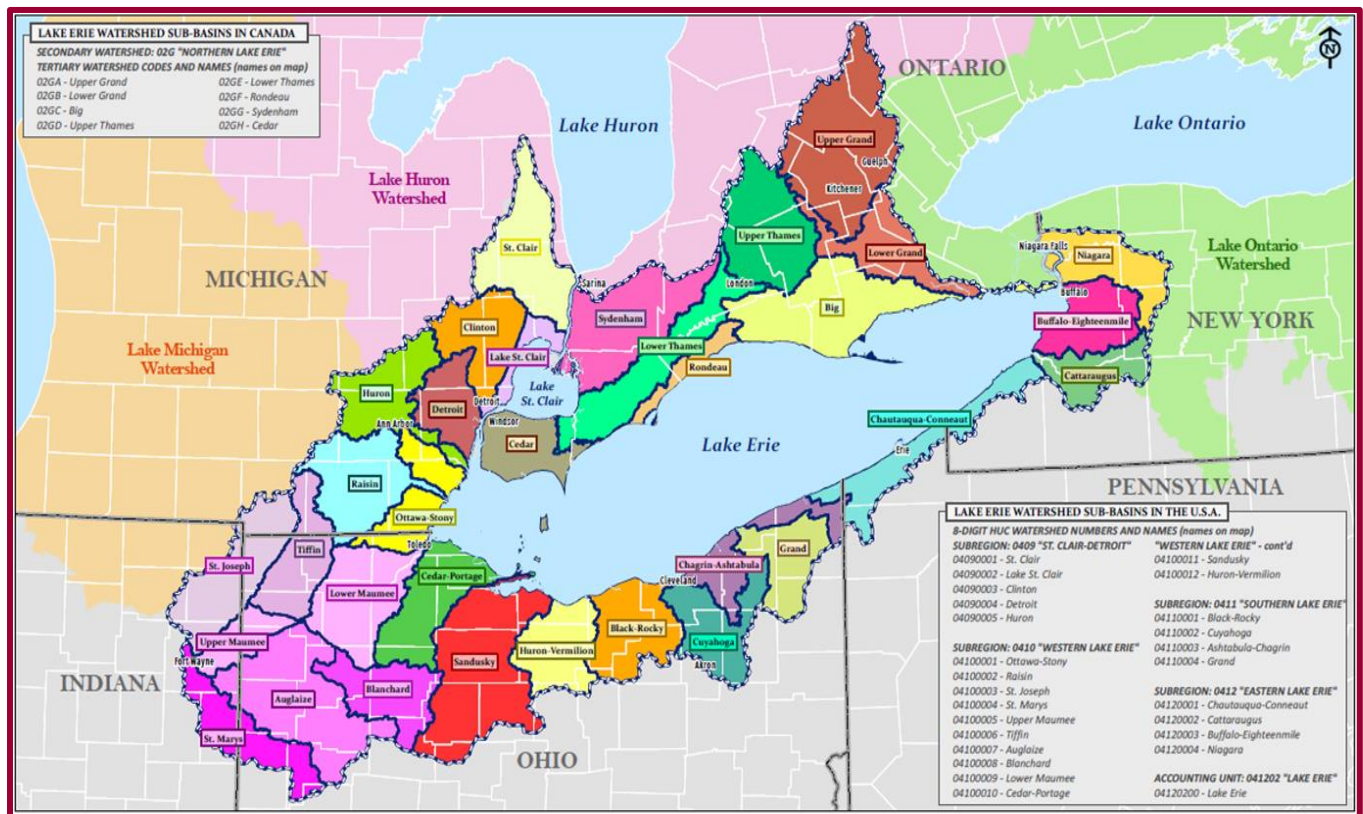


# Evaluating Watershed Management Plans

## Nutrient Management Approaches in the Lake Erie Basin and Key Locations Outside of the Lake Erie Basin



Prepared by the Great Lakes Water Quality Board  
Legacy Issues Work Group  
Submitted to the International Joint Commission

August 2016

## Executive summary

This report presents the recommendations of the Great Lakes Water Quality Board's Legacy Issues Work Group on the topic of how watershed management plans should be used to manage nutrient pollution in Lake Erie. The work group has identified several key success factors necessary for watershed management plans to achieve meaningful nutrient load reductions. These recommendations are offered for consideration by the International Joint Commission (IJC) Great Lakes Water Quality Board (WQB) and ultimately, if approved by the WQB, for IJC Commissioners. The recommendations summarized below are those that have been identified as priority actions for watershed planning by the work group, based on a consultants' report which includes additional recommendations. It is important to state at the outset that Lake Erie is lacking a consistent framework for developing and implementing a lakewide nutrient management plan that incorporates the eastern, central and western sub-basins, as well as watershed and subwatershed plans that consider downstream water quality impacts (Figure 1, Figure 2 and Figure 3). Based on the observations summarized in this report, it would not be appropriate to rely on watershed and subwatershed planning alone to accomplish the necessary nutrient reductions in Lake Erie. However, watershed planning is an important tool and when implemented, presents an opportunity to make water quality improvements if the plans meet certain principles, among them addressing downstream impacts.

**Recommendation 1:** The Canadian and United States federal governments as well as the provincial and state governments should ensure that lakewide basin, sub-basin, watershed and subwatershed management plans (including plans to manage bays, islands and the nearshore) are developed for nutrient management in Lake Erie.

**Recommendation 2:** There are several key success factors, as discussed further below, that the Canadian and United States federal governments as well as the provincial and state governments should ensure are included in the lakewide basin, sub-basin, watershed, and subwatershed management plans for nutrient management.

**Recommendation 3:** The Canadian and United States federal governments as well as the provincial and state governments around Lake Erie should ensure that funding is available to support planning activities and implementation of watershed management plans for nutrients.

## List of terms

Below is a list of definitions of terms used for the purposes of this report.

**Adaptive management** - a systematic process aimed at continuous improvement based on results of previous practices, which involves planning, implementation, monitoring, and modification.

**Lake Erie basin** - consists of Lake Erie and the surrounding area of land that provides drainage into the lake.

**Lakewide Nutrient Management Plan** – a plan that identifies sources of nutrient pollution (i.e. phosphorus and nitrogen) into the lake system and actions necessary to reduce nutrient loadings to the levels necessary to meet water quality objectives. A Lakewide Nutrient Management Plan is an umbrella plan that includes sub-basin, watershed and subwatershed nutrient management plans.

**Subbasin** – An area of land that drains all streams, rivers, and other waters to a common tributary. For the purposes of this report the **Lake Erie basin** is comprised of the western, central and eastern **sub-basins**.

**Watershed management plan** – a plan developed through the cooperative efforts of watershed residents, governments, interest groups and other stakeholders to manage land, water and related resources on a watershed basis. Each plan is a unique reflection of the landscape and concerns of the community within each watershed. Each plan presents shared goals and outlines actions to manage land, water and related resources.

**Watershed management** - managing water resources within specific watersheds by knowing how much water is in the system, where it comes from, who is using it, how it is being contaminated and where it ends up. Watershed management takes into consideration all the outside activities that can influence the quality and quantity of surface and groundwater. (*Conservation Ontario*, <http://conservationontario.ca/what-we-do/what-is-watershed-management>)

**Watershed** – an area of land that drains all surface runoff to a common outlet, such as a main river. For the purposes of this report, watershed refers to the US eight-digit HUC watersheds and the Canadian tertiary watersheds.

**Subwatershed** – an area of land that is a subregion of the larger watershed, which drains all surface water to a common outlet, such as a tributary of a main river. For the purposes of this report subwatershed refers to the US ten-digit HUC subwatersheds and the Canadian quaternary sub-watersheds.

# Legacy Issues Work Group members and consultants

The Legacy Issues Work Group gratefully acknowledges the contributions of the WQB co-chairs and membership as well as the IJC staff support of Antonette Arvai, John Wilson, Cindy Warwick and Dave Dempsey. The work group wishes to recognize the excellent and thorough work of the consultants who produced the report upon which the work group's recommendations are based. Their report is attached as Appendix 1. Finally, a special thank you to the external work group experts who provided review and valuable input on the consultant's report.

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## Water Quality Board – Legacy Issues Work Group Members

### Canadian Members

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## Consultant Team

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## External Work Group Experts

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## History and background of project

The IJC provides advice and recommendations on matters related to the water quality of the Great Lakes, and approaches and options that governments may consider to improve effectiveness in achieving the purpose and objectives of the Great Lakes Water Quality Agreement (GLWQA). In 2015 the Water Quality Board formed the Legacy Issues Work Group, which identified the need to assess the state of watershed management plans for nutrient management in the Lake Erie basin as a priority issue.

Despite significant efforts commencing in the 1970s that succeeded in reducing loading of nutrients (especially phosphorus), recent studies have shown that ongoing and increased nutrient loading is continuing with new adverse effects, including harmful algal blooms. Approximately 11 million people (approximately one-third of the Great Lakes residents) live in and rely on the Lake Erie basin for their drinking water. Toledo's drinking water crisis in 2014 brought important attention to contemporary nutrient loading issues in Lake Erie. And the problems extend beyond the Toledo crisis; in 2011 there was a record algal bloom in Lake Erie, followed in 2015 with yet another record algal bloom.

The 2011 algal bloom prompted the IJC to conduct a binational investigation into the science and opportunities for action by governments to reduce algal bloom-causing pollution, which resulted in the publication of the Lake Erie Ecosystem Priority Report (or LEEP) in 2014. This IJC report recognized the efforts of the Governments of Canada and the United States as well as the Lake Erie basin States and Ontario to restore the lake's health, but provided recommendations for additional immediate actions, including: the adoption of new targets for maximum acceptable phosphorus loadings in Lake Erie; reducing phosphorus loading from agricultural and urban sources; and strengthening monitoring and research in the Lake Erie basin.

In June 2015, the governors of Ohio and Michigan and the premier of Ontario signed an agreement to reduce phosphorus inputs to the western waters of Lake Erie by 40 percent over the next ten years. In February 2016, the Governments of Canada and the United States announced the adoption of a binational target to reduce total phosphorus entering Lake Erie by 40 percent. To meet this target, Canada and the United States are committed to developing domestic actions plans by February 2018, via Annex 4 (Nutrients) of the GLWQA. To address the nutrient crisis in Lake Erie and to help achieve the 40 percent reduction goal, targeted watershed management plans (as proposed in this report) should be developed that focus specifically on nutrient management. These targeted watershed plans should be incorporated into the development of Lakewide Action and Management Plans (under Annex 2 of the GLWQA) as well as in the broader Annex 4 process for addressing nutrients.

The work group has observed that Lake Erie is researched and studied when there is a crisis. Much of the early monitoring and assessment ended in the 1980s when Lake Erie showed an initial recovery. As a result of the lack of longitudinal monitoring and assessment data, the work group believes that the implementation of effective watershed management plans should be used to assist in reducing nutrient loading to the lake. The key was to determine if existing watershed management plans were consistently being developed and implemented in the basin, and whether those plans are robust enough to lead to water quality improvements.

## Summary of report content

Following the signing of the GLWQA in 1972, significant actions were taken by both federal governments and by the state and provincial governments, including monitoring to track Lake Erie's response to the actions taken. By the mid-1980s phosphorous loadings to Lake Erie were reduced by more than half of the 1970s levels. Lake Erie showed visible improvements and a remarkable recovery. However, by the early 2000s Lake Erie was again experiencing increasingly severe eutrophication problems due to excessive nutrient enrichment. In 2015, the IJC Water Quality Board approved this review of nutrient assessments in watershed management plans within the Lake Erie basin and other jurisdictions that could be used as model examples of strategies to achieve nutrient load reduction targets and aid in the restoration of Lake Erie. Instituting a consistent framework with critical components and principles for lakewide basin, sub-basin, watershed and subwatershed management planning will help to keep attention focused on the issue of nutrient management over the long term.

In order to assess the status of watershed management plans, the work group reviewed a list of qualified consultants to identify and provide an inventory of agencies and other governmental/community organizations, interest groups, and stakeholders that develop and/or implement watershed management plans within and outside the Lake Erie basin. A screening matrix<sup>1</sup> for both Lake Erie watersheds and subwatersheds and key areas outside the Lake Erie basin was completed prior to selecting specific watershed management plans for further indepth review (Figure 4). The selected plans were reviewed in detail and a Watershed Plan Summary Sheet<sup>2</sup> was completed for each, which summarized the important aspects of each plan and scored each plan as objectively as possible.

### Link to full report

This report is available for download at: <https://www.scribd.com/document/325067447>

## Work group key observations and recommendations

With the goal of identifying critical components of effective watershed management plans, the consultants and work group inventoried 48 plans from inside and 32 plans from outside of the Lake Erie basin. The group of plans was shortlisted to 20 and 12 for indepth evaluation, respectively. The recommendations of this report stem from key observations from this review.

**Recommendation 1:** The Canadian and United States federal governments as well as the provincial and state governments should ensure that lakewide basin, sub-basin, watershed, and subwatershed management plans (including plans to manage bays, islands and the nearshore) are developed for

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<sup>1</sup> Hull & Associates, Inc. and BluMetric Environmental Inc., March 2016. Evaluating Watershed Management Plans – Nutrient Management Approaches in the Lake Erie Basin and Key Locations Outside of the Lake Erie Watershed. Submitted to the IJC. Appendix A.

<sup>2</sup> *Ibid.*, Appendix B.



nutrient management in Lake Erie. These plans should clearly identify downstream water quality goals, especially for nutrients. The recent binational target of a 40 percent reduction of phosphorus entering Lake Erie, committed to by the Governments of Canada and the United States (and recently agreed to by the Lake Erie States and Ontario), via Annex 4 of the GLWQA, is one of the goals the plans should be designed to achieve.

## Observations

- There is not a consistent approach for developing watershed management plans within the Lake Erie sub-basins and linking the plans to downstream impacts in the Lake Erie basin. Additionally, not all watersheds and subwatersheds have plans in place. The plans for the Portage and Upper Maumee Rivers in Ohio have common components, making them more complementary and potentially good examples for producing watershed management plans in the Lake Erie basin.
- Watershed management plans should be developed for each sub-basin, watershed, and subwatershed within the Lake Erie basin with the goal of meeting local and downstream water quality targets, especially for nutrient pollution.
- The plans should be developed and implemented in a consistent manner, with common components and principles. Common components and consistency among plans allows for comparison and evaluation of elements such as load reduction targets, best management practices, and performance measures. All watershed management plans (lakewide basin, sub-basin, watershed, and subwatershed) should include, where applicable, flood and storm water assessment and management, Areas of Concern (AOCs), source water protection plans for drinking water, septic system assessments, point source permits and any other water-related management/permit activity in the watershed.
- The plans should identify agencies as well as stakeholders responsible for the development and implementation of the lakewide basin, sub-basin, watershed and subwatershed management plans on both the Canadian and United States sides of the border.
- A Lake Erie basinwide network of watershed planners would help to develop common methodologies to characterize, model, implement recommendations, monitor, evaluate and track successes, recognizing the need to understand the cumulative effect of subwatershed nutrient contributions and the need to dedicate resources accordingly.

**Recommendation 2:** There are several key success factors, as discussed below, that the Canadian and United States federal governments as well as the provincial and state governments should ensure are included in the lakewide basin, subbasin, watershed, and subwatershed management plans for nutrient management.

- A **science-based** watershed characterization, including sources and amounts of pollution contributed, should be completed for all plans (including nutrient parameters such as phosphorus, nitrogen, chlorophyll-*a*, microcystin, total suspended solids).
- Clear **goals** should be set with intermediate **milestones** to track progress and maintain accountability, including reductions from specific point and nonpoint sources.
- To increase the probability of success, a **science-driven adaptive management process** that includes an economic cost-benefit component for required actions should be a foundational principle

of the lakewide basin, sub-basin, watershed, and subwatershed management plans discharging into Lake Erie. Training opportunities should also be provided to watershed planners and implementers to foster consistency and understanding of the importance of adaptive management in planning.

- Watershed management planning should have a **consistent watershed wide approach**, reflecting the unique aspects of the watershed and subwatershed impacts flowing into the western, central and eastern sub-basins of Lake Erie.
- A Lake Erie **partnership** should be established consisting of federal, state, provincial, Tribal, First Nation, Métis, local, academic and private stakeholders, as well as representation of the planning team. Each sub-basin, watershed, and subwatershed plan should define responsibilities of the partners in implementing the plan.
- A strategy for generating **public awareness** should be developed and implemented so that watershed stakeholders understand the problems associated with excessive nutrient loading, the sources and amounts of nutrients, the benchmarks for needed reductions, the ways that they and others might contribute to the problems, and the actions they can take to help reduce nutrient loading.
- A strategic, **efficient and effective monitoring program** should be in place to assess the performance of management practices developed from actual data and peer-reviewed scientific models.

## Observations

- Many of the plans reviewed within the Lake Erie basin lack clear milestones and outcomes for implementation and frameworks for accountability. Clear benchmarks help to keep management activities on a trajectory toward success. With a strong adaptive management program that evolves from laws, regulations and best management practices, these milestones can always be modified to meet future goals. The River Raisin management plan provides a good model for defining goals with clear milestones and outcomes for watershed restoration in the Lake Erie basin. The plan contains detailed goals, objectives for priority subwatersheds, quantitative targets, and preferred locations for monitoring progress.
- Watershed management plans from outside of the Lake Erie basin provided examples of plans that generally scored higher than those from inside the basin. The scoring differences between high- and low-scoring plans are mainly attributed to the post-implementation components. Most of the plans from within the Lake Erie basin lack a basinwide assessment and evaluation component, and post-implementation followup with clear milestones and targets/outcomes for restoration. The Chesapeake Bay watershed management plan provides a good example of a basinwide post-implementation followup, through the use of its Chesapeake*Stat* tool.
- Adaptive management is the cornerstone of successful restoration projects for some of the higher scoring watershed management plans, including the Everglades, Chesapeake Bay, Lake Champlain, and the East Holland River (Lake Simcoe watershed). Structuring the plan around a systematic, scientific approach provides the greatest return on investment of time and resources, as well as the flexibility needed to learn from successes and failures.
- Watershed management plans that are successful in achieving goals and objectives have been developed and implemented with participation of all levels of government, citizen groups, industry, agriculture, academics, etc. Continued participation of original planning participants in the



implementation of the plan is another marker of success. Consensus regarding the allocation of responsibilities is necessary and should include being fair, based on good science, and incorporate capabilities of various government sectors as well as those of other stakeholders. The Chesapeake Bay program, which is staffed by personnel from federal, state, nonprofit and academic agencies, provides a good example of multi-organization collaboration toward a common goal.

- Additionally, watershed management plans that are successful in achieving goals and objectives create a desire to conserve and restore the watershed within and beyond its borders. Even though Lake Erie water resources impact so many North Americans, many do not yet appreciate the extent and immediacy of the water quality problems the lake experiences. The Chesapeake Bay Program, Everglades Restoration, and the Lake Champlain Basin Program have conducted extensive public awareness campaigns and outreach that extends basinwide, by using multiple forms of media to support the plan.
- A strategic, effective and efficient monitoring program is necessary to assess progress and to implement a demanding adaptive management program. Monitoring should track inputs of nutrient pollution through the watershed and implementation of the objectives identified in the plans as well as the relevant indicators of water quality. The program should be detailed, incorporate a specific schedule, state who will fund the monitoring, and discuss how and where the results will be reported and used to evaluate success. A commitment to long-term monitoring and modelling is critical to ensuring that water quality continues to be assessed even though an immediate crisis may seem to have passed. Long-term monitoring data is also critical to the calibration of these water quality models.

**Recommendation 3:** The Canadian and United States federal governments as well as the provincial and state governments around Lake Erie should ensure that funding is available to support planning activities and implementation of watershed management plans for nutrients.

## Observations

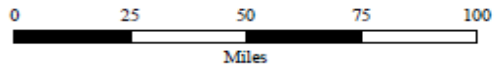
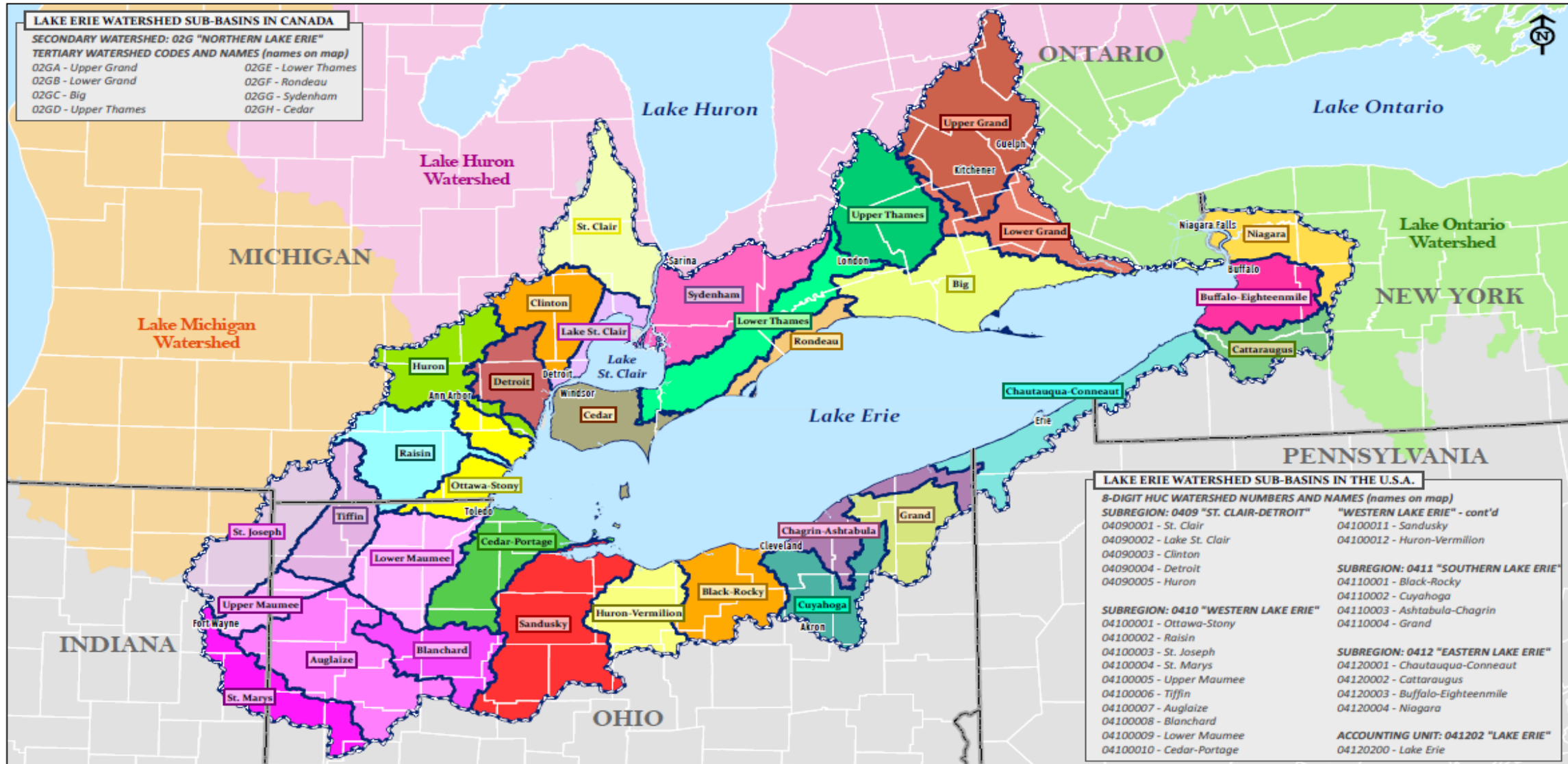
- Funding efforts are more likely to be successful with combined efforts. Combined efforts in the planning and implementation of a plan are more likely to bring implementation and research funding to the region, including resource allocation and special funding initiatives to address priority areas.
- Funding should be leveraged to grow stewardship and volunteerism beyond public awareness. For example, to empower and leverage the energy of youth groups/students to participate in sampling regimes, riparian restoration, etc.

## Summary and conclusions

Nutrient loading from the western and central Lake Erie sub-basins is a significant issue for the whole of Lake Erie. As harmful algae blooms continue in the western and central subbasins, concerns about impacts of excess nutrients on the eastern Lake Erie sub-basin are also mounting. A key tool in addressing this issue is a coordinated approach to developing and implementing a lakewide nutrient management plan that works with and incorporates plans for watersheds and subwatersheds within each sub-basin to address downstream pollution impacts.

# Lake Erie Watershed, showing 8-digit/Tertiary Sub-Basins

LEW3



This map is a product of the Ohio Department of Natural Resources (ODNR) Office of Coastal Management and is intended to provide general information only. [coastal.ohiodnr.gov](http://coastal.ohiodnr.gov) Map created: 01/15

Figure 1 – Lake Erie Watershed and HUC 8/tertiary Subbasins (Source: Ohio Department of Natural Resources, [http://coastal.ohiodnr.gov/Portals/coastal/pdfs/atlas/lake\\_erie/LEW2.pdf](http://coastal.ohiodnr.gov/Portals/coastal/pdfs/atlas/lake_erie/LEW2.pdf))

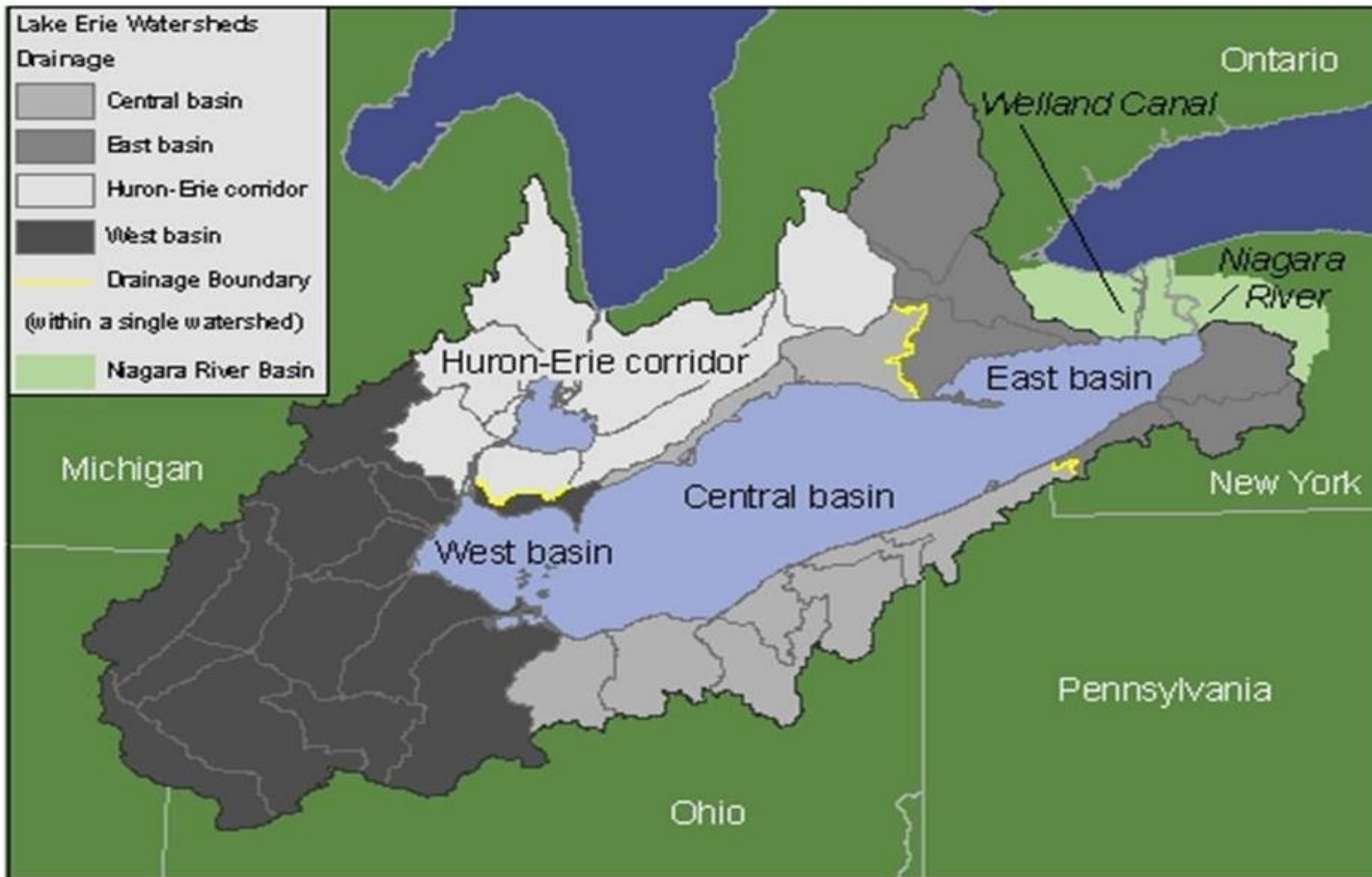


Figure 2 – Lake Erie basin with west, central and east subbasins and associated watersheds (Source: Great Lakes Fishery Commission, [http://www.glf.com/lakecom/lec/spatial\\_inventory/basin\\_lake.html](http://www.glf.com/lakecom/lec/spatial_inventory/basin_lake.html))

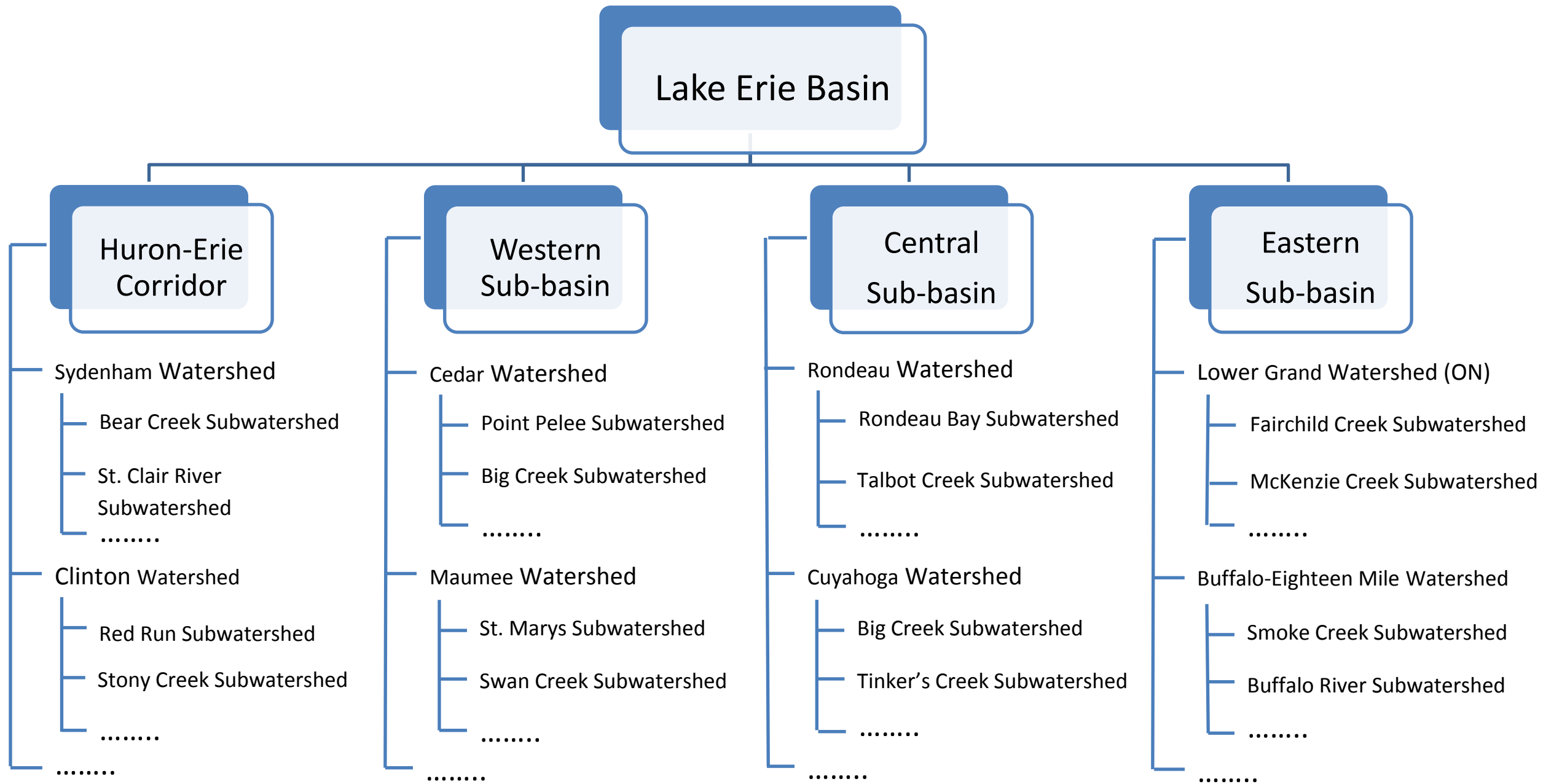


Figure 3 – Hierarchy of watersheds (HUC 8/tertiary) and subwatersheds (HUC 10/quaternary) in the Lake Erie basin (examples used for illustrative purposes, not comprehensive)



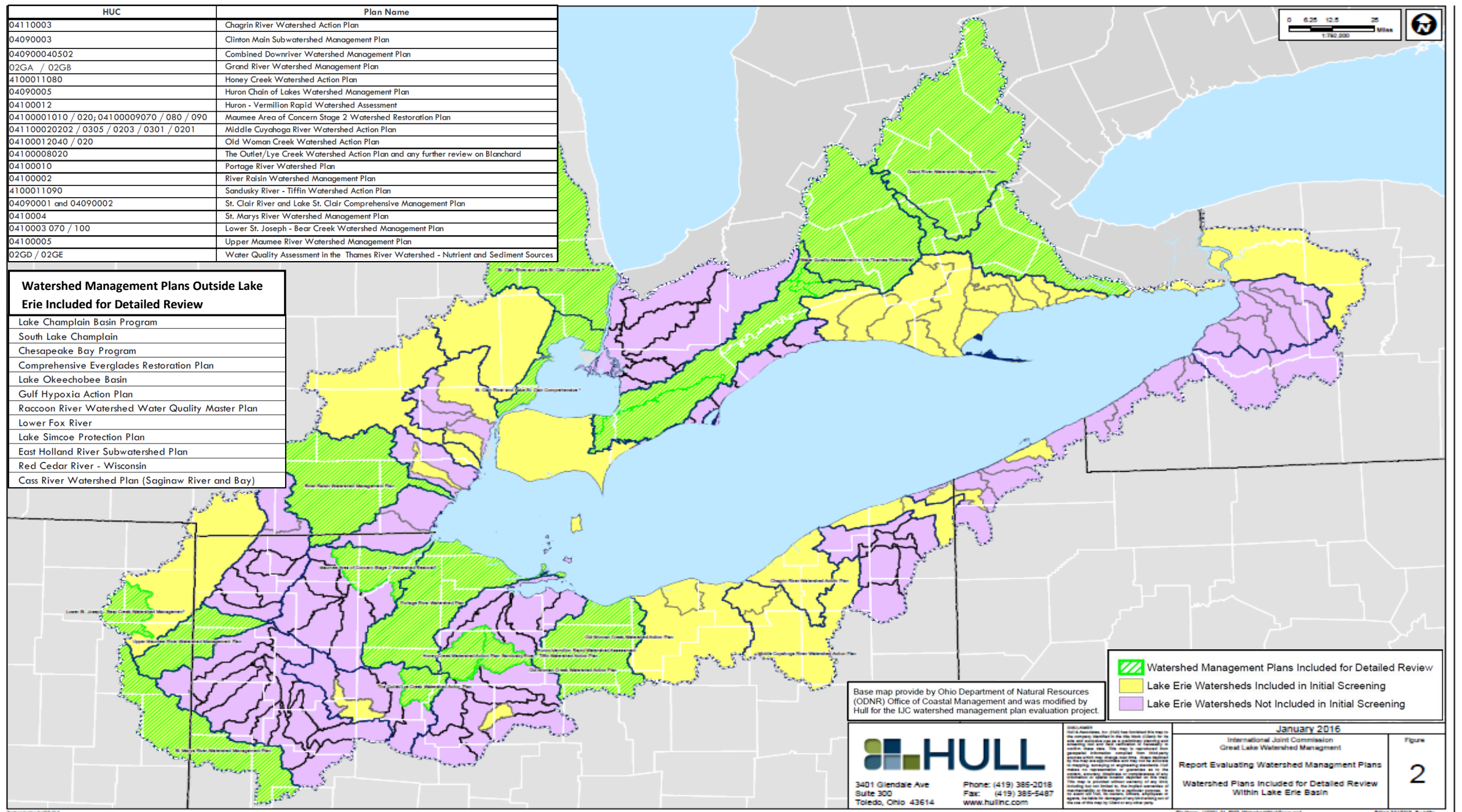


Figure 4 – Lake Erie watershed and subwatershed management plans included in initial inventory (yellow) and for detailed review (green)