and **Lake Erie Volunteer Science Network**

Present

2022 Niagara River Watershed Health Report

A Summary of the Program and Findings of the Lake Erie Baseline Assessment Framework

Data collected and analyzed by:

Buffalo Niagara Waterkeeper Staff and Riverwatch Program Volunteers

Background: Lake Erie Volunteer Science Network

Photo Credit: Buffalo Niagara Waterkeeper

Water quality in the Lake Erie Basin is significantly impacted by human activity more than that of any other Great Lake. These impacts are fueled by a longstanding mix of industrial and agricultural pollution as well as emerging contaminants such as microplastics and PFAS. Unfortunately, the governments and research institutions tasked with managing these issues have limited resources that restrict the scope of water monitoring conducted across the Basin. The results are stark gaps in water quality data, a necessary component of the management, restoration, and advocacy needed to ensure communities' long-term access to clean water for health, business, and recreation.

Fortunately, volunteer water quality monitoring programs, dubbed "Community," "Citizen," or "Volunteer" science groups, have been monitoring water quality across the Basin for years. Dozens of groups regularly collect data from streams and shorelines across the region. Volunteer science has immense potential to improve our approach to water resource management. However, lack of standardized methods as well as limited organizational visibility and credibility have often meant that their data are not considered in decision-making processes. As a result, volunteer science groups have historically struggled to have their voices heard in water resource governance, management, planning, and research conversations.

In 2020 a collaboration of community foundations and Cleveland Water Alliance (CWA) launched the Lake Erie Volunteer Science Network (LEVSN) to unite these groups into a regional network. LEVSN works to fill critical information gaps and inspire action for the benefit of the Lake Erie region. The network inspires action in Lake Erie communities by:

- **Collaborating Across Communities:** LEVSN facilitates regular communication between volunteer groups to empower them to connect with each other, share best practices, identify common challenges, support new program formation, and pursue joint funding.
- **Standardizing Volunteer Monitoring**: LEVSN uses its "Lake Erie Baseline Assessment Framework" to standardize data collection and analysis so that groups from Ann Arbor, Michigan to Buffalo, New York can tell a consistent story about the health of Lake Erie Watersheds.
- **Uplifting the Movement:** LEVSN provides technical tools and standard operating procedures that empower new or old volunteer groups to identify and address local water quality issues, support professional researchers, and advocate for regional change.

Standardizing Volunteer Science: Lake Erie Baseline Assessment Framework

Photo Credit: Buffalo Niagara Waterkeeper

The Lake Erie Baseline Assessment Framework (LEBAF) is a process for standardizing data collection, management, and analysis that unlocks the potential of volunteer science to address gaps in water resource monitoring and tell a regional story about the condition of Lake Erie watersheds. LEBAF was given structure and life by LEVSN's Standards Working Group, a task force composed of volunteer groups as well as experts from research institutions, state agencies, and local government. This Working Group, together with the Water Data Collaborative, led a standards development process that engaged other LEVSN members and over 30 external partner organizations in setting shared priorities and methods that empower local groups to conduct reliable and comparable data across the region. This process resulted in the official launch of LEBAF at the inaugural Lake Erie Citizen Science Summit, co-hosted by the Cooperative Institute of Great Lakes Research and CWA, at the International Association of Great Lakes Researchers' State of Lake Erie conference in March of 2022.

The primary output of this process was a set of Standard Operating Procedures (SOP or "Standards") which describe program requirements and best practices for the collection, analysis, and reporting of volunteer science data. These standards are defined by shared:

- **Monitoring Purpose:** Collection of a common set of measures that support screening of aquatic life impact as an indicator for the baseline conditions and trends in the health of Lake Erie watersheds at various scales.
- **Intended Data Use:** Data collected is intended to be used primarily as a water quality screening tool that drives 1) benchmarking of watershed health, 2) interoperability of results across watersheds, and 3) education and engagement of local communities. It is secondarily intended for use in resource prioritization and decision making (e.g. use support, advocacy, policy, resource management, and adaptive management).
- **Target Data Users:** LEVSN and its partners are the primary target users. Use by Federal, State and local decision makers is a priority, but secondary to the needs of the volunteer science groups implementing LEBAF.
- **Expected Outcomes and Impacts:** The implementation of LEBAF will 1) provide a regional condition assessment of Lake Erie streams over time, 2) identify potential problem areas to be investigated for impairment identification, 3) establish a shared lexicon to communicate program elements, shared goals, and watershed status to volunteers and the public, 4) demonstrate the capacity of regional volunteer science collaboration, and 5) create an iterative process for expanding the scope of shared standardizations and collaborations over time.

2022 LEBAF Field Season: Findings on the Health of the Niagara River Watershed

Emerging from the 2022 Summit, LEVSN groups volunteered to participate in the first regionally standardized Lake Erie Baseline Assessment Framework (LEBAF) sampling season. In addition to the SOP, participants received access to sampling equipment (if needed), data management and analysis tools (Water Reporter), and technical training. Participation was further supported by monthly cadence calls and workshops on data analysis and program evaluation facilitated by CWA.

This inaugural LEBAF field season saw eight participating groups collect, analyze, interpret, and communicate data from 466 samples originating at 67 stations on 14 local waterways across the Lake Erie Basin. The newly drafted LEBAF SOP allowed for reliable and comparable data collection, ensuring that monitoring efforts from Ann Arbor, Michigan to Buffalo, New York could be integrated into a reasonably representative snapshot of an entire Great Lake Basin. Participants also collaborated on a data analysis and interpretation process that used streams' capacity to support aquatic life to examine watershed health across monitored areas and the Lake Erie basin as a whole.

As a result of this standardized assessment, LEVSN is able to present a regional volunteer-driven perspective on the condition of watersheds that feed Lake Erie and provide a benchmark against which future monitoring can be compared. These results are presented alongside the underlying data and analyses in the 2022 LEBAF Field Season Report. Overall, Lake Erie and its watersheds appear to be generally healthy and able to support aquatic life, though some areas were identified that may be experiencing unhealthy conditions. These conclusions are particularly supported by participants' direct measurement of pH and dissolved oxygen as well as expressions of conductivity as TDS, salinity, and chloride.

Buffalo Niagara Waterkeeper volunteers monitored 57 stations throughout the Niagara River Watershed during the 2022 sampling period, 8 of which were analyzed in the Field Report. The stations monitored were either along the Lake Erie shoreline, or along a direct tributary to the lake. Of these stations, two were along the lake shore, two were along the Buffalo River, two were along Eighteenmile Creek, and one each from Smokes and Rush Creeks. These stations were monitored monthly from May through October by volunteer teams composed of 3-4 volunteers.
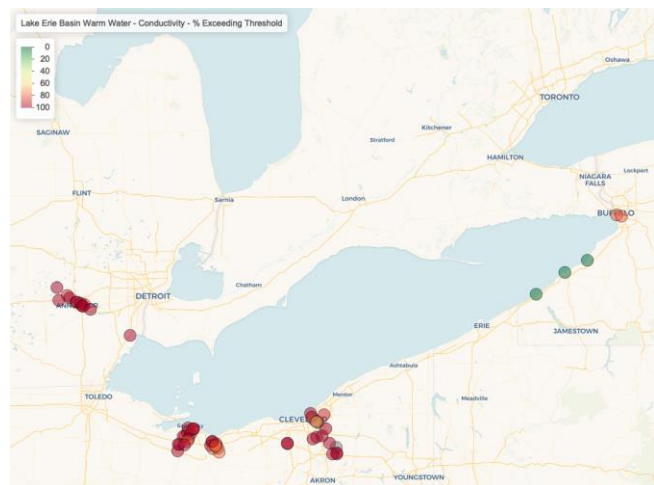

Figure 1. Lake Erie Basin monitoring stations analyzed in the Field Report

Stations monitored by Buffalo Niagara Waterkeeper experienced additional regular exceedances of standards for Temperature, Total Dissolved Solids as well as Conductivity.

Conductivity is an indicator that looks at stream health through the lens of potential impacts to aquatic life from dissolved substances, chemicals, and minerals present in the water. Results of this parameter were persistently high across space and time and are supported by existing macroinvertebrate data where it is available. Data from these stations indicate that aquatic life in the monitored waterways could be impacted, and that some level of disturbance persists along the tributaries and shoreline monitored. Seasonal plotting of conductivity data collected in future years will help determine the scope of this potential impact with greater confidence as well as establish trends over time.

2022 LEBAF Field Season: Identifying Gaps and Improving the Program

A significant outcome of the 2022 field season was the identification of LEBAF's limitations. It is essential to note that this first iteration of LEBAF has many data gaps ranging from underrepresentation of cold-water streams to lack of Canadian participants. Additionally, a single season snapshot cannot make any definitive statements on the overall health of any watershed regardless of how much data was collected. Before drawing any actionable conclusions, it is critical to consider long term variations that provide better context for each season's observations. As a result, ***all observations and interpretation described in this resource should be taken as heavily qualified by a range of limitations described in LEBAF's Field Season Report, particularly in its first year of operation.***

Photo Credit: Buffalo Niagara Waterkeeper

With few stations located on Lake Erie itself, it also is important to recognize that assessment of aquatic life conditions on the open water, as opposed to the streams and rivers of Lake Erie's Watersheds, is not currently possible through LEBAF. It is plausible to suggest that monitored watersheds which appear healthy may have a positive influence on Lake conditions and waters with at risk or unhealthy conditions may negatively influence Lake Erie. However, other factors not included in this assessment should be considered before making any conclusive statements.

Overall, this first year of standardized volunteer monitoring marked great progress towards LEBAF's intended monitoring purpose, data use, and desired impacts. LEVSN was able to equip itself with high quality sampling technology, data management tools, and SOPs to enable credible, standardized volunteer monitoring. As a result, participating groups were able to collaboratively screen for and benchmark the health of their local watersheds, identifying data gaps to guide future monitoring priorities and potential problem areas for further investigation. As of Spring 2023, a full evaluation of LEBAF's processes has been conducted by participants and improvements are in progress to fill gaps and refine program elements. Moving forward

LEVSN aims to build on 2022's successes to expand the number of sampled parameters, historical data record, geographic coverage, and confidence in its interpretation over future sampling years.

As LEBAF monitoring continues, the data collected will begin to provide a regional condition assessment of Lake Erie streams over time that can inform local and regional restoration and protection activities. However, even with the program still in its infancy, the network has already demonstrated the capacity of a regional volunteer network to generate useful science and community impact. LEBAF has helped each participating program enhance or expand their efforts and now it is enabling four new groups to begin volunteer monitoring for the first time in 2023. The movement will continue to build momentum in pursuit of better water quality and quality of life for all Lake Erie Basin communities.

Moving Forward: Growing the Network and Building the Movement

Since 2020, LEVSN participation has doubled, and the network has partnered with scientists and decision makers to create a robust program that can fill data gaps and inform management efforts across the Lake Erie Basin. In 2022 alone, network participants engaged 1052 volunteers in 3534 hours of service and invested over $270,000 in volunteer monitoring programs. Now, as our first standardized field season wraps up, we have shown that we can drive more inclusive water research and management for our region. As a community-based network, no single state or municipality is responsible for supporting our work, so we need your help to keep building the movement! This can look like…

- **Funding the Network** - Direct contributions to build our regional capacity enable the network to retain and grow critical functions such as regional program management, equipment upkeep, and data infrastructure.
- **Funding a Local Hub** - Direct contributions to your local volunteer science program help enable their capacity to collect data, manage local water resources, and participate in regional collaborations like LEVSN. https://bnwaterkeeper.org/donate/
- **Participation -** Bringing a new or existing volunteer program into LEBAF expands our capacity to collect and analyze data for impact, helps us fill data gaps across the region. ***Your group may qualify for sensors, data management licenses, and other support!***
- **Leadership** - Participation in Working Groups or on our Steering Committee grows our organizational capacity to develop standards, expand into new program areas, integrate equity into our work, and manage the ongoing evolution of the network.
- **Technical Resources** - In-kind contributions of monitoring equipment, data tools, and technical support ensure that the network remains at the forefront of water resource monitoring and help increase the credibility and reliability of our data.
- **Scientific Expertise** - Advice from and collaborations with researchers, agency scientists, and water resource managers enable us to ensure that the volunteer science movement remains scientifically rigorous and relevant in our priorities and outcomes.

- **Data User Relationships** - Advocating for the credibility of our data or directly leveraging our data for your own purposes helps us build the partnerships and funding relationships needed to scale our impact and ensure our long-term sustainability.

If you are interested in supporting or partnering with LEVSN, please reach out to Max Herzog with Cleveland Water Alliance at mherzog@clewa.org. For questions regarding Buffalo Niagara Waterkeeper's contributions to the Field Report, please reach out to Elizabeth Cute (ecute@bnwaterkeeper.org). With your help, the story has just begun.

Data Attribution and the Importance of Local Context

All of the data, interpretations, and recommendations presented here have been collected and refined by volunteer-driven groups that bring significant knowledge regarding their local water bodies to the table. LEBAF trusts each group's local wisdom will help inform any use of the data in their outreach, education, restoration and protection efforts. Any groups seeking to leverage LEBAF data or information products outside this local context are heavily encouraged to engage with the relevant participating groups to ensure responsible use.