Toward Integrated Watershed Management on the St. John River: Developing Water Quality Mapping Triggers Linked to the Mapping of Ecosystem Services to Support the Sustainable Management of the Hydrological Alterations Framework

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Report to the Canadian Rivers Institute at the University of New Brunswick

We respectfully acknowledge that this report was prepared on the traditional unceded territory of the Wolastoqey People

THE ST. JOHN RIVER SOCIETY
LA SOCIÉTÉ DU FLEUVE SAINT-JEAN

Canadian Rivers Institute

Overview

The St. John River Society and its project partners: WWF Canada, CRI, OBV du fleuve Saint-Jean and ACAP Saint John received an Atlantic Ecosystems Initiative grant from Environment and Climate Change Canada for a three year project to adapt the social component of the ELOHA model to the St. John River context, thus building on work accomplished through the MAES project at the Canadian Rivers Institute and completing the adaptation of the model to the region; to be available as a tool for use in a broader effort to undertake integrated watershed management along the Wolastoq. The St. John River Society is the managing partner of the project.

The project funding period is August 2018- March 2021. In its first fiscal year (2018/2019), the project received additional funding from The Canadian Rivers Institute ($30,000) and the NB Environmental Trust Fund ($25,000).

The St. John River is a tri-jurisdictional river (Maine, Quebec and New Brunswick). Its 673 kms runs from the deep woods of Maine to the Bay of Fundy. It is Canada's 38th designated Canadian Heritage River through Parks Canada and has recently been prioritized as one of four national working areas for Environment and Climate Change Canada.

Project Overview

The Ecological Limits of Hydrologic Alteration or ELOHA is a holistic framework that pairs both the ecological and human requirements of rivers to determine environmental flows (quality, quantity and timing), or eflows, and are used to inform management decisions. The framework is spilt into two parts – an ecological process (already undertaken by CRI through the MAES project) and a social process that come together to in the end to determine what the priorities for the river are in terms of both ecological integrity and social needs, and not just what is best ecologically or what is best for water users. The completion of this adapted framework for the St. John River will provide a valuable tool to move forward on creating integrated watershed management for the river and will represent the first completed ELOHA framework in Canada.

The social process included in the ELOHA framework requires engagement with public, stakeholders and Rights Holders to ensure all points of views are being considered and therefore determine societal values and management needs for the river. This engagement activity is crucial to the social process as it forms the underlying data to move forward through the framework; therefore, determining the methodology for undertaking this was explored in this first year of the project. The next step of the process is to determine what trade-offs are acceptable for both social needs and ecological needs

from the previous engagement and follow up with key stakeholders and Rights Holder which brings the ecological process and social process together to complete the third step of creating flow standards. The final step, which is the responsibility of government as regulators, will be the implementation of the flow standards which is a policy and decision-making process. Deliverables and activities undertaken in the first year of this three-year project are detailed in the sections below.

Literature Review

This project is the first to truly adapt the social process of ELOHA in Canada and as such a large portion of this first year was dedicated to background research, identifying stakeholders, and talking with external organizations. This was a vital, but time-consuming step, in the process to ensure that the methods and framework used for the social engagement will be appropriate and lead to the success of the engagement and adaptation. To accomplishing this, a literature review was undertaken to determine what other organizations have done for social processes when adapting the ELOHA framework, what engagement has previously been done along the river to inform our social process, and frameworks/methodology that could be used for our engagement. A Google drive folder was created to store all the related ELOHA literature, social engagement, and governance and management literature for all participants in the project to access and will become public. A list of the documents contained within this drive, at the time of writing this report, can be found in Appendix 1 or through this link (https://drive.google.com/drive/folders/1iQrONIw7xxBIb01bhAhmbMNfaSTPMnO9?usp=sharing) for the up-to-date Google drive.

River Summit

The Wəlastəkw/St. John River Summit was held at the Ville Cooperative in Fredericton on November 7th, 2018. Dr. Wendy Monk from Environment and Climate Change Canada and Molly Demma from The St. John River Society presented an overview of the ELOHA framework, previous work done by CRI to adapt the ecological components of the model, and the proposed deliverables for the social adaptation project to roughly 80 participants (presentation slide available upon request). This was the first public/stakeholder forum in which the project was discussed and the general consensus was positive and a broad willingness to support and participate.

ELOHA Conference

On October 17/18, 2018, an Environmental Flow Needs Conference was hosted in Kelowna, British Columbia that was attended by managing partner The St. John River

Society along with project partners WWF Canada and ACAP Saint John. This conference provided a learning opportunity in order to understand the application of the ELOHA model in the British Columbia context and to collect tools and methodology to inform the St. John River project. Contacts were made including Claudia Pahl-Wostl, the author of the SUMHA version of the ELOHA model and good discussions were held with many stakeholders attending the conference. The conference validated that British Columbia continues to use an environmentally focused and fish-centric version of ELOHA modelling and that progress on the integration of the social component of the model is not as advanced in British Columbia. This reinforced the unique value proposition of the project along the St. John River as well as the benefit of the strong and engaged collaborators and partners on the St. John River project.

Internal Project Meetings

Throughout year one of the project, five internal meetings were held to ensure the project was on schedule, tasks were appropriate, resources were allocated, and progress was being made toward the overall goal. These meetings were held on August 21, September 12, November 7 (at the summit), November 19, 2018 and February 2, 2019 with Project Manager Molly Demma, as well as Dr. Wendy Monk, Dr. Michelle Gray, and Roxanne MacKinnon, ELOHA Project Coordinator.

Advisory Committee

In order to ensure the project had the necessary expertise to be successfully implemented, an advisory committee was struck to help determine appropriate methods, resources and engagement strategies. This committee met on February 26th, 2019 at the Charlotte Street Arts Centre from 2:30-4:30 for an overview of the project and the ELOHA framework in order to ensure all committee members are familiar with the context and deliverables of the project. Included on the committee are various topic experts, project partners, and social scientists that are willing to help further our project and ensure that data collection through engagement is successful.

Dr. Monk spoke to the ecological adaptation already done and that many studies have not embarked on the social process due to the difficult nature of the task (presentation from this meeting is available upon request). During this meeting, discussions in relation to the social process not being implemented in many studies were raised and the need to and importance of considering social values was agreed upon by all members. The meeting ended with an overview of the project plan and focus/framing of stakeholder

and Rights Holders engagement and data collection around ecological goods and services was agreed upon.

In attendance:

Dr. Wendy Monk- ECCC and CRI
Kaleigh Holder- Conservation Council of New Brunswick
Gord Yamazaki- CRI
Lois Corbett- Conservation Council of New Brunswick
Don Fox- NB Department of Environment and Local Government
Simon Mitchell- WWF Canada
Dr. Cynthia Stacey- UNB Faculty of Kinesiology
Dr. Tom Beckley- UNB Faculty of Forestry and Environmental Management
William Millar- Nature Conservancy of Canada (observing)

Regrets:
Graeme Stewart-Robertson- ACAP Saint John
Dr. Kelly Bronson- University of Ottawa
Chkwabun Sappier- WNNB

Significant efforts have also been undertaken to connect with external organizations that have used the ELOHA framework and be in a position to provide guidance and advice. These include the Nature Conservancy, the POLIS Institute at the University of Victoria and Sustainable Waters at the University of Virginia.

Government Relations

Throughout the project, Environment and Climate Change Canada was kept up-to-date with the project progress through in-person and phone meeting as necessary as a partner and funder of this project. Additionally, five of the six river MPs and the NB Minister of Environment were made aware of this project and ECCCs designation of the St. John River as a national priority through in-person meetings. To accompany these meetings, a brief overview document was created that details the project and the river which was left with these government officials (Appendix 2). A meeting with the last river MP, René Arseneault: Madawaska-Restigouche is currently being scheduled. All MP's requested that they remain updated on the progress of the project and appreciated the work that all partners were doing along this nationally significant waterway.

Next Steps

In the next two years of the ELOHA project, The St. John River Society and its project partners will embark on stakeholder engagement through both online questionnaires to the public and strategic in-person interviews with various stakeholder groups. Through

research and building on past studies undertaken along the river, along with the implementation of sound social science methodologies, this engagement will be centred around the principles of ecological goods and services (Provisioning, Regulating, Cultural, Supporting/Habitat) and the goal will be to determine society values and needs within this context.

To accomplish this, questionnaires/surveys will be created and framed around ecological goods and services to determine which of services are most important to society, stakeholders, and Rights Holders. This data collection initiative will then allow the project to determine where trade-offs may be needed to between ecosystem needs and social needs and what would be accepted by society. This data will also be merged with the water quality management triggers research and data collection component of the project for a broad overview and understanding of societal priorities and management needs along the Wolastoq. This is a crucial step in the progress of the project, in order to ensure that the final recommendations are reasonable and will be accepted broadly, as well as being integrated into the adapted ELOHA model as a whole.

An ArcGIS story map will be created alongside the data collection and interpretation to highlight the work completed through a visual- based format that is easily understood and shared with the public, stakeholders, partners, and funders. In the end, the project will provide recommendations to decision makers for the implementation of a fully adapted ELOHA model for the St. John River.

Appendix 1 – ELOHA Google Drive Contents

Literature Review Folder

Science Subfolder:

- A Framework for Assessing Ecological Quality Based on Ecosystem Services
- ELOHA: A New Framework for Determining and Managing Environmental Flows Over Large Regions
- Info Sheet on AEI ELOHA Project (English)
- The Dynamics of Interdisciplinary Research Fields: The Case of River Research
- ELOHA Flow Chart
- ELOHA Brochure
- ELOHA Toolkit

St. John River Subfolder:

- Healthy Water Healthy People: New Brunswickers' concerns and attitudes about fresh water and preparedness for extreme weather events
- Improving river health: insights into initiating collaboration in a transboundary river basin
- Mactaquac Project: Final Comparative Environmental Review (CER) Report
- Mactaquac Project: Final Comparative Environmental Review (CER) Report – Summary
- Mactaquac Public Engagement Program: What Was Said Report
- Making Connections on the St. John River
- NB Power Social Impact Comparative Review: The Mactaquac Project (Final)
- Plan Directeur De L'eau Du Bassin Versant Du Fleuve Saint-Jean
- Social-Ecological Inventory of River Health Activities in the St. John River Basin
- St. John River Heritage Corridor: Partners in Linking the St. John River
- The Saint John River: A State of the Environment Report
- Watershed Report: Saint John – St. Croix Watershed

MAES Project Reports Subfolder:

- Fish Passage in Large Rivers: A Literature Review
- Proceedings of the Fish Passage Expert Workshop: Global Views and Preliminary Considerations for Mactaquac
- Environmental Considerations for Large Dam Removals
- Developing Environmental Flows for Wolastoq/Saint John River/Fleuve Saint-Jean Summary Report Workshop 1: Data Resources, Critical Habitats, and Target Taxa
- Developing Environmental Flows for Wolastoq/Saint John River/Fleuve Saint-Jean Summary Report Workshop 2: Developing Flow-Ecology Hypotheses
- Developing Environmental Flows for Wolastoq/Saint John River/Fleuve Saint-Jean Summary Report Workshop 3: Refining Hypotheses and Identifying Flow Needs

- Assessment of the Mactaquac Headpond Geomorphology and Estimated Sediment Distribution
- Interim Report on the Predicted Hydrological Regime: Future Discharge at Fredericton (Station 01AK003)
- Mactaquac Aquatic Ecosystem Study (MAES) Hydrodynamic Model Setup for the Saint John River at Mactaquac

ELOHA Case Studies with Social Component Subfolder:

- Application of the Regional Flow-Ecology Relationships to Inform Watershed Management Decisions: Applications of the ELOHA Framework in the San Diego River Watershed, California, USA
- Application of the Ecological Limits of Hydrologic Alteration (ELOHA) in the United States
- Incorporating Social Preferences into the Ecological Limits of Hydrological Alteration (ELOHA): A Case Study in the Yampa-White River Basin, Colorado
- Meeting Indigenous Peoples' Objectives in Environmental Flow Assessments: Case Studies from an Australian Multi-jurisdictional Water Sharing Initiative

Ecosystem Goods and Services Subfolder:

- A framework for assessing ecological quality based on ecosystem services
- A framework for the social valuation of ecosystem services
- A framework for the social valuation of ecosystem services – appendix 1
- A Review of Sampling Effects and Response Bias in Internet Participatory Mapping
- An operational model for mainstreaming ecosystem services for implementation
- Anticipating and Mapping Future Trade-offs and Complementarities between Ecosystem Services
- Competing Structure, Competing Views: The Role of Formal and Informal Structures in Shaping Stakeholder Perceptions
- Culture, Nature, and the Valuation of Ecosystem Services in Northern Namibia
- Ecological Goods and Services: A review of best practices in policy and programing
- Ecosystem Services in River Landscapes
- Ecosystem Services Toolkit. Completing and Using Ecosystem Service Assessment for Decision-Making: An Interdisciplinary Toolkit for Managers and Analysts
- Ecosystems and Human Well-Being: Synthesis
- Lake Simcoe Basin's Natural Capital: The Value of the Watershed's Ecosystem Services
- Mapping and social valuation of ecosystem services in Bregalnica River watershed, East Macedonia
- Participatory mapping of ecosystem services to understand stakeholders' perceptions of the future of the Mactaquac Dam, Canada

- Quantifying and mapping ecosystem service use across stakeholder groups: Implications for conservation with priorities for cultural values
- Stakeholder analysis and social network analysis in natural resource management
- Stakeholders' frames and ecosystem service use in the context of a debate over rebuilding or removing a dam in New Brunswick, Canada
- Targeting the management of ecosystem services based on social values: Where, what, and how?

Governance and Management Systems Folder:

Governance Subfolder:

- Agreement Between Quebec and New Brunswick Concerning Transboundary Environmental Impacts (French copy)
- Agreement Between Quebec and Maine Concerning Transboundary Environmental Impacts (English copy)
- Canada-wide Strategy for the Management of Municipal Wastewater Effluent
- Canada-wide Strategy for the Management of Municipal Wastewater Effluent: 2014 Progress Report
- A Water Strategy for New Brunswick 2018-2028
- United Nations Declaration on the Rights of Indigenous Peoples

Acts and Regulations Subfolder:

- Federal
    - Canadian Environmental Protection Act, 1999
    - Canada Water Act
    - Fisheries Act
    - International Boundary Waters Treaty Act
    - Navigation Protection Act
- New Brunswick folder
    - Clean Environment Act
        - Clean Environment Act
            - Environmental Impact Assessment Regulation
            - Product Storage and Handling Regulation
            - Regional Solid Waste Commissions Regulation
            - Water Quality Regulation
        - Clean Water Act
            - Clean Water Act
            - Fees for Industrial Approvals Regulation
            - Potable Water Regulation
            - Protected Area Exemption Regulation
            - WAWA Regulation

        - Well Water Regulation
- Quebec folder
    - Environment Quality Act
        - Protection Policy for Lakeshore, Riverbanks, Littoral Zones and Floodplains
        - Regulation respecting municipal wastewater treatment works
        - Regulation respecting the application of the Environment Quality Act
        - Regulation respecting the quality of drinking water
        - Regulation respecting pulp and paper mills
        - Water Withdrawal and Protection Regulation
- Maine
    - Title 7: Agriculture and Animals
    - Title 12: Conservation
    - Title 38: Waters and Navigation
    - Title 38, Chapter 3: Protection and Improvement of Waters

Management Systems Subfolder:

- An Examination of Values, Existing Data, Potential Indicators, and Governance in the Ottawa River Watershed
- Collaborative Governance for Climate Change Adaptation in Canada: Experimenting with Adaptive Co-management
- Collaborative Consent and British Columbia's Water: Towards Watershed Co-governance
- Communicating Ecosystem-Based Management
- Environmental Flows and Water Governance: Managing Sustainable Water uses
- Learning Effects of Interactive Decision – Making processes for Climate Change Adaptation
- Recommendations for Enhanced Watershed Management in New Brunswick
- Resilience in a Watershed Governance Context: A Primer
- The Road to Canada: A Heritage Strategy for the St. John River as a Canadian Heritage River
- Summary of Integrated Watershed Management Approaches Across Canada
- Water for Power, Water for Nature: The Story of BC Hydro's Water Use Planning Program

Appendix 2 – Project Overview Handout

TOWARD INTEGRATED MANAGEMENT OF THE WELASTEKEW/ SAINT-JEAN/ ST. JOHN RIVER

THE ST. JOHN RIVER SOCIETY
LA SOCIÉTÉ DU FLEUVE SAINT-JEAN

Global freshwater resources are under increasing threat from climate change and growing societal demands. There is growing awareness of the need to maintain adequate freshwater levels in rivers, lakes and floodplains to sustain both biodiversity as well as the many benefits derived from the healthy and resilient ecosystems upon which local communities and economies depend. Watershed management systems help governments provide for growing human populations while protecting healthy freshwater ecosystems.

The Ecological Limits of Hydrologic Alteration (ELOHA) is a framework that offers a flexible, science-based model adapted to a specific river for broadly assessing environmental flow needs as a key step toward managing that watershed.

The goal of **ELOHA** is not to maintain or attempt to restore pristine conditions in rivers; rather it is to understand the trade-offs between human uses of water and ecological degradation to inform best watershed management practices.

The ELOHA framework combines environmental and social factors to inform watershed management. The environmental component of the framework for the St. John River has been completed through the Mactaquac Aquatic Ecosystem Study at the Canadian Rivers Institute (UNB). The St. John River Society is now leading the adaptation of the social component of the ELOHA model. The end framework will provide a complete management toolbox as we all aim to work collaboratively to consider all aspects of the river in its future caretaking and management.

WHAT ARE ENVIRONMENTAL FLOWS?

Environmental flows (or e-flows) describe quantity, timing and quality of freshwater flows and levels necessary to sustain aquatic ecosystems, which in turn support human cultures, economies, sustainable livelihoods and well-being.

Through implementation of environmental flows, water managers strive to achieve a flow regime, or pattern that provides for human uses and also maintains the essential processes required to support healthy and resilient river ecosystems.

The St. John River is one of the most significant river systems in Canada. As an impounded river system, it is a perfect candidate for the application of a holistic e-flows model as a tool for watershed management. This will be the first time this model is adapted in a Canadian river context. The St. John River has strong collaborative environment between governments, industry, academia, Rights Holders and Civil Society and adapting this model will ensure everyone can continue to work together and do their best for our good and bountiful Welestekew.

What Are Holistic E-flow Approaches?

A holistic approach means the model is grounded in science and can be scaled up or down depending on the recovery demands of a river as well as available capacity (e.g., people, data, money).

KEY POINTS

River Interim Statement of Cooperation with eight Indigenous Chiefs, Governments of Maine, Quebec and N.B. • 38th Canadian Heritage River (Parks Canada) • One of four national priority areas for Environment & Climate Change Canada • Goal of co-governance around watershed management issues with Rights Holders, Civil Society and Governments along the Welastekew.

THE PROJECT

-Administered by The St. John River Society

-Project Funders: ECCC (Atlantic Ecosystems Initiative), NB Environmental Trust Fund and the Canadian Rivers Institute (in collaboration with NB Power and NSERC CRD).

-Project Partners: World Wildlife Fund Canada, Canadian Rivers Institute (UNB), Organisme de bassin versant du fleuve Saint-Jean (Quebec), ACAP Saint John and NB Power.

The plan

START with Science • PARTNER with Rights Holders & Stakeholders • INFORM Governments

OBV DU FLEUVE SAINT-JEAN

WWF

ACAP SAINT JOHN

Canadian Rivers Institute

VERS UNE GESTION INTÉGRÉE DU FLEUVE WELASTEKEW/ SAINT-JEAN/ ST. JOHN

Les ressources mondiales d'eau douce sont de plus en plus menacées par les changements climatiques et les besoins grandissants de la société. La population est de plus en plus consciente de la nécessité de conserver des niveaux d'eau adéquats dans les rivières, les lacs et les plaines inondables afin de maintenir la biodiversité et les nombreux avantages que procurent les écosystèmes sains et résilients dont dépendent les collectivités et les économies locales. Les systèmes de gestion des bassins versants aident les gouvernements à répondre aux besoins des populations humaines croissantes tout en protégeant la santé des écosystèmes d'eau douce.

Les **limites écologiques d'altération hydrologique** (Ecological Limits of Hydrologic Alteration, **ELOHA**) sont un cadre de référence offrant un modèle de gestion souple et fondé sur des données scientifiques, qui est adapté à chaque rivière et qui permet une évaluation générale des débits environnementaux requis en tant qu'étape importante dans la gestion de ce bassin versant.

L'**ELOHA** a pour but non pas de conserver ou de tenter de restaurer des rivières dans leur état originel, mais plutôt de comprendre les compromis entre les utilisations humaines de l'eau et la dégradation écologique afin d'informer des pratiques optimales de gestion des bassins versants.

L'approche ELOHA allie les facteurs environnementaux et sociaux afin d'informer la gestion des bassins versants. La composante environnementale de l'approche pour le fleuve Saint-Jean a été réalisée dans le cadre de l'étude de l'écosystème aquatique de Mactaquac menée par le Canadian Rivers Institute à l'UNB. La Société du fleuve Saint-Jean dirige présentement l'adaptation de la composante sociale du modèle ELOHA. Une fois complété, le cadre de gestion obtenu fournira une trousse d'outils complète, car nous visons tous à travailler en collaboration pour tenir compte de tous les aspects du fleuve dans les pratiques futures touchant sa protection et sa gestion.

QU'EST-CE QUE LES FLUX ENVIRONNEMENTAUX?

Les flux environnementaux désignent la quantité, la distribution et la qualité des débits d'eau requis pour assurer la subsistance des écosystèmes d'eau douce ainsi que les moyens de subsistance et le bien-être des humains qui vivent de ces écosystèmes.

Par la mise en œuvre des flux environnementaux, les gestionnaires des ressources en eau cherchent à obtenir un régime de débit ou un modèle qui réponde aux besoins des populations humaines tout en préservant les processus essentiels requis pour assurer la santé et la résilience des écosystèmes fluviaux.

Le fleuve Saint-Jean est l'un des réseaux fluviaux les plus importants du Canada. Comme il s'agit d'un réseau hydrographique endigué, il est le candidat parfait pour l'application d'un modèle holistique des flux environnementaux en guise d'outil de gestion du bassin versant. Ce sera la première fois que le modèle est adapté à un contexte fluvial canadien. Le fleuve Saint-Jean est situé dans un environnement caractérisé par une solide collaboration entre les gouvernements, l'industrie, le milieu universitaire, les détenteurs de droits et la société civile. L'adaptation de ce modèle assurera que tous pourront poursuivre leur collaboration et faire de leur mieux pour protéger notre beau et riche Welastekew.

Qu'est-ce que les approches holistiques à l'égard des flux environnementaux?

Une approche holistique signifie que le modèle se fonde sur la science et qu'on peut en varier l'échelle en fonction des mesures de restauration que requiert une rivière ainsi que des capacités disponibles (p. ex. ressources humaines, données, argent).

POINTS SAILLANTS

Déclaration provisoire de coopération riveraine entre huit chefs autochtones et les gouvernements du Maine, du Québec et du N.-B. • 38e rivière du patrimoine canadien (Parcs Canada) • L'une des quatre zones prioritaires nationales d'Environnement et Changement climatique Canada (ECCC) • Objectif de gouvernance commune de la gestion du bassin-versant entre les détenteurs de droits, la société civile et les gouvernements riverains du Welastekew

LE PROJET

- Administré par la Société du fleuve Saint-Jean
- Bailleurs de fonds du projet: Initiative des écosystèmes de l'Atlantique (ECCC), Fonds de fiducie pour l'environnement du N.-B. et le Canadian Rivers Institute (en collaboration avec Énergie NB et le programme RDC du CRSNG).
- Partenaires du projet: Fonds mondial pour la nature (Canada), Canadian Rivers Institute (UNB), Organisme de bassin versant du fleuve Saint-Jean (Québec), ACAP Saint John et Énergie NB.

Le plan

SE FONDER sur la science • S'ASSOCIER avec les détenteurs de droits et les parties intéressées • INFORMER les gouvernements

OBV DU FLEUVE SAINT-JEAN · WWF · ACAP SAINT JOHN · Canadian Rivers Institute