

NSERC Canadian Lake Pulse Network

ANNUAL REPORT

YEAR 1 (2016-2017)

A national research network to assess the health status of Canadian lakes



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From the Network Director

The objectives of the NSERC Canadian Lake Pulse Network (we affectionately call it “Lake Pulse”) are ambitious to say the least: we integrate innovative research with a pan-Canadian assessment of lake health to provide governmental partners and other stakeholders with new knowledge, tools and indicators to advance evidence-based policies and decision-making. This 5-year research Network, initiated in mid-2016, includes 18 university researchers and will train over 40 students. Our partners include federal, provincial and territorial government agencies as well as non-governmental organizations.

Lake Pulse participants collaboratively explore many aspects of limnology, including paleolimnology, spatial modelling, remote sensing, genomics and contaminants. We work closely with our partners and other organizations to determine how to best integrate scientific and technological advances into lake management. Frequent and open communication with diverse stakeholders helps to guide how our national lake database and web-based visualization tools will provide accessible data to policymakers, decision-makers, citizen groups, lake associations and municipalities. By bringing together the essential scientific, technical, communication and collaborative skills and focusing on the practical needs of diverse stakeholders, we are poised to fill a profound gap in the national discourse on lake health management, which can transform the debate and policy discussions on lake health.

Many Lake Pulse participants are finding that a departure from their usual *modus operandi* is required. Enhanced cooperation is essential in this Network, and many individuals are coming together to contribute to common goals. For example, Lake Pulse students will be immersed in our multidisciplinary, collaborative field expeditions to sample 680 lakes across Canada over 3 summers. These students will collect data for the entire Network and cannot simply focus on their individual projects. They will be trained in diverse limnological techniques and will contribute to our large, shared lake database. They will also help to refine our Lake Pulse field manual; these protocols will be applied nationwide and are aligned with the Environmental Protection Agency’s National Lakes Assessment. This transboundary collaborative effort will lead to unprecedented, continental-scale comparative analyses of lake health. Lake Pulse researchers, unlike researchers working in many other NSERC Strategic Partnership networks, are not allocated funds to carry out specific research projects. Instead, they are provided with partial stipends for students. We also ensure that our partners are deeply embedded in all aspects of Lake Pulse from planning to analyses, including data collection and publications.

For our Network to succeed, trust must be built amongst all participants; methods and guidelines must be put in place; and communication must be efficient and flow freely. This was some of the work that was cut out for us during our first 9.5 months, along with building the core team at our host institution, the Université de Sherbrooke.

To say that these months have been fast paced would be an understatement, and to claim that there were no challenges would be a lie. However, we are confidently on track to begin one of the most ambitious limnological field campaigns ever carried out in Canada. We are developing a robust and coherent framework to support national and continental-scale analyses of lake health indicators, now and into the future. I even feel that in many respects we are exceeding expectations.

As Director, I could not be more proud and happy to see what has been accomplished. As you will read in this report, the efforts of many participants have been exceptional. The Scientific Committee probably did not expect to meet 11 times in the first 6 months of coming together. Our Network employees have shown extraordinary dedication, and we would not be where we are today without them. Catherine Brown, our Network Manager, provides invaluable coordination and assistance in virtually all elements of Lake Pulse, including our outreach and communications strategy. I believe that

we are capable of tackling the challenges of the coming year, and our strong collaborative spirit will continue to be essential to our success.

I cannot end this message without expressing sincere thanks to everyone who has played a part. Many people were involved this year: the research offices of member universities and the managers at partner organizations who spent countless hours poring over the Network Agreement; the partner scientists and co-PIs who worked towards the preparation of our first field campaign; and the extended team at the Université de Sherbrooke – especially Thérèse Audet, Denise Bisson (happy retirement!), Marie-Claude Garneau, Geneviève Potvin, Jelena Juric, Marieke Beaulieu and Gabriel Diab. Of course, I also thank NSERC whose funding has made this Network possible.

Yannick Huot
Network Director

1. Introduction: Who we are, what we do, our mission and vision

1.1. Who we are

Funded from July 1, 2016, until June 30, 2021, the NSERC Canadian Lake Pulse Network (hereafter Lake Pulse) was officially announced on November 7, 2016, by the Honourable Marie-Claude Bibeau, Minister of International Development and

"I am happy that the research network led by the Université de Sherbrooke has the opportunity to engage in work that is critical to protecting Canada's numerous lakes. In our region, we are particularly aware of the challenges facing the health of our bodies of water. This network also provides a great opportunity for researchers and stakeholders to work together."

- The Honourable Marie-Claude Bibeau, Minister of International Development and La Francophonie

La Francophonie, on behalf of the Honourable Kirsty Duncan, Minister of Science. Lake Pulse is funded under the NSERC Strategic Partnership Network program. Its overarching goal is to assess the health status of Canadian lakes while carrying out state-of-the-art research in limnology, remote sensing, ecology and other related sciences.

1.2. Mission and vision

The Lake Pulse mission is to bring together leading academic researchers, government and non-

governmental stakeholders, as well as international experts to develop and share state-of-the-art technologies; support multidisciplinary and collaborative research; train HQP; communicate with policymakers and decision-makers; and contribute to policy recommendations.

To achieve its long-term vision of creating more sustainable and science-based lake management policies, the Network strives to increase scientific understanding and awareness - amongst experts, diverse stakeholders and the public - of the health status of Canadian lakes while developing the most promising approaches for lake stewardship and increasing access to data that is directly relevant to policy discussions.

At a glance

Name: NSERC Canadian Lake Pulse Network

Funding: \$5.5M from the Natural Sciences and Engineering Research Council of Canada's (NSERC) Strategic Network Grants program

Host institution: Université de Sherbrooke

Objective: To assess and forecast the health status of Canadian lakes while carrying out state-of-the-art research in limnology, remote sensing, ecology and other related sciences.

1.3. Objectives

Our mission and vision will be achieved by meeting our three key scientific objectives, over the five-year life time of the Lake Pulse Network, which were developed by academic, governmental and non-governmental stakeholders:

- (1) To assess the health status of Canadian lakes, identify their key stressors (including emerging ones), and understand how these stressors have altered and are altering lake biogeochemical functioning.
- (2) To forecast probable future changes in the health status of Canadian lakes using climate and land-use scenarios.
- (3) To develop new observational approaches, such as genomics and remote sensing (past, new and future sensors), to provide managers with new stewardship tools to understand lakes and to provide policymakers with essential knowledge to inform decision-making.

To achieve these objectives, the Network research is divided into 10 projects spread across 4 themes, plus 1 Network project.

This report's purpose is strictly to help the Board of Directors (BOD) and NSERC understand the progress that has been made in the first year of the Network (we are writing about 9.5 months into the first year). This is a realistic portrait of the Network – no rose-tinted glasses – in order to examine our

progress and to identify where any potential problems could arise. The report's structure is simple to facilitate its evaluation by the reader: in each section, we start with a subsection that provides an overview to remind the reader of the proposed work and structure; then, the next subsection highlights the key changes and progress that took place in our first year. But to begin, we paint the broad strokes by comparing the original milestones planned in the proposal with our current progress.

2. Overview of year-1 progress

Table 1 (below) reproduces the timeline that was planned in the initial proposal. It highlights that despite minor delays in achieving most of the milestones, these delays did not impact the Network's progress.

Initial delays in recruiting Board members led to several milestones being delayed: the first BOD meeting, the first annual general meeting (AGM), and recruiting the Network Manager and research professional (RPs). Given the delay in hiring the RPs, we decided to focus the efforts of Jelena Juric (database specialist) on immediate field campaign preparations, especially supporting the geomatics efforts of Geneviève Potvin (geomatics specialist) and preparing our electronic log sheets for field sampling. We believe that we are saving time and increasing our capacity by first focusing the efforts of Jelena on these tasks instead of the immediate deployment of the database. For example, Jelena is aligning the electronic log sheets with the requirements of the future database, which will speed up data acquisition and entry into the database. In addition, the database will not be needed until this fall when we begin receiving data; as such, we feel confident about organizing the development of the database in this way. The Network Director coordinated the work of Geneviève and Jelena, and all geomatics analyses are completed, despite starting later than expected.

In addition to meeting these milestones, the Network Agreement was signed by all parties, except the Newfoundland and Labrador Department of Municipal Affairs and Environment, who cannot sign interprovincial agreements. However, they assured us that they are fully committed to support Lake Pulse as per their original commitment.

Table 1. Progress on milestones planned for year 1 and the beginning of year 2 in the proposal. In **green**, cells that are on track; in **yellow**, those that are or were achieved behind schedule, but with no expected impact on the Network. **Red** cells would show milestones that are behind schedule with either potential or certain impacts on the Network but there are none.

Milestone	Dates planned	Progress
Advertise, interview and hire the Network Manager	Aug. 28, 2016	Catherine Brown was hired on Nov. 1, 2016, but is on track with all responsibilities.
Advertise and hold first AGM	Sept. 23, 2016	First AGM was held on Nov. 21 and 22, 2017
BOD meeting	Sept. 23, 2016	Oct. 31, 2016 (videoconference) Dec. 12, 2016 (face-to-face) Jan. 17, 2017 (videoconference)
Recruit Network RPs to work on database and prepare first field campaign	Nov. 20, 2016	Three RPs were hired between Jan. and Feb. 2017
Recruit students involved in first field campaign	May 12, 2017	This is ongoing. Students who were not recruited had to be replaced by other students or personnel.

Basic database is running and ready to receive data	Feb. 28, 2017	The efforts of Jelena Juric have been directed towards preparations for the field campaign. We expect to have an initial version of the database running during the summer of 2017, and ready to receive field data in the fall.
Geomatics analysis for lake sampling in 2017: delineate watersheds; create an index of human impacts; determine lake sizes; accessibility; etc.	Sept. 30, 2017	An initial analysis was completed in April 2017. This analysis was done rapidly to allow lake selection; it will be refined with new techniques and data as they become available.
Train sampling teams for first field campaign	June 16, 2017	Planned for the first week of July 2017. This was logistically a better approach.

3. Overview of reporting structure and governance

3.1. Management / governance

3.1.1. Overview

The Network is hosted by the Université de Sherbrooke (UdeS), where its Administrative Centre is located. The Network Director is a member of the Department of Geomatics of the Faculté des Lettres et Sciences Humaines (FLSH-UdeS).

As the Network Director, Yannick Huot coordinates Network affairs and leads the overall implementation of Network activities through his participation in research, RP supervision, coordination with partners, and HQP training.

The Board of Directors (BOD) has overall responsibility for the governance of the Network. It is comprised of the Network Director, representatives of Network partners and independent representatives from academia and government. The BOD provides strategic guidance, counsel, foresight, and administrative and financial guidance. The BOD oversees the Network activities and approves the annual budget. The BOD is accountable to NSERC.

The Scientific Committee (SC) is composed of 11 members. In addition to the Chair, also sitting on the SC are the Network Director, 5 Theme Leaders (2 for Theme 1; and 1 for Themes 2, 3 and 4), 2 partner representatives, and 2 external advisors. The SC provides guidance to the Network Director on all scientific aspects and reviews Network research projects.

As the Network Manager, Catherine Brown ensures the day-to-day operations of the Network and supports the Network Director in all responsibilities related to the Network, including communications, outreach, strategic planning, recruitment, organizing meetings and managing finances.

3.1.2. Year-1 progress and changes in structure.

The reporting structure approved by the BOD in year 1 is illustrated in Figure 1.

The nine voting members of the BOD (list provided in Appendix A) were recruited between July and the end of September 2016. Chaired by Richard Butts, the BOD first met on October 31, 2016, when its Terms of Reference were adopted. Two of the original members, Hugh MacIsaac and Kathy McKague, stepped down for personal reasons. Hugh MacIsaac was replaced by Verena Tunnicliffe. With this member, we aimed to balance the BOD through the recruitment of a member with extensive experience in large scientific networks. Professor Verena Tunnicliffe serves on the Science Advisory Committee of our sister strategic network, the Canadian Healthy Oceans Network (a renewed network), and she holds a Canada Research Chair in Deep Ocean Research at the University of Victoria. She was also director of the Neptune project. The position vacated by Kathy McKague is expected to be filled at the next Board meeting on May 24, 2017. In addition to the Chair, the Board has 2 members from government (David Boerner, Bill Donahue), 4 members from academia (Jacques Beauvais, Yannick Huot, Verena Tunnicliffe, Roxanne Maranger), while John Downing (Director of the Minnesota Sea Grant) is the Chair of the Scientific Committee and is an international participant. The BOD also includes two non-voting members: Samir Boughaba is the NSERC representative on the BOD, and Catherine Brown is the Network Manager.

John Downing was recruited as the Chair of the Scientific Committee; Amina Pollard and Daniel Hering were recruited as external advisors; while Jim Rusak and Caren Binding act as the partner representatives. The SC met for the first time on November 23, 2016, in Montreal. A complete list of the Scientific Committee members is provided in Appendix B.

The Network Manager, Catherine Brown, was hired two months late according to the original proposal. She joined Lake Pulse at the beginning of November 2016 but hit the ground running and has managed to keep the Network on schedule. Since she is the spouse of the Network Director, she reports to the Dean of the FLSH-UdeS for evaluation and promotion aspects.

At the request of the BOD, a conflict of interest committee was created to deal with any potential conflicts that may arise within the Network. All Network members have been contacted by email by Thérèse Audet, the Vice-Dean for Research at FLSH-UdeS and are aware that they can contact this committee to raise any concerns about potential conflicts of interest that they perceive. This committee reports to the Dean of the FLSH-UdeS.

3.2. Administrative Centre and common Network Human Resources

3.2.1. Overview

The Lake Pulse Administrative Centre (AC), located at the Université de Sherbrooke (UdeS), is responsible for the day-to-day management and running of the Network. During the first year of the Network, the AC consisted of Yannick Huot (Network Director) and Catherine Brown (Network Manager). They are supported by UdeS personnel, particularly Marie-Claude Garneau (Administrative technician).

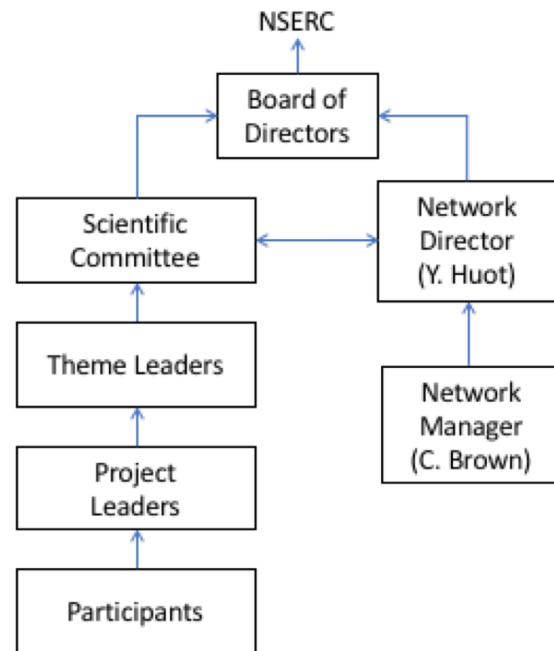


Figure 1: Reporting structure for Lake Pulse.

We refer to our common Network Human Resources as the group of research professionals (RPs) who work for the benefit of the whole Network. They are composed of UdeS professionals who dedicate part of their time to the Network as well as Lake Pulse-paid professionals who support Network activities. The positions of our Network RPs include a GIS specialist, a database specialist and a field coordinator.

3.2.2. Year-1 progress and changes - Administrative Centre and common Network Human Resources

In the first year of the Network, the AC's efforts have been centred on establishing the management and communication tools necessary to facilitate Lake Pulse activities. While Yannick Huot has been overseeing all Network activities, Catherine Brown has been supporting all the administrative and communication aspects of the Network (see below). In particular, she has been organizing the meetings of the Board of Directors and Scientific Committee; developed the Lake Pulse website and other communications tools; organized the first AGM; participated in the recruitment of all research professionals and summer students; coordinated with the Sherbrooke administration for all financial matters (purchases, reimbursements, etc.); and developed the Network's communications strategy with the Network Director.

Our Network Human Resources are key to the success of our Network. Our Lake Pulse RPs are based in Sherbrooke. Additional UdeS staff who spend part of their time on Lake Pulse activities are Patrick Cliche (electrical engineer in the Department of Geomatics; supporting instrument preparation and deployment) and Gabriel Diab (laboratory coordinator in the Department of Geomatics, acting as a field coordinator in Lake Pulse). Gabriel Diab is heavily involved in preparations for our field campaign, especially all aspects linked to safety in the field. He has also been trained at the Environmental Protection Agency's National Lakes Assessment (EPA's NLA) program. In addition, he is coordinating the logistical aspects of our five field teams getting to their field sampling locations.

Three RPs were recruited from January to February 2017:

Remote sensing and GIS specialist - Geneviève Potvin (MSc Ecology) was hired full time. She will also be graduating in mid-2017 with a second MSc in geomatics. Geneviève has been focused on the selection of lakes for the 2017 field campaign.

Database and informatics specialist - Jelena Juric (26 hours per week, BSc Informatics) was hired to work on the Lake Pulse database that will encompass both the data from the field campaigns and the data collected by our partners during their lake monitoring activities. With more than 15 years of work experience in database management, informatics and geomatics, Jelena is bringing vast experience to Lake Pulse. We soon realized that Jelena was bringing more to Lake Pulse than we had expected, and she could achieve her database tasks in $\frac{3}{4}$ of the full-time appointment that was originally planned. Consequently, Jelena will also be joining the Network as a part-time student working on the Lake Observer mobile application (a Network project). This brings strong synergy as she will be uniquely positioned to develop (and link to our database) the Lake Observer application, which promotes community-based data collection for Lake Pulse.

Field coordinator - Marie-Pierre Varin (MSc Limnology) was recruited in January 2017 soon after finishing her master's degree. She has extensive experience sampling lakes. Soon after her recruitment, Marie-Pierre suffered a sports injury and was on sick leave from February until May 2017. During her absence, she was replaced by Marieke Beaulieu (PhD student in limnology at UdeS). The Network was very fortunate to rapidly hire Marieke, who is highly qualified and her excellent work has allowed us to avoid any delays in the preparation of our 2017 field campaign. We are extremely thankful to Marieke Beaulieu for her tremendous contribution to the Network, particularly on the development of our field manual, which required intense coordination with all co-PIs.

Work coordination amongst the research professionals - Two main teams form naturally. First the *field coordination* team composed of Marieke Beaulieu (who replaced Marie-Pierre Varin while on sick leave), Gabriel Diab and Patrick Cliche. From February to April 2017, the field coordination team led by Marieke focused heavily on the preparation of protocols for our field manual. Second, the *data team* is composed of Jelena Juric and Geneviève Potvin. The field coordination team has also been interacting intensely with Jelena because the electronic field log sheets must be closely aligned with the field protocols. In addition to regular team meetings, they have been using the Slack communication platform along with Google's collaborative editing tools to efficiently work on many documents simultaneously. These tools and their use were put in place by our Administrative Centre.

3.3. Challenges faced and solutions

There were various challenges in year 1, many of which were handled by key participants who made extraordinary efforts to keep us on schedule.

As mentioned above, delays in the hiring of our Network Manager were due largely to difficulty in bringing our BOD together to approve the year-1 budget. This led to a very tight timeline for preparing the first AGM and direct involvement of the Director in some aspects before the Network Manager was hired.

A large amount of time was dedicated to a series of important decisions and the preparation of numerous documents by the Scientific Committee and the Director. This has consumed a lot of the time of the Administrative Centre. We expect that the time required for these activities will be reduced in the second year.

Losing our field coordinator to an injury a week after she started was definitely a setback and we had to be creative in finding solutions to address this situation. Ultimately, we found an excellent replacement with Marieke Beaulieu, who has done incredible work in preparing the field season.

4. International collaborations

4.1. Overview

Some countries, in particular the U.S. and many European countries, have had more time and experience in national and large-scale lake assessments than Canada. Learning from their experiences and best practices can greatly enhance our ability to make informed decisions about our national lake survey and database. Therefore, in addition to starting to work with our international collaborators within the different Lake Pulse projects, the Network has been actively seeking the advice of experienced scientists from abroad.

4.2. Year-1 progress

We are currently working with three carefully chosen international advisors within our Scientific Committee.

Daniel Hering (Universität Duisburg-Essen, Professor and Dean of the Faculty of Biology) has been leading a large European network, MARS (*Managing Aquatic ecosystems and water resources under multiple stress*), to assess the states of lakes and rivers. We invited him to join our Scientific Committee as an external advisor. In addition to bringing his expertise, he is helping us link our Network with European initiatives. A member of MARS will participate in our second AGM this fall, while a member of our Network will participate in the last annual meeting of MARS next winter.

Amina Pollard is leading the Environmental Protection Agency's National Lakes Assessment (EPA's NLA). This summer will be their third national assessment of U.S. lakes, following the surveys conducted in 2007 and 2012. In these surveys, the EPA samples approximately 1000 lakes (1122 lakes are planned for this summer) in the continental U.S. and Alaska with the aim of assessing their state. The experience gained by the EPA from these lake assessments is invaluable to our Network and close

collaboration has been useful for many aspects. Amina has been invited to sit on our Scientific Committee. She has been particularly insightful on the Scientific Committee in terms of understanding stakeholder interest in the data gathered by these large surveys. Through our collaboration with Amina, the EPA has hosted Gabriel Diab (in April 2017) and will host Marie-Pierre Varin (in May 2017) to participate in their field training sessions that are normally reserved for the U.S. field sampling teams. Furthermore, we are indebted to Amina for providing us with their latest draft of the NLA's 2017 field manual and helping us prepare our own field manual. Aligning many of the protocols between these two field campaigns will also allow lake assessments that span the U.S. and Canada. This joint effort will be the largest lake assessment using consistent protocols that has ever been carried out.

John Downing is Director of the Minnesota Sea Grant. He is chairing our Scientific Committee. His vast experience in limnology, large-scale sampling and research administration has been extremely useful to the decision-making and organization of the scientific aspects of the Network. In addition, John Downing has shared the QA-QC protocols that are followed in a program he leads to assess lakes. This has formed the basis of our own approach to QA-QC and will certainly lead to vastly improved data quality within the Network.

Patricia Soranno is a professor at Michigan State University. She has developed a large limnological database (LAGOS) that covers the northwestern U.S. We have been in contact with her regarding the development of our database. She has been sharing valuable information on LAGOS.

5. Research

5.1. Overview

The purpose of our research program is to develop knowledge and technologies useful to support science-based and sustainable lake management, particularly in the context of diverse human impacts on lakes such as pollutants, climate change and land-use changes.

Our research program is organized under 4 themes and 10 projects (a list of projects is provided in Appendix F):

Theme 1 - Where, by how much, and why have Canadian lakes changed during the Anthropocene? This theme assesses the state of Canadian lakes and how their biogeochemical functioning is affected by human impacts. It will mostly address objective 1 of the Network and is comprised of 4 projects.

Theme 2 - How do taxonomic, molecular and biochemical features of planktonic, benthic and microbial communities change with lake alteration and which ones can most effectively be used as indicators of the health of Canadian lakes? In this theme, we examine the biological communities living in lakes and their links to lake alterations. This theme also examines new indexes that could be used to monitor the states of lakes for different types of impacts. It will mostly address objectives 1 and 3 of the Network and is comprised of 2 projects.

Theme 3 - What are the optical, morphometric and watershed properties of Canadian lakes that can be applied to "scale up" assessments of health to groups of lakes through remote sensing and spatial modelling approaches? Here, we aim to spatially extend the results of themes 1 and 2 through spatial modelling and remote sensing approaches. This theme will mostly address objective 3 of the Network and is comprised of 2 projects.

Theme 4 - How will lake ecosystems and their services respond to different scenarios of environmental change? This theme aims to forecast future changes in lakes and how their ecosystem services will be affected. It mostly addresses objective 2 of the Network and contains 2 projects.

A key decision was made early in the development of the Lake Pulse proposal: resources would be strongly directed towards common research platforms. This Lake Pulse model is different from a commonly adopted model in which Network researchers receive money to carry out individual projects.

There are two key research platforms in the Network. The first consists of the pan-Canadian sampling campaign, and the second is the database that will receive all of the data from the field campaigns and from our partners. The common Network platforms are supported by the three research professionals hired by the Network (see section 3.2.2). The power of these platforms will be realized through efficient data dissemination and data sharing as well as the formidable training opportunities offered to HQP. Ultimately, the database will be made public, allowing anyone to access this unique database. This model for Network resources also affects student scholarships (the main funding contribution to individual projects), which must be subsidized by approximately 25% from the researchers' own funds.

5.2. Year-1 progress

The first year was largely devoted to setting up the Network: 1) putting in place many guidelines and procedures, which has fallen on the shoulders of the Scientific Committee and the Administrative Centre; and 2) preparing for the first field campaign, which has largely been executed by the Network RPs coordinated by the Director. We will highlight below the work carried out by the SC and RPs, while the Administrative Centre's role is mentioned where appropriate in other sections of the document.

In January 2017, all project leaders were asked to complete a project description template. The theme leaders subsequently presented these project descriptions to the SC for evaluation. For reporting purposes, some projects were divided into sub-reports to improve the readability of the project descriptions, but no new projects were added. All the project descriptions were evaluated by the Scientific Committee, which either approved the project descriptions or they were 'returned for modifications' (sometimes more than once). Some co-PIs were slower to understand the expectations of the Scientific Committee, and we feel that this is part of the growing pains of a Network. Nevertheless, this has consumed significant effort by the Scientific Committee, theme leaders and the Administrative Centre. Two project descriptions are still being revised by project leaders. Appendix F provides the status of the project descriptions as of May 15, 2017. The project descriptions are being used to confirm that project leaders are on track to pursue the work described in the original grant proposal, and they have helped to plan the first field campaign. The project descriptions are also needed to prepare for the annual evaluation of project reports that will be conducted prior to the second AGM by the SC, and whose evaluations will be sent to the BOD for approval with a recommendation with respect to funding for the project.

<p>At a glance: National Lake Pulse Survey in 2017</p> <p>Team training: July 5, 6 and 7, 2017</p> <p>Departure: July 10, 2017</p> <p>Area covered: Ontario to Nova Scotia (excluding Newfoundland and Labrador)</p> <p>Number of ecozones: 4</p> <p>Lake selection: per ecozone, size, human impact in the watershed</p> <p>Numbers of lakes sampled in year 1: 220</p> <p>Number of field team participants: 20 to 25, including 16 to 20 HQP (plus 5 back-up field participants)</p> <p>Field protocols manual: 70 pages, aligned with the US EPA's National Lakes Assessment</p> <p>Metadata collection: Electronic log sheets on tablets</p>

5.2.1. Scientific Committee work

A key decision that was made early on by the SC was the lake selection method. This need arose from discussions at the first annual general meeting when doubts were raised concerning the method described in the proposal (based on clustering approaches to select "representative lakes"). These concerns also reflected some of the comments received from external reviewers and the external examining committee. A stratified random design was chosen instead. In this design, an equal number of lakes is selected for each of nine southern ecozones, and fewer lakes are sampled in four more

northern ecozones. A new ecozone delimitation has been carried out by the Canadian Council on Ecological Areas in 2014. This delimitation added two ecozones in the "core ecozone" regions that we originally planned to sample. The Scientific Committee further decided to stratify according to lake size and human impact in the watersheds. Figure 2 illustrates this separation into nine categories. This was a key decision as it guided all of the work by Geneviève Potvin on the lake selection. The Scientific Committee also asked for a "general" human impact index that would encompass the impacts of different human influences and therefore would be general across ecozones (would reflect the important impacts in any ecozone). This index was also developed by Geneviève Potvin, supervised by the Director, from existing data as we did not find existing indexes that met our needs.

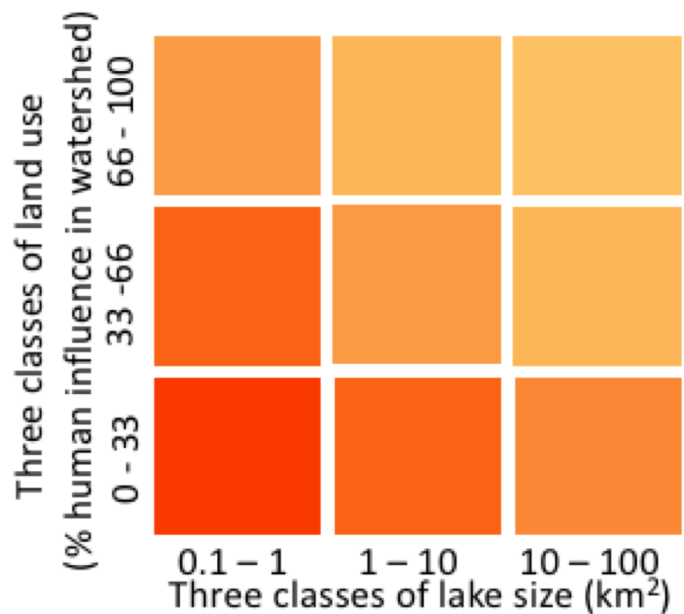


Figure 2: Stratification within ecozones to select lakes according to size and human influence in the watershed.

During the first year, the Scientific Committee also achieved the following:

1) Developed a data-sharing policy. These guidelines, in essence, state that all data collected by the Network can be accessed and used by all members of the Network for preliminary analyses. At the same time, it protects HQP and co-PIs associated with individual projects or who have invested heavily in the data by preventing distribution or publication of these data without formal consent by the concerned individuals.

2) Developed authorship guidelines that provide a clear description of the contributions that are expected for a contributor to be considered as a co-author on a publication.

3) Developed a set of procedures for deciding whether to add new partners, co-PIs or collaborators. These are all based on the central question of whether or not the addition of the new participant would "enhance the ability of the Network to reach its goals".

4) Approved the suggestion by the Administrative Centre to pursue data collection on tablets instead of on paper log sheets. (Back-up paper log sheets will be available for teams in case of tablet failure.)

5) Reviewed the project reports provided by the project leaders: this was by far the most time-consuming task.

6) Developed a procedure for ranking new variables that could potentially be sampled in the field campaigns because several requests for new field samples were expressed by co-PIs at the first AGM and in the project reports. In the procedure, all SC members rank the proposed new variables by considering their scientific value, relevance to policy issues, relevance to partners, relevance to Lake Pulse objectives, etc. Then, the Administrative Centre and field coordinators examine the rankings as well as the budget implications, sampling time in the field, logistics, etc. This procedure strives to ensure that any new variables that were not planned in the proposal are rigorously evaluated and must be shown to considerably enhance the Network's objectives. These variables should also be relevant to existing

projects and not require additional HQP funds. In these efforts, the Network must sometimes rein in the desire of scientists to pursue additional scientific projects because achieving the Network's overall objectives must be prioritized.

7) Recommended a change in the instrument budget to allow more flexibility in preparing the field campaigns.

5.2.2. Research professionals' work

In the model used by the Network, a significant amount of the common work is carried out by three RPs. The first few months have shown that this structure has been successful, even though one RP (field coordinator) was temporarily replaced due to illness.

Jelena Juric (database specialist) has developed a system to replace paper log sheets by electronic tablets for all activities of the field team. This system is based on the Kobo Toolbox framework. It allows all metadata as well as some of the data and photos (e.g., macrophytes, general lake surroundings) to be sent directly to a centralized repository where they can later be automatically parsed and entered into a database. We expect that replacing paper log sheets by tablets will save time for the field teams, which is critical for our tight sampling schedule. Back-up paper log sheets will be available for the teams in case of tablet failure. We also expect that several weeks of personnel time (for transcribing data to Excel sheets) will be saved over the Network life time and that errors will be greatly reduced by avoiding this step. Jelena has also very efficiently assisted Geneviève Potvin, particularly in using Google Earth Engine as well as during the watershed delimitation.

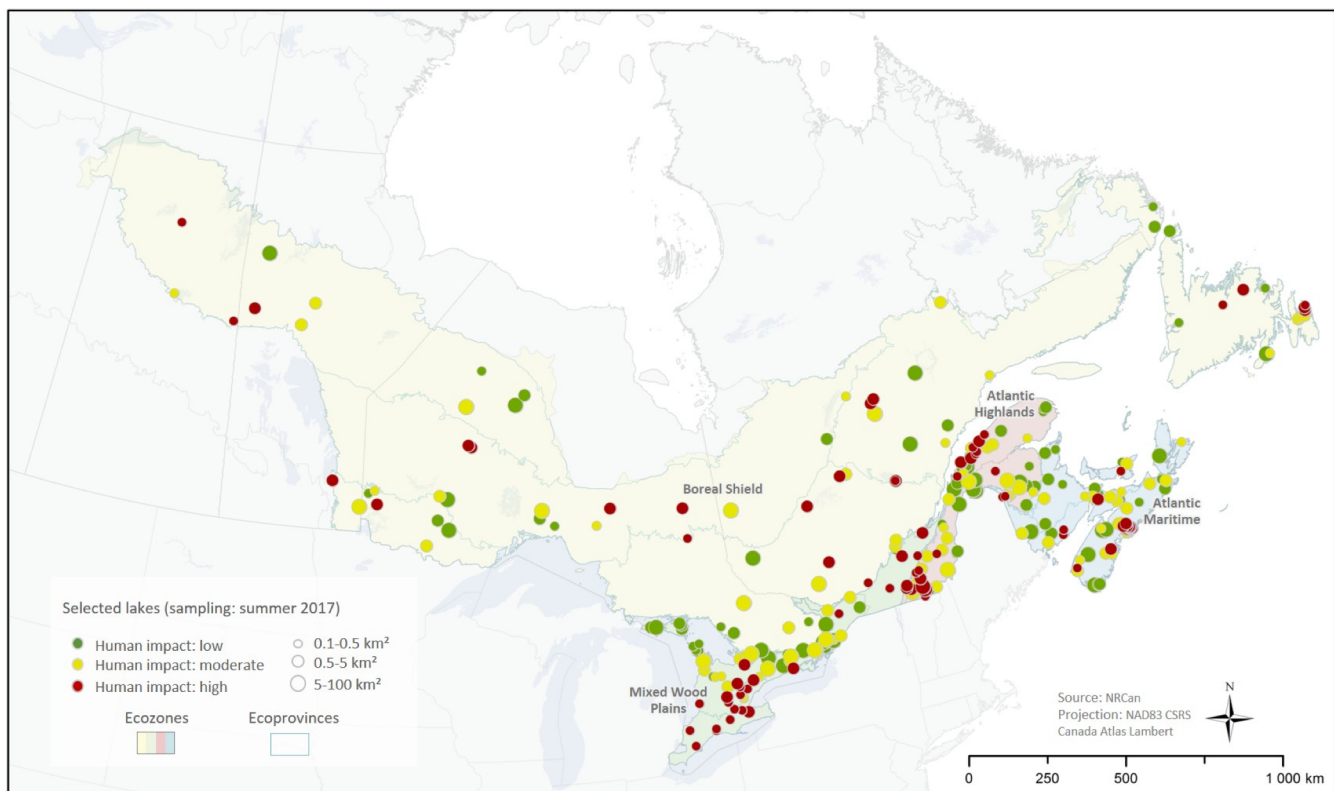


Figure 3: Initial selection of lakes for the National Lake Pulse Survey in 2017. Partners have been asked to look over this selection and propose a few alternatives that are of interest to them. Optimum travel routes are being developed and this may also slightly modify these choices. Lakes in Saskatchewan, Manitoba and Newfoundland and Labrador will be sampled next year.

Geneviève Potvin (geomatics specialist) was assigned the daunting task of selecting lakes for our first field campaign with close coordination by the Network Director (Figure 3). This has required extensive data crunching (she recently told us that the 3-Tb hard drive that was purchased upon her arrival is almost full) and advanced skills in remote sensing and geomatics (for a humorous take on Geneviève's work, see our second [blog post](#) at lakepulse.ca). Despite the enormous challenges, she has managed to deliver rapid results (the green cell in Table 1).

Marieke Beaulieu replaced Marie-Pierre Varin (field coordinator). Marieke has skillfully led all aspects of preparing protocols and the materials lists for the field campaign. She also collaborated closely with Jelena to prepare the electronic log sheets and communicated with all co-PIs within the Network to understand the intricacies and requirements of all their protocols.

The RPs have shown enormous dedication and enthusiastically devoted long hours to the Network. It is certainly fun and energizing when people are so passionate and great to work with.

6. Training and HQP

6.1. Overview

Canada must ensure that we have the highly trained and qualified workforce necessary to ensure the health of our lakes. Over the 5-year life time of the Network, we will train 48 students (15 undergraduates, 5 MSc, 21 PhD and 7 postdocs). Our Network structure encourages training opportunities that go well beyond a graduate student's classic education:

- 1) Our unique national lake survey provides knowledge and experience beyond any single research project providing our HQP with a unique opportunity to acquire very broad training in field methods.
- 2) Our HQP are collaborating and networking with their colleagues across Canada as they participate in collecting each other's data, contribute to a common database and participate in discussions to improve each field season.
- 3) As they become more experienced, they become mentors to other students in the field.
- 4) All graduate students and postdocs (PDF) are offered the possibility of spending time with our partners or abroad in collaborators' laboratories.
- 5) Our HQP are provided with special opportunities for networking (e.g., field training workshops; AGMs; HQP committee) and high visibility through our website and social media.

6.2. Year-1 progress and changes - Training and HQP

Our aim for the first year was to hire 16 HQP (5 undergraduates, 1 MSc, 9 PhD and 1 PDF). Appendix H presents the current recruitment status of each of the planned students. While recruiting students by a given date is not always an easy task, we are on track to recruit most of these students. Six of the ten graduate students were recruited within six months of the planned date (Juric, Kim, Mauro, Lahens, Oliva, Goubet), while the remaining three are not yet identified and we are actively recruiting. Similarly, the postdoc (PDF) has also been recruited and is expected to start within six months of the planned date. One student, Paquette, was planned to start early in year 2 but started at the end of year 1.

Because the summer field campaign requires approximately 25 students and RPs (and back-ups in case of problems), it was recommended by the Scientific Committee to hire more personnel for the campaign. We thus decided to hire more "undergraduate" students. We opted for the first year to use the UdeS co-operative program to hire the summer students. The co-operative program allows both masters (in certain programs) and undergraduates to apply for summer jobs. After reviewing 47 applications, we chose to hire one undergraduate student, and four masters students. We also recruited an undergraduate student from McGill, and a French intern will participate in the summer campaign.

Because both of our undergraduate students were awarded NSERC undergraduate student awards, and the French intern will not receive a stipend, the addition of two students to the planned “undergraduate” trainees had little impact on our overall budget.

We lost one co-PI, Chris Solomon, early in year 1 due to a change of his position to a U.S. institution. It was recommended by the Scientific Committee and approved by the BOD that Chris Solomon remain as a collaborator. However, the student he was supervising (PhD3) will now be supervised by Yves Prairie or Paul del Giorgio and co-supervised by Chris Solomon. The project has not changed.

With the arrival of students, we are actively putting in place tools and events to promote networking among our students. As mentioned below, we have set up the Slack platform and all students have been added to this platform. In addition, we expect that a strong student community will develop from their shared experiences in the Lake Pulse national field campaigns. We are currently preparing their field training workshop in early July 2017. Students will have time to network, and they will also be asked to start planning their Lake Pulse HQP committee. We will also discuss plans for the second AGM, and encourage students to self-organize in advance using tools such as Slack. During the second AGM, events are planned to encourage students to mingle and self-organize. We will actively support the creation of an HQP committee, which could also help to propose activities for students during the second AGM as well as other aspects of Lake Pulse to enhance HQP training and visibility.

Appendix H also shows that recruitments both for HQP and RPs are also well underway for the second year.

6.3. Evidence-based policy and HQP training

In this first year, diverse stakeholders interested in lake health have expressed enthusiasm and interest in our Network. We are working with governments and lake managers as partners, and they will be important end-users. Another group of end-users are property owners, lake associations, districts, municipalities and watershed organizations. These end-users are intensely interested in our deliverables because they grapple directly with how policies affect their local lakes, communities and land values. These end-users are not scientists, but they are often very well informed with many years of experience in promoting evidenced-based policies. These stakeholders participate directly in local policy discussions on lake health in districts and municipalities across Canada. A major question is how these end-users will use Lake Pulse tools and data. Lake Pulse should align its deliverables to be of service to these policy discussions occurring in communities across Canada, which would be an important contribution to the debate and policy context.

To better understand the needs of diverse end-users and to make our deliverables of optimal relevance to facilitating policy discussions, we are examining ways to add HQP who would focus on the shifting context of using lake health data to guide policy development. These HQP would examine how lake health data is currently guiding policies in the Canadian context, and compare this to the deliverables that Lake Pulse proposes. We feel that this will better define the needs of end-users, and help us to fine-tune our deliverables and their delivery to better suit the context of policy discussions. Many policy discussions at the local level integrate water quality and watershed data, and Lake Pulse is poised to provide outputs directly usable by these groups. We are also currently examining how Lake Pulse could contribute to citizen monitoring of lakes. For example, with Living Lakes Canada we are exploring the possibility of submitting a MITACS scholarship where the student would provide citizens with the best methods to monitor their lakes. This is a topic of considerable interest amongst monitoring groups.

Our development of a mobile application is also attracting interest. Many concerned Canadians have observed changes in lake health, and they often feel that there is too little government oversight for sustainable lake stewardship. As a response, many groups are mobilizing to monitor lake health, but

the technical skills to develop and maintain a database - let alone performing quality control, analyzing and synthesizing the data - are often lacking. We are developing a national lake database and a mobile application, and we see that a crucial link should be made with end-users who are enthusiastic to contribute to these efforts. Providing automated reports for their lakes with comparative analyses with other lakes in their regions would be an excellent way of meeting the needs of these end-users. Additional Lake Pulse resources and HQP may be required to achieve these integrative results, deliverables and outreach aspects. End-users who directly participate in lake health sampling using the mobile app also need to understand how they can then compare their data to the Lake Pulse national database, within a policy context.

7. Partnerships

7.1. Overview

Key to the success of our Network is collaboration with partners from government and Ouranos. Our governmental partners provide expertise in sampling their regions and share valuable knowledge about their lakes and the problems facing them, many of them have large amounts of historical data that have been collected in monitoring programs. Their help will be invaluable with field logistics and lake selection as well as for contributing to understanding the data collected. Ouranos will contribute climate forecasts that will allow us to forecast future changes in lake health (objective 2) as well as expertise on ecosystem services.

7.2. Year-1 progress and changes

Appendix E (Table E.1) shows the Network's partners and when they joined. We originally had six partners from provincial and territorial departments and two partners from federal partners as well as Ouranos. Over the last year, New Brunswick joined as a new partner (approved by the BOD), Yukon and the IISD-Experimental Lakes Area have requested to join and have been recommended for inclusion by the Scientific Committee to the BOD.

Because departments in Newfoundland and Labrador cannot sign interprovincial agreements, the Department of Municipal Affairs and Environment (Government of Newfoundland and Labrador), has changed its status to that of a Supporting Organization but has stated that they will provide the support stated in their initial support letter.

All partners have participated in Network activities (see Table E.2 in Appendix E) such as the first AGM and information meetings as well as different administrative aspects. We have been in contact with many partners regarding the possible sharing of instruments as well as sampling opportunities complementary to our field campaigns. In addition, Jim Rusak (Ontario Ministry of the Environment and Climate Change) and Caren Binding (Environment and Climate Change Canada) have participated in the Scientific Committee meetings and field preparations. Environment Canada will be sending an undergraduate student to participate in the field campaigns. Bill Donahue (Environmental Monitoring & Science Division / Alberta Environment and Parks) and David Boerner (Environment and Climate Change Canada) both serve on the BOD. The provinces that will be visited this year (Ontario, Québec, New Brunswick) have also been involved in the lake selection process.

Some partners did not provide the full contribution they committed; however, it should be kept in mind that most partners promised an equal contribution for each year and we have not yet asked for any data. Since the time for preparing data is often a significant contribution to the Network from most partners, this contribution could not happen this year as the Network was not ready to receive or use any data. Some provinces and territories, furthermore, had only limited opportunities to contribute since sampling is not occurring in their region this year. Finally, since students have only just started arriving this year, partner contributions to co-supervision could not happen. Overall, it would thus be very

difficult, at this point, to evaluate the commitment of partners only based on examining the contribution provided.

8. Meetings

8.1. Overview

The Network plans to hold annual general meetings (AGMs) in each year of the Network. The AGMs will provide the opportunity for all members to meet, discuss results and progress, and plan the next steps of the Network.

Two Board meetings as well as two Scientific Committee meetings per year were originally planned for the Network.

Yannick Huot, the Network Director, hosted a general information meeting through video-conferencing (March 31, 2017) with all Network participants to provide a progress update on all aspects of the Network, especially plans for the summer campaign. This meeting was recorded and made available by the Administrative Center to all members of the Network.

Yannick delivered a presentation on the Network as a plenary speaker at the Society of Canadian Limnologists' annual meeting. He was also invited to present the Network to researchers and administrators at Natural Resources Canada, where a discussion followed on a potential partnership, and these talks are ongoing. Similarly, he was invited to meet scientists and administrators of the Québec government to present more details on the Network. These presentations and meetings as well as others are listed in Appendix G.

8.2. Year-1 progress and changes

8.2.1. Annual General Meeting

We organized our first AGM this year at the Longueuil Campus of the Université de Sherbrooke on November 21 and 22, 2016. There was a total of 33 participants (including 13 who participated through WebEx), including 17 university professors. The BOD Chair and the Scientific Committee Chair both attended the meeting as well as representatives from all partners except for British Columbia (who could not attend as they had an internal review that week). This AGM was the first opportunity for many people in the Network to meet face-to-face, share ideas, and connect on a personal level. The AGM helped to increase communication, collaboration and integration amongst the different Network projects and partners. In particular, plans for the collaborative field sampling season were discussed.

All project leaders presented their projects at the first AGM. A number of potential supplemental variables were identified, and strategies to further augment the cooperation among projects were identified. Key to this interaction were the separate meetings for each theme that allowed the theme leaders to take the pulse of the participants and better understand their needs.

Planning for the second AGM is underway and the Scientific Committee has recommended to the BOD that the format proposed by the Administrative Centre be adopted. The dates proposed are November 7 and 8, 2017. A face-to-face Scientific Committee meeting is planned for November 6, 2017, and a face-to-face Board meeting is planned for November 9, 2017.

8.2.2. Board of Directors

The Board of Directors met three times during the first year of the Network. On their first meeting on October 31, 2016, the overall mandate and responsibilities of the Board were outlined and agreed upon. In the two following meetings, they also prepared a metrics document and have reviewed the terms and procedures of the Scientific Committee as well as examined the structures put in place to deal with the potential conflict of interest involving Catherine Brown and Yannick Huot. They will meet again by video conference on May 24, 2017, to review year-1 progress and approve the budget for year 2.

8.2.3. Scientific Committee

The Scientific Committee met 11 times throughout the first year. A face-to-face meeting was held at the Longueuil Campus of the Université de Sherbrooke on November 23, 2016, which was followed by 10 videoconference meetings.

9. Communications strategy

9.1. Overview

We believe that building a positive public perception through good communication has a critical influence on the success of our research Network. Furthermore, internal communication is critical to the good functioning of the Network. We originally proposed to use a website and social media as our main communication tools.

9.2. Year-1 progress on implementing the communications strategy

In Year 1, the Administrative Centre has developed a communications strategy that centres around the use of a website and social media for mostly external communications; email and password-protected areas of the website for internal documents and updates; and the Slack platform for day-to-day internal communications for the common Network Human Resources and Administrative Centre. These efforts will be complemented by occasional media appearances, press releases and, of course, for our scientific colleagues, publications and scientific presentations.

The website and social media will support the outreach component of the Network and the transfer of new knowledge and technology to Canadian-based organizations. We recognize the importance of social media communications, and, as stated in the proposal, we intend to be present in these media, particularly through our blog and Facebook. These efforts will help to direct attention and drive traffic toward our website, which will be the portal for several important deliverables such as our web atlas, our lake database and the Lake Observer mobile app. The Lake Pulse website will evolve in phases, and we have the in-house communications and technical skills to create a user-friendly interface to access our key deliverable for end-users. In phase 1 of the website, we prioritized explaining our methods and deliverables in lay terms. This approach provided a rapid way of communicating with a broad audience and allowed us to begin creating a sense of community around the Network.

Slack is a relatively new tool (initially released in 2013) and is specifically designed to help teams communicate. It brings together texting with file sharing and video conferencing. It is also very well integrated with many collaboration tools such as Google docs/drive and Dropbox.

Email is, of course, still used to communicate within the Network, although its use will likely decrease as Slack is more widely adopted. External communications with particular groups or individuals will remain on email.

9.2.1. Website and blog

Website

The focus of our outreach activities has been online with the launch of our website (lakepulse.ca) in March 2017. The look and feel of our website and logo (both designed by Catherine Brown) are intended to reflect the enthusiasm and openness of the Network, as well as our desire to involve and communicate with diverse stakeholders interested in lake health. Catherine has experience developing websites for research groups, and she rapidly created the content, structure and design, which led to a fully functional, bilingual website in two months. The website's text is based on our proposal but is presented in a more concise style; it targets the interests of diverse stakeholders while being accessible to the general public. We also convey that our website is dynamic and that visitors should return regularly to see new content, such as updates about our upcoming field campaign.

We have received positive feedback on our website, particularly on its intuitive and inviting design and the blog, which encourage the public to visit and read about our work. We have avoided jargon, and we have emphasized the inclusive, multi-stakeholder composition of the Network.

A password-protected area of the website has been prepared and will provide access to internal documents. This area has not been populated yet. This will be done after the Board meeting in the spring, when we expect that many documents will be approved by the BOD thus allowing us to distribute them more widely to the Network. Indeed, records of decisions will be open and transparent and posted on our website's password-protected area with all our procedures and policies.

The blog

The blog on our website offers a fuller picture of who we are by giving a human voice to our Network. It engages stakeholders by discussing Network developments in a light, transparent and humorous style. We offer our Network members, stakeholders and the public the opportunity to subscribe to our blog, and we expect to have one blog post per month. There are currently two entries, and readers appreciate the effort of combining humour with informative content. Many comments have come from non-specialists, who find the blog accessible and engaging. The blog also reinforces our efforts to encourage HQP to communicate with both specialists and non-specialists. We aim to provide HQP with examples of carefully crafted scientific writing for diverse audiences. Our HQP and research professionals have been receptive and enthusiastic about the blog, which also contributes to our sense of community and collegiality.

9.2.2. Social media

We launched our Facebook page in year 1. We also set-up our Twitter, Instagram and YouTube accounts but have not yet posted content. We will start using social media this summer to update everyone about the progress of the field campaign.

9.2.3. Slack

Because we had no prior experience with this platform (though we had heard good things about it), we used the Administrative Centre and the common Network Human Resources as a test for Slack. After a couple of months of testing - and after we shook the habit of reaching for our email software (this took a "no email for a week" challenge) - we were convinced that Slack is truly an efficient approach and we are extending its use to the rest of the Network in a stepwise fashion. We are starting with the field campaign participants and students, who we think may be more technologically inclined to adopt it rapidly. We hope that this will provide our HQP with an efficient first means of networking with each other and self-organizing.

9.2.4. Public interest

The launch of the Network has led to several news stories in the media. This, together with the deployment of the website, has led to countless emails from lake and watershed associations interested in participating, helping, or asking if their lakes can be selected for sampling. We have answered all emails and directed them to resources that we have developed on our website. Indeed, we have written a blog and a FAQ section on our website that explains why we cannot accept requests for sampling specific lakes. Our website and blog describe how lakes are selected randomly for our survey. In addition, the website explains how we hope to eventually produce automated "health" reports for most lakes in Canada with the help of data provided by our partners. We also encourage the public's participation by providing data through the Lake Observer mobile application.

10. Current foreseen challenges for the Network

10.1. Synthesis projects and postdocs

The synthesis of results from the different projects should be carried out by postdocs (PDFs) who will work with several Network scientists. Six PDFs were planned in the Network to accomplish this task (a seventh PDF comes in early and was not meant to carry out a synthesis project). Even at this initial stage, we must ensure that the description and the plans for the PDFs remain true to the Network objectives. Specific questions addressed may change as results come in and opportunities arise, but the concept of having these PDFs work on 'synthesis projects' must remain. The Scientific Committee will have to ensure that these HQP are not diverted to non-synthesis projects.

At the same time, a concern raised by some co-PIs is that the Network resources they receive for postdoc salaries is quite low because some institutions have significantly higher postdoc salaries, particularly if postdocs are unionized. The Network stipends for graduate students and postdoctoral fellows are as follows: 2 years for MSc (\$17 500 per year; \$35 000 in total), 3 years for PhD (\$20 000 per year; \$60 000 in total) and 2 years for PDF (\$40 000 per year; \$80 000 in total). The Network funds (NSERC Strategic Partnership Grant and Partners' contributions) cover approximately 75.918% of the stipend, while the balance of 24.082% is paid from the coapplicants' operating grants. The NSERC grant amount paid for each graduate student and postdoc is as follows, per year: MSc \$13 286; PhD \$15 184; PDF \$30 367. The researcher contribution is generally from a general operating grant such as NSERC Discovery Grants or Canada Research Chair funds.

10.2. Addressing objective 2 of the Network

The Network's second main objective, which aims to forecast future changes in lakes, may require more HQP. This has arisen because 2 (or 3) of the 4 HQP in project 10 are likely examining other aspects that deal more with explaining past or current states of lakes instead of forecasting future changes. The annual report for project 10 is still under revision, and the Scientific Committee has requested greater clarity on the research topics pursued, their connections to Lake Pulse objectives, how the integration objectives will be met, and the role of the 4 associated HQP (2 PhDs and 2 PDFs). If funds become available, objective 2 will have to be a priority for their use in order to achieve the Network's deliverables.

10.3. Requests for new projects

The Scientific Committee received two unexpected requests for new projects. One request was in the form of a project report from researchers outside of the Network; it was explained to them that the Network does not currently have funds for new projects. The other proposal for a new project, including new samples from the field campaigns, is more difficult to handle because it comes from a member of the Scientific Committee. This second proposal has not yet been reviewed by the Scientific Committee. However, since all co-PIs were not aware that new projects could be proposed (the SC's Standard Procedures are to be reviewed on May 24, 2017, by the Board), its submission by an SC member appears premature from the perspective of the Administrative Centre and SC.

10.4. Impacting policy

One of the key aspects by which the Network will be evaluated, if we are going for renewal, is whether we have influenced policy. This is a difficult task in five years for a scientific Network. In addition to keeping communication strong with our partners, the Network is starting to take other steps to address this:

- 1) The ranking procedure for evaluating new variables considered (as one of five criteria) their potential impact on policy. As such, cyanobacterial toxins and mercury levels in the sediments were ranked by the Scientific Committee members at the top of the list of the proposed additional variables.

- 2) At the second AGM, we will invite a policymaker as a plenary speaker to address the following: how water quality and lake observation data are used in policymaking; how Lake Pulse can provide usable information; how to best influence water policies; and what Lake Pulse can specifically contribute to policymaking.
- 3) As mentioned in section 6.3, adding HQP on policymaking within the Network would also help orient our efforts. Funding will be sought for this by examining MITACS opportunities.
- 4) We will also examine how we could use the Canadian Science Policy Fellowships that are offered through MITACS to have a direct link to policymaking.

These efforts are not intended to guarantee that we will make a concrete change in policy, but we can greatly enhance our ability to tailor our deliverables to the needs of diverse stakeholders who work directly on influencing and developing policies.

10.5. Early publications

Early publications in a Network that requires three years to collect its data are very challenging. For this reason, early publications were not promised in the proposal, and we are seeking ways to address this question because it will certainly arise during the midterm review. Initial discussions within the Scientific Committee have suggested that papers on metadata and the lake selection process might be promising avenues to show early publications from the Network, which will also be valuable to the wider scientific community.

11. Financial overview

The budgetary tables are provided in Appendix I for years 1 and 2. Much of the year-1 budget (Table I.1 for NSERC contributions and Table I.2 for UdeS contributions) was meant to be spent on materials and instruments for the field campaign as well as salaries for the RPs and Network Manager. The limitation of these tables is that they were prepared on May 11, 2017, for the Board meeting that is taking place on May 24, 2017. Many of the largest field expenses are not included in these tables. An exact forecast of the year-end budget is therefore still difficult because much of the material required for the field season has not yet been purchased. In Table I.1 (presenting the NSERC contributions), a column titled 'Estimated spending before the end of year' has been included, which makes a forecast of the funds required up to the end of the year.

As discussed in the proposal, a balanced budget for the Network is expected over five years, but we were expecting to have excess money in the first and last years, and deficits in the intervening years. This would lead to a cash flow issue, which was solved by UdeS accepting to provide funds if NSERC cannot help with the cash flow.

As such, it is expected that all the year-1 funds will not be spent by the end of year 1. To balance the year-1 budget in the proposal, it was suggested that we would buy materials required for years 2, 3 and 4 to compensate, and we would rush to sample more lakes in year 2. We now propose to follow an approach that will increase our chances of success and the safety of sampling teams, and which is rooted in good governance, by spreading the number of lakes more equally over the three years of sampling and not buying too much material in year 1 (which might go unused the following years if we have to change our plans or protocols). This will leave unspent funds at the end of year 1. However, we expect that more than 50% of the year-1 funds will be spent (see Table I.1) and, as such, this will meet NSERC's criteria for releasing the funds for the following year (i.e., year 2 will require much more than 50% of the year-1 funds).

The NSERC contributions to the year-2 budget are presented in Table I.3. There are very few changes to the planned budget. The most noticeable are the following:

- 1) The salary of the Network Manager (line 2) is higher than originally planned in the proposal as she was hired at a higher unionized scale.
- 2) In the common Network resources, the purchase of two planned instruments was not done and instead the funds will be used on shipping and calibration of borrowed instruments (line 5) over three years such that some money from year 1 will be carried over after year 2.
- 3) Materials and supplies (line 4) were not all used in years 1 and 2 such that there is a carry-over after year 1.
- 4) Students have started late in many projects and so there is remaining money. Since this does not affect the total amount of money received by the student, these budgetary lines will be balanced over the next few years unless students are never recruited.

There are no departures planned from the original budgets for the Université de Sherbrooke contributions (Table I.4) and the Ouranos contributions (Table I.5).

12. Conclusion

The Network is currently on track for most aspects. Many of our milestones were reached a few months late in the first year, but this should not impact the Network's success. We compensated for these delays largely through the hard work of the Administrative Centre and the recruited RPs. The recruitment of some students is slightly delayed, but this should not impact the Network's ability to meet its goals. It could slightly increase the cost of the first field campaign by requiring the addition of new personnel, but this change appears very small. It is also beneficial in other ways to have the HQP start a little later because they will have more time to work when the data will be available. The Network is financially healthy overall and is tracking to be on budget. Five key challenges have been identified (section 10), and they will require attention over the next year to make sure that appropriate attention is given to them. Currently, they are not likely to affect the Network's success in its first five years. But if these challenges are not addressed, they could impact our ability to renew the Network for a second term.

Appendix A: Board of Directors

Name	Affiliation	Position	Representation on BOD
Jacques Beauvais	Université de Sherbrooke	Vice President for Research	Universities
David Boerner	Environment and Climate Change Canada	Director General	Federal Partners
Richard Butts (Chair of the Board)	Cross Sectoral Strategic Direction /Agriculture Agri-Food Canada	Director General (retired)	External/Independent
Bill Donahue	EMSD /Alberta Environment and Parks	Executive Director, Science Branch	Provincial Partners
John Downing	University of Minnesota Duluth	Professor / Director of Minnesota Sea Grant Program	Chair of the Scientific Committee
Yannick Huot	Université de Sherbrooke	Professor	Network Director
Roxanne Maranger	Université de Montréal	Professor	Network co-PIs
Verena Tunnicliffe	University of Victoria	Professor	External/Independent
Non-voting members			
Samir Boughaba	NSERC	Acting Deputy Director	NSERC
Catherine Brown	Université de Sherbrooke	Network Manager	

Appendix B: Scientific Committee members

Name	Affiliation	Position	Representation on SC
Beatrix Beisner	Université du Québec à Montréal	Professor	Theme 2 Leader
Caren Binding	Environment and Climate Change Canada	Scientist	Federal Partners
Paul del Giorgio	Université du Québec à Montréal	Professor	Theme 1 co-Leader
John Downing (<i>Chair of the Scientific Committee</i>)	University of Minnesota Duluth	Professor / Director of Minnesota Sea Grant Program	External / Independent
Marie-Josée Fortin	University of Toronto	Professor	Theme 3 Leader
Irene Gregory-Eaves	McGill University	Professor	Theme 1 co-Leader
Daniel Hering	Universität Duisburg-Essen	Professor / Dean of the Faculty of Biology	External International Advisor / Independent
Yannick Huot	Université de Sherbrooke	Professor	Network Director
Peter Leavitt	University of Regina	Professor	Theme 4 Leader
Amina Pollard	U.S. Environmental Protection Agency	Scientist	External International Advisor / Collaborator
James Rusak	Ontario Ministry of the Environment and Climate Change	Scientist	Provincial Partners
Non-voting member			
Catherine Brown	Université de Sherbrooke	Manager	Network Manager

Appendix C: List of co-PIs

Name	Affiliation	Position	Role
Dermot Antoniades	Université Laval	Professor	
Beatrix Beisner	Université du Québec à Montréal	Professor	Project 6 Leader; Theme 2 Leader, SC member
Helen Baulch	University of Saskatchewan	Professor	
Simon Bélanger	Université du Québec à Rimouski	Professor	Project 7 Leader
Hubert Cabana	Université de Sherbrooke	Professor	Project 2 Leader
Jeffrey Cardille	McGill University	Professor	
Paul del Giorgio	Université du Québec à Montréal	Professor	Theme 1 co-Leader, SC member
Marie-Josée Fortin	University of Toronto	Professor	Theme 3 Leader; Project 8 Leader, SC member
Irene Gregory-Eaves	McGill University	Professor	Theme 1 co-Leader, SC member
Yannick Huot	Université de Sherbrooke	Professor	Network Director, SC, BOD member
Andrew Lang	Memorial University	Professor	Project 5 Leader
Isabelle Laurion	INRS-ETE	Professor	
Peter Leavitt	University of Regina	Professor	Theme 4 Leader, SC member
Roxane Maranger	Université du Montréal	Professor	Project 9 Leader, BOD member
Yves Prairie	Université du Québec à Montréal	Professor	Project 1 Leader
John Smol	Queens University	Professor	Project 3 Leader
Rolf Vinebrooke	University of Alberta	Professor	Project 10 Leader
David Walsh	Concordia University	Professor	Project 4 Leader

Appendix D: List of partner collaborators

Name	Affiliation	Position	Role
Caren Binding	Environment and Climate Change Canada	Scientist	Partner Scientist, SC Member
Stéphanie Brazeau	Public Health Agency of Canada	Scientist	Partner Scientist
Don Fox	State of the Environment (NB)	Scientist	Partner Scientist
Antoinette Ludwig	Public Health Agency of Canada	Scientist	Partner Scientist
Nicholas Ogden	Public Health Agency of Canada	Scientist	Partner Scientist
Louis Roy	Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques	Scientist	Partner Scientist
James Rusak	Ontario Ministry of Environment and Climate Change	Scientist	Partner Scientist, SC Member
Mike Sokal	Environmental Protection Division (B.C. Ministry of Environment)	Environmental Impact Assessment Biologist	Partner Scientist
Gila Somers	Northwest Territories Department of Environment and Natural Resources	Watershed Management Advisor	Partner Scientist
Ron Zurawell	Alberta's Environmental Monitoring and Science Division	Scientist	Partner Scientist

Appendix E: Partners, supporting partners and proposed partners pending approval

Table E.1 List of partners and current status

Partner	Status
Environment and Climate Change Canada	Founding Partner – current partner
Environment and Natural Resources (Government of Northwest Territories)	Founding Partner – current partner
Environmental Monitoring and Science Division (Government of Alberta)	Founding Partner – current partner
Environmental Protection Division (Ministry of Environment - Province of British Columbia)	Founding Partner – current partner
Ministère du Développement Durable, de l'Environnement et de la Lutte contre les Changements (Québec)	Founding Partner – current partner
Ontario Ministry of the Environment and Climate Change	Founding Partner – current partner
Ouranos Consortium	Founding Partner – current partner
Public Health Agency of Canada	Founding Partner – current partner
Department of Municipal Affairs and Environment (Government of Newfoundland and Labrador)	Founding partner changed status to “supporting organization” – Paperwork still required to confirm status with NSERC.
New Brunswick Department of Environment and Local Government	Partner accepted by Board in Year 1 – Must sign the Network Agreement
Yukon	Recommended by the Scientific Committee Pending approval by the Board – Paperwork still required to confirm status with NSERC and must sign the Network Agreement.
IISD-Experimental Lakes Area	Under review by the Scientific Committee

Table E.2 Contributions of Partners

Partner	Expected contribution (Yr 1)	Received contribution (Yr1)	Comments
Environment and Climate Change Canada	\$30,000 (Staff time and ship time)	-Estimate yet to be received -David Boerner sits on the BOD -Undergraduate student intern at ECCC will come in the field with Lake Pulse (yr 2 but organized in Yr 1).	-Caren Binding participating on the SC & AGM, involved at all levels of science -The ship time promised will be hard to use due to the decision of sampling smaller lakes.
Environment and Natural Resources (Government of Northwest Territories)	10 days of staff time (\$3000)	\$500 Gila Somers sits on the conflict of interest committee.	Gila Somers is an active participant Participation in AGM and information meeting Will certainly be more heavily involved as we move the sampling and geomatics analyses to NT next year
Environmental Monitoring and Science Division (Government of Alberta)	\$20,165	-Estimate yet to be received -3 instruments shared for field campaign -Bill Donahue sits on the BOD	Ron Zurawell participated in AGM & information meeting and helped with data questions Will certainly be more heavily involved as we move the sampling and geomatics analyses to Alberta next year
Environmental Protection Division (Ministry of Environment - Province of British Columbia)	\$1600\$	-Estimate yet to be received	There has been limited contributions. We expect this to increase as geomatics analyses that include BC start this year and data requests go out this year.
Ministère du Développement Durable, de l'Environnement et de la Lutte contre les Changements (Québec)	\$33,200	\$7000	Louis Roy and his team have been extremely active within the Network spending considerable time and resources to help with lake selection and all aspects of preparation for the field campaign.
Ontario Ministry of the Environment and Climate Change	\$5500	\$5500	Jim Rusak is extremely active in the Network and sits on the SC.
Ouranos Consortium	\$7500	- Estimate yet to be received	Robert Siron participated actively in the AGM and project 10 research planning at all stages.
Public Health Agency of Canada	\$35,000	60 h (approximately \$5000) -Providing instrument for the field work.	Many meetings on recruitment of students Co-supervising two students starting in fall 2017. Participation of 3 members in AGM. Time commitment will increase rapidly with start of co-supervision
Department of Municipal Affairs and Environment	\$6000	\$0	We have not received any contributions. Sampling in NL will occur next year, and we hope that contributions will increase.

Appendix F: Status of the project descriptions

Theme# (leader)	Project# (leader) title	Evaluation by scientific committee (SC)
1 (Gregory-Eaves and del Giorgio)	1 (Prairie) Sub-report 1a (Prairie) <i>- Carbon gas concentration, transformation and fluxes in Canadian lakes; - Biogeochemical drivers of carbon sinks, greenhouse gas fluxes, and nutrient regeneration – Patterns in lake metabolism and organic C dynamics; - Development and testing of process-based carbon models to lakes.</i>	Recommends approval
1 (Gregory-Eaves and del Giorgio)	1 (Prairie) Sub-report 1b (Baulch) <u>Only preliminary documents were submitted for SC feedback</u> <i>Sediment phosphorus characterization across Canadian lakes</i>	Revised report requested (but accepted in principle)
1 (Gregory-Eaves and del Giorgio)	1 (Prairie) Sub-report 1c (Cardille) <i>Extrapolating models of current and future C balance to millions of lakes across Canada</i>	Recommends approval
1 (Gregory-Eaves and del Giorgio)	2 (Cabana) <i>Fate and behaviour of contaminants of emerging concern in Canadian lakes</i>	Recommends approval
1 (Gregory-Eaves and del Giorgio)	3 (Smol) <i>Changes in Canadian lakes over the Anthropocene; which lakes are susceptible to different stressors</i>	Recommends approval
1 (Gregory-Eaves and del Giorgio)	4 (Walsh) <i>Linking genetic and microscopic approaches to reconstruct historical conditions of lake ecosystems</i>	Recommends approval
2 (Beisner)	5 (Lang) <i>Microbial contamination in Canadian lakes – risks for human and animal health</i>	Recommends approval
2 (Beisner)	6 (Walsh) Sub-report 6a (Huot) <i>Understanding the information obtained from the “one-shot” large-scale sampling of lakes (LSSL) using the autonomous mooring data</i>	Recommends approval
2 (Beisner)	6 (Walsh) Sub-report 6b (Walsh) <i>Assessment of anthropogenic influences on the structure and function of plankton communities across the lakes of Canada</i>	Recommends approval
2 (Beisner)	6 (Walsh) Sub-report 6c (Gregory-Eaves) <i>Cyanobacteria distribution and dynamics</i>	Recommends approval
3 (Fortin)	7 (Bélanger) <i>Remote sensing as direct observation of lakes water quality and information on land use</i>	Recommends approval
3 (Fortin)	8 (Fortin) <i>Spatial modelling as a tool to integrate results</i>	Recommends approval
4 (Leavitt)	9 (Maranger) <i>What biophysical features package aquatic ecosystem service bundles and how do these bundles change across Canada?</i>	Recommends approval

4 (Leavitt)	10 (Vinebrooke) <i>Forecasting the cumulative impacts of human and natural environmental change on the functioning of Canadian lake ecosystems</i>	Revised report requested
Network project	Network project (Huot) Enable national-scale citizen scientist monitoring of lake health via the “Lake Observer” app	Recommends approval

15 documents to be reviewed annually.

As of May 15, 2017:

- Project 10’s report (Theme 4) is still under revision and has not yet been recommended for approval by the SC.
- Project 1’s ‘sub-report 1b’ (Theme 1) is approved in principle, but must be submitted using the correct template, which includes essential information such as dates for milestones and deliverables. In addition, several questions from the SC must be addressed (e.g., why some data are described as “external” to the Network; why the large budget for ICP-MS when the synchrotron beam-time is free, especially if they provide similar information).

Appendix G: Publications, media and knowledge transfer activities

In the news

- 7 juin 2017, Le quotidien des lacs, Le lac à la Truite d'Irlande choisi parmi plus d'un million de lacs canadiens
- 6 juin 2017, Région de Thetford, Le lac à la Truite d'Irlande choisi parmi plus d'un million de lacs canadiens
- 8 November 2016, Le Sherbrooke Express, Des chercheurs étudient la santé des lacs au Canada
- 8 November 2016, La Tribune (cover): Coup de sonde pour les lacs; article: 680 lacs sous la loupe
- 8 November 2016, Énergie 106, 1 FM Un prof de l'UdeS chargé du bilan de santé de 680 lacs Canadiens
- 8 November 2016, AMEQ en ligne Une initiative scientifique majeure réunissant 18 chercheurs
- 7 November 2016, "680 lacs canadiens sous la loupe" par Isabelle Pion, La Tribune
- 7 November 2016, Money Government invests \$5.5 million in research network to help improve the health of Canada's freshwater lakes
- 7 November 2016, Le Lézard Le gouvernement investit 5,5 millions de dollars dans un réseau de recherche pour améliorer la santé des lacs d'eau douce du Canada
- 7 November 2016, NewsOn6.com Government invests \$5.5 million in research network to help improve the health of Canada's freshwater lakes
- 7 November 2016, WFMJ TV-21 Government invests \$5.5 million in research network to help improve the health of Canada's freshwater lakes
- 7 November 2016, Edmonton Journal Government invests \$5.5 million in research network to help improve the health of Canada's freshwater lakes
- 7 November 2016, WDRB 41 Louisville Government invests \$5.5 million in research network to help improve the health of Canada's freshwater lakes
- 7 November 2016, CNW Telbec Le gouvernement investit 5,5 millions de dollars dans un réseau de recherche pour améliorer la santé des lacs d'eau douce du Canada
- October 19, 2016, "The future of Canada's water" by Anne Craig, Queen's Gazette

Radio interviews

- 10 November 2016, Interview on "la chronique-science" on Écouter l'Estrie, Radio-Canada

Presentations

- Huot, Y., Symposium du Group de Recherche Interuniversitaire and limnologie et environnements aquatiques "The NSERC Canadian Lake Pulse Network", March 17, 2017
- Huot, Y., Canadian Conference For Fisheries Research / Society of Canadian Limnologists, , Montreal, "NSERC Canadian Lake Pulse. Network: A pan-Canadian effort to understand our lakes", University of Windsor, Hyatt Hotel, January 7, 2017
- Huot, Y., Meeting of the NetCOLOR community, Bedford Institute of Oceanography, Dartmouth Nova Scotia, February 14, 2017, "Lake Pulse Network" (presented by Marie Hélène Forget for Yannick Huot due to inclement weather)
- Huot, Y., Presentation to geomatics group at Natural Resources Canada, "NSERC Canadian Lake Pulse. Network: A pan-Canadian effort to understand our lakes", April 18, 2017
- Huot, Y., Presentation to employees from the Quebec MDDELCC and MDFFP "Le réseau du CRSNG sur l'état des lacs du Canada.", April 26, 2018

Posters

- Huot, Y., "NSERC Canadian Lake Pulse. Network: A pan-Canadian effort to understand our lakes", March 17, 2017

Invited non-reviewed article

- SCL article: The Network was highlighted in the society of Canadian Limnologist Newsletter (May 2017). The article describes the Network objectives.

Appendix H: HQP and research professionals' status

Table 3. HQP and Research Professionals (RP). Fill color: **Red** the HQP/RP was expected but not present. **Green** the HQP was expected to be and is present or, for future HQP, has been identified and is expected to be present. **Yellow**, the HQP is expected to start but no HQP is identified. **Gray** the HQP is expected to be present in the future. **Green text**, in a white square represents student that is present (or expected to be present) before he/she was expected to start.

Theme / project	HQP & RP	Supervisor (project collaborators)	Year six month intervals (start month-end mon)									
			2016	2017		2018		2019		2020		2021
			07-12	01-06	07-12	01-06	07-12	01-06	07-12	01-06	07-12	01-06
N [§]	15 BSc	Sampling team leaders and RPs			5		5		5			
N [§]	RP1	Huot		Potvin								
N [§]	RP2	Huot		Juric								
N [§]	RP3	Huot		Varin								
N [§]	MSc1	Huot		Juric								
1 / 1	PhD1	Prairie (del Giorgio)			Kim							
1 / 1	PhD2	del Giorgio (Prairie, Solomon)			Shahabini a							
1 / 1	PhD3	Prairie or del Giorgio (Solomon)										
1 / 1	PhD4	Baulch (Maranger, Leavitt, Engstrom)		Mauro								
1 / 1	PDF1	Cardille (Solomon, del Giorgio, Fortin, Laurion)										
1 / 2	PhD5	Cabana (Barcelo)		Lahens								
1 / 2	PhD6	Walsh (Cabana, Lang)										
J1 / 2	PhD7	Cabana (Barcelo, Bélanger)										
1 / 2	RP4	Cabana										
1 / 3	RP5	Smol (G.-Eaves, Antoniadis, Fortin)			Griffiths							
1 / 3	RP6	G.-Eaves (Antoniades, Smol, Fortin)			Jeziorski							
1 / 3	MSc2 [¶]	Smol (G.-Eaves, Antoniadis)										
1 / 3	MSc3 [¶]	G.-Eaves (Antoniades, Smol)										
1 / 3	MSc4 [¶]	Antoniades (Smol, G.-Eaves)										

1 / 4	PhD8	Walsh (G.-Eaves)																	
2 / 5	PhD9	Lang (Ramey)			Wight														
2 / 5	PhD10*	Lang (Ogden, Ludwig, Turgeon)		Oliva															
2 / 6	MSc5	Huot (Baulch, Solomon)																	
2 / 6	PhD11	Beisner (G.-Eaves, Smol, Leavitt)		Paquette															
2 / 6	PhD12	G.-Eaves (Pick, Beisner, Smol, Leavitt, Antoniadis, Taranu)																	
2 / 6	PhD13	Huot (Beisner, G.-Eaves, Cabana, Vinebrooke)			Cremella														
2 / 6	PhD14	Walsh (Beisner, Huot)																	
2/6	PDF8	Walsh – NEW PDF NOT IN PROPOSAL		Kreamer															
2 / 6	PDF2	Beisner (Walsh, Huot)																	
3 / 7	PhD15	Huot (Cardille, Bélanger, Hunter)																	
3 / 7	PhD16	Laurion (Bélanger)		Goubet															
3 / 7	PhD17	Cardille (Bélanger, Huot)																	
3 / 7	PDF3	Belanger (Huot, Cardille, Antoine, Lubac)			Dorji														
3 / 8	PDF4	Fortin (Lehner, Baulch)																	
3 / 8	PDF5	Fortin (Cardille, del Giorgio)																	
4 / 9	PhD18	Maranger (Baulch, Taranu)																	
4 / 9	PhD19	Maranger (Baulch)																	
4 / 10	PhD20	Vinebrooke (Simpson, Leavitt)																	
4 / 10	PhD21	Leavitt (Vinebrooke, Simpson)																	
4 / 10	PDF6	Leavitt (Simpson, Vinebrooke)																	
4 / 10	PDF7	Huot (Leavitt, Vinebrooke)																	

[§] Network HQP and RP - provide services to all participants

[¶] Fully supported by co-applicants of this project (outside Network's budget)

*Passage from MSc to PhD

#Public Health Agency of Canada scientists (Ludwig, Turgeon, Brazeau, Kotchi, Ogden)

◆Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC)

Appendix I: Budget for years 1 and 2.

Colours in the this appendix: Green represents a surplus; black is a budget amount or balanced budget; red is a deficit.

Rounding values in the appendix: Except for amounts spent (for which we have cents) and calculations that use amounts spent, all amounts are

Table I.1 - Budget Overview for Year 1 (2016-2017)

NSERC contribution

Description	Description	Budgeted	Spent ¹	Difference	Estimated spending before end of year	Comments o
Network administration	Conferences	28 918	8703.09	17214.91	0	Fewer participants participated in the expected. Some pa
Network administration	Technical/professional assistants (Brown)	52 481	50 031.12	2 449.88	0	EPA as this was unr Annual salary of Ne late.
International strategy	Conferences	5 824	2 487.40	3 336.60	2000	Approximately as e
Common Network Resources	Materials and supplies	328 816	977.52	327 838.48	160 000	Amounts for order: only estimated here we are only spendi
Common Network Resources	Equipment or facility - Purchase or rental	386 540	136 606.30	249 933.70	155 000	Two orders are b "Operation and ma
Common Network Resources	Students	6 643	4 671.36	1 971.64	0	Approximately as e
Common Network Resources	Technical/professional assistants (3 RPs)	103 609	67 607.00	36 002.00	0	RPs started late anc
Theme 1	Materials and supplies	5 000	0.00	5 000.00	0	Due to late student
Theme 1	Students	30 367	2 573.68	27 793.32	0	Due to late student
Theme 2	Materials and supplies	2 500	0.00	2 500.00	0	Due to late student
Theme 2	Students	15 184	0.00	15 184.00	0	Due to late student
Theme 3	Materials and supplies	3 750	0.00	3 750.00	0	Due to late student
Theme 3	Postdoctoral fellows	15 184	0.00	15 184.00	0	Postdoc has not sta
Theme 3	Students	15 184	0.00	15 184.00	0	Due to late student
Totals		1 000 000	275 576.40	723 342.53	317 000	

- Salaries are to the end of the first year; everything else is as of 11 May, 2017, but includes all orders that have been submitted at this date of Yr1.

Table I.2 - Budget Overview for Year 1 (2016-2017)
 Université de Sherbrooke contribution

Description	Description	Budgeted	Spent	Difference	Estimated before end of year	Commer
International strategy	Conferences	2800.00	2628.09	171.91	0.00	
	Totals	2800.00	2628.09	171.91	0.00	

Table I.3 - Budget Overview for Year 2 (2017-2018)

NSERC contribution

Line #	Description	Description	Year 1 funds	Proposal Budget	Year 2 budget	Difference (Proposal -Year2)	Year 2 forecasted carry over	Comments on difference
1	Network administration	Conferences	17 214.91	50 157	50 157	0	17 214.91	
2	Network administration	Technical/prof. assistants (Brown)	2 449.88	65 811	84 466	-18 655	-16 205.12	Salary higher than bud
3	International strategy	Conferences	1 336.60	50 686	50 686	0	1 336.6	
4	Common Network Res.	Materials and supplies	167 838.48	251 487	338 450	-86 963	80 875.48	It was expected from and Yr2 and Yr3 over b
5	Common Network Res.	Equipment or facility	94 933.70	0	35 000	-35 000	58 933.70	Expenses spread over :
6	Common Network Res.	Travels (field work)	0.00	192 024	192 024	0	0.00	
7	Common Network Res.	Students	1 971.64	33 671	33 671	0	1 971.64	Remaining uncertainty updated.
8	Common Network Res.	Technical/prof. assistants (3 RPs)	36 002.00	115 203	118 965	-3 762	32 240	Total salaries of 3 RPs i funds from late start d
9	Common Network Res.	Dissemination	0.00	1 250	1 250	0	0	
10	Theme 1	Materials and supplies	5 000.00	1 250	1 250	0	5 000	Remaining uncertainty updated.
11	Theme 1	Students	27 793.32	75 918	75 918	0	27 793.32	Remaining uncertainty
12	Theme 1	Technical/prof. assistants	0.00	151 957	128 674	23 283	23 283	Co-PI and Scientific Cr research professional.
13	Theme 2	Materials and supplies	2 500.00	2 500	2 500	0	2 500	Remaining uncertainty
14	Theme 2	Students	15 184.00	60 734	60 734	0	15 184	Remaining uncertainty
15	Theme 3	Materials and supplies	3 750.00	1 250	1 250	0	3 750	Remaining uncertainty
16	Theme 3	Postdoctoral fellows	15 184.00	30 367	30 367	0	15 184	Remaining uncertainty
17	Theme 3	Dissemination	0.00	1 250	1 250	0	0	Remaining uncertainty
18	Theme 3	Students	15 184.00	30 551	30 551	0	15 184	Remaining uncertainty
19	Theme 4	Materials and supplies	0.00	1 250	1 250	0	0	Remaining uncertainty
20	Theme 4	Students	0.00	7 684	7 684	0	0	Remaining uncertainty
Totals			406 342.53	1 125 000	1 246 097	-121 097	284 245.53	

Table I.4 - Budget Overview for Year 2 (2017-2018)

Université de Sherbrooke contribution

Description	Description	Year 1 funds	Proposal Budget	Year 2 budget	Difference	Year 2 forecasted carry over	Commercial difference
Common Network Res.	Conferences	171.91	2 800.00	2800.00	0.00	171.91	
Common Network Res.	Student	0.00	15 000	15 000	0.00	0.00	
Common Network Res.	Technical/prof. assistants	0.00	50 000	50 000	0.00	0.00	
Common Network Res.	Equipment	0.00	6 666	6 666	0.00	0.00	
Theme 3	Students	0.00	15 000	15 000	0.00	0.00	
	Totals	171.91	89 470	89 470	171.91	171.91	

Table I.5 - Budget Overview for Year 2 (2017-2018)

Ouranos contribution

Description	Description	Year 1 funds	Proposal Budget	Year 2 budget	Difference	Year 2 forecasted carry over	Commercial difference
Theme 4	Students	0.00	7 500	7500	0.00	0.00	
	Total		7 500	7 500	0.00	0.00	