

Lake Darling

A snapshot of success



Look at Lake Darling now!

How one Iowa lake is making real progress



The improvement is clear!

What's the problem?

Before improvements were made, a number of factors were hurting the water quality in Lake Darling and driving people toward other lakes.

Lake Darling was

slowly disappearing. Built in 1950, the 305-acre lake had shrunk to 267 acres. Sediment washing in from the watershed was filling in the lake and causing other problems. Excess nutrients, pesticides and bacteria were washing in with the sediment. The water became cloudy, fish habitat declined and bacteria levels led to swimming advisories at the beach.

Impacts from sediment and nutrients landed the lake on the state's impaired waters list in 1998. High bacteria levels, a measure of contamination from animal and human waste, were added to the lake's impairments in 2002. Those high bacteria levels kept the lake from meeting one of its state-designated

What's a watershed?

The area of land that drains into a lake or stream. Water traveling over the surface or through groundwater may pick up contaminants like sediment, chemicals and waste and deposit them in a body of water.

standards, use for primary contact recreation, such as swimming.

Lake Darling, named for legendary Iowa conservationist Jay "Ding" Darling, has historically been used extensively for fishing, swimming and boating. The lake lies within the 1,400-acre Lake Darling State Park, which sees about

"In the spring, the lake was the same color as hot chocolate.

~Don Kline

200,000 visits per year. However, poor water quality conditions sent anglers and others – as well as their tourism dollars – to different parks.

When Iowans choose a lake to visit, water quality is the factor they look at most, according to a 2003 study by Iowa State University. The study also found that Iowans prefer lakes with clear water and without bacteria problems or water odor.

For Lake Darling, water clarity began to decrease in the mid-1970s as intensive agriculture sent more sediment into the lake.

"It was always darker colored then," said Don Kline, DNR fisheries biologist at Lake Darling. "In the spring, the lake was the same color as hot chocolate."

Kline's monthly water clarity testing since 1978 has shown the effect of sediment washing into the lake. The cloudy water couldn't support the microorganisms that small fish fed on, and larger fish couldn't see to feed. The sediment has also clogged stream channels, destroyed aquatic habitat and covered fish spawning and feeding areas, among other things.

The problems from sediment, nutrients and fecal contamination from the watershed have been evident in the lake. However, now the improvements are just as visible. On the following pages, read how Lake Darling is reclaiming its former glory as a destination lake.

Donnie B. Dickinson: Landowner takes a risk for conservation

Donnie B. Dickinson has conservation practices scattered throughout his farmland – tile outlet terraces, more than 10 ponds and nutrient management. But selling him on no-till practices wasn't easy.

"At first I wasn't very enthused about it, it was a change for me. It seemed like a sloppy way of farming," Dickinson said. However, today he recognizes the benefits of the practice.



Donnie B. Dickinson

"It seems like kind of the thing to do. I figure it's the best for soil conservation, that's the big plus," he said. "Plus you save wear and tear on your machinery. Less trips in the field saves fuel, and there's less erosion."

Dickinson, 60, has farmed in the watershed all his life and currently farms several hundred acres in the watershed. Dickinson also fishes in Lake Darling from time to time, and has noticed a change in the water.

"It's definitely getting better," he said.

Dickinson is not alone in his conservation practices. Grid sampling keeps track of nutrient levels in his and others' fields, a practice made possible by a grant from the Iowa Pork Producers Association to the Lake Darling Watershed Project. One of his tile outlet terraces was a group project with other landowners. That project came about because of the watershed project, he said.

"A lot of credit ought to go to Stan Simmons and the other people in the office," for the watershed project's efforts to clean up the lake, he said.

Making improvements

Landowners and other community members have worked to improve the lake by installing conservation practices and volunteering their time.

While conservation practices have been part of the Lake Darling watershed for years, the last five years has seen a boom of water quality improvement projects.



Photo courtesy Washington Co. SWCD
An erosion pond on Craig Wright's farm helps trap sediment.

During this time, 124 construction projects have been completed, involving 55 of 71 landowners in the watershed. Many of the projects were group projects, collaborations between the watershed project, multiple landowners and other agencies and organizations.

Without conservation practices, more than 16,000 tons of sediment were reaching Lake Darling every year. Initial conservation practices reduced that number to 10,444 tons per year.

During the last five years, the amount of sediment reaching Lake Darling has decreased from 10,444 tons per year to 6,978 tons per year. For more on how these projects (explained below) are showing results, please see pages 6 and 7.

Erosion control ponds

The ponds trap an estimated 95 percent of sediment from their drainage area. They also add recreational, wildlife and aesthetic benefits to landowners. Many of

these ponds were constructed along county roads and within the state park.

Tile outlet terraces and sediment basins

While similar to terraces and sediment basins, these structures are generally smaller. They catch runoff and slowly release it through a vertical underground tile to a stream or ditch. The slow release of the runoff allows sediment to settle out before reaching a stream.

Water control basins

Water control basins are embankments, located in areas with concentrated runoff. The basins trap runoff water and sediment before they can reach a stream.

Conservation Reserve Program (CRP)

Land enrolled in CRP reduces erosion, increases wildlife habitat and improves water quality by applying conservation plans to cropland that is set aside. CRP includes annual rental payments.

Nutrient management

A grant from the Iowa Pork Producers Association is helping the watershed project do grid and pit sampling to help landowners determine the right amount of manure to put on their fields.

"This helps us know what we're spreading and how much needs to be spread," said Stan Simmons, watershed coordinator.



This pond controls erosion and offers great fishing, too!

Roy Rogers: A conservation showcase

Roy Rogers began using conservation practices in 1947 by farming on the contour. Today, his farm in the southern part of the watershed has become a showcase of conservation practices.



Roy Rogers

The 134-acre farm is home not only to corn and soybeans, but to tile outlet terraces, two ponds, contour

buffer strips, filter strips, a windbreak, tree plantings and conservation tillage.

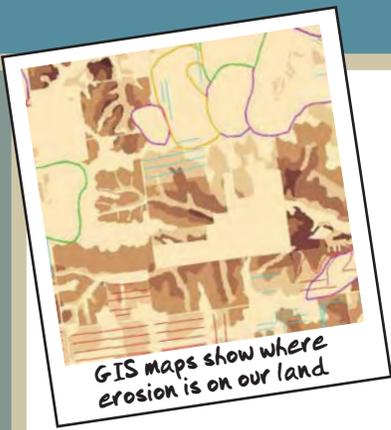
"Soil conservation is very important," said Rogers, who has farmed in the watershed for 62 years. "We're just here on this earth for a little while. I think future generations will appreciate what we've done."

Rogers remembers as a boy watching Civilian Conservation Corps members work on his neighbor's farm. That neighbor, Glen Hofler, influenced the way Rogers looked at conservation on the farm. Today, those conservation practices are showing their benefits.

"The ground retains its potential to produce well, and I don't have the erosion problems I used to have," Rogers said.

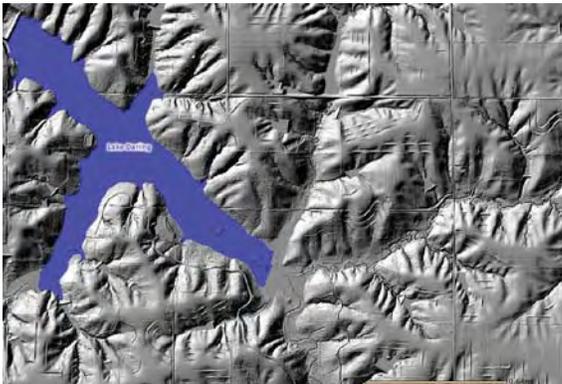
Also an avid deer hunter and fisherman, Rogers has noticed changes for wildlife. He does most of his fishing in farm ponds, but noted that conservation practices throughout the watershed have helped water quality and fishing there, too. And practices on his land, like buffer strips, have created habitat for wildlife.

"All these conservation practices help. The water isn't as muddy as it used to be," he said.



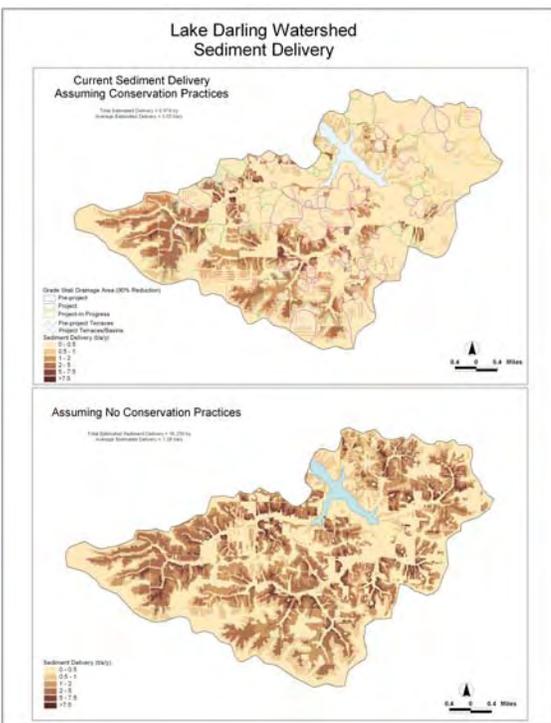
Mapping tools for improving Lake Darling

New mapping technologies are changing the way landowners look at farm planning.



Above: A LiDAR map shows the elevation of the Lake Darling watershed, as well as conservation practices around the lake. LiDAR can be used to plan conservation practices for landowners.

Below: A GIS map shows the amount of sediment that would reach Lake Darling if no conservation practices were used in the watershed (bottom), and the decreased amount of sediment that currently reaches the lake, taking into account conservation practices already installed in the watershed (top).



LiDAR offers accuracy

A new technology called LiDAR— or Light Detection and Ranging— is an interactive topographic map with elevation data accurate within eight inches of actual elevations. The current statewide data has an accuracy of plus or minus five feet. LiDAR is a process of scanning the earth with lasers from an aircraft to obtain accurate elevations. It is similar to sonar in that it measures distance by the time it takes for the laser to reach the ground and bounce back to the aircraft.

LiDAR has been used to map the Lake Darling watershed, and the DNR hopes to expand the mapping statewide. LiDAR has many potential uses for landowners, including:

- Reduction of planning costs for soil conservation structures like terraces and sediment ponds
- Erosion potential measurements and modeling
- Floodplain and flood insurance mapping
- Permitting for animal feeding operations (floodplains and slope)
- Evaluating the performance of conservation practices

GIS maps pinpoint problems

Geographic Information Systems (GIS) use graphics and data to create watershed maps that identify problems and evaluate possible solutions. The maps are helpful in explaining watershed problems and solutions to landowners.

GIS mapping links spatial data – the actual physical location of something – with attribute data, or information about that location. For example, a lake’s physical location is spatial data, while the lake’s name and size is attribute data.

GIS works to combine spatial data with different layers of attribute data. For example, physical data is often combined with information on soil loss, conservation practices and land use to pinpoint areas where practices are needed. GIS has been used in a number of Iowa watersheds and is also being used to evaluate successes in watershed projects.

Interactive mapping on the Web

www.iowadnr.gov – click on “Mapping– GIS Interactive”

LiDAR and color infrared photography available under “Basic Map and Air Photography Viewer”

Getting to the source: Bacterial monitoring

DNR investigations help pinpoint problem areas in the watershed

Routine water monitoring at Lake Darling's beach, conducted since 2000, documented that fecal contamination (indicated by high *E. coli* bacteria levels) was a problem in the lake. But the source of that contamination and bacteria remained a mystery. Was it livestock? Wildlife? People?

In 2003, the DNR began an innovative study to determine just where the bacteria were coming from in the watershed. Numerous tools were used to track the potential sources of bacteria, explained in the box below.

"For this project we looked at the three main sources of bacteria in the watershed – namely livestock, wildlife and humans," said Eric O'Brien, the lead DNR investigator on the project. "We found bacteria from each of these groups, although the vast majority of bacteria seemed to be coming from animal sources."

The results of the investigation have helped target areas in need of management improvements, such as sediment retention basins.

A number of "hot spots" for bacteria already have new management practices installed, and the findings will help

locate future projects. Reducing sediment delivery can also reduce bacteria delivery. Fecal bacteria can attach to sediment and silt particles, which carry bacteria into streams and the lake.

"We installed a couple of critical sediment retention ponds below small cattle feedlots that should reduce bacteria delivery," said Stan Simmons, watershed coordinator.

Immediately after management practices were applied throughout the watershed, improvements in the bacteria levels began to be observed.

Consistently elevated bacteria levels at the beaches have steadily dropped and storm events typically do not deliver as much fecal contamination to the lake as they had in the past.



A water sample

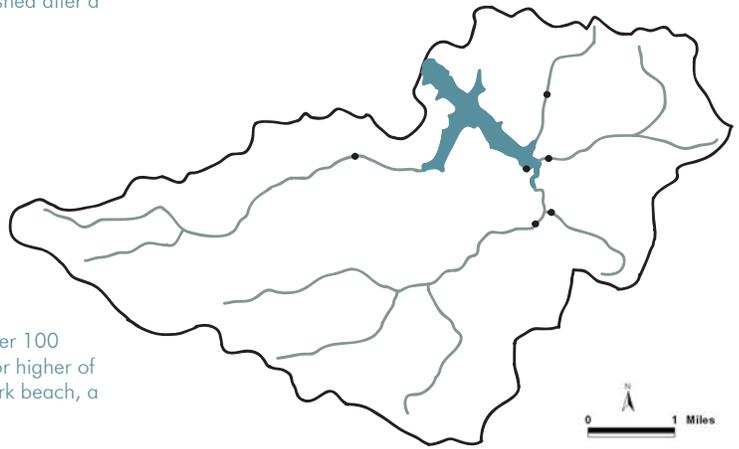
Bacteria levels in Lake Darling watershed: Before and After

Taken from monitoring sites throughout watershed after a rainfall of greater than one inch.

Site	2003	2005
A	23,000	130
B	1,800	5
C	5,300	5
D	27,000	120
E	4,600	290
F		160

Results in CFU/100mL (colony-forming units per 100 milliliters). When a level of 235 CFU/100mL or higher of *E. coli* bacteria is detected at an Iowa state park beach, a swimming advisory is posted.

Not all testing sites represented here.



The research methods

In addition to routine water quality monitoring at fixed points, four innovative methods were used to determine bacteria sources. DNA ribotyping is based on the principle that each individual bacterium has a profile or "fingerprint" that is unique. However, bacteria originating from the same type of animal look very similar. By comparing the "fingerprints" of bacteria in the water with known animal sources, the DNR is able to determine its original source.

Another method is to look for resistance to antibiotics by the same bacteria used in DNA ribotyping. Through antibiotic resistance analysis, we can also compare known sources with bacteria in the water.

Alternatively, the DNR looked for specific markers, such as caffeine, that are only contributed by humans; and monitored for pathogens (disease causing microorganisms) that only originate from specific animals.

Seeing results: Cleaner, healthier water

Changes in the watershed have improved the water and have locals optimistic on fishing, increased park use and effects on local communities.



A cleaner Lake Darling

The truth is in the numbers

During the course of watershed projects, the amount of sediment reaching Lake Darling has dropped from 16,259 tons per year to 6,978 tons per year. Less sediment in the lake means better water clarity. Bacteria levels have dropped dramatically at a number of testing sites.

As you'll read below, Lake Darling showed high bacteria levels when the DNR began monitoring state park beaches in 2000. Those results led to swimming



DNR Fisheries Biologist Don Kline with lake water samples

advisories being posted at the beach, and many visitors stayed away from the beach and the park. But improvements in the watershed, combined with the bacterial monitoring described on page 5, have led to improvements at the beach. In 2005, only three swimming advisories were posted, half the number of a year before and a significant decrease from the 11 advisories posted in 2002. Read on to see how these improvements are impacting the park and nearby communities.

Park use affects "The Home of Lake Darling"

The sign into town welcomes visitors to "the Home of Lake Darling." The small town of Brighton, just east of the park, is proud of its lake. A few years ago, though, the lake wasn't pulling in the people it once did.



Brighton veterinarian Fay Vittetoe

A number of swimming advisories posted at the park's beach due to high bacteria levels didn't mean just fewer swimmers, said Fay Vittetoe, a Brighton veterinarian who enjoys the park's quiet trails. Vittetoe, like other Brighton residents, noticed a decrease in people visiting the park after the advisories were posted. There were fewer campers to bring in their pets for care. Ice fishing was becoming big, Vittetoe said, but anglers stayed away af-

ter the attention the lake got during the summer.



Rose Jaynes at B.J.'s

and it's always hard to get rid of the negative image."

Because of its large watershed, the lake has always had problems, said Merrill Lucas, park manager at Lake Darling State Park. In his 32 years at the park, he would see heavy rains wash in sediment and bacteria. When swimming advisories began popping up, day use and fishing went down. But now the new ponds throughout the watershed are trapping that sediment and bacteria before they reach the lake.

As the water quality has improved over the past

few years, Lucas and Vittetoe have seen camping and park use begin to rebound, and both anticipate more people will visit the park this coming summer.

"It's improving and will keep improving," said Lucas.



Park Manager Merrill Lucas

"I felt like this year, with more boat rentals and more people swimming, it was coming back. I think park use will continue to come back once people realize water quality is improving here."

If water quality had continued to decline, Vittetoe said the park would have been used less, local businesses would be hurt and people might have even moved out of Brighton.

While Jaynes said many different economic issues factor into the success of her business, which is located on the highway leading to the lake, continuing poor water quality could result in fewer people coming through Brighton.

The small town's population of about 670 has remained pretty stable over the past few years, but Vittetoe expects that as water quality continues to improve, the town and surrounding areas will grow.

Jaynes also knows the importance of the lake to the community.

"We have it pretty good here," Jaynes said. "It's nice to drive just three miles to take a hike, watch deer or take kids to the beach. I can't imagine it not being here."

Fish feed on improved water quality

Everyone benefits from improved water quality at Lake Darling. Even the fish. And that's good news for anglers who come to Lake Darling for a shot at the bass, bluegill, crappie and catfish.

With better water quality, the lake is seeing blooms of beneficial

algae. Microscopic zooplankton feed on the algae, small fish feed on the zooplankton, and large fish snack on the small fish.

"I think future generations will appreciate what we've done."
~Roy Rogers

"It's fired up the food chain," said Don Kline, a DNR fisheries biologist who has worked at Lake Darling for 35 years. "The fish are very plump. They have eaten well

this summer and are ready to go into winter."

Kline believes people have

noticed the improved water quality and will visit the lake more often next summer. He saw more people fishing at the lake this fall than he has in many years, he said.

"I've noticed a dramatic change in the past two years," said Kline. "The work that's going on in the watershed has really had an effect."



Fishing at Lake Darling

Partnerships are key to project success

You may have heard the term "it takes a village." In Lake Darling's case, it takes a watershed.

A cleaner lake is the result of the hard work and partnership of many landowners, groups and agencies.

"Lake Darling is a tremendous public resource and it's worth saving and protecting," said Stan Simmons, watershed coordinator. "Without partnerships with various groups and landowners, you can't do what needs to be done."



Landowner Dorothy Schultz and County Engineer David Patterson worked together to install this

Partnerships made individual projects work as well. Dorothy Schultz is one Lake Darling landowner that worked with the watershed project and Washington County to build an erosion control pond.

After workers dug the hole for the pond, the excess dirt was used to build up the road and widen it, preparing it for future paving. The road serves as the dam for the pond, which filled with water naturally after rainfalls. Schultz gained a pond, the county has an improved road and the lake has less sediment washing into it.

"As engineers, we try to be environmentally friendly," said Bob Bauer, a retired Washington County engineer who worked on the project. "These are the little things we can do to help."

The county received some help as well. Having the watershed project's involvement helped create contacts between the county and landowners, and provided some financial assistance, said David Patterson, the current Washington County engineer. Seeing all the benefits of the project made creating partnerships easier, he said.

"They saw the project on a larger scale, with the work benefiting many areas," Patterson said.

Patterson said the county has done these types of projects for 20 years and is currently working on similar projects in the Skunk River watershed. Conservation is also nothing new to Schultz, who has tile outlet terraces, a livestock watering system that keeps cattle out of ponds and streams, three ponds and land in the Conservation Reserve Program. To Schultz, the environmental changes are already clear.

"To me, it's a benefit to everyone. There's an immense difference in how much cleaner the water is," Schultz said. "It's been a very good project and we've seen a lot of improvement already."



Bob Bauer

Lake Darling Watershed Project partners:

Lake Darling landowners and residents; Iowa DNR; Iowa Department of Transportation; Iowa Department of Agriculture and Land Stewardship; Farm Service Agency; Natural Resources Conservation Service; Washington, Jefferson and Keokuk County Soil and Water Conservation Districts; U.S. Environmental Protection Agency; Iowa Pork Producers Association; Iowa Farm Bureau; and Washington, Jefferson and Keokuk County Engineers.

Conservation benefits farm, lake

Lake Darling is cleaner, and Craig Wright is saving money

and soil. And on top of that,

he has another place to take his family fishing.

Wright farms about 400 acres in the Lake Darling watershed and has installed a number of practices, including three ponds.

Beyond creating a family fishing spot, the ponds also hold back erosion from Lake Darling.

"It means soil is staying where it's supposed to be," Wright said.

One of his ponds is the largest installed by the Lake Darling watershed project. Before, it was just a big ditch, not farmable ground, Wright said. However, funding from the project made the pond possible.

"It would have been hard for me to afford to do it without government help," Wright said.

In addition to the lake's benefits, Wright is seeing cost savings from nutrient management and total no-till practices.

Soil tests let him know how much manure to apply to fields. That keeps excess manure from running off into streams, and saves money on fertilizer costs.

With no-till, there's fewer trips across the field, smaller equipment and less fuel. Wright said he's now seeing just as good or better yields with no-till as compared to traditional tillage.

But it's also conserving soil and keeping soil out of the lake, where he takes his family to camp and fish in the summer.

"If we can help Lake Darling, that's the biggest benefit," he said.

What still needs to be

Work is ongoing in the Lake Darling watershed to continue the improvement of the lake. Upcoming projects include:

- DNR to update septic systems in the park, including system at the youth camp
- Four large group terrace projects
- Continuing work with Iowa Pork Producers Association grant for nutrient management
- DNR water impoundments within the park are ready for construction
- 14 total projects planned through the watershed project for fiscal year 2006
- Park and lake cleanup projects by the volunteer group Friends of Lake Darling

These watershed projects have also paved the way for in-lake restoration projects. In the next two to five years, depending on funding, the DNR would

like to begin multi-year restoration projects such as dredging, shoreline restoration and improving fish habitat.

"It's critical that we have the watershed work in place first," said Mike McGhee, DNR lakes and rivers project coordinator. "Restoration is expensive, and you only want to do it once. We want to make sure that work lasts. The work in the watershed is preventative maintenance, keeping the lake clean after restoration."

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