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Designed and published  
for stream and lakefront  
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Vol. 55 No. 3

# THE MICHIGAN RIPARIAN

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DEVOTED TO THE MANAGEMENT AND WISE USE OF MICHIGAN'S LAKES AND STREAMS Published Quarterly



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## FROM THE PUBLISHER



### MLSA and *The Michigan Riparian* Working for you

A couple of easy things you can do to grow your lake knowledge, strengthen your lake association and stay current with political and legal issues regarding lakes is to subscribe to *The Michigan Riparian* magazine and join Michigan Lakes and Streams Association, Inc. (MLSA).

Riparians are our top priority and protecting Michigan inland lakes is our reason for being. We want to hear feedback from you to make sure we are on track and doing the things you want us to do to protect our Michigan lakes!

In this issue of *The Michigan Riparian* we are featuring several articles on the current problem related to high lake levels including the disaster affecting Wixom and Sanford Lakes residents. We have been listening to your concerns about it, and we will cover this topic from a myriad of sources and perspectives in this and future issues of the magazine.

We will continue to work together to keep you informed, educated and provide solutions and ideas. Please join MLSA or continue to support it if you are already on board. We hope all of your lake members get the magazine so they can stay informed and equipped to preserve and protect their lakes. Look for forms in *The Michigan Riparian* to join MLSA and subscribe to the magazine. Or...you can do it easily via our websites. Visit [www.mi-riparian.org](http://www.mi-riparian.org) and [www.mylmlsa.org](http://www.mylmlsa.org).

Please send us your suggestions for initiatives important to you. MLSA and *The Michigan Riparian* magazine are listening.

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# CONTENTS

- 5** Attorney Writes:  
High Water Blues
- 9** MLSA's Spring Webinar Series -  
A Huge Success!
- 10** Could Moving Your Home Back From  
the Shoreline Be the Answer to Rising  
Water Levels?
- 12** Ask The Experts:  
Can Anything be Done About our High  
Lake Level?
- 13** Lake Happenings:  
The Edenville and Sanford Dam  
Tragedies
- 14** Harmful Algal Blooms in Michigan
- 16** Love My Lake:  
How About a Cruise?
- 18** High Water in Inland Lakes:  
What you need to know
- 23** Effects of Fireworks on Inland Lakes:  
A Primer
- 28** Michigan's Lakes and Streams:  
Interesting Facts and Figures
- 34** New Limited Michigan Legislation  
Regarding Emergency Local Boating  
Regulations



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## HIGH WATER BLUES

For the past approximately two years, both the Great Lakes and many inland lakes throughout Michigan have been at record high water levels. Virtually every body of water has surpassed the prior 100-year water level record from the fall of 1986. And unfortunately, it appears that water levels will only rise more during the upcoming summer months.

Is there anything that a riparian property owner can do to help lower water levels or mitigate the damage caused by high water levels? There are some things that can be done, but not many.

With regard to the Great Lakes, apart from simply relying on historical cycles, which will almost undoubtedly lower the levels of the Great Lakes at some time, there is little that governments or individuals can do to lower the lake levels. Unfortunately, no one knows whether we are at the “peak” of the current high water level cycle for the Great Lakes or if the extraordinarily high water levels will continue to occur for a few more years before receding. A little bit can be done by the United States Army Corps of Engineers (“Army Corps”), the Canadian government, and others to regulate the flow of Lake Superior water through the St. Mary’s River, the Soo Locks, and the Chicago River, and also by monitoring several other points of drainage for the Great Lakes.

If your Great Lakes cottage or house is threatened with flooding or destruction, both the Army Corps and the Michigan Department of the Environment, Great Lakes and Energy (“EGLE”) have expedited the permitting process for new or additional riprap (i.e., rocks), sea walls, groins, etc. Regrettably, there is little if any government money available to assist Great Lakes riparians with mitigation efforts. It is possible that a city, village, or township could impose an assessment district with special assessments on properties along segments of the Great Lakes to pay for riprap, sea walls, etc., for the private properties on the waterfront, but those

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assessments would likely be very expensive and could benefit certain property owners more than others.

For inland lakes, there are potentially more ways available to mitigate high water problems than for the Great Lakes:

First, a similar special assessment could occur for sea walls, riprap, etc.

Second, existing dams, outlets, and similar apparatus for lowering the water level on an inland lake could be constructed, improved, cleaned out, or otherwise updated by setting a formal lake level through proceedings in the local circuit court pursuant to the Michigan Lake Level Act, being MCL 324.30701, et seq. For more information regarding that process, please see my earlier article entitled *Who Pulled the Plug on My Lake* in the Summer 2000 issue of this magazine.

Third, recently, Michigan Governor Gretchen Whitmer signed into law Public Act No. 70 of 2020 (House Bill 5401) and Public Act No. 71 of 2020 (House Bill 5402). Effective April 2, 2020, Public Act Nos. 70 and 71 permit the County Sheriff, the Michigan Department of Natural Resources, or the County Emergency Management Coordinator to establish temporary reduced watercraft speed limits upon the request of a local municipality in order to protect life and property during emergency conditions. The temporary speed limits are limited to a maximum duration of 14 days. Violation of a temporary speed limit is a civil infraction. Generally, temporary speed limits can only be issued once per calendar year; however, they may be issued twice if the municipality is seeking to implement the speed limit restrictions under a temporary ordinance.

Fourth, also effective April 2, 2020, Public Act No. 72 of 2020 (House Bill 5463) permits municipalities to request Michigan Department of Natural Resources authorization to implement temporary ordinances regulating the use of watercraft. A temporary ordinance is limited to a maximum duration of six months and may be extended or renewed only if the municipality is seeking to implement the restrictions as a permanent special local rule under MCL 324.80110.

Fifth, municipalities may regulate some inland lake uses and activities under their general police powers. For more information regarding the nuances associated with police power regulation

(Continued on page 7)

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# HIGH WATER BLUES

(Continued from page 5)

of inland lakes, please see my article entitled, *On-Lake Regulations* in *The Michigan Riparian* magazine, at page 11 (Fall, 2015).

What else can local municipalities do about high water levels? Unfortunately, municipal options are limited and will generally involve triage or mitigation rather than preventative measures. The following are several courses of action that a lakefront municipality can take to help minimize negative high water level impacts on the community:

1. Impose a moratorium on building in high water and flooded areas until the appropriate ordinances can be enacted.
2. Increase the setback requirements for lake, river, stream and wetlands areas for zoning and building purposes.
3. For municipalities that have Lake Michigan or Lake Huron frontage, enact an ordinance requiring that all dwellings, fixtures and structures that are likely to fall into the lake soon must either be moved back or removed (in order to prevent debris from ending up in the lake).
4. Apply for state and federal emergency grants and funds.
5. Urge both the Michigan Department of Environment, Great Lakes and Energy and the Army Corps to declare high water emergencies and take action along the shores of Lakes Michigan and Huron and also inland rivers and lakes.
6. Work cooperatively with the adjoining municipalities.
7. Adopt resolutions urging the Michigan Governor and the United States President to declare high water emergency areas in Michigan and provide emergency funding to affected Michigan communities.
8. Streamline and simplify the procedure for obtaining local permits and approvals for seawalls, break walls, rip rap, etc.

Does the current high water level change riparian boundary lines? In general, no. Even where a part of the lakeside yard of a riparian property is temporarily submerged, it does not normally change the legal or ordinary high water mark or the riparian boundary lines locations under the lake. Of course, if high water levels in Michigan persist for many years hereafter, it is possible that the legal ordinary high water mark may be adjusted somewhat inland, but that still should not affect the original riparian property lines. 



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# MLSA's Spring Webinar Series

## A Huge Success!

By Melissa DeSimone, MLSA Executive Director

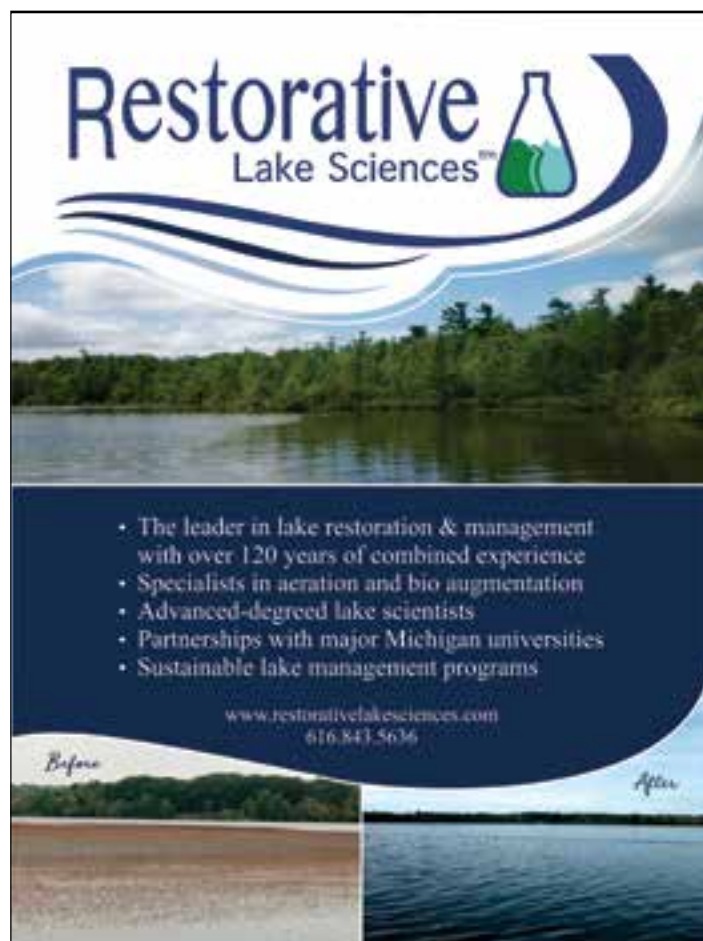


Thank you to everyone who joined us for the 2020 Spring Webinar Series. We are very pleased that the online sessions could bring important issues to our members and friends while we have all been unable to meet in person. If you missed our series, they are all available on our Michigan Lakes and Streams Association YouTube Channel in a playlist called *2020 Spring Webinar Series*. We want to thank the Glen Lake Association for generously sponsoring the series this year. We didn't know what this new webinar format was going to look like, and they supported us all the way. Last, but certainly not least, we want to thank all our incredible speakers who joined us throughout the spring. The series would not have been possible without the time and effort they put in to bring us their expertise on these incredibly important topics.

If you enjoy the online format, we have more opportunities for you. We will continue to do monthly zoom meetings to bring members together to discuss topics that are important to you. Connection information will be made available in our email newsletter each month. Subscribe to our newsletter by signing up on our website: [mymlsa.org](http://mymlsa.org). Our partners are also offering opportunities for you to learn online at the Virtual Michigan Inland Lakes Convention on September 16-18. You can find registration information on our website.

If the online format is not for you, we understand and can't wait to see you in person. Our Annual Conference will be held at Crystal Mountain Resort in Thompsonville, Michigan, on April 30 - May 1, 2021. Save the date and look for information about that event and more as we prepare for face to face opportunities and a healthier future! [Click here](#)

- ◆ **Dr. Jo Latimore** and **Erick Elgin**, both of MSU: *Exotic Aquatic Plant Watch and Secchi Disk Trainings*
- ◆ **Julia Kirkwood**, EGLE Nonpoint Source Program: *MI Shoreland Stewards Program: Are you a steward? Are you sure?*
- ◆ **Ralph Reznick**, EGLE Nonpoint Source Program: *Land Use and River Stability*
- ◆ **Jennifer McKay**, Tip of the Mitt Watershed Council: *Rising Water Levels and Impacts on Inland Lakes*
- ◆ **Gail Philbin**, Director of the Michigan Chapter of the Sierra Club and **Lynn Henning**, Regional Associate of the Socially Responsible Agricultural Project: *Concentrated Animal Feeding Operations*
- ◆ **Attorney Cliff Bloom**: *Riparian Rights*
- ◆ **Attorney Mark Teicher**: *Insurance Issues*
- ◆ **Dr. Doug Pullman**, Senior Aquatic Scientist with Applied Biochemists: *Harmful Algal Blooms*
- ◆ **Representative Jason Sheppard**, House District 56, **Brian Westrin** (Michigan Realtors), **Jennifer Rigterink** (Michigan Municipal League), **John Nash** (Spring Lake Twp. Supervisor): *Panel Discussion on Short Term Rentals*



# Could Moving Your Home Back From the Shoreline Be the Answer to Rising Water Levels?

By Jennifer McKay, Policy Director, Tip of the Mitt Watershed Council



When existing shoreline homes are threatened by high water and erosion, the costs and benefits of moving the structure back from the lakeshore should be weighed along with other alternatives. Moving a home back can compare favorably to other alternatives economically and prove to be environmentally and aesthetically better in the long run.

## HOW DO YOU MOVE A HOUSE?

In the most simple of explanations, moving a house is a four-part process:

1. Site preparation for the new location
2. Building preparation
3. The move
4. Setting the home in its new location

## WHAT DOES THE PROCESS OF MOVING A HOUSE LOOK LIKE?

Before the big move, there's a list of items for the professionals, but the homeowner can leave the house contents alone. The homeowner will need to work with a general contractor on site and building preparation and other aspects of the move, including obtaining permits, disconnecting and reconnecting utilities, excavation, and laying the new foundation. Utilities must be shut off and disconnected from the house.

Depending on the size and shape of a home, the actual moving of the structure can be completed within a day or two. If the situation is dire for a property owner, the home can be moved before the new foundation is laid, although this will increase the cost. Homes can be moved back on the same lot or, if there is not enough room, houses can be relocated to a new lot.

## HOW MUCH DOES MOVING A HOUSE COST?

As you might imagine, moving a house is not a "flat fee" type of service. There are many factors that go into the pricing of a home move, including square-footage, as well

as the structure's length, width, weight, and construction method. Garages, additions, porches, decks, balconies, chimneys, fireplaces, and other accessories can almost always be moved with the house, but add time and increase the project cost.

The total cost of moving a home ranges from as little as \$12,000 for a ranch up to \$100,000, or potentially more, for larger more complex sites. On average, costs for the industry seem to land between \$12 and \$16 per square foot.

## WHY IS MOVING A HOUSE A BETTER OPTION?

Moving structures away from eroding shorelines is a better long-term solution than installing and maintaining shoreline protection. Shoreline armoring can adversely affect the health of the Great Lakes as well as neighboring properties. As waves hit the large boulders or concrete seawalls, energy is directed downwards and sideways. Energy directed downwards erodes, or scours, the lake bottom. Scouring of the lake bottom increases with lake size and wave height, causing a loss of habitat. In addition, seawalls cause wave flanking in which energy is deflected sideways towards neighboring properties, causing erosion in places that may not have been experiencing it.

Furthermore, once a bluff or beach is reinforced, it is an ongoing financial investment to maintain the structure, which will be worn down by the lake over time. Homeowners are civilly liable for damage caused to neighboring properties by failing or incorrectly installed seawalls or riprap. In addition, any property owner whose house falls into the lake is responsible for cleaning up all debris.

While high and low water levels can have a significant impact on human lives, it is also important to recognize that the Great Lakes are a living, dynamic ecosystem. By manipulating them to accommodate our needs, we are creating more problems. In the long-term, moving a house can often be better for your pocket book, your neighbors, and the Great Lakes.



*(Continued on page 11)*



(Continued from page 10)

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**Question:** Can anything be done about our high lake level?

**Answer:** Many inland lakes in Michigan are overflowing with water this year. Riparian property owners on many of those lakes are wondering how the lake level can be temporarily lowered during these record high water times. Unfortunately, in most cases, there is no easy answer. The legal and proper way to regulate a Michigan inland lake level is to have the local county circuit court set a lake level or range pursuant to the Michigan Lake Level Act, being MCL 324.30701, et seq. However, having a circuit court set a lake level or range is usually a time-consuming process that can take anywhere from four months to a year and a half from the beginning of the process through the litigation proceedings.

Can a lake be artificially lowered during an emergency without a county circuit court proceeding setting a lake level range? In general, no. Simply having one or more riparian property owners *ad hoc* lower the lake level is not only unlawful in most cases, but also increases the liability potential when property owners “downstream” are damaged by the increased water flow from the lake.

Does the county drain commissioner have the authority to temporarily lower a lake level without a county circuit court lake level order? It is unlikely. Nevertheless, some have asserted that a county drain commissioner has that authority pursuant to the Michigan Drain Code without a statutory lake level being set by a circuit court order.

For more information regarding setting lake levels under the Michigan Lake Level Act, please see my articles in this edition of *The Michigan Riparian* magazine entitled “High Water Blues” and “Limited Michigan Legislation Regarding Emergency Local Boating Regulations” and “Who Pulled the Plug on my Lake” (in the Summer 2000 issue).

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Bloom Sluggett, P.C.  
Grand Rapids, Michigan  
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Our experts include our riparian attorney, a biologist, a limnologist, an engineer, a college professor and a state agency official. They look forward to responding to your question.



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*A look at the Sanford Dam on Wednesday. (Kaytie Boomer/The Bay City Times via AP)<sup>1</sup>*

On Tuesday, May 19th, the Edenville Dam in Midland and the Sanford Dam in Sanford Village both collapsed causing catastrophic flooding (resulting in the loss of both Wixom and Sanford Lakes). Happily, there was no loss of life in those calamities. In a future issue of this magazine, we hope to have a more detailed article regarding those two dam tragedies specifically, and dam safety in general.

These tragedies should be instructive to both Michigan riparian owners and also lake and river associations throughout the state. There are a variety of different tragedies that can involve lake and river communities, including but not limited to, dam impoundment failures, damaging high water levels, catastrophic tornadoes, fires, pandemics, environmental tragedies (such as sewage releases, oil discharges, and sudden pipeline explosions, failures involving industrial waste (PFAS) and vehicular accidents which leak pollutants into the water), terrorist attacks or riots. Therefore, it is prudent for each lake and river association or community to do all of the following:

- (1) Identify potential lake or river community risks.
- (2) Estimate the likely risk levels.
- (3) Prepare an emergency response plan for the lake or river community (and possibly include other groups, such as the local government, churches, businesses, etc.).
- (4) All riparian property owners should make sure that they have adequate insurance to cover such catastrophes.
- (5) Riparians should investigate how they might be warned of these potential dangers and plan a reasonable access route to leave the community on short notice should a catastrophe occur.
- (6) Have emergency supplies available such as extra food, a backup clean water source, flashlights, a generator, a first aid kit, extra blankets, etc.
- (7) Communicate and coordinate with local and county government bodies, police, first responders, and fire departments to become aware of emergency and safety planning efforts. <https://www.michigan.gov/dnr>

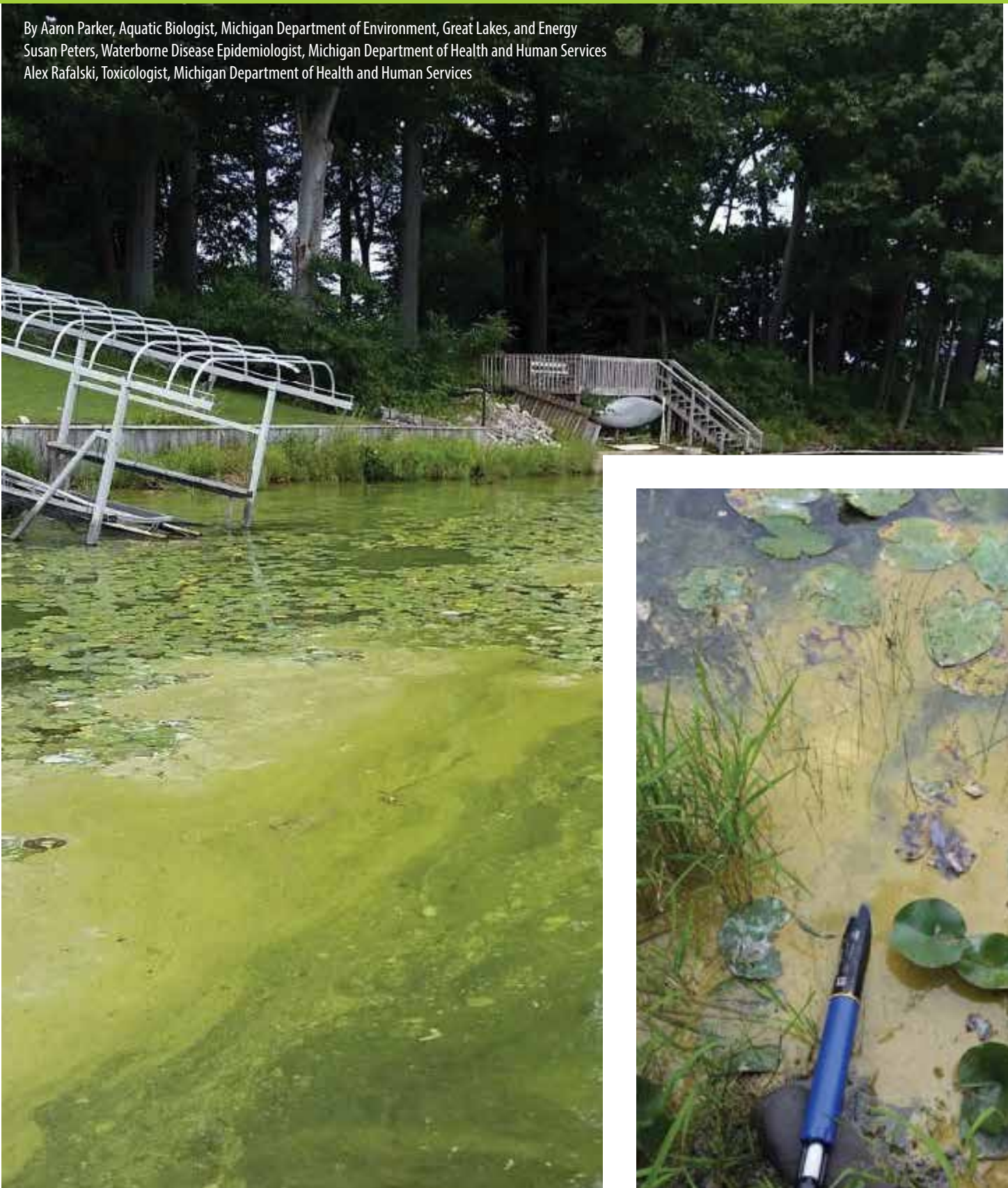


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<sup>1</sup>Photo taken Wednesday, May 20, 2020

# Harmful Algal Blooms in Michigan

By Aaron Parker, Aquatic Biologist, Michigan Department of Environment, Great Lakes, and Energy  
Susan Peters, Waterborne Disease Epidemiologist, Michigan Department of Health and Human Services  
Alex Rafalski, Toxicologist, Michigan Department of Health and Human Services





Cyanobacteria (also referred to as blue-green algae) are one of the oldest life forms on earth and can adapt to living in a wide variety of conditions in terrestrial, marine, and freshwater environments. Cyanobacteria thrive best in freshwater and, under certain conditions, they can form surface blooms that are not aesthetically pleasing, emit foul odors, and can interfere with recreational activities. Some cyanobacterial blooms are capable of producing cyanotoxins that can cause illnesses and even death in humans and animals; these blooms are known as harmful algal blooms or HABs.

Cyanobacterial blooms and their harmful effects on animals have been documented back to the 19th century (Francis 1878). Globally, the frequency, magnitude, and duration of cyanobacterial blooms has increased, with most researchers citing climate change, nutrient pollution, and invasive species as the largest causes of blooms (Ho et al. 2019). Cyanobacteria will typically reach bloom proportions in high nutrient waterbodies; however, they can also bloom in low and medium nutrient waterbodies that have been invaded by zebra and/or quagga mussels (Raikow et al. 2004). These invasive mussels will readily feed on diatoms and green algae but will not necessarily feed on cyanobacteria, which allows the cyanobacteria to proliferate (Vanderploeg et al. 2001).

When ideal conditions exist in a waterbody, either because of nutrients or invasive mussels, cyanobacteria can reach bloom proportions when water temperatures are warm (77° F and higher; Giannuzzi 2018), the water surface is calm, and plenty of sunlight is available. In Michigan, cyanobacterial blooms usually occur in June through October, with the majority of blooms being in August and September. Depending on the extent of those conditions, cyanobacterial blooms can persist for as little as one day or as long as several weeks. Cyanobacterial blooms tend to occur in patches throughout a lake, or even in one localized area, often along windswept shorelines.

Cyanobacterial blooms can be a variety of colors and textures, with an appearance that can look like scum, spilled paint, foam, or discoloration of the water (**Figure 1**). Many blooms are bright green with a “pea soup” appearance. Green algae, aquatic vegetation, duckweed, and oil sheens are sometimes mistaken for cyanobacteria blooms. Some blooms will turn a light blue or teal color as they die off.

Some common freshwater cyanotoxins that are known to cause illnesses in humans and animals include microcystin, cylindrospermopsin, anatoxin, and saxitoxin (Carmichael 2001). Within each of these classes of cyanotoxins, there are different known variants or congeners. From sampling across the state (described below), microcystin is the most common cyanotoxin detected in Michigan waterbodies (EGLE 2020b). The severity of symptoms humans and animals might experience from recreational contact with cyanobacterial blooms depends on how they were exposed, how long and the amount they were exposed to, and an individual’s health. Swallowing water that contains cyanotoxins may make humans and animals feel sick to their stomach, including symptoms such as abdominal pain, vomiting, and diarrhea. Contact with water that contains cyanobacteria may cause irritation, leading to rashes, runny eyes and noses, or asthma-like symptoms. Swallowing a large amount or frequently swallowing water that contains cyanotoxins can cause nervous system, liver, or kidney damage, which can result in weakness, numbness, dizziness, or difficulty breathing in humans and animals. Dog deaths have occurred after drinking from waterbodies with cyanobacterial blooms containing anatoxin-a, including a confirmed case in Michigan in 2019 (EGLE 2020a).

The Great Lakes region has been no exception to the global increase in cyanobacterial blooms. In 2014, a large, toxin-producing cyanobacterial bloom in Lake Erie infiltrated the drinking water supply for Toledo, Ohio and caused the city and several surrounding communities to lose drinking water access for three days. Starting in 2016, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) has partnered with the Michigan Department of Health and Human Services (DHHS) to analyze cyanotoxin concentrations in water samples from Michigan lakes

**Figure 1.** Green Cyanobacteria

**Photo Credit:** Michigan Department of Environment, Great Lakes, and Energy.

(Continued on page 17)

# LOVE MY LAKE

## How About a Cruise?

*Editor's Note: Check out the Michigan.org website for trip ideas. It offers a fascinating look at Lake Michigan cruises that begin on some of Michigan's loveliest inland lakes. Following is just a sample. Find a cruise that appeals to your sense of adventure, from tall ships to ferries to riverboats and more. As they say, "It's Pure Michigan."*



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### Sunshine Charters – Charlevoix

There's a two-cruises-in-one feel on this 40 foot sailing catamaran's tours that start in Lake Charlevoix and end in Lake Michigan with time to swim in the middle. The Sunshine II offers early, late afternoon and sunset sails, and the journey includes glimpses of the city's popular "mushroom houses" as well as the chance to head under the drawbridge between Round Lake and Lake Michigan.

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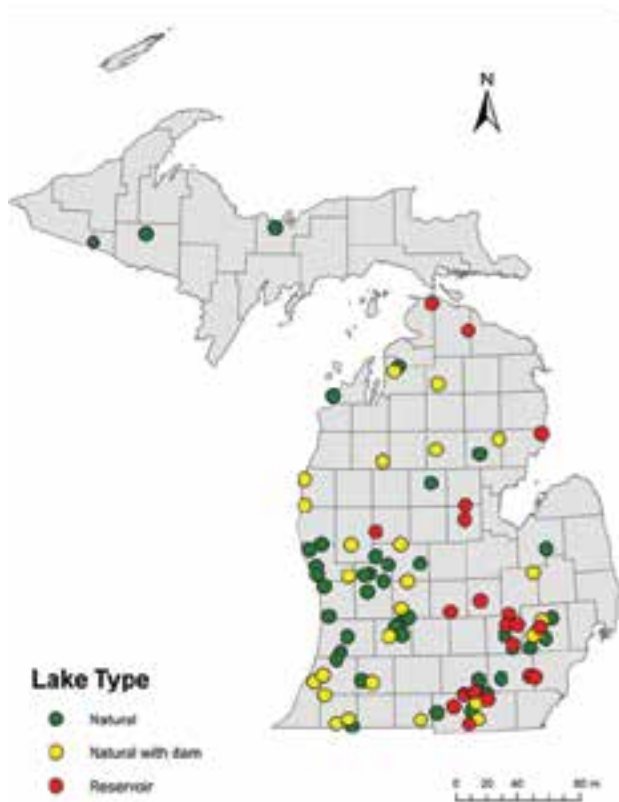
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# Harmful Algal Blooms in Michigan

(Continued from page 15)



**Figure 2.** Map of confirmed cyanobacterial blooms in Michigan lakes, by lake type, 2016-2019. Note: Map does not include five cyanobacterial blooms that occurred in Michigan rivers, wetlands, or private ponds.

and communicate those results and any accompanying recreational risks to citizens and local health departments.

To date, water samples from 223 different Michigan waterbodies have been analyzed for cyanotoxins. One hundred of these waterbodies were lakes randomly chosen for sampling by the Michigan Department of Natural Resources (DNR) Fisheries Division. Of those randomly sampled lakes, only three had detections of the cyanotoxin microcystin, and none of those concentrations were above the U.S. Environmental Protection Agency's (EPA) recreational standard of 8 parts per billion. Based on this information, it has become evident that cyanobacterial blooms are not widespread throughout Michigan to the point that they are regularly found during random lake visits.

Rather, the majority of observed cyanobacterial blooms are ones that state and local agencies are alerted to by concerned

citizens or lake management companies. In response to these reports, EGLE has confirmed cyanobacterial blooms in 93 different waterbodies throughout the state since 2016. The majority of those blooms have occurred in the southern half of the Lower Peninsula (**Figure 2**). EGLE sampling has also shown that during a cyanobacterial bloom, cyanotoxin concentrations change over time and are usually higher in areas with more cyanobacteria. While water with visible cyanobacterial blooms may contain cyanotoxins, clear water a few feet away typically has no toxins or very low toxin levels. These data support the advice that humans and pets should avoid areas with visible blooms, but unless the bloom covers a large portion of the waterbody, people and pets can typically use an unaffected area on the same waterbody.

(Continued on page 27)





*PQ Avenue near Eagle Lake in Kalamazoo County has been flooding recently, making travel treacherous. Rising water levels have had an impact on municipal infrastructure such as roads, campgrounds, wastewater treatment plants, docks and marinas.*

## **High Water and Inland Lakes:** *What you need to know*

By Nick Assendelft and Anne Garwood  
Michigan Department of Environment, Great Lakes, and Energy

Michigan is in the middle of the wettest one-year, three-year, and five-year weather periods since records were first compiled 125 years ago. The Great Lakes recently had their largest 24-month rise in 100 years of records, according to the U.S. Army Corps of Engineers.

*(Continued on page 19)*



(Continued from page 18)

All that precipitation has pushed lake levels to record heights. Whipped up by storms, ferocious waves have eroded huge portions of dunes and beaches and altered shoreline habitat for fish and animals. Left in its wake are battered docks and decks, damaged infrastructure such as roads, parks, marinas and campgrounds, and even undermined homes.

As anyone who lives along the water knows, the extensive impact that high water levels are having around the state aren't limited to Great Lakes shorelines: inland lakes, rivers and streams are experiencing similar problems.

Residents are seeing the effects from Marquette to Monroe, Bay City to Berrien County.

"The sponge is full," said Brian Rudolph of the Michigan Department of Environment, Great Lakes, and Energy's Bay City District Office. "There's nowhere else for the water to go. That means that even with a routine storm the ground can't absorb the water quickly, leading to localized flooding, swollen rivers and high water on inland lakes."

Rivers are moving nearly unprecedented amounts of water. In the first four months of the current water year — which started in October 2019 — more water has passed through the Grand River at Grand Rapids than usually flows in an entire year, as measured by the National Oceanic and Atmospheric Administration. It's the same story for other major Michigan rivers. The Tittabawassee at Midland has seen a year's worth of water in just over three months. The Manistee near Traverse City is on track in 2020 to move its fourth most water of all time. The Manistique is on track to move the most water ever.

"Over the years, draining wetlands, which normally would hold overflow water from storms, and increased development that includes impervious surfaces, means water is directed to streams, rivers and lakes before it can be absorbed into the ground," Rudolph said. "And a high water table means saturated land that can't be farmed or that is undermining infrastructure."

(Continued on page 20)



***Property is flooded behind a shoreline protection structure on Eagle Lake in Kalamazoo County. Several homes on Eagle Lake have been condemned due to the impacts of high water levels.***



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## High Water and Inland Lakes: *What you need to know*

(Continued from page 19)



*Residents living along inland lakes have had to deal with high water levels throughout the year. On Martin Lake, west of Gaylord, after the lake's water level rose, a property owner built a sandbag wall and worked to pump excess water back into the lake.*

High groundwater is flooding homes and businesses. Land is too wet to be farmed. Last spring, more than 900,000 acres of farmland couldn't be planted because of persistent rain that flooded fields, according to the Department of Agriculture and Rural Development. This year was expected to bring the same challenges.

There is just too much water and too few places for it to go.

### IMPACT FELT ON INLAND LAKES, RIVERS

Some lake associations and property owners are looking for solutions to a problem that is not easy to solve.

Among those solutions being studied are ways to lower inland lake water levels through a variety of activities, including moving more water into downstream wetlands, streams, and other lakes. However, these projects are extremely complicated to plan, design, and permit.

"It's important that any work performed that will alter the shoreline, bottomlands or lake levels be approved through the permitting process," said Luis Saldivia of EGLE's Water Resources Division. "There are often unintended consequences if projects aren't done properly. The permit process requires people to look at possible alternatives that accomplish the same goals, but minimize impacts."

During the permitting process, challenging questions must be answered, including evaluating impact on invasive species, downstream flooding and natural resources.

(Continued on page 21)

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If a lake organization is considering such a project, they must apply for a permit from EGLE as early as possible. Due to the inherent challenges, lake drainage projects often take more time to process than other projects. Applying for a permit before the situation becomes critical is important. Even with EGLE expediting permits in critical situations, experienced contractors and engineers to do the work are in high demand and short supply.



If water levels can't be lowered, property owners need to be aware of the effects high levels can have on lake and public health.

When soil is saturated, even a pleasant rainfall can result in increased runoff, which carries fertilizers and other pollutants into lakes. Limiting fertilizer use and managing other polluting materials on land can keep them from being exposed to rainfall and runoff. Reducing what ends up in the lake is even more critical now than ever to maintain lake water quality.

High water levels and flooding can carry sewage from sewers or septic systems into yards, basements or into the lake itself. Flooding can also plug septic drain field pipes by introducing fine particles of silt and mix solids into the system, limiting the effectiveness of a septic system or backing up waste into a home. Be aware, too, that pumping out a septic tank during times of high groundwater can cause concrete tanks to become buoyant and shift toward the surface.

Drinking water wells can also be affected by high groundwater levels or lake flooding. Poorly constructed, unmaintained or damaged wellheads can allow contaminants to enter drinking water. The Michigan Department of Health and Human Services encourages regular maintenance of home well systems. If flooding happens near a well, have

the water tested for coliform bacteria, nitrate and nitrite. Users who suspect their water is contaminated should get water from a safe source to use for drinking, cooking, and food preparation until the well is tested by the local health department to see if it's safe to use.

## PERMITS REQUIRED FOR HIGH WATER RESPONSE ACTIONS

Many property owners are looking for ways to protect their land, homes and other structures. But before any regulated protection activities can be started, a joint permit application must be filed with EGLE. Shoreline protection in one area can have negative impacts on the lake and the land on either side of what's being installed.

To handle the demand for high water related permits, EGLE has bolstered its permitting resources and is expediting applications where homes, critical infrastructure or human health and safety are at risk. "EGLE staff are working with waterfront homeowners to find timely solutions that are effective and that have the least impact on neighbors and Michigan's important natural resources such as lakes, streams, wetlands, and sand dunes," Saldivia said.

(Continued on page 25)





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# Effects of Fireworks on Inland Lakes: A Primer

By Dr. Jennifer L. Jermalowicz-Jones, MLSA Science Advisor

## INTRODUCTION:

Our inland lakes are a valuable water resource that are utilized for recreational and navigational activities and also provide a sense of place in addition to enhancing property values. Inland lakes have been under multiple threats over time due to development, land use issues, invasive species, pollution, erosion, etc. Little is known about the effects of fireworks on the water quality and aquatic biota of inland lake, but this question re-surfaces frequently among riparians. It is important to understand these impacts in order to take appropriate steps to reduce harm to our lakes and preserve them for future generations. This will be the first article of many on this topic over the next few years as we learn more about impacts of fireworks and other materials on our lakes.

## COMPONENTS IN FIREWORKS AND FATE IN THE LAKES:

In order to understand the impacts of fireworks on the water quality of inland lakes, we must first understand the chemical components and their unique characteristics. The majority of fireworks consist of cations such as calcium and magnesium and anions such as chloride. In addition, heavy metals such as copper, barium, aluminum, iron, antimony, lithium, strontium, titanium are present. Other molecules such as carbon, phosphorus, oxygen, potassium, sodium, sulfur and zinc are additionally present. Combustion from ignited fireworks is

commonly known to produce fumes with sulfur, nitric oxide, and ozone.

The primary components in pyrotechnic substances are perchlorate potassium salts and ammonium. Perchlorate in particular has been demonstrated to have a half-life of 29 days and in one study of reflective ponds in New York state, was present in concentrations 30-1,480 times higher than background levels following firework displays (Wu et al., 2011). In lakes, a big concern is the finding that sediments in lakes may not be able to effectively remove perchlorate via chemical adsorption (Wilkin et al., 2007). The EPA has established a reporting limit of 0.02 mg/l for

perchlorate and thus concentrations greater than this in sediments should be further investigated for possible bioaccumulation. In a study on Lake George (USA) during the period of June 17-July 25, perchlorate concentrations were below the detection limit in both the water column and lake sediments. Lake George is 28,800 acres in surface area and has an average depth of approximately 70 feet (Lake George Association) and this may indicate that larger, deeper lakes can tolerate inputs more readily than shallow-water lakes due to dilution and attenuation. That study also determined that levels of barium and antimony remained below detectable levels.

*(Continued on page 24)*



# Effects of Fireworks on Inland Lakes: A Primer

(Continued from page 23)

A study by Vecchi et. al, (2008) in Italy demonstrated that strontium in particular had the highest levels of magnitude compared to baseline concentrations in the air with up to 120 times the baseline levels. This is significant because small airborne particles can easily be deposited onto lake surfaces and interact with the lake chemistry.

One particular concern is the lack of oversight in the development of fireworks to regulate their content prior to sales. The American Fireworks Standards Laboratory (AFSL) developed a testing program which meets U.S. federal requirements; however, the testing process is currently voluntary for all imports and manufacturers. As riparians, we are all aware of the importance of regulations in protecting water quality---think of why we regulate *E. coli* at beaches!

## EFFECTS ON AQUATIC LIFE:

Heavy metals alone can contribute to reproductive and developmental impacts on aquatic animals (Meeker et al., 2009). At very high concentrations (677 ppm) ammonium perchlorate was found to have devastating impacts on spawning of Zebrafish but at lower concentrations (18 ppm) the effects were negligible (Patino et al., 2009). Additionally, the exposure to concentrations of 10 ppm and 100 ppm of ammonium perchlorate to larval fathead minnows (present in many Michigan lakes), resulted in developmental retardation, lack of scales, and poor pigmentation in a study by Crane et al., (2005). There are many more examples of the effects of firework ingredients on different taxa of aquatic life.

## CONCLUSIONS:

Although there is strong evidence that fireworks may impair the water quality and aquatic life within lakes, much more research needs to be conducted on Michigan lakes of varying size, depth, and population. The lower concentrations of firework chemicals measured during the Lake George study could indicate that larger, deeper lakes are less prone to measurable concentrations following large-scale firework events. The reflection ponds studied in Albany, New York had measurable quantities of firework chemicals and thus may indicate that shallower waterbodies are more vulnerable to accumulation. Undoubtedly, Fourth of July

events are an important part of our American culture and celebration and also support community social and cultural capitals. However, we must balance the continuing research findings of firework impacts on aquatic environments with our long-held traditions.

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## High Water and Inland Lakes:

### *What you need to know* (Continued from page 21)

The number of permits that EGLE has approved has jumped compared to previous years. In the first half of the current fiscal year — from October 1, 2019, to April 31, 2020 — EGLE approved nearly 2,000 permits for inland water resource projects and 1,058 permits for shoreline protection on the Great Lakes. The total number of shoreline protection permits for all of Fiscal Year 2019 was 730.

The time it takes to have a permit application approved can range from just a few days in the most dire of situations, to several months. It all depends on the risk of damage to a property, the type of project that is being planned and the quality and timeliness of the materials that are submitted by an applicant.

Some property owners may decide that the best solution is to move homes or structures farther back from the shore. Doing so will likely make the home more resilient to changes in long-term water levels. Homeowners must check with EGLE and local officials about the need for permits.

### **DANGERS FOR RECREATION, TOO**

Michigan's waterways provide plenty of recreational opportunities. Still, common sense and caution is needed when in nearby water during periods of high water. Anyone swimming, boating or using a personal watercraft should know that higher water levels can increase the amount of debris either floating on the water or under the surface.

"Use extreme caution when you venture out into the water because you don't know what has been washed off the shore by waves," said Jay Eickholt, EGLE's emergency manager. "Waves are relentless. Not only have they destroyed structures, but they can also move the debris offshore. So, no matter how you use the beach or water, be aware of the possibility of dangerous debris that you might not see until it's too late."

There are no state or federal funding programs that will cover the cost of removing debris from the water, so it's up to private organizations and property owners to do the task along shorelines or from in front of homes. Any debris collected should be disposed of properly by following local waste removal rules. Manmade debris should not be burned.

*(Continued on page 32)*



*High water levels have had an impact on properties around numerous lakes in Michigan. In Barry County last summer, water from Pine Lake spilled into the yards of homes. Water levels are expected to be high this summer again.*



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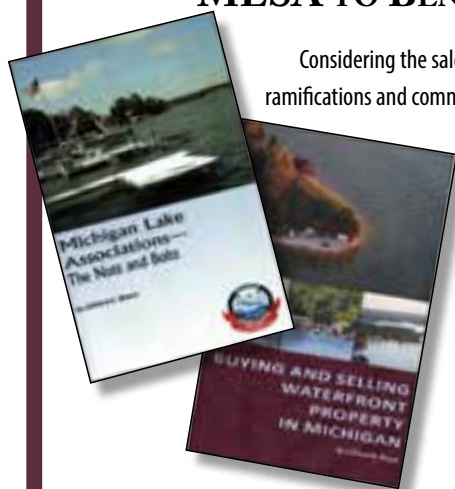
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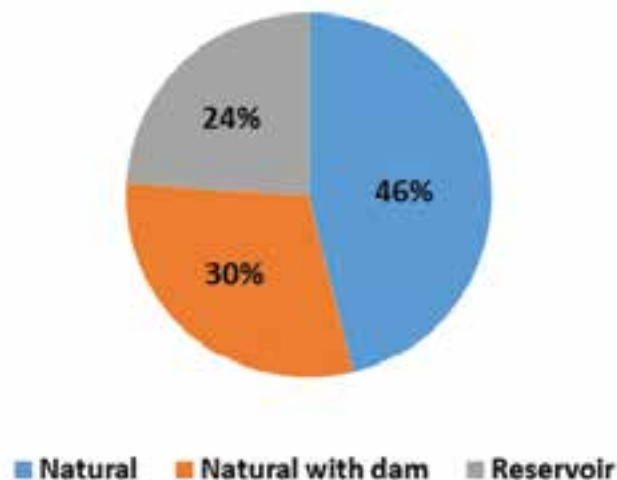
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# Harmful Algal Blooms in Michigan

(Continued from page 17)

## Bloom Lakes by types in Michigan (2016-2019)



**Figure 3.** Distribution of different lake types for Michigan lakes with confirmed cyanobacterial blooms, 2016-2019.

Over half (54%) of the confirmed blooms have occurred in lakes that are impounded, such as reservoirs (lake systems created by placing a dam in a river or stream) or natural lakes that have a dam at their outlet that keeps the water level artificially high (**Figure 3**). In comparison, only around 10% of the lakes in the entire state are impounded in some way. Reservoir systems are often shallow, have numerous coves and embankments that are conducive to cyanobacteria growth, and tend to have larger watersheds that contribute nutrients to them. The reason why natural lakes with artificial dams tend to be over-represented amongst waterbodies that experience cyanobacterial blooms is less clear, since they tend to be deeper than reservoirs and maintain a similar shape to natural lakes with no dams. However, those lakes tend to be in more populated areas of the state, with more residents living on them. Thus, those lakes may experience more nutrient pollution from human activities.

Many agencies and organizations at the local, state, and federal levels collaborate on responses to cyanobacterial blooms. For blooms in Michigan, EGLE evaluates reports of suspected blooms, conducts field visits to confirm the presence of cyanobacterial blooms, and collects water samples for cyanotoxin testing when possible. Cyanotoxin testing is conducted at the MDHHS Bureau of Laboratories, and MDHHS communicates these results to the appropriate local health department. MDHHS and local health departments

work together to assess potential public health risks from a cyanobacterial bloom and its test results, communicate these results to stakeholders, and conduct investigations into any cyanobacterial bloom-associated human illnesses. The Michigan Department of Agriculture and Rural Development (MDARD) is responsible for cyanobacterial bloom-associated animal illness investigations. These agencies, plus DNR, local health departments, and other federal partners in Michigan, coordinate this work through the Michigan Interagency Harmful Algal Bloom Workgroup. In addition, data from Michigan blooms is entered into the Center for Disease Control and Prevention's OHHABS reporting system to contribute to national cyanobacterial surveillance and research.

(Continued on page 31)



*Red Cyanobacteria*

**Photo Credit:** Michigan Department of Environment, Great Lakes, and Energy.



# Michigan's Lakes and Streams: Interesting Facts and Figures

By: Tony Groves and Pam Tynning  
Water Resources Group, Progressive AE

With its vast number of lakes and streams, Michigan is truly a water wonderland. This article explores some interesting facts and figures about Michigan's water resources.

## THE GREAT LAKES

Michigan is surrounded by four of the five Great Lakes: Superior, Michigan, Huron, and Erie; only Lake Ontario is located outside of Michigan. Lake Michigan is the only Great Lake located entirely within the United States. Water moves from the upper lakes in the system (Superior, Michigan and Huron) to the lower lakes (Erie and Ontario) and eventually flows to the Atlantic Ocean via the St. Lawrence River (Figure 1).

In terms of surface area, Lake Superior is the largest of the lakes followed by Huron, Michigan, Ontario, and Erie. Lake Superior is so large, it can accommodate all the water in the other Great Lakes plus some. Based on surface area, Lake Superior is the largest lake on earth. However, in terms of water volume, Lake Superior is dwarfed by Lake Baikal, a lake over a mile deep located in Siberia, Russia. In fact,

the volume of water in Lake Baikal is greater than the water volume in all the Great Lakes combined.

Water residence time is the time it takes the entire volume of water in a lake to be replaced by incoming waters. It is a measure based on the volume of water in the lake and the rate of inflow or outflow. Lake Superior, with its large volume, has a relatively long water residence time while Lake Erie, with its small volume and large drainage area, has a short water residence time.

The elevation difference between Lake Superior and Lake Ontario is almost 360 feet. Most of this drop in elevation occurs between Lakes Erie and Ontario over Niagara Falls, where the total drop in elevation is about 325 feet.

The U.S. Army Corps of Engineers has monitored water levels on the Great Lakes for over 100 years, beginning in 1918 and continuing to the present. Over that time period, water levels have fluctuated significantly. In Lakes Michigan and Huron, the difference in elevation between the lowest and highest recorded levels is about 6 feet. The lowest water

(Continued on page 29)



**Figure 1.** Great Lakes profile. Source: By U.S. Army Corps of Engineers, Detroit District - Wilby, Robert L. (September 2011). "Adaptation: Wells of wisdom". *Nature Climate Change* (1): 302. Nature Publishing Group. DOI:10.1038/nclimate1203. Retrieved on 19 January 2012 "Credit: US Army Corps of Engineers, Detroit District", Public Domain, <https://commons.wikimedia.org/w/index.php?curid=18101369>



(Continued from page 28)



**Figure 2.** Michigan's ten largest lakes.

level on the lakes was measured in 1964 and the highest levels were measured in 1986 and again this past year. In 2020, water levels in Lakes Michigan and Huron are projected to exceed historical high-water levels but, if history is any indication, the high water levels will eventually recede.

Although the levels of the Great Lakes cycle up and down, the cycle is not regular. Rather, the highs and lows in the Great Lakes are driven primarily by climate, which is highly variable and difficult to predict. Climate scientists anticipate that rapid fluctuations between extreme high and low water conditions may become the new normal for the Great Lakes.

## HOW MANY INLAND LAKES IN MICHIGAN?

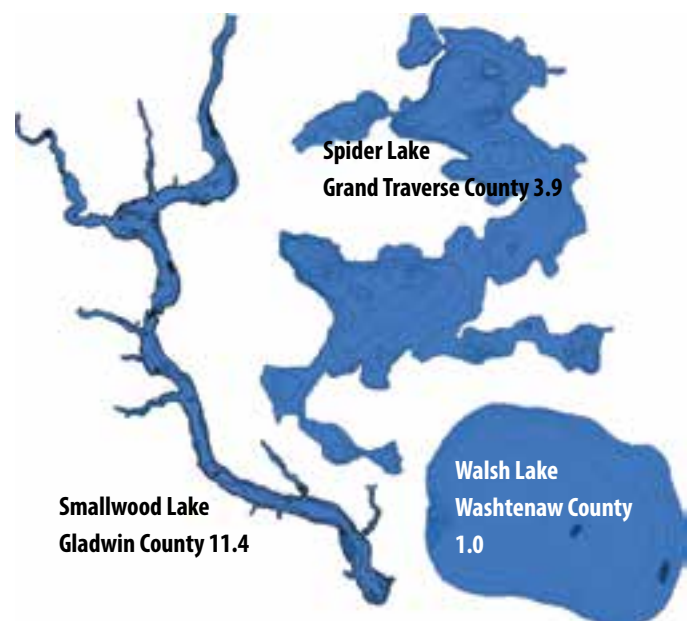
With the final retreat of the glaciers some 10,000 years ago, Michigan was left with thousands of inland lakes. In 1943, the Michigan Department of Conservation estimated that Michigan has 11,037 inland lakes, a number which is commonly quoted even today. Using geographic information systems and remote sensing, we now know that Michigan has

10,031 lakes five acres or greater in size (State of Michigan GIS Open Data). Of those lakes, 89% are less than 100 acres and 1,128 (11%) are 100 acres or larger. The largest lakes in the state are in the northern Lower Peninsula and the Upper Peninsula (**Figure 2**). While lakes are common throughout the state, portions of the central Lower Peninsula and the thumb area are nearly devoid of lakes.

## LAKE SHAPE

Lakes come in all shapes and sizes. Shoreline development factor is a measure of the irregularity of the shoreline (**Figure 3**). A lake with a perfectly circular shoreline would have a shoreline development factor of 1.0. The shoreline development factor increases as the shoreline becomes more convoluted. For example, a lake with a shoreline development of 4.0 has a shoreline twice as long as a lake of the same size with a shoreline development factor of 2.0. Lakes with the highest shoreline development factors are often impoundments. Shoreline development factor can be significant because lakes with more irregular shorelines (and higher shoreline development factors) can accommodate more shoreline development, which creates a potential for greater pollution runoff and lake overcrowding. In Michigan, shoreline development factors range from 1.0 to 13.5 (State of Michigan GIS Open Data).

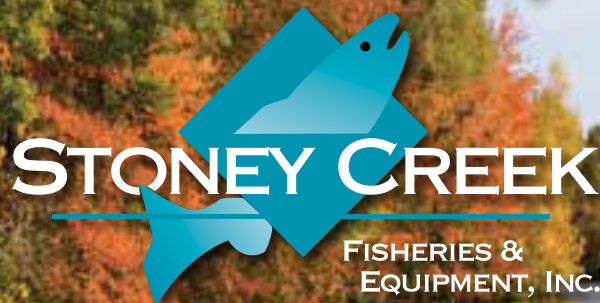
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**Figure 3.** Shoreline development factor of some Michigan lakes.



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# Harmful Algal Blooms in Michigan

(Continued from page 27)

Everyone's help is needed to identify harmful algal blooms in Michigan! Any suspicious-looking cyanobacteria, algae, or bloom-related illnesses can be reported to EGLE by calling the Environmental Assistance Center at 1-800-662-9278 or sending an e-mail to [AlgaeBloom@Michigan.gov](mailto:AlgaeBloom@Michigan.gov). If available, any pictures of suspected blooms are greatly appreciated.

For more information on harmful algal blooms in Michigan, please visit [www.michigan.gov/habs](http://www.michigan.gov/habs).

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*Blue Cyanobacteria*

**Photo Credit:** Michigan Department of Environment, Great Lakes, and Energy.



## High Water and Inland Lakes: *What you need to know*

(Continued from page 25)

For kayakers and canoers, deeper water and stronger currents can make a leisurely exercise more treacherous. Additionally, higher water levels may make it more challenging to go under low-hanging obstacles, such as bridges or trees.

For larger boat owners, be mindful of boating laws and local watercraft controls for specific bodies of water. Wake restrictions protect shorelines, including infrastructure and fish and animal habitats. A boat may create a wake that seems harmless, but it can cause turbulence in an already flooded area.

Anyone enjoying time on the water must always wear a lifejacket. State law requires that all vessels, including kayaks and canoes, have appropriate flotation devices for everyone onboard.

### THERE ARE INSURANCE IMPLICATIONS TO CONSIDER

Most homeowner and renter insurance policies do not cover water damage caused by floods, groundwater entering the property through foundation walls, or water or sewer backup from, for instance, a failing sump pump.

Floods can happen in any area, not just flood zones. Property owners can buy flood insurance only if the community in which they live participates in the National Flood Insurance Program.

Federal disaster assistance is customarily offered to

homeowners and renters in the form of a low interest loan and is only offered when there is a presidential disaster declaration. If a disaster is declared and financial assistance is made available, a property owner or renter may be required to buy flood insurance for the property.

There are licensed insurance companies authorized to sell private flood insurance in Michigan. Speak to a licensed agent to discuss adding coverage to a policy to cover damage caused by water or sewer backups.

### INFRASTRUCTURE FACES CHALLENGES

“Homeowners along inland lakes aren’t the only ones feeling the impacts of rising waters. Municipal parks, roads, utilities, and other infrastructure are being damaged by high water, flooding, and erosion,” said Phil Argiroff, assistant director of EGLE’s Water Resources Division.

EGLE is working with local stormwater and wastewater departments to perform vulnerability analyses of their facilities to identify planning, preparation, and response activities aimed at addressing risks. High water can impact storm water collection systems, industrial permits, wastewater treatment plants, combined sewer overflow outlets, and aquatic nuisance control programs.

Flows from high water into a collection system needs to be controlled so sewage does not back up into homes, which could lead to an unhealthy situation. To protect customers, wastewater treatment plants may need to fix manholes to block water inflow, raise weirs to maintain separation of

(Continued on page 33)

## REPRINTING *Articles from the Magazine*

Frequently, lake associations, the press, educational institutions and others request permission to reprint an article from *The Michigan Riparian* magazine in a newsletter, newspaper, or other publication. In general, *The Michigan Riparian* magazine is relatively liberal in granting permission for such reprints. However, no such reprint can be done without the express prior written permission of the magazine.

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(Continued from page 32)

water holding areas or outflow access and correct water flow in flooded areas.

In a number of locations around the state, high water and fast-flowing currents have undermined roads and made traveling treacherous. Water can also scour the land around critical structures such as piers supporting traffic bridges over waterways.

By the end of April 2020," the MDOT was tracking 40 roadway locations, from Wayne County to the Upper Peninsula, that have been affected by high water. More than \$5 million has already been spent on repairs. In the


long term, however, it could cost more than \$100 million to complete comprehensive work if high waters were to continue.

We can't control water levels and the Army Corps of Engineers sees a continued rise on the Great Lakes, at least through the middle of this summer. Without a change in the current weather patterns, inland lakes will mirror that trend for the foreseeable future. It won't be easy in these tough circumstances, but to mitigate the widespread impacts, local, state and federal officials must work collaboratively with property owners to try to find timely and smart solutions.

*Additional information provided by members of the Michigan High Water Action Team.*

### AVAILABLE RESOURCES FOR PROPERTY OWNERS

- Michigan Department of Environment, Great Lakes, and Energy resources on high water: [Michigan.gov/EGLEHighWater](https://Michigan.gov/EGLEHighWater).
- EGLE resources, FAQs on inland lakes high water levels; [Michigan.gov/EGLEInlandLakes](https://Michigan.gov/EGLEInlandLakes). click on Lakes & Streams Program, then Inland Lakes High Water Levels.
- EGLE permit questions: 800-662-9278 or emailing [EGLE-Assist@Michigan.gov](mailto:EGLE-Assist@Michigan.gov).
- EGLE, U.S. Army Corps of Engineers permit portal: [Michigan.gov/MiWaters](https://Michigan.gov/MiWaters).
- Michigan Department of Insurance and Financial Services information on flood insurance: 877-999-6442 or [Michigan.gov/DIFS](https://Michigan.gov/DIFS).
- National Flood Insurance Program: [Floodsmart.gov](https://Floodsmart.gov) or 877-336-2627.
- Status of public beaches: [www.EGLE.State.MI.US/Beach/](https://www.EGLE.State.MI.US/Beach/).
- Michigan Department of Health and Human Services Drinking Water Hotline: 844-934-1315.
- United States Army Corps of Engineers: [www.LRE.USACE.Army.mil/About/Great-Lakes-High-Water/](https://www.LRE.USACE.Army.mil/About/Great-Lakes-High-Water/).
- National Oceanic and Atmospheric Administration: [GLERL.NOAA.gov/data/wlevels/](https://GLERL.NOAA.gov/data/wlevels/).

All photos courtesy of Michigan Department of Environment, Great Lakes, and Energy. 





## New Limited Michigan Legislation Regarding Emergency Local Boating Regulations

By Clifford H. Bloom, Esq.  
Bloom Sluggett, PC | Grand Rapids, Michigan  
[www.bloomsluggett.com](http://www.bloomsluggett.com)

As everyone knows, during the past year or two, both the Great Lakes and many inland lakes in Michigan have been at historically high lake levels. High water, combined with waves from storms and certain boating activities (particularly, from wake boats), have severely damaged and eroded shorelines throughout Michigan. Such conditions have also flooded lake front yards, harmed docks and seawalls, and flooded basements. Improper boating practices only exacerbate the problem.

Recently, Michigan Governor Gretchen Whitmer signed into law Public Act No. 70 of 2020 (House Bill 5401) and Public Act No. 71 of 2020 (House Bill 5402). Effective April 2, 2020, Public Act Nos. 70 and 71 permit the County Sheriff, the Michigan Department of Natural Resources, or the County Emergency Management Coordinator to establish temporary reduced watercraft speed limits upon the request of a local municipality in order to protect life and property during emergency conditions. The temporary speed limits are limited to a maximum duration of 14 days. Violation of a temporary speed limit is a civil infraction. Generally, temporary speed limits can only be issued once per calendar year; however, they may be issued twice if the municipality is seeking to implement the speed limit restrictions under a temporary ordinance.

Also effective April 2, 2020, Public Act No. 72 of 2020 (House Bill 5463) permits municipalities to request Michigan Department of Natural Resources authorization to implement temporary ordinances regulating the use of watercraft. A temporary ordinance is limited to a maximum duration of six months and may be extended or renewed only if the municipality is seeking to implement the restrictions as a permanent special local rule under MCL 324.80110.

The newly-enacted laws provide municipalities with more options in regulating the use of waters under their jurisdiction. However, the ability of a municipality to implement such regulations on its own remains limited. See Clifford H. Bloom, *On-Lake Regulations*, *The Michigan Riparian* magazine, p 11 (2015) for a discussion of permanent special local rules and the ability of municipalities to implement regulations without Michigan Department of Natural Resources approval. [Bloom](#)

# Michigan's Lakes and Streams: Interesting Facts and Figures

(Continued from page 29)

## MICHIGAN STREAMS

Michigan has over 300 named rivers and streams with a combined length of over 51,000 miles. About 40 percent of the major rivers in the state flow into Lake Superior, 35 percent into Lake Michigan and 25 percent into Lakes Huron and Erie. Interestingly, the rivers in the Lower Peninsula tend to flow in an east or west direction, while the rivers in the Upper Peninsula flow north or south. The longest river in the state, the Grand River, runs 262 miles from its headwaters in Jackson County to its outfall into Lake Michigan.

In Michigan's pre-settlement years, rivers were used primarily for transportation. During the logging era, rivers and streams became the primary means of conveying lumber to sawmills and ports. Unfortunately, the impact on Michigan's rivers and streams was devastating. Riverbanks were denuded, streambeds were scoured, and erosion smothered spawning areas. The Artic Grayling that once thrived in many of Michigan's northern rivers was extirpated; attempts are ongoing to reintroduce the fish into Michigan waters.


As part of logging operations, dams were constructed on many river systems to impound water and power sawmills, and hydroelectric dams were constructed as a means of generating electricity. Dams on rivers are problematic for several reasons: dams warm the water; fragment habitat; and interfere with natural flow, sediment transport, and fish migration. To address these problems, the state is actively promoting the removal of dams. A recent project on northern Michigan's Boardman River involved the removal of three dams and modification of a fourth dam. This is the largest dam removal project in Michigan history and has restored over 160 miles of the Boardman River to a free-flowing, coldwater system.

The Pere Marquette River is the only free-flowing river in the Lake Michigan watershed. In the 1870s, it gained the distinction of being the first river in the United States to be stocked with German Brown Trout. Today, Michigan boasts many blue-ribbon trout streams; rivers throughout the state are used for fishing, canoeing, kayaking and a variety of other recreational pursuits.



**Figure 4.** Michigan's designated Natural Rivers and Wild and Scenic Rivers.

All or part of 16 Michigan rivers are protected under Michigan's Natural Rivers Program (**Figure 4**). The Natural Rivers Program imparts special zoning standards that prevent the excessive removal of streamside vegetation and other activities that could be detrimental to river health. In addition to Michigan's natural rivers designation, there are several rivers in Michigan that are protected under federal Wild and Scenic River designations (**Figure 4**).

Michigan's lakes and streams are truly a blessing. We must all continue the important work of protecting these precious resources. 



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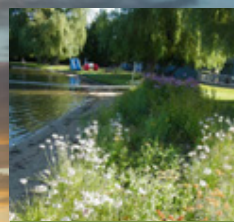
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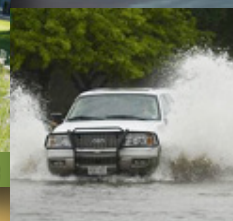
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