



Lake Papakeechee: Beneath the Surface

an investigation into your lake's health

CENTER FOR
**LAKES &
STREAMS**™



GRACE
COLLEGE



LAKE SIZE *178 acres*

WATERSHED SIZE ... *3,301 acres*

MAX DEPTH *40 feet*

AVG DEPTH *5 feet*

INLETS *Flow from
Hammond Lake*

OUTLETS *Flow north to
Lake Wawasee*

ACCESS *Private*

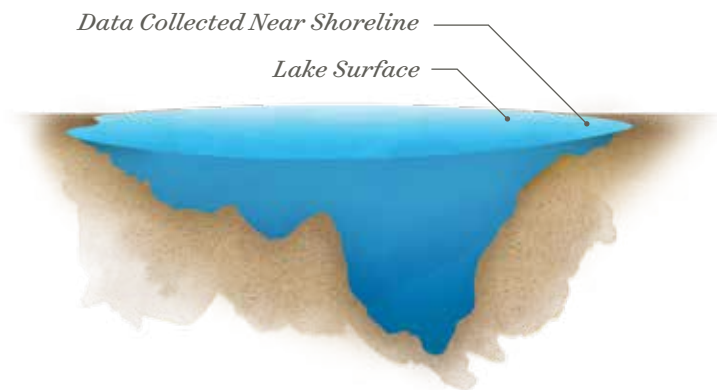
RECREATION *Fishing*

Your Lake, Your Home

At the Center for Lakes & Streams, we know that Lake Papakeecheie isn't just any body of water. It's part of your everyday life. It's where you share memories. It's where your kids (and their kids) play. In other words, it's home. For that reason, we committed to gathering important information to help keep your home safe. This report is a summary of that information, collected over our four-year study.

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Our Study

In 2010, the Center for Lakes & Streams launched an ambitious research project: Studying 44 of Kosciusko County's largest lakes to assess blue-green algae toxins. As we investigated, we collected data on water clarity, dissolved oxygen and other parameters. After four years of research, this left us with a wealth of valuable information.

This is a summary of our results specific to your home: Lake Papakeecheie. Because the majority of contact with water in Lake Papakeecheie takes place near the shoreline, this study uses data collected off a pier from a representative shoreline area and compares Lake Papakeecheie to other Kosciusko County lakes.

A technical report of this data is available online at lakes.grace.edu.

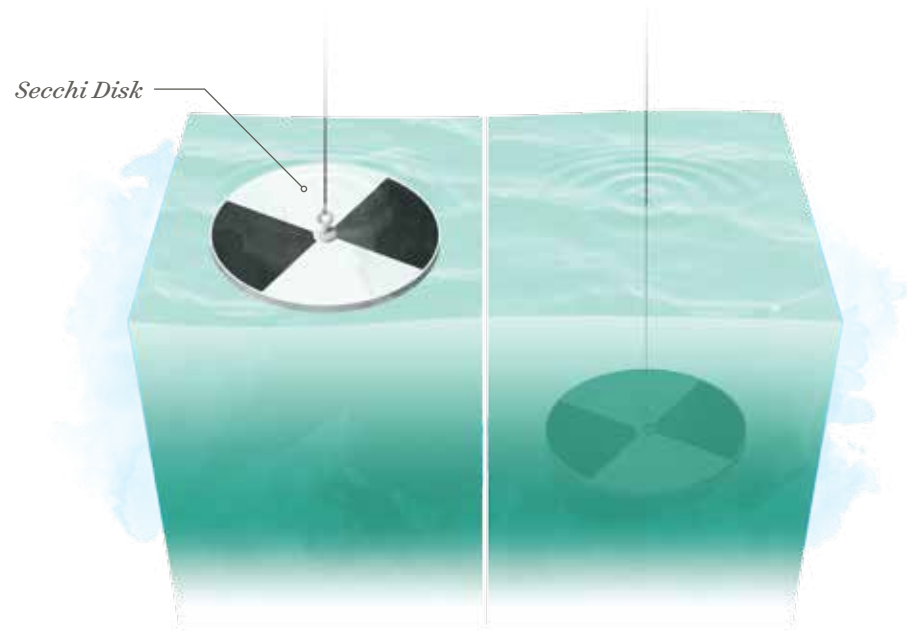
This research was funded by the K21 Health Foundation, Grace College and private donors.

WATER CLARITY

a measure of how far down light penetrates through water

How clear is your water? Measuring water clarity is the first step in assessing the health of a lake. A clear lake is generally a healthy lake, but murky water is a sign that something may be wrong — such as too much sediment, pollution or an overgrowth of algae. Once the clarity of water is assessed, it is important to conduct more tests to find out what is affecting the lake's water.

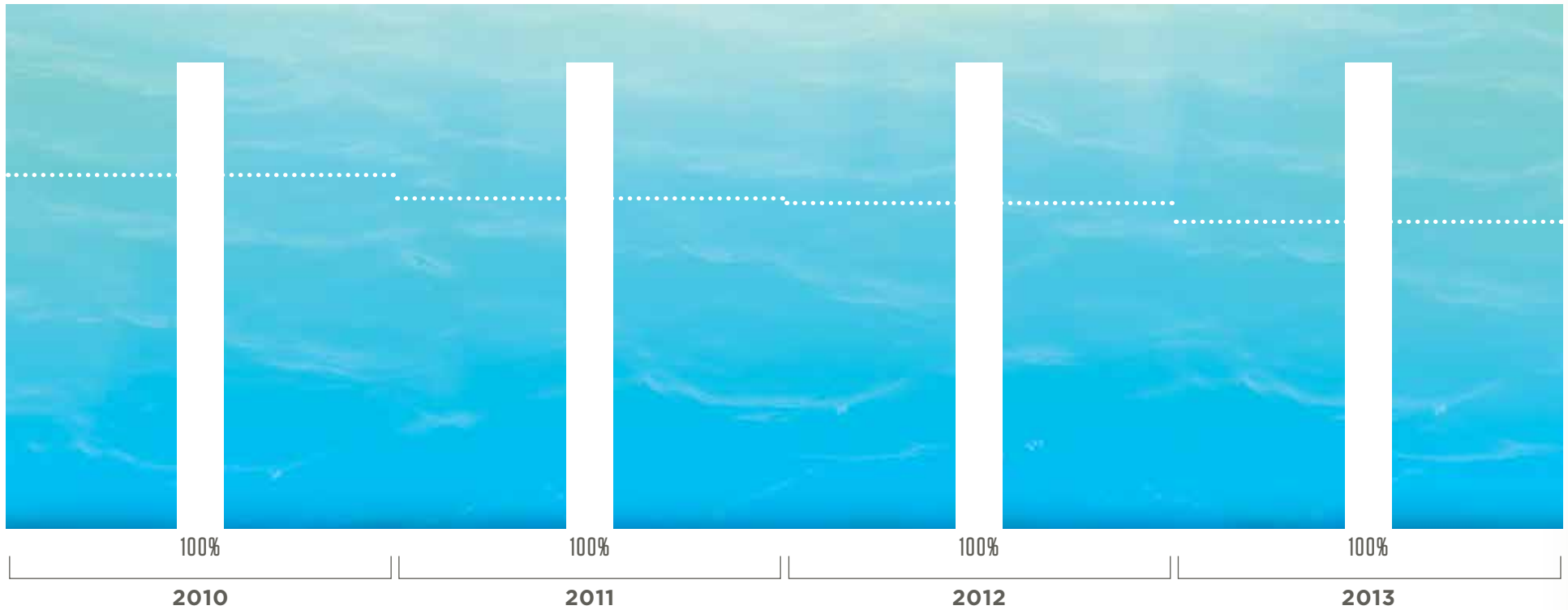
How is water clarity measured? Water clarity is measured with a tool called a Secchi disk. A Secchi disk is a frisbee-sized metal disk that is painted with a black and white pattern. The disk is attached to a string and lowered into the lake water until the black and white pattern is no longer visually distinct. The depth of the disk is recorded as a measure of the water's clarity.



WATER CLARITY *in* LAKE PAPAKEECHIE

■ Lake Papakeechee Other Lakes in County (yearly average)

Percentage of time during the year that the Secchi disk was visible at 3 feet below the surface.



Observations:

- Water clarity was consistently good enough to see to the lake bottom from a pier (at a three-foot water depth)
- Lake Papakeechee's water clarity was better than many other lakes in the county but could still be improved

DATA SUMMARY: Lake Papakeechee's water clarity could be better. Decreased water clarity can be caused by nutrients (phosphorus and nitrogen) making more algae grow during the summer. Additional factors might include boat activity in shallow areas or wind and waves stirring up the lake bottom.

MICROCYSTIN TOXIN

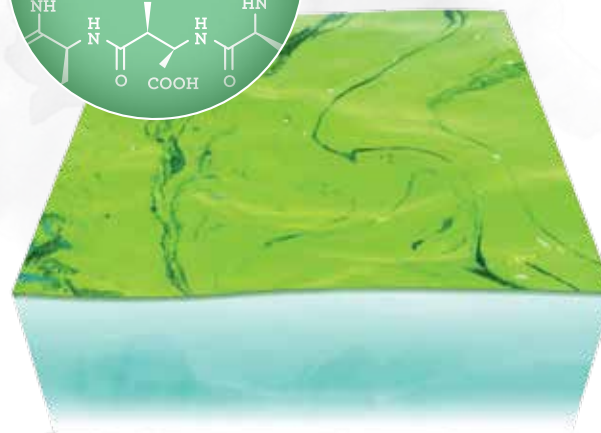
a common toxin produced by blue-green algae that primarily targets the liver but is also a skin, eye and throat irritant

Blue-Green Algae and Toxin Levels

Blue-green algae is distinguishable from other algae by its paint-like or “pea soup” appearance in the water. It is also the type of algae that produces a variety of health-threatening toxins. At this time, it is not clear what causes blue-green algae to produce these toxins. We focused our research on one specific type of toxin, microcystin, because it is the most commonly studied blue-green algae toxin.



Sometimes blue-green algae can produce toxins



HEALTH RISKS BASED ON MICROCYSTIN LEVELS

For recreational waters as outlined by the World Health Organization

	LOW RISK LEVELS	MODERATE RISK LEVELS	HIGH RISK LEVELS
Possible Health Problems	Short-term adverse health outcomes, e.g., skin irritations, gastrointestinal illness	Potential for long-term illness Short-term adverse health outcomes, e.g., skin irritations, gastrointestinal illness	Potential for acute poisoning Potential for long-term illness Short-term adverse health outcomes, e.g., skin irritations, gastrointestinal illness
Typical Actions	Post on-site risk advisory signs Inform relevant authorities	Watch for scums or conditions conducive to scums Discourage swimming and further investigate hazard Post on-site risk advisory signs Inform relevant authorities	Immediate action to control contact with scums; possible prohibition of swimming and other water contact activities Public health follow-up investigation Inform public and relevant authorities

TOXIN LEVELS *in* LAKE PAPAKEECHIE

Lake Papakeechee
 Other Lakes in County (yearly average)



Observations:

- Microcystin levels were consistently in the "low risk" zone but highly variable
- Lake Papakeechee's microcystin levels were similar to other lakes in the county

DATA SUMMARY: Even though Lake Papakeechee's microcystin toxin levels were consistently below guidelines for human health, the high variability of these levels indicates strong potential for future risk. Under the right conditions, such as high nutrient levels and warm temperatures, blue-green algae could produce microcystin toxin levels above human health guidelines in Lake Papakeechee.

E. COLI

Escherichia coli (E. coli) is a bacteria that normally lives in the intestines of people and animals

You have probably heard of public beaches being shut down because of *E. coli*. This bacteria is closely monitored by health officials and others because it is a common problem with water. There are many pathways through which *E. coli* can enter and contaminate lakes, including combined sewer overflows, neglected septic systems, wildlife, and urban/agricultural runoff.

Beach Closure. In public health, *E. coli* levels are used as an indicator of fecal pollution in water. If the levels of *E. coli* in water are too high, the beach is deemed unsafe and the beach is closed. The public beach closure guideline for *E. coli* is established by the Indiana Department of Environmental Management and enforced by local health departments.



E. coli
Bacteria

E. COLI AND YOUR HEALTH

Why monitoring E. coli levels is important

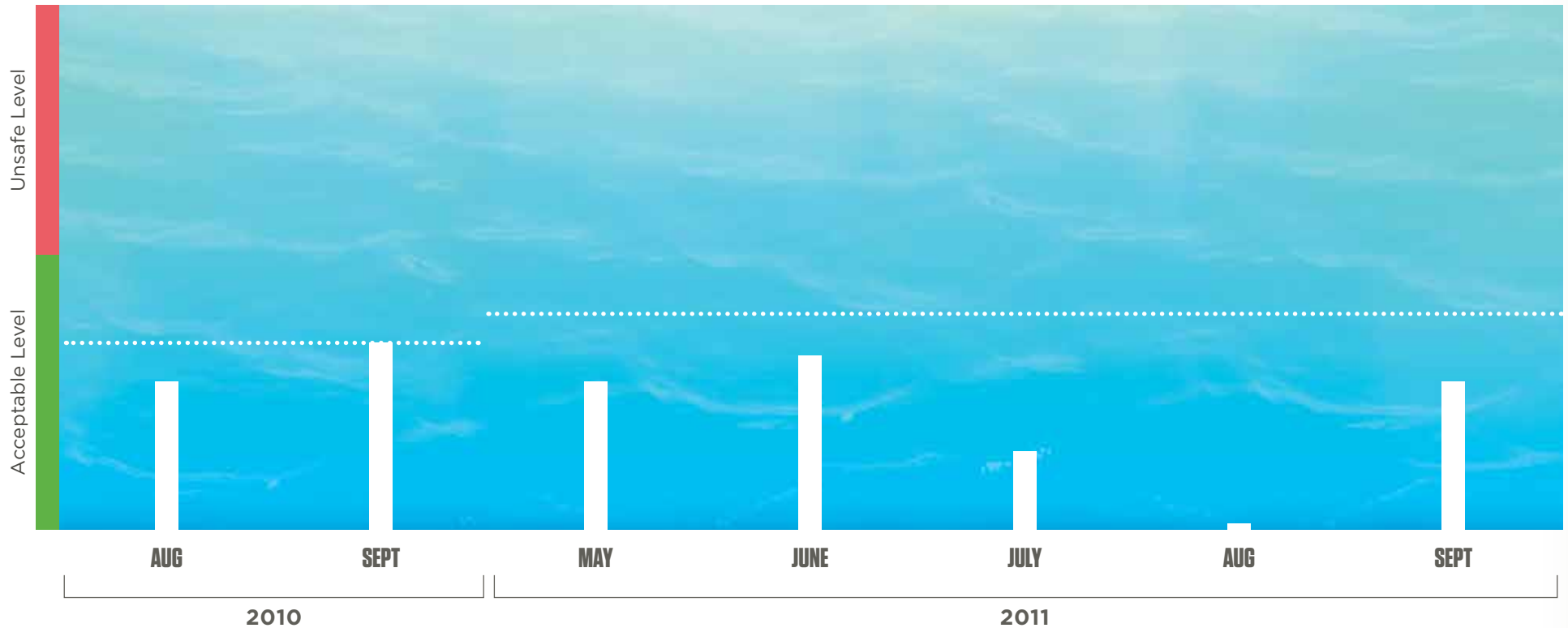
If *E. coli*-contaminated water is ingested, it can cause infections and various other health issues:

UNSAFE *E. COLI* LEVEL

Possible Health Problems	Gastroenteritis, which can cause a variety of symptoms, including nausea, vomiting, abdominal cramps and pain, diarrhea, headache and fever Ear, eye, nose and throat infections
Typical Actions	Close beaches

E. COLI LEVELS *in* LAKE PAPAKEECHIE

|| Lake Papakeechee Other Lakes in County (yearly average)



Observations:

- E. coli levels were well below the human health guideline
- Lake Papakeechee's E. coli levels were lower than other lakes in the county

DATA SUMMARY: At the studied shoreline area of Lake Papakeechee, *E. coli* levels were encouraging. However, it is not clear whether this shoreline area is representative of the entire lake's shoreline.

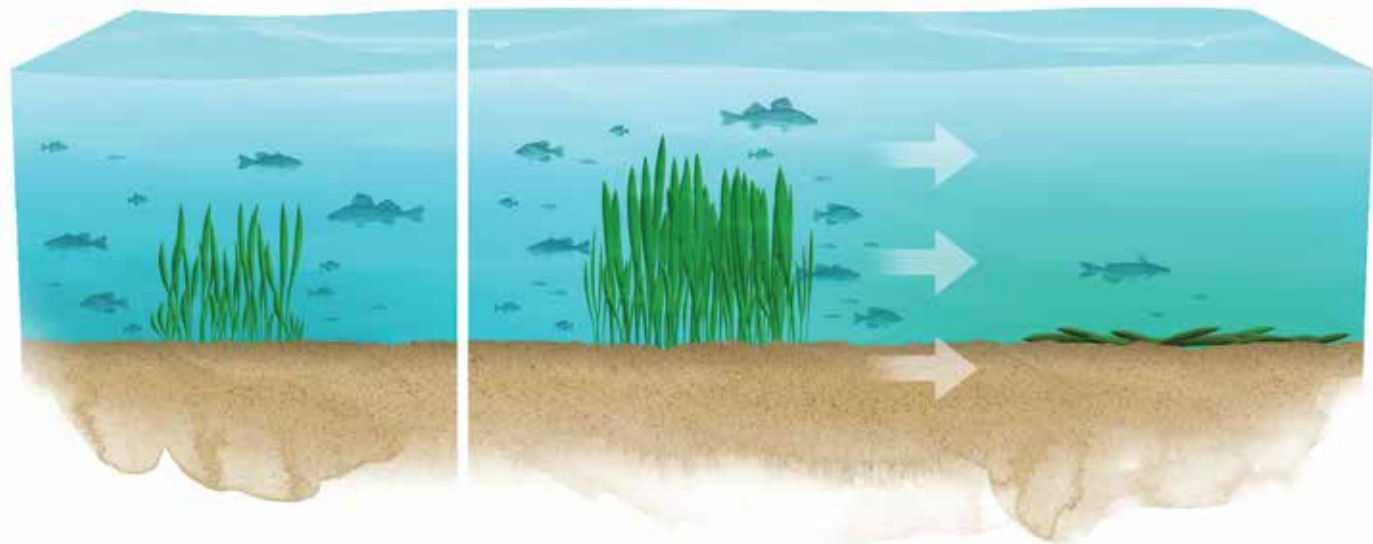
DISSOLVED OXYGEN

gaseous oxygen in water and available to aquatic organisms for respiration

The Effects of Dissolved Oxygen. Dissolved oxygen is the major factor that determines where organisms can survive in an aquatic system. Fish and other organisms require enough oxygen to survive, but high levels of dissolved oxygen can indicate an overabundance of actively growing plants and algae. When plants and algae die, the decomposition process takes oxygen from the water. The presence of too many plants and algae eventually leads to so much oxygen being taken from the water that fish and other organisms do not have enough oxygen to survive. This is one of the primary causes of fish kills (large amounts of fish dying at the same time).

DISSOLVED OXYGEN LEVELS

The amount of Dissolved Oxygen affects the survival of fish and other organisms



Healthy Level of Dissolved Oxygen

Overabundance of Dissolved Oxygen

Not Enough Oxygen

DISSOLVED OXYGEN LEVELS *in* LAKE PAPAKEECHIE

||| Lake Papakeechee ... Other Lakes in County (yearly average)



Observations:

- Oxygen levels were often high through the summer
- Lake Papakeechee's oxygen levels were similar to other lakes in the county

DATA SUMMARY: High oxygen levels in Lake Papakeechee during the summer indicate high algae and plant growth from too many nutrients in the lake. When these excess plants and algae die later in the year, they use up oxygen as they decompose. The resulting lack of oxygen makes it difficult for fish and their food sources to survive. Thus, the presence of too many nutrients is harmful for the fish and other wildlife in the lake.



TAKE ACTION

Help Keep Lake Papakeechee a Great Place to Live. Research is a great start, but we need your support to keep the waters of Lake Papakeechee at healthy and safe levels. Here are a few of the most effective ways that we can all do our part.

What you can do to help

Reduce fertilizer usage on your lawn and garden (especially close to the lake) to save yourself some money and keep extra nutrients out of Lake Papakeechee. If you want to know exactly how much nutrients your lawn or garden needs, the Center for Lakes & Streams can help you with soil testing resources.

Add beautiful vegetation along your shoreline to filter out nutrients as water carries them toward the lake. Native plants (those plants that occur naturally in our region) are best because they cut down on your maintenance costs and provide the best filtration. The Center for Lakes & Streams has information to help you get started.

Avoid yard waste entering the lake. Leaves, grass clippings or other yard waste have nutrients which increase algae growth, reduce water clarity and lead to less oxygen for fish. Use this yard waste as compost in your garden to further reduce your fertilizer use or have it removed from your property. If you would like to start composting and need some direction, the Center for Lakes & Streams can help.

What we can do together

Expand collaborative relationships and projects with non-lake residents. Water flows downhill, so neighborhoods, industries, farmers and businesses in areas surrounding Lake Papakeechee all influence the lake. Your support and participation has allowed the Center for Lakes & Streams to pursue these efforts, and we look forward to working with you to wexpand them.

Provide financial support toward research to solve the identified challenges facing Lake Papakeechee. Our center samples inflowing and outflowing streams and can use this data to start quantifying nutrient sources. This will help us navigate future efforts toward efficiently reducing these nutrient sources. We could also study boating activities and additional algae toxins to make appropriate recommendations based on science.

Engage our lake neighbors and our non-lake community members in educational programs that inform them about how to best take care of Lake Papakeechee. You might consider helping as a volunteer for the Northern Indiana Lakes Festival or financially supporting one of our K-12 programs.



Making our lakes and streams clean, healthy, safe and beautiful

The Center for Lakes & Streams at Grace College conducts important research, engages and educates residents, and collaborates with other organizations to make the lakes and streams of Kosciusko County cleaner.

We have the expertise and tools to conduct guiding research. Led by a professor of freshwater science and outfitted with the necessary equipment, our center can perform high-quality research at a local level, focusing on the lakes and streams of Kosciusko County.

We have the capacity and competency to provide resources. Our website is a clearinghouse of data, tools and other resources pertaining to Kosciusko County lakes and streams. Our offices house educational and scientific resources we make available to local communities.

We have the background and talent to engage and educate residents. Our staff is experienced at national and local levels with operating K-12 and community outreach programs. Our Grace College student

interns and volunteers give us the personnel we need to effectively and efficiently conduct our education programs.

We have the infrastructure and positioning to lead collaborative efforts among local organizations.

Our Grace College facilities accommodate meetings, workshops and other gatherings. With countywide perspective we help create working partnerships and facilitate exchanges of knowledge and expertise.

We want our lakes and streams to be something we can all be proud of, to be clean, healthy, safe and beautiful.

By supporting the Center for Lakes & Streams you're ensuring that every effort is being made to make the lakes and streams of Kosciusko County cleaner.





CENTER FOR
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