About the Grand-Erie Study

Monitoring in the Grand-Erie Interface: Developing a framework for the lower Grand River and nearshore Lake Erie in consideration of cumulative effects

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Why is this research relevant and important?

In September 2015, all 193 United Nations countries voted in the Sustainable Development Goals (SDGs) under Agenda 2030. Soon after, the United Nations General Assembly unanimously decided to prioritize Goal 6 – clean water and sanitation for all, naming the decade from March 22, 2018 to March 22, 2028 the International Decade for Action on Water for Sustainable Development. To address Goal 6, UN-Water's Integrated Monitoring Initiative prioritized cross-sectoral collaboration and capacity building for equitable, whole-water-cycle monitoring. Collaboration, equity and considering the whole water system are key aspects of the Grand-Erie study.

Locally, prioritization of freshwater issues has usually occurred in response to long-term challenges with water quality. Across Canada, consideration of cumulative effects is being recommended across all levels to tackle increasingly complex water challenges. Cumulative effects are changes that occur over regional areas over time, often as a result of many small stresses combined (e.g., rising water temperatures combined with pollution). These small stresses can work together to create big impacts; the algae example below illustrates this well.

Now, authorities in Canada and the United States are looking upstream to the rivers that feed into the Great Lakes to restore water quality. In the Eastern basin, the Grand River is one of the major contributors (historically, the greatest contributor) of nutrients like phosphorus.

Cumulative effects: Algae in Lake Erie

In the late 1960s and 70s, an increase of the nutrient phosphorus in Lake Erie caused an explosion of algae, which in some areas was followed by low-oxygen 'dead zones' in a process called eutrophication. By the 1990s, many sources of phosphorus were thought to have been eliminated after reductions were made in laundry detergents and sewage treatment plant effluents. However, in the new millennium, invasive zebra and quagga mussels near the shores of Lake Erie were found to trap phosphorus, concentrating it in colonized areas and releasing it later in a different form.

Figure 1. Mussels mixed in with Cladophora algae on the shore of Lake Erie. Photo credit: NOAA.

This had several effects that work cumulatively to make the algae problem worse:

- The explosion of mussels clarified the water, allowing sunlight to penetrate more deeply, which allows more algae to grow.
- Climate changes mean more extreme rain events wash even more nutrients (e.g., from farms) into the water system.
- Mussels suck in and filter phosphorus from the water column, convert it in their bodies to a form that algae can use more easily, and then release it (after a brief time delay) close to the shore. This basically creates an algae buffet.
- In the Eastern basin (where we are located), the most common nuisance algae need hard surfaces to grow on/attach to. The dense hordes of mussel colonies turned our sandy/muddy shoreline into a rock-hard surface, providing a base on which algae can grow prolifically (i.e., algae can attach to the mussels themselves).

Nuisance algae in the Eastern basin foul boat propellers and are often found in huge amounts rotting on beaches or clogging pipes. In the Western basin, harmful (sometimes toxic) algae are getting worse as well. The record bloom in 2015 left roughly half a million people without water for days to weeks. Similar conditions were seen in 2017, with predictions for these scenarios to continue worsening.

Figures 2 and 3. Harmful algae bloom in the Western Basin (Fig. 2) and explosion of Algae across Lake Erie (Fig. 3) in March 2012. Photos: NOAA.

What is this study about?

This research is a project under the Lake Futures initiative at University of Waterloo (part of the nationwide Global Water Futures research collaboration). Its purpose is to propose a cumulative effects monitoring framework for the interface area of the Grand River and Lake Erie (also known as a freshwater estuary).

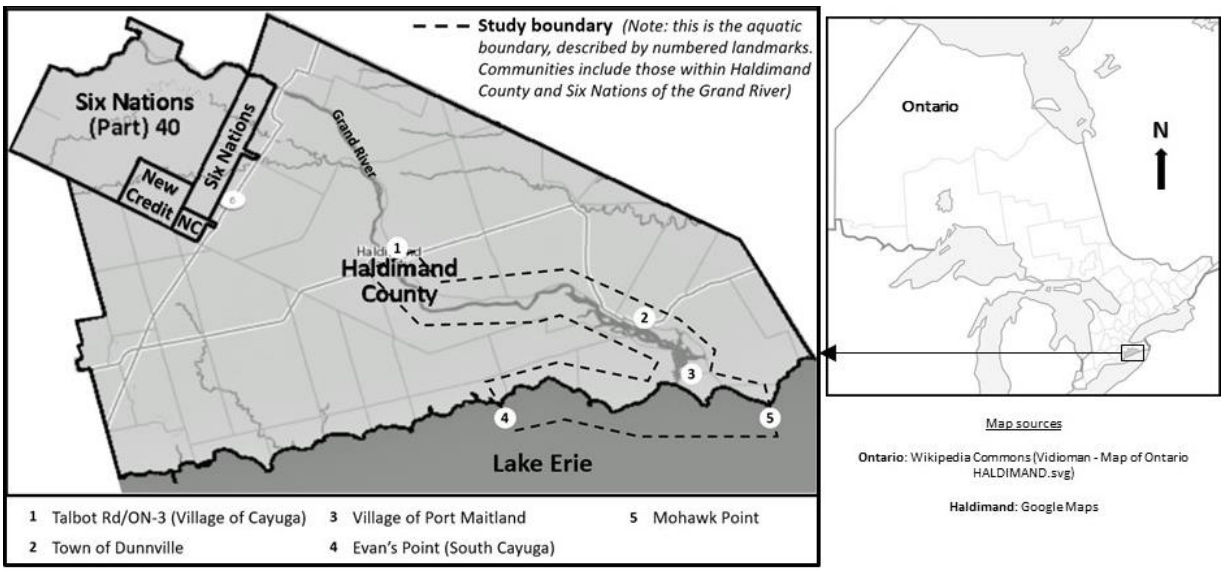

Figure 4. Study area for this research.

Objectives of this research and of the monitoring framework are to:

- Update the monitoring priorities used to guide monitoring in the area, which were last updated in the early 1990s;
- Be guided by a foundation built on a combination of sound science and Indigenous Knowledge;
- Coordinate various monitoring efforts in the interface area while ensuring applicability to decision-making.

The main research question is: How can current monitoring activities in the Grand River-Lake Erie Interface (GEI) be strengthened as a more robust monitoring framework that: (1) considers cumulative effects (CE), (2) is co-created by diverse stakeholders and collaborators, (3) is feasible for implementation post-research and (4) which informs decisions?

This work builds on recent research by the Canadian Water Research Consortium (CWRC), including biomonitoring work done in the upper and middle Grand River watershed.

Methodology – what will I do?

I will be doing the following three things throughout my research:

- Consulting with key stakeholders, partners and rights-holders;
- Reviewing documents and literature; and
- Participant observation – e.g., attending stakeholder/manager meetings and leading a workshop at the Canadian Water Resources Association National Conference.

In addition, there are three time-bound phases of the research:

- Phase 1 – Key Informant Interviews: Interviews with subject matter experts, researchers, community groups, water managers, decision-makers and government scientists;
- Phase 2 – Public engagement: Questionnaires at the Great Art for Great Lakes event series and a photojournalism workshop (with optional competition); and
- Phase 3 – End User Workshop: A final workshop for the people who may implement this monitoring program.

Study materials and summary reports will be posted as they are available. The Phase 1 summary is expected to be completed in July 2019, Phase 2 in September 2019, and Phase 3 in May 2020.

What will come out of this research?

In addition to a PhD thesis (made up of six chapters, each with its own published journal article), a number of theoretical and practical contributions are expected to come of this study. Below are some examples.

Contributions to Theory

- Application of community-based participatory action research, including co-creation, in a Canadian multijurisdictional environmental/water context
- Building on recent work by the Canadian Water Network and others
- Application of existing tools and approaches (e.g., DPSIR method)
- Development of a new, standardized process for selecting and prioritizing monitoring priorities
- Discussion of approaches to align water monitoring with Agenda 2030, Indigenous perspectives and other approaches or practices
- Presentation of a new framework for improved aquatic monitoring in the study area which may be relevant for other regions as well

Contributions to Practice

- Addressing the needs of local communities and contributing to building relationships between stakeholders through collaboration
- Including diverse perspectives on commonly-discussed topics (e.g., the public doesn't usually have a voice in guiding water management and decisions)
- Evaluation of current monitoring activities, with potential improvements discussed (this also provides a synthesis of many documents produced in recent years)
- Long-term/pre-existing water monitoring data are used in new ways to address current issues