WATERSHED ASSESSMENT OF DETROIT RIVER PHOSPHORUS LOADS TO LAKE ERIE

IMPACT REPORT

The rivers flowing into Lake Erie carry phosphorus and other nutrients that can lead to harmful algal blooms in its western basin and hypoxic conditions (i.e., low oxygen levels) in its central basin. Despite nutrient management efforts, algal blooms and hypoxia, which impact drinking water, tourism, swimming, and fishing, have become more extensive in recent years.

In 2012, the U.S. and Canada signed a revised ***Great Lakes Water Quality Agreement*** which, in 2016, led to the adoption of phosphorus-loading targets and the development of action plans for reducing inputs to Lake Erie. The plans were released in 2018. The Detroit River provides approximately 80% of the flow and 25% of the phosphorus entering Lake Erie. However, the sources of this phosphorus have been somewhat uncertain, which has challenged efforts to develop consensus on a regional mitigation plan.

In 2016, the Erb Family Foundation provided support to a project team based at the University of Michigan (Water Center and College of Engineering) to characterize phosphorus sources and evaluate management options for the St. Clair-Detroit River watershed.

The team developed four computer models to simulate the dynamics of this complex, binational watershed, which includes extensive urban and agricultural environments, as well as a large, shallow and productive lake—Lake St. Clair—that receives and processes the loads upstream of the Detroit River. A diverse project advisory group provided critical feedback on the policy context, planned research approach, and resulting products, and advisory group members have helped share project findings with their networks.

KEY PRODUCTS

Engagement: Our project advisory group provided key input to the research, and also fostered learning and networking around Lake Erie issues. We convened a series of two-day meetings in Detroit, Windsor, and Ann Arbor, which are summarized in our report supplemental information. Of the 30 advisory group members, 26 completed a final survey, and those survey results and comments are used illustratively in this document.

Summaries for Management and Policy: To maximize value for a range of audiences, we presented findings in a variety of products: a comprehensive report, infographics, and slide decks, as well as a series of factsheets on each combined sewer overflow basin studied in metro Detroit.

Peer Reviewed Research: The scientific credibility and visibility of project findings have been enhanced through the peer review and publishing process. The research team has published 11 journal articles about this research.

Technical Assistance: Customized results, maps, and personalized briefings have been provided to a number of organizations and agencies outside the academic community, including:

- Great Lakes Water Quality Agreement Annex 4 subcommittees
- Michigan Domestic Action Plan team
- U.S. Environmental Protection Agency
- Environment and Climate Change Canada
- Ontario Ministry of Environment, Conservation and Parks
- Ontario Ministry of Agriculture, Food and Rural Affairs
- Conservation Authorities
- Great Lakes Water Authority
- Oakland County Water Resources Commissioner's Office

These resources and articles are available on our project webpage.

NEW SCIENCE IS FRAMING CONVERSATIONS AROUND LAKE ERIE

This project quantified and built a common understanding of Detroit River watershed contributions of phosphorus to Lake Erie, which is a critical step for developing solutions.

When this project began, the total amount of phosphorus carried by the Detroit River to Lake Erie had been quantified and recently updated, but neither the relative contribution from different sources nor the movement of phosphorus through the St. Clair-Detroit River watershed were well understood. The lack of common understanding around factors driving river loads and, ultimately, Lake Erie algal blooms and hypoxia hindered regional planning and prioritization efforts. This project filled several critical information gaps.

As a result of a close collaboration between the research team and our advisory group, project findings were quickly integrated into conversations about Lake Erie. Many advisory group members reported using project findings in their own discussions of Lake Erie water quality issues. For example, 92% of advisory group members shared products or take-away messages with others, 73% used project findings or products as framing for conversations about the issue, and 42% used our findings in writing or presentations.

> "We have used the information in media articles and presentations to farmers and agriculture groups to discuss the need for practice suites to effectively address phosphorus loading."
>
> *— Project advisory group member*

Key scientific contributions:

- Explained the scale of changes needed across the watershed to reach a 40% reduction target for the Detroit River.
- Compared the relative contribution of different sources of phosphorus—including treatment plants, agricultural run-off, and combined sewer overflows—using consistent and easily interpreted units of comparison.
- Compared inputs from rivers that drain directly to the St. Clair-Detroit River system. Revealed that Lake Huron was a much bigger contributor of phosphorus than previously known, thus expanding conversations about Lake Erie to include the Detroit and St. Clair River watersheds and Lake Huron. (See Figure 1 to see where phosphorus is coming from.)
- Provided an independent assessment of recent improvements in waste water treatment operations and stormwater retention facilities in metro Detroit. Placed those changes within the context of other phosphorus sources and illustrated the complex system dynamics that lead to combined sewer overflows. (See Figure 2 to see how inputs have changed over time.)
- Outlined the key differences between the Detroit River's contributions and the Maumee River's contributions to Lake Erie algal blooms.
- Demonstrated that Lake St. Clair retains a significant portion of the particulate-bound phosphorus that enters the lake each year, but much of the potent dissolved phosphorus passes through the lake.

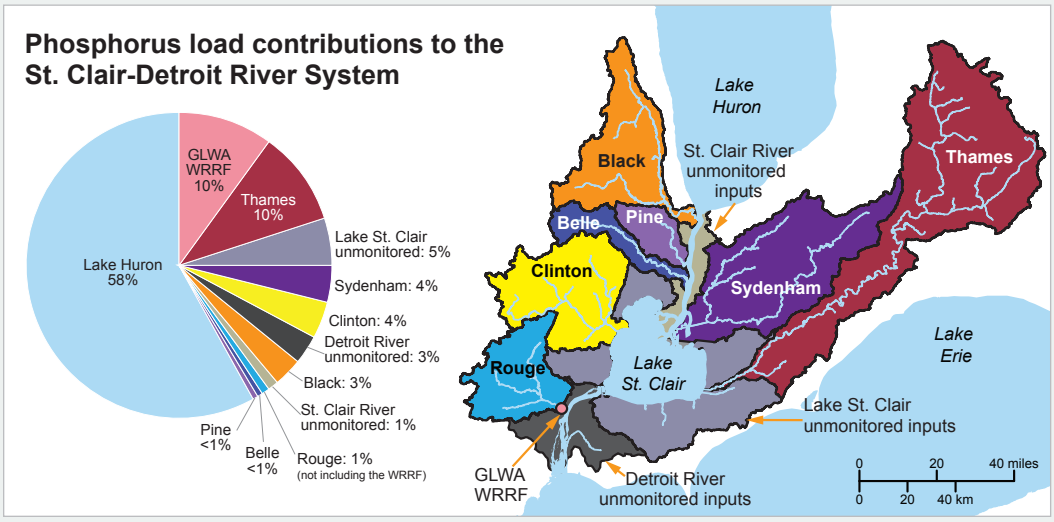
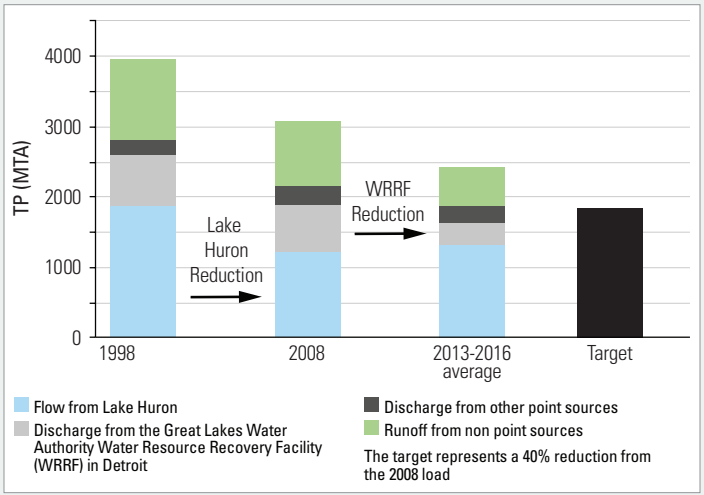


Figure 1. Where is phosphorus coming from? The pie chart shows the relative amounts of phosphorus that come from different parts of the watershed and the Great Lakes Water Authority's Water Resource Recovery Facility (GLWA WRRF) in Detroit. Colors in the pie chart correspond to the map at right.

Figure 2. How have inputs changed over time? This bar chart shows the annual amount of phosphorus input to Lake Erie from the Detroit River during three time periods.



> "It allowed me to communicate very clearly that the phosphorus removal permit requirement at [our facility] may not be the lowest [our regulator] will require in the future and why. I was able to get this concept incorporated in the Master Plan and justify continued research on phosphorus removal capabilities. It was very valuable to efforts to direct considerations for the future."
>
> — *Project advisory group member*

INFORMING PRACTICE AND POLICY

This project provided timely and relevant scientific information that is being used to shape the adaptive management process for Annex 4 efforts under the Great Lakes Water Quality Agreement.

Project advisory group members kept the research team apprised of developments within the policy community and invited the team to provide timely briefings to key groups. As the project results became available, states and provinces had already established domestic action plans for reducing nutrients, but they were also developing a framework for adaptively managing targets and reduction plans under the Great Lakes Water Quality Agreement. This project provided critical input that is being used to expand the scope of Lake Erie planning to include the full St. Clair-Detroit River watershed and Lake Huron. In addition, agricultural interests and wastewater professionals are using results to dampen finger-pointing while pushing for further improvements within both sectors.

Advisory group members identified numerous benefits of the project for their own work, as well as specific ways the project was informing policy and management. For example, 11 of 26 advisory group members adjusted their focus or priorities as informed by the project, and 7 of 28 adjusted a program or policy as informed by the project.

> "Information was very helpful and informed our strategy to reduce phosphorus by 40% in western Lake Erie basin."
>
> — *Project advisory group member*

BUILDING NETWORKS AND CAPACITY TO ADDRESS LAKE ERIE

This project developed a new "network of networks," which is critical for building capacity to address issues that cut across jurisdictional boundaries and sectors.

> "The groups represented on the committee included people doing similar work that I would not have otherwise met and who I now cross paths with at other meetings. This project has certainly increased my network of colleagues, which now also includes those I would call a friend."
>
> — *Project advisory group member*

Lake Erie water quality issues have been particularly challenging to address, in part because so many agencies, organizations, and industry sectors are involved in planning, decision-making, and implementation efforts. Groups often work in silos, leading to tensions and contradictory narratives about which industries (i.e., utilities or agriculture) and locations (i.e., Ohio or Michigan or Ontario) are causing the problem. Recognizing this barrier to advancing solutions, project engagement activities fostered dialogue across disparate stakeholders that could help build consensus around Detroit River water quality issues and create connections that would benefit participants' professional work. All project advisory group members reported that they had made new professional contacts, including on average three new people with similar work, and four new people whose work is different.

EFFECTIVE ENGAGEMENT AND CONSULTATION

A robust engagement process proved crucial to overall project success.

Project group members represented 30 different organizations, including many of the organizations that are meant to benefit from project findings. Throughout the project, we used a variety of mechanisms to engage and solicit input from our project advisory group, as well as additional organizations. Ninety-two percent of advisory group members agreed that the project process achieved each of the stated four project goals: transparency, responsiveness, fairness, and overall effectiveness.

The Watershed Assessment of Detroit River Phosphorus Loads, coupled with similar modeling efforts in connected watersheds, provides tools that are being used to guide policies and practices as the countries work within the Great Lakes Water Quality Agreement adaptive management framework. On-going research and modeling efforts, such as this one, are a critical part of an adaptive management process because they can help track progress and identify when adjustments to action plans and assessment tools are needed.

> "The process was open, transparent, and we appreciated the chance to help with data and messaging for the final report. It made the report better able to be read and synthesized by policy makers and stakeholders."
>
> *— Project advisory group member*

> "This project advisory committee was the best organized and transparent of the project advisory committees I have participated in."
>
> *— Project advisory group member*

This project was managed by the University of Michigan Water Center, Graham Sustainability Institute, and funded by the Fred A. and Barbara M. Erb Family Foundation. For more information on this project and to download research summaries and the full report, please go to: myumi.ch/detroit-river

The Graham Sustainability Institute mobilizes the expertise and passion of scholars, partners, and decision-makers to work together and bring world-class research to real-world sustainability challenges.

The Fred A. and Barbara M. Erb Family Foundation advances an environmentally healthy and culturally vibrant metropolitan Detroit and a flourishing Great Lakes ecosystem.

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