

# Lake Ontario

## 2023-2027 Lakewide Action and Management Plan



**Recommended Citation:**

- Canada Water Agency and the United States Environmental Protection Agency. 2026. *Lake Ontario Lakewide Action and Management Plan, 2023-2027*.

Cat. No. X

ISBN X

EPA X

## Acknowledgements

The 2023-2027 Lake Ontario Lakewide Action and Management Plan (LAMP) was developed by member agencies of the Lake Ontario Partnership. We gratefully acknowledge the efforts of the core Writing Team, led by staff at the Canada Water Agency and U.S. Environmental Protection Agency. This LAMP reflects the input of many resource management agencies, conservation authorities, scientists, non-governmental organizations, Indian Nations, First Nations, and Métis Governments committed to restoring and protecting Lake Ontario and its connecting rivers.

We gratefully acknowledge members of the Lake Ontario Partnership for their review and input in the development of the LAMP. Valuable input was provided by other organizations, academics, stakeholders, and interested members of the public.

### Lake Ontario Partnership

- Bureau of Indian Affairs (BIA)
- Canada Water Agency (CWA)
- Fisheries and Oceans Canada (DFO)
- Environment and Climate Change Canada (ECCC)
- National Oceanic and Atmospheric Administration (NOAA)
- New York State Department of Environmental Conservation (NYSDEC)
- Niagara Peninsula Conservation Authority (NPCA)
- Ontario Ministry of Agriculture, Food and Agribusiness (OMAFRA)
- Ontario Ministry of the Environment, Conservation and Parks (MECP)
- Ontario Ministry of Natural Resources (MNR)
- Parks Canada Agency (PCA)
- Quinte Conservation (QC)
- Saint Regis Mohawk Tribe (SRMT)
- Toronto and Region Conservation Authority (TRCA)
- United States Army Corps of Engineers (USACE)
- United States Department of Agriculture – New York Natural Resources Conservation Service (USDA-NY NRCS)
- United States Environmental Protection Agency (EPA)
- United States Fish & Wildlife Service (USFWS)
- United States Department of Agriculture – Forest Service (USDA-FS)
- United States Geological Survey (USGS)

### Observers

- New York Sea Grant (NYSG)
- International Joint Commission (IJC)

# Table of Contents

- Executive Summary.....iv**
- 1.0 Introduction .....1**
  - 1.1 Lake Ontario Partnership.....2
  - 1.2 Engagement in LAMP Development.....2
  - 1.3 State of the Great Lakes Reporting .....2
  - 1.4 Indigenous Peoples .....2
- 2.0 Lakewide Action Plan.....4**
  - 2.1 Chemical Contaminant Pollution.....4
  - 2.2 Nutrient and Bacterial Pollution..... 10
  - 2.3 Loss of Habitat and Species..... 18
  - 2.4 Invasive Species..... 28
  - 2.5 Other Threats ..... 35
- 3.0 Lakewide Management .....41**
  - 3.1 Engagement and Reporting..... 41
  - 3.2 Collective Action for a Healthy Lake Ontario..... 41

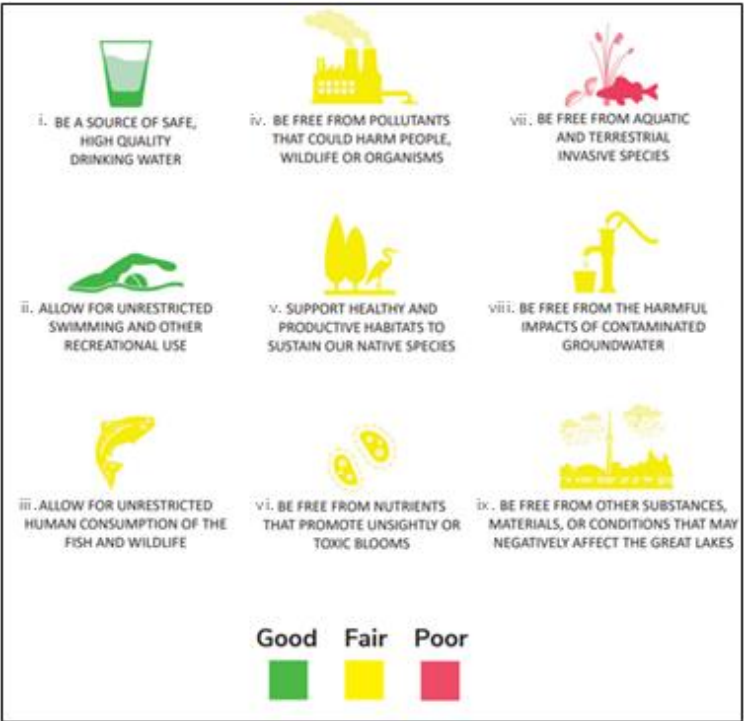
# Executive Summary

Lake Ontario, the easternmost of the five Laurentian Great Lakes, is both the final link in the Great Lakes chain and the gateway to the Atlantic Ocean through the St. Lawrence River straddling the international border. Despite being the smallest of the Great Lakes by surface area, Lake Ontario is the 11th-largest lake in the world by volume and the 14th-largest by surface area, covering 18,960 square kilometres (7,320 square miles). It has the highest ratio of watershed area to lake surface area among the Great Lakes, making it particularly sensitive to influences from its surrounding basin. Lake Ontario is an important natural ecosystem that is surrounded by the second most populous basin among the Great Lakes and is a resource for millions of people who live, work, and recreate in its watershed.

The ecological richness of Lake Ontario supports a remarkable diversity of plants, animals, and fish that thrive in environments shaped by both ancient geological history and current hydrological dynamics. Precambrian and Paleozoic bedrock underpins a landscape of island archipelagos, sand and cobble beaches, dune systems, shallow embayments, and productive tributaries. Meadows and wetlands serve as vital nurseries and migration stopovers for numerous species. At the same time, the lake is large enough to influence local weather and shape shorelines with powerful waves.

Indigenous Peoples have been the original caretakers of the Lake Ontario basin. Indian Nations, First Nations, and Métis communities draw material sustenance, cultural identity, and spiritual strength from these waters and surrounding lands. Their stewardship and knowledge remain essential to understanding and protecting the lake today, and the Lake Ontario LAMP affirms this continuity of responsibility and respect.

Binational efforts to safeguard Lake Ontario, the Niagara River, and the St. Lawrence River to the international boundary (herein after Lake Ontario) are outlined in the [2012 Great Lakes Water Quality Agreement \(GLWQA\)](#), in which Canada and the United States pledged to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes and acknowledge that the quality of the Waters of the Great Lakes may affect the quality of the waters of the St. Lawrence River downstream of the international boundary. The 2023–2027 Lake Ontario Lakewide Action and Management Plan (LAMP) fulfills this commitment by assessing the lake’s condition, identifying key environmental threats, setting research and monitoring priorities, and outlining actions to restore and protect the ecosystem. As assessed in the 2022 State of the Great Lakes (2022 SOGL), the [overall status](#) of the Lake Ontario basin ecosystem is in “Fair” condition. While eight ecosystem indicators are classified as “Good” or



**Figure ES-1.** Status of Lake Ontario in relation to the GLWQA Nine General Objectives (ECCC and EPA, 2022).

“Fair,” one remains in “Poor” condition, reflecting persistent and emerging challenges. Threats include legacy and emerging chemical contaminants, nutrient and bacterial pollution, invasive species, and habitat loss and degradation. Changes in physical conditions compound these pressures, with rising water temperatures, reduced ice cover, and increasingly intense precipitation events altering the lake’s ecological balance.

To address these challenges, the Lake Ontario Partnership—which is a collaborative team of natural resource managers led by the governments of the U.S. and Canada, in cooperation and consultation with State and Provincial Governments, Tribal Governments, First Nations, Métis and watershed management agencies—has developed 80 specific actions that align with the nine General Objectives of the GLWQA. They are designed to respond directly to the most pressing threats, including reducing chemical and nutrient pollution, combating invasive species, conserving habitats, and addressing other threats. Success depends not only on government programs and scientific interventions but also on meaningful collaboration with academic institutions, non-governmental organizations, and local communities.

The actions identified in this LAMP are designed to:

- Reduce legacy and emerging toxic chemicals that continue to drive fish consumption advisories in some areas, as well as land-based stressors from urban and agricultural runoff.
- Reduce excess nutrient inputs, which fuel toxic and nuisance algal blooms, including cyanobacteria, contributing to hypoxia, loss of aquatic biodiversity, and stress on fish and invertebrate communities.
- Reduce loss of habitat and species, which decreases ecosystem productivity and resiliency.
- Reduce impacts from invasive species that alter habitat and nutrient cycling.
- Reduce other substances, materials, and conditions that negatively impact the chemical, physical, or biological integrity of the lake and basin.

The Lake Ontario Partnership will track and report on progress annually, adjust actions based on new science and Indigenous Knowledge, and continue to invite participation from communities across the basin.

The LAMP emphasizes that every sector of society has a role to play in safeguarding Lake Ontario. Partnership agencies have committed to integrating LAMP actions into their programs and investments, and to tracking progress transparently to ensure accountability and continuous improvement. Beyond this institutional leadership, the plan recognizes the impact of grassroots and individual action. Residents, students, community groups, and advocates can support local conservation, reduce pollution, and champion stewardship in tangible ways.

Protecting Lake Ontario requires the combined energy of governments, Indigenous partners, scientists, and public alike. Everyone has a role to play. Whether by restoring natural vegetation along streams, reducing road salt and plastic waste, participating in shoreline cleanups, or supporting local conservation and stewardship organizations, individual and community actions can have a positive impact. **The LAMP’s actions to restore and protect ecosystems will ensure that water quality and economic prosperity go hand in hand.**

**Table ES-1. 2023–2027 Lake Ontario Partnership Management Actions (*Major Highlights - Examples*)**

*Note: This table highlights selected actions. Detailed action tables, with complete agency lists, are provided throughout [Section 2.0 Lakewide Action Plan](#).*

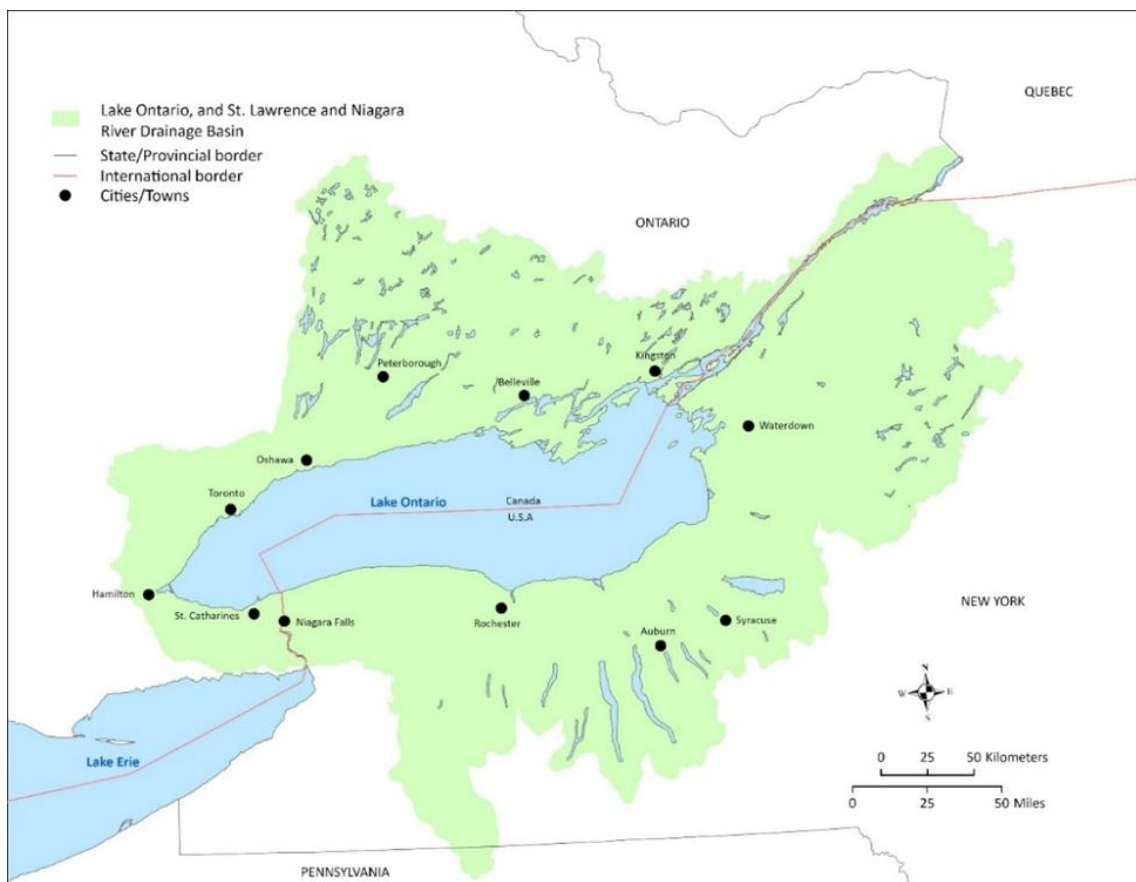
| Major Threat / Focus Area      | 2023–2027 Major Action Highlights                                                                                                                                                                                                                                                                                                                          | Lead / Co-lead Agencies                                                   | GLWQA General Objective |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------|
| Chemical contaminant pollution | Complete or advance contaminated sediment remediation in all Lake Ontario Areas of Concern and other priority nearshore sites; implement Chemicals of Mutual Concern strategies to reduce releases to the lake.                                                                                                                                            | CWA, EPA, MECP, NYSDEC, USACE                                             | iii, iv, viii           |
| Nutrient & bacterial pollution | Reduce phosphorus, nitrogen, and bacterial loadings from priority tributaries and embayments (e.g., Hamilton Harbour, Bay of Quinte) through wastewater upgrades, green infrastructure, and agricultural best management practices; maintain lakewide monitoring of nutrients, harmful algal blooms, and beach water quality to guide adaptive management. | Conservation Authorities, CWA, EPA, MECP, NYSDEC, OMAFA, USACE            | ii, vi                  |
| Loss of habitat & species      | Protect, restore, and connect high-value coastal wetlands, tributaries, and nearshore habitats in Lake Ontario Priority Action Sites and Areas of High Ecological Value; improve tributary connectivity for native fish while maintaining effective Sea Lamprey control.                                                                                   | Conservation Authorities, CWA, DFO, MNR, USFWS, NYSDEC, USACE             | v                       |
| Invasive species               | Maintain Sea Lamprey at or below target levels; implement the binational Invasive Carp Action Plan and other prevention measures; strengthen early detection and rapid response for aquatic and terrestrial invasive species at high-risk locations across the basin.                                                                                      | DFO, EPA, MNR, NYSDEC, USACE, USFWS, USGS (with Annex 6 partners)         | vii                     |
| Other threats                  | Advance science and source-reduction measures for plastics and microplastics, chloride, and other emerging stressors; reduce cumulative nearshore stress and protect areas of high ecological value through targeted work (e.g., living shorelines, wetland and riparian restoration, flood-resilient design).                                             | Conservation Authorities, CWA, ECCC, EPA, MECP, NOAA, NYSDEC, USACE, USGS | ix                      |

## 1.0 Introduction

The 2023-2027 Lake Ontario Lakewide Action and Management Plan (LAMP) is a binational, five-year ecosystem-based strategy to restore and protect Lake Ontario water quality. It follows the successful implementation of the 2018-2022 LAMP, where 17 government agencies undertook actions in cooperation with over 100 other organizations, communities, and academic institutions.

The Lake Ontario LAMP fulfills the United States of America (U.S.) and Canadian commitments under the 2012 Great Lakes Water Quality Agreement (GLWQA, 2012) by assessing ecosystem conditions, identifying environmental threats, setting research and monitoring priorities, and determining further actions for governments and the public. These commitments include integrating nearshore assessment information into lakewide management.

The LAMP is a model for cooperation among governmental jurisdictions and their management agencies. As illustrated in Figure 1, the geographic scope of this LAMP includes activities in the waters of Lake Ontario, the Niagara River, and the St. Lawrence River to the international boundary, including tributaries and watersheds as they impact the waters of Lake Ontario. The LAMP is a resource for anyone interested in the Lake Ontario basin ecosystem, its water quality, and actions to protect this extraordinary Great Lake.



**Figure 1.** Map of Lake Ontario and its watershed. Under the GLWQA, the waters of Lake Ontario include Lake Ontario, the Niagara River, and the St. Lawrence River to the international border (ECCC, 2023).

## 1.1 Lake Ontario Partnership

The Lake Ontario Partnership is a binational collaborative team of agencies and organizations working to protect and restore the lake. It is co-led by the Canada Water Agency (CWA) and the U.S. Environmental Protection Agency (EPA), in cooperation with provincial and state governments, Indian Nations, First Nations, and Métis governments and organizations, municipal governments, watershed management agencies, and other local public agencies (see Acknowledgements for a list of members).

The Partnership is guided by a Management Committee of senior leaders from Canadian and U.S. agencies with decision-making authority for Great Lakes programs and investments. The Management Committee sets the overall direction for the Lake Ontario Lakewide Action and Management Plan (LAMP) and endorses priorities.

Coordination is undertaken by a binational Working Group, supported by technical work groups, science committees, and coordination teams focused on key themes such as water quality, habitat and species, coastal resilience, and public engagement. These teams coordinate efforts and engage stakeholders and the public to identify research, monitoring, and other science priorities for the assessment of current and future potential threats to water quality, and for the identification of priorities to support actions.

## 1.2 Engagement in LAMP Development

Engagement, collaboration, and active participation by all levels of government, Indian Nations, First Nations, Métis, non-governmental organizations, and members of the public are essential to the development and implementation of the Lake Ontario LAMP. The Partnership member agencies funded or collaborated with more than 100 communities, organizations, and institutions to implement the 2018–2022 LAMP, and the results of these efforts inform this LAMP.

For the 2023–2027 LAMP, the Lake Ontario Partnership coordinated the 2021 State of Lake Ontario Conference, a 2021 workshop to identify science priorities, and ongoing public webinars. The Partnership issued a notice inviting early input on the new LAMP. U.S. and Canadian Governments conducted a review of the operation and effectiveness of the GLWQA in 2024 and identified the development and publication of LAMP documents as an area of improvement. A shortened LAMP format is a result of those efforts. A public review of the draft 2023–2027 Lake Ontario LAMP provided further opportunity for feedback and helped shape the final LAMP.

## 1.3 State of the Great Lakes Reporting

Canada and the United States assess the State of the Great Lakes (SOGL) using nine ecosystem indicators and 40 sub-indicators, updated every three years with input from hundreds of scientists and experts. For Lake Ontario, the [2022 SOGL](#) report concluded that the overall status of the lake was **Fair**, with a trend of **Unchanging to Improving**.

In relation to the nine General Objectives of the GLWQA, most indicators show generally stable conditions. Lake Ontario remains a **Good** source of high-quality drinking water, and monitored beaches typically support **Good** conditions for swimming and recreation. Fish consumption, toxic chemicals, habitat and species, nutrients and algae, and groundwater are assessed as **Fair**, reflecting ongoing issues such as legacy contaminants, altered food webs, nutrient imbalances, coastal habitat loss, and elevated chloride levels. Invasive species are assessed as **Poor**, indicating continued significant impacts on habitats and the food web.

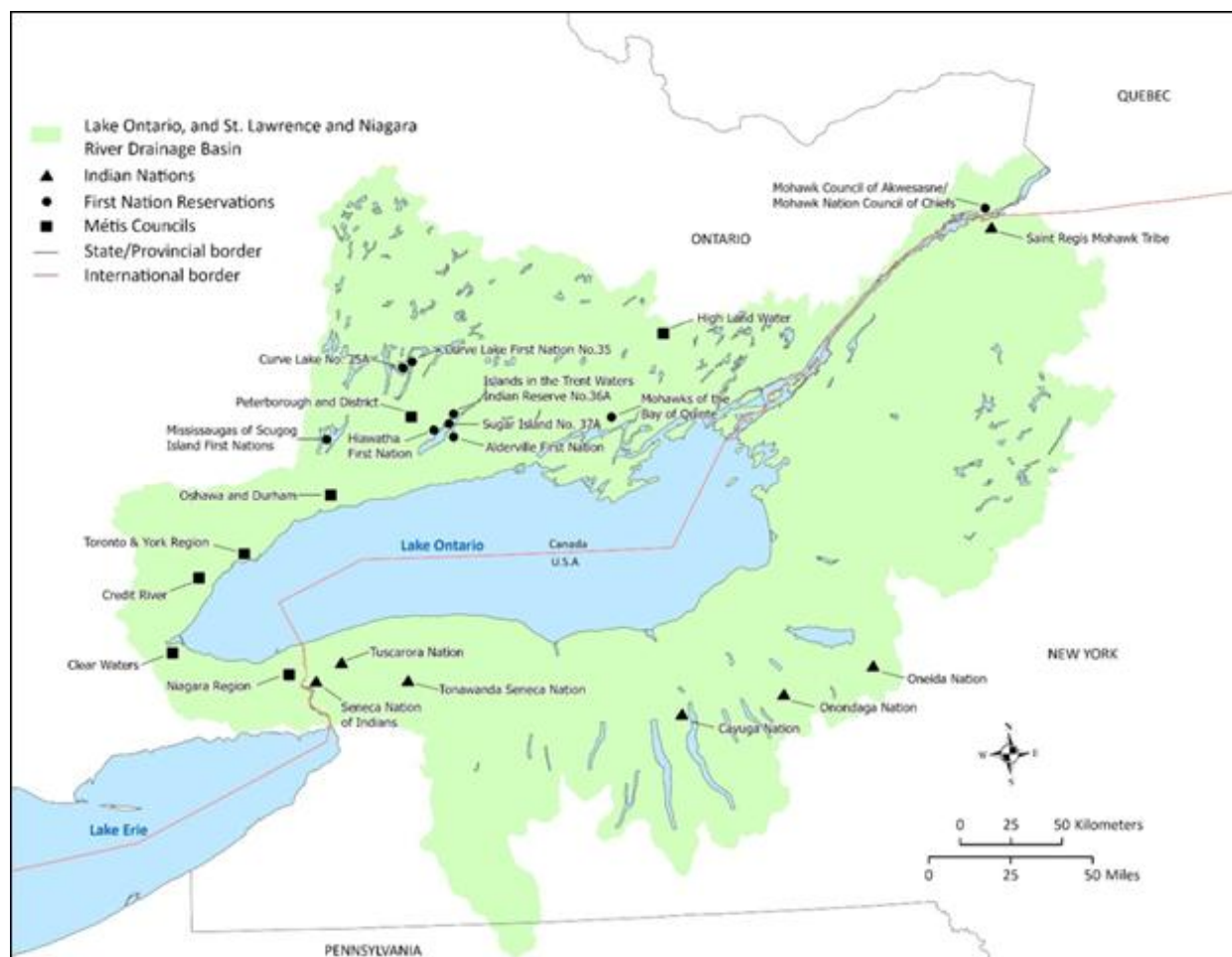
Detailed lakewide and indicator-specific results, including sub-indicator data and trends, are available on [binational.net](https://binational.net).

## 1.4 Indigenous Peoples

First Nations and Indian Nations have deep, longstanding relationships with Lake Ontario, grounded in thousands of years of stewardship, use, governance, and responsibility in relation to the basin's lands and waters. The lake

and its tributaries have sustained communities with food, medicines, transportation routes, and places for ceremony, governance, and trade. The name “Ontario” itself is derived from the Mohawk word “Oniatari:io,” often translated as “Beautiful Lake,” and Toronto from “Tkaronto,” “the place in the water where the trees are standing,” reflecting the central role of these waters in Indigenous life and languages.

Today, the Lake Ontario basin remains home to Indigenous communities of diverse nations and groups, including Anishinaabe, Haudenosaunee, and Métis peoples. Their inherent rights, Treaty Rights, laws, and governance systems continue to shape how they care for the lake and its tributaries. Access to healthy waters, wetlands, fisheries, and shorelines is vital for cultural continuity, harvesting, ceremony, and community well-being.



**Figure 2.** Map of Indian Nation communities, First Nation communities and Reserve Lands, and Métis Nation Councils in the Lake Ontario basin (ECCC, 2023).

Indigenous knowledge—complex, place-based knowledge systems rooted in the worldviews and laws of Indian Nations, First Nations, and Métis—plays an essential role in understanding and caring for Lake Ontario. [Traditional Ecological Knowledge \(TEK\)](#), as one expression of these systems, offers detailed insights into environmental change, species, and relationships among water, land, and all beings. TEK is an independent and sovereign knowledge system that may only be shared at the discretion of Indigenous knowledge holders and in accordance with their protocols.

The Lake Ontario Partnership recognizes the importance of Indigenous-led stewardship and co-development of science and actions under the LAMP. Indigenous governments and organizations help assess lake status, identify priorities, and shape management actions, including through ongoing work under the GLWQA to support better

and respectful engagement of TEK and Indigenous knowledge in Great Lakes research, monitoring, and decision-making.

## 2.0 Lakewide Action Plan

The actions included in the LAMP respond to, and are categorized by, the significant threats that are affecting one or more of the GLWQA's General Objectives, specifically: chemical contaminant pollution; nutrient and bacterial pollution; invasive species; loss of habitat and species; and other potential threats. Government agencies, Indigenous peoples, stakeholders, and the public all play an important role in implementing the actions identified in the LAMP.

### 2.1 Chemical Contaminant Pollution

This section summarizes scientific information about Lake Ontario water quality related to chemical concentrations, current chemical contaminant threats, and corresponding actions to be taken by Lake Ontario Partnership agencies in the 2023-2027 timeframe, and actions everyone can take. Information is aligned to assess the related General Objectives of the GLWQA, specifically drinking water, human consumption of fish and wildlife, pollutants that could harm people and wildlife, and the impacts of contaminated groundwater.

Decades of government action, remediation of contaminated sites and Areas of Concern, and changes in industrial practices have led to significant declines in many legacy toxic chemicals in air, water, sediment, fish, and wildlife. However, challenges remain, including legacy contaminants that persist in sediments and food webs, chemicals of mutual concern (CMCs), and contaminants of emerging concern (CECs).

Chemical contaminants in water, fish, wildlife, and sediments pose risks to Indian Nations, First Nations, and Métis, whose rights, cultures, and ways of life are closely tied to harvesting from the land and waters. Contamination can affect not only physical health but also cultural continuity, language, and spiritual practices. There is no complete cultural or nutritional substitute for traditional foods, and fish consumption advisories cannot fully address these impacts. Some groups, including people who are pregnant or may become pregnant, infants, and young children, may be affected by contaminants at lower exposure levels than the general population. This underscores the need for clear, accessible, and culturally responsive communication about advisories and practical risk-reduction options.

#### 2.1.1 Objectives and Condition Overview

Four of the nine GLWQA General Objectives apply to the management of chemical contaminant pollution such that the Waters of Lake Ontario should:

- i. be a source of safe, high-quality drinking water.*
- iii. allow for human consumption of fish and wildlife, unrestricted by concerns due to harmful pollutants.*
- iv. be free from pollutants in quantities or concentrations that could be harmful to human health, wildlife, or aquatic organisms, through direct exposure or indirect exposure through the food chain.*
- viii. be free from the harmful impact of contaminated groundwater.*

The 2022 SOGL assessments for Lake Ontario indicate that:

- [Treated drinking water](#) and [toxic chemicals in herring gull eggs](#) are in **Good** condition.
- [Contaminants in edible fish](#), [sediment](#), [open water](#), [whole fish](#), and [toxic chemicals in the atmosphere](#) are in **Fair** condition.
- Most sub-indicators show **Unchanging** or **Improving** trends.

Lake Ontario continues to be a reliable source of high-quality treated drinking water, and fish remain a nutritious food source when eaten in accordance with advisories. Groundwater and several ecosystem components are still impacted by contaminants, particularly in more urban and industrialized parts of the basin.

### 2.1.2 Drinking Water

Municipal drinking water facilities in Canada and the U.S. routinely monitor source and treated water for a wide range of inorganic, organic, microbial, and radiological contaminants. Authorities such as the U.S. [Safe Drinking Water Act](#) and the [Ontario Safe Drinking Water Act](#) set the basis for health-based limits and require corrective action when those limits are exceeded.

According to the 2022 SOGL assessment, treated drinking water from Lake Ontario is assessed as **Good**. Potential threats include over-application of fertilizers and pesticides, runoff and combined sewer overflows during heavy rain events, malfunctioning septic systems, spills of industrial or hazardous materials, and atmospheric deposition.

### 2.1.3 Fish and Wildlife Consumption

Partners monitor persistent, bioaccumulative, and toxic substances in fish and wildlife to assess risks to people who consume them. Consumption advisories are issued to protect human health.

Contaminants in edible fish are assessed as **Fair** with **Improving** trends in 2022 SOGL. PCBs and mercury, the primary pollutants driving consumption advisories, have declined markedly since the 1970s. However, contaminants in fish tissue still warrant fish consumption advisories for some species and locations. The contaminants in fish and wildlife can disproportionately affect Indigenous communities and other subsistence fishers who rely on these resources for cultural, spiritual, and nutritional reasons, as well as sensitive populations. However, Lake Ontario fish remain a valuable food source when consumed in accordance with the appropriate advisories.

### 2.1.4 Chemical Contaminants

Long-term monitoring supporting SOGL 2022 shows that toxic chemicals monitored in Lake Ontario are assessed as **Fair**.

Key sources and pathways of chemical contaminants include:

- Inputs to the Niagara River.
- Unremediated contaminated sediments in AOCs and other depositional areas.
- Atmospheric deposition
- Urban and industrial runoff delivering PAHs, metals, and other contaminants.
- Nonpoint sources such as agricultural runoff, road dust, and stormwater.

### 2.1.5 Contaminated Groundwater

Groundwater monitoring programs in Ontario and New York track groundwater quality in monitoring wells across the basin. Groundwater quality in the Lake Ontario basin is assessed as **Fair**, with trends currently **Undetermined** in SOGL 2022. Approximately one-third of monitored wells show good quality, one-third fair, and one-third poor. Median chloride concentrations are the highest among the Great Lakes basins, tied to widespread use of road salt; nitrate levels are moderate. Leaking septic systems, landfills, and other sources are pathways for nutrients, salts, metals, and pesticides to contaminate groundwater. Given groundwater connections to streams, wetlands, and

nearshore areas, the contamination of groundwater is a potential pathway for pollutant loadings over long periods, which can mask improvements from surface-water management efforts.

#### **2.1.6 Actions Table**

The following actions will be taken and/or continued in the Lake Ontario basin to further prevent and reduce chemical contaminant pollution and to track progress through science and monitoring, as listed in Table 1.

**Table 1: Actions to Prevent and Reduce Chemical Contaminant Pollution and Track Progress.**

*Note: Bulleted items under the main actions in this table are not necessarily inclusive of all actions that the Lake Ontario Partnership could implement. Partner agencies are listed in alphabetical order.*

| # | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Agencies Involved                                | General Objective |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------|
| 1 | <p>Implement and enhance existing programs to control and reduce sources of chemical pollution to air, water, soil, and sediment:</p> <ul style="list-style-type: none"> <li>• Continue to implement existing pollution prevention programs;</li> <li>• Develop best management practices to identify contaminant pathways and reduce impacts to tributaries and the lake;</li> <li>• Conduct source track down of chemical contaminants to prevent and mitigate impacts; and</li> <li>• Undertake, support, and/or promote innovative approaches and technologies to reduce chemical releases.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CWA, ECCC, EPA, MECP, NYSDEC, USACE              | iv                |
| 2 | Contribute to the implementation of actions identified in existing and future Chemicals of Mutual Concern (CMCs) binational strategies within the Lake Ontario basin.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | CWA, ECCC, EPA, MECP, NYSDEC, USACE, USFWS       | iv                |
| 3 | <p>Advance remediation of contaminated sediments in Lake Ontario's Areas of Concern (AOC) including, but not limited to:</p> <ul style="list-style-type: none"> <li>• Initiate the last stage of the Hamilton Harbour Randle Reef Sediment Remediation to cap the facility and complete the project (Canada).</li> <li>• Continue dredging in Port Hope Harbour (Canada).</li> <li>• Monitor recovery of contaminated sediment in Niagara River AOC at Lyons Creek East and evaluate options for further management of contaminated sediment (Canada).</li> <li>• Monitor recovery of contaminated sediment in the St. Lawrence River (Cornwall/Akwesasne) AOC and measure sediment stability to support predictions on how extreme weather events may affect natural recovery (Canada).</li> <li>• Continue to implement contaminated sediment remediation at the St. Lawrence River at Massena/Akwesasne AOC (U.S.).</li> <li>• Continue to implement contaminated sediment remediation at the Niagara River AOC (U.S.).</li> <li>• Continue to implement contaminated sediment remediation at source areas impacting the Eighteen Mile Creek AOC (U.S.).</li> </ul> | CWA, EPA, MECP, NOAA, NYSDEC, SRMT, USACE, USFWS | iv                |

| # | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Agencies Involved                                 | General Objective |
|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------|
| 4 | <p>Pursue site-specific remedial actions where needed to address priority legacy chemical pollutants in sediment, soil, groundwater, and surface water:</p> <ul style="list-style-type: none"> <li>• Develop a Sediment Management Plan for implementation in 2027 in Kingston Inner Harbour.</li> <li>• Implement federal, state, provincial, and, as appropriate, Indian Nation, First Nation, and Métis baseline remediation activities, e.g., U.S. Superfund site remediation.</li> <li>• Implement the Whitby Harbour and Pringle Creek Remediation Project.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DFO, ECCC, EPA, MECP, NYSDEC, PCA, USACE          | iv, viii          |
| 5 | <p>Collect data to support continued updates to and, where needed, the development of fish and wildlife consumption advisories and guidance.</p> <ul style="list-style-type: none"> <li>• Work with First Nations, Métis, and Indian Nations to fill consumption and contaminant data gaps on fish species of interest.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Conservation Authorities, MECP, MNR, NYSDEC, SRMT | iii               |
| 6 | <p>Continue efforts to monitor and assess sources, fate, transport, distribution, exposure, and effects of CMCs, contaminants of emerging concern, legacy chemicals, and trace metals in various media (air, water, sediments, fish, mussels, and wildlife) with a focus on chemicals with potential for trophic transfer and bioaccumulation in nearshore and offshore waters of the lake. Activities include, but are not limited to:</p> <ul style="list-style-type: none"> <li>• Long-term monitoring of CMCs to determine concentrations and trends;</li> <li>• Determination of how shifts in Lake Ontario's food web and invasive species affect contaminant trophic transfer;</li> <li>• Determination of the spatial variation of mercury, PCB, and PFAS concentrations in Lake Ontario fish;</li> <li>• Investigation of contaminant bioavailability, cycling, and movement;</li> <li>• Assessment of spatial and temporal trends of contaminants in water, sediment, and biota to inform source tracking and control efforts; and</li> <li>• Monitoring of chemicals found in Lake Ontario water and fish to provide early warning for chemicals that could become CMCs.</li> </ul> | CWA, ECCC, EPA, MECP, NYSDEC, USACE, USFWS, USGS  | iv                |
| 7 | <p>Undertake and promote monitoring and research to improve understanding of groundwater-surface water interactions and their influence on water quality and ecosystem health in the lake, including the development of surface and groundwater conceptual and numerical models.</p> <ul style="list-style-type: none"> <li>• Advance integrated modeling frameworks that quantify hydrologic and biogeochemical processes for sub-watersheds and principal aquifers in the Lake Ontario Basin.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ECCC, MECP, USGS                                  | viii              |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                  | Agencies Involved                          | General Objective |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------|
| 8  | Determine whether microplastics are significant vectors for inter- and intra-basin transport of chemical contaminants and for bioaccumulation.                                                                                                                                         | ECCC, MECP, USGS                           | iv                |
| 9  | Advance knowledge on the extent to which harmful chemicals are released from products at the end of the product lifecycle.                                                                                                                                                             | CWA, ECCC, MECP                            | iv                |
| 10 | Conduct outreach and education to the public on the impacts and use of chemical contaminants with a focus on: <ul style="list-style-type: none"> <li>• Harmful chemicals in consumer and household products;</li> <li>• Contaminant pathways to fish, wildlife, and humans.</li> </ul> | ECCC, EPA, MECP, NYSDEC, SRMT, USACE, USGS | iii, iv           |
| 11 | Support efforts to develop and share information, including TEK-based information, regarding the consumption of Lake Ontario fish, wildlife, and harvested plant resources (including consumption advisories and guidance issued by health authorities) to Lake Ontario communities.   | EPA, MECP, NYSDEC                          | iii, iv           |
| 12 | Support efforts to build capacity for Métis, Indian Nations, and First Nations to address toxic chemical contamination of species of cultural significance through TEK and other culturally appropriate means.                                                                         | ECCC, EPA, MECP                            | iii, iv           |
| 13 | Work with key industrial sectors to develop, support, and enhance programs and best management practices that reduce the release of harmful chemicals.                                                                                                                                 | EPA, MECP, NYSDEC, USACE                   | iv                |
| 14 | Work with small and medium-sized enterprises and facilities that discharge to municipal sewer systems and wastewater treatment plants (WWTP) to reduce their inputs of harmful chemicals.                                                                                              | EPA, MECP, NYSDEC                          | iv                |
| 15 | Conduct outreach and education to encourage individuals to take action to help prevent and reduce the introduction of chemical contaminants to the basin and lake.                                                                                                                     | ECCC, EPA, MECP, NYSDEC                    | iv                |

### 2.1.7 Actions everyone can take

Everyone in the Lake Ontario basin can help reduce chemical contaminant pollution by:

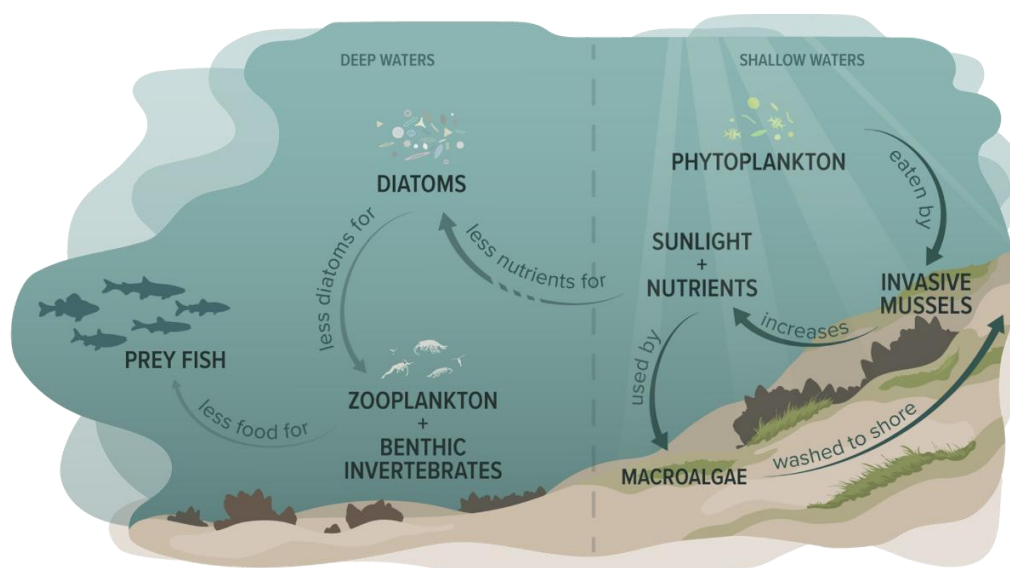
- **Safely disposing of chemicals and medicines** at household hazardous waste and pharmaceutical take-back programs; never pouring them down drains or storm sewers.
- **Reducing winter salt use** on driveways and sidewalks and considering alternatives where appropriate.
- **Following local fish consumption advisories** and sharing this information with family and community members, especially those who fish frequently.
- **Choosing products and practices that use fewer harmful chemicals.**
- **Supporting local source-water protection, AOC remediation, and stewardship initiatives.**

These collective actions, alongside the regulatory and program commitments of governments and partners, will help to reduce chemical contaminants further and protect Lake Ontario as a source of safe drinking water, healthy fish and wildlife, and vibrant communities.

## 2.2 Nutrient and Bacterial Pollution

This section summarizes scientific information on Lake Ontario's nutrient and bacterial pollution, current threats, and actions to be taken by Lake Ontario Partnership agencies within the 2023-2027 timeframe, as well as actions everyone can take. Information is aligned to assess the two related General Objectives of the GLWQA; specifically, that the waters are to be free from nutrients that promote unsightly or toxic blooms, and that the waters allow for unrestricted swimming and other recreational use.

Nutrients, particularly phosphorus, are essential to the lake's food web. They support the growth of algae and aquatic plants that feed zooplankton, benthic invertebrates, and fish. However, too many nutrients, particularly in nearshore areas, can fuel nuisance and harmful algal growth, while too few nutrients can limit productivity and affect the fishery. Likewise, bacterial contamination can temporarily restrict public use of beaches and shorelines, even when long-term conditions are generally good.



**Figure 3.** Dreissenid mussels act as ecosystem “filters”, redirecting nutrients and energy from the open water to the lakebed—clearing the water column, starving zooplankton, and reshaping the Lake Ontario food web (CWA).

### 2.2.1 Objectives and Condition Overview

Two of the nine GLWQA General Objectives are addressed in this section. These objectives state that the waters of Lake Ontario should:

- ii. allow for swimming and other recreational use, unrestricted by environmental quality concerns; and*
- vi. be free from nutrients that directly or indirectly enter the water as a result of human activity, in amounts that promote growth of algae and cyanobacteria that interfere with aquatic ecosystem health, or human use of the ecosystem.*

The 2022 SOGL indicators for nutrients in lakes, harmful algae, *Cladophora*, and beach advisories show a range of conditions for Lake Ontario. Past actions have substantially reduced nutrient levels helping address widespread eutrophication and nearshore algal blooms; however, offshore phosphorus levels are now low enough to raise concerns about food web productivity and impacts to the recreational fishery. At the same time, beaches are open and safe for swimming most of the time, while localized nutrient hotspots, nuisance *Cladophora* growth, episodic harmful algal blooms, and bacterial contamination continue to affect water quality, aesthetics, and recreation in some nearshore and embayment areas.

### 2.2.2 Nutrient Pollution

The waters of the Great Lakes should be free of excess nutrients that enter the water, directly or indirectly, from human activity, in amounts that promote the growth of algae and cyanobacteria that interfere with aquatic ecosystem health or human use. Nutrients such as Phosphorus are still needed to support a robust and resilient aquatic ecosystem including the pelagic food web and recreational fishery.

Binational monitoring programs track nutrient conditions in offshore, nearshore, and tributary waters.

Environment and Climate Change Canada (ECCC) and the U.S. Environmental Protection Agency (EPA) monitor offshore total phosphorus (TP); Ontario's Ministry of the Environment, Conservation and Parks (MECP), New York State agencies, Conservation Authorities, and the U.S. Geological Survey (USGS) monitor tributaries and nearshore waters. These data and other modelling tools such as SPARROW are used to estimate phosphorus loads and help attribute loads to sources across the watershed and from upstream Great Lakes.

The SOGL 2022 assessments classify [Nutrients](#) in Lake Ontario as **Fair** with an **Unchanging** 10-year trend. Offshore TP has declined from eutrophic levels in the 1970s to approximately 5 µg/L, well below the GLWQA Annex 4 interim objective of 10 µg/L. In contrast, some nearshore zones and embayments (for example, Hamilton Harbour, the Bay of Quinte, and Sodus Bay) still experience elevated nutrients, contributing to harmful algal blooms, hypoxia, and nuisance algal mats. Harmful algal blooms remain relatively limited in extent across Lake Ontario as a whole. Most years, only a small percentage of the nearshore experiences detectable blooms, and the [Harmful Algal Blooms](#) sub-indicator is assessed as **Good** with an **Unchanging** trend in SOGL 2022. However, local blooms can still pose risks to people, pets, and wildlife, especially in nutrient-rich embayments.

The presence of Zebra and Quagga Mussels has altered nutrient cycling and water clarity, shunting nutrients to the nearshore and the lake bottom, where they fuel benthic macroalgae such as *Cladophora*. The [Cladophora](#) 2022 SOGL sub-indicator is assessed as **Poor** due to widespread nuisance growth, although trends remain **Undetermined** because of limited long-term data.

Key drivers of nutrient pressures on Lake Ontario include:

- **Urban stormwater and wastewater:** discharges from WWTPs, storm sewers, and combined sewer overflows in highly urbanized areas, particularly at the western end of the lake.
- **Agricultural runoff:** excess application of fertilizers and manure, soil erosion, and tile drainage that deliver phosphorus and nitrogen to tributaries.

- **Septic systems:** poorly sited, aging, or poorly maintained systems that leach nutrients to groundwater and nearshore waters.
- **Upstream sources:** substantial phosphorus loads delivered from Lake Erie and the upper Great Lakes through the Niagara River.
- **Invasive Dreissenid mussels:** increased water clarity, nutrient retention, and recycling in the nearshore, which promote *Cladophora* growth and can help create conditions for localized cyanobacterial blooms.
- **Shifts in weather and runoff patterns:** more frequent and intense rain and storm events that increase runoff and erosion, along with longer warm-water seasons that extend the growing period for algae.

Together, these pressures create a dual challenge for Lake Ontario managers: reducing nutrient enrichment and harmful and nuisance algal growth in nearshore hotspots and embayments, while understanding and addressing low nutrient conditions and altered productivity in the offshore.

### 2.2.3 Bacterial Pollution

Bacterial pollution in Lake Ontario is managed so that most monitored beaches are open and safe for swimming most of the season. However, localized beach closures or postings still occur after heavy rain or in areas with chronic sources. The GLWQA objective is that water should allow swimming and other recreation, without being restricted by environmental quality concerns. Provincial, state, and local agencies sample recreational beaches for indicator bacteria, such as *Escherichia coli* (*E. coli*) and enterococci, and issue advisories or closures when results exceed health-based thresholds.

As summarized in the 2022 SOGL [Beach Advisories](#) sub-indicator, conditions for Lake Ontario are rated **Good** with an **Improving** trend: monitored Canadian beaches were open for 90% of the season, and monitored U.S. beaches were open an average of 95% of the season. Even so, the Canadian [Nearshore Assessment](#) identified that some stretches of Ontario's shoreline experienced postings more than 40% of the time in July and August, often following heavy rainfall.

Key sources of bacterial contamination include failing or poorly maintained septic systems in rural and shoreline areas; agricultural runoff from fields treated with manure or fertilizers; combined sewer overflows and stormwater discharges in urban centres; and direct inputs from wildlife such as gulls and geese at popular beaches. Decaying algal mats, vegetation, and debris accumulating along the shore can also harbour *E. coli* and other pathogens, contributing to elevated bacterial levels in beach sand and nearshore waters.

While long-term trends show improvement, actions targeting management of runoff from intense rain events is needed to reduce the frequency and duration of bacterial exceedances in some locations. Continued infrastructure upgrades, green stormwater solutions, better septic system management, and targeted local actions should protect beach water quality and recreational use.

### 2.2.4 Actions Table

The following actions will be taken and/or continued in the Lake Ontario basin to address nutrient and bacterial pollution as listed in Table 2.

**Table 2: Actions to Prevent Nutrient and Bacterial Pollution and Track Progress.**

*Note: Bulleted items under the main actions in this table are not necessarily inclusive of all actions that the Lake Ontario Partnership could implement. Partner agencies are listed in alphabetical order.*

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Agencies Involved                                             | General Objective |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|-------------------|
| 16 | <p>Wastewater and Stormwater Management Systems/Facilities:</p> <ul style="list-style-type: none"> <li>• Promote compliance and enforcement of regulations to control stormwater and end-of-pipe pollutant discharge.</li> <li>• Implement or support implementation of water quality improvement projects, including upgrades/optimization of wastewater and stormwater facilities and infrastructure.</li> <li>• Inventory and assess stormwater and wastewater treatment and management infrastructure to inform prioritization of upgrades and maintenance in the Lake Ontario basin.</li> <li>• Update existing Ontario wastewater policies and develop a new stormwater management policy to improve water quality and reduce nutrient load.</li> <li>• Improve monitoring and reporting of sewage overflows and bypasses.</li> <li>• Implement best management practices for the storage and treatment of urban stormwater runoff to the Great Lakes, using green infrastructure, low-impact development, and nature-based solutions where feasible.</li> <li>• Minimize the impact of septic systems on the lake and tributaries. <ul style="list-style-type: none"> <li>○ Evaluate septic flow – pathways, volume, and pollutant load - reaching streams in Lake Ontario sub-watersheds.</li> <li>○ Promote proper septic design, maintenance, and operation through initiatives like <a href="#">the EPA's Septic Smart Program</a>.</li> </ul> </li> <li>• Implement and utilize the <a href="#">NYS Septic System Replacement Fund</a> in eligible counties and watersheds in the Lake Ontario Basin.</li> <li>• Where feasible and appropriate, and there is local community support, install central sewers and/or onsite cluster systems to replace failing septic systems in high-density areas.</li> </ul> | Conservation Authorities, ECCC, MECP, NYSDEC, PCA, USACE, EPA | vi                |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Agencies Involved                                                                  | General Objective |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------|
| 17 | <p>Nutrient and Bacterial Load Reduction:</p> <ul style="list-style-type: none"> <li>Continue efforts to improve soil health and reduce overland runoff and subsoil/subsurface migration and travel of nutrients and bacteria to groundwater, tributaries, and the lake.</li> <li>Implement/install agricultural conservation practices in AOC, GLRI, and other priority watersheds, e.g., the Genesee River Basin, the Finger Lakes, and Black River watersheds in the U.S. and Hamilton Harbour and the Bay of Quinte watersheds in Canada.</li> <li>Promote participation in the NYS Agricultural Environmental Management (AEM) program with an emphasis on unregulated farms in priority areas.</li> <li>Collaborate with soil health partners to implement actions in Ontario's Agricultural Soil Health and Conservation Strategy.</li> <li>Increase implementation of green infrastructure practices to infiltrate stormwater runoff.</li> <li>Implement projects such as those through the NYS WQIP and AgNPS programs, Alternative Land Use Services (ALUS) Rural Water Quality Program, and the Western Lake Ontario Land to Lake Initiative.</li> </ul> | Conservation Authorities, CWA, ECCC, MECP, NYSDEC, OMAFA, USACE, USDA-NY NRCS, EPA | vi                |
| 18 | <p>Continue to implement AOC remedial action plans and develop delisting monitoring plans to address the eutrophication, undesirable algae, and beach closures BUIs, including:</p> <ul style="list-style-type: none"> <li>Continue development and implementation of a Phosphorous Management Plan in the Bay of Quinte AOC.</li> <li>Continue water quality monitoring until 2024 in the St Lawrence River (Cornwall/Akwesasne) AOC, to support an assessment of the eutrophication and undesirable algae BUI and the development of a local eutrophication strategy.</li> <li>Commission the recently completed upgrades to the Hamilton Harbour Woodward WWTP in 2023 and confirm targets to support decision-making about upgrades for the Dundas WWTP by 2025 for the Hamilton Harbour AOC.</li> <li>Continue implementation of the Wet Weather Flow Master Plan, including the Don River and Central Waterfront Combined Sewer Overflow Project in the Toronto and Region AOC.</li> </ul>                                                                                                                                                                    | Conservation Authorities, CWA, DFO, ECCC, MECP, OMAFA                              | ii, vi            |
| 19 | <p>Watershed Management Planning and Implementation:</p> <ul style="list-style-type: none"> <li>Develop and/or implement Clean Water Plans in New York State according to NY's <a href="#">Vision Approach</a>, including but not limited to: <ul style="list-style-type: none"> <li>Total maximum daily loads (TMDLs)</li> <li>Nine Element (9E) Watershed Management Plans</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Conservation Authorities, CWA, ECCC, MECP, NYSDEC, EPA                             | vi                |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Agencies Involved                    | General Objective |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>○ Integrated Watershed Action Plans</li> <li>○ Harmful Algal Bloom Action Plans and Roadmap</li> <li>○ Drinking Water Source Protection Program Plans</li> <li>○ Alternative Restoration Plans</li> <li>• Continue to implement integrated watershed planning activities in Ontario. <ul style="list-style-type: none"> <li>○ Ensure that watersheds within the Lake Ontario basin have up-to-date watershed plans in place, particularly those in high-growth areas (Western Lake Ontario basin).</li> <li>○ Support projects to identify priority watersheds and facilitate implementation of priority actions identified in the plans. Projects may range from watershed modeling, monitoring, building multijurisdictional consensus, and on-the-ground implementation activities (e.g., the Western Lake Ontario Land-to-Lake Initiative).</li> <li>○ Establish and regularly review Watershed-based Resource Management Strategies in Ontario.</li> </ul> </li> </ul> |                                      |                   |
| 20 | Develop a Canadian Nutrients Strategy for Lake Ontario to address harmful and nuisance algae blooms, including in Areas of Concern and other nearshore areas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CWA, ECCC, MECP                      | vi                |
| 21 | Develop and implement post-delisting monitoring programs for nutrients and bacteria for the portions of Rochester Embayment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | NYSDEC, USGS                         | ii                |
| 22 | <p>Implement nuisance algae and HAB surveillance and monitoring, including the use of public reporting tools.</p> <ul style="list-style-type: none"> <li>• Promote use of the <a href="#">NYSDEC Suspicious Algal Bloom Report Form</a> and the <a href="#">NYSDEC Shoreline Cladophora Survey</a>, and implement the NYSDEC Harmful Algal Bloom Roadmap</li> <li>• Develop and apply in-situ and remote sensing technologies to detect and forecast HABs in nearshore Lake Ontario.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ECCC, MECP, NYSDEC, USACE, EPA, USGS | vi                |
| 23 | Assess the effectiveness of green infrastructure in reducing stormwater pollutant loads in the Lake Ontario basin, for example, use of the <a href="#">Sustainable Technologies Evaluation Program (STEP)</a> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Conservation Authorities, MECP, USGS | vi                |
| 24 | Conduct monitoring and research to support bacterial source identification/tracking to address sources that are influencing closure rates at designated bathing beaches and impacting other areas used for drinking water, contact recreation, fishing, and/or cultural and spiritual practices.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | MECP, NYSDEC, EPA, USGS              | ii, vi            |
| 25 | Monitor recreational beaches for bacterial contaminants at select locations and beaches in the U.S. and Canada using programs and tools such as:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ECCC, MECP, EPA, USGS, NYSDEC        | ii, vi            |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Agencies Involved                                                 | General Objective |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>New York State county beach monitoring programs under the EPA BEACH Act Grant program.</li> <li>Beach monitoring programs at beaches located in New York State Parks.</li> <li>Use of the USGS NowCast system tool at Lake Ontario beaches.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                   |                   |
| 26 | <p>Develop further understanding of how to reduce the risk of excess nutrient loss from the agricultural sector.</p> <ul style="list-style-type: none"> <li>Research and develop innovative approaches and technologies and investigate the efficacy and economic value of new and existing beneficial/best management practices for improved nutrient, soil, and water resource management in agricultural production that will lead to improved water quality.</li> <li>Continue to improve models and tools to assess the risk of losses of excess phosphorus from agricultural landscapes.</li> <li>Continue to conduct Environmental Farm Plan risk assessments and edge-of-field monitoring to assess the effectiveness of agricultural best management practices.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Conservation Authorities, MECP, OMAFA, USDA-NY NRCS, USGS         | vi                |
| 27 | <p>Update and improve understanding of the inputs, fate, and effects of phosphorus load in Lake Ontario's aquatic ecosystem through research and monitoring in the lake and its watershed, including:</p> <ul style="list-style-type: none"> <li>Spring and summer open water nutrient and lower food web surveys;</li> <li>Coordinated and comprehensive year-round monitoring (or other frequency as appropriate) of stream flows and phosphorus loads from priority tributaries;</li> <li>Nearshore water quality monitoring;</li> <li>Determination of Lake Ontario phosphorus flux to embayments and the lake nearshore</li> <li>Investigation of nearshore nutrient dynamics and circulation features in the western basin of Lake Ontario.</li> <li>Determination of the amount of phosphorus sequestered in Dreissena and other benthos</li> <li>Extend seasonal coverage of water quality monitoring in the lake to better understand the impacts of extreme weather and winter storm events on algal growth.</li> <li>Evaluate the role wetlands play in nutrient loading for all four seasons.</li> <li>Conduct groundwater monitoring to gauge groundwater phosphorus and nitrogen load to the lake and its tributaries.</li> </ul> | Conservation Authorities, CWA, ECCC, MECP, NYSDEC, PCA, EPA, USGS | vi                |
| 28 | <p>Develop updated binational estimates of annual phosphorus loads and share with partners to:</p> <ul style="list-style-type: none"> <li>Evaluate the capabilities of modeling tools to represent current nutrient processes as well as to represent the impacts of changing environmental conditions on nutrient dynamics.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Conservation Authorities, CWA, CWA, DFO, ECCC,                    | vi                |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Agencies Involved                                                                      | General Objective |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>Conduct lakewide hydrodynamic, ecosystem, and other types of modeling (such as fisheries modeling) to simulate the effects of various nutrient loading scenarios on the Lake's aquatic ecosystem.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MECP, NYSDEC, EPA, USGS                                                                |                   |
| 29 | <p>Advance understanding of the extent, drivers, and processes contributing to nuisance <i>Cladophora</i> growth in the nearshore:</p> <ul style="list-style-type: none"> <li>Continue binational <i>Cladophora</i> monitoring at designated U.S. and Canadian sentinel sites.</li> <li>Monitor <i>Cladophora</i> growth in nearshore areas and investigate and track <i>Cladophora</i> wash-ups to further understand nuisance conditions and impacts on communities. <ul style="list-style-type: none"> <li>Include the use of citizen science tools such as the <a href="#">NYSDEC Cladophora Survey</a> and the <a href="#">NCCC Visual Assessment Survey Tool (VAST)</a></li> </ul> </li> <li>Undertake, support, and/or promote the use of innovative approaches and technologies to fill spatial gaps and improve the accuracy of nuisance algae monitoring including the use of remote sensing and satellite imagery.</li> <li>Investigate substrate type using bottom mapping to evaluate conditions affecting <i>Cladophora</i> growth.</li> </ul> | CWA, ECCC, MECP, NYSDEC, USGS                                                          | vi                |
| 30 | Investigate the influence of changing weather patterns on nutrient levels and in-lake conditions by deploying buoys.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ECCC                                                                                   | vi                |
| 31 | Conduct public outreach and education on local and regional scales to increase the understanding of water quality conditions and management challenges to address nutrients, nearshore water quality, beach conditions, and best management practices (BMPs), and to advance efforts to implement watershed management plans and to spur individual action to prevent and reduce the introduction of nutrients and bacteria to the basin and lake.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Conservation Authorities, CWA, ECCC, MECP, NYSDEC, OMAFA, PCA, USDA-NY NRCS, EPA, USGS | vi                |
| 32 | Implement training programs for resource managers to advance sustainable land-use planning, including topics such as green stormwater infrastructure, natural heritage system planning, and the management of natural assets.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Conservation Authorities                                                               | vi                |
| 33 | Provide the public with information about septic systems, the importance of their maintenance, and the potential contamination of non-municipal drinking water wells, to protect public health and reduce potential impacts on Great Lakes water quality.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | MECP, NYSDEC, EPA                                                                      | vi                |

### 2.2.5 Actions everyone can take

Everyone who lives, works, or recreates in the Lake Ontario basin can help reduce nutrient and bacterial pollution. Practical actions include:

- **Maintain septic systems:** pump out tanks regularly, repair failing systems, and ensure systems are correctly sized and sited away from shorelines and streams.
- **Use less fertilizer:** test soil, use only what is needed, avoid applying fertilizers or manure before heavy rain, and keep fertilizers off driveways and sidewalks.
- **Plant and protect vegetated buffers** along shorelines, ditches, and streams to absorb runoff, stabilize soils, and filter nutrients and bacteria.
- **Reduce stormwater runoff** from property by directing downspouts to rain gardens or permeable areas, using rain barrels, and minimizing hard surfaces.
- **Pick up pet waste** and dispose of it properly so that bacteria and nutrients do not wash into storm drains and waterways.
- **Avoid feeding gulls and geese** at beaches and waterfronts and support local efforts to manage waterfowl populations humanely.
- **Stay informed about beach advisories and algal blooms**, follow public health guidance, and report suspected blooms or sewage spills to local authorities.

By combining these individual actions with the coordinated efforts of governments, Indigenous partners, municipalities, community groups, and scientists, the Lake Ontario Partnership will continue to protect and improve water quality for swimming, fishing, and the health of the lake's ecosystems.

## 2.3 Loss of Habitat and Species

Lake Ontario water quality depends on the health of the basin's ecosystem. This section summarizes the scientific information about Lake Ontario's habitat and species, current threats, and corresponding actions to be taken by Lake Ontario Partnership agencies in the 2023-2027 timeframe, as well as actions that everyone can take. Information is aligned in response to the habitat and species General Objective of the GLWQA.

Lake Ontario supports a mosaic of habitats, dunes, coastal wetlands, barrier beach complexes, cobble and bedrock shores, coastal forests, islands, tributaries, nearshore waters, and deep offshore areas. These diverse environments provide breeding, feeding, and migratory habitat for fish, birds, amphibians, reptiles, invertebrates, and plants, and underpin important recreational, cultural, and economic activities around the lake.

### 2.3.1 Objective and Condition Overview

One of the nine General Objectives of the GLWQA is addressed in this section. This objective states that the waters of Lake Ontario should:

***v. support healthy and productive wetlands and other habitats to sustain resilient populations of native species.***

The Habitat and Species indicator in the 2022 SOGL report combines information on coastal wetlands, tributaries, and the aquatic food web, with a focus on native species. For Lake Ontario, most sub-indicators are assessed as **Fair** or **Good**, with trends ranging from **Unchanging** to **Improving**. Still, several key components remain **Poor**, notably [Coastal Wetland Plants](#), [Diporeia](#), and [Lake Sturgeon](#).

The 2022 SOGL assessments for Lake Ontario show that:

- **Coastal wetlands:** [fish](#), [amphibians](#), and [birds](#) are generally **Fair** with some **Improving** trends; [plants](#) are **Poor** and **Unchanging**, reflecting widespread dominance of invasive vegetation such as hybrid cattails and *Phragmites*.
- **Tributaries:** [aquatic habitat connectivity](#) is **Fair** and **Improving**, as barriers are removed or mitigated and fish passage projects advance.
- **Aquatic food web:** [phytoplankton](#) and [zooplankton](#) are **Good** and **Unchanging**; [benthos](#) is **Fair** and **Unchanging**, [Diporeia](#) is **Poor** and **Deteriorating**; [native prey fish diversity](#) is **Fair** and **Improving**; [Lake Trout](#) is **Fair** and **Improving**; [Walleye](#) is **Good** and **Unchanging**; [Lake Sturgeon](#) is **Poor** and **Improving**.

Overall, Lake Ontario still supports many healthy native communities. Still, habitats and species are under stress from land-use change, shoreline alteration, invasive species, extreme fluctuations in water levels, changes in nutrient cycling, contamination, and changing physical conditions of the lake. Protecting what remains in good condition while restoring degraded areas is essential to maintaining a resilient ecosystem. More detailed information on indicator methods, status, and trends for Lake Ontario is available in the 2022 SOGL assessment.

### 2.3.2 Loss of Habitat and Species

The waters of the Great Lakes should support healthy and productive wetlands and other habitats to sustain resilient populations of native species.

Across the Lake Ontario basin, habitat and species monitoring is carried out by federal, Indian Nation, First Nations, Métis, provincial, state, and local agencies, as well as academic and community partners. Together, these programs track the condition of coastal wetlands, tributaries, and the aquatic food web, and provide the foundation for the Lake Ontario Partnership's priorities and actions.

Key binational guidance and monitoring efforts include:

- [Lake Ontario Biodiversity Conservation Strategy \(LO BCS, 2009\)](#) and [Implementation Strategy \(2011\)](#): identifies priority biodiversity targets, five major threat categories (incompatible development, invasive species, dams and barriers, nonpoint source pollution, and large-scale environmental change), and 26 Priority Action Sites across the basin.
- [Great Lakes Fishery Commission \(GLFC\) – Lake Ontario Committee \(LOC\)](#): sets Fish Community Objectives, identifies fish habitat priorities, and guides lakewide fisheries management and restoration.
- **Coastal wetland and coastal habitat surveys:**
  - EPA's [Great Lakes Coastal Wetlands Monitoring Program](#) uses standardized methods to assess fish, birds, amphibians, vegetation, macroinvertebrates, and water quality at coastal wetlands around the lake.
  - The [Canadian Baseline Coastal Habitat Survey](#) and [Canadian Nearshore Assessment](#) map coastal habitat, evaluate physical condition, and identify Areas of High Ecological Value along the Lake Ontario, Niagara River, and St. Lawrence River shorelines.
- **Aquatic food web monitoring:** long-term surveillance of phytoplankton, zooplankton, benthos, prey fish, and top predators such as Lake Trout, Walleye, and Lake Sturgeon.

These coordinated efforts reveal a basin that still supports many healthy native communities, but where critical habitats remain fragmented or degraded, and several key species are vulnerable.

## **Coastal wetlands and nearshore habitats**

Coastal wetlands are among the most productive and sensitive habitats in the Lake Ontario ecosystem. They provide spawning and nursery areas for fish, breeding and stopover habitat for birds and amphibians, and essential ecosystem services such as nutrient and sediment retention, shoreline protection, and flood attenuation.

Monitoring results show that coastal wetland fish, amphibians, and birds are responding positively in many locations, with noticeable improvements over the past decade. However, wetlands in heavily developed areas, particularly along the western shoreline, continue to show lower ecological condition than those in less disturbed regions of the lake.

In contrast, coastal wetland plant communities remain highly degraded in many places. Invasive cattails, *Phragmites*, and other non-native species dominate large portions of the wetland zone, displacing native vegetation and reducing structural diversity. This has implications for waterfowl, fish, amphibians, and invertebrates that depend on native wetland mosaics for shelter, foraging, and reproduction.

Survey work along the Canadian shoreline shows that many coastal wetlands are small, isolated, and underrepresented in protected areas, even though they support numerous species at risk and provide high ecological and cultural value. [Nearshore assessments](#) indicate moderate cumulative stress along much of the coast, with hotspots where shoreline hardening, intensive land use, nutrient enrichment, and invasive species overlap.

Shoreline development and armouring (e.g., seawalls, revetments, breakwalls) interfere with natural sediment transport, reduce habitat complexity, and disconnect wetlands and beaches from the processes that sustain them. These changes reduce the ability of shorelines and wetlands to adjust to fluctuating water levels and to increased storm exposure, narrowing habitat for fish, birds, and other wildlife and undermining natural coastal resilience.

## **Tributaries and aquatic connectivity**

Hundreds of rivers and streams flow into Lake Ontario, providing critical habitat for migratory and resident fish, invertebrates, and riparian communities. These tributaries strongly influence nearshore water quality and habitat condition.

Dams, weirs, perched culverts, and other in-stream structures fragment river networks and limit access to spawning, nursery, and rearing habitats. While ongoing barrier removal and fish passage projects have improved connectivity in parts of the basin, only a fraction of historically connected tributary habitat is currently accessible to migratory fishes. Some regions, such as the Bay of Quinte, have a particularly high density of barriers.

Efforts to restore connectivity must carefully balance re-opening migration routes for native and desirable species while maintaining structures that limit upstream spread of invasive Sea Lamprey and other unwanted species. Strategic barrier management, removing, modifying, or replacing some structures and retaining others for biosecurity, will be essential to recovering native fish populations while preventing new ecological damage.

## **Aquatic food web condition**

Lake Ontario's aquatic food web has undergone significant restructuring over recent decades due to changing nutrient conditions, invasive species, contaminants, and habitat pressures.

At the base of the food web, phytoplankton and zooplankton communities generally reflect mesotrophic to oligotrophic conditions. Overall biomass and indicators of condition are stable, but community composition has shifted in response to Dreissenid mussels and other stressors. These changes affect the quantity and quality of food available to prey fish and higher predators.

On the lake bottom, native benthic communities have been transformed by dense Dreissenid mussel populations, which now dominate biomass in many areas. While some measures of benthic condition are stable, *Diporeia*,

formerly a key native prey item, remains at very low densities. This loss has reduced the energy available to some native fish and altered pathways by which nutrients move through the ecosystem.

Among fish, there are encouraging signs and ongoing concerns. Lake Trout and Walleye have responded to decades of coordinated management, including stocking, harvest controls, and habitat improvements. Adult Lake Trout abundance has increased, and natural reproduction has improved in some areas, although wild recruitment remains below desired levels. Walleye populations in places such as the Bay of Quinte and eastern Lake Ontario have stabilized or improved after earlier declines.

Native prey fish diversity has also improved as Alewife dominance has decreased, with native species such as Deepwater Sculpin becoming more prominent. However, Lake Sturgeon remains far below historical abundance, even as targeted restoration, stocking, and connectivity initiatives have begun to show early signs of progress in key rivers. Sturgeon populations remain highly vulnerable to habitat loss, barriers, and other stressors.

### **Key threats to habitat and species**

Drawing on the Lake Ontario Biodiversity Conservation Strategy, the Canadian Nearshore Assessment, and long-term monitoring, the main stressors affecting habitats and species in Lake Ontario include:

- **Incompatible development and shoreline alteration:** loss and fragmentation of wetlands, coastal forests, and natural shorelines; increased hardening that simplifies habitat and disrupts sediment dynamics.
- **Invasive species:** Dreissenid mussels, *Phragmites*, invasive cattails, water chestnut, and others that transform habitat structure, displace native species, and alter nutrient and energy flows.
- **Dams and barriers:** reduced tributary connectivity, blocked migration routes, and altered flow patterns that limit access to critical spawning and nursery areas.
- **Nonpoint source pollution:** nutrient and sediment inputs that degrade coastal wetlands, tributaries, and nearshore habitats and exacerbate other stressors.
- **Water-level regulation and hydrologic change:** altered patterns of water-level variability and more frequent extremes, with consequences for wetland extent, plant communities, and coastal processes.
- **Large-scale environmental change:** shifting temperature and precipitation patterns, more frequent and intense storms, and synergistic effects with land-use pressures.

Addressing these threats will require a combination of protection, restoration, and better management of remaining high-value areas, particularly the 26 Priority Action Sites identified in the LO BCS and the [Areas of High Ecological Value](#) identified through Canada's nearshore assessments. By focusing on these places and the processes that sustain them, the Lake Ontario Partnership can help maintain and rebuild a resilient, native-dominated ecosystem.

### **2.3.3 Actions Table**

The following actions will be taken and/or continued in the Lake Ontario basin to address habitat loss and species declines.

**Table 3: Actions to Protect and Restore Habitat and Species and Track Progress.**

*Note: Bulleted items under the main actions in this table are not necessarily inclusive of all actions that the Lake Ontario Partnership could implement. Partner agencies are listed in alphabetical order.*

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Agencies Involved                                                                                                 | General Objective |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|-------------------|
| 34 | <p>Improve aquatic habitat in nearshore and shoreline areas of Lake Ontario by:</p> <ul style="list-style-type: none"> <li>• Promoting beneficial and resilient nature-based shoreline management practices to reduce soil erosion, provide habitat, and soften artificially hardened shoreline structures.</li> <li>• Maintaining and restoring sediment supplies to beach and barrier bar ecosystems through the protection/conservation/restoration of sediment source areas, sand bypassing, dredge material management, and other projects that facilitate natural sediment transport.</li> <li>• Promoting integration of habitat improvement projects and invasive species management to ensure the long-term success of restoration efforts and include post-restoration monitoring.</li> <li>• Continuing to develop science-based approaches to prioritizing and restoring stream and shoreline habitats, some examples include: <ul style="list-style-type: none"> <li>○ TRCA's watershed and waterfront Integrated Restoration Prioritization approach and Nature-Based Climate Solutions Siting Tool.</li> <li>○ <a href="#">NYSDOS Statewide Shoreline Monitoring Framework</a> to evaluate shorelines and educate landowners.</li> </ul> </li> </ul> | Conservation Authorities, DFO, ECCC, MECP, MNR, NOAA, NYSDEC, PCA, SRMT, USACE, USDA-FS, USDA-NY NRCS, USFWS      | v                 |
| 35 | <p>Protect, restore, and monitor Lake Ontario, St. Lawrence River, and lower Niagara River coastal and inland wetlands to support fish and wildlife diversity and habitat through:</p> <ul style="list-style-type: none"> <li>• Wetland protection using land use policy and land conservation incentives to landowners (e.g., Ontario Conservation Land Tax Incentive Program, MECP Wetlands Conservation Partner Program).</li> <li>• Opportunities for land securement in flood-prone areas that would also benefit coastal wetlands.</li> <li>• Binational monitoring of coastal wetland conditions using standardized methods and indicators to track changes and trends over time.</li> <li>• Improved understanding of wetland vulnerability to impacts through: <ul style="list-style-type: none"> <li>○ Science-based assessment of coastal wetland vulnerability and lake-level fluctuations.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                      | Conservation Authorities, DFO, ECCC, EPA, MECP, MNR, NOAA, NYSDEC, PCA, SRMT, USACE, USDA-FS, USDA-NY NRCS, USFWS | v                 |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Agencies Involved                                                                                            | General Objective |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>○ Results and tools from the US ACE <i>Great Lakes Coastal Resiliency Study</i> and the multi-Agency <i>Framework for Resilient GLRI Investments</i>.</li> <li>○ Risk-informed decision frameworks for the restoration and protection of coastal ecosystems for the Great Lakes Basin.</li> <li>● Implementation of the US ACE Braddock Bay Restoration Monitoring and Adaptive Management Plan.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                              |                   |
| 36 | <p>Increase stream connectivity to allow for aquatic species passage, spawning, and migration while excluding invasive species:</p> <ul style="list-style-type: none"> <li>● Inventory the location of barriers (e.g., dams, weirs, culverts, road crossings, high flows) and characterize the impact of these barriers on the aquatic community.</li> <li>● Prioritize key stream barriers for action.</li> <li>● Undertake actions to remove, replace, or retrofit priority barriers.</li> </ul> <p>Restore in-water tributary habitat:</p> <ul style="list-style-type: none"> <li>● Implement in-water habitat projects in larger tributary/river systems (Niagara, St. Lawrence, and the Genesee). These may include substrate and structure enhancement and Submerged Aquatic Vegetation (SAV)/Emergent Aquatic Vegetation (EAV) plantings.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                      | Conservation Authorities, DFO, EPA, MNR, NOAA, NYSDEC, PCA, USACE, USFWS, USGS                               | v                 |
| 37 | <p>Maintain and restore habitat integrity and resilience at the watershed scale.</p> <ul style="list-style-type: none"> <li>● Encourage adoption of low-impact development and improved stormwater management through installation of green infrastructure and other measures to reduce the impacts (e.g., sediment and nutrient transport) of urban development on in-stream and nearshore fish and wildlife habitat.</li> <li>● Promote beneficial and resilient nature-based streambank management practices to reduce soil erosion, improve riparian buffers, provide habitat, and soften artificially hardened structures.</li> <li>● Implement projects that increase ecosystem resilience in watersheds and coastlines with flood reduction and recreational co-benefits.</li> <li>● Plan and implement programs related to open space conservation and land/forest stewardship, including efforts to increase habitat resiliency in the watershed, including the: <ul style="list-style-type: none"> <li>○ New York State Open Space Conservation Plan, New York State Pollinator Protection Plan, and the New York State Wildlife Action Plan.</li> <li>○ Conservation Authority stewardship incentive programs.</li> </ul> </li> </ul> | Conservation Authorities, DFO, ECCC, MECP, MNR, NOAA, NYSDEC, PCA, SRMT, USACE, USDA-FS, USDA-NY NRCS, USFWS | v                 |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Agencies Involved                                                                     | General Objective |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>○ Collaborative work with land trusts in the Lake Ontario Basin to identify priority parcels for land protection, preservation, and restoration.</li> <li>• Protect, enhance, and provide habitat connectivity to support important native species, and maintain Indian Nation cultural uses and/or provide benefits to people.</li> <li>• Support protection and restoration of Lake Ontario, Niagara River, and St. Lawrence River islands that support rare, endemic, or other important species and habitats</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                       |                   |
| 38 | <p>Advance restoration of beneficial uses related to fish and wildlife populations and habitat in Lake Ontario Areas of Concern, including but not limited to:</p> <ul style="list-style-type: none"> <li>• Implementation of the Cootes Paradise and Grindstone Creek Wetlands Rehabilitation projects in the Hamilton Harbour AOC (Canada).</li> <li>• Completing the Don River Mouth Naturalization Project in the Toronto and Region AOC in 2024 (Canada).</li> <li>• Continuing to implement the Toronto Waterfront Aquatic Habitat Restoration Strategy (TWAHRS) and Waterfront Integrated Restoration Prioritization (WIRP) projects in the Toronto and Region AOC (Canada).</li> <li>• Completing the BUI assessment and community engagement activities related to re-designating the fish and wildlife BUI within the Niagara River AOC (Canada).</li> <li>• Continuing BUI assessment and improving fish and wildlife habitat and populations at the St. Lawrence River AOC at Massena/Akwesasne (U.S.) via:               <ul style="list-style-type: none"> <li>○ Conducting habitat assessments;</li> <li>○ Implementing habitat restoration projects that support the removal of the fish and wildlife habitat and populations BUIs;</li> <li>○ Assessing Lake Sturgeon populations and habitat needs utilizing an overarching Mohawk cultural use perspective; and</li> <li>○ Integrating TEK into BUI evaluations.</li> </ul> </li> </ul> | Conservation Authorities, DFO, ECCC, EPA, MECP, MNR, NOAA, NYSDEC, SRMT               | v                 |
| 39 | <p>Continue development, implementation, and evaluation of species protection and restoration plans, including enhancement through stocking, habitat restoration, control of invasive species (e.g., Sea Lamprey), diversification of prey resources, monitoring to measure success, and research.</p> <ul style="list-style-type: none"> <li>• Support place-specific and species-specific habitat restoration plans, such as but not limited to:</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Conservation Authorities, DFO, MECP, MNR, NYSDEC, NOAA, PCA, SRMT, USACE, USFWS, USGS | v                 |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Agencies Involved                                                             | General Objective |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>○ the Black River/Chaumont Bay spawning bed/habitat areas for Walleye and Lake Sturgeon; and</li> <li>○ Onondaga Creek Watershed Aquatic Habitat Restoration Strategy (in development) to protect and expand reproduction of the native brook trout population.</li> <li>• Support the lifecycles of key native species by protecting and restoring fish spawning and nursery habitat in embayments, nearshore areas, and tributaries.</li> <li>• Implement the integrated Great Lakes basin-wide <a href="#">Coregonine Restoration Program</a> in Lake Ontario to rehabilitate sustainable populations of Coregonines to re-establish their historical roles as forage for predators.</li> <li>• Support binational collaborative actions guided by the GLFC <a href="#">2017 Fish Community Objectives for Lake Ontario</a>.</li> </ul>                                                                                                                                                     |                                                                               |                   |
| 40 | <p>Evaluate the aquatic food web, including primary production, phytoplankton, zooplankton, mysids, Dreissenid mussels, and other benthic species and populations.</p> <ul style="list-style-type: none"> <li>• Implement recommendations made by the Annex 4 <a href="#">Lake Ontario Objectives and Targets Task Team</a> to understand changing species dynamics, food web structure, and energy transfer in Lake Ontario, including the benthos, microbial food web, zooplankton, and fish.</li> <li>• Continue to support DFO/MNR Kingston Basin Station 81 and DFO Hamilton Nearshore-Offshore Transect lower and upper food web sampling and analysis.</li> <li>• Continue the long-term DFO late-fall lakewide Mysis and zooplankton survey.</li> <li>• Continue lower trophic level monitoring done by the GLFC Lake Ontario Committee members.</li> <li>• Conduct EPA GLNPO spring and summer surveys in support of the Great Lakes Biology Monitoring Program and Great Lakes Water Quality Monitoring Program.</li> </ul> | DFO, ECCC, EPA, MECP, MNR, NOAA, NYSDEC, USGS                                 | v                 |
| 41 | <p>Improve understanding of current fish population dynamics, fish ecology, and distribution during critical periods and apply new and existing techniques to address key knowledge gaps and inform management decisions.</p> <ul style="list-style-type: none"> <li>• Use telemetry to understand fish ecology through the <a href="#">Great Lakes Acoustic Telemetry Observation System (GLATOS)</a>.</li> <li>• Investigate the effects of chemical contaminants on fish populations.</li> <li>• Conduct nearshore and tributary fish surveys, e.g., electrofishing.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Conservation Authorities, DFO, EPA, MNR, NOAA, NYSDEC, PCA, SRMT, USFWS, USGS | v                 |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Agencies Involved                                       | General Objective |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>• Conduct lakewide binational forage fish surveys.</li> <li>• Improve understanding of fish dynamics through hydrodynamic simulations and predictions of ice cover.</li> <li>• Where applicable, establish sentinel fisheries monitoring locations to better support future <i>Degradation of Fish and Wildlife Populations</i>, Beneficial Use Impairment assessments in Canadian AOCs.</li> <li>• Use models to assess stream suitability for migratory fish.</li> <li>• Use thermal imaging to find critical cold-water areas in tributaries for salmonids.</li> </ul> |                                                         |                   |
| 42 | Increase understanding of the physical drivers of fish habitat quality and impacts on fish recruitment and production.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | DFO, NYSDEC, USFWS, USGS                                | v                 |
| 43 | Survey and map lake bottom substrates at targeted locations in Lake Ontario. Leverage <a href="#">Lakebed 2030</a> to investigate and research lake substrate in the context of habitat limitations and suitability.                                                                                                                                                                                                                                                                                                                                                                                             | DFO, NYSDEC, USFWS, USGS                                | v                 |
| 44 | Increase understanding of the impacts of lake-level fluctuations on habitat, wetland health, and ecology.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | DFO, ECCC, EPA, NYSDEC, USGS                            | v                 |
| 45 | Conduct winter limnology research to understand the impacts of a changing winter season on lake and wetland ecosystems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | DFO, USGS                                               | v                 |
| 46 | Evaluate the success of habitat and native species restoration activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Conservation Authorities, DFO, MNR, NOAA, NYSDEC, USFWS | v                 |
| 47 | Monitor groundwater base flow, which is important for maintaining cold-water fish habitats.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Conservation Authorities, MECP, USGS                    | v                 |
| 48 | Engage the public, landowners, and students on the importance of Lake Ontario's ecosystem habitats and species, including restoring degraded habitat, protecting and preserving high-quality habitat.                                                                                                                                                                                                                                                                                                                                                                                                            | Conservation Authorities, MNR, NYSDEC, PCA, USFWS       | v                 |
| 49 | Share the findings of baseline habitat surveys and other monitoring programs to highlight the significance to native species and their conservation in the Great Lakes and Lake Ontario communities.                                                                                                                                                                                                                                                                                                                                                                                                             | DFO, ECCC, MNR, PCA, USFWS                              | v                 |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                         | Agencies Involved | General Objective |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| 50 | Share with the public the results of a science-based assessment of coastal wetland vulnerability to changing water levels, storm-related and other long-term environmental pressures, and priority adaptation strategies and measures to guide the enhancement of coastal wetland resilience. | CWA               | v                 |

### 2.3.4 Actions everyone can take

Everyone in the Lake Ontario basin has a role to play in protecting and restoring habitat and species. Practical actions include:

- **Protect and restore natural shorelines:** choose soft-shore solutions (e.g., plantings, bioengineering) instead of hard structures where possible; maintain natural vegetation along the water's edge.
- **Support wetland protection and restoration:** avoid filling or draining wetlands; work with land trusts, Conservation Authorities, and community groups to conserve wetland and floodplain areas; support projects that reconnect wetlands to the lake and tributaries.
- **Plant native species and control invasives:** use native trees, shrubs, and grasses in yards and along shorelines; help remove invasive plants such as *Phragmites* where safe and appropriate; avoid planting invasive species.
- **Reduce runoff and erosion:** manage stormwater with rain gardens, permeable surfaces, and vegetated buffers; minimize soil disturbance near watercourses.
- **Prevent the spread of aquatic invasive species:** clean, drain, and dry boats and equipment; never release baitfish, aquarium species, or unwanted pets into local waters.
- **Respect sensitive habitats and species:** keep pets out of nesting and spawning areas; observe signs and restrictions in protected areas; stay on designated trails.
- **Participate in stewardship and citizen science:** join local habitat restoration days, shoreline clean-ups, wetland planting events, and community monitoring programs.

Collectively, these actions help maintain and restore the habitats and species that make Lake Ontario a healthy, resilient ecosystem and support the water quality, recreation, and cultural values that communities depend on.

## 2.4 Invasive Species

This section summarizes the scientific information about Lake Ontario's invasive species, current threats, and corresponding actions to be taken by Lake Ontario Partnership agencies in the 2023-2027 timeframe, as well as actions that everyone can take. Information is aligned to address the General Objective on invasive species of the GLWQA.

Lake Ontario's ecosystem has been reshaped by non-native plants, animals, and pathogens introduced over the past century. Some of these non-native species have become invasive, spreading rapidly, displacing native species, altering food webs, and imposing significant economic and cultural costs.

### 2.4.1 Objective and Condition Overview

One of the nine General Objectives of the GLWQA is addressed in this section. This objective states that the waters of Lake Ontario should:

***vii. be free from the introduction and spread of aquatic invasive species and free from the introduction and spread of terrestrial invasive species that adversely impact the quality of the Waters of the Great Lakes.***

The 2022 SOGL assessment uses several sub-indicators to assess invasive species status and trends in Lake Ontario:

- **Rate of New Aquatic Invasive Species (AIS) Establishment – Fair and Unchanging:**  
New establishments from outside the Great Lakes basin have declined markedly compared with the pre-

1950 period, primarily due to strengthened ballast water management. However, some species continue to spread among the lakes and within the Lake Ontario basin.

- **Impacts of AIS – Poor and Deteriorating:** the cumulative ecological and economic consequences of AIS continue to grow as existing invaders expand their range and affect more habitats, even though the rate of new introductions has slowed.
- **Sea Lamprey – Good and Improving:** long-term binational control programs have reduced Sea Lamprey to near-target levels, significantly decreasing parasitic pressure on Lake Trout and other hosts, provided control efforts are sustained.
- **Dreissenid Mussels – Poor and Deteriorating:** Zebra and especially Quagga Mussels remain dominant in much of the benthic zone, with deep-water populations still increasing in density and biomass and continuing to reshape nutrient and energy pathways.
- **Terrestrial Invasive Species – Undetermined:** data are insufficient for an integrated status assessment, but several terrestrial invaders—such as Emerald Ash Borer, *Phragmites*, and Japanese Knotweed—are clearly affecting coastal and watershed ecosystems.

Overall, the rate of new introductions has declined. Still, the ecological footprint and impacts of established invaders continue to grow, underscoring the importance of prevention, early detection, rapid response, and long-term control. More detailed information on indicator methods, status, and trends for Lake Ontario is available in the 2022 SOGL assessment.

#### 2.4.2 Invasive Species

Delivering on this GLWQA objective in an extensive, complex system like Lake Ontario requires coordinated efforts in prevention, early detection, rapid response, and long-term control. Detecting and managing invasive species relies on a network of binational and local programs that together build a picture of status, trends, and emerging risks:

- **Aquatic invasive species (AIS):**
  - Long-term surveillance and early detection programs.
  - Targeted monitoring for **Sea Lamprey** (adult abundance, lamprey marking rates on Lake Trout) and **Dreissenid mussels** (density and biomass in nearshore and offshore areas).
  - Binational **Early Detection and Rapid Response Initiative** under GLWQA Annex 6, using both traditional sampling and **environmental DNA (eDNA)** at high-risk areas such as the Lower Niagara River, Irondequoit Bay, and Oswego Harbor.
  - **Invasive carp surveillance** coordinated through the [Invasive Carp Regional Coordinating Committee \(ICRCC\)](#), combining netting, electrofishing, and eDNA to detect Grass Carp and other carp species.
- **Data and reporting tools:**
  - [Great Lakes Aquatic Nonindigenous Species Information System \(GLANSIS\)](#).
  - USGS [Nonindigenous Aquatic Species](#) (NAS) database.
  - Citizen-science reporting through [EDDMapS](#) and [iMapInvasives](#).

- **Terrestrial invasive species:**

- Provincial and state strategies and partnerships, including Ontario's [Invading Species Awareness Program](#) and New York's [Partnerships for Regional Invasive Species Management \(PRISMs\)](#).
- Online reporting platforms and apps, and local rapid response and management projects.

These monitoring efforts support risk assessments, response plans, and prioritization of control efforts, while recognizing that complete coverage of the basin is not feasible and data gaps remain.

As of 2020, **130 aquatic non-native species** were established in Lake Ontario, and **188** in the Great Lakes as a whole. Not all non-native species are invasive, but many have significant ecological or economic impacts.

- **Rate of new introduction:**

- From outside the Great Lakes, the current establishment rate for aquatic species is approximately 0.1 species per year, much lower than the pre-1950 average.
- Spread within the basin remains more active: several species have colonized new watersheds or moved down from the upper lakes into Lake Ontario over the last decade.
- Strengthened ballast water regulations are the main driver of the decline in new introductions; other pathways (organisms in trade, canal connections, recreational boating, bait, and aquarium releases) exist.

- **Cumulative impacts:**

- The [Lake Ontario Cumulative Impact Index \(LCII-LO\) for AIS](#) has increased several-fold since 1950, reflecting a larger number of invaders, expansion into more watersheds, and growing ecological and economic effects.

Key invasive (or high-risk) groups include:

- **Benthic invaders and invertebrates**

- **Dreissenid mussels (Zebra and Quagga):** dominant components of the benthos, especially Quagga Mussels in deeper waters. They filter vast quantities of water, alter nutrient and energy pathways, reduce phytoplankton available to native zooplankton, and promote nearshore algal growth by shunting nutrients to the lake bottom.
- **Spiny Water Flea and Bloody Red Shrimp:** alter zooplankton communities via predation and competition, with implications for larval fish and nearshore productivity.

- **Fish and pathogens**

- **Sea Lamprey:** a long-established parasitic fish whose populations are now well controlled at a lakewide target level, owing to binational lampricide treatments, barriers, and trapping.
- **Round Goby, Alewife, Rainbow Smelt:** widespread invaders that prey on eggs and juveniles of native species and alter food-web dynamics; also serve as prey for some sport fish, transmitting contaminants up the food chain.
- **Grass Carp:** detected in low numbers in Lake Ontario and key tributaries since 2013, including recent captures in Bay of Quinte, Jordan Harbour, and the Toronto Islands. To date, there is **no evidence of a self-sustaining population**, but the risk to aquatic vegetation and habitat structure is significant.

- **Tench:** detected once in eastern Lake Ontario and early detection surveillance is necessary due to its potential to compete with native minnows and disturb sediments.
- **Viral hemorrhagic septicemia (VHS):** a fish pathogen affecting multiple species, with ongoing management measures to limit spread via bait, stocking, and fish movement.
- **Aquatic and riparian plants**
  - Species such as **Water Chestnut, Eurasian Watermilfoil, European Frogbit, Hydrilla, Water Soldier** and **Curly Leaf Pondweed** can form dense mats, displace native vegetation, and alter habitat and water quality. Some are already present in parts of the watershed, and others remain high-risk if introduced or further spread.
- **Terrestrial invasive species**
  - Trees and shrubs such as **Common Buckthorn**, and **Japanese Knotweed**, as well as herbaceous invaders like **Garlic Mustard** and tall emergent plants such as **Phragmites**, degrade riparian and wetland habitats, increase erosion risk, and affect cultural practices and traditional livelihoods.
  - **Emerald Ash Borer** infestations have resulted in the loss of millions of ash trees throughout the basin. The loss of native ash trees, which are an important component of riparian habitats, can result in impacts to the food web, physical habitat, and water quality of the ecosystem.
  - **Mute Swan**, introduced for ornamental purposes, impacts submerged aquatic vegetation and can displace native waterfowl.

Perspectives on invasive species vary among communities. Some Indigenous partners may describe these organisms as “non-local beings”, emphasizing the need for respectful, relationship-based approaches to management and recognizing that complete eradication is often neither feasible nor desirable.

Despite progress, Lake Ontario remains under significant pressure from invasive species:

- **Ongoing spread of established invaders** within the lake and into new tributaries and wetlands.
- **Multiple pathways** for introduction and spread, including commercial shipping, canals, trade in live organisms, recreational boating and fishing, and the movement of firewood and soil.
- **Synergies with other stressors**, such as altered nutrient regimes, shoreline development, and extreme water-level and storm events, which can enable invaders to establish and outcompete native species.
- **Economic and cultural impacts**, including infrastructure fouling, increased management costs, reduced recreational quality, and impacts on traditional food systems and practices.

Prevention (e.g. sea lamprey control and ballast water treatment) remains the most effective and cost-efficient strategy, supported by early detection, rapid response, and long-term control where invasive species are already established.

### 2.4.3 Actions Table

The following actions will be taken and/or continued in the Lake Ontario basin to address invasive species in and to track progress through science and monitoring, as listed in Table 4.

**Table 4: Actions to Prevent and Control Invasive Species and Track Progress.**

*Note: Bulleted items under the main actions in this table are not necessarily inclusive of all actions that the Lake Ontario Partnership could implement. Partner agencies are listed in alphabetical order.*

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Agencies Involved                                                                 | General Objective |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------|
| 51 | <p>Implement programs and measures that protect the Great Lakes Basin Ecosystem from the discharge of aquatic invasive species in ballast water.</p> <ul style="list-style-type: none"> <li>Evaluate the effectiveness of ballast water treatment in reducing introductions of aquatic invasive species.</li> <li>As appropriate technologies are developed, create and implement protocols for the treatment of contaminated cargo, packaging, hull fouling, and ballast water to eradicate aquatic invasive species.</li> </ul>                                                                                                                                                               | DFO, EPA                                                                          | vii               |
| 52 | <p>Early Detection and Response:</p> <ul style="list-style-type: none"> <li>Implement early detection and rapid response initiatives to find new aquatic and terrestrial invasive species and prevent them from establishing self-sustaining populations.</li> <li>Engage with NYS Partnerships for Regional Invasive Species Management (PRISMs) on early detection and response.</li> <li>Employ techniques such as environmental DNA (eDNA) testing for early detection of new aquatic invasive species in Lake Ontario, embayments, and connecting river systems.</li> <li>Target high-priority habitats and public access areas for early detection and rapid response efforts.</li> </ul> | Conservation Authorities, DFO, EPA, MNR, NYSDEC, PCA, USACE, USDA-FS, USFWS, USGS | vii               |
| 53 | <p>Implement domestic and regional invasive species management plans for long-term control, and short-term response (and ensure the feasibility of any response plan). Examples include:</p> <ul style="list-style-type: none"> <li>NYS Invasive Species Comprehensive Management Plan and NYS Aquatic Invasive Species Management Plan</li> <li>Watercraft inspection and stewardship programs</li> <li>Invasive Mussel Collaborative</li> </ul>                                                                                                                                                                                                                                               | Conservation Authorities, DFO, MNR, NYSDEC, USACE, USGS                           | vii               |
| 54 | <p>Continue to implement Sea Lamprey control efforts in Lake Ontario:</p> <ul style="list-style-type: none"> <li>Control the larval Sea Lamprey population with selective lampricides.</li> <li>Maintain operation and maintenance of existing barriers and design and install new barriers where appropriate.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                       | Conservation Authorities, DFO, NYSDEC, USACE, USFWS                               | vii               |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Agencies Involved                                              | General Objective |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>Modify existing impassable barriers to allow for target fish species passage while excluding sea lamprey.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                |                   |
| 55 | Prevent the establishment of invasive carp species: <ul style="list-style-type: none"> <li>Implement the 2023 Invasive Carp Action Plan through participation in the Invasive Carp Regional Coordinating Committee (ICRCC).</li> <li>Monitor and respond to invasive carp in the Canadian and U.S. waters of the Great Lakes.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | DFO, EPA, MNR, NYSDEC, USACE, USFWS                            | vii               |
| 56 | Maintain watershed, coastal, and nearshore aquatic habitat diversity and function through appropriate invasive species control, such as: <ul style="list-style-type: none"> <li>Efforts implemented by <a href="#">NYS PRISMs</a> to control and prevent the spread of <i>Phragmites</i>, hybrid cattail, Japanese Knotweed, and other species deemed a priority by the PRISMs.</li> <li>Water Soldier management plans in the Trent-Severn Waterway, Bay of Quinte, and the eastern basin of the Lake.</li> <li>Ongoing Water Chestnut control and management to prevent the spread and suppress existing populations of Water Chestnut in Lake Ontario embayments, the Oswego River, Oswegatchie River, Oneida Lake, Rideau Canal, and Bay of Quinte, and other connected areas that may facilitate range expansion from these waterbodies.</li> <li>Hydrilla control projects implemented throughout the Lake Ontario watershed.</li> </ul> | Conservation Authorities, MNR, NYSDEC, PCA, SRMT, USACE, USFWS | vii               |
| 57 | Implement and enforce existing regulations, policies, and management strategies to prevent the establishment and spread of new and potential aquatic invasive species, including outreach and enforcement of boat-cleaning regulations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | MNR, NYSDEC                                                    | vii               |
| 58 | Investigate the impacts of invasive species on wetlands, particularly invasive plants. <ul style="list-style-type: none"> <li>Study whether the use of road salt and its transport are driving increases in invasive aquatic plants.</li> <li>Conduct biocontrol research to identify effective long-term management approaches for AIS control.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | PCA, USGS                                                      | vii               |
| 59 | Engage in horizon scanning and risk assessment for new threats to Lake Ontario. Examples include: <ul style="list-style-type: none"> <li>Conduct joint binational coordinated risk assessments of potential new invasive species and pathways.</li> <li>In areas treated for AIS, conduct aquatic plant establishment and habitat suitability surveillance in priority locations within Lake Ontario and its watershed.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | DFO, MNR, NYSDEC, USFWS                                        | vii               |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Agencies Involved                                      | General Objective |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|-------------------|
| 60 | <p>Investigate the biology, ecology, and impacts of AIS on Lake Ontario.</p> <ul style="list-style-type: none"> <li>• Further understanding of <i>Dreissenid</i> mussel population dynamics (including fecundity/recruitment and predation by Round Goby) and ecosystem impacts.</li> <li>• Consider how substrate type and quality can affect recruitment and competition with native mussels.</li> <li>• Assess the feasibility of small-scale temporary exclusion of round goby from lake trout spawning grounds.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | DFO, EPA, PCA, USFWS, USGS                             | vii               |
| 61 | Evaluate the success of ballast water control programs in reducing introductions of aquatic invasive species.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DFO                                                    | vii               |
| 62 | Address discharges that occur with regular operation of large vessels (79 feet or longer) through the development and implementation of national performance standards for ballast water management systems under the Vessel Incidental Discharge Act to reduce the spread of invasive species in the Great Lakes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EPA                                                    | vii               |
| 63 | Conduct aquatic plant monitoring and surveys of waterbodies in the Lake Ontario watershed on a rotational basis to detect new invaders.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | NYSDEC                                                 | vii               |
| 64 | <p>Undertake additional invasive species prevention outreach and education, including discussions with recreational boaters and lake access site signage, to minimize the spread of invasive species by recreational boating, fishing equipment, and other recreational activities.</p> <ul style="list-style-type: none"> <li>• Use “vendor alerts” for commercial vendors (e-commerce) that might sell exotic species and plants that could be released into the environment. Promote the use of the Great Lakes Commission <a href="#">GLDIATR tool</a>.</li> <li>• Publish a “least wanted” list based on the <a href="#">example</a> provided by the Great Lakes and St. Lawrence Governors and Premiers.</li> <li>• Provide training on identification and regulatory information for <a href="#">Organisms in Trade (OIT)</a> to local enforcement agency officers.</li> <li>• Implement programs such as the Ontario Federation of Anglers and Hunters campaign focused on the clean, drain, dry regulation and principles for watercraft (e.g., guidance for watercraft users), as well as education and outreach related to other pathways and high-risk AIS.</li> </ul> | Conservation Authorities, DFO, MNR, NYSDEC, PCA, USFWS | vii               |
| 65 | Engage the public and k-12 students in using reporting tools such as hotlines, <a href="#">EDDMapS</a> , <a href="#">iMAPinvasives</a> , <a href="#">iNaturalist</a> , and websites to report occurrences of suspected invasive species.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Conservation Authorities, MNR, NYSDEC, PCA             | vii               |

#### 2.4.4 Actions everyone can take

Everyone in the Lake Ontario basin can help reduce the risk and impacts of invasive species. Practical actions include:

- **Clean, Drain, Dry:** Thoroughly clean boats, trailers, fishing gear, and other equipment; drain water from bilges and live wells; and dry equipment before moving between waterbodies.
- **Don't dump bait or aquaria:** Never release live bait, aquarium fish, plants, or invertebrates into lakes, rivers, wetlands, or storm drains. Return unused bait to land or dispose of it properly.
- **Use native or non-invasive plants:** Choose native or non-invasive species for gardens and shoreline plantings.
- **Don't move firewood:** Buy and burn local firewood to reduce the spread of forest pests like Emerald Ash Borer and Asian Longhorned Beetle.
- **Report what you see:** Learn to recognize priority invasive species and report sightings through tools such as [EDDMapS](#), [iMapInvasives](#), or local hotlines and stewardship organizations.
- **Support local control and restoration efforts:** Participate in invasive species pulls, shoreline and wetland restoration projects, and community monitoring programs led by Conservation Authorities, PRISMs, and Indigenous and community partners.
- **Respect decontamination and access rules:** Follow any posted requirements for boat decontamination, trail or site closures, and restricted areas where control work is underway.

Taken together, these actions help protect Lake Ontario from new invasions and limit the spread and impact of existing invasive species, supporting healthier, more resilient ecosystems and communities.

#### 2.5 Other Threats

Microplastics, land-use change across the watershed, increasingly variable temperature and water-level patterns, and cumulative stress in the nearshore all interact with the lake's chemical, physical, and biological integrity.

This section summarizes scientific information on other threats specific to Lake Ontario and the corresponding actions to be taken by Lake Ontario Partnership agencies in the 2023-2027 timeframe, as well as actions everyone can take. This section responds to the other substances, materials, or conditions-related General Objective of the GLWQA.

##### 2.5.1 Objective and Condition Overview

One of the nine General Objectives of the GLWQA is addressed in this section. It states that the Great Lakes should:

***ix. be free from other substances, materials or conditions that may negatively impact the chemical, physical or biological integrity of the Waters of the Great Lakes.***

Other substances, materials and conditions that may impact Lake Ontario include plastic and microplastic pollution, watershed impacts from land use and shoreline alteration, changes in physical conditions including temperature, precipitation, ice cover, and water levels, and cumulative effects causing stress in nearshore waters.

Most threats described here are already considered under existing GLWQA Annexes, the binational SOGL indicators, and other sections of the LAMP (e.g., nutrients, habitat and species, contaminants). The 2022 SOGL assesses the status and trends of these threats as:

- [land cover](#) - **Fair** and **Deteriorating**,
- [hardened shorelines](#) - **Poor** and **Deteriorating**,
- [water quality in tributaries](#) and [forest cover](#) - **Fair** and **Unchanging**, and
- The [human population](#) is increasing, with growth concentrated around the western end of the lake.

The [Canadian Nearshore Assessment](#) and the [U.S. National Coastal Condition](#) Assessment both indicate stressors are negatively affecting localized areas and also that there are areas of high ecological value which warrant protection. Together, these findings reflect a range of conditions.

## 2.5.2 Other Threats

Multiple pressures are impacting how Lake Ontario functions. Plastic and microplastic particles have been detected in tributaries, nearshore sediments, and fish. At the same time, expanding urban areas, intensive agriculture, and increasing shoreline armoring affect how water, sediments, and pollutants move through the basin, reducing natural filtration and buffering capacity by wetlands, riparian zones, and coastal areas.



**Figure 4.** Erosion along the Lake Ontario shoreline at Old Fort Niagara (U.S. Army Corps of Engineers)

Shifts in temperature, precipitation, ice cover, and water-level patterns interact with these land-based and in-lake pressures. Heavier downpours and more variable runoff can increase erosion, nutrient and chloride pulses. At the same time, changes in ice cover and water levels affect shoreline stability, coastal wetland extent, and habitat availability. In many places, these shifts coincide with already hardened shorelines and fragmented habitats, leaving fewer natural features available to absorb and adapt to rapidly changing conditions.

Assessments on both sides of the lake show a range of conditions, stretches of relatively low stress, areas of high ecological value that provide important refuges for biodiversity, and localized

areas where multiple stressors converge. In these areas, pollution, watershed runoff, shoreline modification, and more variable weather and water patterns combine to degrade water quality, habitat quality, and recreational value. Understanding how these pressures interact is essential to designing actions, as outlined in Section 2.5.3 and the associated actions table.



**Figure 5.** The Central Lake Ontario Conservation Authority (CLOCA) is taking action to enhance coastal resilience by creating wetlands on former agricultural land. The site will improve connectivity between neighbouring wetlands while also providing important refugia during periods of both elevated and reduced water levels (CLOCA).

### 2.5.3 Actions to Address Other Threats

The Lake Ontario Partnership agencies will implement the 2023-2027 LAMP within the context of existing laws and regulations. There is other federal, state, and provincial legislation that addresses other threats including [Canada's Impact Assessment Act \(2019\)](#) and the [United States' Protecting our Infrastructure of Pipelines and Enhancing Safety Act \(2016\)](#). Spill prevention and contingency plans are in place in [Ontario](#) and New York State, where applicable. In addition, the [Canada-United States Joint Inland Pollution Contingency Plan](#) is in place, should there be a significant accidental and unauthorized release of pollutants along the Canada-U.S. border. The [Joint Marine Pollution Contingency Plan](#) is a mechanism for Canada and the U.S. to coordinate planning and response to spills in shared waters. This plan covers all potential sources of marine pollution in contiguous waters (e.g., ships, offshore platforms, mystery spills).

### 2.5.4 Actions Table

The following actions will be taken and/or continued in the Lake Ontario basin to address other threats and to track progress through science and monitoring, as listed in Table 5.

**Table 5: Actions to Address Other Threats.**

*Note: Bulleted items under the main actions in this table are not necessarily inclusive of all actions that the Lake Ontario Partnership could implement. Partner agencies are listed in alphabetical order.*

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                    | Agencies Involved                                    | General Objective |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------|
| 66 | Develop and share tools and approaches to minimize cumulative stress to the nearshore, including: <ul style="list-style-type: none"> <li>New York Great Lakes Natural and Nature-Based Feature Decision Support Tool.</li> <li>CWA 2019 nearshore assessment web mapping tool.</li> </ul>                                                                                                | CWA, DFO, NYSDEC                                     | ix                |
| 67 | Implement and/or support implementation of source water protection measures, including: <ul style="list-style-type: none"> <li><a href="#">NYSDEC Drinking Water Source Protection Program</a>.</li> <li><a href="#">Ontario Drinking Water Source Protection Plans</a> and measures.</li> </ul>                                                                                         | Conservation Authorities, MECP, USDA-NY NRCS, NYSDEC | ix                |
| 68 | Organize, participate in, or support capture and cleanup projects to prevent and remove plastic pollution from Lake Ontario.                                                                                                                                                                                                                                                             | Conservation Authorities, MECP, NYSDEC, PCA          | ix                |
| 69 | Determine the value of ecosystem services that Lake Ontario provides to guide decisions about where to invest in restoration efforts and to support public outreach.                                                                                                                                                                                                                     | DFO, USGS                                            | ix                |
| 70 | Collaborate with partners to develop and implement integrated watershed management plans to address local stakeholder concerns and maintain, protect, and restore key ecosystem services and the benefits they provide, including natural flood storage and mitigation capacity, habitat restoration and conservation, clean drinking water, and sustainable recreational opportunities. | Conservation Authorities, NYSDEC                     | ix                |
| 71 | Support the development of lake-specific priority actions to address current and future threats to water quality and ecosystem health, including the Western Lake Ontario Land to Lake Initiative and the St. Lawrence River Strategy Initiative.                                                                                                                                        | CWA, MECP                                            | ix                |
| 72 | Assess cumulative stress to the nearshore waters of Lake Ontario, including the St. Lawrence River and Niagara River.                                                                                                                                                                                                                                                                    | CWA, DFO, EPA, MECP, NYSDEC                          | ix                |
| 73 | Develop and deploy cross-cutting ecosystem models to better understand ecosystem impacts beyond single-purpose models and studies.                                                                                                                                                                                                                                                       | DFO, USGS                                            | ix                |
| 74 | Review and adapt existing restoration, surveillance, and monitoring programs to account for changes in lake levels.                                                                                                                                                                                                                                                                      | Conservation Authorities, ECCC,                      | ix                |

| #  | 2023-2027 Lake Ontario Partnership Management Actions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Agencies Involved                            | General Objective |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------|
|    | <ul style="list-style-type: none"> <li>Use available results from the <a href="#">Great Lakes Coastal Resiliency Study</a> and the <a href="#">Framework for Resilient Great Lakes Restoration Initiative (GLRI) Investments</a> through federal and state collaboration to enable people and communities better to address conditions under a range of scenarios.</li> <li>Use results from <a href="#">Canada's Assessment of the Resilience of Great Lakes Coastal Wetlands</a> better to understand coastal wetland vulnerability to different scenarios, and to inform adaption approaches to enhance future resilience.</li> </ul> | MECP, NOAA, NYSDEC, PCA, USACE, USGS         |                   |
| 75 | Characterize the abundance and distribution of microplastics in Lake Ontario.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CWA, ECCC, MECP, USACE, USFWS, USGS          | ix                |
| 76 | Assess pathways for road salt into groundwater, impacts of road salt use on groundwater, and groundwater as a source for salt contamination to surface water bodies and aquatic ecosystems; and investigate technologies or processes for preventing chloride from road salt entering groundwater and surface water.                                                                                                                                                                                                                                                                                                                     | ECCC, MECP, NYSDEC, USGS                     | ix                |
| 77 | Improve understanding of groundwater-surface water interactions and their influence on Great Lakes water quality and ecosystem health                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | MECP, USGS                                   | ix                |
| 78 | Identify and communicate the importance of changes in physical conditions and resulting impacts on the Lake Ontario ecosystem.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ECCC, NOAA, NYSDEC                           | ix                |
| 79 | Reduce the impacts of road salts by working with municipalities, the private sector, and other partners to promote best management practices for salt application, certification, and alternatives for both public and private salt applicators, including on private roads, sidewalks, and parking lots.                                                                                                                                                                                                                                                                                                                                | Conservation Authorities, ECCC, MECP, NYSDEC | ix                |

### **2.5.5 Actions everyone can take**

Everyone who lives, works, or recreates in the Lake Ontario basin can help reduce other threats, land-use impacts on watersheds, and stress on nearshore waters. Individual choices, when scaled across millions of people, can reduce the amount of debris, contaminants, and runoff entering the lake and its tributaries, and can increase the resilience of shorelines and communities.

#### **Reduce plastic waste and microplastics.**

- Consider reusable bags, bottles, and food containers instead of single-use plastics.
- Avoid products with unnecessary plastic packaging and seek out repair, refill, or bulk options.
- Dispose of waste properly and secure recycling and garbage so it does not escape into streets, ditches, or waterways.
- Consider using a lint filter or external microfibre filter on washing machines to reduce fibers entering wastewater.
- Participate in or organize local litter cleanups along shorelines, rivers, and in neighbourhoods.

#### **Protect watersheds and nearshore areas.**

- Keep streets and storm drains clear of litter, leaves, and debris so they are not washed into streams and the lake.
- Limit the use of de-icing salt on driveways and walkways, using sand where appropriate, and following “just enough” salt guidance from local municipalities.
- Maintain natural vegetation along shorelines and streambanks and avoid hardening banks with walls or rock where softer, more natural approaches are feasible.
- Plant native trees, shrubs, and deep-rooted plants to stabilize soils, filter runoff, and support biodiversity in yards, along fence lines, and in community spaces.

#### **Support resilient communities and stewardship.**

- Stay informed about local watershed and shoreline plans and support municipal and community initiatives that protect green spaces, wetlands, and natural shorelines.
- Consider nature-based solutions (such as rain gardens, permeable paving, or rain barrels) at home or at work to reduce runoff and pressure on stormwater systems.
- Volunteer with local conservation authorities, Indigenous communities, watershed groups, or environmental organizations working on tree planting, wetland restoration, shoreline projects, and monitoring.
- Share information about protecting and restoring Lake Ontario within your community, schools, workplaces, and social networks to help build a culture of protection and care for Lake Ontario.

By combining these everyday actions with the Lake Ontario Partnership’s commitments for 2023–2027, residents and communities across the basin can help reduce other threats, strengthen the resilience of nearshore and watershed ecosystems, and support a healthier future for the lake.

## 3.0 Lakewide Management

Achieving the General Objectives of the Great Lakes Water Quality Agreement for Lake Ontario requires collective action by many partners throughout the basin. The 2023–2027 Lake Ontario Lakewide Action and Management Plan (LAMP) presents current ecosystem conditions and threats, sets research and monitoring priorities, and identifies actions for governments and the public. The LAMP is a resource for anyone interested in the Lake Ontario basin ecosystem, its water quality, and the actions necessary to help protect this Great Lake.

Lakewide management is an adaptive, long-term effort. As new information emerges and conditions change, the Lake Ontario Partnership will refine priorities and actions.

### 3.1 Engagement and Reporting

The Lake Ontario Partnership will report on progress through concise annual updates to the public.

The Partnership complements these annual updates with periodic webinars which may include updates on science, threats and actions.

Indigenous governments and organizations are essential partners. The Partnership will continue to seek respectful, distinctions-based engagement that recognizes Indigenous rights, responsibilities, and knowledge systems, including opportunities to co-develop priorities, contribute Indigenous Knowledge alongside western science where appropriate, and participate directly in LAMP actions.

The public also has a crucial role. The LAMP will point to opportunities for residents and communities to participate in shoreline clean-ups, tree planting and wetland restoration, community-based monitoring, invasive species reporting, and responsible recreation.

Together, these engagement and reporting measures meet GLWQA Annex 2 expectations for regular reporting and public involvement.

### 3.2 Collective Action for a Healthy Lake Ontario

Protecting Lake Ontario requires the combined energy of governments, Indigenous partners, scientists, and public alike. Everyone has a role to play. Whether by restoring natural vegetation along streams, reducing road salt and plastic waste, participating in shoreline cleanups, or supporting local conservation and stewardship organizations, individual and community actions. **The LAMP's actions to restore and protect ecosystems will ensure that water quality and economic prosperity go hand in hand.**