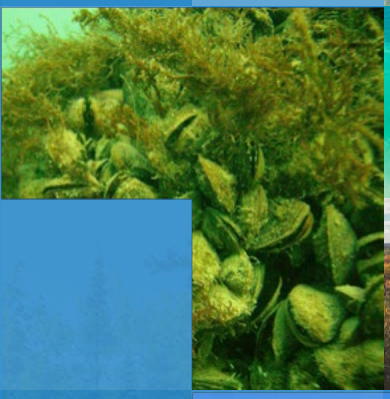
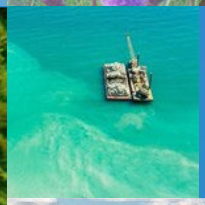
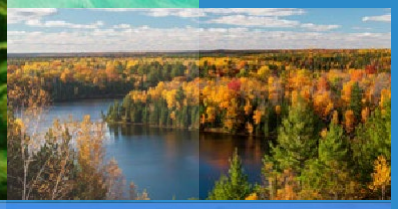









Great Lakes Restoration Initiative

Action Plan IV

Fiscal Years 2025-2029

November 2024

Revised August 2025

Great Lakes RESTORATION

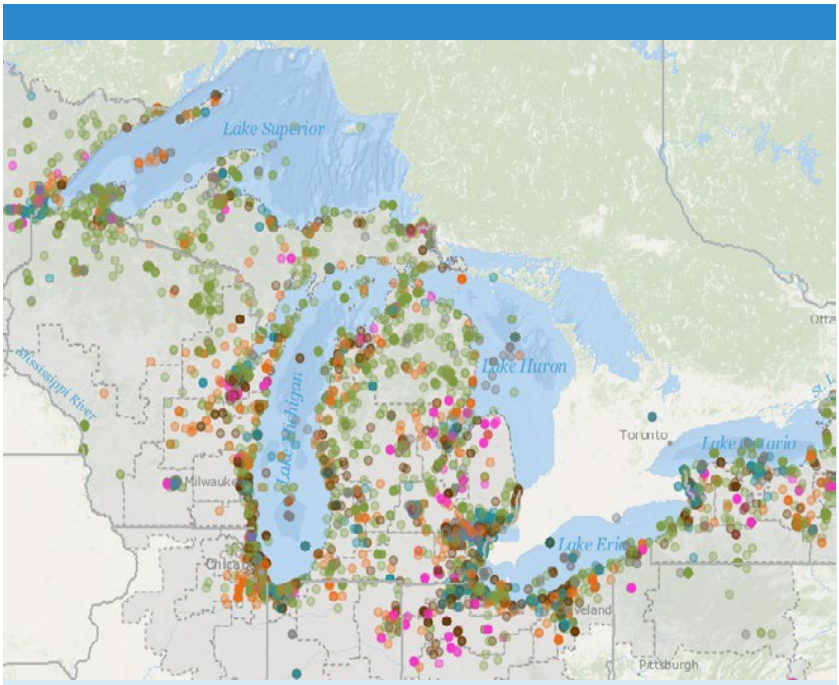
Table of Contents

Great Lakes RESTORATION

The **Great Lakes Restoration Initiative** (GLRI) was launched in 2010 as a nonregulatory program to accelerate efforts to protect and restore the largest system of fresh surface water in the world by providing additional resources to help achieve the most critical long-term goals for this important ecosystem.

The GLRI has been a catalyst for unprecedented federal agency coordination that has accordingly produced unprecedented results. Five U.S. Areas of Concern (AOCs) have been delisted since GLRI's start and the remaining AOCs have moved dramatically closer to their eventual delisting. A total of 118 environmental impairments, known as Beneficial Use Impairments (BUIs), have been removed in AOCs since the start of GLRI. Over 6 million cubic yards of contaminated sediments have been remediated since the start of GLRI. This activity reflects a major change from the 25 years before the Initiative, when only one AOC was cleaned up and delisted and 10 BUIs were removed. GLRI resources have also been used for projects that have prevented over 2.3 million pounds of phosphorus from entering the Great Lakes between 2015 and 2022 and have reduced the phosphorus runoff contribution to harmful algal blooms in western Lake Erie, Saginaw Bay and Green Bay. The GLRI also produces economic benefits — a 2018 University of Michigan study showed that every dollar of federal spending on GLRI projects between 2010 and 2016 will produce $3.35 in additional economic activity in the Great Lakes region through 2036. This report described several cases where Great Lakes communities experienced significant new real estate and commercial development as well as increased water-based recreation and tourism as a result of GLRI-funded remediation and habitat restoration projects. Restoration under GLRI includes ecosystem protection, enhancement, rehabilitation and restoration. Since restoration is generally more costly than protection, GLRI agencies recognize the importance of ecological protection (actions taken to prevent stress to ecosystems).

GLRI Action Plan IV outlines the next five years of work on Great Lakes environmental problems, many of which will still take decades to resolve. GLRI Action Plan IV lays out the necessary next steps to get us closer to the day when we will be able to achieve our long-term goals for the Great Lakes and U.S. domestic commitments under the Great Lakes Water Quality Agreement, including the priority actions for each lake identified in the Lakewide Action and Management Plans. The GLRI federal agencies that make up the GLRI Interagency Task Force and Regional Working Group (see back cover) will continue to use GLRI resources to strategically target the biggest threats to the Great Lakes ecosystem and associated



Through Fiscal Year 2023, GLRI federal agencies have invested over $4 billion for over 8,000 projects to improve water quality, protect and restore native habitat and species, prevent and control invasive species and address other Great Lakes environmental problems. Points on this image represent past and current GLRI projects. Please visit glri .us for more information.

human health issues in partnership with states, Tribes and other nonfederal stakeholders. The federal agencies will also continue to work collaboratively with partners to move forward effectively and efficiently to achieve those goals, maintain the progress that has been made and communicate results. Federal agencies and partners will ensure that all communities can benefit from the GLRI.

By adding GLRI resources to federal agency base budgets and by using these combined resources to implement protection and restoration projects with nonfederal partners, federal agencies will continue to accelerate progress toward achieving long-term goals. All proposed federal actions are subject to final Congressional appropriations.

The Infrastructure Investment and Jobs Act (IIJA) has provided an additional $1 billion in funding over 2022-2026. The additional funds will largely be applied to further accelerate cleanups of the Great Lakes AOCs. With this funding, we can now aim to have work completed at all but three AOCs by 2030.

GLRI Action Plan IV is responsive to Clean Water Act Section 118 amendments in 2015 and 2016 that codified the GLRI. This codification includes a mandate to review and revise the Action Plan every five years and to address five priority areas. These Focus Areas are not silos; GLRI agencies will continue to coordinate and encourage collaboration across Focus Areas in recognition of the interrelated nature of many Great Lakes issues and the multiple benefits that can accrue from larger projects across several Focus Areas.

Under GLRI Action Plan IV

GLRI Action Plan IV continues to specify objectives with related commitments and measures of progress for each Focus Area that will be used to evaluate the actions implemented under this Action Plan. Recognizing that it will take many years to document ecological and human health benefits for an ecosystem as large and complex as the Great Lakes, the measures of progress focus on outputs and/or outcomes that can be measured over the five-year period covered by this Action Plan. They track progress toward achieving the GLRI's long-term goals. Agencies will report annually on 24 measures of progress, identified on page 8-11, including 18 measures that have numeric targets.

GLRI Action Plan IV includes many ideas shared with the federal agencies during the public engagement sessions in 2023. Please see glri.us for a summary of this input along with how it factored into the development of GLRI Action Plan IV. The Great Lakes Advisory Board also provided valuable recommendations. The federal agencies are grateful for these recommendations and will continue to actively seek additional input from their many partners to protect and restore the Great Lakes. These combined efforts will hasten the day when we can achieve and maintain our long-term goals.

The Great Lakes Restoration Initiative Accelerates Great Lakes Protection and Restoration in Five Focus Areas

1. **Toxic Substances and Areas of Concern**
2. **Invasive Species**
3. **Nonpoint Source Pollution**
4. **Habitats and Species**
5. **Foundations for Future Restoration Actions**

Long-Term Goals for the Great Lakes Ecosystem

- All Areas of Concern (AOCs) delisted
- Improved access to restored areas
- Community and economic revitalization through restoration and protection actions
- Fish safe to eat
- Water safe for recreation
- Safe source of drinking water
- No new self-sustaining invasive species
- High-impact invasive species controlled
- Harmful/nuisance algal blooms eliminated
- Habitat protected and restored to sustain healthy ecosystem function and native species
- A more resilient ecosystem to multiple stressors

The following operating principles will guide GLRI planning and implementation under GLRI Action Plan IV

Accountability and Reporting — The GLRI agencies will continue to track the progress and results from GLRI and continue to report on GLRI progress through the annual Report to Congress required under Clean Water Act Section 118. Annual reports and other documents that describe GLRI reporting methodology are at glri .us/documents.

Communication and Outreach — The GLRI agencies will continue to update publicly available online information about GLRI and will seek new ways to communicate about the program and status of ongoing work. The agencies will continue to communicate scientific findings broadly to help inform and prioritize future work.

Community Engagement — The GLRI agencies will prioritize meaningful outreach and engagement with and involvement from all communities as part of project planning and implementation (see Page 6). Partnerships (see below) will be used as a tool to improve engagement.

Partnerships — The GLRI agencies will continue to draw from clearly communicated priorities and actions identified in Lakewide Action and Management Plans and Biodiversity Conservation Strategies by Lake Partnerships and other Great Lakes Water Quality Agreement activities to influence annual planning and project selection. In selecting the best combination of programs and projects, GLRI agencies will continue to consult with the Great Lakes states, Tribes and Indian Nations. The GLRI agencies will also continue to work with Tribal governments in the spirit of self-determination and consistent with federal Indian trust responsibilities to support Tribal priorities that are consistent with GLRI goals and objectives (see Pages 8-9).

Resilient and Sustainable Projects — The GLRI agencies will continue to encourage project plans and designs that are resilient to multiple stressors (see Page 7). GLRI agencies will also encourage project stewardship to promote the sustainability and long-term benefits of projects.

Science-Based Adaptive Management — The GLRI agencies will continue to support and enhance science-based adaptive management, including the Cooperative Science and Monitoring Initiative. The GLRI agencies will use a structured management approach for addressing environmental uncertainties by testing hypotheses, linking science to decision-making and adjusting project implementation, as necessary, to improve the probability of success. GLRI agencies will use this flexible approach to monitor project effectiveness and inform future restoration actions using the best available science and Indigenous Knowledge in decision-making.

Community Engagement

The GLRI federal agencies will encourage fair treatment and meaningful involvement of all Americans in agency decision-making and other Federal activities that affect human health and the environment. Every American should have access to a healthy, sustainable, and resilient environment in which to live, play, work, learn, grow, worship, and engage in cultural and subsistence practices.

"Meaningful involvement" means providing timely opportunities for members of the public to share information or concerns and participate in decision-making processes; fully considering public input provided as part of decision-making processes; seeking out and encouraging the involvement of persons and communities potentially affected by activities; and providing technical assistance, tools, and resources to assist in facilitating meaningful and informed public participation, whenever practicable and appropriate.

GLRI agencies will ensure that all communities can benefit from the GLRI. Remediating contaminated sediment benefits nearby communities by reducing potential exposures to contamination. Benefits of restoration activities can also include improved access to restored areas for recreation and cultural uses. Further, benefits can also include a reduction in flooding using green infrastructure or wetland restoration.

It is equally important that the communities that may benefit from the GLRI are able to provide input on restoration activities.

For example, within AOCs, GLRI agencies and local Public Advisory Committees are committed to having meaningful involvement with communities by supporting opportunities that promote engagement. GLRI agencies and partners will support engagement opportunities with communities to provide a general understanding of the GLRI and identify where their needs and priorities intersect with GLRI objectives. GLRI agencies will initiate job training activities that could give residents the opportunity to work on the restoration activities in their community.

In 2024, EPA created several Great Lakes Community Project Grant Programs. Each Program will develop and oversee their own subgrant competition that will fund environmental restoration projects that advance the goals of the GLRI in communities throughout the Great Lakes Basin. Many communities lack the resources needed to apply for, obtain and oversee the implementation of federal grant projects.

These new programs will ease these administrative barriers and help communities more effectively access federal funding for important local projects. This investment will encourage even greater environmental, economic, health and recreational benefits for communities in the Great Lakes.

Resilient and Sustainable Projects

Changes to the Great Lakes, fish and wildlife, natural resources and communities may occur due to projected future conditions such as extreme heat, more frequent droughts, warmer winters, declining lake ice extent and duration, rising water temperatures, and flooding. These stressors may cause damage to infrastructure and habitats, increased sediment and nutrient delivery to waters, increased harmful algal blooms, reduced beach health, increased pressure from non-native species and loss of culturally significant resources and recreational opportunities for communities.

Under Action Plan IV, consideration of projected future conditions by agencies, Tribal Nations and other entities will be emphasized during the design and implementation of the next phase of GLRI projects. Future GLRI investments will 1) consider, as appropriate, future projected conditions into project planning and implementation; and 2) protect and sustainably manage lands and water that provide benefits to our communities.

Approaches for GLRI Projects

Considering future projected conditions will increase the capacity of the environment to adapt or take advantage of opportunities resulting from future conditions. These approaches also reduce the vulnerability of the environment to multiple stressors. GLRI federal agencies and partners will evaluate approaches that increase the capacity of the environment to adapt or take advantage of opportunities resulting from future projected conditions. These approaches also reduce the vulnerability of the environment to multiple stressors. GLRI projects will also consider other approaches for future investments including:

- Vulnerability assessments that identify the greatest risks to species, habitat, working lands, infrastructure, communities or ecosystems from the impacts of multiple stressors.
- Adjustment of project designs and plans to moderate harm or exploit beneficial opportunities. This approach may be "incremental," "transformative" or a "piloting" of innovative project features.

Finally, GLRI projects may include one or more of the following options:

Resistance: Actions that improve the defenses of a site or system against anticipated changes or directly defend against disturbance to maintain relatively unchanged conditions.

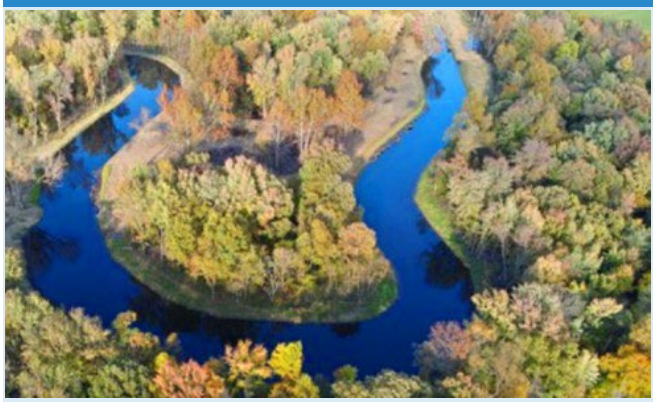
Resilience: Actions that increase the capacity of connected social, economic and ecological systems to cope with projected future conditions, responding or reorganizing in ways that maintain their essential function, identity and structure. For GLRI, this would include communities, working lands, species or populations, adapting to changing conditions and withstanding and recovering from adverse conditions.

Transition: Adjustment to projected future conditions and their effects. Actions or behaviors that reduce losses or enhance benefits of natural variations in extreme weather events.

GLRI Distinct Tribal Program

The Great Lakes Basin includes the ancestral, traditional and contemporary lands and waters of many Indigenous peoples. Reservations and off-reservation land in which Tribes and Indian Nations retain rights comprise millions of acres within the basin. As original caretakers of the waters and lands within the basin and as holders of continuing legal rights to use those waters and lands, Tribes and Indian Nations continue to lead in the stewardship of the Great Lakes and their associated ecosystems, preserving and protecting them for generations to come. Tribes and Indian Nations have unique expertise and valuable place-based ecological knowledge that play a critical role in protecting Great Lakes ecosystems, for the benefit of both Indigenous peoples and natural resources (also referred to as relatives by Indigenous peoples).

Since 2010, the GLRI has been instrumental in building the capacity of Tribes and Indian Nations to participate in intergovernmental stewardship of Great Lakes natural resources. It is important to ensure that Tribes and Indian Nations have the resources necessary to meaningfully participate when interjurisdictional management decisions are made. GLRI Tribal capacity funding has also supported efforts that increase Tribal community awareness and educational opportunities on Great Lakes issues and solutions. These opportunities support Tribes and Indian Nations in their ability to share subsistence, cultural and traditional practices within Tribal communities, with Tribal youth, and to non-Tribal neighbors.



Restored historic meander bends in the Dowagiac River in Michigan on Pokagon Band of Potawatomi lands.
Photo credit: Pokagon Band of Potawatomi

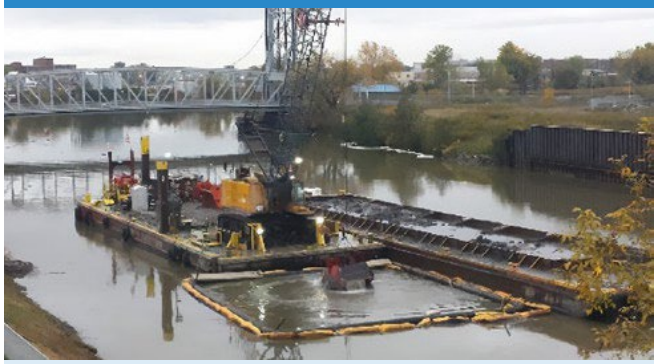
Beginning in Fiscal Year 2020, the GLRI Distinct Tribal Program (DTP) has been a significant source of funding for Tribes and Indian Nations to implement projects that advance Great Lakes restoration under GLRI Action Plans and bolster the protection and restoration of culturally important species that support Tribal lifeways and underlie treaty-reserved rights. The DTP respects Tribal sovereignty through a government-to-government relationship that supports the Tribes' development and implementation of holistic programs to efficiently pursue Tribal priorities under the GLRI Action Plan with appropriate flexibility.

Poling through manoomin.
Photo credit: Fond du Lac Tribe

The DTP continues building Tribal capacity while funding implementation of Tribal priority projects to protect, enhance and restore culturally important and treaty-reserved species. Numerous Tribal success stories under the GLRI are highlighted in a Tribal Great Lakes Restoration report. The DTP also provides opportunities for the inclusion of Indigenous Knowledge (IK), or Traditional Ecological Knowledge (TEK), into stewardship efforts by ensuring Tribal participation and input in intergovernmental partnerships and through Tribally led protection and restoration efforts. This knowledge is based in traditional Indigenous world-views of the interconnectedness of systems, which have shaped the ways Indigenous communities work to protect water quality, ecological health and community well-being.

Continuing a Long History of Federal-State Partnerships in the Great Lakes

The Great Lakes Restoration Initiative continues to be a model, large-scale ecosystem restoration program that includes a strong federal-state collaboration process in program planning and implementation. This long history of federal-state collaboration in prioritizing the most pressing Great Lakes issues dates to the 1970s with the original signing of the Great Lakes Water Quality Agreement and in the 1980s during the initial development of Lakewide Action and Management Plans (LAMPs) and Remedial Action Plans. In 2003, the Great Lakes Governors identified nine priorities for restoration and protection, which led to the Great Lakes Regional Collaboration Strategy. It was this strategy that provided the framework for the first GLRI Action Plan in 2010. The federal-state collaboration process has evolved over the past 15 years and



Mechanical dredging of contaminated sediment in the Buffalo River. *Photo credit: Brian Murphy*

will continue to guide implementation under GLRI Action Plan IV. This collaboration happens across many environmental issues and levels of government, and it is further facilitated by multi-state entities, including the Great Lakes Commission and the Great Lakes Fishery Commission. The states — Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York — play a critical role in setting GLRI priorities, including the Objectives, Commitments and Measures of Progress in this and previous GLRI Action Plans. Since GLRI's inception in 2010, over $521 million of GLRI funds have been awarded to Great Lakes states through the end of 2022. GLRI funding leveraged with state and local resources has allowed states to successfully implement hundreds of projects.

These projects simultaneously advance state priorities, contribute to progress under the Great Lakes Water Quality Agreement, including LAMPs, and are essential for meeting GLRI goals.

Pollinators at work in a Waterfowl Production Area.

Under GLRI Action Plan IV, state partnerships will remain especially impactful in the cleanup of Areas of Concern (AOCs), with their leadership role in identifying and co-funding projects and facilitating Public Advisory Committees as well as community engagement activities. Coordinated restoration of habitats by the federal and state private lands programs will continue in future years through the GLRI Pollinator Task Force to enhance native pollinators such as native bees. The Council of Lake Committees will continue to be an important venue for state fishery managers to provide direction on GLRI-funded native prey fish restoration in individual lakes. Cross-discipline expert groups convened by the Great Lakes Commission, such as the Invasive Mussel Collaborative, will advance state fishery priorities to increase native fish populations while identifying best practices for controlling invasive mussels. Federal agencies and states will continue to advance green infrastructure and water quality goals through local partnership projects such as in Duluth, Minnesota, to reduce high stream flows and pollutant loadings from urban streams. Finally, state-led education programs will continue to promote Great Lakes ecosystem and education stewardship where students get hands-on experience to learn about Great Lakes habitats and species.

FY2025-2029 Great Lakes Restoration Initiative

Action Plan Summary

The responsibility of pursuing and meeting the following objectives rests with the federal agencies as well as recipients of GLRI funding.

While the GLRI's highest priority over the next five years is to continue to implement management actions necessary to remove Beneficial Use Impairments and delist Areas of Concern, funding allocations will be made across the entire range of Objectives, Commitments and Measures and change from year to year.

Focus Area	Objectives	Commitments	Measures
Toxic Substances and Areas of Concern	**1.1.** Remediate, restore and delist Areas of Concern.	**1.1.a.** Implement management actions necessary to remove Beneficial Use Impairments and delist Areas of Concern. **1.1.b.** With input from community partners on the benefits they would like to see included in GLRI projects, investigate opportunities for enhancing planned projects. **1.1.c.** In Areas of Concern that have management actions yet to be completed, ensure that agencies and local Public Advisory Committees have meaningful involvement with communities to ensure fair treatment.	**1.1.1.** Areas of Concern where all management actions necessary for delisting have been implemented. **1.1.2.** Beneficial Use Impairments removed in Areas of Concern. **1.1.3.** Areas of Concern delisted. **1.1.4.** Meaningfully involve communities within Areas of Concern in all phases of Management Actions.
	1.2. Engage communities to share information on the risks and benefits of consuming Great Lakes fish, wildlife and harvested plant resources with the people who consume them.	**1.2.a.** Provide information, including Indigenous Knowledge-based information, regarding the consumption of Great Lakes fish, wildlife and harvested plant resources to Great Lakes communities.	**1.2.1.** Risks and benefits of consuming Great Lakes fish, wildlife and harvested plant resources are shared to inform consumption choices.
	1.3. Increase knowledge about contaminants that have impacted or pose the potential to impact the ecological health of the Great Lakes and their natural resources and/or pose a public health risk.	**1.3.a.** Fill critical data gaps and communicate results for priority contaminants in the Great Lakes through discrete monitoring and assessment activities.	**1.3.1.** Contaminant monitoring and assessment activities conducted to address data gaps.

cus Area	Objectives	Commitments	Measures
Invasive Species	**2.1.** Protect native species and communities by preventing introductions of new non-native species.	**2.1.a.** Target introduction pathways at state, multi-state, reservation and other similar regional scales for surveillance, education, technology development and enforcement.	**2.1.1** Number of regional introduction pathways for non-native species invasion addressed through comprehensive approaches.
	2.2. Reduce economic, ecological and human health impacts by limiting range expansion, including lake-to-lake transfers, of non-native species.	**2.2.a.** Conduct standardized, basin-wide early detection and surveillance activities. **2.2.b.** States, Tribes, local governments and non-governmental organizations conduct targeted early detection, surveillance and rapid response actions. **2.2.c.** Regional and local organizations sustain containment after initial response projects and complement federal, state and Tribal surveillance.	**2.2.1** Percentage of aquatic, high-priority locations for potential new non-native species occurrence under surveillance. **2.2.2.** Number of rapid responses, exercises and post-response follow-up activities conducted annually.
	2.3. Provide ecosystem and human benefits through prioritized and collaborative invasive species control efforts.	**2.3.a.** Implement invasive species control efforts that sustain ongoing and past GLRI restoration efforts, providing benefits to native species, habitat and Great Lakes communities. **2.3.b.** Pilot and test new control tools including, where applicable, tools derived from Indigenous Knowledge, for high-impact invasive species.	**2.3.1.** Acres controlled for invasive species to benefit habitats, native species and communities.

Piping plover, an endangered species in the Great Lakes, stands on a Great Lakes beach.

Focus Area	Objectives	Commitments	Measures
Nonpoint Source Pollution	**3.1.** Reduce nutrient loads from agricultural watersheds to prevent harmful and nuisance algal blooms.	**3.1.a.** Implement systems of conservation practices on farms and in watersheds to reduce and prevent nutrient runoff. **3.1.b.** Increase adoption of enhanced nutrient management practices through peer-to-peer learning and one-on-one assistance. **3.1.c.** Support development, expansion and capacity of demonstration farms to reach new producers.	**3.1.1.** Estimated pounds of phosphorus reductions from conservation practice implementation. **3.1.2.** Acres receiving technical or financial assistance on nutrient management in priority watersheds. **3.1.3.** Number of active demonstration farms created or sustained with GLRI funding.
	3.2. Reduce or prevent stormwater runoff to improve and sustain water quality.	**3.2.a.** Increase implementation of green infrastructure practices in communities impacted by polluted runoff. **3.2.b.** Implement projects in urban and rural communities designed to reduce or prevent runoff, flooding and erosion.	**3.2.1.** Estimated gallons (in millions) of stormwater runoff reduced. **3.2.2.** Miles of Great Lakes streams and shoreline restored or protected. **3.2.3.** Acres of riparian buffers, wetlands and floodplains restored or reconnected.
	3.3. Improve effectiveness of nonpoint source control efforts to prevent harmful and nuisance algal blooms.	**3.3.a.** Monitor and assess nutrient conditions in western Lake Erie, Green Bay, Saginaw Bay and priority tributaries to the Great Lakes. **3.3.b.** Demonstrate new, improved or collaborative approaches to achieve water quality goals.	**3.3.1.** Nutrient monitoring and assessment activities conducted. **3.3.2.** Nutrient and stormwater runoff reduction demonstration projects implemented.
Habitats and Species	**4.1.** Protect, enhance and increase resilience of habitats necessary for sustaining native aquatic and terrestrial species important to the Great Lakes ecosystem.	**4.1.a.** Protect, enhance and provide connectivity for habitats to support important native species, maintain Tribal cultural uses and/or provide benefits to people. **4.1.b.** Implement projects that increase resilience in watersheds and along coastlines, considering flood reduction and recreational benefits to communities.	**4.1.1.** Acres of coastal wetland, nearshore and other habitats protected or enhanced. **4.1.2.** Miles of connectivity established for aquatic species.
	4.2. Increase resilience and representation of native species.	**4.2.a.** Update and implement recovery actions for federal threatened, endangered and candidate species. **4.2.b.** Support population-level protections, enhancements and reintroductions for state, Tribal and other native species important to Great Lakes ecosystems.	**4.2.1.** Species benefited where actions have been completed to significantly protect or promote recovery of populations.

Focus Area	Objectives	Commitments	Measures
Foundations for Future Restoration Actions	**5.1.** Educate the next generations about the Great Lakes ecosystem and teach people the skills needed to enter the environmental restoration and protection workforce.	**5.1.a.** Support and implement experience-based learning opportunities to promote Great Lakes stewardship. **5.1.b.** Support and implement environmental workforce development programs.	**5.1.1.** Number of youth impacted through education and stewardship projects. **5.1.2.** Number of people trained through workforce development programs.
	5.2. Conduct targeted science to inform and assess Great Lakes restoration.	**5.2.a.** Assess Great Lakes ecosystem health and implement interdisciplinary science projects that will guide Great Lakes restoration and help protect the lakes from current and future threats.	**5.2.1.** Annual Great Lakes monitoring conducted; interdisciplinary science projects and assessments implemented to support the GLRI and U.S. domestic actions in support of the Cooperative Science and Monitoring Initiative, lake-specific priorities identified in LAMPs and other GLWQA activities.

Kuehn-Haven Middle School's Flint River GREEN Bridges students plant native riparian plants along the Flint River at Barber Park in Montrose, Michigan. *Photo credit: Kelly Sanborn, Kuehn-Haven Middle School*

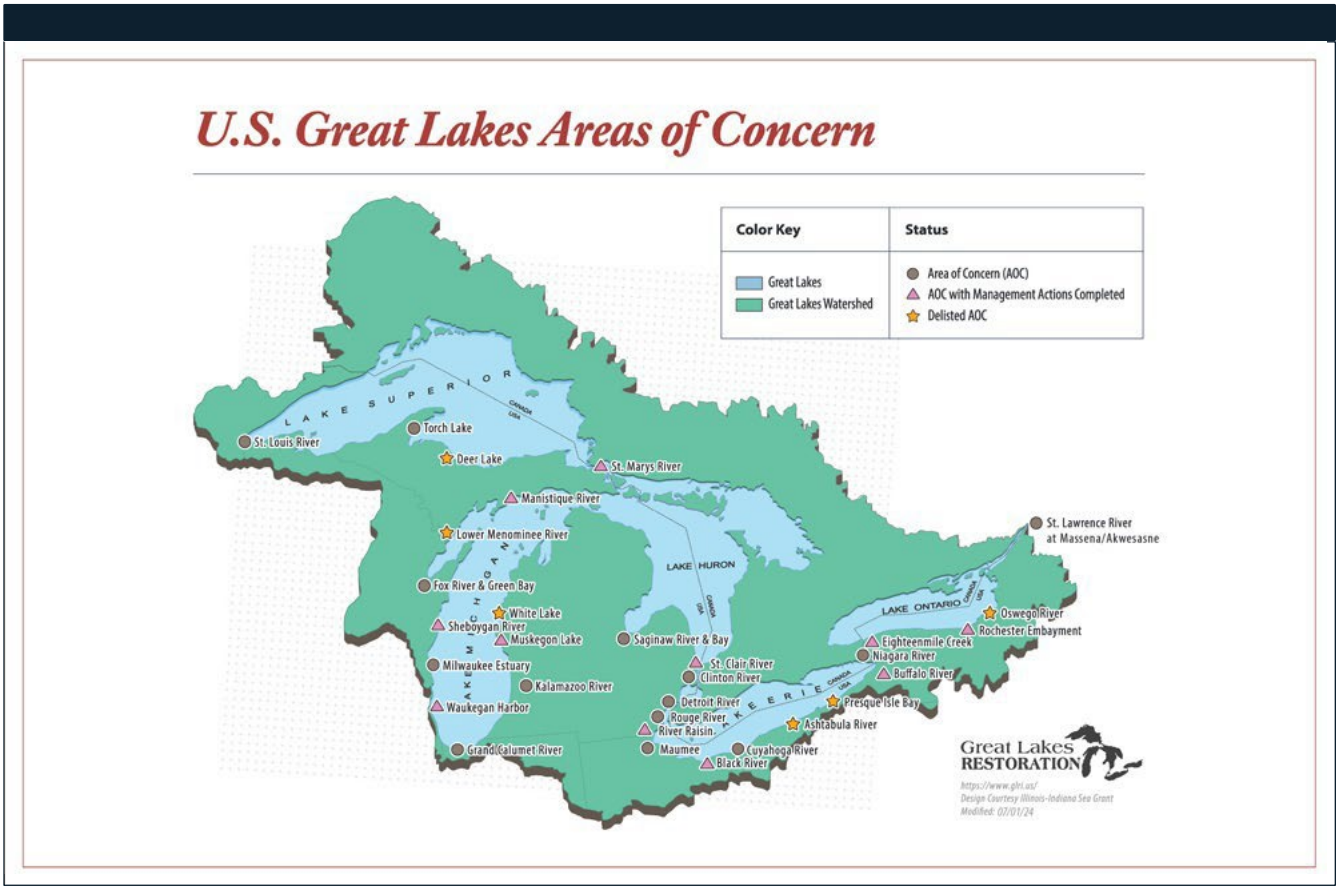
■ Focus Area 1

Toxic Substances and Areas of Concern

Objective	**1.1.** Remediate, restore and delist Areas of Concern.
Commitments	**1.1.a.** Implement management actions necessary to remove Beneficial Use Impairments and delist Areas of Concern. **1.1.b.** With input from community partners on the benefits they would like to see included in GLRI projects, investigate opportunities for enhancing planned projects. **1.1.c.** In Areas of Concern that have management actions yet to be completed, ensure that agencies and local Public Advisory Committees have meaningful involvement with communities to ensure fair treatment.

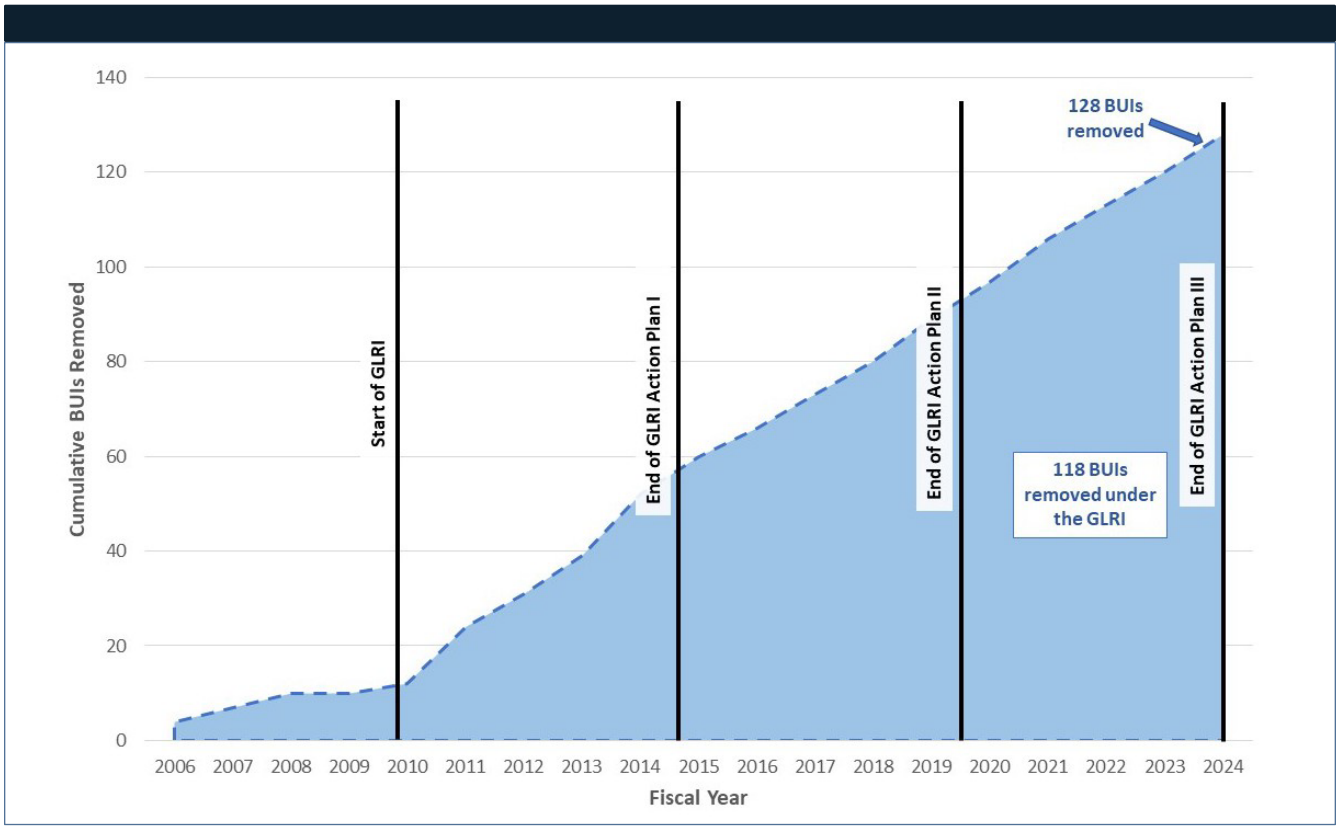
Since the start of the Great Lakes Restoration Initiative, federal agencies and their partners have accelerated cleanup of Areas of Concern — areas designated as the most contaminated sites on the Great Lakes under the Great Lakes Water Quality Agreement. Cleanup of Areas of Concern (AOCs) has led to community and economic revitalization.

The cleanup of AOCs is achieved through remediation and restoration work, which then leads to removing Beneficial Use Impairments (BUIs) — such as *Loss of Fish and Wildlife Habitat.* AOCs are delisted when all the BUIs have been removed. Since the start of the GLRI, GLRI federal agencies and their partners have removed 118 BUIs — over 11 times the number removed in the 22 years preceding the establishment of the GLRI, which greatly accelerated progress



Toxic Substances and Areas of Concern (continued)

in restoring the U.S. AOCs. Two additional AOCs have also been delisted since the start of GLRI Action Plan III: Lower Menominee River in Wisconsin and Michigan, and Ashtabula River in Ohio. Additionally, GLRI federal agencies and their partners completed all the management actions at 11 more AOCs that will ultimately lead to delisting. Management actions are on-the-ground actions, including remediating contaminated sediment through public/private partnerships and restoring habitat (e.g., improving fish passage, restoring wetlands and removing dams), that will ultimately lead to the removal of Beneficial Use Impairments. When management actions are completed in an AOC, the ecosystem can begin to recover — set on the path to removing all BUIs and, ultimately, delisting.



■ Focus Area 1

Toxic Substances and Areas of Concern (continued)

Measures of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
1.1.1. Areas of Concern where all management actions necessary for delisting have been implemented.	17 / 31	17	18	20	22	23
1.1.2. Beneficial Use Impairments removed in Areas of Concern.	128 / 255	136	144	151	158	165
1.1.3. Areas of Concern delisted.	6 / 31	7	9	12	13	14
1.1.4. Meaningfully involve communities within Areas of Concern in all phases of Management Actions.						

"Baseline" identifies results through the end of FY2024. "Targets" are cumulative. "Universe" represents the total number possible for applicable measures.

Under GLRI Action Plan IV, GLRI federal agencies and their state, Tribal, local and private partners will continue to remediate and restore Areas of Concern (AOCs). GLRI agencies will leverage additional resources from the Infrastructure Investment and Jobs Act to significantly accelerate the implementation of management actions in all remaining AOCs. These remediation and restoration efforts will contribute to meeting the lofty goal of completing management actions necessary to ultimately delist all AOCs. Following input from states and Tribes, the following AOCs have been identified where completion of management actions could be achieved by FY2029: Clinton River, Cuyahoga River, Grand Calumet River, Maumee, Rouge River, St. Louis River and Torch Lake.

Under GLRI Action Plan IV, GLRI federal agencies and their state, Tribal and local partners will remove 40 Beneficial Use Impairments (BUIs), with a cumulative total of 165 BUIs removed by the end of FY2029. These removals will leave fewer than 100 BUIs remaining — a huge milestone for the GLRI. Given the progress achieved under the GLRI and maturity of the AOC program, we will begin to use the number of delisted AOCs as a new measure of progress. We anticipate delisting eight more AOCs under Action Plan IV.

Under GLRI Action Plan IV, GLRI federal agencies and their State, Tribal and local partners will have meaningful involvement with communities impacted by AOCs to explore opportunities to enhance existing and planned AOC projects with increased access, recreation and cultural uses. Examples of meaningful involvement with communities include public outreach during management action development through implementation, increased membership to local public advisory groups, development of state guidance for Public Advisory Committee (PAC) community engagement and supporting workforce development opportunities.

Toxic Substances and Areas of Concern (continued)

Objective	**1.2.** Engage communities to share information on the risks and benefits of consuming Great Lakes fish, wildlife and harvested plant resources with the people who consume them.
Commitment	**1.2.a.** Provide information, including Indigenous Knowledge-based information, regarding the consumption of Great Lakes fish, wildlife and harvested plant resources to Great Lakes communities.
Measure of Progress	**1.2.1.** Risks and benefits of consuming Great Lakes fish, wildlife and harvested plant resources are shared to inform consumption choices.

Since the GLRI began, federal agencies and their state and Tribal partners have worked together to increase the public's knowledge of Great Lakes fish consumption advisories through innovative and impactful outreach projects across the basin. These projects have targeted vulnerable populations, including subsistence fishers, and provided them with up-to-date advice on the risks and benefits of eating fish caught in the Great Lakes Basin. Over the last several years, GLRI partners have also tackled the challenge of moving away from restrictive-only messaging to a more balanced approach, delivering information on both the risks and benefits of consuming fish. Fish may contain elevated levels of harmful chemicals that lead to consumption advisories, but can provide important nutritional benefits such as omega-3 fatty acids as well.

Under Action Plan IV, GLRI federal agencies and state and Tribal partners will continue implementing projects to enhance the delivery of critical information to the public concerning the risks and benefits of eating Great Lakes fish, wildlife and harvestable plant resources. There will be continued focus on enhancing outreach material targeting vulnerable populations and subsistence fisher communities. There will also be continued focus on providing new and updated consumption advice regarding emerging issues such as per- and polyfluoroalkyl substances (PFAS) in fish and wildlife. Partnerships such as the Great Lakes Consortium for Fish Consumption Advisories will continue to play a pivotal role in advancing more cohesive fish consumption advice messaging in the Great Lakes.

Reducing Contaminant Exposures Through Targeted Outreach and Education in Milwaukee, Wisconsin

The Wisconsin Department of Health Services (WDHS) conducted a study in Greater Milwaukee aimed at reducing exposure to persistent environmental contaminants from sportfish consumption among Asian women of childbearing age. WDHS conducted in-depth focus groups with the Chinese, Hmong and Karen communities to understand perceptions on eating fish, fish consumption patterns and advisory awareness, and to identify strategies to increase healthy fish consumption. WDHS tested health messages with community members to identify effective framing that has led to enhanced consumption advice outreach materials and more protective health behaviors.

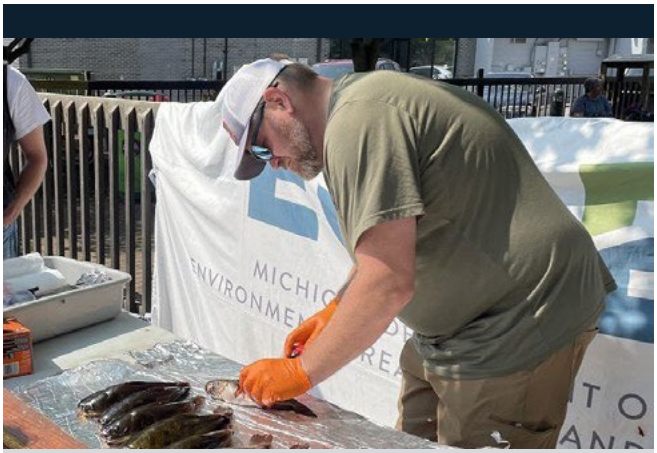
Toxic Substances and Areas of Concern (continued)

Objective	**1.3.** Increase knowledge about contaminants that have impacted or pose the potential to impact the ecological health of the Great Lakes and their natural resources and/or pose a public health risk.
Commitment	**1.3.a.** Fill critical data gaps and communicate results for priority contaminants in the Great Lakes through discrete monitoring and assessment activities.
Measure of Progress	**1.3.1.** Contaminant monitoring and assessment activities conducted to address data gaps.

Chemical contaminants are important stressors to monitor and assess in the Great Lakes. Under Action Plan III, federal agencies and their partners supported and concluded a multiyear assessment of emerging contaminants (e.g., pharmaceuticals and personal care products) and their potential impacts on Great Lakes ecosystems. GLRI federal agencies and partners also began implementing discrete monitoring and assessment projects to assess the potential ecosystem impacts of priority contaminants, such as mercury, polychlorinated biphenyls (PCBs) and per- and polyfluoroalkyl substances (PFAS). For example, GLRI federal agencies and their partners have assessed pathways of PFAS into the Great Lakes and advanced the understanding of how PFAS accumulate in the aquatic food web.

Priority Contaminants

GLRI priority contaminants include chemicals designated under the Great Lakes Water Quality Agreement as Chemicals of Mutual Concern and other contaminants that may threaten Great Lakes fish and wildlife populations. GLRI partners are developing and refining biological surveillance tools that will allow resource managers to make better decisions about possible adverse effects from these contaminants.



Biologist fillets brown bullhead catfish caught at a youth fishing derby to be tested for contaminants like PCBs and PFAS and used to support fish consumption advice.
Photo credit: Michigan EGLE

Assessing PFAS in Lake Michigan

The Wisconsin Department of Natural Resources has begun assessing the concentrations of PFAS in Lake Michigan to establish a baseline of how these contaminants are distributed in the nearshore area of the lake and the aquatic food web. The goal of the project is to describe current concentrations of PFAS in water, sediment, mussels, fish and eagles along Wisconsin's Lake Michigan nearshore waters. The project will also enhance the understanding of how PFAS accumulate through the Lake Michigan food web.

Under Action Plan IV, GLRI federal agencies and their partners will continue monitoring priority contaminants and assessing their impacts on Great Lakes ecosystems. GLRI federal agencies and partners will use already identified knowledge and data gaps, including those identified by the Lake Partnerships for the Cooperative Science and Monitoring Initiative of the Great Lakes Water Quality Agreement, and in national plans to conduct discrete monitoring and assessment projects. The results of these projects will be communicated through understandable methods to appropriate Great Lakes stakeholders.

Focus Area 2

Invasive Species

Objective	**2.1.** Protect native species and communities by preventing introductions of new non-native species.
Commitment	**2.1.a.** Target prioritized introduction pathways at state, multi-state, reservation and other similar regional scales for surveillance, education, technology development and enforcement.

Measure of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
2.1.1. Number of regional introduction pathways for non-native species invasion addressed through comprehensive approaches.	**0 / N/A**	**1**	**1**	**2**	**2**	**3**

"Targets" are cumulative.

GLRI federal agencies and their partners have continued activities and education to prevent new introductions of non-native species in the Great Lakes ecosystem. Prioritizing the prevention of new introductions of non-native species into the Great Lakes remains the more cost-efficient and proactive strategy to protect native species, habitats and the benefits they provide to Great Lakes communities. A total of 122 projects in FY2020-2022 helped block priority pathways of introduction for non-native species, including canals and waterways, recreational boating, illegal trade of banned species and the release of aquarium species and live bait. For example, GLRI supported state game and wildlife officers to prevent sales of prohibited species.

GLRI federal agencies and their partners continued to forecast potential future non-native species establishment and help natural resource agencies target their prevention and response activities for greatest effectiveness. The U.S. Fish and Wildlife Service estimated the suitability of future Great Lakes conditions for global fresh-water species (i.e., horizon scans) to understand which species may become established if transported here.

Preventing bighead and silver carp from becoming established in the Great Lakes ecosystem remained a priority for GLRI under Action Plan III. GLRI-funded actions during this period included conducting contract fishing to remove invasive carp from the Upper Illinois Waterway near Lake Michigan, maintenance of barriers that block invasive carp from swimming into the Great Lakes watershed and assisting the Invasive Carp Regional Coordinating Committee to implement the Invasive Carp Action Plan.

An educational kiosk at Isle Royale National Park about invasive species. *Photo credit: National Park Service*

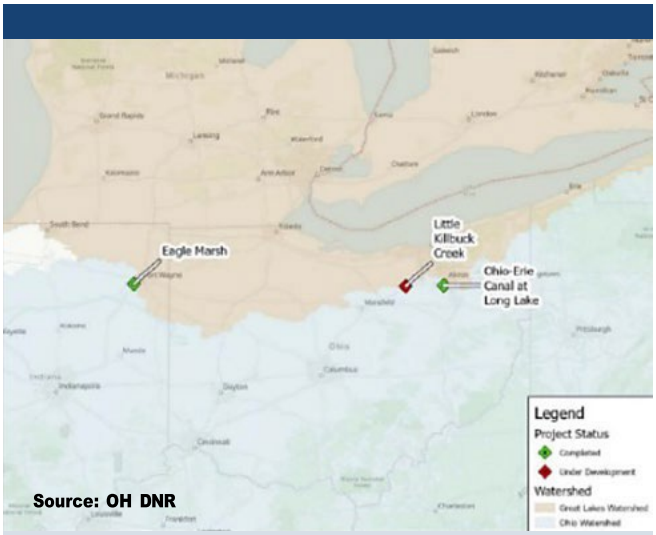
Invasive Species (continued)

Under GLRI Action Plan IV, GLRI federal agencies and their partners will implement a prioritized plan to significantly reduce pathways by which non-native species may still enter the Great Lakes Basin. Coordination and planning with states, Tribes and other entities, as well as feedback received by the Great Lakes Panel on Aquatic Nuisance Species (ANS), will inform prioritized and interjurisdictional projects that significantly address pathways including recreational boating, releases of fish from unused bait and for ceremonial/cultural reasons and organisms-in-trade. Existing state (e.g., Michigan Invasive Species Watch List), interjurisdictional (e.g., GLANSIS Watchlist Species) and basin-wide lists of "least wanted" species, such as the Great Lakes St . Lawrence Governors and Premiers list, will guide species-specific prevention projects.

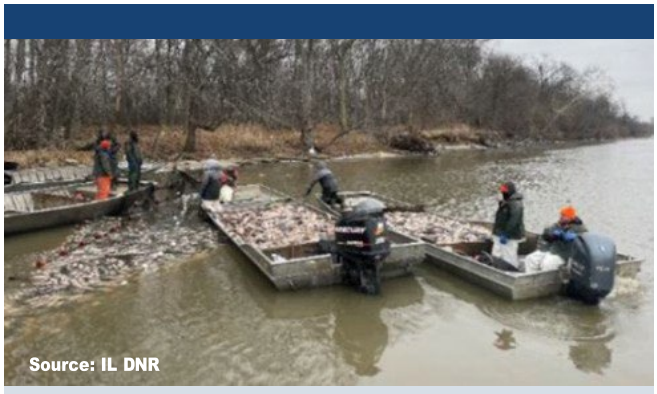
Through directed support from GLRI, incremental progress to address regional pathways will be achieved through comprehensive approaches by maintaining or increasing specialized staff across the basin, conducting surveillance activities within specific pathways and collaborating regionally to reduce the risk of invasion and establishment of new non-native species. Targeted education and outreach activities will inform Great Lakes residents about the continued risks of non-native species so that everyone can play a role in this important prevention step.

GLRI will support efforts to test and implement new technologies holding great promise to assess, block or manage specific pathways. Emerging technologies will be prioritized for GLRI support based on their ability to accelerate and widen surveillance and manage species on "least wanted" lists already adopted for the Great Lakes. The Great Lakes remain an invasion pathway to the 31 states within the Mississippi River watershed and beyond, making these GLRI prevention efforts important to the entire nation.

GLRI will continue to help protect the Great Lakes from invasive carp, principally through high-priority projects that prevent silver and bighead carp introduction into the Great Lakes, prevent grass carp establishment in the Great Lakes and promote better understanding of the spread of black carp toward the Great Lakes. The GLRI will build upon past completed projects at Eagle Marsh, Indiana, and the Ohio-Erie Canal in Akron, Ohio, to close pathways of potential invasive carp introduction into the Great Lakes as identified by the Great Lakes and Mississippi River Basin Study, including the Little Killbuck connection between the Great Lakes and Mississippi River Basin in Ohio. GLRI will continue to support the monitoring of invasive carp populations in the Illinois River to inform future suppression of fish densities close to the Chicago Area Waterway.



Blocking and managing potential pathways for bighead and silver carp to enter the Great Lakes watershed is a focus of GLRI projects.



Contract fishing on the Illinois River reduces population numbers close to the Great Lakes.

■ Focus Area 2

Invasive Species (continued)

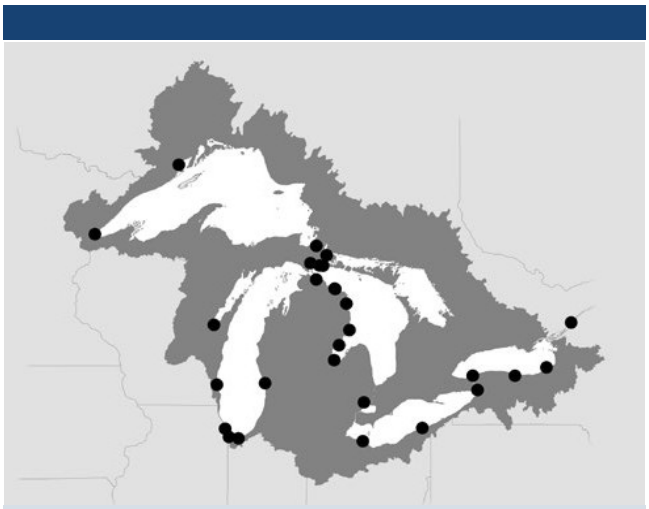
Objective	**2.2.** Reduce economic, ecological and human health impacts by limiting range expansion, including lake-to-lake transfers, of non-native species.
Commitments	**2.2.a.** Conduct standardized, basin-wide early detection and surveillance activities. **2.2.b.** States, Tribes, local governments and non-governmental organizations conduct targeted early detection and surveillance and rapid response actions. **2.2.c.** Regional and local organizations sustain containment after initial response projects and complement federal, state and Tribal surveillance.

Measures of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
2.2.1. Percentage of aquatic, high-priority locations for potential new, non-native species occurrence under surveillance.	65 / 100	65	70	80	85	90
2.2.2. Number of rapid responses, exercises and post-response follow- up activities conducted annually.	12 / N/A	12	12	12	12	12

"Targets" are cumulative for measure 2.2.1 but not cumulative for measure 2.2.2. "Baseline" for Measure 2.2.1 is the projected result for end of FY2024. "Baseline" for Measure 2.2.2 identifies regularly expected annual responses, exercises and activities.

Since GLRI began, surveillance programs operating at basin-wide, regional and local levels have been a priority, forming the foundation for a multispecies early detection network. Basin-wide surveillance activities were conducted by the U.S. Fish and Wildlife Service, annually sampling up to 26 hot spots and associated habitats across the basin that are predicted to be locations of greatest risk for new non-native species introductions and establishment. This basin-wide surveillance effort was complemented by state inland lake and stream monitoring to further detect non-native species occurrence and range expansion at locations under pressure by high recreational use or known to have isolated populations of non-native species.

Local partners supported by GLRI complemented basin-wide and state efforts through targeted GLRI projects to contain the spread of non-native species and implement pilot projects to test the effectiveness of control methods. Examples of non-native species that were detected early and are being targeted by GLRI partners to contain or limit

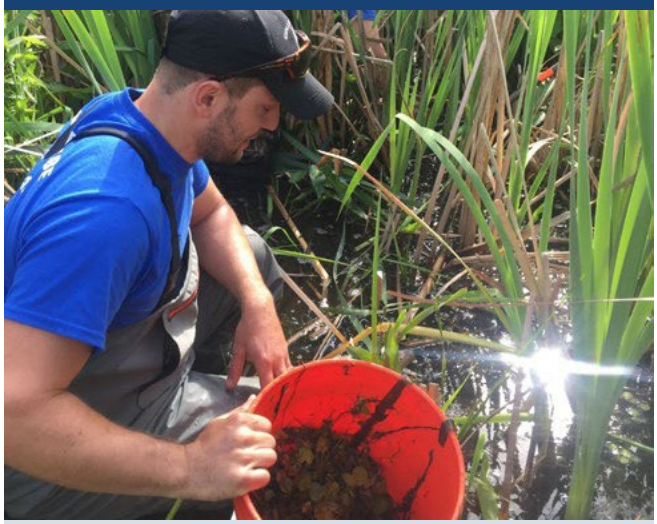


Locations where the U.S. Fish and Wildlife Service conducts annual surveillance of fish and invertebrates to detect non-native species occurrence and spread in the Great Lakes.

Invasive Species (continued)

spread include European frogbit, hydrilla and red swamp crayfish. GLRI funding also supported states, Tribes and other partners to train staff and conduct rapid responses to reports of new non-native species occurrences. Rapid responses can confirm new occurrences and eradicate or contain isolated populations. In all, 127 GLRI-supported rapid response actions were taken from FY2020-FY2022.

The Great Lakes Commission and The Nature Conservancy annually convened federal, state, Tribal and other entities to share the latest information on non-native species detections within the basin and develop interjurisdictional approaches. These annual forums and regular sharing of lessons learned were critical to cultivating comprehensive approaches to stop the spread of impactful non-native species that are likely to cause economic, ecosystem, or human health impacts (i.e., invasive species). Additionally, the National Oceanic and Atmospheric Administration and the Great Lakes Sea Grant Network continued to use GLRI funding to provide information on the distribution of non-native species through the Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS).



Manual checking and removal of invasive plants infesting coastal wetland habitats by GLRI partners. *Photo credit: Gun Lake Tribe, Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians*

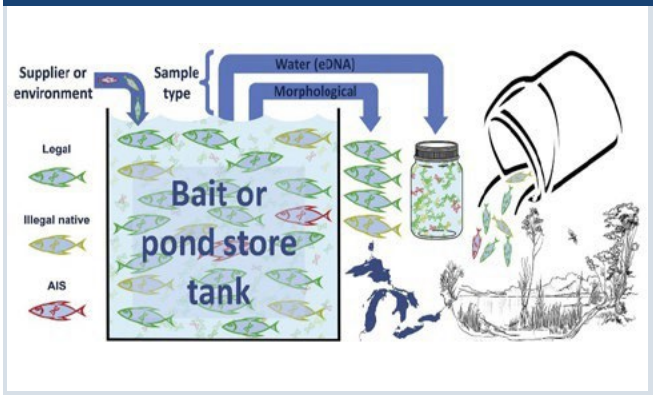
A new detection of red swamp crayfish in 2020 in Illinois. This specimen was photographed and a formal report was made to the Midwest Invasive Species Information Network as well as the Illinois DNR. *Photo courtesy of T. Kevin O'Donnell.*

■ Focus Area 2

Invasive Species (continued)

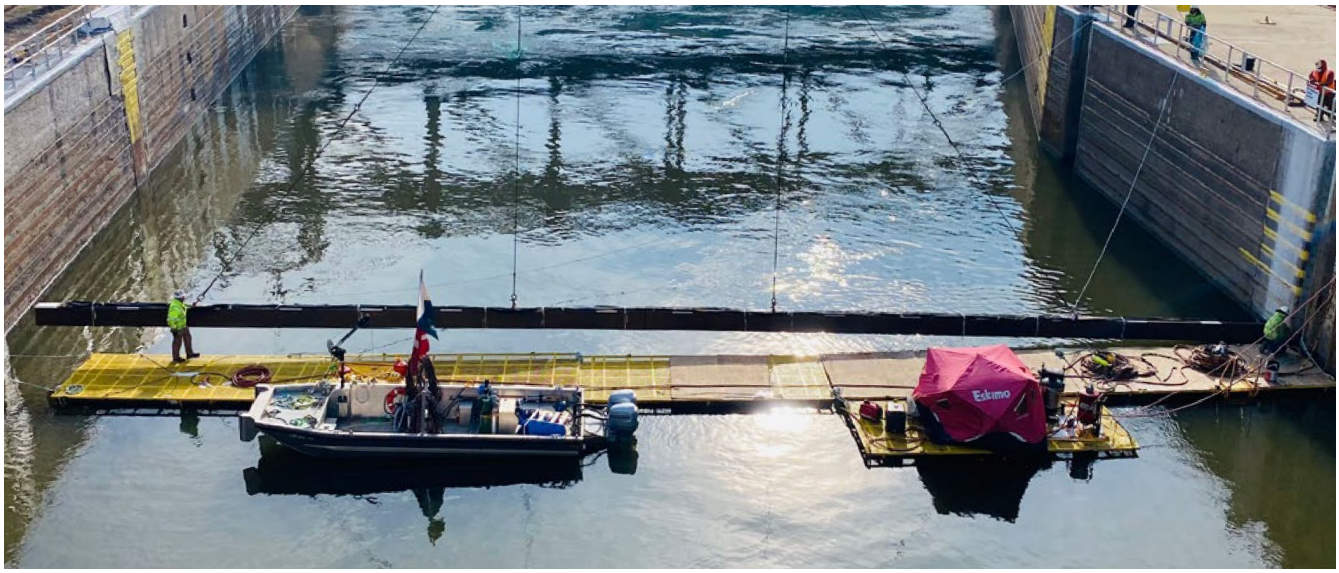
Under GLRI Action Plan IV, frequent sharing of results from surveillance activities and pilot control projects among partners will be critical to ensuring a basin-wide approach to limiting range expansion of non-native species continues. The U.S. Fish and Wildlife Service will maintain and enhance the efficiency of surveillance through its Great Lakes Aquatic Invasive Species Surveillance Program, including annual sampling of new locations. These approaches will increase the probability of detecting non-native species through refinement of current detection strategies and deployment of new sampling technologies and approaches.

Sustained support of states and Tribes will be a key strategy to ensure rapid response, eradication or containment efforts can occur after new detections of non-native species. State and Tribal inland waters surveillance will complement federal surveillance activities to ensure a comprehensive approach to understanding non-native species distributions takes place. Cooperative Invasive Species Management Areas, Partnerships for Regional Invasive Species Management and other local partner organizations will also be supported by GLRI funding under Action Plan IV. These front-line organizations will continue to serve as the "eyes" in the water and on land to help resource agencies understand regional impacts of non-native species and deploy the latest control technologies and approaches.



Example of eDNA transfer from bait release into waterways. Development and expansion of eDNA surveillance techniques in the Great Lakes during Action Plan IV will increase our ability to detect possible non-native species presence, informing traditional field sampling and response actions.

Forums including the Great Lakes ANS Panel will be places where strategic planning at basin scales will continue. Emerging technologies including metabarcoding eDNA and ballast water treatment systems for Great Lakes commercial vessels will be tested for their utility in widening non-native species surveillance and ability to limit inter-basin spread of non-native species already present, respectively.



■ Focus Area 2

Invasive Species (continued)

Objective	**2.3.** Provide ecosystem and human benefits through prioritized and collaborative invasive species control efforts.
Commitments	**2.3.a.** Implement invasive species control efforts that sustain ongoing and past GLRI restoration efforts, providing benefits to native species, habitat and Great Lakes communities. **2.3.b.** Pilot and test new control tools, including, where applicable, tools derived from Indigenous Knowledge, for high-impact invasive species.

Measure of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
2.3.1. Acres controlled for invasive species to benefit habitats, native species and communities.	307,000 / N/A	320,000	330,000	340,000	350,000	360,000

"Targets" are cumulative. "Baseline" for Measure 2.3.1 is the projected result for end of FY2024.

Since GLRI began, many Great Lakes partners have implemented projects to reverse impacts of aquatic and terrestrial invasive species at project sites across the basin. These projects were carried out with the understanding that while spread of non-native species is likely in many cases once a population becomes established in the Great Lakes, there are cases where control and reduction of invasive species populations should be prioritized. This regional or local prioritized control activity can provide significant benefits to communities as well as exercise caregiver responsibilities of indinawemaaganag (our relatives). GLRI funding was used to significantly reduce invasive wetland plants occurring in coastal habitats such as:

Presque Isle State Park coastal wetlands enhanced by invasive species control efforts removing monocultures of phragmites and providing more open water and shallow water habitats for fish and wildlife.
Photo credit: T. Kevin O'Donnell

Chiwaukee Prairie dune swale habitat that has been protected from invasive species infestation through continued invasive species control efforts.
Photo credit: T. Kevin O'Donnell

- Big Marsh Park, Illinois
- Presque Isle, Pennsylvania
- Mentor Marsh, Ohio
- Wigwam Bay State Wildlife Area, Michigan
- Chiwaukee Prairie State Natural Area, Wisconsin

■ Focus Area 2

Invasive Species (continued)

These GLRI projects provided fish and wildlife with enhanced habitats for breeding, feeding and overall use while also providing residents increased opportunities for recreation, such as hiking, boating, fishing and bird-watching. Additional invasive species control efforts in National Forests such as the Huron-Manistee and Ottawa in Michigan and Chequamegon-Nicolet in Wisconsin increased native understory forested habitats for important pollinator insect species and wildlife such as the Karner blue butterfly and eastern massasauga rattlesnake. Tribes continued to control invasive species on reservation and ceded territory lands to ensure culturally important fishing, hunting and food resources will still be available to current and future generations. In many cases, these invasive species control projects sought to maintain the harvest of manoomin (wild rice) and other plants of cultural and medicinal value to Tribes. The U.S. Army Corps of Engineers and Great Lakes Fishery Commission worked in collaboration with states, Tribes and others to decrease sea lamprey populations in tributaries to the Great Lakes. The projects protected populations of native fish important to the Great Lakes fishery, including lake trout.

GLRI partners continued to identify the need for new technologies that better reduce invasive species populations and increase opportunities to reverse infestations in important Great Lakes locales. The Great Lakes Commission, National Park Service, State of Michigan and others implemented new invasive mussel controls at Good Harbor Reef, providing new information on the possibility of targeted suppression at key fish spawning habitats. Innovative technologies were also field-tested for control of invasive wetland plants including hydrilla, European frogbit and phragmites.

Under GLRI Action Plan IV, GLRI federal agencies, states, Tribes and their partners will prioritize maintaining the benefits of previously completed aquatic and terrestrial invasive species control projects so that infestations do not reappear. Funding to communities and partners that maintain stewardship of completed projects, provide access to project sites for recreation and provide employment opportunities and educational experiences to residents will be prioritized. Additionally, living alongside bakaan ingoji gaa-ondaadag, which means "that which comes from somewhere else and now resides here" and who are sometimes referred to as "non-local beings" (i.e., non-native species), may be considered based on lessons learned from previous control projects.

Quagga and zebra mussel infestation on cobble habitat used by native fish and other invertebrates.
Photo credit: NOAA GLERL

■ Focus Area 2

Invasive Species (continued)

GLRI will continue to support collaborative networks of invasive species practitioners and innovative technology development. Species-specific collaboratives will advance the science and technologies of treating invasive species within the Great Lakes and demonstrate measurable benefits on the ground. Advancing the Great Lakes Sea Lamprey Control Program will continue as a priority under GLRI Action Plan IV. Sea lamprey control will be critical to ensuring that lake trout restoration accomplishments made through past GLRI investments are maintained and accelerated further.

New invasive species control projects including technology development, testing and field trials will be prioritized to address critical, continuing pathways for non-native species to enter the Great Lakes as well as reduce populations already established in the Great Lakes in habitats highly valued for the ecosystem benefits provided.

Examples of technologies that are growing in interest for their potential benefit in the Great Lakes include selective biocides for invasive mussels, genetic biocontrols including gene drives to disrupt populations of established invasive species, breeding of pest-resistant trees and selective application of chemicals and secondary management to eradicate aquatic invasive populations. These technologies will be further examined during Action Plan IV to maintain or increase benefits of GLRI invasive species control projects.

Installation of educational signage explaining changing water levels in this coastal wetland and opportunities for the public to document conditions via their cell phone cameras. Picture taken at Big Marsh Park, IL, by Audubon Great Lakes interns.
Photo Credit: Teri Valenzuela/ Audubon Great Lakes

Focus Area 3

Nonpoint Source Pollution

Objective	**3.1.** Reduce nutrient loads from agricultural watersheds to prevent harmful and nuisance algal blooms
Commitments	**3.1.a.** Implement systems of conservation practices on farms and in watersheds to reduce and prevent nutrient runoff. **3.1.b.** Increase adoption of enhanced nutrient management practices through peer-to-peer learning and one-on-one assistance. **3.1.c.** Support development, expansion and capacity of demonstration farms to reach new producers.

Measures of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
3.1.1. Estimated pounds of phosphorus reductions from conservation practice implementation.	**2,800,000 / N/A**	**3,100,000**	**3,400,000**	**3,700,000**	**4,000,000**	**4,300,000**
3.1.2. Acres receiving technical or financial assistance on nutrient management in priority watersheds.	**2,150,000 / 10,000,000**	**2,300,000**	**2,450,000**	**2,600,000**	**2,750,000**	**2,900,000**
3.1.3. Number of active demonstration farms created or sustained with GLRI funding.	**39 / N/A**	**43**	**46**	**49**	**52**	**55**

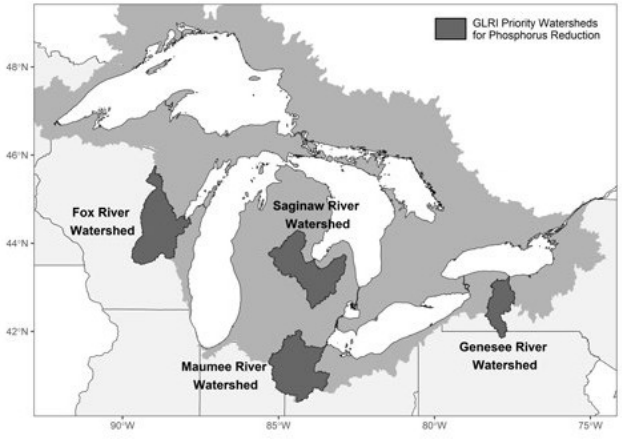
"Targets" are cumulative. Activities throughout the Great Lakes watershed are counted, unless specified otherwise (as in 3.1.2, which is limited to the priority watersheds). "Baseline" for 3.1.1 is the FY24 Target. "Baseline" for 3.1.2 is the expected result for FY24. "Baseline" for 3.1.3 are the number of active GLRI demonstration farms as of FY24.

Since GLRI began, more than 2 million pounds of phosphorus has been prevented from washing off farmlands and more than 2 million cropland acres are under improved nutrient management in agricultural priority watersheds. Runoff from agricultural lands is a significant source of excess nutrients in the Great Lakes and phosphorus in particular is critical to control because it is the biggest driver of harmful and nuisance algal blooms.

Harmful algal bloom in the Fox River, Green Bay, WI.

Photo credit: NEW Water

Agricultural Priority Watersheds



Four agriculture-dominated watersheds — Fox River, the Saginaw River, the Maumee River and the Genesee River — are prioritized for phosphorus reductions.

Nonpoint Source Pollution (continued)

GLRI supports multiple activities to reduce phosphorus runoff and prioritized this work in the Maumee (Ohio), Saginaw (Michigan), Fox (Wisconsin) and Genesee (New York) River watersheds, which are the largest sources of phosphorus contributions. Efforts included farmer education and assistance to adopt conservation methods like soil testing, keeping the ground covered with plants year-round and planting seeds and applying fertilizer while minimally disturbing the soil. In addition, conservation practices were implemented beyond farm fields — at the edge of fields, along streams and throughout watersheds.

Since GLRI began, the number of farmland acres enrolled in voluntary conservation programs in the Great Lakes watershed has more than doubled. Under GLRI Action Plan III, conservation practices were targeted to expand the adoption of nutrient management — which is managing the amount, placement and timing of fertilizer applications to minimize runoff. By leveraging GLRI with other Natural Resources Conservation Service programs, farmers improved their nutrient management on 800,000 acres in priority watersheds. Continued support for conservation planning and assistance will be vital to sustaining and expanding on these accomplishments.

GLRI also supported farmer-led innovation. GLRI demonstration farm networks, created through agreements with local conservation partners, showcase management practices that prevent nutrient runoff from farmlands. The participating farms host field days and tours for neighboring farms and resource professionals to share their successes and lessons learned in adopting new practices. Outreach and peer-to-peer learning motivate other farmers to try these approaches.

Lower Fox Demonstration Farm Network

GLRI supported the first demonstration farm network in the Great Lakes Basin. What began as a single network of four farms in the Lower Fox watershed has grown to eight networks in the Great Lakes Basin comprising over 30 farms.

Phosphorus in Lake Erie

In 2016, as part of a renewed call to action to address HABs in Lake Erie, the U.S. and Canada made a joint commitment to reduce phosphorus loads by 40%. In the U.S., this is equivalent to a reduction of 7.3 million pounds to the lake. The magnitude of reduction needed in the western Lake Erie watershed far surpasses the capacity and resources available from any one of the GLRI partners, and requires us to work collectively and strategically to maximize our impact with the funding and authorities we have. GLRI is just one of many programs contributing to phosphorus reduction goals to prevent HABs in Lake Erie. Taken together with other federal and state programs, EPA estimates 3 million pounds have been reduced from agricultural and municipal sources to date, which is a significant step toward meeting the 40% target.

For the latest status on progress being made in Lake Erie, visit the EPA website .

Nonpoint Source Pollution (continued)

Under GLRI Action Plan IV, GLRI federal agencies and their partners will continue to support direct farmer assistance and outreach to reduce nutrient losses in agricultural watersheds as well as continue to strategically target and design projects based on the latest science. Specifically, GLRI federal agencies and their partners will:

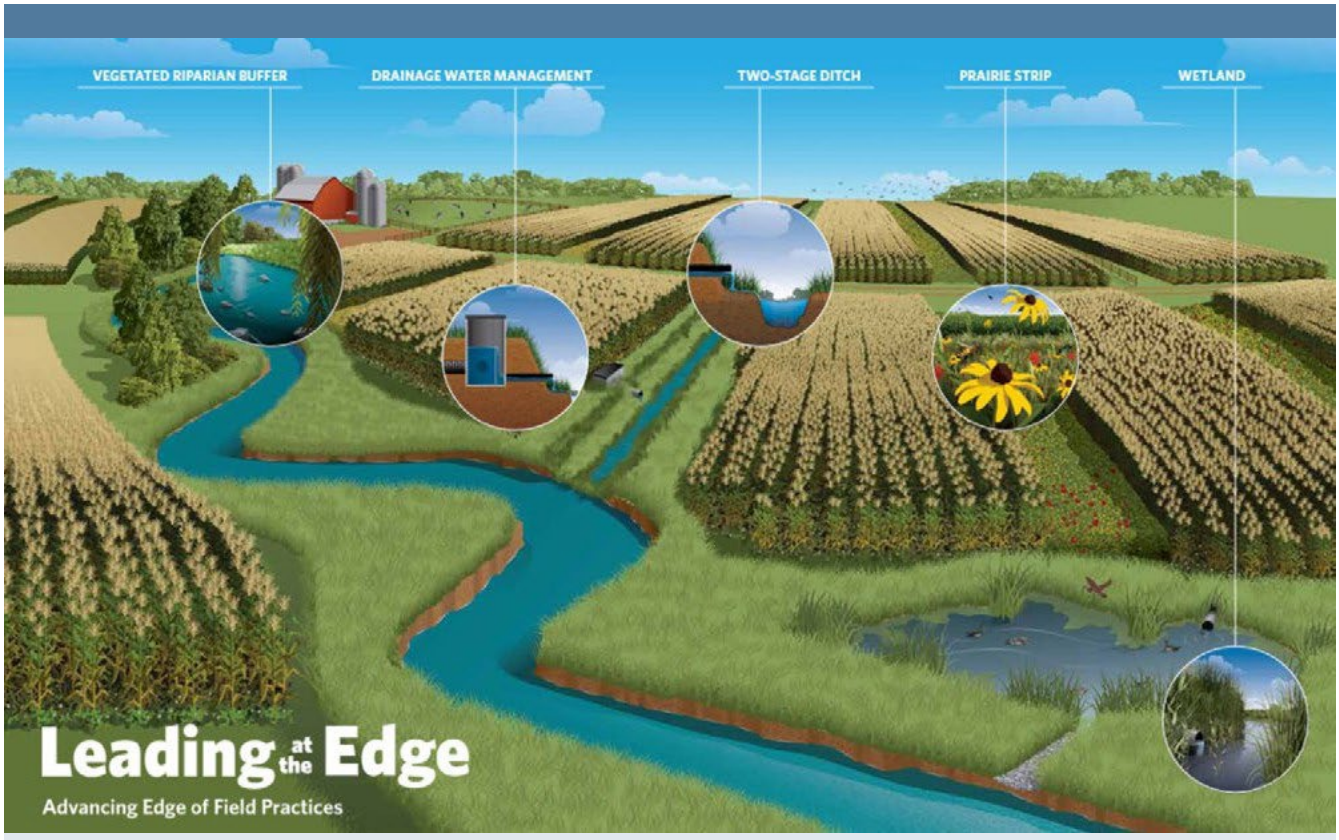
· Expand outreach and demonstration farm networks to improve adoption of on-farm nutrient management practices, with an emphasis to include a broader range of farm types, such as smaller farms, vegetable and grazing farms.

· Increase technical expertise and capacity at the local level to promote peer-to-peer learning and one-on-one assistance. Activities may include maintaining or adding expert staff at the county conservation districts in priority watersheds, or engaging other trusted farmer advisers such as nutrient management planners.

· Support practices that slow down and filter agricultural stormwater runoff, such as expanding buffers to waterways, widening floodplains on drainage ditches and creating wetlands in receiving waterbodies that can also contribute to reductions in flooding and erosion.

Research tells us that focusing our efforts on in-field practices alone is not enough to meet phosphorus reduction goals. Improved nutrient management on farm fields, coupled with filtering practices at the edge of fields and in areas of high legacy[1] phosphorus, is needed to further reduce nutrient runoff.

1. Here, legacy phosphorus refers to the accumulation of phosphorus in farm fields or deposited in streambeds and streambanks.



A few examples of edge-of-field practices to better manage water and filter nutrients and sediments in runoff from farm fields.
Source: The Nature Conservancy nature.org/EdgeofField

Nonpoint Source Pollution (continued)

Objective	**3.2.** Reduce or prevent stormwater runoff to improve and sustain water quality.
Commitments	**3.2.a.** Increase implementation of green infrastructure practices in communities impacted by polluted runoff. **3.2.b.** Implement projects in urban and rural communities designed to reduce or prevent runoff, flooding and erosion.

Measures of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
3.2.1. Estimated gallons (in millions) of stormwater runoff reduced.	550 / N/A	625	700	775	850	925
3.2.2. Miles of Great Lakes streams and shoreline restored or protected.	61 / N/A	74	87	100	113	126
3.2.3. Acres of riparian buffers, wetlands and floodplains restored or reconnected.	0 / N/A	50	100	150	200	250

"Targets" are cumulative. "Baseline" for Measures 3.2.1 and 3.2.2 are the target values for 2024 set in Action Plan III. "Baseline" for Measure 3.2.3 is 0 because this is a new measure for Action Plan IV.

GLRI-funded projects have prevented more than 500 million gallons of untreated urban stormwater runoff from entering the Great Lakes. In addition, more than 300 local watershed projects have been implemented in Great Lakes communities and more than 60 miles of streams and shoreline protected through nature-based methods.

Since GLRI began, GLRI federal agencies and their partners have reduced the loading of sediment, nutrients, toxic contaminants and pathogens to Great Lakes tributaries and nearshore waters from stormwater runoff. GLRI funding supported green infrastructure projects in Great Lakes communities to reduce untreated stormwater runoff and to improve nearshore water quality. These green infrastructure projects have the added benefit of increasing greenspace in urban areas, offering flood mitigation and providing habitat for pollinators.

Under GLRI Action Plan IV, GLRI federal agencies and their partners will continue to encourage and accelerate implementation of projects to reduce or prevent stormwater runoff to protect nearshore water quality. GLRI federal agencies and partners will continue to support green infrastructure practices to capture or slow the flow of untreated runoff and filter out sediment, nutrients, toxic contaminants, pathogens and other pollutants from runoff before it reaches the Great Lakes, with a focus on communities impacted by polluted runoff.

In Gary, IN, GLRI supported a project to remove impervious cover, repair a failed subsurface drainage system and redirect stormwater from drains to a newly constructed rain garden. Post-project monitoring demonstrated that the rain garden captures 98% of precipitation.

Nonpoint Source Pollution (continued)

These projects may also provide flood mitigation benefits by reducing peak flows. Projects may require maintenance to handle increasingly intense rain events. GLRI agencies and partners will consider projected future stormwater volumes in the design of projects.

GLRI federal agencies will continue to work with public-private partnerships such as the Southeast Michigan Resilience Fund and the Chi-Cal Rivers Fund to leverage GLRI investments in communities for delivering on-the-ground projects where they make a difference. GLRI federal agencies and partners will also continue to support watershed-based, collaborative approaches that bring urban and rural communities together to address water quality concerns.

Actions such as reconnecting a floodplain to a stabilized vegetated streambank can help increase a stream's resilience to stressors such as large storms. Restoration projects along coastlines can incorporate nature-based features to mitigate effects of more extreme storms, high wave action, interrupted sediment transport and presence of man-made physical structures. Activities to reduce stormwater runoff and streambank erosion also complement these restoration efforts and increase coastal resiliency. These efforts will protect over a hundred miles of Great Lakes streams and shoreline, restore and reconnect riparian buffers along streams and filter hundreds of millions of gallons of stormwater runoff.

Green Infrastructure

Milwaukee, WI, elementary students learning in the newly built bioswale in their schoolyard. *Photo credit: Reflo Inc.*

Nonpoint Source Pollution (continued)

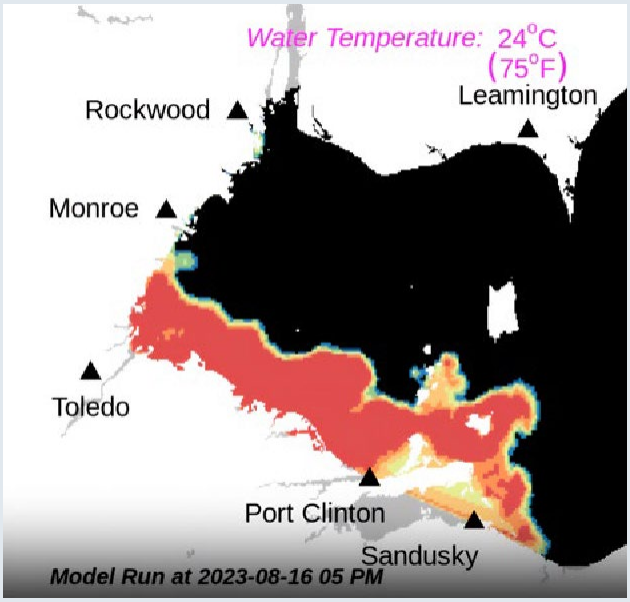
Objective	**3.3.** Improve effectiveness of nonpoint source control efforts to prevent harmful and nuisance algal blooms.
Commitments	**3.3.a.** Monitor and assess nutrient conditions in western Lake Erie, Green Bay, Saginaw Bay and priority tributaries to the Great Lakes. **3.3.b.** Demonstrate new, improved or collaborative approaches to achieve water quality goals.

Measures of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
3.3.1. Nutrient monitoring and assessment activities conducted.	30 / N/A	30	30	30	30	30
3.3.2. Nutrient and stormwater runoff reduction demonstration projects implemented.	10 / N/A	10	10	10	10	10

"Targets" are not cumulative. "Baseline" and "Targets" for Measures 3.3.1 and 3.3.2 identify activities conducted annually.

GLRI has supported the deployment of state-of-the-art technologies to predict and understand the environmental drivers of HABs. Scientists use an integrated approach consisting of satellite images, real-time buoys and a comprehensive monitoring program to predict algal bloom intensity and movement in western Lake Erie. HABs are tracked in real time, and weekly bulletins are issued that report the HAB's current location, forecast its future movement and categorize its intensity. Bulletins are available online, allowing decision-makers, coastal community residents and visitors alike to better monitor and plan around the presence of HABs. Modeled after Lake Erie, similar approaches are being piloted in Saginaw Bay and Green Bay. GLRI has also supported the development of Runoff Risk forecasts, which incorporate weather forecasts with soil moisture models to help farmers decide when to apply nutrients, based on where and when there is a likelihood of surface water runoff.

GLRI federal agencies and partners have conducted 30 monitoring and assessment activities ongoing each year to examine nutrient sources and impacts. In addition, 10-15 multiyear projects were launched to evaluate approaches to manage runoff at the watershed and field scales and pilot new technologies. Research to date has provided valuable insights, including that performance of individual practices is highly variable and implementing systems of conservation practices (nutrient management,



Lake Erie HABs Forecast during its peak severity in 2023. Red indicates high cyanobacterial concentrations. Forecasts are updated daily during the bloom season. *Source: NOAA*

cover crops and drainage management) in specific priority areas will have the greatest impact on preventing nutrient losses from farms. The information learned from these studies will help improve future project designs so that water quality benefits are maximized.

Under GLRI Action Plan IV, GLRI federal agencies and partners will continue to:

· Test or pilot new/innovative ways to achieve nutrient reductions, such as slow-release fertilizer and manure transformation technologies.

· Assess the potential for wetlands to act as sinks for nutrients, and quantifying phosphorus load reductions based on actual performance.

· Monitor and assess nutrient levels in the major tributaries to the Great Lakes and nearshore areas experiencing algal blooms.

Scientists aboard a small aircraft obtaining hyperspectral imagery of a Lake Erie algal bloom. *Photo credit: NOAA GLERL*

Aerial image of phosphorus optimal constructed wetland in Defiance, Ohio. *Photo credit: USACE*

Phosphorus Optimal Wetland Demonstration

The Phosphorus Optimal Wetland Demonstration project is a GLRI-funded effort to test and demonstrate the ability of certain soil types to capture and retain nutrients such as phosphorus. Following a research effort to classify the ability of soil to capture phosphorus, a group of federal and local partners built a 10-acre demonstration wetland in 2021 and will continue research at the site through 2026.

Focus Area 4

Habitats and Species

Objective	**4.1.** Protect, enhance and increase resilience of habitats necessary for sustaining native aquatic and terrestrial species important to the Great Lakes ecosystem.
Commitments	**4.1.a.** Protect, enhance and provide connectivity for habitats to support important native species, maintain Tribal cultural uses and/or provide benefits to people. **4.1.b.** Implement projects that increase resilience in watersheds and along coastlines, considering flood reduction and recreational benefits to communities.

Measures of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
4.1.1. Acres of coastal wetland, nearshore and other habitats protected or enhanced.	**530,000 / N/A**	**540,000**	**547,000**	**554,000**	**561,000**	**568,000**
4.1.2. Miles of connectivity established for aquatic species.	**8,170 / N/A**	**8,300**	**8,450**	**8,600**	**8,700**	**8,800**

"Targets" are cumulative. "Baseline" for Measures 4.1.1 and 4.1.2 are projected results for end of FY2024.

Since GLRI began, GLRI federal agencies and their partners have protected, restored and enhanced habitat in the Great Lakes Basin. Key accomplishments include:

Protecting brook trout populations in Michigan's cold-water streams: GLRI funds have significantly accelerated the projects needed to replace failing road stream crossings that were blocking free movement of brook trout populations within these watersheds. These watersheds now have the needed resilience to support this fishery into the future for residents and visitors.

Increasing pollinator habitats and benefiting Great Lakes bee and butterfly populations: Collaborative pollinator conservation in the Great Lakes among multiple federal and state partners was accelerated under Action Plan III by enhancing or creating habitat important to native bee and butterfly species.

Aphrodite fritillaries nectaring on wild bergamot at Chequamegon-Nicolet National Forest in Wisconsin.

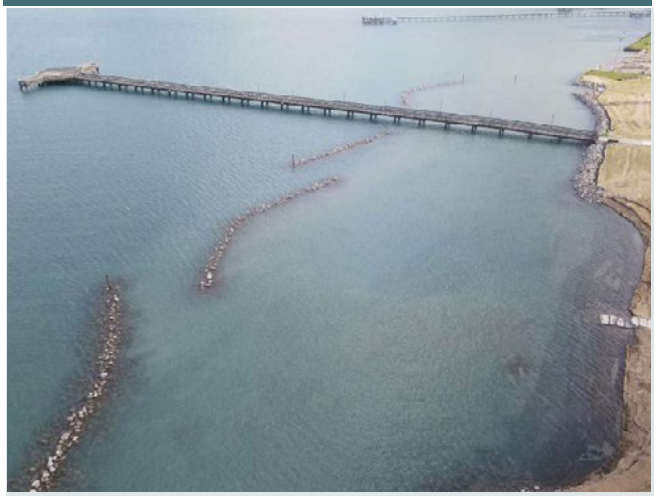
A host of partners led by the Conservation Resource Alliance (CRA) completed the Free Spanning the Maple River Initiative in 2023, removing the remaining last significant barriers to 55 miles of aquatic organism and fish passage throughout this watershed. Funding provided by GLRI, especially during Action Plan III, accelerated this effort to the point of completion. This is the first time a major river in the United States has been completely opened stem-to-stem. *Map courtesy of CRA.*

Habitats and Species (continued)

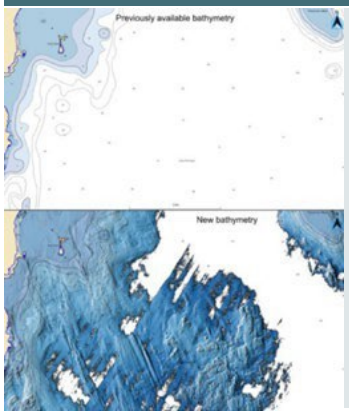
Protecting and creating coastal habitat through innovative approaches: Following historic high water in the Great Lakes during the years preceding Action Plan III, partners increased coastal resilience using GLRI funding. In 2021, GLRI supported Chesterfield Township in Michigan to restore approximately 740 linear feet of shoreline and 1.5 acres of nearshore habitat by constructing rock shoals and planting submerged vegetation at Brandenburg Park. The project increased fish habitat in Lake St. Clair and replaced deteriorating and undercut metal sea walls that were unsafe for residents and visitors wishing to enjoy the shoreline from the park.

Under GLRI Action Plan IV, GLRI federal agencies and their partners will build upon past restoration efforts targeted at critical habitat types. Recently completed and new projects will consider incorporating increased access and use of project sites by local residents, Tribes, communities, and continue to generate lessons learned from projects so that future projects are more resilient. Increasing use of Indigenous Knowledge upfront and throughout projects will be sought, exercising caregiver responsibilities of indinawemaaganag (natural resources or relatives).

Watersheds with cold-water habitat necessary for native fish populations will be identified for future GLRI investments while positioning partners and communities to steward projects after completion. Providing fish passage in these watersheds through removal of barriers and construction of passages better designed for future stream flow conditions will occur and be coordinated with sea lamprey control by retaining strategic barriers in some cases. New efforts will be taken using emerging eDNA surveillance techniques and propagation so that native freshwater mussels are included in comprehensive watershed restoration efforts.



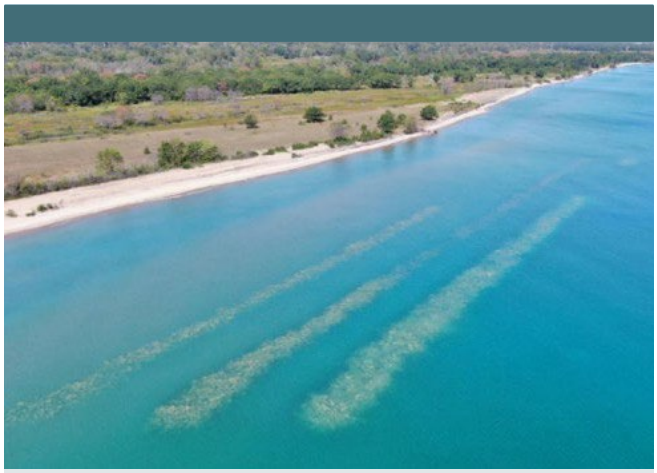
Brandenburg Park under construction showing the softening shoreline work as well as the offshore shoals providing erosion control and habitat for fish, reptiles and amphibians. *Photo credit: NOAA Fisheries*



Investments by GLRI are increasing knowledge about important coastal resources including surrounding submerged habitats and depths (bathymetry), including areas around Washington Island, Wisconsin. *Source: NOAA Office of Coastal Management*

Agencies and local communities will use GLRI funding to catalyze and leverage other federal and state funding available for protection and enhancement projects along our coasts. Coastal habitats including wetlands, beaches and reefs will be mapped and assessed through GLRI-supported projects using the latest science and survey techniques. Agencies and local communities working along the Great Lakes coasts will use this needed information to appropriately site and design innovative and resilient projects to allow species and ecosystem benefits to continue under future projected water levels. Strategic and comprehensive on-the-ground coastal projects will be supported by GLRI that promote productive fisheries, migratory birds and wildlife and recreational and cultural uses by communities.

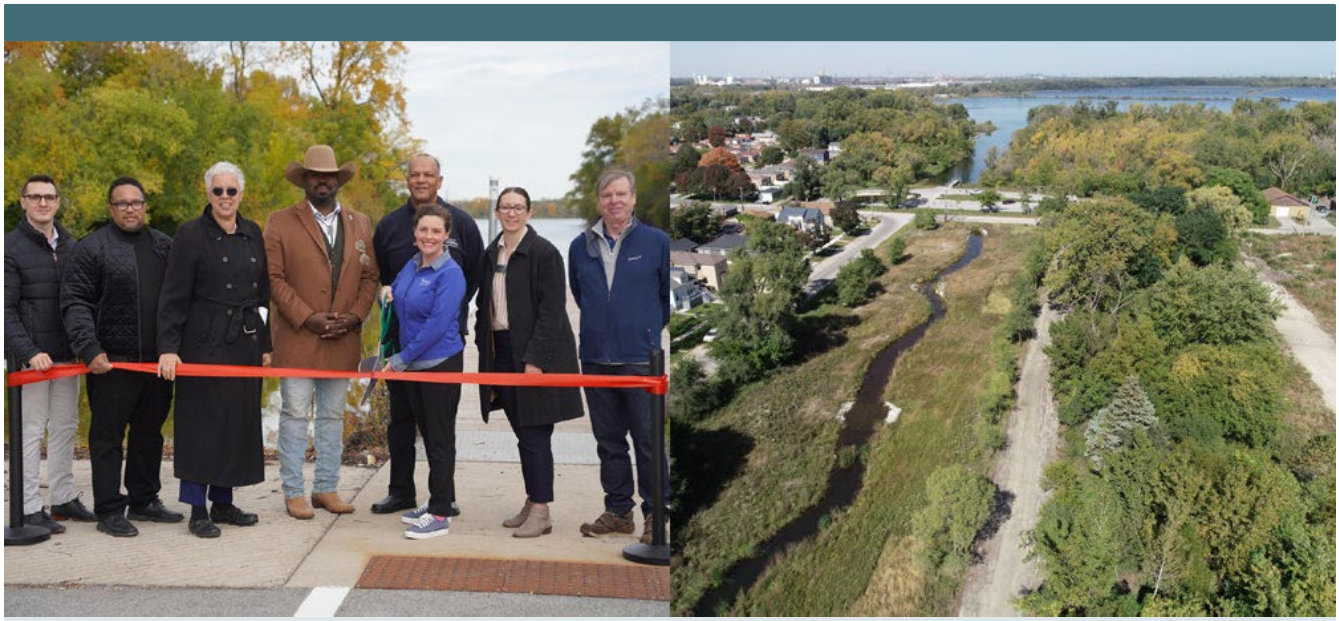
Habitats and Species (continued)



Aerial view of fully installed submerged rubble ridges at Illinois Beach State Park. *Photo credit: US Army Corps of Engineers*

Forest ecosystems, subtypes and associated communities of species that provide resiliency for insect and wildlife populations or enhance critical corridors for movement of species will also be prioritized by GLRI for protection and enhancement.

An overarching goal for future GLRI investments in habitat restoration will be to use local project information with future projections of weather, water temperatures, stream flows and coastal conditions to implement projects that maintain or enhance the resilience of habitat types. By using this science-based, systematic planning and implementation approach, GLRI federal agencies and partners will seek to minimize investments that are short-lived, more prone to damage from projected future conditions and don't consider a particular habitat's ability to respond to future disturbances. Additionally, benefits of GLRI investments to communities will be considered in the project planning process alongside benefits to Great Lakes ecosystems. For example, future project siting along the Great Lakes coasts can seek to expand and support approaches to provide dual flood protection and wildlife benefits while considering critical infrastructure and community priorities (e.g., see https://resilientcoasts .org).



Elected officials and natural resource representatives celebrate the completion of the Powderhorn Lake Restoration Project in Chicago, IL. Improvements to habitat and improved water level control within the preserve and downstream areas along Lake Michigan's coast provide benefits to fish and wildlife as well as flood reduction to neighboring residents. *Photo credit: Audubon Great Lakes.*

Habitats and Species (continued)

Objective	**4.2.** Increase resilience and representation of native species.
Commitments	**4.2.a.** Update and implement recovery actions for federal threatened, endangered and candidate species. **4.2.b.** Support population-level protections, enhancements and reintroductions for state, Tribal and other native species important for Great Lakes ecosystems.

Measure of Progress With Annual Targets	Baseline/ Universe	FY2025 Target	FY2026 Target	FY2027 Target	FY2028 Target	FY2029 Target
4.2.1. Species benefited where actions have been completed to significantly protect or promote recovery of populations.	8 / N/A	9	10	11	13	15

"Targets" are cumulative. "Baseline" identifies the projected result for end of FY2024.

Since GLRI began, GLRI federal agencies and their partners have continued to focus on restoration of iconic and culturally significant Great Lakes species and assessment of populations through time to determine impacts of GLRI activities. Benefits of this strategic GLRI approach to species restoration include stopping the possible extinction of fish and wildlife found only in the Great Lakes, restoring the aquatic food web of the Great Lakes and making sure broader fish and wildlife communities remain resilient and sustainable.

Projects that increased population levels or made species more self-sustaining during Action Plan III focused on Great Lakes piping plovers, manomin/manoomin (wild rice), lakeside daisy, Mitchell's satyr butterfly, brook trout, breeding marsh bird species, lake trout and other native species. GLRI federal agencies closely coordinated these efforts with other management agencies in the Great Lakes that play an important role in stewarding these GLRI accomplishments through their own restoration and management efforts. The Council of Lake Committees, Upper Mississippi and Great Lakes Region Joint Venture, Great Lakes Coastal Assembly, Great Lakes Pollinator Task Force and state and Tribal fish and wildlife agencies are important partners that contributed to species-specific activities during Action Plan III.

Notable accomplishments during Action Plan III included the continued upward number of piping plover pairs found in the Great Lakes, a result in large part due to GLRI-funded captive rearing and release of chicks back into the wild as well as protection of newly hatched chicks on Great Lakes beaches. During Action Plan III, more than 50% of lake trout found in Lake Huron were determined to be wild; increasing population trends in wild lake trout populations also occurred in middle and southern Lake Michigan; and the first observed natural reproduction of lake trout in Lake Erie in 60 years was documented. These observations demonstrated the continued stocking and assessment of this native top predator is restoring the lakes' food webs.

Release of brook trout back to northern Wisconsin stream.
Photo credit: U.S. Fish and Wildlife Service

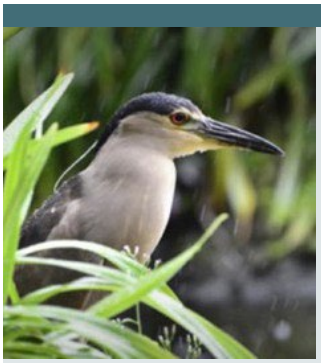
Habitats and Species (continued)

Restoring the diversity and interspersion of native wetland plants and open water in Great Lakes coastal wetlands has already resulted in increasing use of these habitats by secretive marsh birds. For example, through a partnership between the National Oceanic and Atmospheric Administration and the Great Lakes Commission, the Cook County Forest Preserve and Audubon Great Lakes, a GLRI-funded project enhanced the Powderhorn Lake Forest Preserve by upgrading the water management infrastructure necessary to create preferred conditions for these bird species. Additionally, this water control and habitat restoration project provided relief and future protection to downstream residents on the South Side of Chicago, Illinois, who historically have experienced flooding.

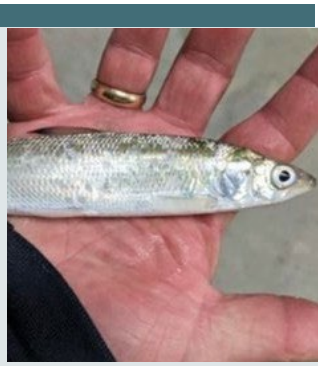
Under Action Plan IV, the GLRI will continue to provide significant support to agencies, entities and Tribes that stock, enhance and reach significant population milestones for native species or answer critical questions for future management. Reintroduction of species important to Tribes will be planned and implemented to continue to provide important food resources and cultural uses.

Examples of species that may benefit under this measure during Action Plan IV include, but are not limited to:

- Lake trout
- Native prey fish (ciscos and bloaters)
- Michigan monkey flower
- Dwarf lake iris
- Great Lakes piping plover
- Pitchers thistle
- Marsh breeding birds
- Lake sturgeon
- Brook trout
- Native fluvial mussels
- Lakeside daisy
- Eastern massasauga rattlesnake
- Copperbelly water snake
- Mitchell's satyr butterfly
- Native bees
- Poweshiek skipperling
- Eastern prairie fringed orchid
- Karner blue butterfly



Marsh birds such as the black-crowned night heron are a focus of current coastal wetland enhancement projects. *Photo credit: Audubon Great Lakes*



Native prey fish species, such as cisco, will continue to be a focus of restoration of the native food web of the open Great Lakes. *Photo credit: U.S. Fish and Wildlife Service*

GLRI agencies will continue restoring the native top predator (lake trout) and native prey fish species (cisco, bloater, kiyi and others), bringing back critical elements of the food webs in Lake Ontario, Lake Huron and additional Great Lakes locations. An approach to broader ecosystem recovery to the lakes as opposed to single-species approaches will guide this work.

Coastal wetlands, reefs and other habitats important to native fish and breeding marsh birds will be prioritized so projects provide increased resiliency and the habitat diversity needed for breeding, nursery and feeding. State and Tribal fishery agencies will provide support and direction to federal agencies to continue habitat restoration in the lakes and reintroduction/stocking of native fish. Funding will be provided to agency, academic and local partners so that continued population assessments occur, improve our understanding of project impacts and direct future management for native Great Lakes species. A subset of federally threatened and endangered species will be identified for accelerated population recovery actions so that iconic species found in the Great Lakes not only persist but are restored to self-sustaining populations and are down-listed in the future.

Focus Area 5

Foundations for Future Restoration Actions

Objective	**5.1.** Educate the next generations about the Great Lakes ecosystem and teach people the skills needed to enter the environmental restoration and protection workforce.
Commitments	**5.1.a.** Support and implement experience-based learning opportunities to promote Great Lakes stewardship. **5.1.b.** Support and implement environmental workforce development programs.
Measures of Progress	**5.1.1.** Number of youth impacted through education and stewardship projects. **5.1.2.** Number of people trained through workforce development programs.

Since GLRI began, GLRI federal agencies and their partners have promoted Great Lakes ecosystem education and stewardship through a focus on engaging educators and youth through place-based experiential learning. Federal agencies and partners have implemented many activities to promote Great Lakes-based environmental education and stewardship, including these programs:

· The Great Lakes Sea Grant Network's Center for Great Lakes Literacy (CGLL) has created a community of Great Lakes-literate educators, students, scientists, environmental professionals and citizen volunteers dedicated to improved Great Lakes stewardship.

· NOAA's Great Lakes Bay Watershed Education and Training (B-WET) program promoted locally relevant, authentic experiential STEM learning for K-12 students and teachers. The core component of B-WET projects is the Meaningful Watershed Educational Experience, a learner-centered framework that focuses on investigations into local environmental issues and leads to informed stewardship action.

· National Park Service (NPS) and United States Fish and Wildlife Service (USFWS) delivered place-based learning experiences at National Parks and National Wildlife Refuges with local partners to promote stewardship of Great Lakes ecosystems among community members, especially youth.

· State-led efforts, such as Ohio Department of Natural Resources program, provided hands-on experiences for students in restored wetlands and the Old Woman Creek National Estuarine Research Reserve. Programming includes kayaking excursions focused on teaching students in grades 6-12 about Lake Erie water quality and habitat restoration and providing schools with transportation resources to remove barriers that deter students from accessing outdoor areas and habitats for field trips in Lake Erie watersheds.

Collectively, CGLL, NOAA B-WET, NPS, state programs and other education projects resulted in the training of more than 1,300 educators from FY2019 through FY2022, who in turn have provided hands-on experiential learning to an estimated 220,000 students.

Foundations for Future Restoration Actions (continued)

Under GLRI Action Plan IV, GLRI federal agencies and partners will continue to promote Great Lakes-based ecosystem education and stewardship for K-12 school students and community members (for example, courses at parks, nature centers, museums and zoos and aboard vessels). GLRI agencies and partners will continue to support activities centered on providing experience-based learning opportunities, with an emphasis on youth, and continue to develop Great Lakes-literate educators using the essential principles and fundamental concepts included in the Great Lakes Literacy curriculum.

These activities will advance the overall goal of educating students and next generations to foster Great Lakes stewardship, promote conservation and expose and prepare youth for higher education opportunities in natural resource management. Where appropriate, activities will encourage opportunities to incorporate Indigenous Knowledge and cross-cultural learning. GLRI activities will also include evaluation of the effectiveness of education programs.

A U.S. Fish and Wildlife Service biologist helps Michigan high school students identify fish during an introductory biological sampling program in a freshwater wetland at Detroit River International Wildlife Refuge. *Photo credit: U.S. Fish and Wildlife Service*

Kindergarten students in Green Bay grew wild rice in their classroom and transplanted it in a local wetland to provide food and cover for local birds and fish, part of a program supported by NOAA B-WET. *Photo credit: Sandra Benton*

Michigan teachers attend a summer workshop for place-based education where they participate in the same activities they will share with their students. *Photo credit: Southeast Michigan Stewardship Coalition (supported by NOAA B-WET Program)*

Hands-On Educational Opportunities

A FWS biologist teaches Michigan Girl Scouts how to sample fish with cages and nets in Monguagon Pond, a reconstructed wetland that flows into the Detroit River, to learn about different sampling techniques used by biologists in their jobs. *Photo credit: USFWS*

With new focus under Action Plan IV, GLRI agencies and their partners will implement workforce development programs to train and teach people the skills needed to enter the environmental restoration and protection workforce that supports GLRI projects. These job training programs will work toward a goal of providing additional skilled workers and build a local environmental workforce in the Great Lakes. The programs will provide underemployed residents training in skills needed to accelerate career paths and perform remediation and restoration work.

Foundations for Future Restoration Actions (continued)

Objective	**5.2.** Conduct targeted science to inform and assess Great Lakes restoration.
Commitment	**5.2.a.** Assess Great Lakes ecosystem health and implement interdisciplinary science projects that will guide Great Lakes restoration and help protect the lakes from current and future threats.
Measure of Progress	**5.2.1.** Annual Great Lakes monitoring conducted; interdisciplinary science projects and assessments implemented to support the GLRI and U.S. domestic actions in support of the Cooperative Science and Monitoring Initiative, lake-specific priorities identified in LAMPs and other GLWQA activities.

Science is a key foundation to any successful ecosystem restoration and protection program. Assessing the overall health of the Great Lakes and identifying and investigating the most significant problems affecting their heath is essential for resource managers to be able to take actions to address chemical, biological and physical stressors.

Under Action Plan III, GLRI federal agencies and their partners implemented projects to enhance understanding of the drivers of harmful algal bloom toxicity and the impacts of changes in lake levels, ice coverage, waves and surge, and sediment transport on coastal resources. Enhanced Great Lakes monitoring and research activities were implemented through the Cooperative Science and Monitoring Initiative to generate data and information that filled critical data gaps in each Great Lake and advanced the management of Great Lakes resources while confronting the challenges of eutrophication, contaminants, invasive species and habitat loss.

Monitoring Ecosystem Health of the Great Lakes

Federal agencies and partners conduct comprehensive monitoring to assess the status and trends of the Great Lakes ecosystem. Monitoring of Great Lakes coastal wetlands and other nearshore areas; contaminants in air, fish and sediment; water quality and nutrients; zooplankton; phytoplankton; harmful algal blooms; benthic communities including invasive mussels; and fish populations is conducted throughout the basin. The data and information from these monitoring programs are used to track restoration progress and monitor for changes in lake condition and emergence of new stressors.

Cooperative Science and Monitoring Initiative (CSMI)

CSMI provides natural resource managers with the science and monitoring information necessary to make management decisions on each Great Lake. The coordinated intensive CSMI sampling in each lake basin focuses on filling data and information needs of the GLWQA Lake Partnerships to help advance the management of stressors including eutrophication, contaminants, invasive species and habitat loss.

Interdisciplinary Science by Federal, State and Tribal Partners

Federal, state and Tribal partners work collaboratively to implement interdisciplinary science projects targeting priority topics such as HABs, hypoxia and coastal resiliency. Results produced through these efforts are specifically designed to assist resource managers in making better management decisions regarding restoring and protecting the Great Lakes.

Foundations for Future Restoration Actions (continued)

Under Action Plan IV, GLRI federal agencies and their partners will continue to support targeted science projects and implement programs that will help track progress toward GLRI long-term goals and inform future restoration actions. There will be continued focus on priority issues such as HABs and coastal resilience, but also new efforts such as ecosystem monitoring in winter. There will also be continued support for assessing the health of the Great Lakes through long-term monitoring programs and CSMI.

Students and technicians sample invertebrates in emergent wetland vegetation at a CWMP monitoring site. *Photo credit: U.S. EPA*

Developing the Next Generation of Great Lakes Resource Managers Through Wetland Monitoring

The EPA Great Lakes Coastal Wetland Monitoring Program (CWMP) is a GLRI-supported, basin-wide monitoring program implemented to regularly assess the health of over 1,000 Great Lakes coastal wetlands. The university field crews that conduct this monitoring are staffed by a combination of undergraduate student technicians, interns (recent graduates) and graduate students from CWMP university partner institutions. The hands-on training and experience gained by these students and recent graduates is crucial for career building in the field of resource management. Since CWMP fieldwork began in 2011, 28 undergraduate and graduate students and recent graduates who were funded by the CWMP have moved on to Great Lakes resource management career positions at federal, Tribal, state and local government agencies. Many other former CWMP students and field staff have since pursued additional graduate research or attained university scientist positions, as well as positions with nongovernmental agencies.

Great Lakes RESTORATION

Interagency Task Force and Regional Working Group Agencies

U.S. Environmental Protection Agency

Great Lakes National Program Office

U.S. Department of State

U.S. Department of the Interior

Bureau of Indian Affairs

U.S. Fish & Wildlife Service

National Park Service

U.S. Geological Survey

U.S. Department of Housing and Urban Development

U.S. Department of Agriculture

Animal and Plant Health Inspection Service

Natural Resources Conservation Service

U.S. Forest Service

U.S. Department of Commerce

National Oceanic & Atmospheric Administration

U.S. Department of Transportation

Federal Highway Administration

Maritime Administration

U.S. Department of Homeland Security

U.S. Coast Guard

U.S. Department of the Army

U.S. Army Corps of Engineers

Executive Office of the President of the United States

U.S. Department of Health & Human Services

Agency for Toxic Substances and Disease Registry

Centers for Disease Control and Prevention