

# The Great Lakes Nearshore Framework



## Acknowledgements

The Great Lakes Nearshore Framework represents the collective effort of many individuals. This document is a product of the Lakewide Management Annex Nearshore Framework Task Team under leadership of Janette Anderson of Environment and Climate Change Canada and Elizabeth Hinchey Malloy of the U.S. Environmental Protection Agency. Task Team members included: Eric Anderson, Deborah Brooker, Tim Bruno, Jan Ciborowski, Paris Collingsworth, Lisa Fogarty, Bonnie Fox, Amy Klei, Julia Koh Hatcher Ayyoub, Gail Krantzberg, Fred Luckey, Wendy Leger, Jim Lehnem, John Masterson, Greg Mayne, Jody McKenna, Gary Muller, Catherine Riseng, Rachel Melzer, Julie Simard, Dawn Walsh, Peder Yurista and Pete Zuzek. Nearshore Framework Writing Team members included: Janette Anderson, John Dettmers, Elizabeth Hinchey Malloy, Jim Lehnem, Jody McKenna, Scott Parker, Paul Seelbach and Pete Zuzek.

Many thanks go to the participants who attended numerous workshops and meetings, and to the reviewers who provided input, feedback and overall advice on Nearshore Framework development.

**Cover photo credits:** Brenda Jones and Anna McCartney.

## Contents

|   |    |
|---|----|
| Acknowledgements.....   | 2  |
| Introduction .....  | 4  |
| Purpose and Scope of the Nearshore Framework.....                 | 4  |
| Call to Action.....   | 5  |
| Nearshore Framework Components: .....                             | 6  |
| 1: Comprehensive Assessment of Nearshore Waters .....             | 7  |
| 2: Action .....   | 9  |
| 3: Continuous Learning and Informed Decision-Making .....         | 10 |
| Guiding Principles .....  | 12 |
| The Path Forward: Initial Steps along the Great Lakes Coast ..... | 14 |
| Conclusion.....   | 14 |
| References .....  | 15 |

## The Great Lakes Nearshore Framework

### Introduction

The Great Lakes are the world's largest freshwater resource, providing a source of drinking water and valuable ecosystem services for over 40 million people in Canada and the United States. Nearshore areas are a key priority for restoration and protection because they are the source of drinking water for most communities within the basin, are the areas of the lakes where most human recreation (e.g., swimming, boating, fishing, wildlife viewing) occurs, and are the critical ecological link between watersheds and the open waters of the Great Lakes.

As envisioned by the updated Great Lakes Water Quality Agreement of 2012, Canada and the U.S. will collaborate with their partners to develop and use an integrated "Nearshore Framework". Work under this Nearshore Framework will reduce the impact of non-point source runoff, shoreline hardening, climate change impacts, habitat loss, invasive species, dredging and contaminated sediment issues, bacterial contamination, contaminated groundwater, and other threats in the nearshore environment.

This document describes the major components of the Nearshore Framework and the path forward for working with our partners to initiate its implementation. The Nearshore Framework is envisioned to be a new impetus for aligning the efforts of federal, provincial, state, tribal governments, First Nations, Métis, municipal governments, watershed management agencies, local public agencies and the public to protect the Great Lakes nearshore.

### Purpose and Scope of the Nearshore Framework

The waters of the Great Lakes, together with their 16,000 kilometres (10,000 miles) of coastline, connecting river systems and watersheds are globally significant ecosystems. Substantial progress has been made towards protecting the Great Lakes since the Canada – United States Great Lakes Water Quality Agreement was first signed in 1972; however, continuing ecological degradation of nearshore waters threatens the health and sustained productivity of this valuable ecosystem.

A "Nearshore Framework", *i.e.*, a systematic, integrated and collective approach for assessing nearshore health and identifying and communicating cumulative impacts and stresses, is needed to inform and promote action at all levels to restore and protect the ecological health of Great Lakes nearshore areas. To address this need, the 2012 update of the Great Lakes Water Quality Agreement (GLWQA) requires that Canada and the United States (the "Parties") develop a Nearshore Framework for the Great Lakes to be implemented through the GLWQA's Lakewide Management process. Specifically, through the GLWQA the Parties committed to: provide a comprehensive assessment of nearshore waters; share the information from the assessment; identify areas that would benefit from protection, restoration or prevention activities; and identify causes of impairment and threats.

The purpose of the Nearshore Framework is to address ongoing and emerging challenges to the nearshore waters of the Great Lakes, where restoration, protection and prevention activities are critical to improving and sustaining the ecological health of Great Lakes coastal areas and supporting attendant

social, cultural, recreational and economic benefits. Continued and strengthened coordination and collaboration are needed to manage and protect our nearshore waters and to prevent and minimize lakewide water quality and ecosystem impacts which may result from chemical, physical, or biological stresses within the Great Lakes Basin. The Nearshore Framework will support action for nearshore areas under stress and protection for nearshore areas of high quality.

The Nearshore Framework represents the culmination of discussion, inspiration and input from a wide range of people and organizations throughout the Great Lakes basin. The Nearshore Framework was developed for use by the governmental agencies that comprise the Lake Partnerships charged with developing and implementing Lakewide Action and Management Plans (LAMPs) for each Great Lake<sup>1</sup> and also for use by local communities and individual agencies.

The Nearshore Framework's scope addresses the nearshore waters and embayments along the coast of the Great Lakes, the lakes' connecting river systems and the international section of the St. Lawrence River. The GLWQA recognizes the interconnectedness within the basin watersheds where material and water flow from problem areas and deliver degrading influences to the lakes and connecting channels. The Nearshore Framework acknowledges the relationship between the zone of impact in the lakes and the zone of influence (the location where a problem originates, which can occur up in the watersheds far-removed from the lakes themselves).

For the purposes of assessment, the nearshore is defined as the area of the Great Lakes and connecting rivers near the coastline where waters are subject to direct influences from shorelands and watersheds, while recognizing there are also off-shore influences. The nearshore will not be rigidly defined by depth or distance from shore but by a zone of impact where these shoreland and watershed influences are observed.

Under the Great Lakes Executive Committee's oversight and coordination, the Nearshore Framework will be integrated with other GLWQA activities. The Nearshore Framework's approach is consistent with other large ecosystem management initiatives underway in North America and beyond including: UN Strategic Plan for Biodiversity 2011-2020; U.S. National Ocean Policy Implementation Plan; U.S. Coastal Zone Management Act of 1972; Integrated Coastal Zone Management (1992 Earth Summit, Rio de Janeiro); The Strategic Vision of the Great Lakes Fishery Commission 2011-2020; Canada's National Framework for Canada's Network of Marine Protected Areas; UN Transforming our World: The 2030 Agenda for Sustainable Development; The Upper Midwest/Great Lakes Landscape Conservation Cooperative; 2014 Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health; and Ontario's Great Lakes Protection Act, 2015.

## Call to Action

As the world's largest freshwater ecosystem, the Great Lakes are socially, economically, and environmentally significant to the region, the nation and the planet. The Great Lakes are ecologically

---

<sup>1</sup> This framework does not recommend changes to existing federal/state/provincial/tribal/First Nation legal or statutory definitions or standards affecting the Great Lakes nearshore.

and culturally rich, and they provide ecological goods and services that are important to the region's societal health and well-being. Nearshore areas are a key priority for restoration and protection because they are the source of drinking water for most communities within the basin, are the areas of the lakes where most human recreation (e.g., swimming, boating, fishing, wildlife viewing) occurs, and are the critical ecological link between watersheds and the open waters of the Great Lakes. A sustainable and prosperous Great Lakes economy is dependent upon a healthy nearshore ecosystem and clean freshwater (Vaccaro and Read, 2011; Seelbach *et al.*, 2014).

At numerous places along the Great Lakes nearshore, conditions have become degraded due to a variety of human-induced, climate-induced and invasive species-induced stressors. Human activities in the landscape have a more direct influence on nearshore water quality than on offshore water quality (Yurista *et al.*, 2015). Nearshore water quality may serve as a sentinel for the longer-term trajectory of offshore water quality and lake-wide condition (Yurista *et al.*, 2015, Yurista *et al.*, 2016). Management of the nearshore is challenging because it is a complex, highly variable environment in which tributary inflows and open water processes vary spatially, and across daily, seasonal and annual temporal scales.

Government agencies, academics and non-government organizations have made significant investments in localized nearshore monitoring, assessment and protection and/or restoration; however, there is no comprehensive binational assessment of overall nearshore condition and the key stresses affecting that condition. Consequently there is no accepted means to identify areas most in need of remediation and/or protection from cumulative stresses. The Framework recognizes that preventing degradation in currently healthy areas is much less costly than remediating areas that have been allowed to degrade.

The "Nearshore Waters of the Great Lakes" (Edsall and Charlton 1997) and the "Nearshore Areas of the Great Lakes" (EC and U.S. EPA 2009)<sup>2</sup> provide rationale for a binational focus on the Great Lakes nearshore aquatic system. The concept of a Great Lakes Nearshore Framework was introduced at an International Joint Commission (IJC) Nearshore Priority Expert Consultation Workshop in 2007 (IJC 2009). The 2009-2011 IJC Priority Cycle "Work Group Report on A Nearshore Framework" (IJC 2011) recommended an adaptive management approach for the Nearshore Framework and focused heavily on the need for better agency collaboration and integration of watersheds in nearshore management.

The 2012 GLWQA presents both a commitment and a unique opportunity to establish a nearshore assessment and management framework that adapts to a changing climate and changing ecological conditions and embraces innovative solutions to maximize ecological function, sustain desirable ecosystem services, and increase resilience to current and anticipated stressors.

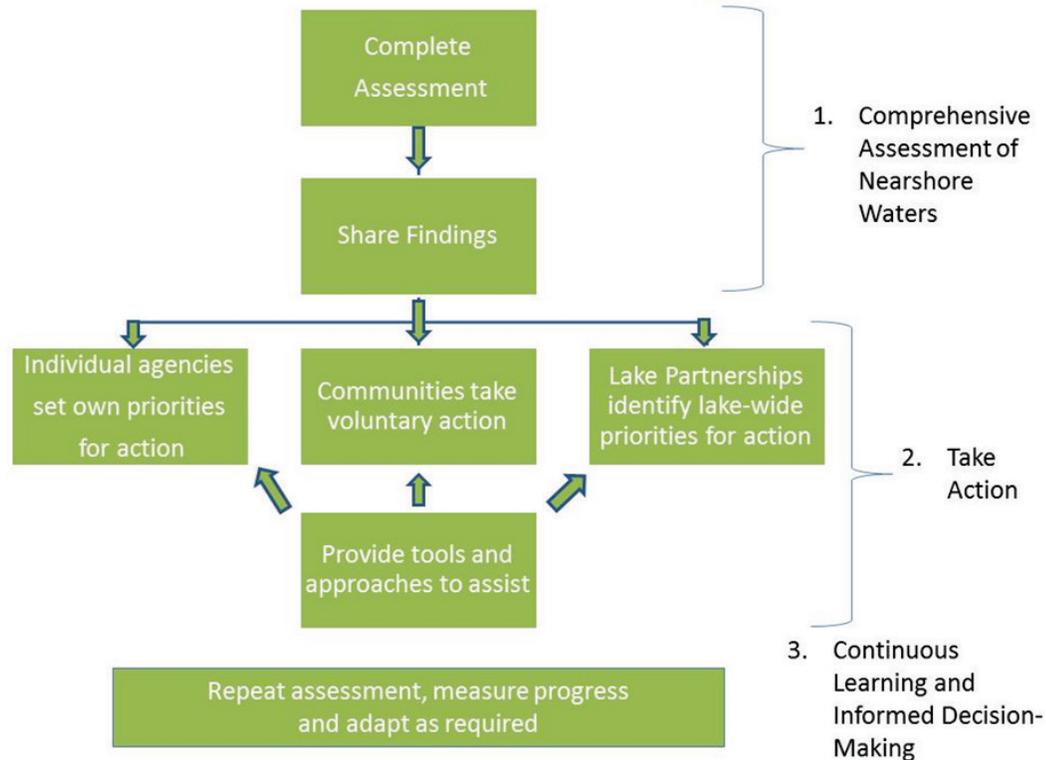
## Nearshore Framework Components:

The Nearshore Framework has three components: 1) Comprehensive Assessment of Nearshore Waters, 2) Action, and 3) Continuous Learning and Informed Decision-Making (Figure 1), described below.

---

<sup>2</sup> These background papers were developed for the 1996 and 2008 State of the Lakes Ecosystem Conferences.

## Nearshore Framework Components



### 1: Comprehensive Assessment of Nearshore Waters

The Parties, building upon existing monitoring, research and reporting and in collaboration with key governmental and non-governmental partner agencies and organizations, will assess available data on the state of Great Lakes nearshore areas to produce information and maps showing areas of high quality and areas under stress. Knowledge of ecological thresholds, other Great Lakes assessments, stressor information, indicators and local and traditional ecological knowledge will be used to aid in: 1) the identification and mapping of high quality nearshore areas and areas that are or may become subject to high stress and; 2) the determination of factors and cumulative effects that are causing stress or threats.

The assessment will require the assembly and coordination of a range of data from multiple sources and collaborators. The long-term goal is to develop a coordinated geospatial data framework<sup>3</sup> facilitated by the ongoing and future adoption of “open data” initiatives by Great Lake partner agencies, organizations and communities. The ability to use geospatial data to analyze effects of a combination of different impacts on coastal systems is valuable not only for measuring the health of coastal environments but also for coastal planning and management assistance (European Environment Agency, 2013). Maps produced with geospatial data can integrate information that has traditionally been analyzed separately, allowing for effective ecosystem-based management (European Environment Agency 2013). The

<sup>3</sup> Geospatial data has explicit geographic positioning information included within it allowing it to be depicted on maps and charts (National Research Council 2004).

approach to completing the assessment involves three phases, as described below. (Additional details will be found in the forthcoming “Conducting a Baseline Survey of Great Lakes Habitat” document in preparation by the Parties.)

- Phase 1 involves delineation of the nearshore into units which are then classified by ecosystem type (*e.g.*, shoals, high energy shores, coastal wetlands, river mouths, embayments, depositional areas). These ecosystem types have been created and are maintained by physical processes and lake characteristics that change at a relatively slow rate (*e.g.*, wave energy, bathymetry, substrate type, geomorphology, annual mean temperature and distance to rivers). Once ecosystem types are classified, human impacts can be assessed, individual units and/or ecosystem types can be prioritized for protection and/or restoration and the condition of these units and ecosystem types can be compared and monitored for change over time (Roff *et al.*, 2003, McKenna and Castiglione, 2010).
- Phase 2 involves the assessment of each unit using dynamic parameters (*i.e.*, characteristics of habitat that are likely to change at a more rapid rate than physical parameters). To determine the condition of each unit, data and information on water quality (*e.g.* pH, dissolved oxygen, conductivity), water clarity, aquatic vegetation composition, sediment condition, benthic community composition, chlorophyll *a* and other parameters as appropriate, will be compared to thresholds. The assessment will also take into account the impact of nearshore conditions on human uses by incorporating data related to designated uses for nearshore waters (*e.g.*, fishing, swimming, drinking water), and social and cultural impacts (*e.g.*, local, traditional and aboriginal cultural heritage and Traditional Ecological Knowledge).
- Phase 3 involves the review of biological information, because biota (*eg.*, fish, waterfowl, reptiles and amphibians, and benthic organisms) are the final interpreters of the physical variables and dynamic parameters. Whether native biota thrive or not indicates whether habitat is of adequate quality to support their life processes. The final phase of the assessment will use existing data on key attributes of biological assemblages, guilds and communities to confirm findings of the condition assessment of units.

The assessment will involve the many Great Lakes experts and the input from a variety of ongoing initiatives, possibly including, but not limited to: the Great Lakes Aquatic Habitat Framework (GLAHF), the Great Lakes Environmental Indicators (GLEI) project, the Great Lakes Environmental Assessment and Mapping (GLEAM) project, the GLWQA Ecosystem Indicators and Lakewide Ecosystem Objectives (under development), the Lake Biodiversity Conservation Strategies, the GLFC Fisheries Environmental Objectives, Great Lakes Blue Accounting, the Upper Midwest/Great Lakes Landscape Conservation Cooperative (LCCC), State and Provincial fish and wildlife plans, the U.S. Coastal Zone Management Program, the Provincial Great Lakes Protection Strategy and the Ontario Conservation Authority’s Watershed Plans.

The Parties will work with each of the Lake Partnerships to perform the assessment over a five year cycle. This will help ensure a degree of consistency in these assessments and be a source of multi-lake institutional knowledge for the refinement of the effort in future years, as described in Step 3.

It is proposed that the Nearshore Framework assessment align with the reporting year of the GLWQA Cooperative Science and Monitoring Initiative (CSMI) rotational cycle for a given lake<sup>4</sup>, to take advantage of opportunities to incorporate relevant nearshore data from the CSMI year of cooperative monitoring into the assessment and allow the Lake Partnerships to incorporate the assessment results into their respective LAMP.

Results of the assessments will be shared with individual agencies, communities and the public. The Parties will share the following information, tools and approaches:

- Provide the assessment results and maps;
- Provide access to all information upon which assessments are based;
- Assist in identifying causes of stress in areas found to be in poor condition;
- Assist in assessing risk and threats to areas found to be in high quality condition;
- Share tools and approaches to help communities engage and take action to improve nearshore water quality and ecosystem health and protect nearshore areas of high quality;

As the data and information to support the Nearshore Framework are assembled and applied to complete the assessment, cumulative effects impacting the nearshore and future threats to areas of high ecological value will be better understood and the knowledge shared will assist in priority setting for science and management at a meaningful and practical spatial scale within each Great Lake and connecting channel.

Improvement in nearshore condition will be measured over time by reassessing nearshore conditions using the comprehensive assessment approach described above in each Great Lake and connecting river system and comparing assessments over time.

## **2: Action**

Building upon the information provided by the assessment, collaborations which may include Federal, State and Provincial Governments, Tribal Governments, First Nations, Métis, Municipal Governments, watershed management agencies, local public agencies and the Public will be able to identify management priorities, take action to protect nearshore areas of high ecological value, protect water

---

<sup>4</sup> CSMI implementation timeline: Year 1: Report communicating results from previous monitoring year & identification of science/monitoring needs; Year 2: Planning; Year 3: Field year of cooperative science and monitoring; Year 4: Laboratory analysis; Year 5: Data analysis and report writing (and repeat cycle) (Richardson et al. 2012).

quality, and restore degraded areas. It is recognized that some activities may occur through existing initiatives.

The Lake Partnership meetings and conference calls will provide an open venue for partners to discuss and coordinate implementation actions under the Nearshore Framework, as well as provide an opportunity to share results and lessons learned from communities that have successfully addressed nearshore issues. The highlights of these implementation activities will be more broadly communicated in Lake Partnership Annual Reports. Key lessons learned will inform subsequent cycles of LAMP development and priority action identification.

### **3: Continuous Learning and Informed Decision-Making**

The comprehensive assessment of available nearshore data will be repeated on a five-year rotational cycle i.e., one lake and its associated connecting river system(s) will be assessed per year. Recognizing that there are limitations to data available to undertake large scale assessment activities, the Parties will assess information gaps and work with collaborators to fill data needs to increase the comprehensiveness of the assessment. The consistency of the assessment approach will allow trends to be identified and will enable the determination of improvement or degradation of water quality and ecosystem health across nearshore ecosystem types.

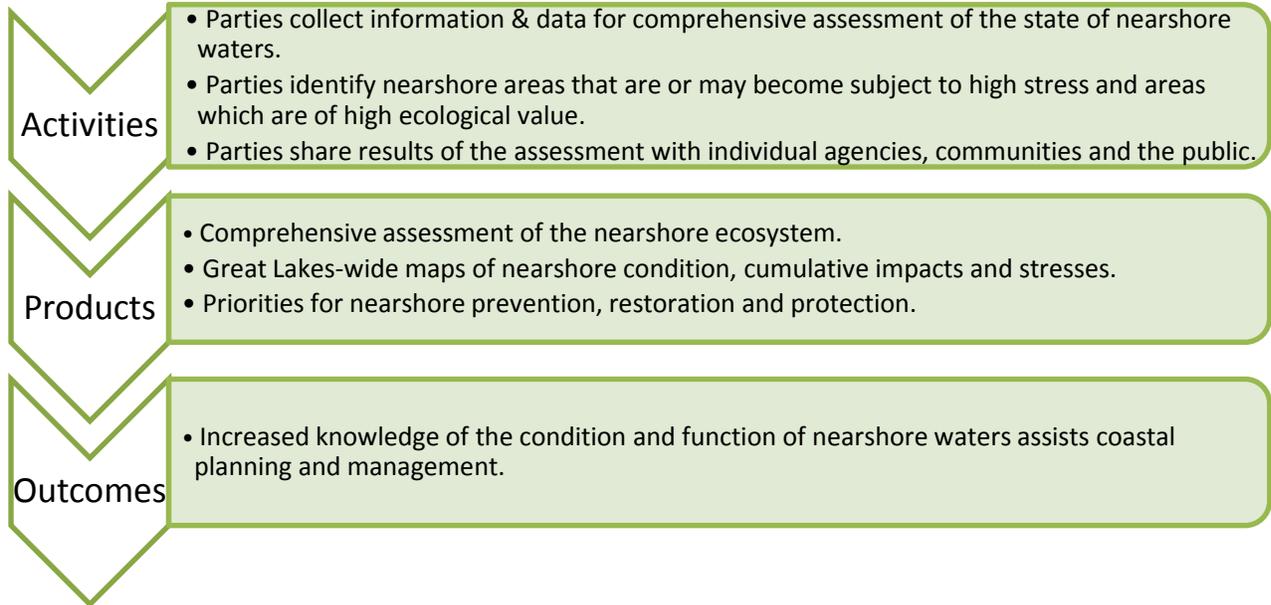
The Nearshore Framework approach will evolve over time based on experience gained in applying the framework and through advancements in science. In the same manner, tools and approaches for community action will be regularly reviewed by the Parties and updated to reflect lessons learned from implementation. Successful models from outside the Great Lakes ecosystem should be regularly reviewed and considered for applicability to the Nearshore Framework.

The implementation of this Nearshore Framework will result in an increased understanding of the state of nearshore waters and an increase in our collective understanding of the importance and need to prevent degradation, restore and protect nearshore areas. Seeking ways to enhance the transfer of knowledge, expertise, and approaches across both sides of the border will maximize our binational successes under the Nearshore Framework. This knowledge should inform decision making that ultimately leads to the following long-term outcomes:

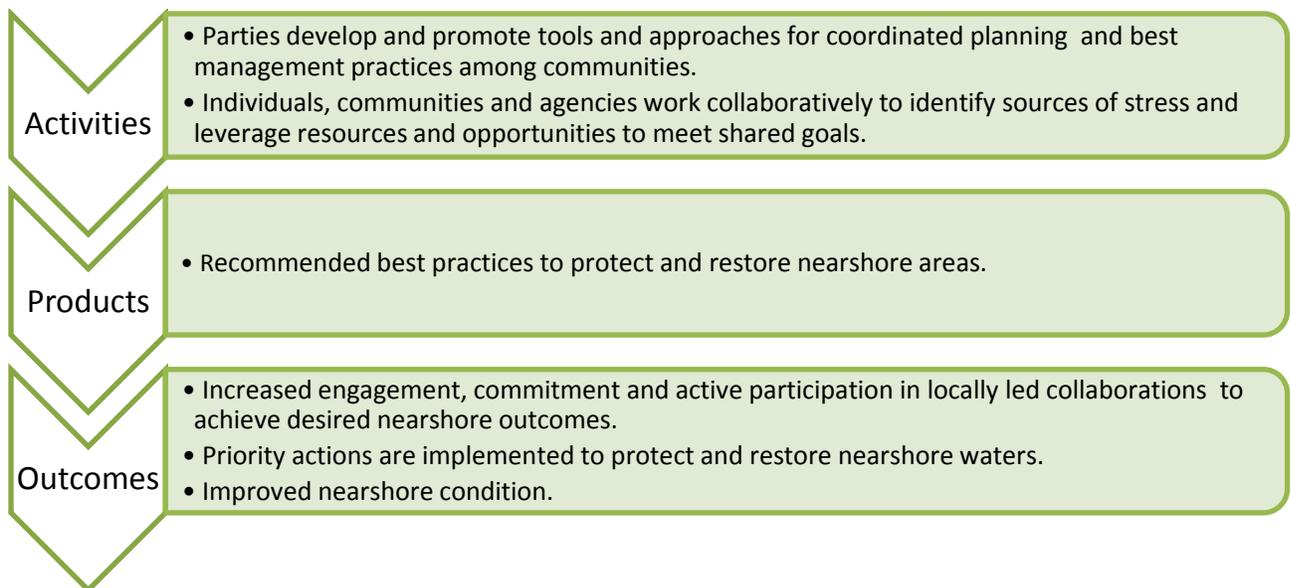
- Improved water quality and ecosystem health at both local and lake-wide scale;
- improved and more resilient structure and function of nearshore ecosystems;
- reduced cumulative impacts of human activities in nearshore areas;
- a decrease in unsustainable uses of nearshore waters;
- increased provision of ecosystem services from Great Lakes waters; and
- increased public and partner awareness of the value of and, stewardship of, and investment in, the Great Lakes.

For each Nearshore Framework component, the following activities, products and outcomes are identified:

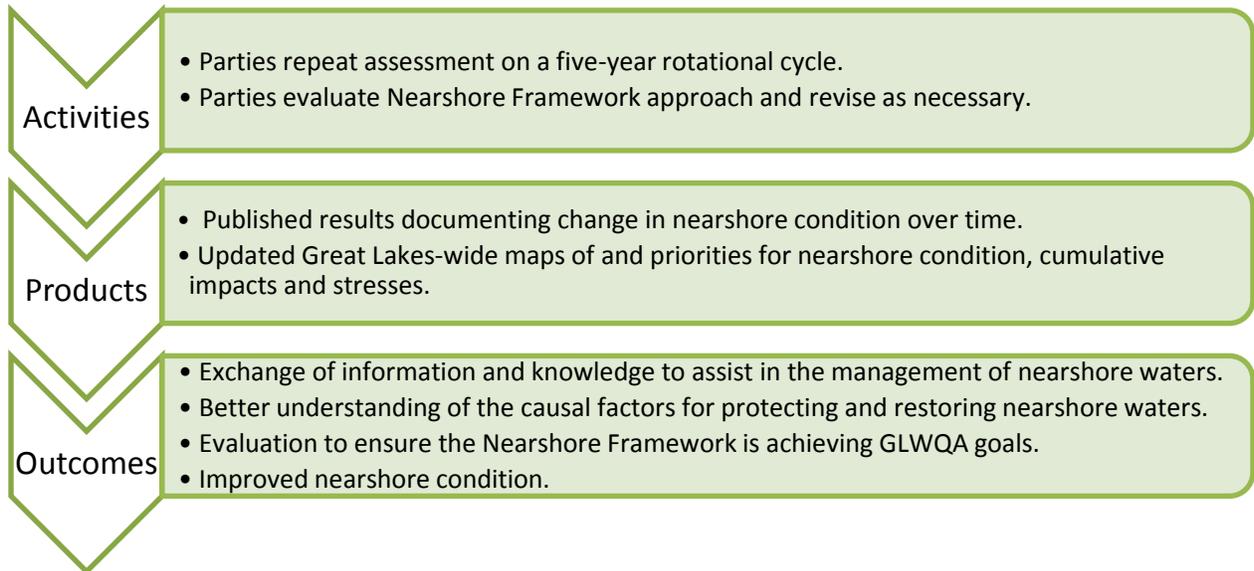
### Component 1: Comprehensive Assessment of Nearshore Waters



### Component 2: Action



### Component 3: Continuous Learning and Informed Decision-Making



### Guiding Principles

While there is broad support for the basic components of the Nearshore Framework, it is recognized that this initiative will evolve beyond this basic structure. Principles are a powerful guide for uniting and engaging partners under the Lake Partnerships, including governmental and non-governmental agencies and local communities and organizations, to collectively develop solutions and promote action. The following five key principles reflect expert input and lessons learned from other international examples of collaborative approaches for ecosystem management and will be used to guide our collective efforts to assess condition and to take action to protect and restore the nearshore under the Nearshore Framework.

#### Key Principle 1: Healthy Great Lakes Support Healthy People:

- Recognize that the Great Lakes and their watersheds are the foundation of the region’s prosperity and collective well-being and sustain a rich variety of plants, animals, and habitats;
- Recognize that the Lakes also provide a source of drinking water for over 40 million people, foster subsistence that is integral to the heritage of many traditional and aboriginal cultures, and create recreational opportunities vital to our economy and well-being; and
- Recognize that the Great Lakes are a vast shared resource containing a significant portion of the world’s freshwater, and that they provide the foundation for trillions of dollars in economic activity.

**Key Principle 2: Collaborative Governance:**

- Recognize the sovereign rights of the states and province as stewards of the natural resources within the nearshore zone.
- Base decisions on listening and seeking wisdom among parties representing the spectrum of societal interests.
- Respect the roles of governments, the private sector, and society in decision making, and the need for highly cooperative and integrated interventions to address coastal management issues and opportunities.
- Foster and maintain working relationships with First Nations, Métis and tribal governments in the context of their traditional territories, cultural beliefs and traditional ecological knowledge.
- Foster and maintain working relationships with other expert knowledge institutions and organizations.
- Acknowledge aboriginal rights and title, treaty rights, and perspectives.

**Key Principle 3: Ecosystem-based Management:**

- Apply holistic, science-based and place-based approaches to understand and manage landscapes and resources in a healthy and sustainable manner.
- Recognize zones of influence and zones of impact using a cause and effect analytical approach.
- Work across geographies, jurisdictions, and disciplines.
- Focus on underlying processes that drive systems at multiple scales.
- Recognize that humans are a part of the ecosystem and that our activities affect the ecosystem and that we depend on the services that the ecosystem provides.
- Maintain resilient ecological systems such that desired ecosystem structures and functions are maintained following disturbances.

**Key Principle 4: Iterative Learning and Action:**

- Agree to be a “learning community”, regularly adjusting actions to address changing conditions and new knowledge through adaptive management.
- Collaborate with adaptive management, knowledge-based programs as needed.

**Key Principle 5: Responsibility and Accountability:**

- Establish clear and unambiguous roles and responsibilities.
- Be publically accountable for making decisions and taking action to achieve mutually-desired outcomes for the Great Lakes nearshore.

## The Path Forward: Initial Steps along the Great Lakes Coast

It is in the spirit of continuous learning that the Parties will implement the Nearshore Framework beginning with pilot testing of the approach. Following pilot testing the Nearshore Framework will be modified based on lessons learned prior to being applied on a lakewide scale.

The Parties will facilitate multi-agency coordination of the initial assessment and pilot it in one or more areas of the Great Lakes nearshore. Ideally, the pilot would include an area of high ecological value and an area that is or may become subject to high stress. The Nearshore Framework assessment will be limited to the nearshore waters and will have additional components such as the consideration of water quality impacts on human uses. A product of the pilot will be a manual detailing the analysis procedures and quality control measures required and recommendations leading to full implementation in the Great Lakes.

As recognized in the GLWQA, no single government or agency has the ability to achieve the Agreement objectives alone; involvement and participation of State and Provincial Governments, Tribal Governments, First Nations, Métis, Municipal governments, watershed management agencies, local public agencies, and the Public is essential. Successful implementation of the Nearshore Framework will require partner support at all levels. Communication, coordination and/or collaboration with ongoing initiatives are essential.

## Conclusion

Active participation along with ecosystem based management, multi-jurisdictional collaboration and a shared sense of responsibility for stewardship by the people and their leaders are needed for sustainable governance of the Great Lakes (Manno and Krantzberg, 2008). The Nearshore Framework is envisioned to be a new impetus for aligning the efforts of federal, provincial, state, tribal governments, First Nations, Métis, municipal governments, watershed management agencies, local public agencies and the public to protect the Great Lakes nearshore.

## References

- Great Lakes Water Quality Agreement Protocol, 2012.
- EC and U.S. EPA. 2009. Nearshore Areas of the Great Lakes 2009. ISBN 978-100-13562-5.
- Edsall, T.A. and Charlton, M.N. 1997. Nearshore Waters of the Great Lakes. State of the Lakes Ecosystem Conference 1996 Background paper.
- European Environment Agency. 2013. Balancing the future of Europe's coasts - knowledge base for integrated management. ISSN 1725-9177.
- IJC (International Joint Commission). 2011. Work Group Report on a Nearshore Framework. IJC 2009-2011 Priority Cycle.
- IJC (International Joint Commission). 2009. Workgroup Report on Nearshore Framework. Priorities 2007-2009 Series.
- Manno, J. and Krantzberg, G. 2008. Rediscovering and revitalizing the Great Lakes governance. In Governance for Sustainability—Issues, Challenges, Successes; Bosselmann, K., Engel, R., Taylor, P., Eds.; IUCN: Gland, Switzerland, pp. 159–170.
- McKenna, J.E. and Castiglione, C. 2010. Hierarchical multi-scale classification of nearshore aquatic habitats of the Great Lakes: Western Lake Erie. *J. Great Lakes Res.* 2010, 36, 757-771.
- National Research Council. 2004. A Geospatial Framework for the Coastal Zone. The National Academies Press, Washington, D.C. ISBN: 0-309-53110-1.
- Richardson, V., Warren, G.J., Nielson, N., Horvatin, P.J. 2012. Cooperative Science and Monitoring Initiative (CSMI) for the Great Lakes—Lake Ontario 2008. *J. Great Lakes Res.* 2012, 38, 10–13.
- Roff, J.C., Taylor, M.E. and Laughren, J. 2003, Geophysical approaches to the classification, delineation and monitoring of marine habitats and their communities. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 13:77-90.
- Seelbach, P.W, J.G. Read, K.A. Buckner, T. Eder and C. Manninen. 2014. Great Lakes Blue Accounting: Empowering Decisions to Realize Regional Water Values. A Report to the Council of Great Lakes Governors, in response to the governor's 2013 resolution on water monitoring, March 28, 2014.
- Vaccaro L, and Read J. 2011. Vital to Our Nation's Economy: Great Lakes Jobs Report (Michigan Sea Grant), Available at <http://www.miseagrant.umich.edu/downloads/economy/11-203-Great-Lakes-Jobs-report.pdf>. Accessed March 2016.
- Yurista, P.M., Kelly, J.R., Cotter, A.M., Miller, S.E., and Van Alstine, J.D. 2015. Lake Michigan: Nearshore variability and a nearshore–offshore distinction in water quality. *Journal of Great Lakes Research.* 41:111-122.

September 2016

Yurista, P.M. Kelly, J.R., and Scharold, J.V. 2016. Great Lakes nearshore-offshore: distinct water quality regions. *Journal of Great Lakes Research*. 42: 375–385.