



MICHIGAN

Thank you.

Many thanks to the experts, contributors, partners, writers, editors, and designer who contributed their time and efforts to this 2022 State of the Great Lakes Report. The contents reflect the dedication of our region's natural resource stewards and community voices within our state who all share a passion for Michigan's Great Lakes water resources. The views and opinions expressed within this publication are those of the individual authors and do not necessarily reflect the official policy or position of the Michigan Department of Environment, Great Lakes, and Energy; the Office of the Great Lakes; or their partners.

Gretchen Whitmer, Governor

Liesl Eichler Clark, Director, EGLE

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State of the Great Lakes

2022 REPORT

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MICHIGAN DEPARTMENT OF
ENVIRONMENT, GREAT LAKES, AND ENERGY

If you seek a world treasure, *look about you*

Our waters define us. Together, we will protect them.

Here in Michigan, the Great Lakes shape our state, our lives, and our livelihoods. They are our source of drinking water, transport our goods, afford us the world’s greatest recreation, and power our economy. Michiganders have a special connection to the water, and especially our Great Lakes. It is our duty to preserve these natural wonders for future generations.



In the past year, we have made investments and taken several steps to protect our waters, many explored in this 2022 State of the Great Lakes Report.

In March, I signed into law the bipartisan Building Michigan Together Plan, which invested over \$1.9 billion in our water infrastructure. The water investment is a key component of the nearly \$5 billion plan that protects our environment, grows the economy, creates jobs, and supports families throughout our state. The plan includes \$1.27 billion to protect drinking water, such as funding to replace lead water lines, and more than \$700 million for clean water initiatives to address stormwater and wastewater.

Meanwhile, hundreds of Michiganders came together to shape the [MI Healthy Climate Plan](#) that we unveiled in April. The plan outlines a path for us to build a prosperous, carbon-neutral future that grows our economy and defends our natural resources from the worst impacts of climate change while ensuring that we leave no one behind.

The year also saw the bipartisan [MI Clean Water Plan](#) we created in 2020 keep making progress, delivering \$186.4 million to fund water infrastructure improvements in more than 100 communities across our great state.

And the current bipartisan state budget I signed includes \$56 million to improve oversight of drinking water and help communities leverage state dollars to improve water infrastructure and replace lead service lines.

All of these investments in our water are crucial down payments whose impacts will be felt far into our future. They will support good-paying jobs and give every parent peace of mind to give their kid a glass of water, knowing that it’s safe. They are also a testament to what we are capable of when we work together to get things done.

I will work with anyone to defend our Great Lakes and build a state worthy of our kids.

Let’s keep getting it done,

Governor Gretchen Whitmer

Investments worthy of the Great Lakes

Michigan steps up to support the waters that make us who we are

Watch the waves roll in on a Michigan coast, and you might think the Great Lakes are timeless and unchanging. But slowly and surely, wave after wave reshapes the shore. In a similar way, time and experience change people’s perception of the lakes. Many in the past saw a seemingly limitless resource to exploit. Today, thankfully, we see a vital, vulnerable ecosystem that calls for our respect and care.



Perhaps the wisdom of the Anishinaabe people – who have lived here the longest, in harmony with the natural world – is gaining ground. We in the Michigan Department of Environment, Great Lakes, and Energy (EGLE) learn from them as we work together to protect the wild rice, or manoomin, that grows in Michigan lake shallows, a cultural touchstone for Tribal Nations.

That effort and many more are detailed in this 2022 State of the Great Lakes Report. It comes as we celebrate the 50th anniversary of two milestones in water protection: the federal Clean Water Act and the U.S.-Canada Great Lakes Water Quality Agreement. The report, in addition to addressing hundreds of millions of dollars in direct bipartisan support for crucial water infrastructure, dives deep into the ways Michiganders invest our time, talents, and ingenuity into:

- Our natural and cultural heritage, such as the manoomin tribal-state partnership and the Ottawaing Biosphere Region.
- Our future, through innovations in electric boating, creating the nation’s first marine electric vehicle charging corridor, and the [MI Healthy Climate Plan](#) for a robust carbon-neutral economy.
- Freshwater education and talent development, through expanding the collaborative From Students to Stewards Initiative for K-12 students to create the next generation of Great Lakes champions.
- Research and monitoring, such as collecting real-time Great Lakes data and studying ways to measure stream flows or support resource managers in data-driven decision making.
- Remediation, restoration, and environmental justice, such as plans to revitalize Ox Creek in the community of Benton Harbor.

Wise investments like these not only support clean drinking water, flourishing waterways, and Great Lakes literacy, they strengthen our region’s water-driven “blue economy.” By one measure – according to research coordinated by the Great Lakes Commission, Council of Great Lakes Industries, and others – every dollar of federal spending on projects through the Great Lakes Restoration Initiative from 2010-16 will produce \$3.35 in additional regional economic output through 2036.

The Great Lakes are the planet’s greatest freshwater ecosystem, containing 20% of Earth’s fresh surface water. And they hold Michigan in their embrace. Protecting our fresh water goes hand in hand with prosperity for our great state. These waters provided for our past and enrich our present. If we care for them, they will surely sustain our future.

Liesl Eichler Clark
Director, Michigan Department of Environment, Great Lakes, and Energy

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Cover image: On the north shore of Drummond Island, forest and water meet as shelves of limestone bedrock step down into Lake Huron at the eastern edge of Michigan's Upper Peninsula. Photo courtesy of the Michigan Department of Natural Resources.

U.S., Canada weigh in on Great Lakes

Governments' triennial report explores ecosystem status, trends

A system as vast and vital as the Great Lakes will always have countless stewards keeping watch over its health. The United States and Canada work cooperatively under the 2012 version of the Great Lakes Water Quality Agreement (GLWQA) to manage and protect these shared waters of the two nations. The year 2022 marked the 50th anniversary of the GLWQA. Every three years, the governments of the U.S. and Canada release a State of the Great Lakes report highlighting status and trends of Great Lakes ecosystem health.

The [2022 report](#) recognizes tremendous progress to restore and protect the lakes, including reducing toxic chemicals and reducing establishment of invasive aquatic species. But it also notes significant challenges, including the impacts of nutrients, especially in Lake Erie and localized areas; invasive species; and climate change.

The two governments work with numerous partners to produce the report, pursuant to the binational GLWQA. To assess the overall status and trends in the Great Lakes ecosystem, the report considers nine measures of ecosystem health:

- Can we drink the water?
- Can we swim at the beaches?
- Can we eat the fish?
- Have levels of toxic chemicals declined in the environment?
- Are the lakes supporting healthy wetlands and populations of native species?
- Are nutrients in the lakes at acceptable levels?
- Are we limiting new introductions and the impacts of non-native species?
- Is groundwater negatively affecting the water quality of the lakes?
- Are land use changes or other stressors impacting the lakes?

Based on these criteria – and 45 science-based sub-indicators – the 2022 report finds the overall Great Lakes status “Fair” and the trend “Unchanging.” Here’s a closer look at the report’s general findings, lake by lake:

Superior: Good and Unchanging

Forested watershed and coastal wetlands help maintain water quality and a healthy aquatic ecosystem.

Michigan: Fair and Unchanging

Habitats support a diverse array of plant and animal species, and its waters provide opportunities for swimming and recreational use. However, invasive species and other stressors continue to affect both water quality and the lake’s food web.

Huron: Good and Unchanging

Remains healthy despite nearshore algal blooms and a reduction in offshore nutrients by invasive filter-feeding mussels. Its status is upgraded from “Fair” in the 2019 report.

Erie: Poor and Unchanging

Despite a productive walleye fishery, elevated nutrient concentrations and algal blooms are persistent problems.

Ontario: Fair and Unchanging to Improving

Improvements include fewer beach closings and declines in contaminant concentrations in fish. ♦



Grand Portal Point, Pictured Rocks National Lakeshore, Lake Superior.

Funds flow to communities for much-needed water infrastructure improvements

A rising tide of water infrastructure funding lifted communities all over Michigan in 2022

By Kelly Green, Michigan Department of Environment, Great Lakes, and Energy

Confronting challenges including outdated systems, toxic lead water service lines, inadequate sewers, and harm to underserved populations, Gov. Gretchen Whitmer in March signed the bipartisan [Building Michigan Together Plan](#) (Public Act 53). The state’s largest-ever infrastructure investment at \$4.7 billion, it allocated more than \$1.9 billion to be administered by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) for water improvements. Funding is through the federal American Rescue Plan Act, federal Infrastructure Investment and Jobs Act, and the state’s general fund.

Meanwhile, the bipartisan [MI Clean Water Plan](#) enacted in 2020 has wrapped up 206 awards totaling \$186.4 million for water infrastructure needs in communities all over Michigan. The total included:

- \$98.5 million for lead service line replacement in 36 municipalities.
- \$36.5 million to study 108 communities’ water infrastructure and identify potential hazards.
- \$22.2 million to reduce per- and polyfluoroalkyl substances ([PFAS](#)) contamination in 11 communities.
- \$29.2 million to improve drinking water infrastructure and planning in 51 communities.

All told, the MI Clean Water Plan directed \$102.1 million in federal funds to replace lead service lines in low-income communities and \$105 million for general fund programs that address PFAS or other contaminants, lead service line identification, planning and rate studies, and asset management planning.

The Building Michigan Together Plan’s \$1.9 billion for water infrastructure improvements dedicates \$1.27 billion in federal funds to the state’s drinking water and wastewater revolving funds over two fiscal years. More than \$7 billion has been allocated since 1988 for 1,100 projects under the revolving funds, an average of \$205 million and 32 projects a year.



Work crews replace lead drinking water service lines in Benton Harbor in 2022. Photo courtesy of Abonmarche Consulting.



(Above) The Building Michigan Together Plan includes at least \$341 million to replace lead water lines, like this one in Benton Harbor. Photo courtesy of EGLE. (Right) A worker installs steel water mains in Fraser in fall 2021. Photo courtesy of EGLE.

In June, the governor signed a package of bills to update the State Revolving Fund statute, lowering communities’ burden to accessing state financing and funding, and allowing flexibility to ensure financing is equitably distributed. Also part of Building Michigan Together:

- At least \$314.8 million to replace lead water service lines statewide – including all such lines in Benton Harbor.
- \$40.6 million to help communities tackle toxic contaminants such as PFAS in drinking water and wastewater.
- \$20 million to help drinking water suppliers develop and update asset management plans and take stock of materials in their systems, such as lead service lines, through the [Drinking Water Asset Management](#) grant program.

Opening the tap further is the balanced, bipartisan 2023 state budget, with \$48 million in technical assistance to help communities seek funding to replace lead water lines or other water infrastructure, and \$7.9 million for drinking water permitting, both through EGLE.

The Michigan Executive Office of the Governor estimates that the MI Clean Water Plan, the Building Michigan Together Plan, and other water investments since 2019 have supported tens of thousands of good-paying jobs for Michiganders.



Still, the water infrastructure needs in Michigan remain great. The latest investments follow decades of underfunding and years of study to quantify needs. In 2016, the state’s 21st Century Infrastructure Commission reported that Michigan needed to invest \$800 million a year for water infrastructure. In 2018, the American Society of Civil Engineers estimated that Michigan’s water systems were underfunding improvements for Safe Drinking Water Act compliance by \$284 million to \$563 million a year. All of these investments will make progress toward addressing infrastructure needs and help to provide clean and safe drinking water, protect public health and water quality, and build stronger and more resilient communities. ♦

LAKES' HEALTH DEPENDS ON DECARBONIZATION

MI Healthy Climate Plan charts a course to a cleaner, stronger future

By Cory Connolly, Climate and Energy Advisor, Office of Climate and Energy, Michigan Department of Environment, Great Lakes, and Energy

Michigan and the Great Lakes already feel the effects of changing climate. Warmer waters feed bacteria and toxic algal blooms. Disrupted ecosystems displace native species and make invaders feel at home. Extreme rain events cause sewer overflows and generate sediment-filled runoff. People are moving full-time into formerly seasonal lakefront homes and neighborhoods, overloading septic systems that then add nutrients to inland lakes and increase aquatic plant growth.

The [MI Healthy Climate Plan](#) aims to accelerate Michigan's transition to a carbon-neutral economy, capturing new economic opportunities and protecting our natural lands and waters.

Gov. Gretchen Whitmer called for the Plan in 2020, setting a goal of economywide carbon neutrality by 2050 to fuel a clean-energy economy and avert the worst impacts of climate change. After a process gathering input from hundreds of Michiganders, the Office of Climate and Energy (OCE) in the Michigan Department of Environment, Great Lakes, and Energy (EGLE) presented the Plan in April 2022, calling for ambitious action, including:

- A 60% renewable energy goal and retirement of coal-burning power plants.
- Infrastructure to support two million electric vehicles on the road by 2030 – a commitment that will also drive investments in infrastructure to clean maritime transportation at Michigan's ports and harbors.
- A 17% emissions reduction from Michigan's buildings by 2030, with a strong focus on home repairs such as investments in water infrastructure.
- Protecting 30% of Michigan's land and water by 2030.



Turbines harness the wind near Pigeon as part of Michigan's clean energy transformation. Photo courtesy of Michigan DNR.



Michigan's electric vehicle infrastructure includes these charging stations at a Meijer store in Roseville, near Detroit. Photo courtesy of EGLE.

Recognizing that the fossil-fuel economy disproportionately harms indigenous communities that rely on the Great Lakes fishery to feed their families and earn a living, the Plan also calls for strategies and actions that respect and align with Tribal Nations' heritage and treaty rights.

Michigan's investments in a prosperous clean-energy future for the lakes began even before the Plan's unveiling. In fall 2021, for instance, EGLE's Office of the Great Lakes awarded a \$100,000 grant to Michigan Technological University's Great Lakes Research Center (GLRC) to advance the region as a maritime industry hub while reducing environmental impact.

The economic ecosystem surrounding the Great Lakes also offers other opportunities to mitigate greenhouse gas emissions in line with the Plan, such as outfitting Michigan's harbors and ports with charging infrastructure for electric watercraft (see page 17), along with research and commercialization of new potential maritime fuels such as hydrogen. And ports and waterways enable Michigan's manufacturing might to reach and transform the global economy. For example, the Port of Monroe sends wind turbine towers across the globe via companies like Monroe-based Ventower Industries. Implementing the Plan will reduce emissions from Michigan's ports and harbors and maritime vessels and leverage those same cleaner assets to position Michigan in a future carbon-neutral economy.

As Michigan's waters face the impacts of climate change today, the State of Michigan is mobilizing around the MI Healthy Climate Plan to drive decarbonization across all of Michigan's economy through clean energy, innovation in industry, and new mobility solutions. EGLE's advisory [Council on Climate Solutions](#) will continue to guide the implementation, meeting on a quarterly basis. ♦

Great Lakes' changing vital signs

- Average regional air temperatures in 2021 were 1-3 degrees Celsius over long-term averages.
- 2021 water temperatures were up an average of 1.3 degrees Celsius.
- 2021 water levels were up 0.27 meters, but below record highs observed in 2019 and 2020.
- Winter ice covered 45.8% of the lakes in 2021, down from the long-term average of 53.3%.
- Precipitation is 14.25 mm below average across the Great Lakes basin.
- Evaporation for all lakes is above average at 117.15 mm.
- A 2021 Lake Erie algal bloom was more severe (6.0 on a severity index) than the mild bloom predicted (2.0-4.5). Anything over 5.0 is considered potentially harmful.
- To reduce the possibility of invasive species establishing themselves within the Great Lakes ecosystem, researchers have identified 144 species to watch.



EDUCATION FROM 'CRADLE TO GRAY'

EGLE resources foster an environmental ethic in Michiganders of all ages

By Eileen Boeckstein, Michigan Department of Environment, Great Lakes, and Energy

Environmental education plays an important role in achieving the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) mission to protect Michigan's environment and public health. Our staff work to manage air, water, land, and energy resources. But a vibrant, healthy Michigan community and a thriving Great Lakes ecosystem

depend on both the work of environmental managers and on the residents who practice environmental stewardship day to day. EGLE's Environmental Education Program is designed to help Michiganders of all ages understand their role in protecting and improving Michigan's environment through resources that develop environmental literacy.

(Above) EGLE staff demonstrate how macroinvertebrates can indicate water quality at an Earth Day event for the public. Photo courtesy of EGLE.

To be environmentally literate means that an individual knows about environmental issues and has the skills and competencies needed to put their knowledge into action and the opportunities to engage in activities that effect change. EGLE's Environmental Education resources intentionally provide opportunities to learn information, practice skills, and engage in active stewardship to build environmental literacy in Michiganders of all ages. This work focuses on three primary areas:

- Supporting educators.
- Facilitating public outreach.
- Developing environmental career pathways.

Educators across the state – formal and nonformal – receive support through [EGLE Classroom](#). This online resource provides lesson plans on Michigan's environment, professional development opportunities, educational videos, and an educational lending library supported by funding from the Great Lakes Restoration Initiative. EGLE also administers the [Michigan Green Schools](#) program, which encourages environmental education and action in K-12 school buildings. Supporting educators improves the environmental literacy of both educators and the youth they work with, but to develop "cradle to gray" environmental literacy, efforts must go beyond K-12 and college classrooms to facilitating education with the public. EGLE provides opportunities for learning and action on environmental issues through public presentations and opportunities for comment, through a robust training and outreach calendar, and through volunteer opportunities such as the Michigan Clean Water Corps and the Clean Water Ambassadors.

Becoming environmentally literate leads some people to new career paths. In some of the most critical environmental management jobs, including the water and wastewater utilities, high proportions of the workforce are becoming eligible for retirement in the upcoming years. Part of EGLE's environmental education efforts include partnering with agencies and organizations across the state to raise awareness and build equitable access to the most-needed environmental careers.

This environmental literacy-building work is grounded in four core values:

1. Environmental education is place-based, using Michigan's natural history, resources, challenges, and people as the context for learning.
2. Environmental education is experiential, providing opportunities to interact with the natural world, perform firsthand investigations, and become equipped to act on the findings.
3. Environmental education happens over the course of an entire lifetime, not just in grade school.
4. Environmental education is inclusive of all ages; all areas of the state; and of all races, ethnicities, genders, sexual orientations, and cultural backgrounds.

EGLE protects the environment and public health for all Michigan residents, and environmental education also serves all, especially those communities who have been historically marginalized or excluded from environmental decision making, education, career opportunities, or access to nature. We are all connected – to each other and to our environment – and through learning to care for our environment, we learn to care for one another. ♦



Materials such as this EnviroScope Ecological Restoration model are available in EGLE's Environmental Education Lending Station to provide hands-on learning about the Great Lakes and Michigan's environment. Photo courtesy of EGLE.



EGLE Classroom



K-12 MAKING ADVANCEMENTS IN GREAT LAKES LITERACY

MiSTEM Playbooks helping to close water literacy gap through From Students to Stewards Initiative

By Megan Schrauben, Michigan Department of Labor and Economic Opportunity’s MiSTEM Network, and Emily Finnell, Michigan Department of Environment, Great Lakes, and Energy, Office of the Great Lakes

How do you foster an appreciation of freshwater and grow Michigan’s next generation of water stewards, skilled workers, and leaders? You provide opportunities for students to experience the wonder of Michigan’s freshwater wonderland to ignite their interest – and do it one classroom at a time.

That’s why 16 Michigan school districts were awarded more than \$200,000 in 2022 to develop Great Lakes-based science, technology, engineering, and math (STEM) educational programs for K-12 students. The project is intended to help close the water literacy gap in Michigan and educate the future workforce needed to solve complex water issues in a changing world.

Michigan’s economic competitiveness depends on a workforce proficient in STEM. Gov. Gretchen Whitmer has called for empowering young Michiganders to learn

more about the Great Lakes and continue advancing conservation efforts.

The grants are a continuation of the From Students to Stewards (FS2S) Initiative, a collaboration of the Michigan Department of Environment, Great Lakes, and Energy’s (EGLE) [Office of the Great Lakes](#) (OGL) and the Michigan Department of Labor and Economic Opportunity’s (LEO) [MiSTEM Network](#). FS2S launched in 2020 to find new ways to teach students about the Great Lakes, Michigan watersheds, and the impact of people on water resources. The program engages students by integrating water literacy principles into place-based, problem-based, and project-based (3P) STEM learning across all grade levels.

The EGLE and LEO partnership supports students and educators through innovative approaches to STEM

(Above) Children’s natural curiosity is a powerful driver of “3P” STEM learning, based on projects, problems, and place.



In true hands-on learning about invasive species, sixth-graders remove spotted knapweed from Calumet Township Park in September 2021. Photo courtesy of MiSTEM Network.



Sixth-grade students explore an ancient Lake Superior shoreline in Calumet Township Park in May 2022. Photo courtesy of MiSTEM Network.

education to help close Michigan’s talent gap and prepare students for high-demand career paths in STEM and other fields.

The MiSTEM Network is reimagining STEM education using transdisciplinary approaches outlined in its new MiSTEM Playbooks that are under development. The playbooks are step-by-step guides with resources, implementation tools, and examples of school practices to help schools and districts implement innovative 3P STEM learning strategies.

Michigan’s economic competitiveness depends on a workforce proficient in STEM. Gov. Gretchen Whitmer has called for empowering young Michiganders to learn more about the Great Lakes and continue advancing conservation efforts.

Pilot and phase 2 FS2S grantees continue to work with the MiSTEM Network research team to co-design the playbooks and test strategies to support successful implementation. Playbooks will be housed on the [MiSTEM website](#) with an intended public release for implementation in the 2023-24 school year. The playbook content is designed to provide educators, districts, and business/community partners adequate support and resources to implement 3P instruction and integration in their communities.

The intention is to help districts understand how to move from a content-centric focus for curriculum design to engaging with their local community on issues that ignite passions. The goal is a STEM culture in Michigan that empowers teachers, integrates business and education, and ensures high-quality STEM experiences for all students.

Districts will use their grants in the 2022-23 school year and share their findings with other districts interested in developing similar programs linking water literacy to STEM concepts.

Funding for FS2S is provided by EGLE’s OGL through the Michigan Great Lakes Protection Fund, the MiSTEM Network, and the U.S. Environmental Protection Agency’s Great Lakes Restoration Initiative. ♦



FILLING THE BLUE JOBS PIPELINE

How Northwestern Michigan College is building Michigan's water-driven workforce

By Hans VanSumeren, director, Great Lakes Water Studies Institute, Northwestern Michigan College

Michigan's coastal communities – the state's “front door” – represent some of the state's greatest potential for economic development. The U.S. Environmental Protection Agency estimates that over the next few decades, hundreds of billions of dollars in economic activity will result from the cleanup of approximately 294,000 waste sites across the country. Building on years of concentration on water-driven “blue” career pathways, the [Great Lakes Water Studies Institute](#) (GLWSI) at Northwestern Michigan College (NMC) has developed a water quality and environmental technology degree pathway focused on environmental cleanup, remediation, and water quality assessment.

In 2022, the program began training a workforce supporting the direct monitoring and cleanup of waters

within the Great Lakes watershed and focusing on the direct impact to the quality of our water resources. It comes at a time of increased financial allocations supporting this work and an aging and declining current workforce.

The GLWSI has found success by bridging gaps between environmental stewardship, scientific understanding, and technical application culminating in opportunities for graduates, emphasizing programs that are competency-driven and adaptable to the ever-changing needs of blue industries and the organizations they serve.

In 2009, the institute launched the nation's first associate degree focused solely on freshwater studies and built around an interdisciplinary approach to water management, sustainability, and scientific

understanding of water resources. The degree program included partnerships with local and regional organizations and capitalized on NMC's institutional strengths, such as its robust environmental science and water focus and its campus on Lake Michigan. The degree quickly caught the attention of several university partners and bachelor's degree transfer opportunities.

Building from this success, Kongsberg Maritime, a large Norwegian marine technology provider, supported the GLWSI with hydrographic survey equipment and personnel to train staff. This led to initiatives at NMC including development of the marine technology associate and bachelor's degree pathways and the [Marine Center](#), a professional training center to confer valuable career advancement credentials. Since their creation, the marine technology degree pathways have seen 100% employment of all graduates in jobs directly supporting the understanding of the Great Lakes and world's waterways. The marine technology Bachelor of Science degree is unique to the United States in terms of content and preparation strategies.

Today, a significant strength of the marine technology program continues to be the numerous partnerships and relationships with industry, governmental agencies, and numerous key players throughout the region and world. Companies continue to support the program with no-cost use of their equipment.

[Traverse City Fresh Water Research & Innovation Center](#), now in early stages of development, will be a collaborative hub of freshwater and marine technology applications, research on technologies, and public policy affecting the Great Lakes and similar freshwater systems throughout the world. It will include incubation/accelerator space and lab space to support early startup businesses. This project will drive economic growth and establish the region and Michigan as a center of technology development addressing water challenges. Partners include:

- [Michigan Technological University](#).
- [20Fathoms](#), a regional career and business accelerator for entrepreneurs, innovators, and others.
- [Traverse Connect](#), the lead economic development organization for the Grand Traverse region.
- Discovery Center & Pier.



An ROV captured this first-ever image in North America of a deepwater sculpin guarding an egg sac in the nest in 620 feet of water in March 2021 in East Grand Traverse Bay. Photo courtesy of Great Lakes Water Studies Institute, NMC.

The future management of the Great Lakes will rely on the development of new businesses supporting new technologies and a skilled workforce ready to enter these new markets. These in turn will fuel more business development, additional new technology and greater student opportunities – a multiplier effect for a vibrant community adding high-paying jobs and filling the talent pipeline for Michigan's blue economy. ♦

About the Institute

Located at the Northwestern Michigan College Great Lakes Campus on Lake Michigan in Traverse City, the [Great Lakes Water Studies Institute](#) has long been a leader in innovative, water-focused programming. It is strategically positioned to engage individuals and organizations, both locally and globally, in advancing skills, knowledge, and understanding of the world's dynamic water resources. Degree programs include water quality and environmental technology, freshwater studies, and marine technology.

(Above) Students from universities across the country prepare for a remote-operated vehicle (ROV) dive while attending marine technology bootcamp training activity at Northwestern Michigan College (NMC). Photo courtesy of Great Lakes Water Studies Institute, NMC.



MICHIGAN PIONEERS MARINE EV CHARGING NETWORK

Plans for northern lakeshore corridor reflect electric boat market growth

By Charlie Tyson, Michigan Economic Development Corporation, and Warren Call, Traverse Connect

Innovators and state agencies are partnering in northern Michigan to establish the first freshwater electric boat charging network in the U.S. Their target is a busy stretch of Great Lakes coastline – from Frankfort on Lake Michigan to Mackinac Island in Lake Huron – with a high concentration of marinas and harbors and primed to be an early adopter for e-boats.

Elk Rapids and Northport marinas have installed AQUA superPower rapid chargers, and plans are underway for chargers at marinas in Traverse City, Bay Harbor, Charlevoix, and on Torch Lake.

Water is a fast-growing frontier for vehicle electrification. MarketWatch expects the electric boat market to expand to \$18 billion in 2027, up from \$8.31 billion in 2021. Electric boats can be powered by inboard or outboard motors. Like electric vehicles on land, they are ecofriendly and do not burn fossil fuels. That’s important with Michigan focused on reducing greenhouse gas emissions through initiatives such as

the [MI Healthy Climate Plan](#) for a prosperous carbon-neutral economy by 2050.

According to the National Marine Manufacturers Association, Michigan has more than 806,000 registered boats, and recreational boating brings in an estimated \$7.4 billion a year to the state’s economy, supporting 31,000 jobs and 1,458 businesses. But only recently have efforts zeroed in on the dockside charging networks required to navigate the boating sector toward renewable energy.

Momentum is building across the recreation market for electric vehicles, boats, and more, yet our national infrastructure is not set up to support the growing consumer demand or business technological advancements. There are also challenges that new technologies bring that require public-private coordination and partnerships.

In the case of Michigan’s e-boat charging network, the partners supporting this effort include the Michigan

Department of Natural Resources (DNR); the Michigan Economic Development Corporation (MEDC) and its Office of Future Mobility and Electrification (OFME); the Michigan Department of Environment, Great Lakes, and Energy (EGLE); the Michigan Department of Transportation (MDOT); and Traverse Connect, the lead economic development organization for the Grand Traverse region.

MEDC’s most recent strategic plan calls for developing auto manufacturing, e-mobility, and electrification as strategic industries. It also highlights outdoor recreation as a statewide strength, championing the business development case where e-mobility and outdoor recreation meet. Traverse Connect is working closely with MEDC and others to attract new enterprises at the forefront of e-mobility tech, provide them with a test bed for new technologies, and help them network, navigate state infrastructure, and select locations.

Electrifying change is ramping up on land, too, with progress continuing toward a multistate Lake Michigan EV Circuit Tour. In August, Gov. Gretchen Whitmer announced a collaboration with her counterparts in Indiana, Illinois, and Wisconsin to build and maintain the network of electric vehicle chargers spanning over 1,100 miles of drivable shoreline around Lake Michigan. These efforts will contribute toward a connected land and water EV charging corridor in northern Michigan and beyond. ♦



Elk Rapids and Northport marinas have installed rapid chargers for electric watercraft as part of a planned EV charging corridor stretching from Frankfort to Mackinac Island.

CHARGING UP

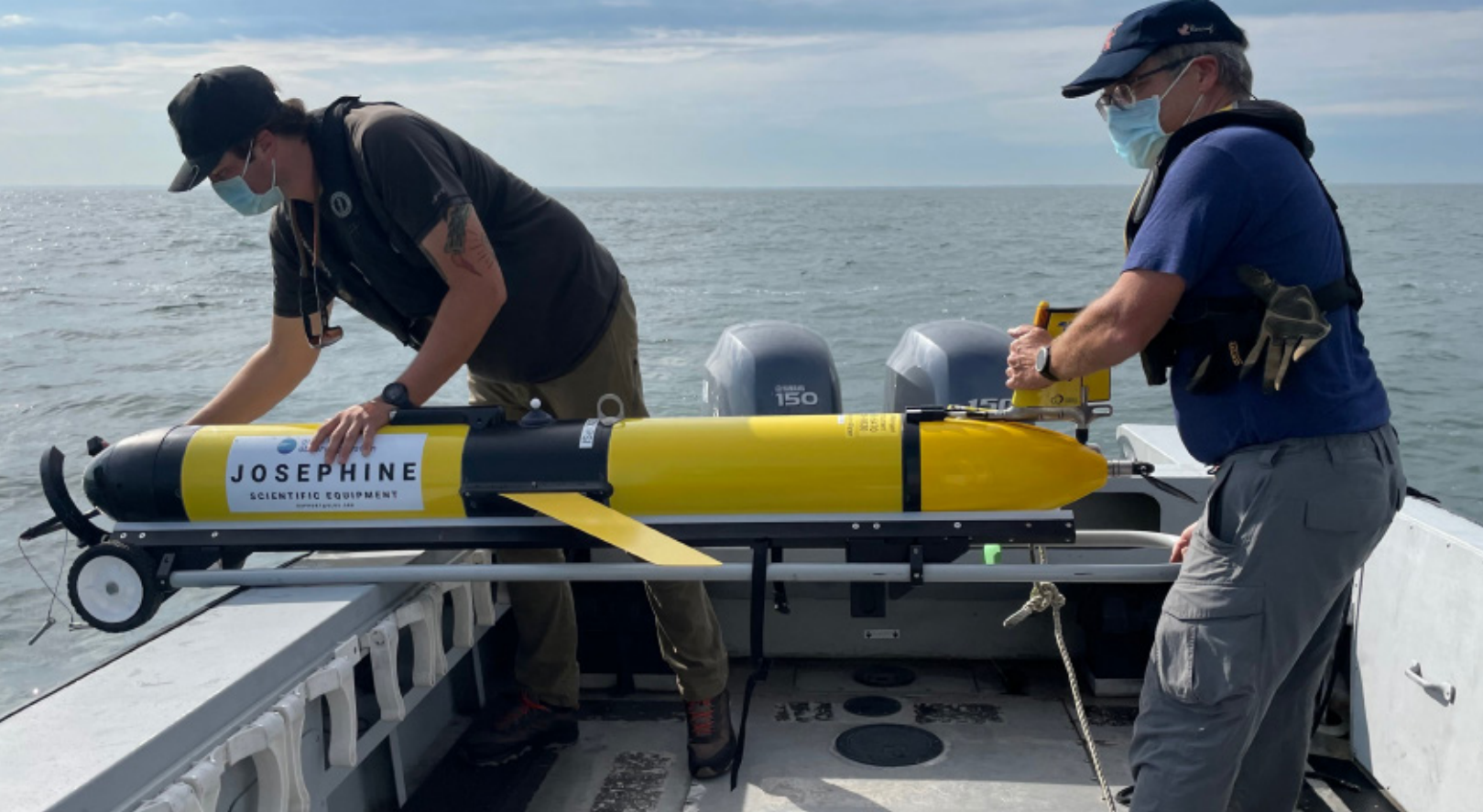
Recreational boating supports [more than 31,000 jobs](#) in Michigan. From November 2021-June 2022, manufacturers added more than 350 jobs in [Fenton](#), [Watertown Township](#), and [Owosso Township](#). Support for innovation in boating – recreational and commercial – and at Michigan ports and marinas continues to grow. A few examples beyond the northwest Michigan corridor:

Gov. Gretchen Whitmer signed bipartisan legislation in July 2022 to provide maritime improvement grants to allow ports to upgrade infrastructure while protecting local communities, water, and air.

In fall 2021, Michigan Technological University’s Great Lakes Research Center, DockTech, Lilypad, and the Mackinac Economic Alliance received a total of \$247,997 in grants from OFME and EGLE to support new water-based mobility solutions and innovations in water infrastructure.

Lilypad’s solar-powered, low-speed boat, using clean energy and autonomous vehicle technology, can be rented for cruises in Saugatuck.

Hercules Electric Mobility of Farmington Hills signed an agreement in 2022 to supply Kansas-based Coach Marine Group with electric propulsion systems to power Coach pontoon boats.



Improving real-time data collection

Smart monitoring technologies support Great Lakes science, policy, management, and industry

By Ana Sirviente, Chief Technology Officer, Great Lakes Observing System

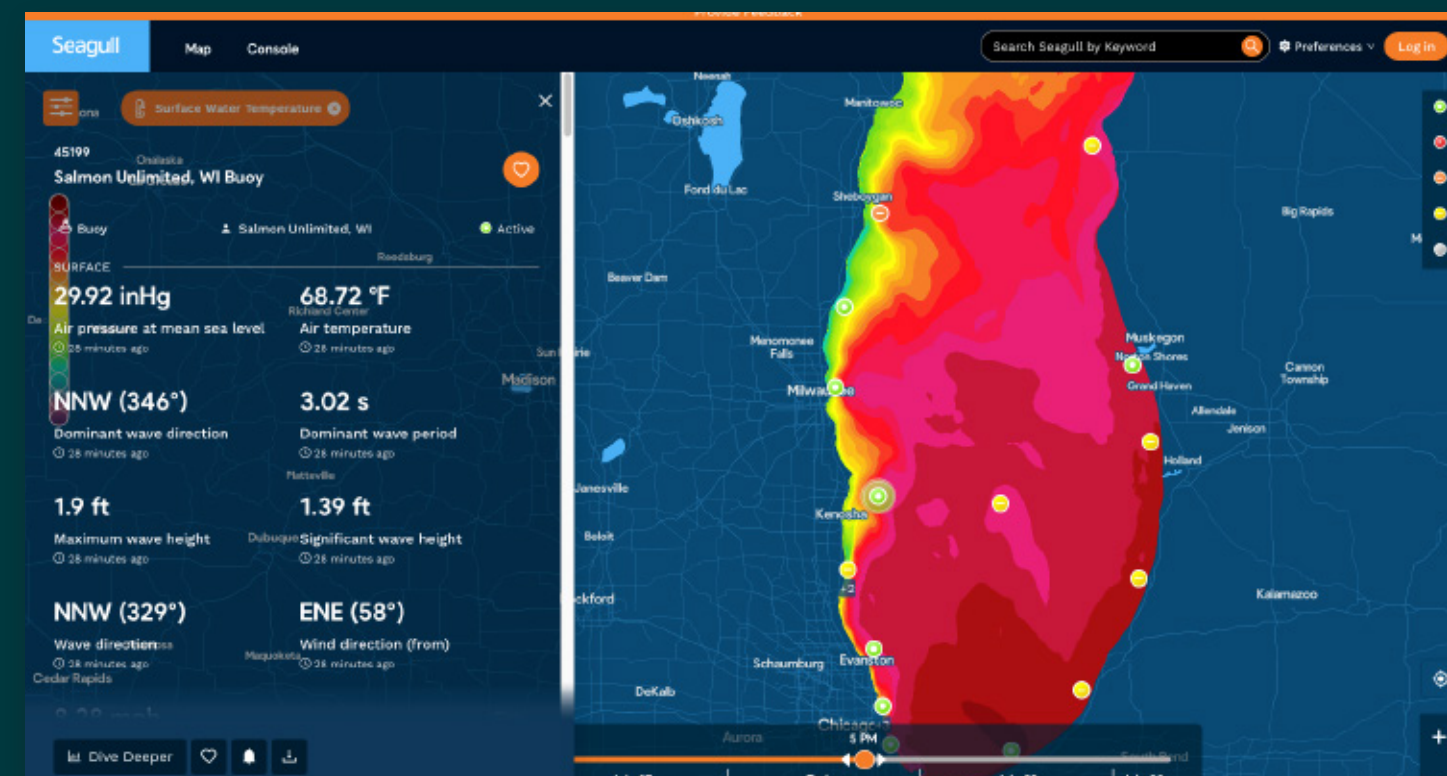
Continuously improving the understanding, use, and management of the Great Lakes is crucial to their long-term sustainability. The [Great Lakes Observing System](#) (GLOS) is key, supporting a network of monitoring platforms to collect, analyze, and share lake and watershed data. A new [Smart Great Lakes Initiative](#) (SGLi) by GLOS leverages technology to advance data management and analysis. The SGLi focuses on improved information systems, year-round observation, autonomous technology, and numerous partnerships.

GLOS serves as the region's certified regional association of the National Oceanic and Atmospheric Administration's (NOAA) Integrated Ocean Observing System (IOOS). Physical and biogeochemical information from GLOS sheds light on hydrodynamic and meteorological conditions, the health of ecosystems, and the impact of environmental stressors.

As part of SGLi, in early 2022 GLOS launched the Seagull IT platform to integrate different types of information from real-time data collection into numerical model forecasts. Continuously improved to serve regional needs, Seagull provides free, accessible data and information that is scalable and can connect to apps, dashboards, and other platforms.

GLOS also works to fill gaps in the regional observing network. For example, GLOS, alongside the State of Michigan and the Mackinac Bridge Authority, supported Michigan Technological University's installation, testing, and operation of the first regional high-frequency radar. This system provides continuous surface current mapping of a portion of the Straits of Mackinac to improve navigation safety, aid in search-and-rescue missions, and monitor situations that could impact the ecosystem and public health.

(Above) Researchers at the Cooperative Institute for Great Lakes Research (CIGLR) launch a GLOS autonomous underwater glider into Lake Erie to monitor conditions during a harmful algal bloom. Photo courtesy of CIGLR.



The Seagull IT platform collects data securely for many sources, like this data from a buoy operated by the University of Wisconsin-Milwaukee near Racine. Users can view the data in real time alongside National Oceanic and Atmospheric Administration model layers, such as for surface water temperature. (Right) GLOS, alongside the State of Michigan and the Mackinac Bridge authority, supported the Great Lakes' first high-frequency radar installation, to the west of the Mackinac Bridge. It monitors the waterway's swiftly changing surface currents in real time. Photo courtesy of Michigan Technological University.

GLOS also continues to support the development of early warning systems that help people understand environmental hazards. Currently, GLOS is working with NOAA's Great Lakes Environmental Research Lab and National Centers for Coastal Ocean Science, Monterey Bay Aquarium Research Institute, Florida Atlantic University, University of Wisconsin, NewWater, and Cellcom to test and deploy technologies that can provide real-time data on harmful algal blooms (HAB) and toxicity levels. In addition, work is underway with the Cooperative Institute for Great Lakes Research (CIGLR) to support development of an experimental model to forecast flooding.

Great Lakes winter data is scarce, which hinders the understanding and forecasting of lake processes. GLOS recently supported the testing of a near real-time overwinter system deployed in Lake Ontario by the Upstate Freshwater Institute.



Work is also underway to expand the observing network with increased use of autonomous vehicles. These systems can collect data continuously over large areas and long time periods. They're being used to monitor ecosystem dynamics, track fish movement, and assess climate variability. This work is done in partnership with University of Windsor-RAEON, University of Minnesota-Duluth, CIGLR, and University of Wisconsin-Milwaukee.

Overall, through these efforts, GLOS aims to make the use and management of the lakes smarter by using technology to provide stakeholders and communities with accurate, actionable information, while also gathering long-term historical data that can help inform regional policy. ♦

GROUNDWATER

OUT OF SIGHT, TOP OF MIND

Data warehouse is expected to streamline access, inform resource management decisions

By Jim Milne and Nathaniel Shuff, Michigan Department of Environment, Great Lakes, and Energy

When Great Lakes water levels swelled to record highs in 2019-20, so did most of Michigan's groundwater tables, leading to inland flooding. But at the same time, other groundwater levels, especially in southwest Michigan, measured low. Resource managers were puzzled by what was happening with Michigan's precious underground water reserves.

It takes quality groundwater data to solve such mysteries. That's something the Michigan Department of Environment, Great Lakes, and Energy (EGLE) has in abundance, but much of it has not been easily accessible to all EGLE staff, regulated parties, consultants, researchers, and the public. In addition, there are different data standards for quality and format across EGLE programs.

As part of a Lean Process Improvement (LPI) project, EGLE staff are working to create a centralized, searchable

database for groundwater data including well construction logs, soil boring logs, location and elevation data, water quality samples, aquifer properties, geologic unit descriptions, and more.

This Groundwater Data Warehouse is expected to enable more-informed decision making, improve data quality, and increase transparency and confidence in EGLE data and decisions. The database will receive data directly from external parties and EGLE staff. It also will be linked to other EGLE databases and the Geographic Information System (GIS). An easily accessible format will allow for comparisons among datasets, resulting in greater confidence in decision making. Links also will allow transfer of data to existing data sources within Michigan and external databases in other governmental agencies, such as the U.S. Environmental Protection Agency (EPA) or U.S. Geological Survey (USGS).

(Left) Data from more than 8,000 water wells produced this 3-D rendering (vertically exaggerated 100 times) showing the subsurface geology of Gladwin County looking to the northwest. The color coding indicates glacial till (green) and glaciolacustrine clay confining units (yellow). The underlying bedrock is mostly shale (black) and sandstone aquifers (tan). Image courtesy of EGLE.

Four teams are developing implementation plans and schedules for achieving the project's goals:

- An external research team to identify best practices and whether existing data storage systems might be adapted for EGLE's use.
- A standardization team to develop requirements for submitting different types of data and the use of electronic data deliverables.
- A structure team to research EGLE's current data management and oversee development of the database structure.
- An outreach team to develop training materials and engage with regulated parties, consultants, researchers, governmental agencies, and other interested parties about how they can access and contribute data.

Better access to information will improve understanding of groundwater science in Michigan and the region and make decisions about water use more transparent – along with raising awareness about the importance of good stewardship.

New groundwater information will be the first data to populate the warehouse and follow the new standards. Existing groundwater data will then be retrofitted into the warehouse, which will be expandable in future phases to include not only groundwater information but interrelated data from all environmental media, such as soils data and stream data.

While implementation is just getting started, this is an exciting opportunity to create a system that has consistent data standards, is integrated, and improves access for users. The goal is to improve data inventory so it can be better used to support resource management decisions to protect the environment and align with a long-term data management plan. The centralization of data in a warehouse that both stores and retrieves data will also allow for greater internal efficiency. Look for an update in the 2023 State of the Great Lakes Report. ♦



Drill rigs take core samples for geological mapping by the Michigan Geological Survey to better understand Michigan's often complex subsurface glacial and bedrock aquifers. Photos courtesy of Michigan Geological Survey.

Better access to information will improve understanding of groundwater science in Michigan and the region and make decisions about water use more transparent – along with raising awareness about the importance of good stewardship.

WATER USE PROGRAM'S MISSION: KNOW THE FLOW

Streamflow data collection can help assess water withdrawals

By Clayton Joupperi, Michigan Department of Environment, Great Lakes, and Energy

If you want to assess the impact of withdrawing large amounts of water from a watershed, you need to know how the water flows. Michigan's [Water Use Advisory Council](#) (WUAC) recommended in December 2020 that the state's [Water Use Program](#) collect more data around the state on geology and the flow of streams.

With the help of two new program geologists, the program measured streamflow in summer 2022 at 21 sites in Michigan watersheds. A joint funding agreement with the U.S. Geological Survey (USGS) provides for streamflow measurements at 30 additional sites and continuous gages that measure daily streamflow year-round at 15 sites.

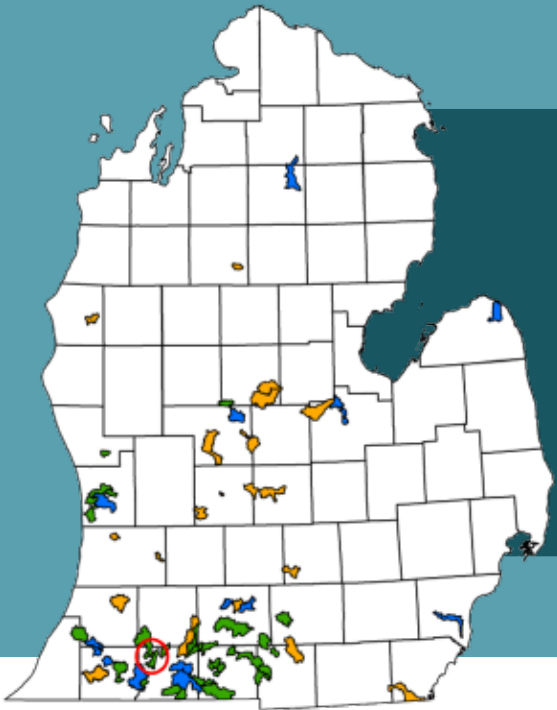
This data will improve 3-D models of groundwater, surface water, and streamflow depletion that can help determine the effects of new and existing large-quantity water withdrawals (LQW). Using a wide variety of data, the program helps manage Michigan's surface water and groundwater resources to protect streamflow and fish populations. Measurements collected by staff and from the continuous gages show watershed status in real time and provide insight on the impact of LQWs and climate.

The program plans to collect more hydrologic data to analyze streambed conductivity: the ability of water to move in either direction between the stream and the underlying groundwater. The program will continue monitoring previously visited watersheds while exploring additional watersheds.



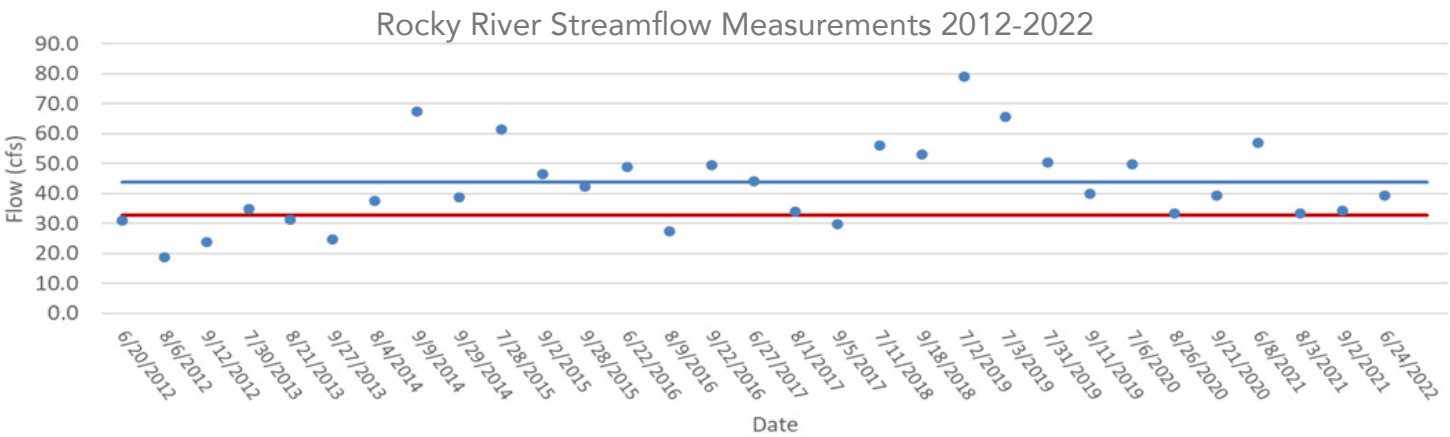
This U.S. Geological Survey gage has collected daily streamflow data for the Pigeon River in Ottawa County since June 2017 at 120th Avenue. Photo courtesy of EGLE.

The Michigan Legislature appropriated \$10 million for the program in fiscal years 2022 and 2023 to support the WUAC's 2020 recommendations. Some of this funding will be used to keep the 15 stream gages operating through September 2024. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) and USGS plan to present to the WUAC a proposal for additional stream gages that will provide extensive coverage of Michigan's streams and rivers and help determine the effects of LQWs and climate on a watershed scale. ♦



This map shows Michigan watersheds with streamflows actively monitored in 2022. The red circle highlights the Rocky River watershed graphed below.

- Stream segments visited and measured by EGLE staff.
- Watersheds with a continuous gage installed.
- Stream segments visited and measured by U.S. Geological Survey staff, via a joint funding agreement.



Blue dots show fluctuations in 2012-22 streamflow measurements of the Rocky River near Flowerfield Township. The blue line indicates the index flow value – the median streamflow for the low-flow summer months – of 43.9 cubic feet per second (cfs). The red line indicates 32.9 cfs, the threshold where low flow has an adverse impact on the river. Figure courtesy of EGLE.

About the Water Use Advisory Council

The state established the Water Use Advisory Council to study and make recommendations to the Michigan departments of Environment, Great Lakes, and Energy (EGLE); Natural Resources (DNR); Agriculture and Rural Development (MDARD); and the Legislature. The WUAC studies, evaluates, and advises regarding Michigan's water management, conservation, and efficiency programs. It also helps the agencies on technical issues, implementation, and monitoring progress of Michigan's Water Use Program.

About the Water Use Program

The Water Use Program registers large-quantity water withdrawals, collects annual water use data, makes determinations on the potential impacts to water resources from proposed withdrawals, and processes water withdrawal permits. Information managed by the program provides an environmental baseline for managing water resources in an integrated manner and strengthens the legal basis for opposing unwarranted diversions of Great Lakes water. ♦

Empowering Michigan communities to collaboratively manage and protect water resources

Team of MSU researchers will develop practical guide for Water User Committees

By Adam Zwickle, Department of Community Sustainability, Michigan State University

Stand on the dunes near Big Sable Point Lighthouse in Mason County, and the waters of Lake Michigan seem vast and endless, part of a water basin so enormous it can be seen from the moon. But there is more to successfully protecting the future of Michigan's water resources than meets the eye.

Large-quantity water users in Michigan — any water user that withdraws more than 100,000 gallons per day — tap into surface water or sources hidden underground that connect not just to the Great Lakes, but to Michigan's streams that support recreation, key fish populations, and other vital ecosystems. Michigan's [Water Use Program](#) was created to help effectively manage these surface and groundwater resources and to restrict, when necessary, large-quantity water withdrawals. In doing so, Michigan upholds its end of the 2008 [Great Lakes Compact](#) that bans the diversion of water outside the Great Lakes basin as long as states successfully regulate their water use.

One facet of Michigan's Water Use Program is the ability to form Water User Committees, or WUCs, that can use the program's data and technology to create local management strategies. Facilitating successful WUCs is now a pressing issue in Michigan, which in spring 2022 entered the driest six-month period prior to planting agricultural crops in over 120 years, causing a significant increase in demand for high-capacity water withdrawals. As water becomes increasingly scarce, it will be unlikely that the program will be able to work with individuals denied withdrawal registrations on a case-by-case basis, and the need for water users to form local WUCs to obtain the water they seek will increase. To date, no WUCs have been formed in the state of Michigan.

(Left-top) Recreation, like fly fishing on the Au Sable River, relies on sustainable management of surface and groundwater resources. Photo courtesy of Michigan Sea Grant. (Left-bottom) Blueberry growers struggle to keep up with the shallow-rooted bushes' demand for water. Photo courtesy of Michigan State University Extension.

Based on a recommendation to the state Legislature by the Water Use Advisory Council in 2020, Michigan Sea Grant and the Michigan Department of Environment, Great Lakes, and Energy's (EGLE) Office of the Great Lakes are jointly funding an interdisciplinary team of scientists from Michigan State University and its Institute of Water Research to understand and recommend ways to overcome barriers to forming WUCs. The two-year grant project will culminate in a practical WUC guide that inspires and empowers large-quantity water users to form successful groups and develop shared solutions to support sustainable water use at the local level.

In spring 2022, MSU researchers began the project by collaborating with the grant's Leadership Team — representatives from EGLE and the Michigan departments of Natural Resources (DNR) and Agriculture and Rural Development (MDARD) with a long history in water use policy and law — to recruit key stakeholders and experts as members of the Stakeholder Advisory Board. The Advisory Board includes 15 members representing the cultural, economic, and social diversity of Michigan's water users, including tribal governments, scientists, agriculture, business, and environmental organizations.

With guidance and feedback from the Advisory Board and Leadership Team, a first-of-its-kind Water User Survey was developed to take the pulse of large-quantity water users' current knowledge of policy and their perceived risks and benefits to local, collaborative management. In the coming months,

the MSU researchers will convene focus groups to engage in a research-supported process of co-creating shared knowledge about large-quantity water use that, in tandem with accurate models of underground water flow, will be used to explore realistic, shared management techniques under different climate and water flow scenarios. Results from the survey and focus groups will inform the first draft of the WUC guide and be further evaluated by actual water users through participatory case studies, representing the first WUCs to be convened in Michigan.

Water use and regulation in Michigan is exceedingly complex, with myriad databases and support tools available that require various levels of technical capabilities. The MSU team's history and expertise in this area uniquely positions them to compile the resources and information needed for potential water users. The collaborative process used in the grant to generate the WUC guide is itself part of the solution, leading water users to build mutual trust as they co-create management solutions necessary for sustainable water governance. ♦

(Right) The health and abundance of wildlife, like this blue-winged teal pair, and water-based recreation in Michigan rely on sustainable management of surface and groundwater resources. Photo courtesy of Michigan Sea Grant.



Harnessing investments to accelerate restoration of Michigan's Areas of Concern

Great Lakes Restoration Initiative among funds helping to clean up contaminated sites

By Rick Hobrla, Michigan Department of Environment, Great Lakes, and Energy

In the 1987 amendments to the [Great Lakes Water Quality Agreement](#) – now marking its 50th anniversary – the federal governments of the United States and Canada committed to restoring beneficial uses in designated Areas of Concern (AOC). AOCs were defined as “geographic areas designated by the parties where significant impairment of beneficial uses has occurred as a result of human activities at the local level.” Thirty-one U.S. AOCs were subsequently identified, 14 of which were located wholly or partially in Michigan.

The overall goal of the program is to address these impaired beneficial uses in each AOC and formally remove or “delist” them from the designated AOC list. While many types of actions can address impaired beneficial uses, the most common ones are remediating contaminated sediments and restoring degraded habitat to improve conditions for fish and wildlife. Sediment and habitat projects are implemented as federal and state agencies are successful in recruiting local partners and identifying suitable funding sources.

(Above) Children experience the outdoors at the Muskegon Lake Nature Preserve. Photo courtesy of West Michigan Shoreline Regional Development Commission.

From 1987-2004, there was little progress in cleaning up AOCs, due primarily to a lack of funding. The federal Great Lakes Legacy Act (GLLA) was authorized in 2002, with the first appropriation in 2004. The GLLA provided significant federal funding to clean up legacy contaminated sediments, a widespread problem in AOCs. The very first GLLA cleanup project was completed in 2005 in the Black Lagoon, an inlet along the Detroit River.

Progress in the [AOC Program](#) was accelerated even further in 2010 with the establishment of the [Great Lakes Restoration Initiative](#) (GLRI), a federal program that has provided roughly \$300 million annually for Great Lakes restoration. Approximately one-third of this GLRI funding has supported work in AOCs.

Three AOCs have been successfully restored and delisted as work continues on the 11 others. State, federal, and local officials gathered in spring 2022 to celebrate the Muskegon Lake AOC having completed all required management actions, a key step before delisting. Remediation over 20 years included wetland creation, sediment removal, culvert replacement, shoreline softening, debris/fill removal, and habitat restoration at 18 sites.

The AOC Program has received an additional boost with the 2021 passage of the federal Bipartisan Infrastructure Law (BIL). The BIL will provide an additional \$1 billion in Great Lakes funding over the next five years. The U.S. Environmental Protection Agency (EPA) plans to direct most Great Lakes BIL funding to the AOC Program. Encouraged by this new funding, the EPA has established the ambitious goal of completing work in 28 U.S. AOCs by 2030, including 12 of Michigan's 14 AOCs.

This large federal investment in AOCs, which often consist of degraded urban areas, will be a huge boost for Michigan. Although the GLRI was intended to be an environmental restoration program, it has served as an economic stimulus, as well. A 2018 study led by the Council of Great Lakes Industries and the Great Lakes Commission indicated that every dollar of federal spending on GLRI projects between 2010 and 2016 is expected to produce \$3.35 in additional economic activity in the Great Lakes region through 2036. The benefits include increased tourism and a significant rise in property values, both residential and commercial.

A lot of progress is expected over the next few years, and the Michigan Department of Environment, Great Lakes, and Energy (EGLE) will be an active partner with the EPA, other federal agencies, and our local partners in working to restore the Great Lakes ecosystem and improving the quality of life for all Michiganders. ♦



Remediation in the Muskegon Lake Area of Concern includes shoreline habitat restoration. Photo courtesy of EGLE.



Students from Muskegon's Bunker Elementary School join the annual Grand Trunk Restoration Day, cleaning up a former illicit dump site that now features docks, a picnic area, and trails along Muskegon Lake. Photo courtesy of West Michigan Shoreline Regional Development Commission.

PARTNERS ARE DRAWING A LINE IN THE ‘STAMP SANDS’

State and task force work to save Lake Superior fishery from spread of mining waste



By John Pepin, Michigan Department of Natural Resources, and Stephanie Swart, Michigan Department of Environment, Great Lakes, and Energy

It took many decades to create Michigan’s stamp sands environmental crisis. It will take many years to undo. But 2022 saw important early steps on the long road to halting this spreading ecological threat to the Lake Superior fishery.

As a task force – whose members and participants represent the U.S. Environmental Protection Agency (EPA); U.S. Army Corps of Engineers (USACE); U.S. Fish and Wildlife Service (USFWS); U.S. Coast Guard (USCG); Keweenaw Bay Indian Community (KBIC); Great Lakes Indian Fish and Wildlife Commission (GLIFWC); Michigan Department of Natural Resources (DNR); and Michigan Department of Environment, Great Lakes, and Energy (EGLE) – works toward a permanent solution, the State of Michigan budgeted \$10 million to begin construction of a 2,000-foot-long jetty into the lake. The jetty will partly wall off the sands rolling across the lakebed while also serving as a base of operations for removing sand from the lake.

Efforts center on saving Buffalo Reef, a rocky 2,200 acres of lake bottom off the Keweenaw Peninsula where lake trout and whitefish spawn. The reef is estimated to produce about one-third of all lake trout caught in the Michigan waters of Lake Superior, and the GLIFWC estimates it adds about \$1.7 million a year to the regional economy. Stamp sands have begun to infiltrate the reef, covering the rocks and filling in the crevices where fish lay eggs and hatchlings shelter from predators.

(Left) Earth-moving crews in November 2019 work to move stamp sands away from the shoreline near a former stamp mill. Photo courtesy of Michigan DNR.



(Top) As seen in this aerial image, millions of tons of stamp sands left over from copper mining line the shore of the Keweenaw Peninsula for miles south of Gay, Michigan, and extend into Lake Superior. (Right) Boot prints show the scale and coarse texture of stamp sands. Photos courtesy of DNR.



Dark, coarse stamp sands are the tailings, or pulverized rock, left over from processing copper ore. Over about a century ending in the 1930s, Upper Peninsula copper mines produced and dumped tens of billions of pounds of the waste material on land and into the lake. Waves, winds, currents, and ice have spread it for miles along the Lake Superior coastline south of the community of Gay, leaving a barren strand where nothing grows due to toxic copper residue.

In 2017, the EPA, USACE, KBIC, and State of Michigan joined forces to form the Buffalo Reef Task Force. The EPA used funds from the Great Lakes Restoration Initiative (GLRI) to dredge stamp sands as a temporary measure while the task force whittled as many as 13 potential solutions down to a final three options.

Among the options is building a 240-acre landfill away from the shore to hold stamp sands removed from the lake. Any of the possible solutions include using the jetty as part of the logistics for sand removal. A comprehensive “long-term adaptive management plan” is expected from the USACE, to be followed by an opportunity for public comment and a responsiveness summary from the task force.

The costly project to move the 22.7 million metric tons, or 16 million cubic yards, of material involved is expected to take up to 20 years. The EPA is seeking nongovernmental sponsors to help contribute to the cost of this massive project. ♦

ON GUARD AGAINST PFAS IN MICHIGAN'S WATERS

Response team and partners collect and test fish from dozens of water bodies each year

By Brandon M. Armstrong, Michigan Department of Environment, Great Lakes, and Energy

Seven state agencies, including the Michigan Department of Environment, Great Lakes, and Energy (EGLE), are part of the [Michigan PFAS Action Response Team](#) (MPART), coordinating resources to address concerns about per- and polyfluoroalkyl substances (PFAS).

These toxic “forever chemicals” persist in the environment and can accumulate in the food chain and the human body. As part of this work, EGLE’s [Fish Contaminant Monitoring Program](#) collects fish from about 50 water bodies a year, with help from state, federal, and tribal partners, to test for PFAS and other contaminants.

The fish are processed as they would be for eating (for example, as fillets) and sent to the Michigan Department of Health and Human Services’ (MDHHS) lab for analysis. Test results provide data used to monitor contaminant trends and inform fish consumption advisories and



guidelines. These advisories are designed for the health and safety of all fish consumers, especially children and people who are elderly, pregnant, or have health problems.

The most common contaminants causing fish consumption advisories and guidelines in Michigan are mercury, polychlorinated biphenyls (PCB), perfluorooctanesulfonic acid (PFOS, a type of PFAS), and dioxins. These persistent bioaccumulative contaminants are of most concern because they remain in the environment for a long time and build up in fish through the food chain.

Testing fish also helps MPART determine where additional PFAS investigation is needed. For example, elevated PFOS in fish from Pike Lake in the Upper Peninsula’s Luce County led to an MPART investigation of a 2012 fire where some type of firefighting foam was known to have been used. This investigation involved

learning more about the foam and sampling potentially affected surface waters, nearby residential wells, and drinking water wells used at two state campgrounds.

MPART also works with agencies in other states to stay current on PFAS issues in the Great Lakes region. The Wisconsin Department of Natural Resources (WDNR) recently issued a consumption advisory for rainbow smelt from Lake Superior based on elevated levels of PFOS. Soon after, MDHHS also issued a precautionary fish consumption to match the WDNR advisory. EGLE then worked with its partners to collect rainbow smelt from lakes Superior, Huron, and Michigan, as well as two inland lakes. Results indicate that rainbow smelt from these water bodies have elevated PFOS concentrations. MDHHS is reviewing sample data to determine if the consumption guidelines need to be updated.

EGLE has also tested other fish species from Lake Superior and found that PFOS levels in lake trout and whitefish from Lake Superior were below the MDHHS fish consumption screening values. In addition, many of the tested surface waters in Michigan’s Lake Superior watershed have met Michigan’s water quality values for PFOS. These data support the notion that there is not a significant source of PFAS to Lake Superior but rather reflect how this contaminant builds up at much higher rates in rainbow smelt compared to other fish species.

Recently, EGLE received two grants that will expand MPART’s knowledge of PFAS in fish:

- \$600,000 from the U.S. Environmental Protection Agency for a project entitled “Fish Contaminant Monitoring in Select Environmental Justice (EJ) Areas of Michigan.” EGLE will try to collect at least two species of fish in 20 EJ areas. Many of these locations are water bodies used for youth fishing events. The data will inform the MDHHS fish consumption advisories and guidelines. Sampling will conclude in 2023.
- \$191,130 from the U.S. Fish and Wildlife Service for a project entitled “Evaluating Persistent Chemicals of Mutual Concern (CMCs) in Prey Fish of Fish-Eating Birds of Michigan.” CMCs include PFAS, as well as polybrominated diphenyl ethers (PBDEs), PCBs, and mercury. This study will evaluate CMCs in fish eaten by bald eagles and herring gulls along the shoreline of Lake Huron and in PFAS-impacted tributaries of Lake Huron.



Aquatic biologist Mike McCauley holds two walleye collected from the Flint River in August 2022 for the Michigan Fish Contaminant Monitoring Program. Photo courtesy of EGLE.

Test results provide data used to monitor contaminant trends and inform fish consumption advisories and guidelines. These advisories are designed for the health and safety of all fish consumers, especially children and people who are elderly, pregnant, or have health problems.

MPART continues to sample fish from across the state to protect public health and the environment and to help identify and mitigate sources of PFAS. For the latest updates on PFAS in Michigan’s fish and surface waters, visit the [MPART surface water workgroup](#) page. More information on Michigan’s fish consumption guidelines can be found on the [Eat Safe Fish](#) website. ♦

(Top) Aquatic biologist Mike McCauley collects fish from the Carp River near Negaunee. (Above) A brook trout collected from the Carp River near Negaunee. Photos courtesy of EGLE.

Breaking down the problem of microplastics in the Great Lakes

Collaborative strategies underway to address debris from consumer products found throughout lakes

By Sarah Lowe, National Oceanic and Atmospheric Administration Marine Debris Program, Lynker Technologies

A big challenge to the health of the Great Lakes takes a tiny form: microplastics, pieces of plastic no larger than 5 mm in size, or about the size of a pencil eraser. They have been documented throughout the lakes, in oceans, and even in tap and bottled water, sea salt, and other products we eat and drink.

Microplastics' many forms include beads, fragments, pellets, film, foam, and fibers. They can be created when larger plastic items break up in sun and wave action over time, or they can be intentionally manufactured, as in microbeads and pellets. In a study of microplastics on 37 National Park beaches, microfibrils were found at every site and made up 97% of the microplastic debris. The highest concentration of microplastics in this national study was found at the Apostle Islands National Seashore in Wisconsin, with an average of 221 pieces of microplastic per kilogram of sand.

Modeling studies have estimated that approximately 10,000 metric tons of plastics enter the Great Lakes every year. Microplastics studies in the five Great Lakes have shown that larger amounts are found close to urban and nearshore areas, particularly near locations where rivers, stormwater, and wastewater discharge. Likewise, there have been greater amounts found in Lake Erie and Lake Ontario, which are smaller and have larger urban populations and thus more potential sources of microplastics.

Zooplankton, fish, mussels, and birds in the Great Lakes have been found to ingest microplastics, mistaking the debris for their natural food. Microplastics can both attract and carry pollutants already in the water and release chemicals added to plastics to make them colorful, flexible, or flame-resistant. Lab studies have shown that microplastics may impact animals by delaying their developmental stages, causing problems with reproduction, and may even make it difficult for them to fight off disease. Although wildlife may

ingest or be exposed to microplastics and their chemical additives, more research is needed to understand how they might be affected and especially how impacts can translate up the food chain.

Efforts to solve the complex problem are underway regionally, nationally, and internationally.

The U.S. Marine Debris Act (2006) and Save our Seas Acts (2018 and 2020) prioritize the prevention, research, assessment, and removal of marine debris, with specific actions to understand and address microplastics. The U.S. also passed the Microbead-Free Waters Act of 2015, which banned rinse-off cosmetics that contain intentionally added plastic microbeads.

A [Great Lakes Marine Debris Action Plan](#) was developed in 2020 through a voluntary, collaborative effort of 39

Small material, big concern

What are microplastics? Plastic pieces less than 5 mm in size.

What do microplastics look like? Their many forms include beads, fragments, pellets, film, foam, and fibers.

How are they formed? Microplastics can be created when larger plastic items break up, or they can be manufactured, as in microbeads and pellets.

Where are they found? Throughout the oceans and Great Lakes and even in tap and bottled water, sea salt, and other products we eat and drink.

Why are they a problem? Lab studies show that microplastics may impact the health and development of animals that ingest them.



(Left) Microplastics found on a Great Lakes beach. Photo courtesy of Eileen Stegemann.

organizations from the United States and Canada to address marine debris through coordinated actions. This five-year Action Plan lays out 47 actions focused on research and monitoring, policy and management, prevention, and removal of marine debris.

More recently, in March 2022, the United Nations Environment Assembly unanimously agreed to formal negotiations on a legally binding treaty to end plastic pollution, with the goal to conclude negotiations by the end of 2024. In 2022, Canada also prohibited the manufacture, import, sale, and eventually export of many types of single-use plastic items.

At the local level, businesses are becoming more aware of the issue. In places like Chicago and Put-in-Bay, Ohio, restaurants are voluntarily phasing out straws and

reducing single-use plastics to prevent waste before it becomes marine debris.

Solutions also begin with our personal choices. Single-use and disposable items are deeply ingrained in our everyday lives, and they can all become marine debris and microplastics. By working as a community, we can all help protect the Great Lakes. We can pick up the trash we find on our local streets, in our rivers and streams, and on our beaches. We can reduce the amount of plastics we purchase and carry reusable alternatives wherever we go. Together, we can be part of the solution and prevent microplastics in the Great Lakes.

For more information on microplastics and marine debris, visit the National Oceanic and Atmospheric Administration's [Marine Debris Program](#) website. ♦

Stewardship in the sands

It wasn't enough for juniors and seniors from a West Michigan high school to simply learn about microplastic pollution on local beaches. They took the next step and did something about it – winning a statewide environmental honor in the process.

Environmental Field Studies students from Holland's Careerline Tech Center in the Ottawa Area Intermediate School District collected samples of plastic pollution from the sands of six Ottawa County beaches. They found that microplastics and single-use plastics were the main contaminants.

Instructor Avril Weirs told the Holland Sentinel the students felt empowered to seek change in their community. They brainstormed solutions with mentors from the Holland-based [ODC Network](#), [Allegan Conservation District](#), and [Ottawa County Parks and Recreation](#) and decided to create recycling stations for beachgoer's plastics. These "Beach Buddy Stations" were installed at four locations with funding from the U.S. Environmental Protection Agency's [Trash Free Waters](#) program and the Inland Seas Education Association's [Great Lakes Watershed Field Course](#) program. The stations engage beachgoers in cleanup and show what types of plastics end up in the Great Lakes.

The project won Michigan's 2022 Environmental Service Award recognizing school-sanctioned environmental projects that benefit plants, wildlife, or ecosystems native to Michigan. The Michigan departments of Environment, Great Lakes, and Energy (EGLE), Natural Resources (DNR), and Agriculture and Rural Development (MDARD) sponsor the annual award.

(Left) Careerline Tech Center students collect data on microplastics at an Ottawa County beach. Photo courtesy of Careerline Tech Center.



OX CREEK'S CURRENT CARRIES HOPES FOR BENTON HARBOR'S FUTURE

Community and partners unite behind waterway restoration and revitalization

By Alex Little, City of Benton Harbor; Craig Borum, University of Michigan; and Marcy Hamilton, Southwest Michigan Planning Commission

Ox Creek is more than simply a tributary of the Paw Paw River, cutting through the underserved communities of Benton Harbor and Benton Charter Township on its way to Lake Michigan. It's a key environmental and social element in Benton Harbor's urban fabric, linking the city's downtown with neighborhoods and commercial corridors along Pipestone Street and Napier Avenue and linking the city with its history, social life, and natural environment.

In 2021, Benton Harbor's Mayor Marcus Muhammad and City Commission set revitalization of Ox Creek as one of the city's highest economic and recreational development priorities. Governmental and academic partners are joining the effort.

The city envisions a vibrant recreational and economic Ox Creek corridor with bike paths, lighted walkways, pedestrian bridges, outdoor classrooms, and new commercial development and housing opportunities. The

corridor would include Hall Park – the city's largest park – and the Art District.

Restoration creates the potential for redevelopment of the Ox Creek corridor to have a significant positive impact on the community through its recreational potential, and as a catalyst for economic development and housing not only in the valley but throughout the city. The improved creek and nonmotorized trail will link Benton Charter Township's commercial and retail area and Benton Harbor's downtown, including the Harbor Shores complex.

Much needs to happen to restore the creek, including addressing nonpoint source pollution, flooding, habitat restoration, contamination at two former industrial sites, stopping and cleaning up illegal dumping, and improving public access. Degradation of Ox Creek over decades represents a classic example of environmental injustice wrought through industry closure, neglect, and poor

stormwater management throughout the watershed, which extends eastward into the rural fields of Berrien County.

This city has hired a team from the University of Michigan's (U-M) Taubman College of Architecture and Urban Planning, led by Professor Craig Borum and Jen Maigret, to engage local residents and help the community develop and articulate a shared vision for Ox Creek revitalization and a framework for future development along the creek corridor. U-M is working with partners including the Michigan Department of the Environment, Great Lakes, and Energy's (EGLE) Office of the Great Lakes, Office of the Environmental Justice Public Advocate, Water Resources Division, and Brownfield Redevelopment Assessment Program; the Southwest Michigan Planning Commission (SWMPC); and the U.S. Environmental Protection Agency's (EPA) Technical Assistance to Brownfields program.

The scope of the project includes six critical priorities:

- Remove debris and illegal dumping that lines the creek valley and restore the riparian buffer to beautify the corridor.
- Continue to improve the creek's water quality by addressing nonpoint source pollution with better stormwater and agricultural management practices throughout the watershed.
- Restore the creek and corridor habitat to increase resilience to storm events and changing lake levels.
- Restore and enhance Hall Park, a significant social and recreational site for more than a century. Ox Creek runs along the entire western edge of the park, and the neglect and degradation of the creek has severely damaged the park and its ballfield due to flash flooding.
- Design and build an elevated, accessible, nonmotorized trail along the creek to connect downtown to Hall Park and extend to the Napier Avenue commercial corridor near I-94. The trail will include outdoor classrooms, picnic areas, educational opportunities, lighting, and several points of crossing to increase connections and access for neighborhoods on either side of the creek valley.
- Remediate legacy industrial contamination to support future use and redevelopment.

The city, visioning team, experts from EGLE, and other community partners hosted workshops and presented information about Ox Creek's current environmental condition and progress underway in conjunction with Benton Harbor's Master Plan efforts during a planning



Benton Harbor community members join discussions about the future of Ox Creek during a planning week in June 2022. Photo courtesy of the University of Michigan.

week in early June 2022. These events were followed up by additional opportunities for community input, including information booths at the Benton Harbor Farmers Market and the summer Riverfest, and a presentation and listening session at the Benton Harbor Senior Center annual picnic. The design team also circulated an online survey soliciting further input from the community and stakeholders.

Several efforts are underway to begin restoration of the creek, including habitat restoration between Main Street and Highland Avenue at the Michigan Gas Utility property. This \$1 million project is repairing the banks, removing debris and invasive plants, and restoring habitat along and within the stream. Along the western bank, a wetland and expanded floodplain area was created to relieve flooding during storm events. In addition, EGLE has received an EPA Brownfield Assessment Grant for \$2 million that includes the city of Benton Harbor. Funding will be used to assess eligible sites in the city, including Ox Creek. The U.S. Army Corps of Engineers also has agreed to carry out a hydrologic analysis of the creek.

The design team currently is synthesizing the community feedback and developing design proposals for critical locations that reflect the community's desires. Plans will be developed and presented to the public and the City Commission for additional feedback before being finalized and incorporated into the City Master Plan. The city continues to work with state and federal agencies, U-M, SWMPC, and community partners to develop the implementation plan and leverage new state and federal funding opportunities to support this transformative community project. ♦

(Below) Plans for the creek include an elevated nonmotorized trail. Artist rendering courtesy of the University of Michigan.





Sowing the seeds of partnership for NATIVE WILD RICE

Manoomin is one of the state's most culturally and ecologically significant native plants

By Katie Lambeth, Michigan Department of Environment, Great Lakes, and Energy; Co-chair, Michigan Wild Rice Initiative Team

The grassy stalks grow in the sheltered shallows of Great Lakes bays and coves, quiet inland lakes, and gently flowing streams. A partnership supported by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) aims to keep it that way.

At issue is wild rice: *Zizania palustris* and *Zizania aquatica*, North America's only native grains. Once thick in areas like northern Michigan, wild rice is now under threat from climate change, habitat loss, uninformed harvesting practices, degraded water quality, and more.

But it retains its ecological, social, cultural, and economic value, especially for the Anishinaabe communities who have tended and cultivated the wild plant they know as manoomin or mnomin for untold generations. Manoomin translates to "the good berry," and Anishinaabe communities in the Great Lakes region strive to retain their

(Left) Wild rice is native to Michigan's shallow waters. Photo courtesy of EGLE.



(Clockwise from top) Wild rice grows near Alberta, Michigan, as part of restoration efforts. Photo courtesy of Michigan Sea Grant. Katie Hager, environmental outreach specialist for the Saginaw Chippewa Indian Tribe, explains the wild rice restoration project at Lake Tawas to EGLE Director Liesl Clark and others in September 2022. Photo courtesy of EGLE. Rice grains are winnowed, or separated from chaff, at a Manoomin Camp presented by the Keweenaw Bay Indian Community and partners in L'Anse, Michigan. Photo courtesy of Michigan Sea Grant.



connections to this important plant. Wild rice is an integral part of Michigan's Native American heritage, and many tribes continue to harvest manoomin each year.

A two-year, \$100,000 EGLE grant announced in March 2022 supports a cross-cultural partnership to protect wild rice. The Office of the Great Lakes awarded the grant through the Michigan Great Lakes Protection Fund to the University of Michigan Water Center. The grant supports the collaborative creation of a wild rice stewardship plan at the request of the Michigan Wild Rice Initiative Team (MWRIT). The team includes representatives from EGLE; the state departments of Natural Resources, Agriculture and Rural Development, and Transportation; and each of the 12 federally recognized tribes in Michigan.

The U-M Water Center will partner with MWRIT to develop the Tribal-State Manoomin Stewardship Plan, engaging with the tribes to identify all elements of the plan and working with relevant decision makers to secure commitments and resources for implementation. Water Center Director Dr. Jennifer Read is the project lead.

Danielle Fegan, wildlife assessment biologist with the Sault Ste. Marie Tribe of Chippewa Indians, said MWRIT is excited to work toward a collaborative manoomin stewardship plan that acknowledges the plant as a sacred relative and important member of aquatic communities across the Great Lakes region. Fegan is co-chair of MWRIT. The stewardship project advances a priority recommendation in the Michigan Water Strategy for the state to work with federally recognized tribes and other stakeholders with an interest in preserving and enhancing wild rice resources across the state.

Since MWRIT formed in 2017, the group has worked collaboratively to protect, preserve, and restore wild rice and wild rice culture in Michigan for ecosystem health and the benefit of present and future generations.

The plan will lead to more coordinated research, protection, and restoration of wild rice in Michigan and facilitate collaboration where appropriate among tribal and state agencies. ♦

OBTAWAING BIOSPHERE REGION BRIDGES LANDS, WATERS, PEOPLE

Large swath of northern Michigan designated as globally significant for ecology and culture

By Knute Nadelhoffer, University of Michigan Biological Station; Jon W. Allan, School of Natural Resources and Environment, University of Michigan; and Adam Schubel, U-M Biological Station

The [U.S. Biosphere Network](#) consists of 28 internationally recognized Biosphere Regions (BR) across the continental U.S., Hawaii, and Puerto Rico. These regions are acknowledged for their natural beauty and potential to model collaborative efforts for environmental, cultural, and economic well-being. They're part of a world network of more than 700 BRs in 128 nations, recognizing some of the most unique regions worldwide and including coastal, mountain, grassland/savanna, island, and wetlands systems.

And one of them is right here in Michigan. Northern Michigan's Obtawaing Biosphere Region is one of three recently recertified BRs in the U.S. A total of nine BRs – six in Canada and three in the U.S. – lie within the Great Lakes Basin, the heart of the largest surface freshwater system on Earth.

Biosphere Regions are neither governing nor regulatory entities, nor are they parks in a traditional sense, though they often include parks. Instead, they are areas well recognized for unique attributes, cultures, and natural features. At its heart, BR designation acknowledges the importance of a region and opportunities to foster positive and harmonious interactions between people and the natural world of which humans are a part.

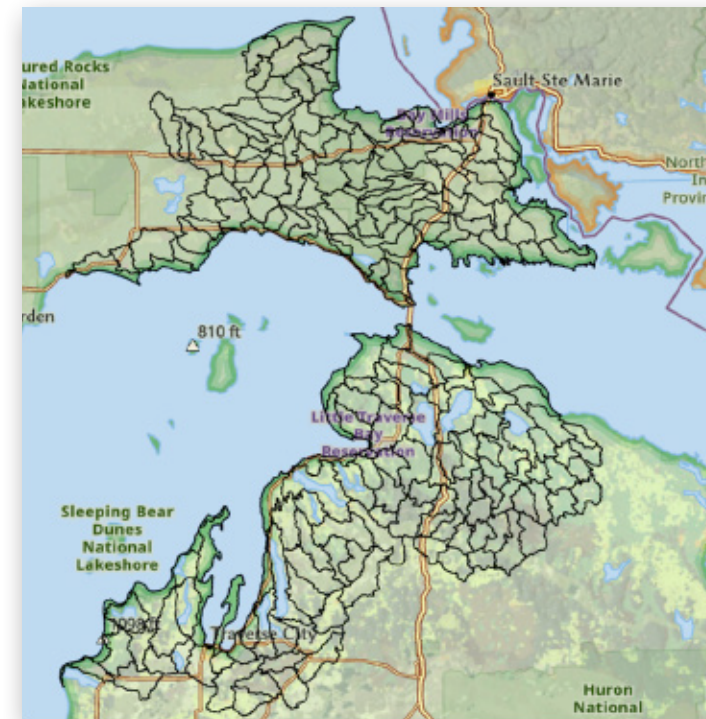
The 2022 Obtawaing Biosphere Region recertification expands dramatically on the approximately 13,000

acres managed by the University of Michigan Biological Station (UMBS) that was recognized in 1979 as a United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve. In seeking renewed status in 2018, the scope was broadened to include a wide range of agencies, conservancies, Tribal Nations, and academic institutions (see accompanying list).

The lands and waters these organizations steward, manage, and study comprise hundreds of individual protected or conserved parcels stretching from Sleeping Bear Dunes National Lakeshore at its southern end, to the northern coast of Lake Huron, and across the Mackinac Straits to Sugar Island near the U.S.-Canada border. The Obtawaing Biosphere Region name comes from the Anishinaabemowin (Odawa, Ojibwa, and Potawatomi language) word roughly translated as the central meeting place or middle village, reflecting this region's location at the convergence of three Great Lakes, two peninsulas, and multiple cultures, all at the center of the larger Great Lakes Basin.

A core premise of the Obtawaing BR is a widely held love for the Great Lakes and a desire to maintain, manage, and steward lands and waters in a manner that strengthens regional economies, knits people and place together, advances regional identity and cohesion, and seeks a vision for the future that strengthens long-term interest in healthy forests, lands, and waters.

(Above) Sleeping Bear Dunes rise near the shore of Lake Michigan within the Obtawaing Biosphere Reserve. Photo courtesy of Michigan Department of Environment, Great Lakes, and Energy (EGLE).



The Obtawaing Biosphere Region takes in 216 watersheds averaging about 36 square miles each. Geographic Information System image.

The expanded and renamed BR functions with its independent partners working together to better understand natural processes that foster environmental quality, advance stewardship of human-natural systems, and protect the natural world. It recognizes humans as active participants within the natural world that sustains our cultures and well-being. These collaborative efforts aim to sustain environmental, cultural, and socio-economic well-being in the region at the heart of the Great Lakes Basin.

This focus is the outcome of a series of eight strategic planning workshops held from January through June 2022, led by the National Park Service's Midwest Regional Office of the Rivers, Trails, and Conservation Assistance Program. Obtawaing partnering organizations attended these virtual meetings, contributing significantly to a planning document – now being finalized – that will inform Obtawaing partner collaborations going forward.

Regular communication among Obtawaing BR partners is serving to identify opportunities to develop and amplify collaborative sustainability projects and programs with increased potential for positive impacts. These collaborations are likely to expand as the Obtawaing Biosphere Region continues to develop. ♦

A place of partnership

Tribal Nations, educational institutions, conservancies, and agencies thus far included in the newly designated Obtawaing Biosphere Region:

- Audubon Great Lakes
- Bay Mills Indian Community
- Beaver Island Association
- Burt Lake Band of Ottawa and Chippewa Indians
- Central Michigan University Biological Station
- Chippewa Ottawa Resource Authority
- Grand Traverse Bay Band of Ottawa and Chippewa Indians
- Grand Traverse Regional Land Conservancy
- Huron Pines
- Land Information Access Association
- Little River Band of Ottawa Indians
- Little Traverse Bay Bands of Odawa Indians
- Little Traverse Conservancy
- Loyola University (Chicago)
- Sault Ste. Marie Tribe of Chippewa Indians
- Sleeping Bear Dunes National Lakeshore
- The National Wildlife Federation
- The Nature Conservancy
- The Superior BioConservancy
- Tip of the Mitt Watershed Council
- University of Michigan Biological Station
- U.S. Forest Service
- Northern Institute of Applied Climate Science



Members and friends of the Burt Lake Band of Ottawa and Chippewa Indians begin an annual Walk of Remembrance commemorating the illegal burning of their village on Burt Lake in 1900. Burt Lake lies within the Obtawaing Biosphere Reserve. Photo courtesy of Burt Lake Band of Ottawa and Chippewa Indians.

Protecting water from ‘Forest to Mi Faucet’

Michigan DNR initiative will plant trees, seeds of knowledge

By Mike Smalligan and Rachel Coale, Michigan Department of Natural Resources

If you followed the water in your tap backward to the source, where would it come from? A river? A lake? A well in the ground? The surprising answer for most people in Michigan is – a forest!

The Great Lakes State’s 20 million acres of forests, covering 56% of its land area, play a crucial role in protecting and providing drinking water. Forests clean and cycle about six trillion gallons of rainwater annually, water that eventually ends up in homes as clean drinking water. Trees move water into the soil to reduce surface runoff and filter out contaminants.

Many of Michigan’s environmental problems are in parts of the state with the most people and the fewest trees. Without the benefits of trees and forests, people need to work harder to keep water healthy.

The way Michigan takes care of its land — through agricultural practices, developing communities, and harvesting trees in forests — has a direct effect on water quality and the cost to treat drinking water. That’s why utilities develop source water protection plans. Good strategies can include responsible forest management, tree planting, community outreach, best practices for loggers, and conservation easements.

A cleaner starting point means less work to remove contaminants. This isn’t important for cities alone – good forest management protects the groundwater in rural areas and those relying on private wells, too.

Data from the U.S. Environmental Protection Agency (EPA) and U.S. Department of Agriculture (USDA) Forest Service show clear links between declining forest cover and watershed status. If forest lands are lost or managed poorly, the consequences show up in quality of life. Lake Erie’s woes are an example: With just 19% of forest cover remaining, persistent issues with nutrient overloads and algae growth harm wildlife, fish, and communities relying on this drinking water source.

Contrast this with Lake Superior, the cleanest Great Lake, whose watershed is 91% forested. Southeast Michigan – home to 40% of Michigan’s population – is fortunate that Lake Huron, the primary drinking water source for most residents, still has forests covering two-thirds of its watershed.

To help forests protect drinking water, the Michigan Department of Natural Resources (DNR) has launched a three-year initiative called [Forest to Mi Faucet](#). The DNR Forest Stewardship Program is leading a dozen partners in connecting conservation groups to municipal water utilities and educating woodland owners about the relationships between forests and drinking water. Forest to Mi Faucet will strategically plant more than 800,000 trees to maintain or enhance water quality benefits.

The project builds on the federal [Forests to Faucets 2.0](#) analysis of priority watersheds for protecting surface drinking water. The analysis, detailed in an [interactive story map](#), identifies watersheds with potential for forest protection or restoration.

(Left) Since 1989, Greening of Detroit has planted more than 135,000 trees along streets and within parks and playgrounds in the cities of Detroit, Hamtramck, and Highland Park. Photo courtesy of DNR.



Michigan’s plentiful forests are vital filters for groundwater and surface water, such as the Ocqueoc River near Millersburg in Presque Isle County. Photo courtesy of DNR.

The DNR’s Forest to Mi Faucet initiative has five main components:

1. Help at least 15 municipal water utilities implement source water protection plans.
2. Inspire and empower landowners to manage and conserve their woodlands to protect drinking water.
3. Plant 60,000 trees in riparian zones of urban and rural forests for water quality and reduced runoff.
4. Educate people about connections between forests and their drinking water.
5. Plant 750,000 trees in state forests to help protect water quality.

The goal of Forest to Mi Faucet is to build the foundation for a program to provide payment for ecosystem services where forest owners are compensated for practices that provide clean water.

The Great Lakes are the drinking water source for 30 million people in the U.S. and Canada. Michigan can help protect this globally significant resource by thoughtfully managing public and private forests.

Forest to Mi Faucet is funded by grants from the USDA Forest Service: a \$300,000 Landscape Scale Restoration grant and a \$315,000 Lower Great Lakes grant through the National Fish and Wildlife Foundation. All partners are equal opportunity employers and providers. ♦

(Right) Forest cover within Great Lakes watersheds correlate with lake quality as determined by the EPA and USDA Forest Service. Lake Superior (with 91% forest cover in its watershed) and Lake Huron (67%) have “good” EPA status, Lake Michigan (49%) is “fair,” and Lake Erie (19%) is “poor.” Many Michigan communities’ drinking water systems draw from these lakes: Marquette from Lake Superior, Detroit from Lake Huron, Grand Rapids from Lake Michigan, and Monroe from Lake Erie. Map courtesy of EGLE.

