Community-based monitoring pilot for Garden River and St. Marys River Area of Concern

Final report

Prepared by Dr. Elaine Ho-Tassone, Science Lead

Report to Dr. Brie Edwards, Ministry of Environment, Conservation, and Parks (Great Lakes Local Action Fund)

March 14, 2022

Northern Ontario Research, Development, Ideas and Knowledge
NORDIK INSTITUTE

KETEGAUNSEEBEE GARDEN RIVER First Nation

Contents

Drone photographs: Richard Perrault, Lands and Resources Department, Garden River First Nation.

Ground photographs: Dr. Elaine Ho-Tassone, NORDIK Institute/ Algoma University (unless otherwise specified).

Territorial acknowledgement

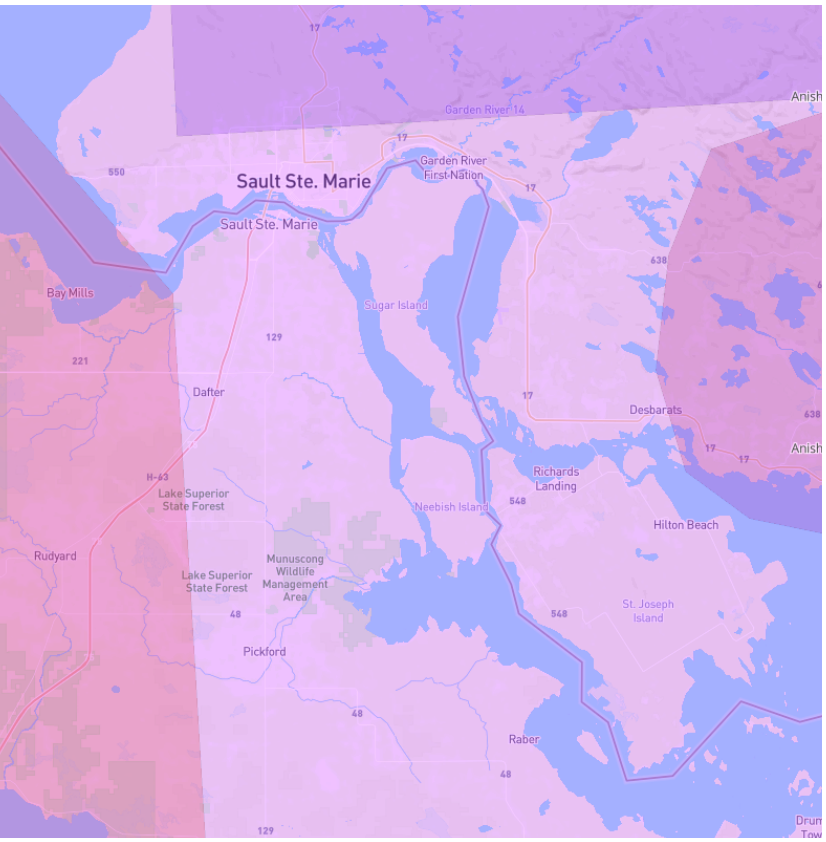
This project is implemented in Robinson-Huron Treaty territory, the traditional territories of the Anishinaabeg and Métis peoples—including Garden River First Nation, Batchewana First Nation, Métis Nation of Ontario, Missanabie Cree First Nation, and many others (including our friends across the present-day Canada-US border). The project team also recognizes the Dish with One Spoon wampum (Gdoo-naaganinaa).

We thank the Indigenous peoples and nations surrounding Baawatigong (St. Marys River) for their stewardship of the lands, waters, air, and everything within them, which settlers have benefited from often at the expense of original peoples. We recognize the many injustices perpetuated by colonialization, which continue to impact individuals and societies across Nayaano-nibiimaang Gichigamiin (Great Lakes region—see Appendix 1).

With these acknowledgements, we take seriously our role as allies as we progress towards a more respectful and collaborative future.

To our project partners who steward Ketegaunseebee (Garden River), we are grateful for your willingness to collaborate in your territory—chi miigwech.

Below: Screenshots from native-land.ca representing traditional (left) and treaty (right) territories in the region of the St. Marys River Area of Concern. Native Land Digital is a Canadian not-for-profit organization, incorporated in December 2018. Today Native Land Digital is Indigenous-led, but it was founded in 2015 by Victor Temprano, a settler hailing from Okanagan territory.



Project background

The Garden River First Nation water quality monitoring program was conceived in the fall of 2020. It was collaboratively developed by Chief Andy Rickard (Garden River First Nation), three staff at the Lands and Resources Department (Garden River First Nation), and Dr. Elaine Ho-Tassone (NORDIK Institute/Algoma University). As the project progressed, additional persons at Garden River First Nation took the lead on this project, namely Aaron Jones and Sebastian Belleau. This project contributes to postdoctoral research by Dr. Ho-Tassone and is funded primarily by the Great Lakes Local Action Fund via the Ontario Ministry of the Environment, Conservation, and Parks. Mitacs provided matching funds to support the Postdoctoral Fellowship and Eco Canada provided a wage subsidy for two Garden River First Nation students from June to August, 2021. Swim Drink Fish provided additional funds and resources to create an *E. coli* testing hub at the First Nation.

Garden River First Nation sits in the lower area of the Garden River subwatershed at its confluence with the St. Marys River—one of 12 Areas of Concern (AOC) identified by the International Joint Commission. Garden River First Nation is concerned about its water quality, fish stocks/fisheries, and related human health issues. Similarly, managers and scientists involved in improving the St. Marys River AOC are focused on the following priorities: fish consumption, degradation of fish, wildlife, and benthos populations and habitats, dredging restrictions, and fish tumors and deformities.

This project aims to collaboratively generate actionable community-based data and information to inform local and regional management and decisions related to the St. Marys River AOC. Led collaboratively by Garden River First Nation and NORDIK Institute, other collaborators included Algoma University, Waterlution, Water Rangers, Swim Drink Fish, and DataStream Initiative (formerly part of the Gordon Foundation). This pilot project was implemented by Indigenous community members who monitored water quality at seven locations. Sampling occurred from July to November 2022, resulting in 1,067 data points and two benthic invertebrate surveys (541 tallied).

Monitoring undertaken as part of the pilot project contributes to a baseline understanding of conditions in the Garden River and nearshore St. Marys River, while providing context for training basic monitoring and ecological observation skills. From this project, a more comprehensive community-based monitoring program is being designed, using priorities and feedback from the community. Among other changes, the program is being expanded to include *E. coli* testing of water samples in a laboratory provided by Swim Drink Fish, as well as winter sampling using an ice auger. Further, the researcher continues to explore approaches for implementing Two-Eyed Seeing as part of water quality monitoring. She is also considering the role of community-derived data as a compliment to conventional water quality data (e.g., through the Provincial Water Quality Monitoring Network) for informing freshwater management and decisions in Ontario.

Project team and collaborators

Team members at Garden River First Nation

Chief Andy Rickard	Elected leader of Garden River First Nation.
Aaron Jones	Fish and Wildlife Coordinator, Lands and Resources Department at Garden River First Nation, who joined our team in October 2021. Aaron is our primary contact: ajones@gardenriver.org.
Stephanie Seymour	Manager, Lands and Resources Department at Garden River First Nation.
Richard Perrault	Environmental Coordinator, Lands and Resources Department at Garden River First Nation.
Amanda Cress	Administrative Assistant, Lands and Resources Department at Garden River First Nation.
Sebastian Belleau	Community Water Quality Coordinator (until at least March 2022).

External team members (outside the Nation)

Elaine Ho-Tassone	Mitacs Postdoctoral Fellow at Algoma University (July 2021-June 2030); Science Lead.
Istvan Imre	Acting Academic Dean and Biology Professor at Algoma University. Elaine's faculty supervisor for the postdoc position.
Sean Meades	Director of the NORDIK Institute at Algoma University; signing authority.
Alex Sarno	Biology Intern, Algoma University. Alex completed our data analysis.

Project collaborators

Karen Kun	Director and Co-Founder, Waterlution. Waterlution is the 'industry partner' for Elaine's Mitacs Postdoctoral Fellowship. Also, Waterlution provided social media messaging training to youth at Garden River First Nation as part of our culminating event series on February 14, 2022.
Lindsay Day	Program Manager, Gordon Foundation. Gordon Foundation provided us with information booklets (basic info re: different monitoring parameters) and included us as part of the launch of the Great Lakes DataStream. The DataStream Initiative also featured this project on its website.
Jessica Gordon	Great Lakes Water Monitoring Manager – Communications, Swim Drink Fish (SDF). SDF helped us create and Environmental Health and Safety Survey, offered a pre-recorded webinar for training volunteers, and is including Garden River First Nation as one of six communities across Canada that are setting up an *E. coli* testing hub.
Gregary Ford	Great Lakes Water Monitoring Manager - Science & Operations, Swim Drink Fish. See above for SDF's role.

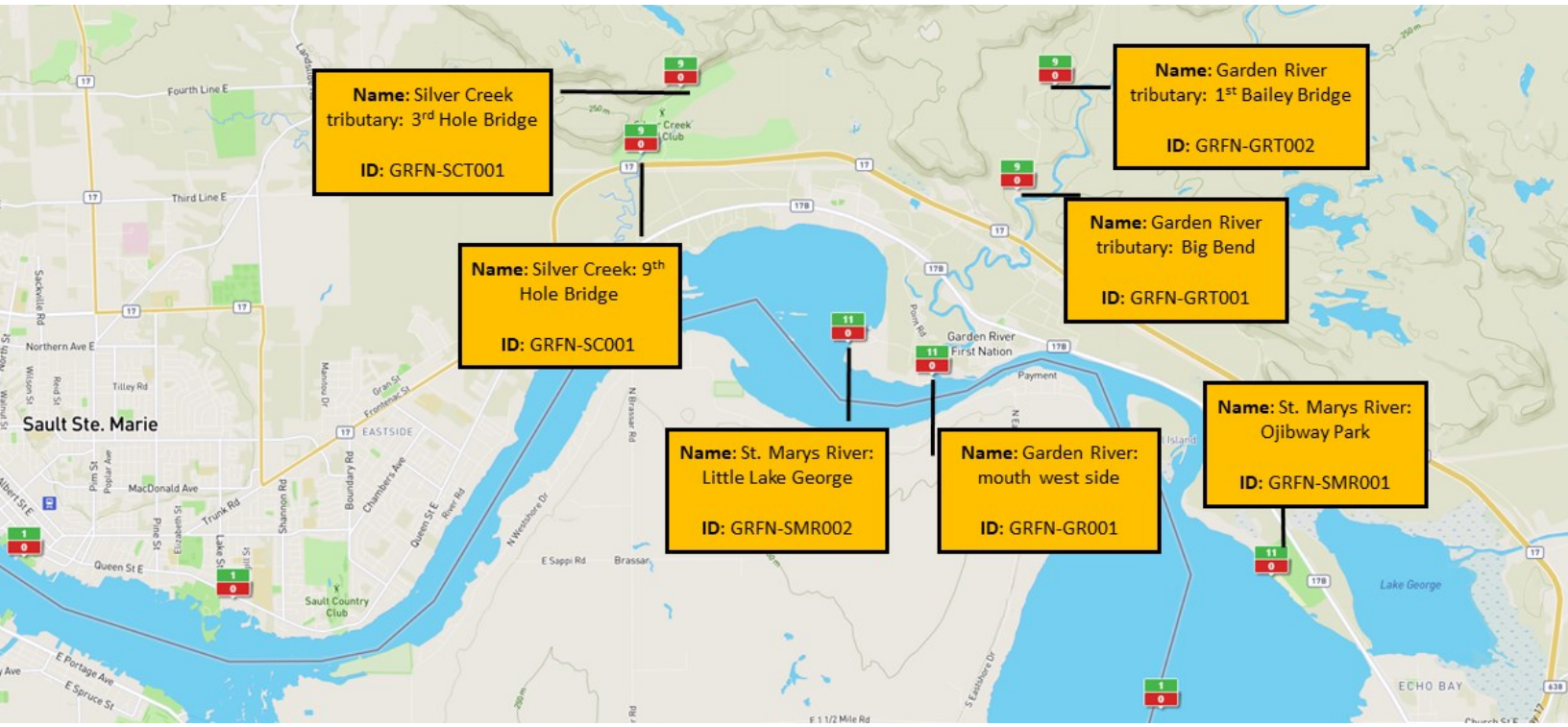
Emelia Duguay	Sustainable Development Coordinator, Water Rangers. We purchased four Water Rangers Freshwater Explorer Testkits. Water Rangers also provided us with access to training webinars and is hosting our data on their online application.
Gabrielle Parent-Doliner	Director, Water Rangers. In addition to the role described above, Water Rangers also donated a refill pack in March 2022 to kick-start the 2022 monitoring season.

Former team members whose terms have ended with us

Alexis Vanderheyden	Former Manager, Lands and Resources Department at Garden River First Nation.
Meggie Lesage	Former Community Coordinator, Garden River First Nation (June-November 2021). She was the driving force of implementation. Some of Meggie's time was also dedicated to the Lands and Resources Department, increasing their capacity to address their needs.
Cade Nolan	Former Community Coordinator, Garden River First Nation. He joined us from June to August 2021, sharing Meggie's tasks and also contributing to the Lands and Resources Department.
Yashoda Fernando	Undergraduate student in Algoma University's Bachelor of Computer Science program. She joined our team from July to August 2021 as a Research Assistant to help with interim data analysis and a literature review.
Celeste Schoahs	Grade 12 co-op student at Superior Heights Collegiate & Vocational School. She committed 90 hours to this project between October 2021 and January 2022.

Sampling method

Step 1: Monitoring sites were selected by members of Garden River First Nation – namely, staff at the Lands and Resources Department and project staff – in collaboration with Dr. Ho-Tassone. Sites were selected for a combination of diversity, ease of access (including safety considerations), and whether located up or downstream of potential or known polluters in the community. There are 10 monitoring sites recorded on the Water Rangers application in the St. Marys River area—see map below. Of these, seven sites are monitored weekly by Garden River First Nation (identified in the yellow boxes). Other sites are infrequently monitored (e.g., annually or less).



Step 2: Resources and training were provided to two monitoring staff (summer students hired by the project, subsidized by Eco Canada) and are accessible to participating Lands and Resources Department staff.

Resources provided included:

- A 29-minute video and 7-minute field demonstration of how to use the Water Rangers Freshwater Explorer Testkits.
- The weblink to sign into the Water Rangers application, along with a 9-minute video and 1.5 minute quick review video about how to use the online platform.
- Water Rangers' *Field Guide – Freshwater Explorer Testkit* (booklet that comes with the testkit).
- The Gordon Foundation's *A Monitor's Guide to Water Quality*.
- A copy of a benthic invertebrate field guide – Field *Guide to Freshwater Invertebrates of North America* (Thorp & Rogers, 2010) – was provided for use during benthic sampling, along with information excerpted from the Ontario Benthos Biomonitoring Network Protocol manual.
- A four-page 'get started' resource summarizing this information and including some other introductory information was also provided.

Training provided included:

- An asynchronous 1-hour webinar by Water Rangers Executive Director Kat Kavanagh that goes through everything (about Water Rangers, the testkit, and the data platform) in detail.
- An asynchronous 1-hour webinar by Swim Drink Fish about the Environmental Health and Safety Survey (EHSS).
- An in-person training session (3 hours on August 3, 2021) for two members of the Lands Department (Richard and Amanda) and our Community Coordinators (Meggie and Cade) to practice the kick-and-sweep method of sampling and how to identify benthic invertebrates.

To ensure support was provided onsite, Dr. Ho-Tassone accompanied the Coordinators for the first day of sampling at the first five sites in July 2021 and also carried out benthos sampling with Meggie at two sites in September 2021.

Step 3: At each site, before water chemistry was measured, a visual Environmental Health and Safety survey was undertaken. For the pilot program, the EHSS was discussed orally only and was not recorded, but is to be recorded for the permanent program commencing in 2022—see Appendix 2 for a sample template.

Step 4: Water Rangers Freshwater Explorer Testkits were used to monitor basic water parameters: air and water temperature, alkalinity, chlorine, hardness, pH, conductivity, Dissolved Oxygen, and water depth; in addition, the conversion to Total Dissolved Solids was calculated from conductivity. These data were collected on a weekly basis from July 23 until October 2, and then periodically until November 5, 2021. Protocols for the use of Water Rangers equipment can be found on their website.

Step 5: Data were uploaded to the Water Rangers online application (an openly accessible database), which is integrated with Gordon Foundation's Great Lakes DataStream (another openly accessible database, launched in October 2021—See Appendix 3).

Step 6: Two benthos sampling events occurred (data not included in the interim report):

- September 16, 2021 at Big Bend (samplers: Dr. Ho-Tassone and Meggie Lesage)
- September 23, 2021 at 1st Bailey Bridge (samplers: Dr. Ho-Tassone, Meggie Lesage, Joanie McGuffin, and Gary McGuffin).
  - ⇒ This location was found to be a salmon spawning ground and will not be used again.

Step 7: Present to global water practitioners at the 24th International RiverSymposium conference on September 29, 2021.

Step 8: Dr. Ho-Tassone compiled the interim water chemistry data from each site (collected until September 24) and provided the full dataset to Research Assistant Yashoda Fernando, who did a preliminary review of water chemistry data. Ms. Fernando flagged low dissolved oxygen as an issue in some monitoring locations.

Step 9: Dr. Ho-Tassone compiled the complete water chemistry data from each site and the benthos tallies from the first and second samples. These data and Ms. Fernando's interim analysis were provided to Mr. Sarno for a complete analysis.

Step 10: Communicate monitoring result summary to Chief and Council, with more detail provided to the Chief and environmental portfolio holders (subset of Council).

Step 11: Hold culminating event series, which consisted of three final events:

- *Understanding Anishinaabek G'giikendaaswinmin (knowledge) on N'bi (water)*—February 10: organized for members of the Garden River First Nation community, collaborators who contributed to the development of our pilot water quality monitoring program, and non-community members that wish to learn more about N'bi (water). A notable water researcher from the community, Susan Chiblow, provided a keynote talk before Aaron Jones presented on the pilot water quality monitoring program. About 30 community members provided feedback on the program, though more than 100 people from across the Great Lakes basin attended the keynote talk (164 registered).
- Social media training—February 14: Garden River First Nation youth participated in a training organized by Waterlution, which provided an introduction to effective messaging using social media.
- *Sault area fresh water collaboration meeting*—February 16: convened to increase collaboration across the region towards coordinated freshwater monitoring/science, management, and stewardship. There were 48 attendees (62 registered, who represented ~20 agencies/ organizations across the US, Canada, and six Indigenous nations/communities). A Google Folder of resources was compiled, which includes the PDF slide deck, a Jamboard on which we compiled current projects and needs, and the meeting recordings.

Weekly water quality monitoring dates

We monitored water quality at seven locations using the Water Rangers Freshwater Explorer Testkit.

Ojibway Park (ID GRFM-SMR001): 15 observations
July 23, 30; August 6, 13, 20, 27; September 3, 10, 17, 25; October 2, 9, 15, 29; November 5

Little Lake George (ID GRFM-SMR002): 15 observations
July 23, 30; August 6, 13, 20, 27; September 3, 10, 17, 24; October 2, 9, 15, 29; November 5

West side of the river's mouth (ID GRFN-GR001): 15 observations
July 23, 30; August 6, 13, 20, 27; September 3, 10, 17, 25; October 2, 9, 15, 29; November 5

Big Bend (ID GRFN-GRT001): 13 observations
August 6, 13, 20, 27; September 2, 9, 17, 24; October 2, 8, 17, 29; November 6

1st Bailey Bridge (ID GRFN-GRT002): 13 observations
August 6, 13, 20, 27; September 2, 9, 17, 24; October 2, 8, 17, 29; November 6

Silver Creek Golf Course 3rd hole, upstream (ID GRFN-SCT001): 13 observations
August 6, 13, 20, 27; September 2, 9, 19, 24; October 2, 8, 17, 29; November 6

Silver Creek Golf Course 9th hole (ID GRFN-SC001): 13 observations
August 6, 13, 20, 27; September 2, 9, 19, 24; October 2, 8, 17, 29; November 6

Monitoring and survey results

Compiled by Alex Sarno, excerpted and revised by Dr. Elaine Ho-Tassone

Historical data scan

Figure 1 illustrates many of the water quality assessments completed in the St. Mary's River and surrounding area; however, many of these locations are either noncontinuous (e.g., "one-offs" completed because of other various projects/studies) or are historical.

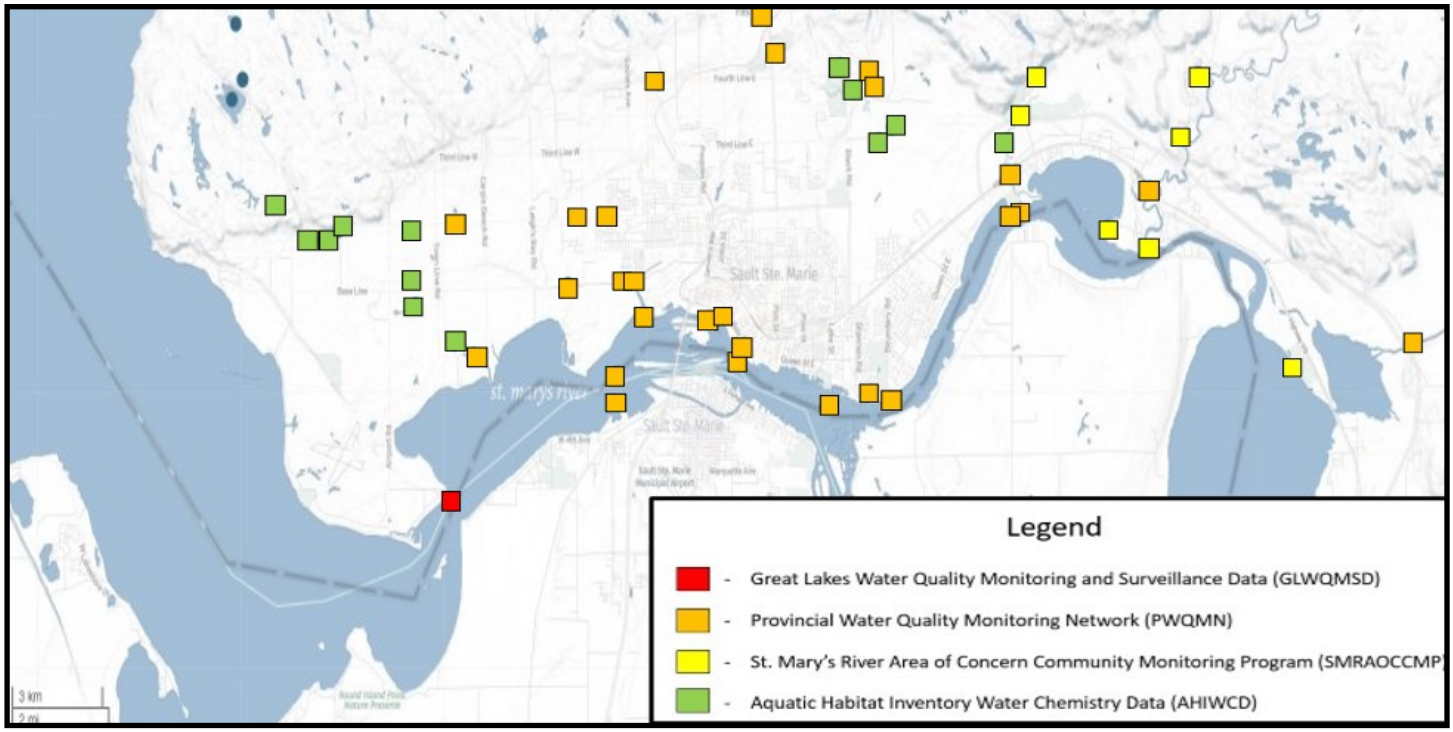


Figure 1. Map with historical water quality monitoring in and around the St. Marys River AOC, adapted from the Great Lakes DataStream.

Water chemistry

On the following pages, we summarize some of the water quality parameters measured during our pilot monitoring program. The 'normal values' we refer to are summarized in Table 1, below.

Table 1. Normal range for water parameters, per Great Lakes DataStream.

Parameter	Values
Alkalinity	Very low: 10 mg/L Low: 11-50 mg/L Moderate: 51-150 mg/L High: 151-300 mg/L Very High: >300 mg/L
Conductivity	0 – 200 µS/cm
Dissolved Oxygen	Above 6.5 – 8 mg/L
Hardness	Soft: 0-60 mg/L $CaCO_3$ Medium: 61-120 mg/L $CaCO_3$ Hard: 121-180 mg/L $CaCO_3$ Very Hard: >180 mg/L $CaCO_3$
pH	6.5 - 9.0
Total Suspended Solids/Total Dissolved Solids	0 – 400 mg/L
Turbidity	Low: < 10 NTU Moderate: 50 NTU High: > 100 NTU

Based on the 1,067 datapoints collected from all seven sites over 13-15 weeks (depending on the site), Table 2 presents the average value for each location. Overall, most sites fell well within the normal ranges which supports the argument of water in these areas being of good or higher quality.

Table 2. Average value for each water quality parameter at each site: green = normal, yellow = borderline, red = outside normal.

Water Quality Assessment Data Averages								
Location	**Alkalinity (mg/L)**	**Water Depth (m)**	**Chlorine (ppm)**	**Conductivity (uS/cm)**	**Water Temp (°C)**	**Hardness (mg/L)**	**Dissolved oxygen (mg/L)**	**pH (0-14)**
GR: GRFN 1st Bailey Bridge	45	0.2	0	36	16.1	0	8.9	6.5
SC: GRFN 9th Hole Bridge	46	0.5	0	56	15.5	4	4.5	6.3
SC: GRFN 3rd Hole Bridge	42	0.2	0	28	15.5	0	9.4	6.4
SMR: GRFN Little Lake George	65	0.2	0.1	101	18.5	7	8.6	7.2
SMR: GRFN Ojibway Park	64	0.3	0	93	18.3	7	9	7.2
GR: GRFN Garden River mouth west side	52	0.2	0	47	16.9	7	8.8	6.6
GR: GRFN Big Bend	74	0.5	0	123	16.4	4	5.3	6.9

At each site, water depths were consistent with one another and varied between 0.2-0.5m in depth. Water temperatures were also consistent with one another and fall within the seasonal average. The pH levels at each site were deemed normal, as values were close to neutral with the highest calculated average being 7.2. Conductivity at each site was considered normal as it fell within the 0-200uS/cm range as well. There was little to no presence of chlorine at each sampling site. All sites fell into the category of soft on the hardness value scale (0-60 mg/L CaCO3). Based on the results, it can be said that most of these streams are consistent with one another and in good health based off water quality parameters.

The Little Lake George, Ojibway Park, and Big Bend sites had normal alkalinity values (51-150mg/L) while the remaining sites had low alkalinity values (11-50mg/L). Sites with low alkalinity could be the result of the surrounding geology (e.g., lack of limestone). In addition, dissolved oxygen was either borderline or low compared to what would be considered normal for most freshwater streams (per CCME guidelines). Figure 2 shows each dissolved oxygen measurement taken throughout the monitoring season, while Figure 3 provides an average and range of dissolved oxygen for each site.

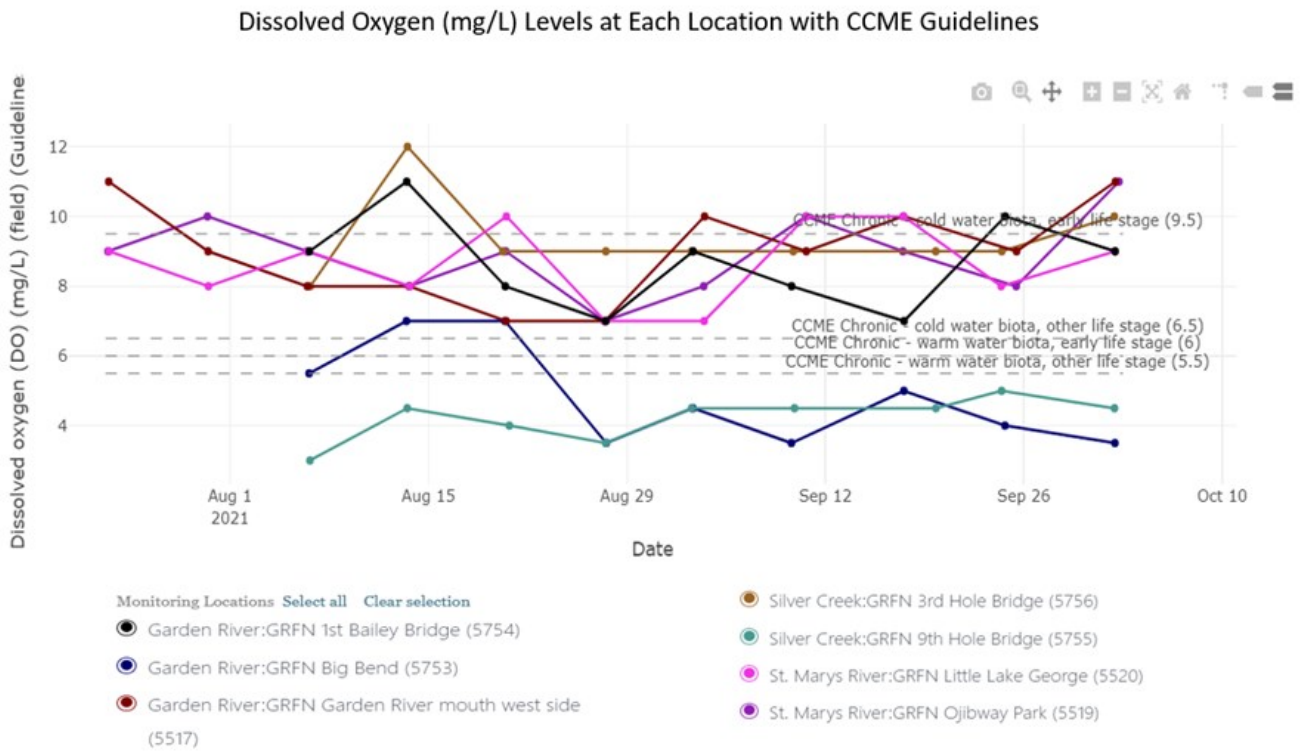


Figure 2. Dissolved oxygen levels at each site over 13-15 weeks (depending on the site).

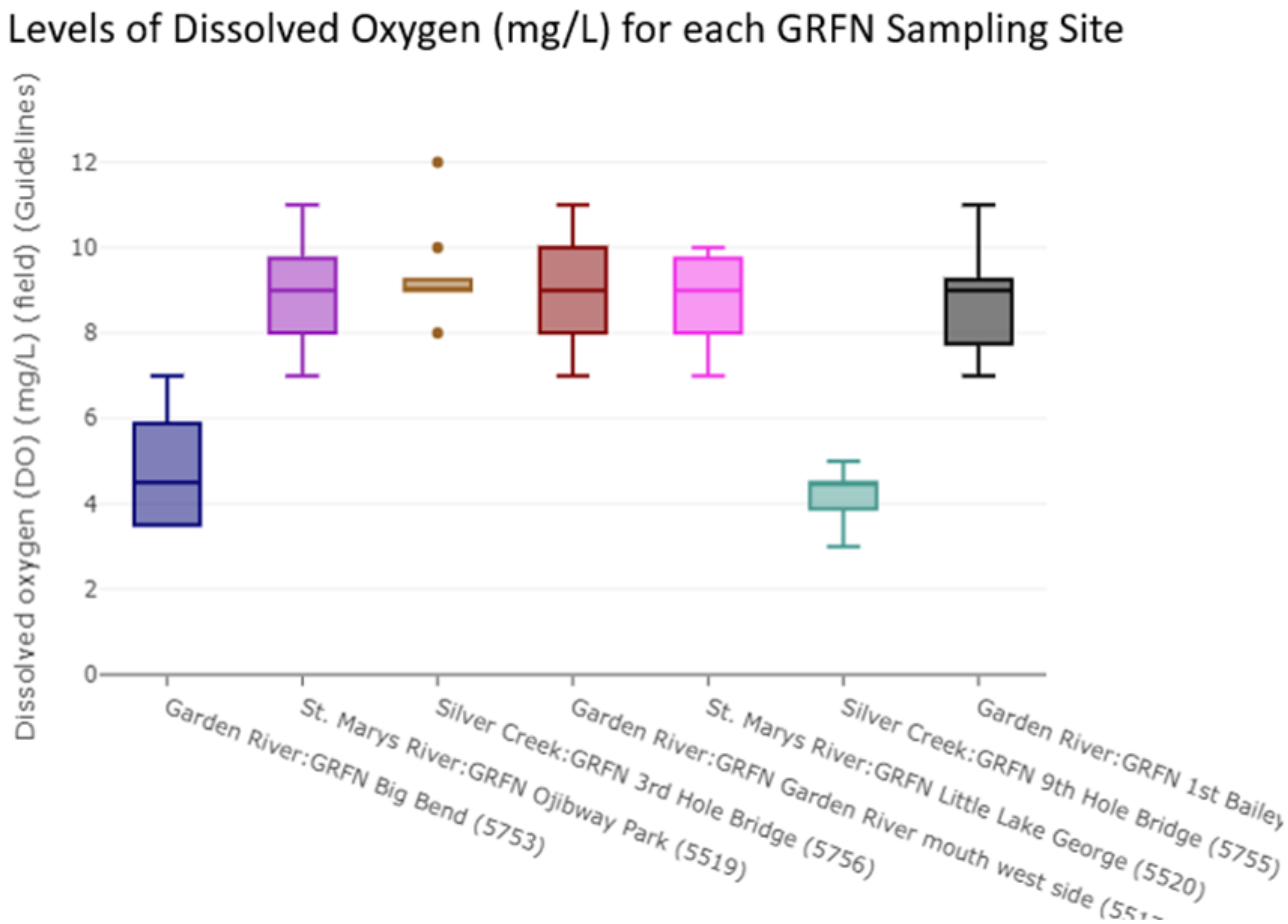


Figure 3. Average dissolved oxygen levels and their ranges at each site.

Benthic invertebrates
We completed benthic invertebrates at two locations. The upstream site, “1st Bailey Bridge”, is upstream of a known stressor (garbage dump) and is a natural/unmanaged stream. We sampled at the 1st Bailey Bridge on September 23, 2021. We sampled at the downstream location, known as “Big Bend”, on September 16, 2021. A total of 541 invertebrates were recorded, of which 173 were found at the upstream site of the 1st Bailey Bridge, and 368 were found at the downstream site of Big Bend.

It is important to note the inexperience of the samplers - especially the Community Coordinator and our volunteer community members, who had never previously sampled and tallied benthic invertebrates (except for one brief training for the Coordinator, in a sandy beach environment versus the cobble environment we surveyed at). As such, the following notes were also recorded:

- Lepidoptera in 'Big Bend' were likely misidentified coleoptera larvae.
- "Other" in both subsamples of 'Big Bend' were noted to likely be seed shrimp
- A tally of 100 means there were too many to count (not that we counted 100)
- For 1st Bailey Bridge, the 'pool' values for Other, Plecoptera, and Trichoptera were estimated and are expected to be lower than actual values, as not all tallies were recorded due to one sheet being erased prematurely (e.g., we used laminated tally sheets with dry erase markers)

EPT taxa—Ephemeroptera, Plecoptera, Trichoptera—are commonly used as biomonitoring species as they are relatively intolerant of pollution. A total of 34 EPT were identified at the Bailey Bridge, while 9 were found at Big Bend—or, 2.44% and 19.65% of each site’s total sample, respectively. We should note that the Big Bend site was also associated with some of the lowest dissolved oxygen levels (other than the 9th hole bridge, where we did not survey for invertebrates).

Conclusion
Based on the combined (water quality + benthic invertebrate) results, the region’s water quality varies but is largely considered to be in good condition. Two stressors demonstrating impacts in this study include the garbage dump and golf course, based on the dissolved oxygen levels and invertebrates (where surveyed) that were recorded downstream. We also note the limited scope and duration of this study, which cannot provide conclusive discussion without further monitoring over multiple seasons (e.g., to determine normal variation and verify the issues and locations).

Timeline

TPA C.3.__	Action	Status
1	Order test kits and sampling equipment	Complete
2	Establish advisory committee[1]	Adapted
3	Hire research assistant	Complete
4 (first)	Review literature and identify available data	Complete
4 (second)	Assess and select monitoring sites	Complete
5	Recruit community volunteers and/or youth	Complete
6	Hire Garden River Community Coordinator[2]	Complete
7	Initiate Postdoctoral Fellowship	Complete
8	Deliver training webinars	Complete
9	Deliver single-day practical trainings	Complete
10	Implement monitoring program	Complete
11	Prepare interim data summary	Complete
12	Hire first student intern[3]	Complete
13	Data entry into open databases	Complete
14	Data analysis and reporting materials	Complete
15	Deliver community-led gathering	Complete
16	Monitoring program assessment[4]	Complete
17	Hire second student intern	Complete
18	Host culminating event	Complete
19	Final report	Complete
20	Conference-level presentation submission[5]	Complete

Footnotes:

1. We put out calls to form this committee with no response (largely due to COVID as meetings would take place in-person, which was not ideal in 2021), then later attempted to engage the environmental committee; however, this committee is newly formed and unable to consult on projects yet. Rather than establish a formal committee, Lands Department staff contributed to the formation and feedback on the program was also provided by multiple members of the community during the monitoring and at the end of the project.
2. We hired two Garden River youth with subsidization from Eco Canada.
3. Instead of a University intern, we hired a high school co-op student.
4. See footnote #1.
5. Accepted and delivered online at the International RiverSymposium conference on September 29, 2021.

Scope obligations

Obligation	Expected	Completed	Notes
2 written reports	2	3	Interim report; interim data analysis; and final report
3 oral presentations	3	6	Meggie presentation to youth at camp; conference presentation; panel presentation at NORDIK AGM; GRFN presentation x3 (portfolio managers, community gathering, culminating event)
4 workshops and/or training sessions	4	4	Water rangers webinar; Swim Drink Fish webinar; benthic invertebrate training; youth media training
4 education/ communication materials produced	4	4	Program brochure; 'get started' handout; info sheet about pending E. Coli lab; ____; recording of community presentation Feb 10 (guest speaker, info about the monitoring results, discussion)
2 community engagement sessions	2	3	Meeting with portfolio managers; community gathering; regional water meeting (across St. Marys River)

Performance measures

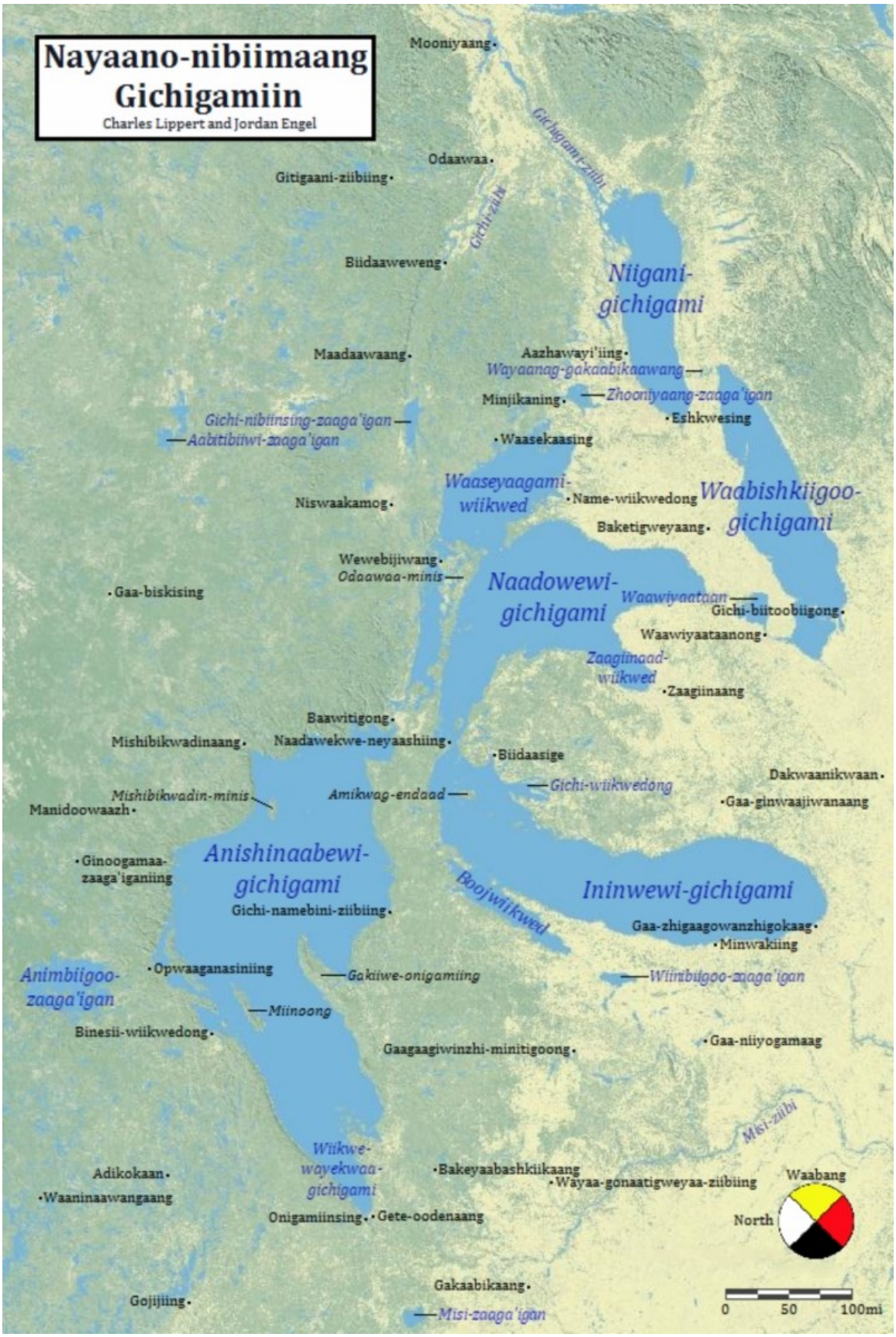
Measure	Expected	Completed	Notes
10 community members trained and engaged	10	11	Staff at lands department (3); project staff (2); volunteer community members (6)
10 community gathering attendees indicating they learned something about water conditions	30	30	Feb 10: Over 150 registrants, about 100 attendees, of which 30 were from the community and others were from across the region (both sides of the border)
10 community gathering attendees who helped assess the program	10	30	Per community event on Feb 10
50 weekly water quality samples (5 or more sites)	10	30	Per community event on Feb 10
15 monthly benthic samples (5 or more sites)	50	97	97 sampling events (taken at 5-7 sites over 13-15 weeks) x 11 parameters = 1067 data points
3 summaries/assessments communicated to GRFN	2	2	We modified this measure via the interim report to commit to one seasonal survey at each of two sites
5 elders/knowledge keepers[2] engaged in the Advisory Committee	3	4	Interim report; interim data; final data; final report (this report)
30 attendees at the community gathering	5	5	These were the 4 portfolio managers, Dr. Sue Chiblow, and Chief Rickard.
30 attendees at the culminating event	30	48	We had 59 registrants for the February 16 meeting (recording, notes, and resources were sent to all participants)
1 local school involved in some leadership-related aspect of the pilot program	1	7	All four public secondary schools in the Sault Ste. Marie area (Algoma District School Board) were engaged during our public engagement sessions about the Canada Water Agency. Students were asked about their experiences with water in their every day lives, their perspectives on local water issues, and their vision for a water secure future for everyone in the region. In addition, students from Algoma University, Sault College, and Shingwauk Kinoomaage Gamig were also engaged.
10 youth involved in some leadership-related aspect of the pilot program	10	158	For our Garden River First Nation youth media training, we had 16 registrants and 6 attendees (recording of workshop sent to all registrants). Also, we engaged with 152 youth through our Canada Water Agency-themed public discussions.
3 post-secondary students hired	3	6	Meggie Lesage; Cade Nolan; Yashoda Fernando; Alex Sarno; two notetakers for 4hrs who also helped pull the notes together for this report.

Budget ($172,498.20 total budget = $50,000 GLLAF Round 1 + $122,498.20 matching)

Project Expenditures	(1) Budgeted Cost	(3) Amount from the Fund	(2) Cash confirmed from other sources	(2) Value of confirmed in-kind support	Sources of Other Funding or In-Kind Support
STAFF					
Postdoctoral fellowship	*$31,250.00*	$28,250.00	$3,000.00	$0.00	Mitacs Industrial Postdoctoral Fellowship program via Waterlution
Garden River Indigenous Staff Members x2 @ $20/hr (total 649.2 hours) - JUN-NOV	*$20,642.40*	$12,522.40	$8,120.00	$0.00	Eco Canada
Summer Research Assistant salary	*$5,000.00*	$0.00	$5,000.00	$0.00	Algoma University
Second water quality community coordinator (Dec-Feb)- also see final row in this table (cell A33, under "other")	*$2,506.45*	$1,818.60	$687.85	$0.00	Cash through Mitacs
EHT + WSIB	*$107.12*	$107.12	$0.00	$0.00	N/A
Fall 2021 term co-op student @16/h	*$1,280.00*	$0.00	$0.00	$1,280.00	Algoma District School Board
Winter 2022 term intern @18/hr	*$1,440.00*	$0.00	$0.00	$1,440.00	Algoma University
GOODS					
Water Rangers Freshwater Explorer test kits: 4 x $345.00 + HST + shipping	*$1,385.20*	$1,227.00	$0.00	$158.20	Water Rangers reduced price (including HST)
Ward's Ward's® Multi-Use Insect Net (professional D-ring domed aquatic insect net with 550-micron mesh and a draining gromet in the sleeve) 4 x $52.95 + HST + shipping	*$92.69*	$0.00	$92.69	$0.00	Cash through Mitacs
Ice auger, spare parts, drill (for winter sampling)	*$608.02*	$608.02	$0.00	$0.00	N/A
Chest waders x1	*$2,562.14*	$0.00	$62.14	$2,500.00	Cash through Mitacs; Additional waders (fits/ sizes), nitrile gloves, and other resources available via Algoma University - Dr. Istvan Imre's lab; other waders by Garden River staff
Marketing and communications (e.g., printing training materials, advertising)	*$2,113.78*	$0.00	$113.78	$2,000.00	Cash through Mitacs; NORDIK institute, Algoma University (via faculty), and Garden River First Nation promoting across networks
Microscope	*$2,249.72*	$0.00	$2,249.72	$0.00	Cash through Mitacs
Microscope camera	*$1,444.95*	$0.00	$1,444.95	$0.00	Cash through Mitacs
Microscope adapter	*$220.80*	$0.00	$220.80	$0.00	Cash through Mitacs
Shipping on microscope items	*$65.38*	$0.00	$65.38	$0.00	Cash through Mitacs
Benthos ID books x2	*$62.69*	$0.00	$62.69	$0.00	Cash through Mitacs
Honoraria (opening/closing prayers, keynote talk)	*$900.00*	$900.00	$0.00	$0.00	N/A
SERVICES					
Water test kit training (webinar); review of entered data	*$2,000.00*	$0.00	$0.00	$2,000.00	Water Rangers
Development of the Environmental Health and Safety Survey; observational surveys training (webinar)	*$2,000.00*	$0.00	$0.00	$2,000.00	Swim Drink Fish
Project coordination and implementation - quantified staff time dedicated to the project (20% of 140 monthly hours over 5 months at $100/h) - note: other staff time dedicated too, not quantified	*$14,000.00*	$0.00	$0.00	$14,000.00	Garden River First Nation Lands Dept for Aaron Jones time in coordination and supervision of water quality coordinator
Organizing and hosting youth media training	*$9,147.47*	$4,147.47	$0.00	$5,000.00	Waterlution
OTHER					
Office, meeting and event space for the year (i.e., 2x offices, event space x5 days, meetings as needed)	*$5,000.00*	$0.00	$0.00	$5,000.00	Algoma University and NORDIK Institute (collaboratively)
International RiverSymposium ticket conference registrations x3	*$419.39*	$419.39	$0.00	$0.00	N/A
E. Coli laboratory set up, training, and salary for second water quality coordinator (included in this section because the breakdown from the contributing organization is not available at this time)	*$66,000.00*	$0.00	$51,000.00	$15,000.00	Swim Drink Fish
TOTALS	***$172,498.20***	**$50,000.00**	**$72,120.00**	**$50,378.20**	

Appendix 1: Great Lakes map through an Indigenous lens

Original image caption: Nayanno-nibiimaang Gichigamiin (The Great Lakes) in Anishinaabemowin (Ojibwe), by Charles Lippert and Jordan Engel.



Source: Lippert and Engel. (2015). *The Great Lakes: An Ojibwe Perspective*. The Decolonial Atlas: https://decolonialatlas.wordpress.com/2015/04/14/the-great-lakes-in-ojibwe-v2/

Appendix 2: Sample Environmental Health and Safety Survey

Observer's name: _____

Environmental Health and Safety Survey (EHSS)

An EHSS determines whether the area you are entering is safe for you to work and safe for others to use after you leave. It helps you identify potential risks that may need to be addressed (whether within or outside the scope of water quality monitoring). Different versions of an EHSS are used for different things, but they are all tools to record environmental conditions that have implications for human health. Usually used as part of seasonal beach openings and at other recreational areas, an EHSS identifies potential chemical, physical, and biological hazards along shorelines. For example, sewage and stormwater are some of the most common sources of pollution you might see. In addition to the information on the previous pages, the following should be recorded:

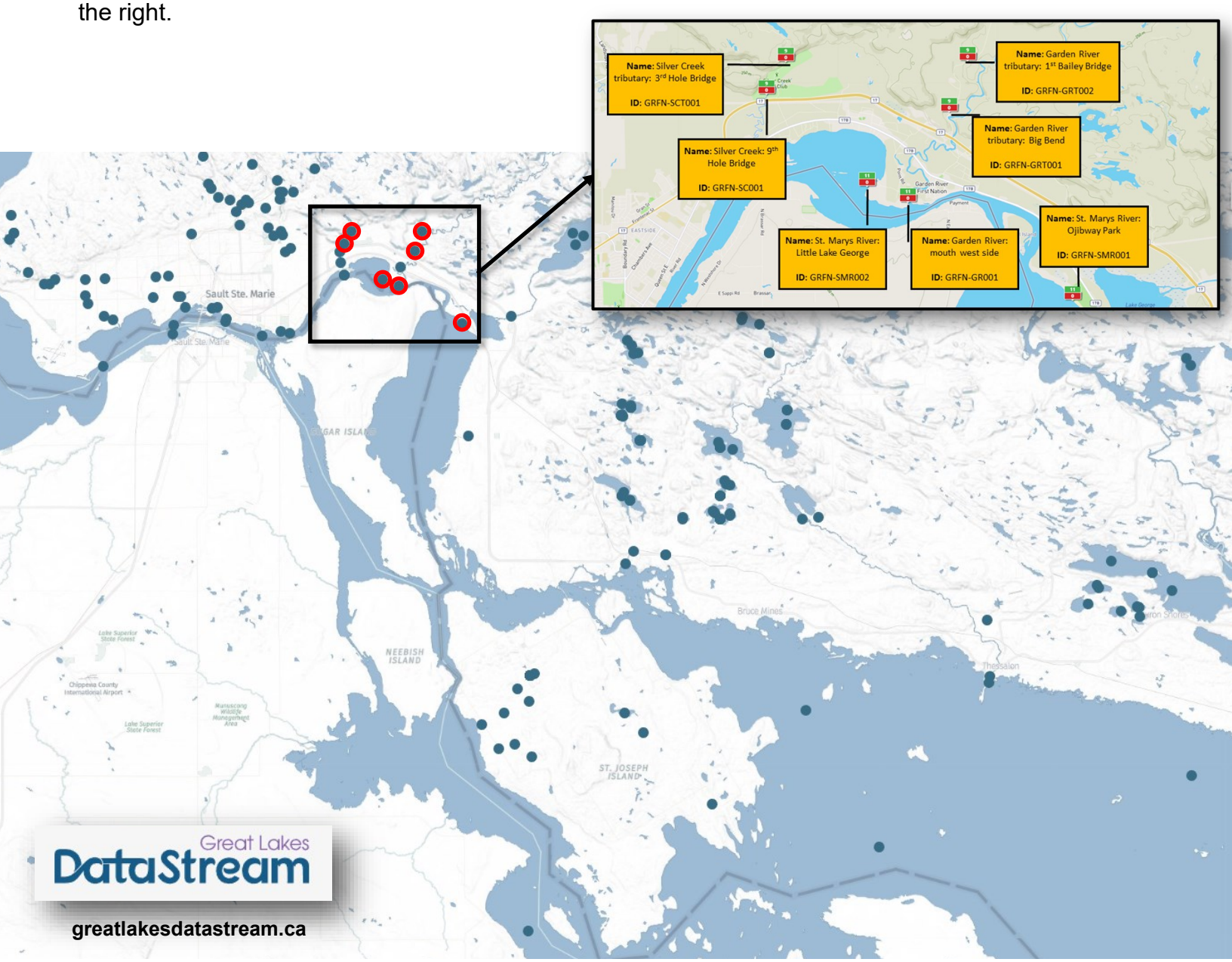
- Microbiological hazards (e.g., potential sources of human or animal fecal contamination, proximity to sampling area)
- Chemical hazards (e.g., potential sources of contaminations, proximity to sampling area, whether you can see any effects of potential contamination like smells or a film on the water's surface)
- Other biological hazards (e.g., algae blooms, overgrowth of aquatic plants, sick or injured wildlife, seasonal nature of the hazard (e.g., continuous, annual, sporadic), presence of contributing factors)
- Physical hazards and aesthetic considerations (e.g., surface hazards like steep slopes or uneven terrain, potentially hazardous water conditions, litter, floating debris, medical waste, broken glass, vehicles or boats at or near the monitoring area, aquatic vegetation washed up on the beach/at the monitoring site)

Record your EHSS observations and any actions taken (e.g., litter picked up) below.

Appendix 3: Great Lakes DataStream positioning

Great Lakes DataStream is an open access platform for sharing information on freshwater health. It brings together water quality datasets collected by monitoring groups throughout the Great Lakes and Saint Lawrence Basin. DataStream was developed by The Gordon Foundation and is delivered in collaboration with regional monitoring networks. The Gordon Foundation is a philanthropic charity with a longstanding commitment to protecting Canada's water. The Foundation supports innovative research, communication, and collaboration to strengthen citizen engagement in freshwater management, and to drive the development of sound freshwater policy.

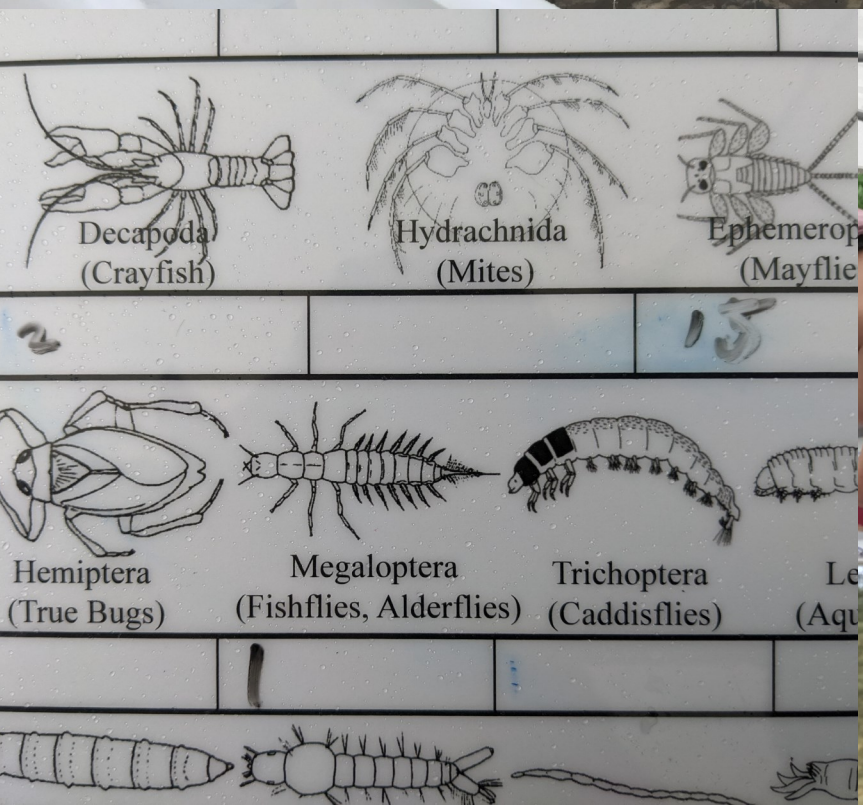
Great Lakes DataStream launched in October 2021, ensuring over 7 million data points from various organizations are now openly accessible and easily interpreted. While there are dozens of monitoring stations in the vicinity of our pilot project, most have not been updated in years (many stopped collecting data after the 1980s). Our seven monitoring sites are outlined in red below, and are shown as red locations in the box to the right.



Photos of team members training

Our team in action

Photos courtesy of Meggie Lesage



Photos courtesy of Joanie/Gary McGuffin

Local conservationists Joanie and Gary McGuffin joined us for a benthic survey at '1st Bailey Bridge'

Photos courtesy of Joanie/Gary McGuffin (lower three) and Dr. Ho-Tassone (top image)

Photos courtesy of Joanie/Gary McGuffin (top left, bottom) and Dr. Ho-Tassone (top right)

We thank all our supporters for making this project possible, especially our funders:

Ontario Ministry of the Environment, Conservation, and Parks

Swim Drink Fish

Mitacs

Eco Canada

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