreign and domestic patents, including one patent on the Touchtone dial. Iowa Engineer regrets the error.

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Strike Up the Band  College of Engineering students make up a significant proportion of the Hawkeye Marching Band: 32 of the band’s 250 members—almost one of every eight—are engineers. Iowa Engineer caught up with some of the marching engineers as they got ready for the Homecoming Parade October 15. Left to right: Julie Trachta (E4, Cedar Rapids), piccolo; Rebecca Seidl (E2, Cedar Rapids), trumpet; Brad Johnson (E4, DeWitt, Iowa), baritone; Michelle Cwick (E4, Arlington Heights, Ill.), clarinet; Stephen Gruber (E1, Cedar Falls, Iowa), alto sax; Meredith Landorf (E1, Warrenville, Ill.), clarinet; Matt Schafer (E1, Charles City, Iowa), trumpet; Robert Schwan (E3, Davenport, Iowa), alto sax; and David McWeeny (E4, Gowrie, Iowa), mellophone.