ENVIRONMENTAL MONITORING STRATEGY

A 10-year strategy that will direct future focus on activities and investment for Kawartha Conservation's Environmental Monitoring programs.

October 2021

KAWARTHA CONSERVATION

Discover · Protect · Restore

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Executive Summary

Kawartha Conservation's Integrated Watershed Management department currently undertakes monitoring activities to provide scientific data and evidence to inform decision making locally and provincially. In the course of our work, we identified the need for a strategy to guide our focus on activities and investment moving forward. In 2021, the development of a 10-year (2022-2032) environmental monitoring strategy was embarked upon which aligns with our corporate strategic plan and provides benefit to all our high-level goals, having specific relevance to ensuring the ongoing health of our watershed, encourage participation in environmental initiatives and ensuring the safety of people, property, and public infrastructure from natural hazards such as flooding and erosion.

To provide direction for this strategy, the project team developed a high-level goal and clear objectives that set out areas of focus for the next 10 years. These are highlighted below:

Goal:

'To provide a cost-effective environmental monitoring network that facilitates evidence-based decision making, and that provides accessible, real-time science and data to our community, while aligning with our strategic goals and that of our municipal partners.

Objectives:

- Develop a baseline of data to support our climate change strategy and strategies of our partners.
- Reduce long term costs of our monitoring network with effective upfront investment.
- Maximize the use of technology to enable remote data management and reduce staff resources.
- Consolidate the number of sites we monitor where possible, identifying if we require new locations or opportunities to streamline existing site locations.
- Provide up to date and where possible, live information and data to our customers through our website and partner platforms.
- To utilize standardized protocols across organizations when available across our network to provide consistency in field methods and data collection.
- Develop our connection and use of stakeholder data and information by sharing and collaborating.
- Exploring sustainable ways to work with partners to provide long term monitoring networks.

The development of this strategy is critical to all parts of our business at Kawartha Conservation. The information we gather enables us to protect people and property across the Kawartha Lakes and assists with targeting action on the ground, making the most of finite resources. These investments in turn help to protect the natural resources and lakes that are the engines of our local economy and provide for long term community sustainability.

A total of 87 stakeholders, community partners and public representatives provided valuable feedback through an online engagement survey at the early stages of strategy development. Questions were geared towards knowledge of organization, watershed, and programs, what their environmental concerns were and how they would like to see information disseminated.

We undertook an in-depth review of existing programs that assessed the value and benefit of each program, conducted a SWOT analysis of each program, analyzed the operational and in-kind program resources, and identified new program areas that are not currently delivered. The initial review of programs provided valuable information for each program, but some clarification was required, so additional review was conducted that narrowed in on policy, upfront investment, monitoring network capacity, data management and reporting. This information was then cross referenced with the initial assessment which provided a deeper understanding of the programs.

To help assist in the development of this strategy, and to provide guidance through this process a strategic guidance group of 10 members was formed that included Kawartha staff and members from various external community groups and organizations. Meetings were held on the completion of each major milestone so that members had the opportunity to provide feedback and to help guide strategy next steps.

Upon compiling all information, a clear picture was formed as to where our focus should be over the next 10 years including what 3 high priority actions should be undertaken do to achieve them. The following recommendations and actions have been proposed.

R1. Keep monitoring the core elements of the existing Environmental Monitoring Program

 ➢ Continue to focus monitoring efforts in Biomonitoring, Climate, Groundwater, Landuse, Temperature Monitoring, Water Quality and Water Quantity programs.
 ➢ Take advantage of opportunities to integrate monitoring stations between programs where possible.
 ➢ Ensure data being collected remain relevant in terms of meeting the needs of municipalities and other key partners, and based on watershed management priorities.

R2: Migrate key parameters in monitoring equipment to real time where feasible, to reduce long term costs.

 ➢ Increase real time capabilities by 65% for water quantity and climate monitoring programs, by investing in technology that permits instantaneous internet access to data.
 ➢ Install water temperature monitoring sensors at existing or proposed water quantity gauge stations.
 ➢ Continually explore new opportunities to cost-effectively collect real time data.

R3. Establish new monitoring sites that will help fill in data gaps across watershed.

 ➢ Increase the number of stations within our monitoring network by 30% in high priority sub watersheds.
 ➢ Increase the number of stations within sub watersheds that contain sensitive streams, high development pressures and degraded water quality.
 ➢ Increase the number of climate monitoring stations to obtain a better understanding of weather patterns across the watershed.

R4: Continue to track land use changes across the Kawartha Watershed

- ➢ Obtain aerial imagery across the watershed every 5 years and characterize dataset using Ecological Land Classification methodology.
- ➢ Identify major trends in land use over time.
- ➢ Identify priority areas and subwatersheds that require enhanced watershed monitoring and management.

R5: Report regularly on environmental monitoring programs in an understandable and accessible format to support decision making by Kawartha Conservation and partners to enhance watershed health.

- ➢ Produce an annual watershed health report that summarizes key findings.
- ➢ Take advantage of internet software opportunities to make key findings easiliy understandable online.
- ➢ Provide regular updates on key findings to all internal departments, watershed municipalities, Board of Directors and other key watershed management partners.

R6: Move towards 'open data' to establish a platform for sharing data.

- ➢ Work towards making 75% of collected data accessible through our website.
- ➢ Develop an open data policy
- ➢ Ensure rigorous data quality control and assurance practices.

R7: Continue to collaborate with municipal and community partners, agriculture, academia and first nations moving forward.

- ➢ Regularly liaise with key partners to ensure our monitoring programs meet their organizational needs.
- ➢ Reduce duplication in efforts by sharing data, key findings, and integrating monitoring efforts with partners where ever possible.
- ➢ Encourage participation from volunteers in assisting with the collection of data.

R8: Continue exploring efficiencies and innovations in environmental monitoring programs and emerging issues across the watershed.

- ➢ Utilize monitoring data and staff technical expertise to support funding proposals to address emerging lake and watershed management issues.
- ➢ Keep up to date on the 'state of the science' related to emerging watershed management issues, for example: invasive species and climate change.
- ➢ Take advantage of technological advancements to improve collection, management, analysis and reporting of environmental monitoring data.

Introduction

Kawartha Conservation is committed to providing high quality science and data that facilitates policy and decision making locally within our watersheds and across our geographical jurisdiction.
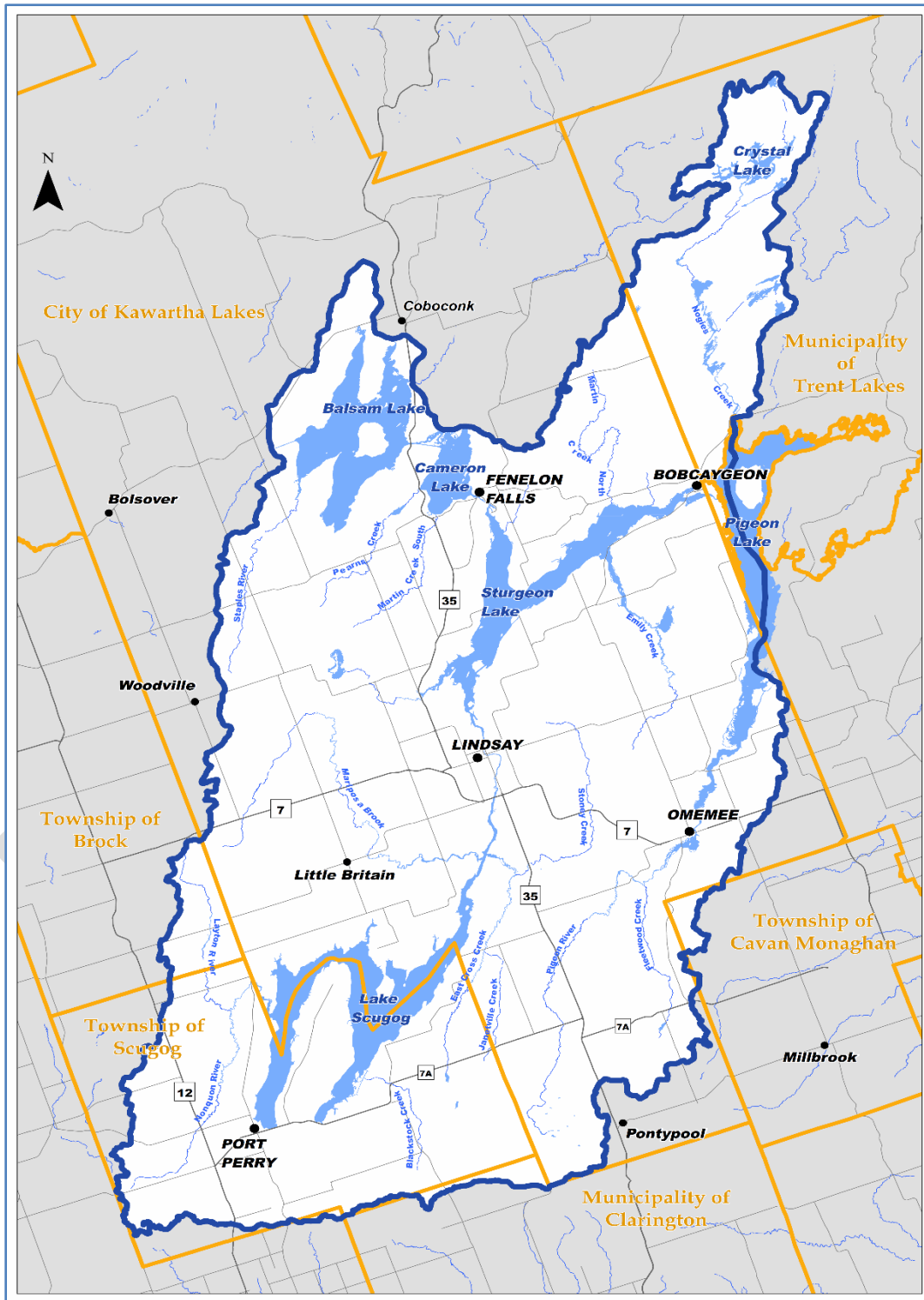

FIGURE 1 – KAWARTHA CONSERVATION WATERSHED JURISDICTION

To direct the efforts of the organization for the future in terms of what data we collect, how we collect and where/when this is done, a monitoring strategy was proposed to provide the framework in support of future monitoring activities.

The development of a monitoring strategy aligns with Kawartha Conservations' strategic plan (2022-2026) and provides benefit to all our high-level goals, having specific relevance to the following:

Protect and Restore –

- **Ensure the ongoing health of our watershed**
    - Provide data-driven recommendations to advise on water resource issues
    - Continue to adapt to changing climates by enhancing our flood forecasting services and monitoring network
- **Encourage participation in environmental initiatives**
    - Support and expand our volunteer-based programs
- **Ensure the safety of people, property, and public infrastructure**
    - Track key environmental trends impacting the watershed and report on results at least every 3 years
    - Continued implementation and review of measures to address climate change

Engage and Inspire –

- **Community Building**
    - Expand engagement collaboration and knowledge sharing with our first nation communities
    - Expand our connections with our municipal partners and establish working relationships for projects of benefit to the community
    - Continue to engage with, and cultivate positive relationships with our agriculture, business, urban, rural, and lake-based sectors.

Innovate and Enhance –

- **Increase efficiency and effectiveness of service delivery**
    - Make information and data more easily accessible and understandable for everyone.
    - Continue conversations with our community, business, and agency stakeholders on environmental issues to support positive change

To provide direction for the strategy, the integrated watershed management team developed a high-level goal and clear objectives that set out areas of focus for the next 10 years. These are highlighted below:

Goal:

'To provide a cost-effective environmental monitoring network that facilitates evidence-based decision making, and that provides accessible, real-time science and data to our community, while aligning with our strategic goals and that of our municipal partners.

Objectives:

- Develop a baseline of data to support our climate change strategy and strategies of our partners.
- Reduce long term costs of our monitoring network with effective upfront investment.
- Maximize the use of technology to enable remote data management and reduce staff resources.
- Consolidate the number of sites we monitor where possible, identifying if we require new locations or opportunities to streamline existing site locations.
- Provide up to date and where possible, live information and data to our customers through our website and partner platforms.
- To utilize standardized protocols across organizations when available across our network to provide consistency in field methods and data collection.
- Develop our connection and use of stakeholder data and information by sharing and collaborating.
- Exploring sustainable ways to work with partners to provide long term monitoring networks.

The development of a monitoring strategy is critical to all parts of our business at Kawartha Conservation. The information we gather enables us to protect people and property across the Kawartha Lakes and assists with targeting action on the ground, such as environmental stewardship and restoration projects, making the most of finite resources. These activities in turn help to protect the natural resources and lakes that are the engines of our local economy and provide for longer term community sustainability. Examples would include shoreline restoration and naturalization activities on a particular lake.

Internally, the data and information we develop is also used to inform decisions taken by our planning and permitting teams, ensuring a timely and evidence-based response to our customers and stakeholders.

Data that we gather as part of our ongoing lake management planning studies also indicate where future pressure points are likely to exist along shorelines and suggests actions that can be taken to help alleviate future pressures.

Externally, our data and information are requested from a wide range of stakeholders. This can inform research by academia, direct provincial and federal government decision making and provide insight to public and private landowners regarding a specific land use issue.

The diagram below illustrates the customers that value and request our data externally. Appendix 4 provides a list of partnering agencies that we are actively working with or have in the past.

FIGURE 2 – CUSTOMERS THE ENVIRONMENTAL MONITORING PROGRAMS AIMS TO TARGET

Process

In early 2020, the Integrated Watershed Management team-initiated discussions on the Environmental Monitoring Strategy and established the goal and objectives. A high-level timeline was established and is illustrated below for reference.
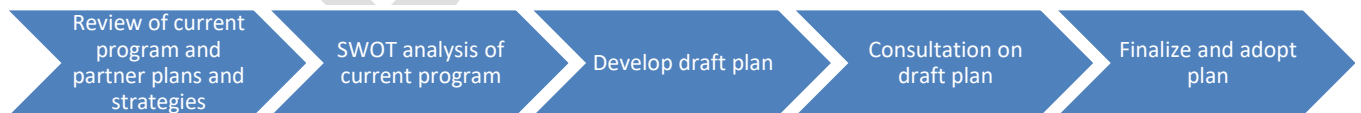
To help inform the strategy, at the early stages of the development, it was important to engage our stakeholders, community partners and the public to get a better understanding of how well they knew Kawartha Conservation and their knowledge of the current environmental monitoring programs being performed. Two separate engagement surveys were created for stakeholders/community partners and for the public, each asking 10 questions with multiple answer options provided in most cases. The delivery of each survey differed slightly. A targeted stakeholder/community partner distribution list was generated by staff and the survey was sent out through email, while a month-long social media campaign was used to facilitate the public engagement survey.

The second stage of the strategy development included an in-depth review of our existing programs. This involved the following activities:

- Assessing the value and benefit of each program.
- Conducting a SWOT analysis of each program.
- Analyzing the operational and in-kind program resources.
- Identifying new program areas that are not currently delivered

The in-depth review provided valuable insight into each program area but also highlighted some areas that required further analysis and clarification. A series of additional questions were developed to test each current program relating to policy, upfront investment, monitoring network capacity, data management, and reporting. This information was then cross referenced with the initial assessments to provide a deeper understanding of the programs.

In addition to the internal analysis and review, a Strategic Guidance Group was formed in early 2021 to help provide support and guidance to the project team. This committee comprised of 8 to 10 members and comprised of all levels of Government, First Nations, Academia, Community Partners, Consultant and Kawartha Conservation staff. This committee met approximately 6 times throughout 2021 with the following purpose.

- Providing technical guidance in the development of the Environmental Monitoring Strategy
- Help to establish the scope, goals, objectives, and content to be included in the Strategy
- Peer review of strategy document providing commenting
  Represent their community type and provide valuable input on how the strategy document will inform their organization moving forward

The committee was able to draw on their relevant experiences and backgrounds to help ensure Kawartha Conservation developed a monitoring strategy that was relevant to the communities it serves and was aspirational with regards to what could be achieved over the subsequent 10 years.

Results

Stakeholder/ Community Partner and Public Engagement Survey

The results of both stakeholder/community partner and public engagement survey were compiled separately and summarized. Each survey provided valuable information on varying demographic information, program knowledge or lack of, understanding of gaps and what types of monitoring they felt would be valuable moving forward. This information helped to inform the direction of the strategy and a synopsis of the results can be found in the Appendix.

Program Review

A comprehensive review of each current environmental program was crucial to perform before the strategy for the next 10 years could be proposed. Assessing the value and benefit of each program as well as outlining the programs strengths, weaknesses, opportunities, and threats through a SWOT analysis helped to rationalize importance, decipher relevance, and identify gaps and efficiencies as we move forward. This review also allowed us to see the value of each program and how it impacts not only Kawartha Conservation but the broader watershed community and our municipal partners.

Table 1 represents the environmental monitoring programs that went through a comprehensive review and a brief description summarizing the program details.

TABLE 1 –ENVIRONMENTAL MONITORING PROGRAMS THAT WENT UNDER A COMPREHENSIVE REVIEW.

PROGRAMS		DESCRIPTION	
BIOMONITORING	**Aquatic Life (Macro vertebrates)**	*Collect aquatic life in spring, summer and fall to monitor health of water quality in streams and lakes.* **# Of Sites = 10 to 20** **Area of Interest** *Rural and Urban Stream environments.*	

CLIMATE	**Precipitation and Snow Survey**	Monitors weather and climate parameters around the watershed including precipitation, air temperature, humidity, wind speed and direction to help assist the flood forecasting and warning operation that the organization performs on behalf of municipalities**.** *# Of Sites =* 3 All weather stations 5 Tipping Buckets 4 Snow Courses
	Low Water Response	Monitors local conditions with regards to a deficit in precipitation and flow in watercourses and coordinates community response to low/water drought situations when they arise.
	Senior Climate Change Program	Volunteer based program that monitors precipitation, air temperature and water temperature across the watershed while encouraging networking and use of technology. *# Of Sites* = 30 *Area of Interest* Distributed throughout rural and urban Centres within watershed
GROUNDWATER	**Baseflow**	Monitors the amount of water in a watercourse that comes from groundwater and to capture long term trends in groundwater status over time, critical for rural living. *# Of Sites* = Depends on sub watershed size

		Area of Interest *Year to Year rotates through 23 sub watersheds.*
	Provincial Groundwater Monitoring Network (PGMN)	*Provincial program that monitors the state of groundwater resources, both quantity and quality at 13 wells within the Kawartha Watershed.* *# Of Sites - 13*
	Shallow Groundwater Monitoring	*Evaluates the impacts of climate change and land use changes on shallow groundwater resources less than 3 metres deep across the watershed.* *# Of Sites = 4*
LANDUSE	**Ecological Land Classification**	*Categorizes land use using GIS and monitors changes over time. Helps to quantifying existing conditions of our natural areas and helps us understand how development pressures are impacting the health of our watershed.*
TEMPERATURE MONITORING	**Coldwater Streams**	*Monitors water temperature across our watershed to evaluate the thermal habitat status of our most sensitive streams.* *# Of Sites = 30* *Area of Interest* *Coldwater Streams*

WATER QUALITY	**Provincial Water Quality Monitoring Network (PWQMN)**	*Provincial program that collects water quality information from rivers and streams to help bring awareness to water quality issues in our area.* ***# Of Sites** = 11* ***Area of Interest*** *Outlet of Lakes*
	Kawartha Water Watch (KWW)	*Volunteer based program that monitors water quality across watercourses and lakes that augment water quality data where little or no data exists across our watershed and surrounding area.* ***# Of Sites** = 17 Active* ***Area of Interest*** *Streams and Lakes*
WATER QUANTITY	Water Levels and Flow 	*Monitors the quantity of water in rivers and streams by continuous automatic measurement and recording of water levels. The collection of water level monitoring data on local watercourses is crucial for the flood forecasting and warning program at it provides a good indication of high-water levels and adversely low water conditions.* ***# Of Sites =** 5 ECCC Sites 4 Water Flow **Sites*** ***Area of Interest*** *Set Locations across watershed*

To gain a better understanding of each programs resource an analysis was done looking at various program components and the internal effort and external contribution required. Program components were broken down into staffing, travel, supplies, equipment, lab fees and professional development. The financial information gathered allowed us to then estimate the effort per hour and cost for each sampling site.

After reviewing each program there were still some additional questions that needed to be asked to fully understand the complexity of each program, these questions were geared to Strategic Plan/Policy, financial investment, data collection, technology, and reporting.

All program areas meet one or all of Kawartha Conservation's strategic goals and objectives (Table 2).

TABLE 2 –STRATEGIC GOALS AND OBJECTIVES THAT EACH ENVIRONMENTAL MONITORING PROGRAM MEETS. MANDATED PROGRAMS (SHADED GREEN) AND NON-MANDATED PROGRAMS (SHADED ORANGE).

STRATEGIC GOALS			
Program	**PROTECT AND RESTORE** *O1 - Ensure the ongoing health of Watershed* *O2 – Encourage participation in environmental initiatives* *O3 – Ensure the safety of people, property, and public infrastructure*	**ENGAGE AND INSPIRE** O2 – Community Building	**INNOVATE AND ENHANCE** O1 – Increase efficiency and effectiveness of service delivery O2 – Share our stories to enhance community awareness O3 – Ensure we have the resources we need to provide services
Biomonitoring			
Aquatic Life (macro-vertebrates)	√		
Climate			
Precipitation and Snow Survey	√		√
Low Water Response	√	√	√
Senior Climate Change Program	√	√	√
Groundwater			
Baseflow	√		
Provincial Groundwater Monitoring Program (PGMN)	√		
Shallow Groundwater	√	√	
Land Use			
Ecological Land Classification	√		√
Temperature Monitoring			
Coldwater Streams	√		
Water Quality			
Provincial Water Quality Monitoring Network (PWQMN)	√		
Kawartha Water Watch (KWW)	√	√	√
Water Quantity			
Water Levels and Flow	√		√

The difference in shading represented in Table 2 indicates what programs are defined as "Mandated" and "Non-Mandated" in the new regulations of the Conservation Authorities Act (2021). Those programs that are shaded orange indicate that a Memorandum of Understandings be established by each municipality to continue.

Table 3 highlights the extensive list of internal and external policies (government), by-laws and strategies that drive the current monitoring programs.

TABLE 3 –INTERNAL AND EXTERNAL POLICIES GUIDING THE ENVIRONMENTAL MONITORING STRATEGY

| Internal | External | | |
	Federal	*Provincial*	*Regional/Local*
• Conservation Authorities Act R.S.O. 1990 • Kawartha Conservation Strategic Plan • Kawartha Conservation Climate Change Strategy • Lake Management and Implementation Plans • Plan Review and Regulation Policies • Kawartha Conservation Flood Forecasting and Warning Program • Watershed Report Cards	• Canadian Environmental Sustainability Indicators (CESI) • Canada Water Act • The Department of the Environment Act • Canadian Environmental Protection Act, 1999 • Fisheries Act • The Emergency Management and Civil Protection Act • Great Lakes Strategy • Internal Rivers Improvement Act	• The Greenbelt Act, 2005 • Oak Ridges Moraine Conservation Act 2001 • The Planning Act • Provincial Policy Statement • Ontario Water Resources Act • Environmental Protection Act • Environmental Assessment Act • Safeguarding and Sustaining Ontario's Water Act • The Drainage Act • Natural Heritage Systems (Kawartha Naturally Connected) • Provincial Water Quality Objectives	• Municipal Water and Wastewater Legislation • Envision Durham and other OP Municipal Comprehensive Policies • Lake Simcoe Protection Act

From the in-depth review process eight of the current programs were flagged as requiring upfront investment costs if additional sites were to be added to enhance the current network. These programs included Aquatic Life (Macro vertebrates), Precipitation, PGMN, Shallow Groundwater, Coldwater streams, PWMQN, Kawartha Water Watch and Water Levels and Flow. The requirements used to determine the upfront investment costs included staff time, equipment purchases or upgrades and travel expenditures. It was also identified that most of the current programs would require additional sites to fill in data gaps we currently have across the watershed. These program areas either don't have evenly distributed locations across our watershed or require additional sites to ensure we meet the appropriate data standards for analysis and reporting. Table 4 represents the programs that were determined that could benefit from having increased sites as well as the recommended minimum and maximum number of sites to effectively address the missing gaps.

Program	Minimum # of Sites	Maximum # of Sites
Aquatic Life (Macro vertebrates)	10	20
Precipitation	1	2
Shallow Groundwater	4	7
Coldwater Streams	5	10
PWQMN	2	4
Kawartha Water Watch	4	8
Water Levels and Flow	1	4

Improvements to technological capabilities amongst each program to allow for remote data accessibility were also reviewed. Two programs were identified that could facilitate the required equipment upgrades, they included the Provincial Groundwater Monitoring Network (PGMN) and Water Levels and Flow program.   Ten of our thirteen current programs demonstrate having collaboration with external partners whether it be through financial or in-kind support. In-kind support was provided through several different mechanisms which included providing technical support, data management and analysis or providing various types of equipment.

The information we collected on program resources was also analyzed to determine effort and cost for each program area (see Appendix 3 for breakdown). The Senior's Climate change program is estimated to have the greatest investment from external volunteers/parties amongst all monitoring programs. Snow survey, Provincial Groundwater Monitoring network and water levels and flows have the highest investment of effort per sampling site, followed by the Provincial Water Quality Monitoring Network. The PWQMN and PGMN currently benefit from the greatest financial cost-share of the monitoring program from external sources, while water levels and flows, PGMN, snow surveys and the monitoring of benthic macro-invertebrates and baseflow have the highest direct per station costs of the monitoring programs.

When analyzing the reporting aspect of our current programs, five programs currently report every 5 years through either Watershed Report Cards or through watershed plans. However, the two volunteer programs report annually, and our Low Water Program reports monthly. All other current programs report on an as needed basis or do not report at all. Overall majority of the current monitoring programs have over 5 years of data collected which allows for the ability to track long term trends and provide more frequent reporting.

Conclusion

We have conducted an in-depth look at the environmental programs we currently run, including assessment of resources and requirements to migrate to real time data collection, plus opportunities to enhance the monitoring network, by filling data gaps across our watershed. All this valuable information helped us to gain insight and provide recommendations on where the Integrated Watershed Management department should focus efforts across our environmental monitoring programs for the next 10 years. We ensured that the analysis addressed our established goals and objectives for the strategy along with that of our organization and partners, cross referencing with policies and plan drivers. We engaged both our stakeholders/community partners and the public through surveys and gained great insight on their knowledge of our programs, what environmental concerns they feel are important for our watershed and where they feel our attention should be focused as we move forward.   We also sought guidance and direction from our steering group, helping to bring different expertise and knowledge from across the jurisdiction and province to shape the strategy.

Recommendations

The culmination of this work is a series of recommendations that will ensure the organization is fit for the future and able to adapt to environmental and technological changes and challenges. The recommendations are set out below and for each recommendation there are 3 actions that we plan to execute to achieve these recommendations over the next 10 years.

Recommendation 1: Keep monitoring the core elements of the existing Environmental Monitoring Program
Action 1: Continue to focus monitoring efforts in Biomonitoring, Climate, Groundwater, Landuse, Temperature Monitoring, Water Quality and Water Quantity programs. **Action 2:** Take advantage of opportunities to integrate monitoring stations between programs where possible. **Action 3:** Ensure data being collected remains relevant in terms of meeting the needs of municipalities and other key partners, and based on watershed management priorities.
Recommendation 2: Migrate key parameters in monitoring equipment to real time where feasible, to reduce long term costs.
Action 1: Increase real time capabilities by 65% for water quantity and climate monitoring programs, by investing in technology that permits instantaneous internet access to data. **Action 2:** Install water temperature monitoring sensors at existing or proposed water quantity gauge stations. **Action 3:** Continually explore new opportunities to cost-effectively collect real time data.
Recommendation 3. Establish new monitoring sites that will help fill in data gaps across watershed.
Action 1: Increase the number of stations within our monitoring network by 30% in high priority sub watersheds.

Action 2: Increase the number of stations within sub watersheds that contain sensitive streams, high development pressures and degraded water quality.

Action 3: Increase the number of climate monitoring stations to obtain a better understanding of weather patterns across the watershed.

Recommendation 4: Continue to track land use changes across the Kawartha Watershed

Action 1: Obtain aerial imagery across the watershed every 5 years and characterize dataset using Eoclogical Land Classification methodology.

Action 2: Identify major trends in land use over time.

Action 3: Identify priority areas and subwatersheds that require enhanced watershed monitoring and management.

Recommendation 5: Report regularly on environmental monitoring programs in an understandable and accessible format to support decision making by Kawartha Conservation and partners to enhance watershed health.

Action 1: Produce an annual watershed health report that summarizes key findings.

Action 2: Take advantage of internet software opportunities to make key findings easily understandable online.

Action 3: Provide regular updates on key findings to all internal departments, watershed municipalities, Board of Directors and other key watershed management partners.

Recommendation 6: Move towards 'open data' to establish a platform for sharing data.

Action 1: Work towards making 75% of collected data accessible through our website.

Action 2: Develop an open data policy.

Action 3: Ensure rigorous data quality control and assurance practices.

Recommendation 7: Continue to collaborate with municipal and community partners, agriculture, academia and first nations moving forward.

Action 1: Regularly liaise with key partners to ensure our monitoring programs meet their organizational needs.

Action 2: Reduce duplication in efforts by sharing data, key findings, and integrating monitoring efforts with partners where ever possible.

Action 3: Encourage participation from volunteers in assisting with the collection of data.

Recommendation 8: Continue exploring efficiencies and innovations in environmental monitoring programs and emerging issues across the watershed.

Action 1: Utilize monitoring data and staff technical expertise to support funding proposals to address emerging lake and watershed management issues.

Action 2: Keep up to date on the 'state of the science' related to emerging watershed management issues, for example: invasive species and climate change.

Action 3: Take advantage of technological advancements to improve collection, management, analysis and reporting of Environmental monitoring data.

Appendix 1

Stakeholder/Community Partner Survey

A total of 34 survey responses were received for the stakeholder/community partner survey. Our goal was to ensure survey responses were captured for the following community types; Government, Academia, First Nations, Community Partners, Consultants, NGOs, and Agriculture.

We asked the question 'Has your organization been involved in or provided financial support towards any environmental projects in the past?' This question was important to us as one of our strategic goals is around fostering relationships with stakeholders and community partners. Based on the 34 survey responses 65% indicated that they had provided financial support towards our projects in the past. Graph 1 represents the breakdown of support based on organization type. This illustrated that most of our financial support comes from all levels of government, community partners and NGOs, while academia and the agriculture sector tend to contribute more through In-Kind and volunteer opportunities.
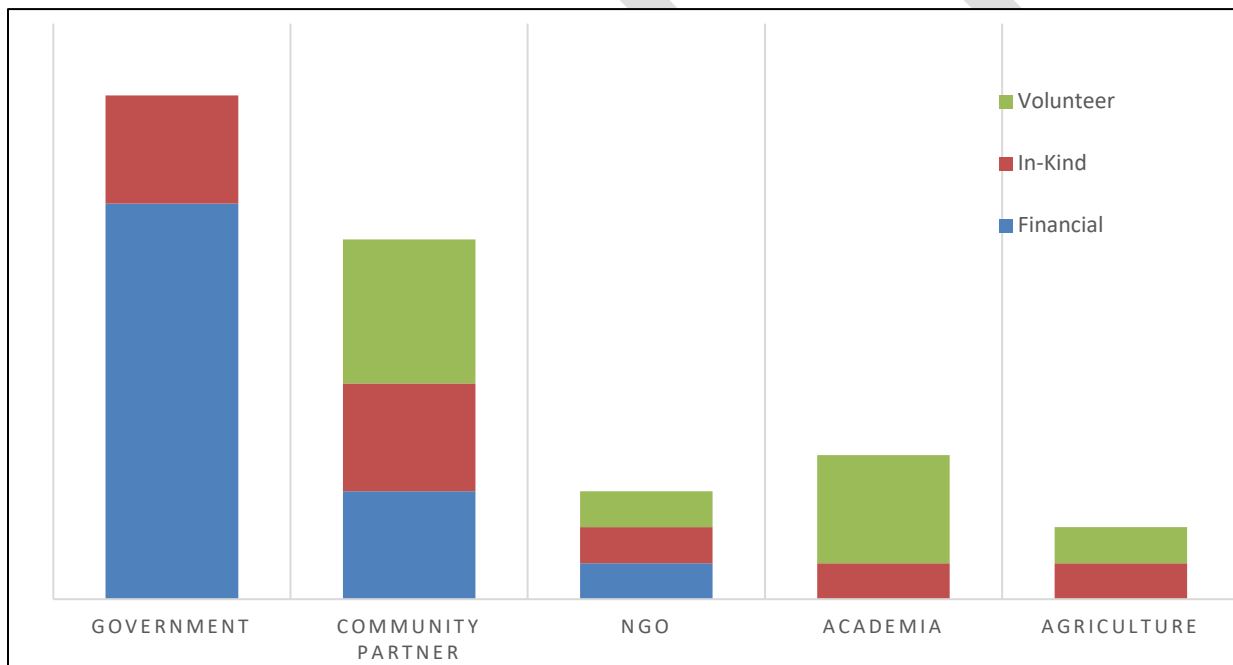
GRAPH 1- REPRESENTS ORGANIZATION TYPE VS SUPPORT TYPE.

We inquired with the stakeholders/community partner about their familiarity with our current environmental programs being offered, anticipating that most responses would indicate that they were familiar with our programs. However, we found that 15% of respondents said they were not familiar with our programs. They included participants from municipal government and a local resident.

Of those (85%) that said they were familiar with our programs, specified their knowledge in the following areas.
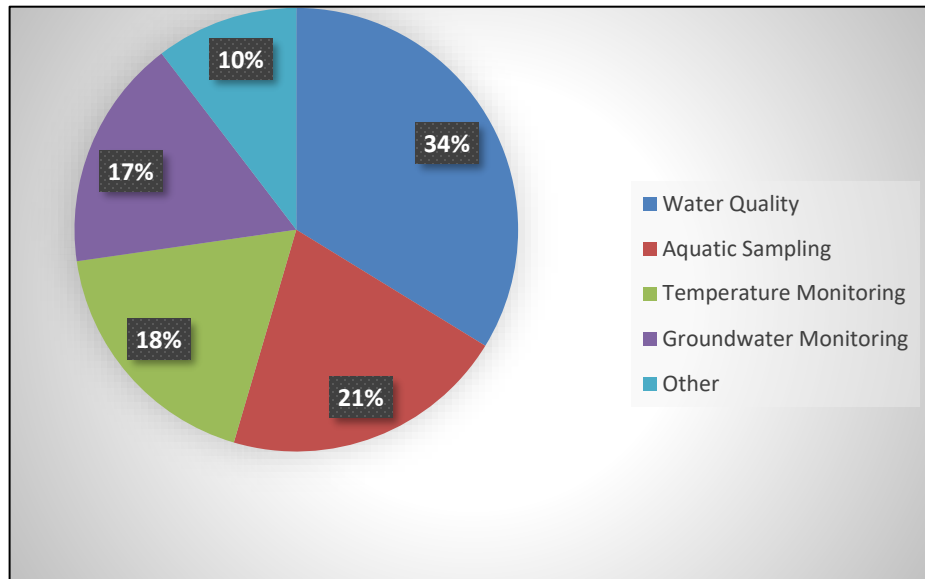
Based on the survey responses from the stakeholders/community partners, our environmental monitoring information is primarily conveyed to them in reports, via email or by presentations our staff make.

Public Engagement Survey

A total of 53 survey responses were compiled for the public engagement survey. Many questions were focused on demographics with a few questions focused on our current monitoring program knowledge, issues that concern them and how they would like to see reporting delivered over the next 10 years.

91% of the public survey responses had heard about Kawartha Conservation, of those 64% represented permanent residents of the Kawartha watershed and 36% represented seasonal residents. Just over 51% of the responses fell between the ages of 46-64, with 38% showing in the age grouping of 19-45. The age group category 65 and older followed in third with 11%. Unfortunately, we had no responses from the age group 18 and younger (Graph 3).
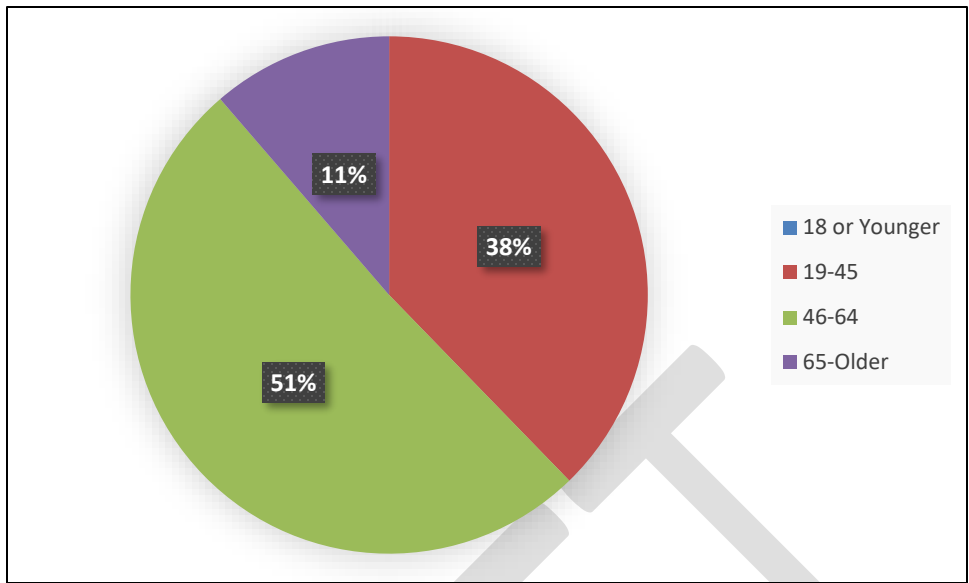
GRAPH 3- AGE DEMOGRAPHICS FOR PUBLIC ENGAGEMENT SURVEY

The Kawartha watershed is approximately 2500 square kilometers in size and has many lakes and rivers situated within. It was very important to capture input from both land and shoreline residents. Based on the survey responses almost equal representation was recorded.

From the 47% shoreline residents that responded to the survey, results showed that we had a great distribution amongst the lakes within our watershed as each lake had representation (Graph 4). Of those 53% of survey responses who live on land, 92% of those lived within an urban centre environment.
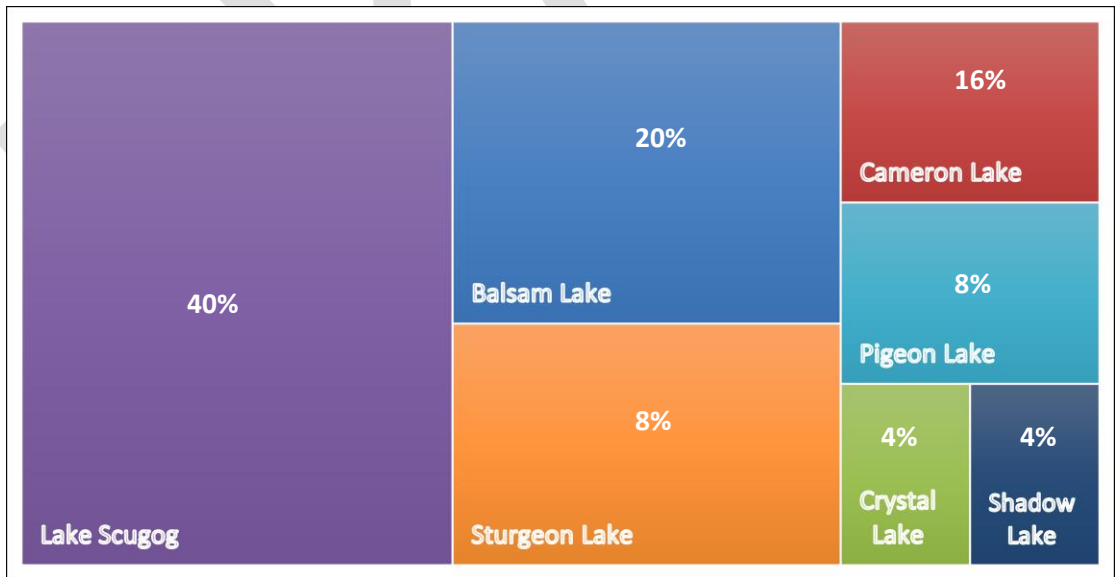
GRAPH 4 – SHORELINE DISTRIBUTION AMONGST LAKES

The knowledge around our current environmental monitoring programs from survey responses was slightly under 50%. For those that responded that they were familiar with our programming, water quality and aquatic sampling were the two programs that were most recognized (Graph 5).
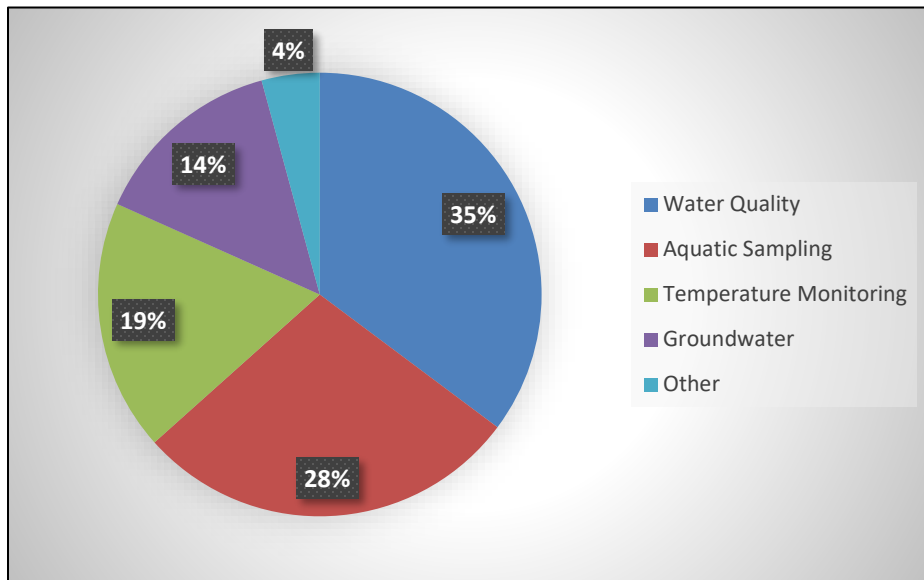
GRAPH 5 – PROGRAM AWARENESS BREAKDOWN

Water Quality and Development topped the list of environmental concerns facing the watershed today based on public survey responses followed by aquatic plants, flooding/water levels, loss of fish habitat/stock and climate. In terms of what the public would like to see be monitored into the future, water quality continued to top the list with collection of fish information coming in second and biological assessment and aquatic plant information following respectively. The reporting of user-friendly data also ranked high amongst survey responses.

The public responses acknowledged that they would like to see environmental information shared through our website and social media channels as well as documented in reports. Some other suggested ways of providing information included hosting open houses and holding meetings and workshops. The use of interactive dashboards to access real time data was also suggested to report information. Most of those who responded said they would like to see information reported seasonally.

Full summary of both the Stakeholder/Community Partner and Public Engagement Survey can be provided upon request.

Appendix 2

Comprehensive Program Review Document (46 pages) can be provided upon request.

Appendix 3

Comparison of Monitoring programs – Effort and Cost per program area.

Program	Initial Station Cost	Internal Effort Hrs/site	Internal Cost $/site	External Contribution hrs/site	External Cost Contribution $/site
Aquatic Benthic Macro-Invertebrates	$0	17	$164 (annual)	9.3	N/A
Precipitation	$20-25K	8.75	$38.25 (annual)	1.25 hrs/site	N/A
Snow survey	$100	36.75	$176 (annual)	2.5	
Low Water Response	N/A	N/A (Could not work this out)	N/A	N/A	N/A
Seniors Climate Change Program	$86.33	2.75	N/A	52	N/A
Baseflow [1]	$0	6.22	$114.67	0	$0
PGMN		35.3	$197.70	3.77	$211.54 [2]
Shallow Groundwater	$275[3]	12.75	$96	$0	$0
Ecological Land Classification	N/A	N/A	N/A	N/A	N/A
Temperature Monitoring	$115	6.07	$84.67 [4]	N/A	N/A
Water Levels and Flows	20K (ISCO) 30-50 K (WSC)	35.78	$255.56	13.2 (for 5 sites)	$89.60 (for 5 sites)
PWQMN	$0	22.68	$104	1.82	$563.64
KWW	$100	5.76	$44.94	1.94	$17.65

[1] Estimated at 3 sites/day for 20 days = 60 sites
[2] Assumed water level equipment has a lifespan of 8 years, prorated annually accordingly.
[3] Assumed that the $1,100 in supplies relates to initiation costs for the site, not ongoing costs.
[4] Kept all items as an annual cost.

Appendix 4

Below is a list of groups that we 'actively partner with' amongst the environmental monitoring programs. The groups in orange represent those that we have partnered with but not as frequent (greater than 3 years).

Community Type	Area of Interest
Federal Government Agencies	
Parks Canada	• Flood Forecasting • Lake Management Planning
Environment and Climate Change Canada	• Water Flow Monitoring • Climate Change Strategy
Fisheries and Oceans Canada	• Fish Habitat classification • Watershed Management Plans
Provincial Government Agencies	
Ontario Ministry of Northern Development, Mines and Natural Resources and Forestry	• Natural Heritage • Water resources monitoring and mapping • Flood Forecasting
Ontario Ministry of Environment, Conservation and Parks	• PWQMN • PGMN • Aquatic Biomonitoring
Ontario Ministry of Agriculture, Food and Rural Affairs	• Precipitation Monitoring
Federation of Ontario Cottagers' Association	• Lake Partner Program • Invasive Species Monitoring
Ontario Federations of Anglers and Hunters	• Lake and Watershed Management Planning
Municipal Partners	
City of Kawartha Lakes	• Activities that promote economic viability of the municipality, including environmental health, lake management planning, drinking water source protection and climate change initiatives
Region of Durham	
Township of Scugog	
Municipality of Trent Lakes	
Township of Brock	
Municipality of Clarington	
Township of Cavan Monaghan	
Peterborough County	
Haliburton Kawartha Pine Ridge District Health Unit	• Water Quality Beach Sampling
City of Kawartha Lakes Environmental Advisory Council	• Water Quality
Scugog Environmental Advisory Committee	• Emerging watershed issues
Academia	
Trent University	• Water Quality and Quantity Projects • Co-op Opportunities
Fleming College	
Ontario Tech	
Trillium Lakelands District School Board	• Watershed Science Education • Children's Water Festival • Guest Speaking – Watershed Related Topics
Durham Region School Board	• Watershed Science Education

	• Wetland Festival
First Nations	
Mississauga's of Scugog Island	• Lake Scugog Enhancement Project
Curve Lake First Nation	• Lake Management Planning
Williams Treaties First Nation	• Natural Resource Management
	• Watershed and Lake Planning
Community Partners	
Scugog Lake Stewards	• Lake Scugog Environmental Management Planning
Kawartha Lakes Stewards Association	• Lake Water Quality Monitoring
Lake Associations	• Lake Management Planning
Kawartha Land Trust	• Restoration Projects and Monitoring
Invading Species Awareness Program	• Invasive Species Monitoring and Management
Finger Lake Institute	• Invasive Species Monitoring
Coalition of Equitable Water (Haliburton)	• Lake Management Planning
Kawartha Field Naturalists	• Natural Heritage Monitoring
Trent Matters	• Lake Management Planning
Conservation Authorities	
Conservation Ontario	• Watershed Report Cards
	• Great Lakes Data Stream
Neighboring CA's	• Flood Forecasting
	• Natural Heritage
WISKI Eastern Ontario Collaborative	• Data Management

Appendix 5

To summarize the recommendations and our actions we hope to implement over the next 10 years, the visual illustration below identifies our recommendations and some key performance indicators we aim to achieve.