CMD 22-H7.111C

File / dossier : 6.01.07
Date: 2023-05-03
e-Doc: 7033271

At the request of the Kebaowek First Nation, the submission filed on May 1st, 2023, CMD 22-H7.111B, was removed and replaced by CMD 22-H7.111C.

À la demande de la Première nation de Kebaowek, le mémoire déposé le 1er mai 2023, CMD 22-H7.111B, a été retiré et remplacé par le CMD 22-H7.111C.

Supplementary Information

Renseignements supplémentaires

Written submission from the Kebaowek First Nation

Mémoire de la Première nation de Kebaowek

In the Matter of the

À l'égard des

Canadian Nuclear Laboratories, Chalk River Laboratories

Laboratoires Nucléaires Canadiens, Laboratoires de Chalk River

Application to amend its Chalk River Laboratories site licence to authorize the construction of a near surface disposal facility

Demande visant à modifier le permis du site des Laboratoires de Chalk River pour autoriser la construction d'une installation de gestion des déchets près de la surface

Commission Public Hearing
Part 2

Audience publique de la Commission
Partie 2

May 30 to June 3, 2022

30 mai au 3 juin 2022

In the Matter of
Canadian Nuclear Laboratories

Application to amend the Nuclear Research and Test Establishment Operating Licence for the Chalk River Laboratories site to authorize the construction of a Near Surface Disposal Facility

Submissions of the Kebaowek First Nation

Pursuant to the *Procedural Direction*, dated July 5, 2022
(amended January 31, 2022)

May 1, 2023

1. INTRODUCTION

The Kebaowek First Nation ("**KFN**") provides these submissions as part of the Canadian Nuclear Safety Commission's ("**CNSC**") hearings on Canadian Nuclear Laboratories' ("**CNL**") proposed Near Surface Disposal Facility ("**NSDF**").

At the hearings in June, KFN highlighted to the CNSC that CNSC Staff ("**Staff**") and CNL had so far failed to properly consult KFN on this project. At that time, both Staff and CNL insisted that consultation with KFN had been adequate, and they urged the Commission to make a licensing decision on the given record.

Thankfully, the Commission declined to do so. Instead, the Commission recognized KFN's concerns and issued a Procedural Direction, dated July 5, 2022, stating:

> "The Commission is leaving the record open in order to accommodate the information that Kebaowek First Nation and the Kitigan Zibi Anishinabeg were not adequately consulted… This additional time is to allow for the Commission to receive further evidence and/or for more engagement and consultation to take place in respect of Kebaowek First Nation and the Kitigan Zibi Anishinabeg."

The Procedural Direction initially stated that additional evidence would be submitted by January 31, 2023. At the request of KFN and Kitigan Zibi Anishinabeg, the Commission extended the Procedural Direction deadline to May 1, 2023.

KFN is grateful for the additional time afforded by the Procedural Direction. It has allowed us to begin much-needed expert review and fieldwork regarding the NSDF's environmental impacts. Our preliminary Indigenous-led studies have, to date, shown large gaps in the NSDF's environmental assessment.

Now obliged by the Procedural Direction, Staff and CNL have also taken some steps to directly consult with KFN on the NSDF. Having said this, the relationship between Staff, CNL and KFN must be considered within the broader context, including:

- state-sanctioned assimilation and oppression, and resulting intergenerational trauma;
- displacement from traditional territory, and competition or complete exclusion from resource use;
- historical exclusion from decision-making about and access to the Chalk River Labarotories ("**CRL**") site; and
- KFN's relatively limited capacity and high volume of consultation requests.

In these circumstances, KFN faced some difficulties in building a relationship with Staff and CNL that is based on reconciliation, equal partnership, and mutual trust. These issues will be outlined below.

2. KFN'S INTERACTIONS WITH CNSC AND CNL

Once aware of the additional time for consultation on the NSDF, KFN diligently participated in consultation process with both Staff and CNL. This included entering into long-term arrangements with both Staff and CNL, to set a foundation for meaningful consultation on the NSDF and beyond.

However, the negotiation process and information gathering took longer than expected, for various reasons.

a. Disagreement about the Procedural Direction's scope

To begin, the parties had different understandings of the scope of the consultation required under the Procedural Direction. In KFN's view, the Procedural Direction required that KFN be consulted on determinations in the NSDF licensing process that they had been excluded from. Specifically, KFN would be entitled to conduct its own Indigenous-led studies and community consultations to verify or challenge Staff and CNL's previous determinations in the NSDF licensing process. For example, KFN proposed studies on animal displacement, engineering and resettlement effects, as well an Indigenous land use and occupancy study. These studies would provide baseline data that KFN could trust and that were informed by Indigenous knowledge. Such baseline data was necessary to make any assessment on impact to KFN's rights.

Staff and CNL had a much narrower view of the Procedural Direction. For instance, in a meeting on August 10, 2022, Staff suggested that the Procedural Direction is focussed on simply updating section 9.3.1 of Staff's Environmental Assessment Report (that is, the Rights Impact Assessment ("**RIA**") with respect to KFN). They specifically stated that the Procedural Direction did not contemplate revisiting past decisions on the NSDF project.

Similarly, CNL appeared concerned that KFN wanted to conduct an Indigenous land use and occupancy study, as well as a socio-economic wellbeing study, to provide baseline data for consultation. In CNL's view, these studies were relevant to the CNL site as a whole, rather than specific to the NSDF project, so the studies could be done later.

Staff and CNL's narrow view of consultation indicated they had closed their minds to revisiting previous decisions and processes (such as certain environmental studies done) on the NSDF. From the outset, they appeared to operate on the assumption that the NSDF would inevitably be approved, and any impacts to our rights could and would be accounted for. This idea is clearly reflected in CNL's repeated attempts reassurances that consultation is "ongoing" and that KFN can remain involved after the NSDF is approved.

Staff's approach also consistently deferred to CNL's promises of environmental monitoring and follow-up programs (such as a sustainable forest management plan to account for the loss of 37 hectares of forests). Yet, it was unclear whether Staff had actually independently verified the adequacy of these programs. In the instance of the sustainable forest management plan, Staff admitted it had not reviewed the plan in any capacity.

The point of consultation is to ensure impacts to rights are assessed and accommodated **before** a project is approved. The regulator and proponent cannot assume the project will go forward, then promise to do such assessments and accommodation later. It may very well be that consultation shows the impacts to rights are so severe or of a certain quality that any proposed mitigation is insufficient, such the project cannot be approved. At the very least, the substance of proposed mitigation should be independently assessed **before** a decision is made, to ensure the proposed mitigation would actually address the impacts to rights. It is not enough to say "there will be a plan to address this"; you have to actually evaluate the plan.

Staff and CNL's narrow approach to consultation exacerbated KFN's feelings of mistrust. As such, it was often difficult for us to find common ground with Staff and CNL in negotiations.

b. Funding issues

Relatedly, KFN also faced difficulties securing funding to support consultation under the Procedural Direction. The lack of certainty around funding caused delays in ramping up the necessary consultation activities.

For example, on October 12, 2022, KFN submitted a funding request to Staff to support consultation activities regarding the NSDF, pursuant to the Procedural Direction. In response, Staff suggested that KFN remove activities regarding KFN's review of CNL's Environmental Impact Statement ("**EIS**"), since this was CNL's responsibility to fund this work. KFN did not agree with this attempt to deflect financial responsibility to CNL. A review of the EIS was necessary before KFN could provide comments on Staff's RIA.

Further, on October 26, 2022, KFN informed Staff that additional funding would be required to cover the costs of negotiating the Arrangement for Long Term Engagement and Consultation, as well as project-specific Terms of Reference. Staff suggested that KFN could rely on funding previously given for attending the CNSC's public hearing. This reflected a significant underestimation or lack of appreciation of the costs required to participate in these activities. Previous funding for attending the hearing has been completely spent.

Chief Haymond was required to write these concerns in a formal letter to Michael DeJong, the Vice-President of Regulatory Affairs and Chief Communications Officer at the CNSC. Only after writing this formal letter did KFN see movement on funding from Staff.

With CNL, KFN signed a Letter of Intent with CNL in January 2022 ("**LOI**"). This LOI was not specific to NSDF but rather, expressed a commitment to negotiating a general "Framework Agreement" between the parties The Framework Agreement would govern how CNL consults with KFN about various projects. The LOI allocated funding for negotiation of the LOI and the Framework Agreement.

While KFN and CNL were negotiating the Framework Agreement, CNL indicated that the amount allocated for the negotiations in the LOI could be used to support NSDF-specific activities. KFN appreciated this gesture. However, KFN wished to ensure CNL had committed to reimbursing specified amounts for the work KFN intended to complete. In our experience, this specificity was necessary to avoid any conflicts after about reimbursement later. KFN was not prepared to carry the extensive costs of consultation up front without a corresponding guarantee that it would be reimbursed. As indicated earlier, there was also some delay in agreement on funding, given CNL's position that certain studies were out of the Procedural Direction's scope.

c. Erosion of trust after KFN's extension request

Given the above noted concerns, as well as some obstacles when conducting fieldwork (as will be outlined later), KFN asked the Commission for an extension to the Procedural Direction deadline. In a letter sent on December 5, 2022, Chief Haymond described the work done to date and reasons for an extension. Specifically, KFN required more time to complete the studies necessary to assess the NSDF's impact to our rights.

Staff and CNL were sent this letter on the same day that it was sent to the Commission. When asked their position on KFN's request, CNL replied that they would support any decision by the Commission's Registrar. They did not identify whether they would support or oppose KFN's request. Similarly, Staff told KFN they were at a working level and did not know what position upper management would take.

The Registrar held a case conference to consider KFN's request on December 14, 2022. The purpose of this case conference was procedural: to briefly canvass other parties' position on KFN's request, and set next steps for dealing with the request (e.g. whether formal written submissions would follow, and if so, when they would need to be submitted by). Yet, at this case conference, both Staff and CNL made extensive oral submissions that the Procedural Direction had already been fulfilled, and as such, an extension was not required. Staff and CNL referenced KFN's signing of (or intention to sign) a long-term relationship agreement in support of their claims.

KFN was blindsided by these submissions. Despite being specifically asked about their positions for the case conference, Staff and CNL had failed to tell KFN they would be opposing KFN's extension request. KFN also felt like Staff and CNL has misrepresented and weaponized KFN's interest in long-term consultation agreements against us. During the case conference, Chief Haymond expressed frustration that Staff and CNL were approaching consultation as just box to tick off rather than a meaningful relationship, and attempting to discredit KFN's good faith efforts to engage in consultation. This incident was a serious setback in KFN's relationship with Staff and CNL.

Leadership from CNL and KFN met in person shortly after the case conference in attempts to realign priorities. CNL ultimately agreed to support KFN's request for an extension after this leadership meeting. While KFN was appreciative of CNL's eventual support, the incident (and consequent damage control) expended a lot of resources and energy that could have otherwise been directed towards consultation activities.

d. Obstacles while completing fieldwork

The Procedural Direction gave KFN an unprecedented and much-appreciated opportunity to physically access the CRL site and NSDF footprint to conduct fieldwork. Having said that, KFN faced familiar frustrations with CNL when doing this work. KFN felt like CNL was, at times, obstructing or, at the very least, unnecessarily delaying their work.

While KFN understands the importance of ensuring safety at a nuclear facility, it often felt like CNL used this rationale to assert control over KFN's processes and unduly limit KFN's ability to complete its fieldwork. Examples include:

- **Delays in authorization for wolf DNA sampling work.** On January 14, 2023, KFN's technical team met with a CNL representative (Environmental Department) to discuss KFN's wolf study needs. CNL's aggressive questioning of KFN's methods came off as an interrogation that did not respect KFN's expertise in the area. CNL strongly resisted KFN's proposed methods of blood and hair sampling, and insisted that scat or urine sampling would be sufficient.

  KFN was forced to involve a senior research scientist at the Ontario Ministry of Natural Resources. This scientist confirmed that standard protocol for collecting non-invasive genetic samples from wolves involves baiting and snow-tracking during the winter, during which hairs from beds and estrous blood are collected. KFN provided this information to CNL on January 26, 2023.

Yet, CNL still did not approve KFN's proposed methods of DNA collection. Instead, they suggested that permitting was required to bait wolves and refused to provide authorize for KFN's work until this question was resolved. KFN explained permitting is not required to bait for wolves. KFN (on its own initiative) followed up with CNL to confirm that no permit was required for baiting. KFN reiterated their experience with winter baiting and sought more detail on CNL's alleged safety concerns, so KFN could work to mitigate them. KFN followed up on this issue on February 7, 10, 27, and 28, 2023.

There was no movement on this issue until a meeting between KFN and CNL on March 3, 2023. At this meeting, KFN received authorization to use scent lures rather than bait lures. This was not KFN's preferred method. However, given the rapidly closing window to conduct this fieldwork, KFN was forced to settle for this method of wolf study on CNL site.

- **CNL control of placement and use of on-site cameras.** A large part of KFN's fieldwork involved installing live cameras to allow wildlife on the site to tell their own stories. Yet, CNL's desire to control the cameras led to delay or inefficacies in data collection.

  For instance, CNL wanted to buy their own cameras, rather than letting KFN provide their own. This meant KFN needed to wait for CNL's supplier to ship the cameras. On February 7, 2023, KFN emailed CNL to let them know they could not go to the site as planned because they did not have the cameras available to install.

  CNL also insisted on having their staff install these cameras and would not allow KFN to remotely reposition the cameras. This meant that sometimes, the cameras would not be adequately pointed at the correct location and would fail to capture the data KFN was looking for. Additional time was spent on physically revisiting the camera and repositioning it.

  In another case, CNL's insistence on controlling the cameras meant that cameras were incorrectly programmed to time lapse mode, rather than motion detection. Due to this error, two cameras took upwards of 15,000 photos each in the span of a couple days until the batteries died. These cameras were in critical positions to our work, based on wolf tracks in the snow. Due to this error, KFN believes they missed valuable wildlife photographs (e.g. wolves crossing the ice from Quebec and moose walking/bedding in the NSDF).

- **CNL assertion of ownership over all data.** There was an incident where CNL staff were accessing cameras without KFN's knowledge or involvement. While there was no known loss or alteration of data, KFN felt like CNL had incorrectly assumed ownership and control over data that KFN had rights to.

  KFN raised issue of Indigenous data sovereignty and principles of ownership, control, access, and possession (OCAP). CNL appeared open to this discussion, but later proposed a wide-ranging confidentiality agreement that asserted CNL's ownership over all the data

> that KFN was collecting. This is despite KFN leading these on-site studies pursuant to its inherent stewardship rights. Data control is an issue of ongoing concern and discussion between CNL and KFN. However, CNL's starting point (as reflected in its proposed confidentiality agreement) suggests there is much more learning that needs to occur. It was difficult for KFN not to feel like CNL was attempting to stifle the free flow of information regarding the CRL site, which has historically been limited to the public.

Indeed, the CRL site is highly secure and militarized. This environment led to two separate incidents where Elders were left uncomfortable and not wanting to return to the CRL site. These incidents are particularly unfortunate, given that many Elders (like general membership) are concerned about contamination at the site and already have high levels of distrust surrounding the nuclear industry.

Trust in CNL was further eroded after KFN's technical team experienced an unexpected radiation exposure on April 27, 2023. KFN's team were brought to tour an old nuclear reactor building. Before entering the lower levels of the building, one member of the team requested to sit out. The rest of the team continued with the tour.

At the end of the tour, upon exiting the lower levels of the building, all members of the team tested for contamination. They were told it was likely radon that would disappear in a half hour. The member who had not participated in the underground tour also tested contaminated. The KFN team was confused and uncomfortable at this occurrence and did not feel like CNL's responses to their questions adequately prepared them or addressed their concerns.

While this incident occurred during a meeting for a different project (the Nuclear Power Demonstration closure project), it did not inspire confidence in CNL's transparency or handling of contamination risks to the general public.

3. ADDITIONAL DATA GATHERED BY KFN

a. Community background and consultation

Please see attached Appendices A and B.

b. Ecological baseline gaps

Baseline studies are of high priority to KFN when assessing and managing environmental assessments concerning imperiled species. Successful environmental assessments cannot be adequately developed without reliable estimates of imperiled species land use and population size. As such, during these past several months, KFN has been conducting fieldwork at the CRL site and NSDF footprint.

After starting fieldwork, it quickly became evident to KFN technical staff that there were significant gaps in the baseline environmental work done for the NSDF. Specifically:

- CNL had not conducted animal population counts in the NSDF for moose, deer, or bear, nor studied prey-predator relations; in particular, there was a lack of documentation of eastern wolf presence, population, and prey-predator relations since the beginning of the NSDF EIS process in 2016.

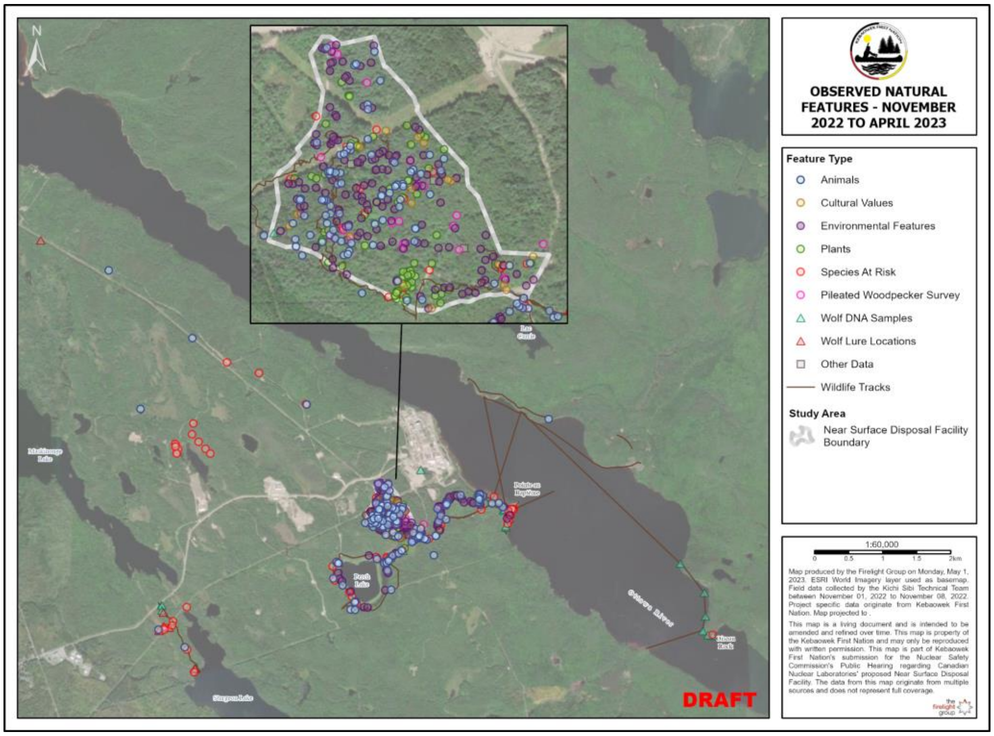
- The long term, structural habitat implications of removing 37 hectares of select old growth forest habitat for Eastern wolf and other mammals in the NSDF footprint (e.g. their future population distribution and status) was unclear.

As such, KFN's fieldwork focused on locating and identifying species at risk, as well as identifying cultural and habitat values that would be lost or impacted by the NSDF. KFN collected data within the NSDF footprint, as well as the surrounding areas that would be affected, including Perch Lake and Perch Creek.

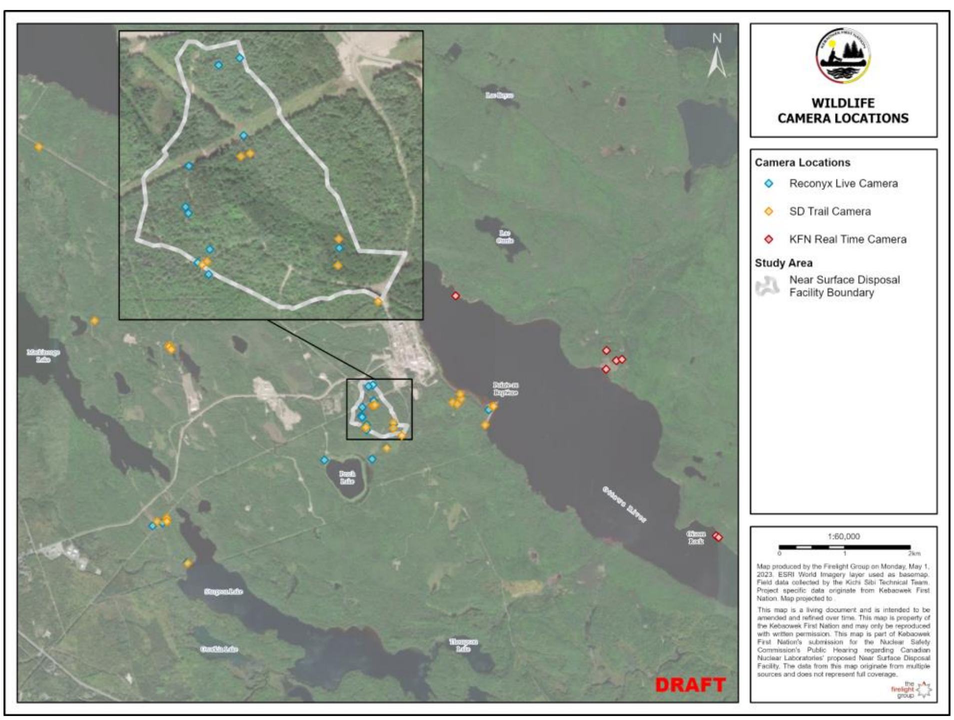
KFN faced delays and difficulties while completing this fieldwork, such as CNL imposed delays in KFN carrying out its own study methodologies (as outlined above); scheduling conflicts (e.g. with hunting season for community members); seasonal requirements for studies; uncomfortable tick levels; and winter holiday closures.

Despite these obstacles, KFN managed to gather numerous data points which support KFN's stewardship rights and responsibilities. From September 19, 2022 to April 17, 2023, KFN's environmental technical team collected data points on site, in real time direct to digital format using Kobo toolbox. A total of 609 data points were collected from a selection of seven categories, as seen in the Value Table below. Of particular importance is the presence of three active bear dens, winter moose and deer habitat, potential threatened species Eastern wolf, milkweed, and several bat species in the NSDF.

Value	Frequency	Percentage
Environmental Features	199	32.46
Culturally Important Animals	151	24.63
Species at Risk	96	15.66
Plants	91	14.85
Birds	36	5.87
Other (please specify below)	21	3.43
Cultural Site and Features	18	2.94



The purpose of collecting this data was to locate and identify species at risk as well as cultural and habitat values that would be lost or impacted in the construction of the NSDF. Data was collected within the NSDF footprint and in the surrounding areas which would be impacted including Perch Lake and Perch Creek. It is important to note that while wolf observation data is included in the species at risk data, it is better defined in KFN's complimentary data sets, being animal tracks, and wolf DNA samples mapping and results. KFN also employed real time camera trapping in the NSDF in March 2023 to let animals tell their own story.



KFN's fieldwork included wolf-specific research, in attempts to begin addressing the lack of documentation of eastern wolf presence, population and prey-predator relations. Also, more generally, wolves are an important animal in Algonquin culture. Relations between Indigenous hunter gatherers and canid companions were based on mutual respect and cooperation.

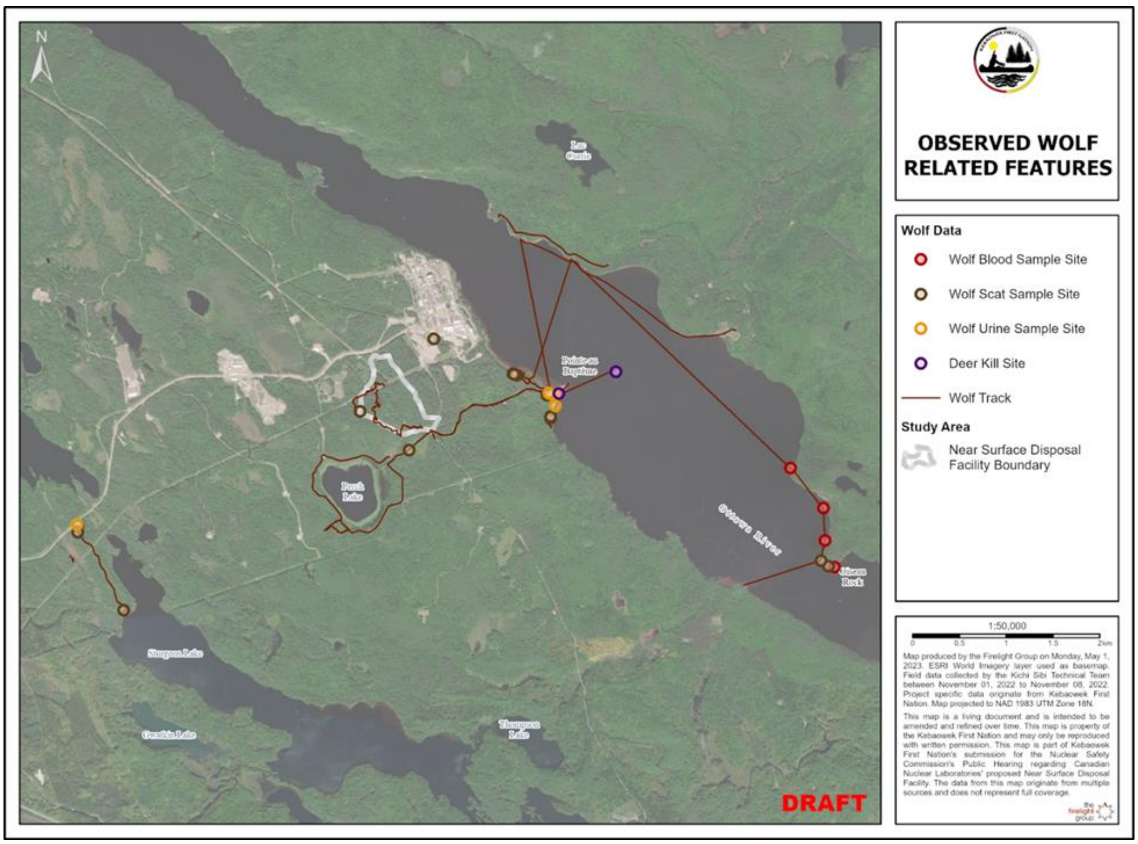
This Ma'hingan (wolf) research story takes place on Algonquin unceded lands near Point du Baptheme and Ouiseaux Rock on the Kichi Sibi, which are areas of particular ceremonial jurisdictional significance to Algonquin peoples. These sites represent an important portal to past relationships and laws of the land that both Ma'hingan and Anishinaabeg Peoples are struggling to maintain.

KFN's work included wolf DNA sampling, non-invasive wolf tracking, and preliminary prey-surveys.

KFN Scent Lure Camera Station Methodology

KFN Wolf Tracking Methodology

KFN Photo ID Genetic sample matching methodology



Due to delays in data-collection and processing, a detailed analysis of the wolf data is still underway. This analysis will more thoroughly outline KFN’s methodology and results (e.g. of the tracking program, prey survey, and DNA sampling). It will also outline the logistical and time challenges of completing this study within the constraints of the Procedural Direction. At a high level, KFN found that the NSDF displays important use activity by both wolves and their prey. However, more baseline population and prey-predator studies are required.

Given the abundance and diversity of these numerous high value components KFN is particularly concerned about the permanent deforestation of the 37-hectare footprint for the NSDF. In a meeting on March 27, 2023, CNL Staff insisted that the forest footprint was not unique habitat for the species that use the site. CNL's assertion is inconsistent with the presence of old red and white oak forests and red and white pine old growth forests in the footprint, which are not found outside of the NSDF footprint. The removal of these trees from the project area means that biota will unlikely to find the same habitat in the surrounding area.

Bear still at den site in NSDF footprint

Staff have relied too heavily on CNL's promise to implement a sustainable forest management plan ("**SFMP**") to mitigate the deforestation. Staff not received baseline information on animal populations for the NSDF necessary to determine whether a SFMP would actually address the impacts of deforestation or not. KFN does not understand how Staff can determine the proposed deforestation as minimal or justifiable, when they have not actually assessed the proposed measures to mitigate the impact.

Staff say that they will review the SFMP prior to any clearing taking place, but to our knowledge, they did not request to review it before making their recommendations to the Commission. Staff was also very unclear about the process by which they will review and approve the SFMP. When asked about whether Staff had the power to reject the SFMP and what the role of public consultation would be in reviewing the SFMP, Staff did not have specific response. They appear to believe it was not their role to facilitate consultation and deferred to the CNL's process for gathering public input.

KFN is troubled by this deflection of responsibility. If the SFMP is a crucial mitigation measure for the NSDF's impact, Staff have a duty to consult with Indigenous communities like KFN when deciding whether to approve or reject the SFMP. This is standard practice in Quebec and Ontario under their respective forestry legislation.

KFN is also concerned that CNL's data collection is unreliable, and that Staff have not done the work to independent verify CNL's claims. For instance, the NSDF Footprint Forest Inventory

Polygon indicated the presence of Cedar as denoted 40CW, on the NSDF Forest Inventory map. However, upon KFN's field request to ground truth the stand for plants correlated to traditional use there was no cedar stand.

In another instance, Dr. Lauren Gallant, on behalf of KFN, asked CNL about milkweed as habitat for endangered monarch butterflies. CNL responded that: "The proposed footprint for the NSDF currently does not have any Milkweed as it is mainly forested. Large Milkweed patches are available at CRL and will remain available for the species. The EIS committed to not remove any Milkweed plant that have any life stages of the species." Yet, KFN's fieldwork identified milkweed in the NSDF footprint. CNL made a general and inaccurate statement that there is no milkweed because the NSDF is forested. This type of blatant error underlines that CNL has not conducted a thorough or accurate inventory of tree stands, understory plants and their uses in the NSDF footprint.

Please see Appendix C for an expert review of the aquatic environment relating to the NSDF, and Appendix D for the Kitchi Sibi Technical Team's Conservation Plan for the Ottawa River. The latter document is living document by three First Nations – KFN, Wolf Lake First Nation, and Timiskaming First Nation – that released a joint Statement of Asserted Rights and Title. KFN anticipates it will rely on these documents in its final submission and they are relevant for addressing the adequacy of consultation that occurred for the NSDF.

4. CONCLUSION

While KFN has faced significant obstacles in obtaining the information required to provide meaningful comments on the NSDF. It has been challenging to build a relationship based on mutual trust, respect, and equality with Staff and CNL. The parties have had significant disagreements regarding the scope of consultation required pursuant to the Procedural Direction. There were delays in funding and numerous problems when conducting fieldwork. This is on top of a serious setback in the parties' relationship, after Staff and CNL opposed KFN's reasonable request for additional time to conduct necessary studies.

Nevertheless, KFN has collected important community input and ecological baseline data that was missing from this environmental assessment. KFN will reserve its arguments about the implications of this data for its final closing submission. For now, it is sufficient to emphasize just how much work KFN was able to accomplish in the limited (but appreciated) additional time provided under Procedural Direction. Had KFN been involved earlier in the process, it is not difficult to imagine how much more robust KFN's inputs could have been.

APPENDIX A: KFN SOCIAL, CULTURAL, AND ECONOMIC SNAPSHOT

I. Introduction

The Kebaowek First Nation ("**KFN**") undertook a socio-cultural-economic impact study (the "**Study**") in the winter of 2022. The Study was to provide baseline picture of our social fabric, cultural traditions, governance, economy, and overall livelihood. We wanted to know how our people are dealing with the past cumulative effects of colonial development, and to canvass our future hopes and worries about the future development of our lands. This Study would provide a starting point for various environmental assessments.

The information in this appendix contains information from the Study, adapted for the purposes of the 2022-2023 hearings regarding the proposed Near Surface Disposal Facility ("**NSDF**") with the Canadian Nuclear Safety Commission ("**CNSC**").

We carried out the Study by three methods:

- key informant interviews/conversations with department heads, knowledge holders, and leadership in KFN (16 informants);
- a survey of a sample of the membership over the age of 15 (44 respondents); and
- a literature review.

II. Background on KFN

Kebaowek First Nation ("**KFN**") is an Algonquin Anishinabeg First Nation and one of the eleven communities that constitute the broader Algonquin Nation. The term "Anishinaabeg" directly translates as "original man".

For centuries, the Algonquin Nation occupied the length of the Kichi Sibi (Ottawa River) watershed, from its headwaters in north central Québec, all the way to its outlet in Montreal. Algonquin peoples have long exercised their customary laws and governance, known as *Ona'ken'age'win*, on this traditional territory. This law is based on Algonquin peoples' mobility on the territory, to hunt, gather, and control the use of the lands and waterways for future generations. Social, political, and economic organization was based heavily around the watershed, which served as transportation corridors and family land management units.

The Algonquin Nation has never ceded its traditional territory, and its rights and title have not been extinguished. Algonquin peoples regard themselves as keepers of the land, with seven generations worth of responsibilities for livelihood security, cultural identity, territoriality, and biodiversity.

KFN's reserve lands are on Lake Kipawa, Québec. KFN represents over 1100 registered members living on and off reserve, largely in Québec and Ontario. KFN maintains an office in Mattawa, Ontario for its members.

KFN (along with two other Algonquin First Nations, the Wolf Lake First Nation and Timiskaming First Nation) has asserted Aboriginal title and rights over a broad area that straddles the Kichi Sibi basin on both sides of the Quebec-Ontario boundary, as depicted on the following page:

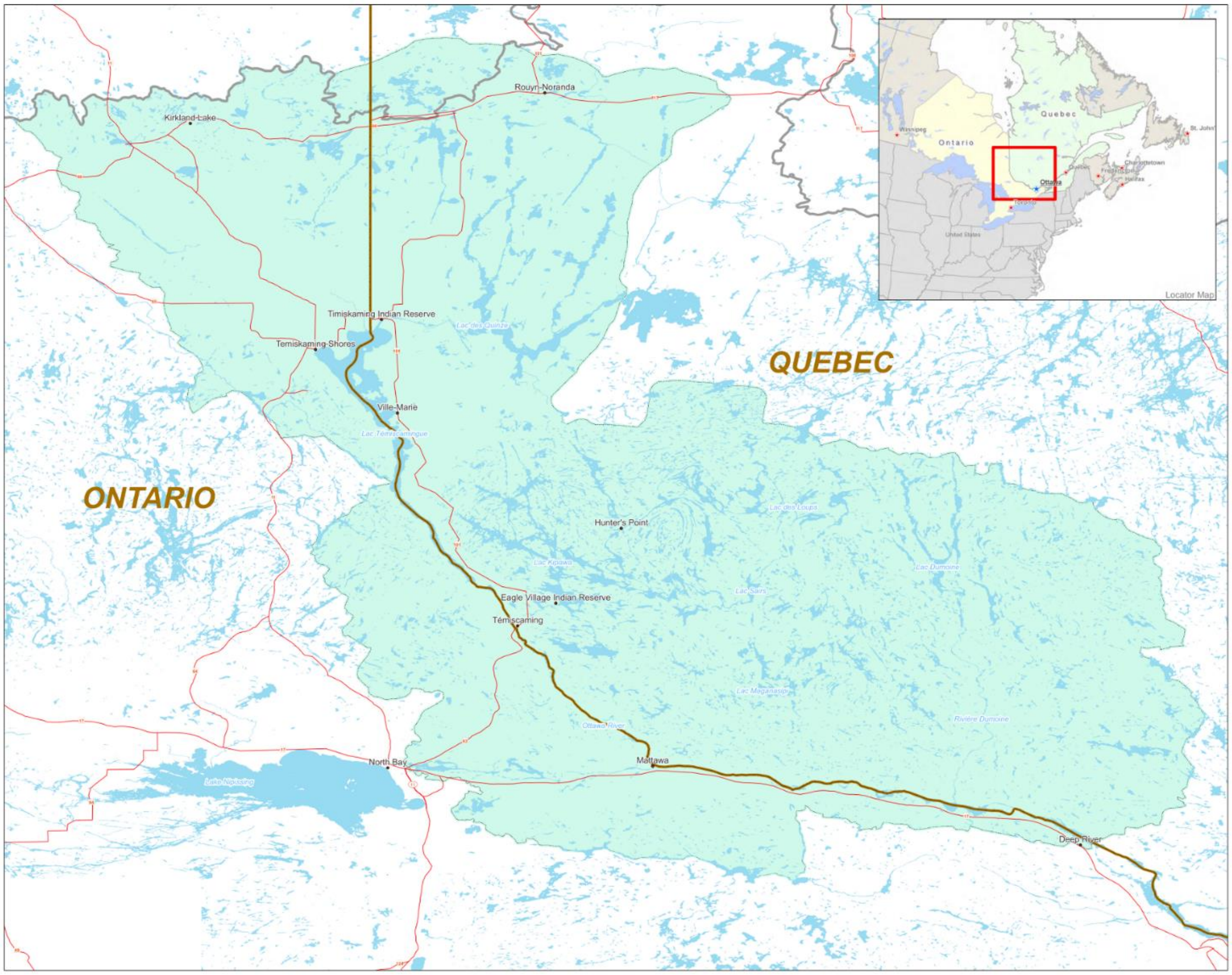


Figure 1: Map of Asserted Rights and Title of Kebaowek First Nation, Wolf Lake First Nation and Timiskaming First Nation (2013)

This map, as well as a corresponding Statement of Asserted Rights and Title ("**SART**"), was provided to the government of Canada, Québec, and Ontario in January 2013. The map was based on the best evidence available at the time and is subject to change. It reflects the area where the three First Nations' have the strongest claims to title.

KFN members — as members of the broader Algonquin Nation — can still exercise their rights throughout the Algonquin Nation's entire traditional territory, as depicted on the following page:

Figure 2: Map of traditional territory of Algonquin peoples
(data from Peter di Gangi / based on original map from Plan Lab)

This map was created based on the evidence at the time and is subject to change.

Our mandate is to support community members to continue to occupy, manage, safeguard and intensively use lands and waterways as they carry out traditional and contemporary activities on their traditional lands. All such initiatives are based on a community model of self-determination and a history of Algonquin culture, language, traditional knowledge, ecological sustainability, territoriality, and land governance.

III. Community objectives

Our Indigenous-led assessment has determined that the following are the key community objectives for KFN on Algonquin territory:

a. sufficient lands and services to enable our people and future generations to live in harmony with one another and with the land, plants, animals and waters around us;
b. culturally safe space and opportunity for younger generations to reclaim our language and culture;
c. control over development (e.g. increased contamination) on our territory;
d. ability to heal our people and territory from historical events (in part through social, cultural, economic and environmental reparations for the cumulative effects visited upon us);
e. recognition of our Indigenous laws and jurisdiction; and
f. recognition of our Statement of Asserted Rights and Title.

IV. Cumulative effects

Any understanding of KFN's current wellbeing needs to begin with the various colonial, oppressive and assimilatory forces imposed on us since Europeans arrived in Canada. The following is a brief review of the key cumulative effects on KFN. It is not a comprehensive summary and is provided only for context.

Beginning in 1760, the Algonquins entered a number of peace and friendship treaties with Great Britain: at Swegatchy and Kahnawake in 1760 and at Niagara in 1764. They were not land surrender treaties but agreements to be allies to Britain. The Royal Proclamation took place in 1763, which promised to protect a portion of their lands. Until the early 19th century, the Algonquins in the Upper Ottawa remained relatively free of colonial intrusions, except for the fur trade and the missionaries, which began with Champlain. In addition, in 1791, the Ontario-Quebec (Upper and Lower Canada) border was fixed with no regard to Algonquin governance and use. As a result, Algonquin peoples found themselves having to deal with multiple levels of hostile governments (in two languages not their own) whose relentless and express policies were to assimilate the "Indians" and to take their lands and future from them.

MISSIONARIES

Many early visitors to Algonquin territory were missionaries who intended to convert Algonquins to Catholicism. Catholicism was rooted deeply in foreign concepts of original sin and eternal damnation for unrepentant sinners. The religion also emphasized subduing nature and natural human impulses, patriarchal supremacy, and obedience to authority.

Catholicism was the antithesis of Algonquin culture. Since time immemorial, Algonquin peoples, saw rocks, plants, and animals as relatives and understood human dependence on their bounty. They practiced gratitude and respect for the natural environment, which was a gift central to all life. Algonquin peoples also had a spirit – Nanabozho (or *Tcakabech*) – as a key transmitted of life lessons and stories. An androgynous shape-shifter, Nanabozho learns through their errors and helps create the world. Generally, in Algonquin culture, gender was fluid, with a recognition that many people were two-spirited. Women were also highly respect and valued equally with men.

Missionaries' attempts to impose Catholicism on Algonquin peoples (e.g. through the cultural genocide of residential "schools") greatly disrupted Algonquin peoples ability to retain their values and way of life.

NON-INDIGENOUS SETTLEMENT AND EXPLOITATION OF WILDLIFE

From the time of Samuel de Champlain in the early 1600s, the Kichi Sibi and its tributaries were key waterways for the fur trade. Obadjiwon (Fort Timiskaming) was an important gathering place for Algonquin peoples and a centre for trade, cultural and spiritual exchange with Europeans. In 1821, a Hudson's Bay company trading post was established there. Such trading posts brought traffic, alcohol and disease (e.g. diptheria, typhoid, influenza, and tuberculosis) into Algonquin territories.

Records indicate that Algonquin Anishnaabeg gathered at Lac des Allumettes, a wide part of the Ottawa River across from present-day Petawawa. Consequently, the Hudson's Bay Company (HBC) sent an apprentice trader in 1821 to Lac des Allumettes in order to intercept the Anishnaabeg as they came from their hunting grounds and be the first to trade with them. Although there was a small post at Fort Coulonge, the HBC decided to establish a trade post at Lac des Allumettes in 1823. Five years later, additional buildings were added. The Company named this frontier trading post Lac des Allumettes and later Fort William, after William McGillivray, the Managing Director of the Northwest Company.

Though the post was a site where large numbers of Algonquins started for their hunting-grounds, the amount of furs did not compensate for the expense of maintaining the establishment. In the 1830s under the tenure of Nicholas Brown, the post added a farm in order to sell provisions to lumber companies for their camps. Lumber camps needed vegetables to feed the shantymen, feed for their horses, and other provisions. The post adjusted its merchandise to serve these camps and local settlers.

Figure 3: Hudson Bay Company traders bringing out furs and rolls of birchbark out to the Ottawa River from Lake Kipawa in 1902.

By 1844, the Lac des Allumettes Post had taken over most of the trade with the Algonquins of the region. Under the management of Hector McKenzie, the Post was profitable from retail trade with lumber companies and the settlers. Settlers came to the area in the 1830s, some to seek land while many of them worked in lumbering. Some Irish squatters were living around the post and the HBC quickly secured title to the 800 acres of land used for the post's operations including the farm.

This encroachment would only increase in the coming years. Many fur-traders would take up farming from the Ottawa Valley all the way to the head of Lake Timiskaming. Relatedly, the Oblate clergy promoted major colonization schemes in these same areas, to the shores of the Georgian Bay on the west. These farmers displaced Algonquin peoples from large swaths of land. Although governments encouraging Algonquin peoples to take up farming, the best lands were given to settlers.

As settlements and industry grew, the pressure of wildlife increased dramatically. In the late 1800s, Quebec began selling lakes, rivers, and hunting territories to exclusive hunting and game clubs. Algonquin territory became dotted with "no-go" zones, while non-Indigenous people poured into the region. By the 1920s, beaver and other fur-bearers were almost wiped out. Commercial fishers on Lake Timiskaming and Lake Kipawa also operated tugboats with large nets that dragged beneath the water, scooping everything in their path and destroying valuable fish habitats. Fish stocks became seriously diminished in the first decade of the 20th century.

In the 1940s, Quebec introduced a registered trapline system, which resulted in many Algonquin territories being licensed to non-Indigenous people. Such provincial game and fishing regulations often forced Algonquin peoples hunt in secret. They feared fines or jail time for simply exercising their inherent rights and trying to make a living from the land.

FAILURE TO RESPECT TREATIES

As succinctly outlined in a presentation to the Federal Special Representative regarding Canada's Comprehensive Claims Policy:

> "Beginning in 1760 the Algonquins entered into a number of treaties with Great Britain: at Swegatchy and Kahnawake in 1760, and at Niagara in 1764. They were not land surrender treaties: these agreements assured the British of our alliance, and in turn the British promised, among other things, to respect and protect our Aboriginal title and rights. In addition, the Royal Proclamation of 1763 applies to our traditional territory: it guaranteed that our lands would be protected from encroachment, and that they would only be shared with settlers if and when we had provided our free and informed consent through treaty. Algonquin Chiefs were given copies of the Royal Proclamation by Sir William Johnson in 1763-64.
>
> Unfortunately, despite these commitments, the British Crown, and later the Canadian government, took our lands by force, without our consent, and without any compensation. Sixty years after the Royal Proclamation of 1763 had been given to them, our Chiefs still had their original copies, which they presented to government along with petitions for protection of their lands and just compensation. Instead of dealing with them honestly, government ignored its commitments and continued to take the land without treaty and without consent. Our people suffered greatly as a result, even as those around them became rich from the furs, timber, minerals and other resources."

In 1791, the Ontario-Quebec (Upper and Lower Canada) border was fixed with no regard to Algonquin governance and use. As a result, Algonquin peoples found themselves having to deal with multiple levels of hostile governments (in two languages not their own) whose relentless and express policies were to assimilate the "Indians" and to take their lands and future from them.

As well, we have seen considerable impact to their rights, culture and social fabric from other treaty processes: the Robinson-Huron Treaty of 1850 and the Williams Treaties of 1923 which affect their claims on the Ontario side of the Ottawa River. More recently, the Algonquins of Ontario are having an impact.

STATE CONTROL OF FIRST NATIONS' WAY OF LIFE

The notorious *Indian Act*, first enacted in 1876, was a key legal tool used to oppress First Nations people in Canada. The Act was premised on a paternalistic, assimilatory approach to First Nations. Among other devastating things, the Act:

- set up the reserve system, which corralled First Nations people to severely limited land bases (often without consultation);
- neutered First Nations' ability to organize and defend their rights, by making it illegal for First Nations people to gather in groups of more than three; leave the reserve without a pass; to hire a lawyer; or own property;
- disrupted First Nations' ability to express and pass on their culture, by making it illegal to practice religious ceremonies and cultural gatherings (such as the potlach, powwows, and the sun-dance);
- imposed discriminatory rules of who is and is not an "Indian", and therefore received certain privileges under the Act (e.g. women could lose their status if their husbands died or abandoned them); and
- set up a foreign governance system, the band council, which was designed to turn families and members against each other.

The Act has undergone many amendments since it was first passed. However, the oppressive assumptions underlying the Act remain, both throughout the Act itself and in various government actions towards Indigenous peoples today. Governments have yet to recognize Indigenous peoples' inherent jurisdiction over themselves and their territories. The theft of Indigenous peoples' control and governance over themselves continues to have devastating impacts on communities today.

INDUSTRIAL DEVELOPMENT

Settlements and industrial development were mutually reinforcing. Settlers increased as industry grew, and vice versa. Many sites of industrial development had negative effects on the environment, which further limited Algonquin peoples' ability to practice their rights and way of life. Further, for almost all of history, Algonquin peoples have not been consulted about any of this industrial development, and were never offered any of the economic profits of same.

For instance, there are 50 dams within the Kichi Sibi watershed. Seven are on the main course of the river, forming more than 14 billion cubic meters of water storage capacity. Beginning around the 1880s, vast areas were flooded and natural rapids eliminated, as the river was changed to enable easier access for settlers and industry, to control water levels, and to provide hydro-electricity. On the SART territory, there are numerous dams, including a major dam at the outlet of Lake Timiskaming; the Otto Holden Dam near Mattawa; the Des Joachims Generating Station ("**Da Swisha**"); and the Quinze River Dam, to name a few.

These dams have altered the natural flow of water bodies, with numerous and continuing butterfly effects. Dams have altered bird habitat, such as mud flats. They have blocked migratory species like American shad and eels. Indeed, the American eel – once a mainstay of the Algonquin diet, prized as highly nutritious travelling food – has practically disappeared from Algonquin territory. More generally, unnatural fluctuations of water levels, siltation behind the dams and the trapping of pollution from upstream agricultural and industrial uses has meant that few First Nations people can depend on the river for fish or on the vegetation around it for food.

Not only has the flow of waters changed, but also the quality. For instance, the paper and pulp mills (like the one established in the early 1900s near Timiskaming) release not only effluents into the water, but also emissions into the atmosphere. Similarly, mining operations has impacted water quality – consider the legacy of arsenic contamination from cobalt and silver mine tailings established in the early 1900s near Cobalt, Ontario.

NUCLEARIZATION ON THE KICHI SIBI

Finally, nuclear development looms large on Algonquin territory. Nuclear activities result in waste, not only radioactive but also chemical.

Location on Algonquin territory

The nuclearization of a very large area of Algonquin territory started over 70 years ago, with the construction of the CRL site on the Kichi Sibi. Across from the CRL site, 150 meters above the Kichi Sibi, there is a rock face known as Migizi Kiishkaabikaan or "Oiseau Rock".

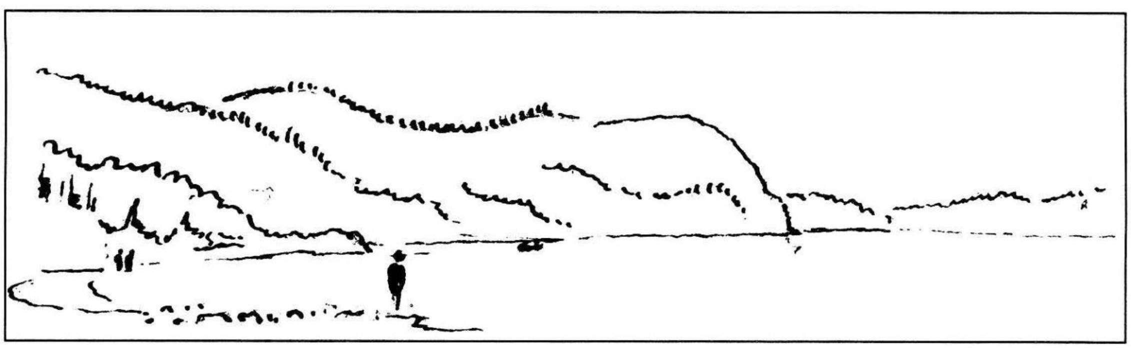


Figure 4: View of Migizi Kiishkaabikaan (The Journal of Sir William E. Logan, 1845-1846, p. 134)

Indigenous peoples painted pictographs at this sacred site at least several hundred years ago. There are 77 pictographs including fish, people in canoes, tally marks, a human like figure, arrows, an archer, thunderbirds, arrowheads, and a bear, many of which are covered with graffiti. This is only one reminder of how important the Kichi Sibi and the surrounding area of the CRL site is to Algonquin peoples.

Figures 5 and 6: Migizi Kiishkaabikaan and graffiti covering pictographs (Dagmara Zawadska)

Figure 7: Graffiti at Oiseau Rock (Perry Mongrain)

The CRL site also includes Pointe au Baptême. When fur trader Alexander Henry made his first voyage up the Ottawa River in 1761, he commented on “the riveiere Creuse, twenty six miles in length where the water flows, with a gently current, at the foot of a high mountainous, barren and rocky country, on the north, and has low sandy soil on the south. On this southern side, is a remarkable point of sand, stretching into the stream, and on which it is customary to baptize novices.”

William Logan, an early geological surveyor from the mid-1800s, noted that Indigenous people in his party baptized first time travelers at Point au Baptême, across from Oiseau Rock, and conducted naming ceremonies there.

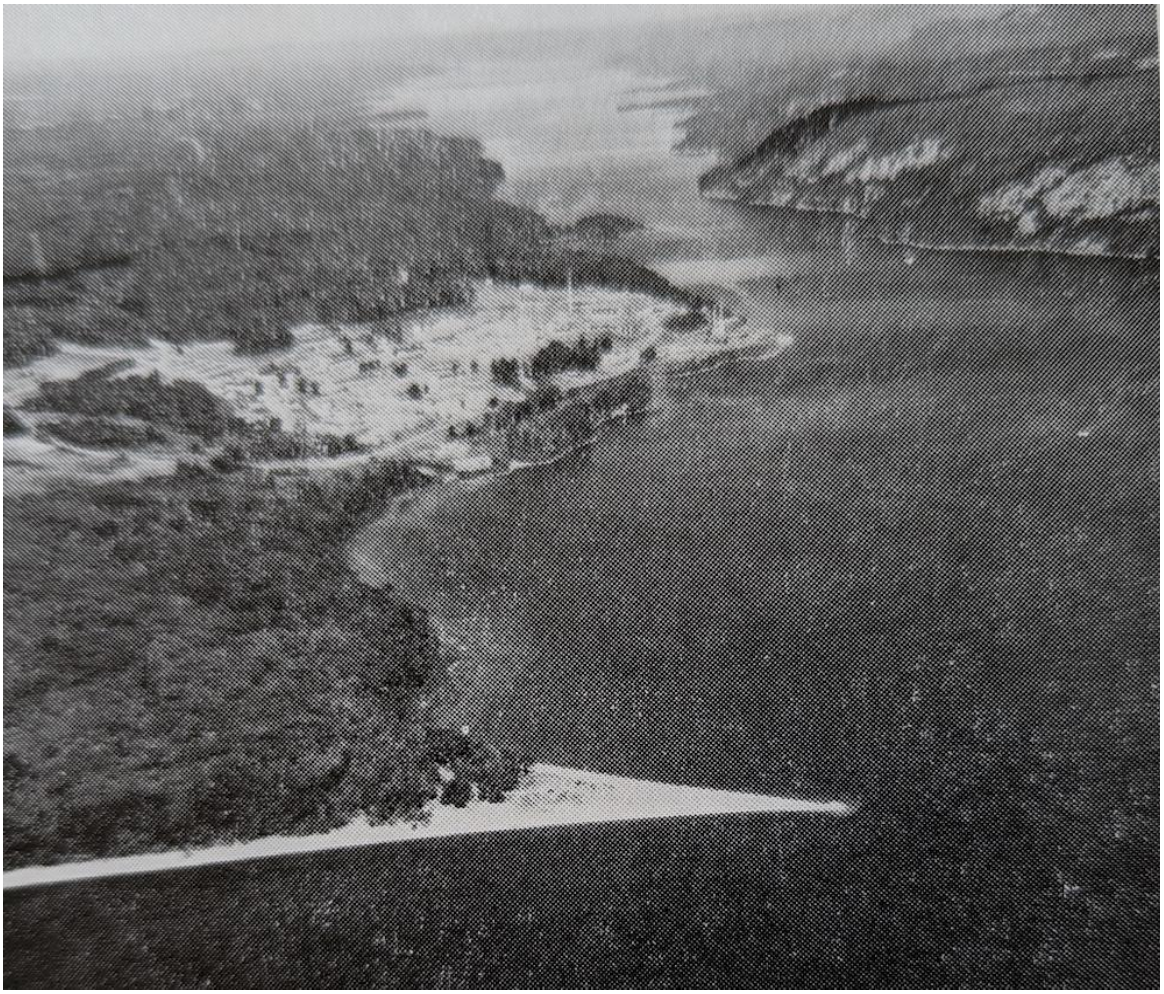


Figure 8: Photo of Point au Baptheme shaped like an arrowhead (Cliff Baskin)

Despite the cultural importance of this area to Algonquin peoples, the CRL site and Point au Baptheme was appropriated from them without any consent (let alone consultation). KFN (like other Algonquin First Nations) have historically been excluded from decision-making about the site. Currently, the CRL site is fenced off and there is no public access available. This site is important in terms of Algonquin Anishinaabeg ceremonial jurisdiction.

This denial of ceremonial jurisdiction is inconsistent with the historical ceremonial significance of the site. It also runs afoul of several articles in the UN Declaration of the Rights of Indigenous Peoples that recognize First Nations' rights to:

- their lands, territories, and resources (Articles 25, 26, 28, 29, 32), including the right "maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard" (Article 25);
- the practice and revitalization of their cultural traditions and customs (Article 11);
- the continued practice of their spiritual and religious traditions; the maintenance, protection, and private access to their religious and cultural sites; and the use and control of ceremonial objects (Article 12);

- the designation and retention of their own names for communities, places, and persons (Article 13); and
- the maintenance, control, protection, and development of their cultural heritage, traditional knowledge and traditional cultural expressions (Article 31).

Historic operations at the CRL site

During WWII, Canada joined the US and the UK in their efforts to produce a nuclear bomb. The fission of uranium, the method used to harness the energy found within the atom, was discovered in 1939. Scientists from the UK, the US and France collaborated to design the zeroenergy experimental pile ("**ZEEP**") reactor. It was decided to build the ZEEP at Chalk River because of its remote location, supply of deep water, background levels of geological radiation in the area and access to electricity.

The ZEEP was a small prototype reactor constructed to prove that natural uranium and heavy water could be used to create and sustain nuclear fission (also known as achieving "criticality"). The reactor was also used to demonstrate the design's potential to generate plutonium for the Allies' military programs. In September 1945, it was the first reactor to achieve criticality outside the US.

The ZEEP was followed by a larger reactor, the National Research Experiment ("**NRX**"), in 1947. The NRX operated for 45 years, being shut down permanently on 30 March 1993. A laboratory to extract plutonium from irradiated fuel rods from the NRX was developed and operated until 1954.

Although the owner of the CRL, the Atomic Energy of Canada Ltd. ("**AECL**") promotes the peaceful use of its nuclear energy, from 1955-1985 it provided 252 kgs of plutonium to the US for nuclear weapons (most prior to 1976). Between 1959 and 1964, plutonium contained in used nuclear fuel was exported to the US from Chalk River Laboratories to South Carolina, where it was processed and blended with the remaining US nuclear weapons program inventories.

In 1948, planning started for construction of a successor facility, the National Research Universal reactor ("**NRU**"), which started self-sustained operation (or "went critical") in 1957. It was ten times more powerful than NRX. The NRU was the test bed to develop fuels and materials for the CANDU reactor. At the time of its retirement on March 31, 2018, it was the world's oldest operating nuclear reactor.

In 1954 a group of engineers and scientists assembled at Chalk River to investigate the feasibility of building natural uranium heavy water reactors. The result was the Nuclear Power Demonstration Project ("**NPD**") at Rolphton. Construction at the site was initiated in 1958, the station was completed in 1962, and first critical was achieved in 1962.

Known accidents

1952. On December 12, the NRX reactor suffered a partial meltdown due to operator error and mechanical problems in the shut-off systems. About 10 kilocuries (400 TBq) of radioactive materials, contained in about 4,000 cubic metres of water, were dumped to the basement of the reactor building during the next few days.

The NRX reactor core and calandria, damaged beyond repair, were removed and buried on site and an improved replacement was installed. The refurbished reactor was operating again within two years. Clean-up of the site required several months of work, partially carried out by 150 US Navy personnel who had been training in the area.

1958. The second known accident, involved a fuel rupture and fire in the NRUreactor building. Some fuel rods were overheated. With a robotic crane, one of the rods with metallic uranium was pulled out of the reactor vessel. When the arm of the crane moved away from the vessel, the uranium caught fire and the rod broke. The largest part of the rod fell down into the containment vessel, still burning. The whole building was contaminated. The valves of the ventilation system were opened, and a large area outside the building was contaminated. The fire was extinguished by scientists and maintenance men.

2008. On December 5, heavy water containing tritium leaked from the NRU. The leaked water was contained within the facility. The public was informed of the shutdown at the reactor, but not the details of the leakage, since it was not deemed to pose a risk to the public or environment. The leak stopped before the source could be identified, and the reactor was restarted on December 11, 2008.

2009. In mid-May, the heavy water leak at the base of the NRU reactor vessel, first detected in 2008 returned at a greater rate and prompted another temporary shutdown that lasted until August 2010. The lengthy shutdown was necessary to first completely defuel the entire reactor, then ascertain the full extent of the corrosion to the vessel, and finally to effect the repairs. This was all with remote and restricted access from a minimum distance of 8 metres (26 ft) due to the residual radioactivity in the reactor vessel.

In an unrelated incident, the same reactor had been leaking 7,001 litres of light water per day from a crack in a weld of the reactor's reflector system. This water was being systematically collected, purified in an on-site Waste Treatment Centre, and eventually released to the Ottawa River.

Renovation, decommissioning and existing wastes

The NPD closed in 1987. AECL reports that nuclear fuel and non-nuclear equipment have been removed from the site, but much of the nuclear equipment (reactor vessel, pipes, tanks etc. that have become radioactive in the process of operation of the reactor) are still present. AECL intends to leave potentially active or contaminated equipment on site for some decades yet to allow for further radioactive decay.

The NRU reactor licence expired in 2016. However, the licence was extended to March 31, 2018. The reactor was shut down for the last time. on March 31, 2018, and has entered a “state of storage” prior to decommissioning operations which will continue for many years within the scope of future operating or decommissioning licences issued by the CNSC.

The site remains in active use. In 2016, $1.2 billion CAD was allotted over ten years to decommission 120 old buildings and build new ones. The new buildings were completed starting in 2020, as the Canadian Nuclear Laboratories Research Facilities. None of this was ever discussed with the Algonquins.

The Chalk River laboratory site has more than 70 per cent of all the radioactive waste ever produced by AECL and its predecessor, the National Research Council of Canada, in some form of storage on the 37-square-kilometre site. An estimated half of these federal nuclear legacy liabilities are the product of Cold War activities in the 1940s, 50s and 60s, with the remainder generated through research and development activities and other programs at the Chalk River Laboratory.

CNL stores liquid from fuel reprocessing (done between 1949 and 1956). The waste is stored in three tanks. The last transfer of radioactive liquid solutions to any of these storage tanks occurred in 1968, and no liquids have been added since then.

Between 1958 and 1960, AECL conducted some experiments to convert high-level radioactive liquid solutions into a solid (glass). The program generated 50 glass blocks, each weighing about 2 kilograms, which are now safely stored onsite.

AECL manages its ongoing production of low and intermediate level radioactive waste (L&ILRW) on site at Chalk River and provides a waste storage service at Chalk River for smaller producers on a fee-for-service basis.

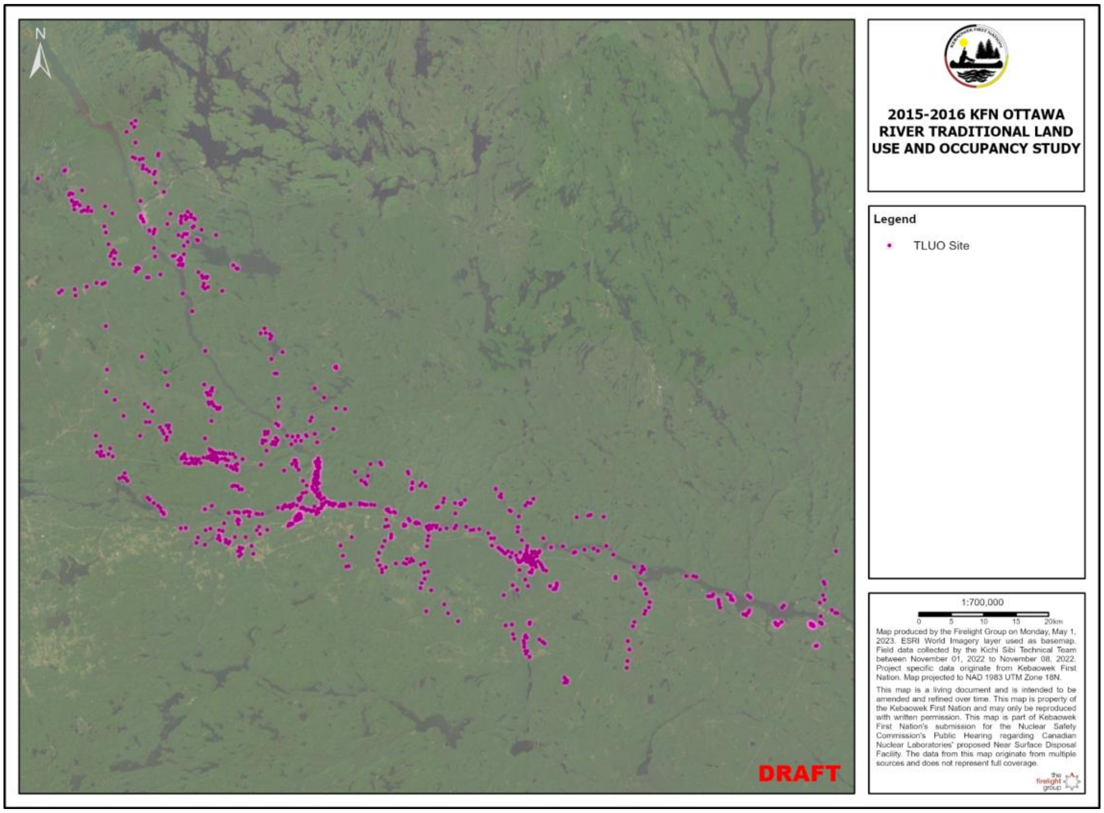
There are currently four different projects currently proposed and in environmental assessment at Chalk River, all of which affect the Algonquins on the Ottawa River and are of serious concern:

- An engineered dump for low level radioactive waste, called the Near Surface Disposal Facility (NSDF), which is being strongly opposed by Algonquins and by many citizen groups. An operational NSDF would allow CNL to dispose of the radioactive wastes from its Chalk River and Pinawa modernization projects, conduct environmental remediation by moving contaminated soils on site to the facility, and accept other AECL low level waste.
- The Advanced New Materials Research Centre facility to develop small scale nuclear reactors for use in places like remote mines, and to research and undertake the reprocessing of radioactive fuel.
- The decommissioning of the Nuclear Power Demonstration Project at Rolphton which contemplates en-tombing radioactive materials from the site in concrete and leaving them beside the KichiSibi in perpetuity.
- The Global First Power/OPG Micro Modular Nuclear Reactor Demonstration Project.

Radioactive loads in water and sediment above levels to which the aquatic biota of a given ecosystem are adapted can have drastic negative effects on the health and survival of the organisms in that waterbody including endangered hickory nut mussel. An influx of suspended sediment into a system, whether as a result of a natural or anthropogenic disturbance can negatively influence water quality, impact biodiversity and composition of biological communities, decrease reproductive capacity and growth rates of fish, increase disease incidence of fish, modify migration patterns of fish and alter feeding success in site-feeding species. As such, cumulative impact to the aquatic biota from the NRX reactor outlet in situ contamination zone and nonradioactive contaminants and tritium from the NSDF wastewater into the Perch Creek outlet is of special concern to KFN.

V. Land use and occupancy

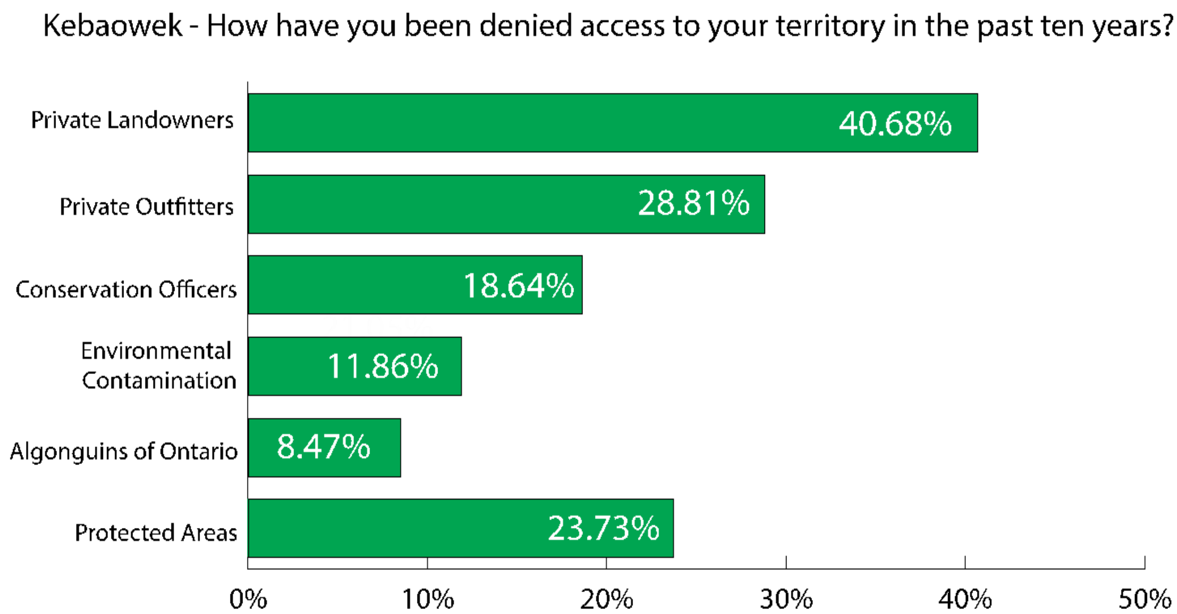
In 2015 and 2016, KFN conducted a survey to obtain baseline inventory of harvesting and fixed cultural sites that living KFN members had used during their lifetimes. From November 2015 to May 2016, 46 members completed individual map-biography interviews to determine where they had engaged in each of 53 different land use activities. They mapped 10,344 features, including some in and around the Chalk River.



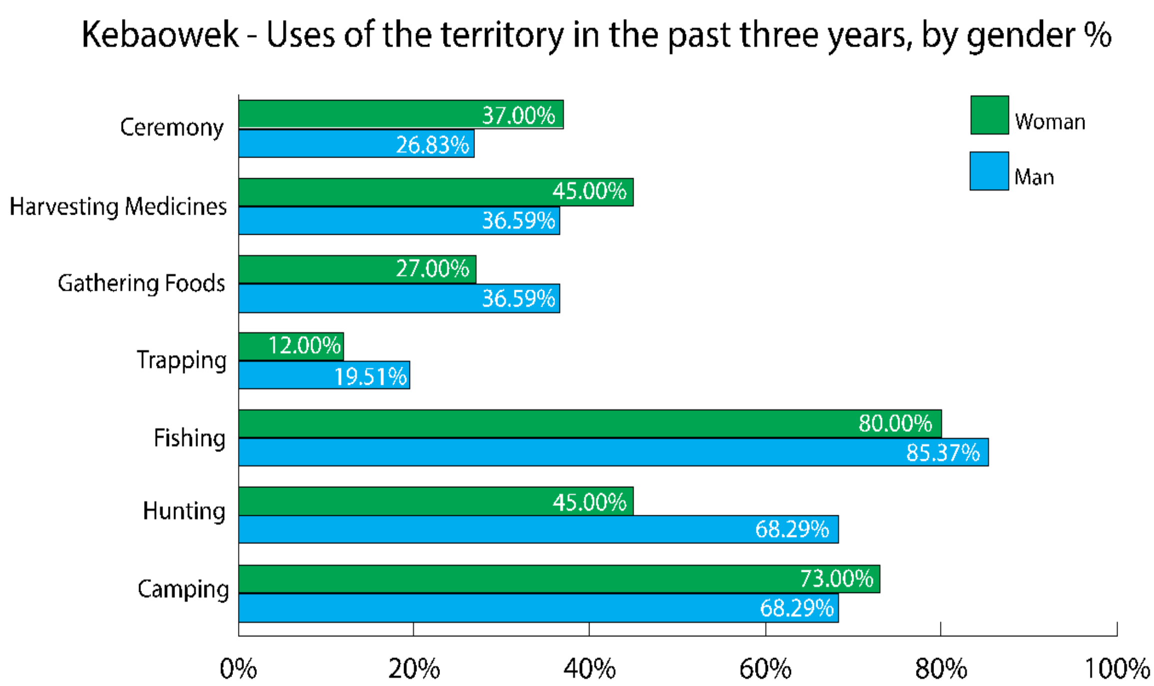
From 2022-2023, KFN became involved in the acquisition of forestry operations at Swisha as well as the development of an Indigenous Protected Conservation Area at Fitzpatrick Island near Allumette and Morrision Islands in the Ottawa River. This has increased KFN member activity in the area. In May 2023, Kebaowek completed a Rights Impact Survey related to the NSDF project which has presented more opportunities for land use and occupancy mapping of rights and responsibilities data collection in the area. This land use and occupancy information is not comprehensive, but it does provide a robust sample of the exercise of rights, livelihood, and cultural practices, and continued current use of lands and resources by the community members within Algonquin traditional territory.

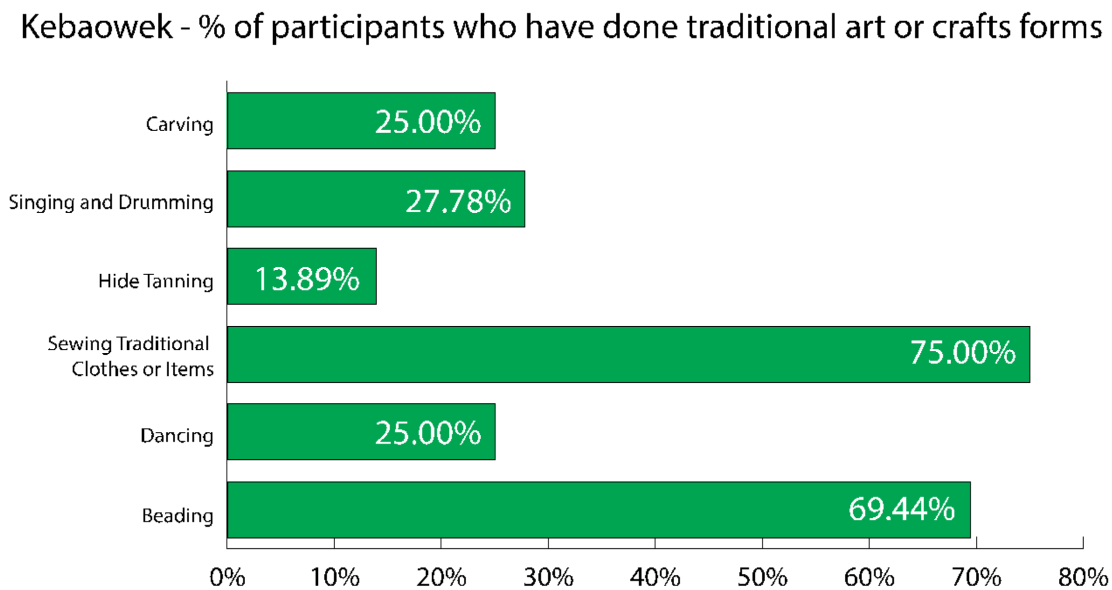
Of course, we must remember that contemporary land use and occupancy requires access to lands and waters. The cumulative effects of colonialism (such as the Catholic church, non-Indigenous settlement and theft of land, industrial development without consent, and legal oppression, as outlined earlier) had a devastating effect on KFN members' ability to access and use their land.

In the survey conducted for this SCEIA, approximately 79% of male respondents and 82% of female respondents reported they did not get to practice traditional activities as much as they would like to. Notably, members reported various ways they have been denied access to their traditional territory, as follows (members could select multiple answers):

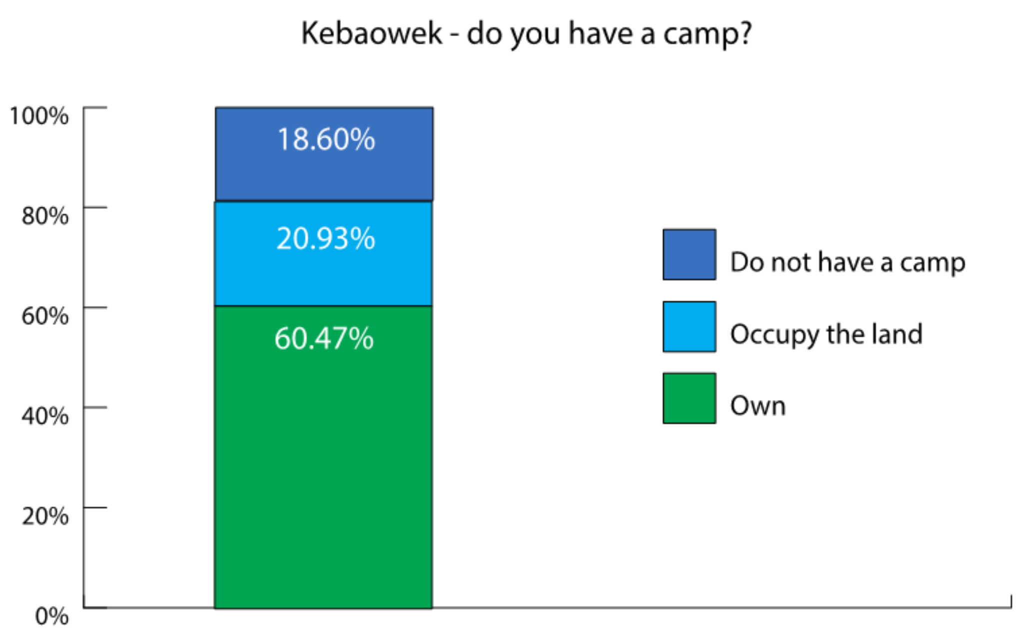


Despite such obstacles, KFN members are resilient. Many are on a journey to reclaim their territory, jurisdiction, and ability to exercise their rights freely. Members continue to use the territory for various cultural activities, as outlined below in the following graphs:



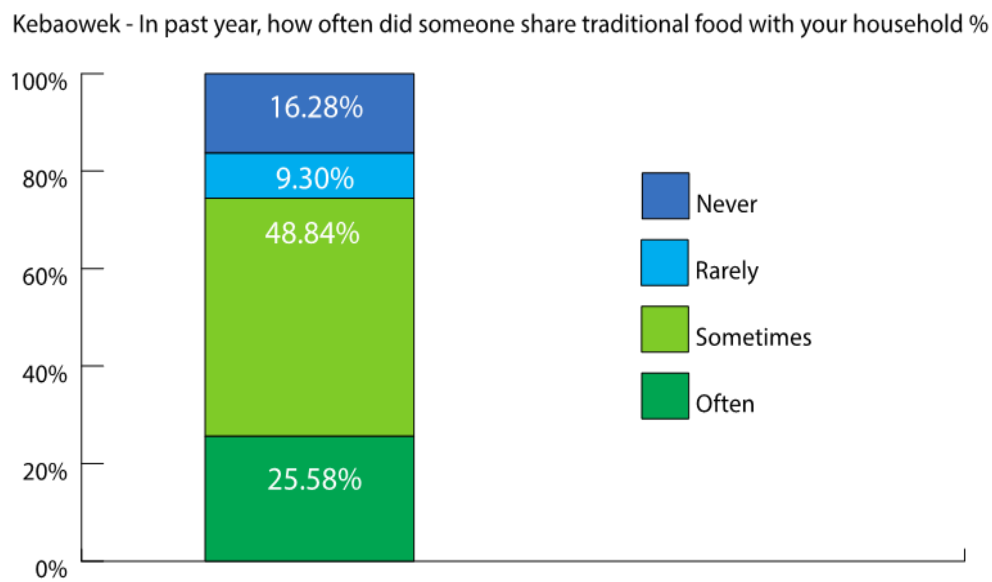


For KFN, the camp is a particularly important place for cultural activities. It is the place where families reconnect with one another around the campfire; where games are played, stories are told, values are transmitted; and where members can connect with our ancestors. In these ways, the "camp" is more a home than a house or apartment where one has to live to work. The camp may be anything from a lean-to to a modern summer home with a generator or solar power, and a septic system. Most members report having a camp, as outlined below:



Fishing is also an important activity for members. KFN members caught an average of 62.48 fish a year. Most learn where, when, and how to do so from elders and relatives. Fishing is done by rod and by net. Winter is no obstacle, as members regularly ice fish.

A traditional practice of sharing country foods, like wild-caught fish, also remains important for KFN members. Approximate 75 per cent of surveyed members reported that someone “often” or “sometimes” shared traditional food with their household in the past year. On average, respondents also reported they shared their harvest with 2-3 households. This reflects how traditional foods and sharing is an important part of members’ lives.



VI. Socio-cultural fabric

DEMOGRAPHICS

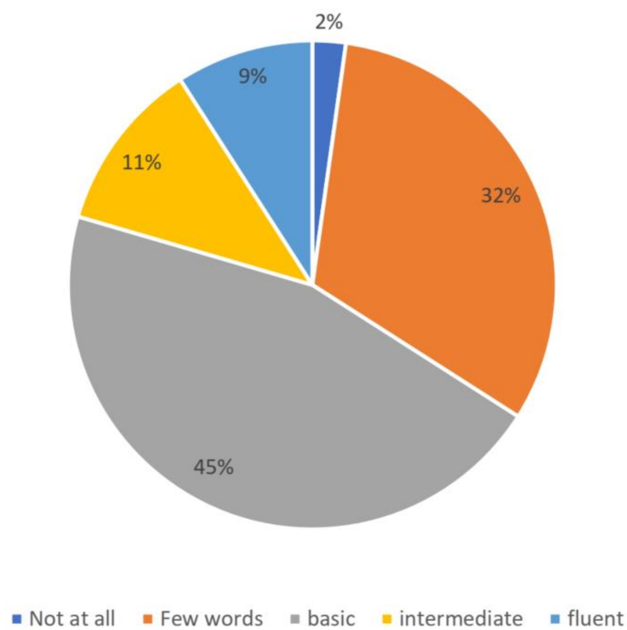
On reserve, the population is divided relatively equal between men and women. The median age on is 45.7. Unfortunately, there was no data for members who lived off reserve. Many respondents reported living outside of the community for a considerable amount of time. However, their attachment to the community remains strong.

In Algonquin communities, the extended family is a crucial social unit. It is a network of relationships based on trust, caring, sharing, and an informal economy. Most of it exists outside what can be measured in dollars. Some of it, like health care centers, daycares and schools, homecare workers, emergency services and food banks, are now established as paid work in the communities. But none of these institutions can function without volunteer effort from band members. Outside of reserve communities, band members work with others to create culturally safe spaces in Friendship Centers and organizations like Mino M’shkiki.

Despite working full time, we find time to volunteer for annual and continuing community events and activities like sports and the food banks, to care for children, elders and disabled persons, to barter and trade with one another for services. Women undertake most of the caring work. What becomes clear from our survey is that the culture of caring for one another is still an important part of our way of life, even when wage labour and disabilities use up so much time. The social fabric is, however, overstretched and fragile.

LANGUAGE

Members speak English on a daily basis, while knowledge of French is varied. Only 2% reported being fluent in French.



The fact that most members do not speak French fluently causes serious problems. French language proficiency is a condition of most employment in Quebec. Most services in Quebec are only grudgingly provided in English. As a result, KFN members must rely heavily on services and job opportunities in English-speaking Ontario.

As for the Algonquin language, Algonquins of the upper Kichi Sibi have lost most of our fluent language speakers. A number of community-based studies and most key informants said that reclaiming their ability to speak and understand Algonquin was a very high priority for the members. Revitalizing the language is key to rebuilding culture.

There were, however, many barriers to doing this, besides the lack of fluent Algonquin speakers. The dialect for the upper Kichi Sibi communities differs somewhat from that in the southern reaches of the River. People who continue to speak the language are over-worked already, and it is difficult to find teachers.

WELLNESS

Respondents (especially the women) indicated that alcohol, drug use, lateral violence (especially on social media) and bullying were major concerns. These diseases of despair permeate all aspects of community life and result from years of well-documented oppression. The health centres all have many different programs to try to prevent addictions and alleviate damage, but do not feel they are particularly effective. On the other hand, overdose and suicide rates are low, and more members are seeking help for mental health issues.

Both health care systems in Ontario and Quebec are suffering from a serious shortage of health care workers, especially nurses. While KFN delivers some community and wellness programs, we have to compete with urban centres and mines for staff.

VII. Economic factors

HOUSING

Housing on reserve is in fair to good condition and there is little overcrowding. However, there is not adequate housing to meet the needs of members who want to move home, or to retain young members who want their own place. KFN plants to offer more lots for owner-builds in the near future, but these will still not be enough to meet the demand. The housing "department" is one person, with maintenance support, so work overload is an issue. Getting decent off-reserve housing – especially for low income members – is a real problem, especially for women.

EDUCATION

Traditionally, children learn through observation and modelling of behaviors, and through activities on the land. This is still the preferred way to pass on traditional knowledge, although the lack of elders and mentors has become more severe with succeeding generations.

It has been a struggle to get a good education for our children in the Quebec school system. For decades, many children attended the Guy-Théberge school in Timiskaming. This school has a French and English program, each part of a different school board. The English program has been substantially underfunded and neglected by Quebec, leaving Indigenous children with sub-standard education.

Due to the high drop-out rate that that high school, many parents decided to send their children to schools in Ontario, or relocate to Ontario generally. This creates funding issues, since Quebec pays less for schooling than Ontario. KFN has had to make up the difference out of its federal funding allocation, and now pays for buses to take children to and from Ontario schools. This work around has greatly helped educational outcomes, though it does not address the high drop-out rate amongst adult members.

KFN also has its own daycare which offers cultural program and language learning.

EMPLOYMENT

A major source of employment is the forestry industry (in particular Rayonnier Advanced Materials in Timiskaming, and for harvesting, GreenFirst). KFN has agreements through the province with these companies. They attempt to limit permanent damage to the forest, protect special places, and provide subcontracts for the band businesses and jobs for members.

The other major employer on reserve is the band, which is dependent on both block and project funding from the federal and provincial governments. Tough advocacy in recent years has increased the amount of money available to reserve communities from governments. However, funding has not increased for off-reserve Indigenous organizations.

There is shortage of people to work on reserve, which adds strain to already-overworked staff. Large, nearby projects with high wages often produce a “skimming effect”, which draws workers away from the reserve (e.g. somebody trained as a nurse going to work for the mines). Limited housing on reserve also affects peoples’ ability to work in the community.

The other very serious problem, both on and off-reserve is the incredibly low and punitive disability and social-assistance rates – set by the provinces- available for those 30% of indigenous people who are unable to work for one reason or another.

TRANSPORTATION

There is no public transportation to, from, or in the reserve or from our closest neighbouring communities. Members regularly travel long distances for school, shopping, health reasons, visiting family and friends, harvesting and so on. We cope by owning a vehicle and by giving rides to neighbours and family. Such travel is expensive, time consuming and dangerous. Any increased traffic on well-used roads is of serious concern.

FOOD SECURITY/SCARCITY

Historically, Algonquin peoples obtained all the food we needed from our lands and waters. We regulated our own behaviour to protect that supply.

These rights and food sources have been seriously depleted, as outlined in the cumulative impacts section. Many people no longer fish in the Kichi Sibi due to fear of contamination. Wild rice beds have been destroyed by dams. There is serious competition from non-Indigenous hunters for moose harvesting on the territory.

The cost of obtaining food is a serious issue for many members. KFN does not have a grocery store on reserve, and members do their major shopping in Ontario cities (especially North Bay). Getting the food requires driving quite long distances. This is expensive and time consuming.

Many people both on and off reserve indicated that they ran short of food from time to time and that they needed to use a food bank to manage.

VIII. Legal-political issues

POLICING

KFN has an Indigenous police service, but it is small and underfunded, without the same status as non-Indigenous police forces. We have been working with Timiskaming First Nation and Long Point First Nation to create an Algonquin Police Force which would provide 100% of public security services in the three First Nations. It would provide equity in employment salaries and conditions with the Quebec Provincial Police.

Our community does not have a restorative justice program, but are following a pilot project at Kitigaan Zibi First Nation with interest.

Most police files are related to lateral violence, drugs, and alcohol. Members generally indicated that they generally felt safe in their communities, and they thought the police would help them if necessary. A few key informants complained that the police force was young, inexperienced and non-Indigenous.

GOVERNANCE

The *Indian Act*'s imposition of band membership and band councils have made it very difficult for KFN to maintain their own system of governance (e.g. customary leadership selection).

Band governance and administration is determined largely by interactions with government funding sources, and with any own-source revenue we are able to get. We struggle to the skilled people we need to do the work of running a small municipality, including negotiating with more than three levels of government and various industry players. As a result, we are often dependent on outside technical advisors to do this work, at rates that are established by a market outside our control. Trying to explain all of this to our members is difficult and can lead to serious misunderstandings and community conflicts.

Chief and council are elected every two years. There are three councillors.

The federal government expects the Chief to be a micro-managing band administrator, which means that there can be little time or resources left to strategize and resist government and industry political agendas, to reclaim indigenous self-government, or to communicate with the band members. KFN consistently rejects this expectation. We insist that the Chief's role is to handle political negotiations with governments for control and funding, to make agreements with other First Nations, and to hire competent staff to run the band administration.

The Councils have given band managers and department heads more authority over the administration of their departments. Our investment in post-secondary education for our members is an important aspect of this.

APPENDIX B: COMMUNITY SURVEY REGARDING THE NSDF

In March 2023, KFN conducted a community survey regarding the CRL site, the NSDF project, and potentially impact rights. The survey addressed topics like:

- what cultural practices members engage in around the CRL site;
- the ease of engaging in these cultural practices around the CRL site;
- whether members would hunt, fish, trap or forage at or near the CRL site;
- the nature of members' relationship with animals, particularly bear, wolves, clams and Lake Sturgeon;
- the nature of members' relationship with the natural environment, including the Kichi Sibi;
- the amount of wild foods that members consume;
- members' knowledge of and concerns regarding the NSDF.

KFN received 113 responses. Given the time constraints of the Procedural Direction, a detailed analysis with accessible graphics and explanations on methodology is still underway. We have included a preliminary, general snapshot of data below.

Members were asked what Algonquin "cultural activities, traditions, customs, or rights" they engaged in around the CRL site. Their answers are summarized in the following table:

Activity	**Approximate % of members engaging in the activity**	**Species or resources harvested, or type of activities engaged in**
Hunting	32%	Partridge, turkey, moose, deer, bear, rabbit, small game, beaver, marten, otter, muskrat
Fishing	42%	Pickerel, lake trout, pike trout, walleye, bass, sucker, catfish, rock bass, sunfish, smelts, whitefish, silverfish, sturgeon
Harvesting/ gathering/ foraging	31%	Chaga, wild edibles, medicines, firewood, wintergreen, berries (blueberries, rasberries, pin cherries, cranberries, strawberries, goose berries), mushrooms, cedar, sage, sweetgrass, mint, acorn, nuts, maple syrup, wild garlic, rhubarb, pine needles, balsam gum, skunk root, lycopodium mullein, jewelweed, hemlock, "all of our foods are in this area"
Spiritual/ ceremony	12%	Visiting Oiseau Rock, offering tobacco, taking in "the beauty of the area" and "feeling of connection knowing that our ancestors were here", smudging, offering, praying, sweat lodge, picking medicine, drumming, fall feast, cleansing, fasting, full moon ceremony

Many respondents also reported they engaged in activities like boating, swimming, prospecting, hiking, canoeing, picking rocks, tree planting, exploring trails, and having family gatherings in the area.

About 27% of respondents said that wild foods make up 25%-50% of their diet. A little less than 1% of respondent said that wild foods make up more than 50% of their diet.

Approximately three quarters of respondents consider their relationship animals to be sacred. They identified various reasons behind this belief, such as a respect for animals as equals on this Earth, who help maintain and teach us about the circle of life, and who we share resources with. For instance, members wrote:

- "Many such as bear, moose, deer, etc, feed us. They also clothe us. They also without realizing help the environment by leaving carcasses that enrich the soil and by eating greenery" which "promotes growth"
- Animals "provide a food source to sustain us" and "teach us to maintain the delicate balance of living in harmony with the natural world".
- "They are fellow beings sharing the same resources as us. To abuse the gifts they provide is to abuse one's own right to live and the rights of future generations to have a healthy bountiful place to live. All animals and resources either above or below the earth must be treated with respect if you wish to be able to respect yourself."
- "We live side by side and they give themselves so we can live."
- "We are all connected. Each soul is valuable. As the dominant species of this planet we humans do not get to choose what life is lesser. We all share this Earth."

Respondents also identified a spiritual element in their relationship with animals, identifying them as "sacred spirits" or "spirits of our ancestors" that must be protected.

- Animals are "Elder spirits and when we kill, we offer tobacco and thank them for giving their life so we can eat."
- One member recalled receiving messages from owls, who are considered messenger birds.
- Another member wrote that "I feel certain wolves are actually our ancestors. One wolf lying alone on a beach in Grassy Lake, just like a lion, watches us closely in our boat. Then trotted away slowly when we approached. We had just lost my mother-in-law in previous months and she had her hair color match the fur color."
- "I believe they are giving us signs, communicating messages, watching over us."

Respondents expressed a strong and clear understanding of their responsibility to protect animals and the natural environment more generally. Specifically, members were asked to rate how much they agree with the following statement: "Kebaowek First Nation and it's members are guardians of the land, water, animals, plants and resources in Algonquin territory". Virtually all responses agreed or strongly agreed with this statement.

Respondents described a variety of responsibilities they understood they have in relation to the natural environment in and around the CRL site. Answers include the following:

- "To obtain as much information as possible and stay on top of what the CRL is doing…To occupy the land and conduct studies on how our resources and lands wildlife have been impacted by the CRL to be the eyes ears and messengers for the animals who cannnot speak."

- "As a member of KFN and direct ancestor of original stewards of the land I feel its important to make sure there is no danger directly placed on our territory and to keep it protected from possible disaster, especially radiation and a huge altering of the animals home by clearing the land for the plant to be built."
- "Mother Earth supplies us with so much food plants as food and medicines. It's our responsibility to keep mother earth clean and safe for everyone to have clean water to drink."
- "I have a responsibility to speak up for my relations. The world is currently in a major shift, we have to ensure that it does not go beyond repair so that the next 7 generations have a chance to live."
- "We as First Nations people have to be the voice for our native land and environment before its ruined by commercialism."
- "As stewards of the land, water and animals, we need to be the voice in order to ensure that these things are protected. The government and big businesses can't be left to assume that they will take care of the above mentioned…It is up to us to monitor what is happening in our territory."
- "Protect our waterways and water quality because water is life. We must protect our land because this is our home. We must protect our wildlife because they are what feed us (we must only take what we need)."
- "I believe as First Nation people we must preserve and protect anything and everything on the land and on the waters. No matter where it is located or the distance. If its our traditional territory we must do our best to protect it for future generations."

Respondents were specifically asked whether certain species had special significance for them. Their responses are outlined in the table below.

Animal	**Approximate % of members answering that the animal has a special significance to them**	**Examples reasons why the animal had a special significance**
Bear (and bear dens)	60%	Members identified that the bear is a "powerful spirit" in Algonquin culture, that is "held in the highest regard" and is "sacred". The bear was identified as a symbol of a brother or sister, and "relay the message of courage". Several respondents reported being part of or associated with the bear clan. One member noted that bears "carry the knowledge of medicines" and they "show up to help when I need them". Members also noted that bears play an important part in the ecosystem by catching fish and leaving carcasses in the

		bush to nourish the soil, as well as eat berries and spreading their seeds to regenerate. Bear dens were acknowledged as necessary for their hibernation. Their “livelihood depends on their security of their homes” and “our homes go unbothered, so should theirs”.
Wolf (and wolf dens)	61%	Wolves were identified as another important animal in Algonquin culture, with some members identifying they are part of or associated with the wolf clan. Like the bear, wolves are “powerful spirits in the bush” that symbolize guardianship, loyalty, and being humble and not arrogant. Members noted their dens are important - “if we destroy their dens we upset the balance of nature”. Wolves were also identified as a true sign to a healthy environment.
Freshwater clams	34%	Members repeatedly identified clams help filter the water and help indicate water quality or health. They also provide a good food source to people.
Lake sturgeon	39%	One member report that “Elders say they were a primary food source and prove many assets to our lives”. For instance, the skin is used for containers, glue is extracted from the bladders, arrowheads made from tailbone, their eggs can be eaten, and generally, the fish is used in special offerings or ceremonies. These fish also transport the eggs of clams in their gills.

When asked whether, given an opportunity, they would hunt, fish, trap, or forage at or near (within a 10km radius) of the CRL site, approximately 60% of respondents answered “no”. Similarly, approximately 60% of respondents also said they would not eat game, fish, or plants that were taken from or near (within a 10km radius) of the CRL site. A large majority of answers cited concerns around contamination. As one member described, they would know they are “walking on soil that’s poison. How can we feel sacred knowing that our walk there is not in balance or harmony.” Another member noted “I have previously hunted and fished in the CRL site would like to continue without fear of radionucleides”.

Relatedly, respondents do not appear to have much trust in CNL. Less than 10% said that they trusted CNL to protect them from radiation at the CRL site. Many respondents had concerns about the NSDF, including worries about a catastrophic event or accident; risks of contamination; and uncertainty about long term environmental reprecussions. Some representative answers include:

- “We cut into Mother Earth for temporary gain leaving a lifetime of impacts that cannot be undone.”

- “As an Indigenous person, I feel that it is our right to have concerns. This site may not be directly in my backyard but it will affect land, water, animals and plants for many years to come. My concerns include; future consultations, probability of contamination and leaking, protection of lands, waters, plants and animals in site area and long term assessments.”
- “There is no way that Mother Earth can filter anything but natural waste. All other man made waste will eventually seep into our rivers, lakes, streams over time.”
- “As previously stated, storing waste of this magnitude has lots of potential for leaking into the ground and eventually into the Ottawa River. Membranes erode and eventually leak. There has been many times that do this procedure and from what I understand, membranes breakdown over time, and then the problems begin. We may not see them in our lifetime but it could happen. And if it does then, everything below that area could be affected.”
- “Once the damage is done, they are nowhere to be found. We the people suffer and need to do the cleanup.”
- “I'm afraid it may leak into the river and contaminate the river closer to where I live and also the Ottawa River is so large it could potentially ruin the territory near the site and those people may need to come hunt and fish closer to me. That could strain the resources.”
- “Obviously the concerns for me would be how much toxins/waste actually seeps through the grounds and waters making it unsafe to eat/harvest from our territory. Have all these scientists saying it's safe to get what they want only to apologize after the harm and damage is already done to our land.”
- “I don't think that mankind should be making things that they can't control and that can hurt everyone and everything all to make a dollar.”

Virtually all respondents agreed that KFN should be consulted about where the NSDF will be located.

APPENDIX C: AQUATIC ENVIRONMENT EXPERT REPORT

Comments and Concerns on Impacts to the Aquatic Environment of the Proposed Near Surface Disposal Facility at Chalk River, Ontario.

Prepared for Kebaowek First Nation
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Introduction

The following notes and comments were prepared on behalf of Kebaowek First Nation of Kipawa, Ontario expressing potential impacts of Near Surface Disposal Facility (NSDF) for treating low level nuclear waste (LLW) at the Chalk River Nuclear facility. Concerns and comments expressed will focus largely on the potential impacts to the aquatic environments downstream of the new disposal facility.

My credentials for commenting on the Environmental Impact Statement (EIS) for the NSDF include a master's degree in aquatic ecology from the University of Guelph where I studied the distribution dynamics of the larval stage of the zebra mussel in the great lakes. I currently work as an ecologist for a small environmental consulting company in North Bay, Ontario. Previously I taught in the biology department at Nipissing University with a focus on environmental science and freshwater biology courses. More recently, I have worked with the Kebaowek First Nation developing a conservation and monitoring plan for Lake Sturgeon in the Ottawa River, below the Temiskaming dam.

It has become evident through examination of the Section 5.5 Aquatic Environment of the EIS that the major issue of concern to the aquatic environment downstream of the new NSDF are the potentially elevated levels of tritium that will come from the new Wastewater Treatment Plant (WWTP). The effects of the effluent will potentially impact aquatic species at the population and community level in wetlands, Perch Lake, Perch Creek as well as the Ottawa River. Unfortunately, there is currently no effective method for reducing elevated levels of tritium in water apart from allowing the radioactivity to decay over time, reducing its potential to have deleterious effects on organisms and ecosystems that may be exposed to tritium.

Tritium is a radioactive isotope of water (a radionuclide) with a half- life of 12.3 years. It's a common by – product of nuclear reactors. As tritium decays, it emits a 'beta' particle, an ionizing form of radiation, as it decays into helium. The beta particle is the component of tritium that is potentially hazardous.

The beta particle given off by tritium when it decays is low energy, traveling about 6 mm in air, and unable to penetrate skin. Tritium is therefore only considered hazardous if taken into the body in large quantities by inhalation, skin absorption and ingestion. It can be taken into the body as tritiated water, however, more importantly, it can enter the body as organically bound tritium (OBT), where it may pose a slightly greater health risk as the body will retain it longer. It has no chemically toxic effects and is only a hazard due to the particle it emits. Exposure (in humans) very slightly elevates the probability of developing cancer over a lifetime. A person would have to take in billions of becquerels of tritium to cause any effects on health. (CNSC, 2012).

Tritium levels downstream of the NSDF

Page 207 of EIS. The discharge target for effluent from the WWTP into Perch Lake is 360,000 becquerels per liter (Bq/L) which will meet the discharge target into Perch Creek of 7,000 Bq/L the safe benchmark from the Ontario Provincial Water Quality guidelines. My question is, how can we be confident that this level of tritium will be achieved in Perch Creek when it comes into Perch Lake at such elevated levels?

Bio – accumulation and bio – magnification of Tritium

Since there is no treatment option of tritium other than radioactive decay over time, effluent discharge may at times be substantially elevated with a target of 360,000 becquerels. The ecological risk benchmark for tritium is 17,400,000 Bq/L, which is substantial margin of safety relative to the discharge levels. However, the EIS does not make any reference to the potential hazardous effects of bio – accumulation and bio – magnification in the tissues of aquatic organisms.

Radionuclide exposure, such as tritium, can drive macromolecule alteration, with DNA being a major target. This damage can ultimately have consequences at the population level, with the beta particle emission from tritium presenting a special risk to DNA (Adam – Guillermin et. al., 2012). Concluding that invertebrates are more sensitive than vertebrates, Adam – Guillermin et. al. (2012) suggest that their work calls into question the current benchmark levels of tritium set for aquatic organisms.

Terrestrial organisms that rely on prey or forage species with an aquatic base in the food web are also at risk of tritium and other contaminant uptake through bio – magnification. This is nicely illustrated for contaminated Ottawa river sediments by Bond et. al., (2015). Moose, which have been documented in the LSA feed largely on aquatic plants in summer, including fragrant water lily (*Nymphaea odorata*) and watershield (*Brasenia shreberi*). These aquatic plants will transfer radionuclides to higher trophic levels, including tritium, to animals feeding on these plants.

Fathead minnows, (*Pimephelas promelas*), exposed to a gradient of tritium ranging from 12,000 to 180,000 Bq/l had no effect on fish condition or their metabolic indices. However, tritium did induce genotoxicity, neural and immune responses that were correlated with internal dose rate of tritium to the fish (Gragnaire et. al., 2018).

Clearly, there does appear to be an association with tritium bio – uptake and deleterious effects to organisms which will appear largely at the population level. The EIS indicates that due diligence has been done in keeping tritium levels, as well as other contaminant levels, below benchmark levels for current ecological risk assessment. Determination of the effects of a persistent pollutant at the population level would require long – term studies of populations in question. However, it must be kept in mind that the potential for hazardous consequences to aquatic populations exposed to contaminants, including tritium, remains real.

Blanding's Turtle

The regional study area (RSA) for this project encompasses critical habitat for the Blanding's turtle, a 'threatened' species in Ontario. The RSA resides within the Ottawa Valley Forest which has been deemed one of the last remaining "strong holds' for Blanding's turtle in Ontario and Canada (Ottawa Valley Forest Management Plan). The Perch Lake Swamp complex is in close proximity to the location of the NSDF in the site study area (SSA). As a result, Blanding's turtles are likely to be exposed to both radiological and non – radiological contaminants that will enter the Perch Lake wetland complex through East Swamp groundwater and the Perch Lake discharge outlet.

The assessment of the impacts that could result from the development of the NSDF on Blanding's turtles and their habitat in the RSA appears to be quite comprehensive with mitigation strategies that in theory should have a net neutral impact on the Blanding's turtle population. The residual effects analysis focuses largely on potential physical destruction to habitat and individual turtles. However, the potential for effects from contamination from the effluent discharge have **not** been addressed in the residual effects section in the EIS, 5.6.7.8 .1.

Blanding's turtles are omnivorous, feeding on a variety of diet items, mostly benthic in nature. Crustaceans, molluscs, insects, tadpoles, small fish, leeches and some plant material make up the bulk of their diet. Bio – accumulation of contaminants, and most notably, tritium, is a potential concern for Blanding's turtles which are considered a sentinel species within the guild of herpetiles with a semi – aquatic existence, including the snapping turtle.

Blanding's turtles are a very long – lived species, reportedly living up to 83 years and taking up to 25 years to reach maturity (Blanding's Turtle Recovery Strategy). As a result of their life – history and varied diet of aquatic organisms, there is great opportunity within this species for bio – accumulation and bio – magnification of contaminants released from the NSDF treated effluent. The effects of contaminants at levels below the ecological risk benchmark are not likely to be evident through external examination of an individual, such as a Blanding's turtle. The effects of bio – magnification may show up in reduced reproductive success and genotypic effects (damage to DNA) leading to mutagenesis which could have deleterious long-term effect o at the population level.

Turtles can be effective bio - monitors and environmental indicators as they can facilitate bio – detection of contaminants at low levels, including radionuclides (Gibbons and Green, no date given). Studies examining the effects of radionuclides on reptile health and life – history are lacking. As part of the ongoing monitoring plan through the next 50 years of operation and beyond closure of the Chalk River site, an examination of tissue samples (non – invasive, such as blood and scute/carapace samples) from Blanding's turtles may give some indication of levels of tissue uptake of contaminants, including tritium, as a result of surface and groundwater effluent from the NSDF.

Hickorynut Mussel

The Ottawa river is home to the largest population of the Hickorynut mussel in Canada, with the highest densities found in Lac Coulonge, downstream of the Chalk River nuclear facility. The Hickorynut was deemed 'endangered' and added to the Species At Risk in Ontario list in January of 2013. **No mention** was made of the Hickorynut in the Aquatic Environment section 5.5 of the EIS, nor mention of CNL conducting baseline studies, despite the fact that it is an endangered species, and highly likely to be present within 8 km downstream of the Perch Creek outflow into the Ottawa river.

The Hickorynut prefers a habitat with a substrate of sand and sediment, typically with moderate flows, in 2 – 3 meters of water in large rivers. The outflow of Perch Creek drains into the Allumette lake portion of the Ottawa river, where contaminants could potentially be taken up by the endangered Hickorynut mussel. Although the EIS states that the contaminant levels flowing into the Ottawa river from the NSDF are not likely to be measurable above background concentration, the one constituent that was noted to be potentially elevated above background was tritium (page 761 of the EIS).

Levels of tritium in Perch Creek are predicted not to exceed 7,000 Bq/L, the maximum allowable level for Provincial Water Quality Objectives, however, this does not address the impact on the endangered Hickorynut through bio – accumulation of radionuclides, or additional tritium exposure in this case.

Although the average level of tritium in Perch creek in 2021 was 2,868 Bq/l, and the trend in tritium levels has been declining (CNL 2021), there remains the question of tissue uptake and storage by these filter – feeding bivalves in the Ottawa river.

A number of studies show that mussels do bio – accumulate radionuclides from their food source both as organically bound contaminants and as free water. Studies with *Elliptio camplanata*, a common large mussel, showed uptake of both free water tritium and OBT when exposed to an abrupt increase in tritium. This study was conducted by placing mussels collected from the Ottawa river into Perch Lake. Levels of tritium in mussel tissue reached a steady state within 2 hours exposure to free water tritium (Yankovich et. al).

Incorporation of tritium into the tissues of the blue mussel, Mytilus edulis, showed a linear relationship with the number of feedings of phytoplankton that had been cultured in tritiated water. After only three feedings, blue mussels showed significant levels of tritium. The accumulation of tritium into mussel tissue from tritiated phytoplankton demonstrates an environmentally relevant transfer pathway for tritium (Jaeschke and Bradshaw, 2013). Their study suggests that tritium can act as a persistent organic pollutant. Further suggested by Jaeschke and Bradshaw (2013) is that the toxic effects of tritium may be underestimated as current legislation does not take into account adequately the nature of organic forms of tritium.

Lake Sturgeon

Lake Sturgeon are known to inhabit the section of the Ottawa river near the CRL site. The Great Lakes – St. Lawrence population of lake sturgeon is threatened in Ontario, under the Endangered Species Act. Lake Alumette, the portion of the Ottawa river, where the CRL sits, and where the Perch Creek outflow will spill into, is home to a healthy population of Lake Sturgeon.

The EIS reports that on average, two lake sturgeon per year are impinged at the water intake the services CRL, with a maximum of 10 fish in one year being impinged. It is likely that these fish were juvenile sturgeon as they would be most vulnerable to impingement as a result of their smaller size relative to an adult sturgeon. This is an issue that should be addressed to determine if there is any way to reduce the likelihood of impingement.

The hickorynut relies on the lake sturgeon for part of its life – cycle. The larvae of the hickorynut are expelled from the gravid adult hickorynut when opportunity arises in the form of the larvae, or glochidia, adapted to clamping onto the gills of a sturgeon. The larvae will encyst in the gills and feed on the fluids of the lake sturgeon until they become large enough to drop off and resume life in the benthos (river bottom). It is thought that juvenile sturgeon are the most likely host of the hickorynut larvae as they are most likely to feed in areas where the hickorynut subsists.

It is important that the lake sturgeon population is kept at a healthy status in the Ottawa river, from both a cultural and ecological perspective. The lake sturgeon is Ontario's largest and longest - lived fish species. Being so long – lived, there is ample opportunity for lake sturgeon to bio – accumulate toxins, including tritium that is found in the sediments of the Ottawa river near the CRL site. Although levels of tritium were found to be below benchmark values for ecological risk, other radionuclides including Cesium 137, Strontium – 90 and Cobalt – 60 were elevated relative to upstream and downstream of the CRL site. Lake sturgeon, being a benthic feeder, is potentially at risk of incorporating radionuclides into it's tissue, which can potentially build up to what I would think could be significant levels over the fish's lifetime.

Maintaining a healthy population of lake sturgeon in the Ottawa river is important for the ecological health of the river and for the health of the hickorynut population. It is thought that part of the reason for the decline in the hickorynut population may be a result of low sturgeon numbers relative to the past, before commercial fishing and damming of the river caused a drastic decline in sturgeon numbers in the Ottawa river.

Conclusion

The Environmental Impact Statement appears to have **not addressed** baseline information on hickory nut mussel and Lake sturgeon including many aspects of the potential and cumulative effects on the aquatic environment that could potentially result from the development of the new Near Surface Disposal Facility. It will be prudent to conduct these studies in advance of any project licensing decisions as well as consider the removal of tritium from waste disposal plans as discharged into Perch lake and subsequently making their way into Perch creek and ultimately the Ottawa river, especially when proposed levels at Perch Lake are proposed to exceed risk assessment benchmark levels.

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APPENDIX D: SART KITCHI SIBI TECHNICAL TEAM CONSERVATION PLAN FOR THE OTTAWA RIVER

SART Kitchi Sibi Technical Team Conservation Plan for the Ottawa River

March 2023

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Executive Summary

Lake Sturgeon (Acipenser fulvescens), also known as Name (Ojibwe), Namay Namaeu (Cree) and Nme (Ottawa and Ojibwe), are one of the largest, longest-lived, freshwater fish species in Canada and have special significance to Indigenous Peoples. The Great Lakes – Upper St. Lawrence Lake Sturgeon populations in Ontario are facing imminent extinction or extirpation if nothing is done to reverse the factors leading to their decline.

The goal of this conservation plan is to where feasible, restore, rehabilitate or re-establish, self-sustaining Lake Sturgeon populations in the Ottawa River which are viable in the long term and in a manner that is consistent with maintaining the integrity and function of the aquatic ecosystem they rely on.

In order to achieve this, several recommendations have been made that will help focus conservation efforts and potential partnerships. In formulating these recommendations, consideration was given to Lake Sturgeon ecology including their longevity, delayed reproductive maturation, spawning periodicity, ability and tendency to migrate long distances and the requirement of distinct habitat types for various life history stages (e.g., eggs, larvae, juveniles, subadults, adults).

1. Address knowledge gaps (i.e., population status and habitat availability) that are intended to inform future protection, conservation and recovery efforts as it relates to the Ottawa River population;
2. Assess, monitor, maintain, enhance and, where feasible, restore habitat in order to support the critical life history stages of Lake Sturgeon in the river; and
3. Increase public awareness of the cultural and ecological significance and uniqueness of Lake Sturgeon and the importance of maintaining, enhancing and restoring Lake Sturgeon populations for future generations.

1.0 Objectives of the Conservation Plan

A conservation plan is a site – specific, action – oriented document that addresses the current state of a specific population of organisms or natural resource with the intent to define methods and strategies to maintain or enhance that natural resource. The *SART Lake Sturgeon Conservation Plan for the Ottawa River* will act as a guide to help manage Lake Sturgeon populations in the Ottawa River in the area below the Temiskaming dam, known otherwise as Lac la Cave. This is a live document that will be updated with the most current and relevant information as it becomes available. The ultimate goal of the plan is for the Kebaowek, Wolf Lake and Temiskaming First Nations to work in conjunction with other interested stakeholders in helping to restore Lake Sturgeon population numbers to pre – colonization levels in the Ottawa River. The geographic focus of this conservation plan will be the stretch of the Ottawa River from the Temiscaming Dam to the Otto – Holden Dam upstream of the town of Mattawa, Ontario,, an impounded portion of the river that runs for approximately 70 km. However, the communities are looking at branching out into other Lake Sturgeon (*Acipenser fulvescens)* and Hickory nut Conservation initiatives throughout the watershed.

1.1 Algonquin Initiatives on Lake Sturgeon

Lake Sturgeon (*Acipenser fulvescens*) have been greatly impacted as a result of unregulated fisheries, overfishing, overexploitation, pollution, construction of dams and hydroelectric facilities, logging and pulp and paper operations that established in the Ottawa river watershed in the early 1800's and continue today (Bruch et al., 2016).

Lake Sturgeon (*Acipenser fulvescens*) are one of the Earth's longest living freshwater species and they are one of the largest fish in Canada. Lake Sturgeon can grow up to a length of 3 meters and can live up to a lifespan of 154 years. Lake Sturgeon known as *Neme* in our language are important to our peoples; historically every part of the fish was used and absolutely nothing was wasted. The cartilage in the head resembles a man reminding Anishinaabeg (original man) of our special relation to *Neme.* Traditionally the Ottawa River watershed was known as Neme Sibi (Sturgeon River) because Neme travelled freely into all parts of the watershed. Some of the ways that sturgeon was used traditionally by our peoples include:

- Meat is an important source of food
- Oil was extracted for medicinal purposes
- Cartilage was used to make needles, spears and arrowheads
- The lining of the stomach was used for drum coverings
- Isinglass was obtained from the swim bladders to make glue and paint for teepees, often used as a paint stabilizer
- The skin was used as a container to hold the extracted oil

Lake Sturgeon was often harvested as a primary food source to help get through long winters when food was scarce, it was often preserved by being smoked and dried over an open fire (C. Hardy Jr. BZA First Nation., n.d.). Every spawning season created an important meeting place for many families within the Nation to gather in the spring at sturgeon spawning sites to share their harvest.

Prior to establishment of the logging and lumber operations, the Ottawa River was a crystal-clear source of water, where the riverbed could easily be seen. The water chemistry of the Ottawa River has since been affected due to the accumulation of bark and wood chips during the logging era, which had also altered the riverbed causing optimal fish habitats to degrade overtime. Log movements mostly occurred in the spring; this unfortunately could have abraded the Lake Sturgeon spawning ground in the Ottawa River. The destruction of spawning beds continues to occur on the Ottawa River and the species continue to be under threat. The SART communities are currently (2023) assessing the effects of the Temiskaming Dam complex replacement in a key sturgeon spawning bed. Lake Sturgeon have very low reproductive potential, females spawn for the first time between 14-23 years of age, then only every 7-9 years afterwards.

2.0 History of Lake Sturgeon in the Ottawa River

The Ottawa River was colonized by Lake Sturgeon after the retreat of the Wisconsin ice sheet approximately 10,000 years ago. They colonized the Ottawa River from the Mississipia refugia through the Fossmill outlet, and later the North Bay outlet (Mandrak and Crossman, 1992). The Ottawa River was not colonized by the St. Lawrence river sturgeon population due to the existence of the marine Champlain Sea. The St. Lawrence sturgeon came from the Atlantic refuga. As a result, there is some indication that these populations are morphologically distinct, based mainly on head measurements (Guenette et. al., 1992), however, genetic studies between the two populations do not indicate significant genetic differences (Guenette et al., 1993).

Lake Sturgeon were once considered abundant in the Ottawa River prior to the 1900's (Dymond, 1939) and were found throughout the entire Ottawa River and many of its tributaries (Harkness and Dymond, 1961). Small (1883) in the Transactions of the Ottawa Field Naturalist, notes that Lake Sturgeon frequented the Ottawa River and curiously, he mentions a second species, the Sharp - nosed Sturgeon to be found in the river. With European colonization came industry and increased anthropogenic stressors of various kinds on Lake Sturgeon, ultimately causing a decline in sturgeon population numbers in the Ottawa river that have yet to rebound to historical numbers.

Historical reports indicate that some large fish were taken from the Ottawa River. In March of 1931, the Globe and Mail reports a large Lake Sturgeon of 216 pounds being caught near Montebello. A fisherman near Davidson, Quebec, in 1952 had a 35 pound sturgeon jump out of the water and land right in his boat, making for an interesting fish tale (Egan, 2020).

Sturgeon were at one time considered a nuisance species as there was no viable market for them, as they wreaked havoc on fishermen's nets creating unnecessary work in repairing holes in the nets. Sturgeon were seen as such a nuisance that they would be stacked up on the shore like 'cord - wood', and once dried enough, set ablaze with their rich oil content (Harkness and Dymond, 1961), or used as fertilizer. They were used to feed steamship boilers as well, not having yet appreciated their value as anything other than fuel.

Around the year 1860, sturgeon became valued for its meat when smoked, caviar and isinglass. Isinglass is the dried swim bladder which is composed of connective tissue, and used in the clarification of beers and wines and also the production of gelatin. The first commercial fisheries for sturgeon were set up on the Ottawa River in 1881. By 1898, the harvest of sturgeon in the Ottawa River peaked at 28,780 kilograms, never to reach those levels again (Dymond, 1939).

Despite reports that Lake Sturgeon were historically abundant in the Ottawa River, there does not appear to be any information indicating just how large the population of Lake Sturgeon once was. However, reports do indicate that there is no question that sturgeon stocks have plummeted throughout their range over the past century. This decline in population numbers post - European colonization is attributed to a multitude of stressors including commercial fishing, impoundment of waterways, declining water quality as a result of industrialization, ecological changes due to factors such as invasive species and more recently, climate change.

Spawning habitat for Lake Sturgeon in the Ottawa river prior to hydro-electric development is not well-documented. It is believed that spawning now occurs at most generating stations (Haxton, 2008) and generating station and dam infrastructures are looking to include more fish friendly operating solutions. For example, see https://fb.watch/i5rGbklk9f/.

3.0 Cultural and Historical Significance of Lake Sturgeon to the Statement of Asserted Rights and Title communities of Kebaowek, Timiskaming and Wolf Lake First Nations

3.1 The Historical Connection of Anishinaabeg and Lake Sturgeon

Algonquin Anishinaabeg Peoples have been associated with the Ottawa River for at least 6,000 years, and likely longer. Their presence in the Ottawa Valley coincided with the recession of the ice sheets from the Wisconsin ice age that started melting around 9,000 years ago. The Algonquins were involved in inter - tribal trade along the Ottawa river pre - dating the arrival of the French. With neighbouring tribes they traded furs and dried fish in exchange for corn and cornmeal, wampums and fishnets.

Despite the relationship of the First Nations people to the Ottawa River spanning several millennia, there is little written historical information stressing the importance of lake sturgeon to the Alqonquins.

To the Anishinaabeg living in the Great Lakes watershed, the Lake Sturgeon's importance to them was equivalent to what the buffalo were to the First Nations of the great plains (Haxton, 2009). The sturgeon was the King of Fish, attested to by the many names the different tribes used for sturgeon. For the Ojibwe, Sturgeon were Name; Cree called them Namay Namaeu, the Ottawa used Nme. Numae and Hahma were also used by First Nations.

Lake Sturgeon were, and continue to be, an important food source and are strongly linked to the spiritual and cultural identity of First Nations people. Lake Sturgeon being a typically large fish, were used as food; the meat could be smoked, or pounded and dried to make pemmican. The caviar, or roe, was eaten and the cartilaginous back-bone could be used to make soups. The swim bladders made of proteinaceous connective tissue, called isinglass, was used in the clarification of beer, wine and other liquids and also used to make gelatin. No part of the fish was wasted. The rough skin, covered in bony plates known as denticles, was used to make containers while oil extracted from the head, viscera and gonads was valued as a high energy product. The bony plates of the skin could be used for grating and rasping and even arrowheads. A spring tradition was to gather where the Lake Sturgeon spawned to catch the fish using spears, weirs, hook and line and harpoons. Wooden platforms were sometimes built over the rapids to allow for easier access to catch these giant fish.

In general, there is little written of the historical importance of sturgeon to the First Nations associated with the Ottawa River. However, archeological digs have revealed information regarding the importance of Lake Sturgeon to this community. On Allumette and Morrison Islands, 1.9% of all fish remains found were made up of Lake Sturgeon (Clermont et. al., 2002). The high absolute numbers of sturgeon uncovered in these digs indicates that the tribe in this area was using these fish as a food source.

Apart from the physical importance to the indigenous people, there was, and continues to be a strong spiritual and cultural connection to sturgeon. In the Anishinaabe clan system, the Sturgeon clan, in the Giishkihingwan group, was charged with teaching and healing.

4.0 Life History and Ecology of Lake Sturgeon in the Ottawa River

Lake Sturgeon are one of 27 sturgeon species worldwide. They are considered a prehistoric fish with ancestral ties to species from the Jurassic period, 200 million years ago. The first fossil evidence of sturgeons dates back to the late cretaceous period (145.5 to 66 mya). They have remained virtually unchanged since then, hence are often regarded as a primitive group. In contrast to most fish species that have a bony skeleton, sturgeon have a largely cartilaginous skeleton, similar to sharks. Contrary to sharks however, the cartilaginous skeleton of sturgeon is a feature that is derived from a bony skeleton. Sturgeon do not have scales as do most fish, but instead they have 'denticles', which are scale-like plates that give their skin a very rough texture. The heterocercal tail (the upper lobe larger than the lower) is an indication that sturgeon frequent the lower stratums of the water column as the tail is adapted to pushing the fish downwards.

Sturgeon are the largest freshwater fish on the planet with lake sturgeon reaching a length of greater than 2 meters and weights up to 180 kg. They are a long-lived species, reaching ages of more than 100 years. Lake sturgeon are slow to mature, putting their energy into growth during the first 15 - 20 years rather than reproduction. Putting energy into growth during their first years allows them to decrease predation rates during their early years. This trend towards late maturity makes it difficult for a fast population recovery under circumstances when large numbers of adults are taken out of the population i.e. when exposed to commercial fishing pressure.

Lake Sturgeon are almost exclusively freshwater, preferring lakes and rivers with a substrate of soft mud, sand or gravel at depths of 5 - 20 meters. Sturgeon have a sucking mouth located on the underside of their head, ideal for pulling a variety of prey from the river bottom. They are a benthic generalist feeder, taking bottom-dwelling organisms such as amphipods, chironomids (midge fly larvae), oligochaetes (worms), ephemeroptera (mayflies), trichoptera (caddisflies), diptera (two-winged flies), molluscs, crayfish and fish eggs. Ephemeroptera have been identified by Beamish et al. (1998) as a primary food item. Some studies of lake sturgeon in rivers suggest a preference for drifting prey, especially among juvenile fish (Chiasson et al. 1997; Kempinger, 1996; Nilo et al., 2006). Sandilands (1987) found that crayfish were more frequently consumed by larger sturgeon.

Age at maturity ranges from 14 - 33 years for females, and 12 - 20 years for males in the Ottawa river. Length and age at 50% maturity. was 106.7 cm and 20.4 years for males and 112.2 cm and 25.4 years for female lake sturgeon. Males spawn on average every 2-3 years while females only spawn every 4 - 9 years. Fecundity, or the number of eggs produced per female was 12,170 eggs per kg of body weight in the Ottawa river. Annual mortality of sturgeon in the Ottawa River was estimated to be around 15% overall (Haxton, 2008).

For the purpose of this description of species biology and the description of habitat requirements that follows, Lake Sturgeon life history stages are defined as follows:

eggs: from deposition, through incubation, to hatch;

larvae: including drift phase of life cycle;

young-of-the-year: larvae once drift phase is complete up to the end of the first year of life;

yearlings: age one up to end of the second year of life;

juveniles: age 2 to 10 years;

sub-adults: 10 years up to onset of maturity; and adults: from onset of maturity onwards (Golder Assoc., 2011).

Spawning occurs in the spring in relatively fast water (up to 1.5 m/s), over a substrate of gravel and boulders that provide interstitial spaces to protect the eggs and larvae. Spawning occurs below waterfalls, rapids and dams. Lake sturgeon are potamodromous, meaning they are migratory strictly within a freshwater system. It's not uncommon for lake sturgeon to make long-distance migrations from their over-wintering areas to the spawning grounds, with movements greater than 200 km documented. Migrations of this distance are not possible now in the Ottawa river due to the multiple man-made barriers that now only allow a certain amount of movement. Other than during the spawning season lake sturgeon are relatively sedentary as evidenced by a number of tagging studies (Haxton 2008). Telemetry of juvenile lake sturgeon in Upper Alumette lake showed no extensive movement, and a propensity towards site fidelity (Haxton, 2008).

Males show up to the spawning grounds first, typically in early male to late June, with variation in timing depending on seasonal climate and location. Spawning can occur anywhere from 10 - 20 deg. C. Sturgeon typically spawn in the Ottawa River at about 17 deg. C, based on work done by Haxton (2008) and recent studies conducted at the Temiskiming Dam by Hatch environmental consultants. Their appears to be no preference between day and night spawning (Bruch and Binkowski, 2002). Male lake sturgeon only spawn every 2 to 3 years whereas females spawn only every 4 - 9 years. Typically there is one spawning period, however, there can be two separate spawning events involving different females. The number of spawning events seems to be linked to migration distance, warming trends and temperature fluctuations. Bruch and Binkowski (2002) reported a second spawning event in lake sturgeon up to four weeks following the first, likely as a result of a sudden decline in temperature.

During spawning, a female will be surrounded by multiple males, where they deposit their adhesive eggs over a rock and rubble substrate. The males will release their milt or gametes to fertilize the eggs as the female deposits them. There may be multiple acts of egg deposition by a female with different males. Once spawning is complete, the sturgeon will immediately abandon the spawning grounds.

A curious behaviour that has been documented by lake sturgeon in some rivers is that of 'porpoising' prior to, and during the spawn. During porpoising, sturgeon swim upstream and with their head out of the water and occasionally jump completely clear of the water (Bruch and Binkowski, 2002). To date, this behaviour has not been reported on the Ottawa river, however, it is something to look for on spawning grounds in spring on the Ottawa River.

Depending on temperature, the eggs will incubate for 5 - 14 days prior to hatching. No parental care is given to the eggs which have a mortality rate estimated to be approximately 99%. Egg mortality can result from sedimentation that essentially smothers the eggs as well as a rapid increase in flow (Kempinger, 1988) as may occur below dams that regulate water flow. Low water levels as a result of flow regulation and predation on eggs also contribute to mortality. Optimal temperature for egg survival is 14 - 17 deg. C. with 100% mortality when temperatures rise above 20 deg. C. (Wang et al., 1988). The egg stage is when the highest predation rates occur on lake sturgeon. Fish predators include sucker sp., logperch, yellow perch and sturgeon, all species that occur in the Ottawa River. Crayfish, which are able to get into the interstitial spaces, are also known to consume lake sturgeon eggs (Caraffino et al., 2010; Scribner and Baker, 2008).

Soon after lake sturgeon eggs hatch, they enter a pelagic life stage known as 'larval drift'. Emergence of the hatched larvae is largely temperature dependent. Smith (2003) reports that the larval drift stage didn't start until the temperature was 15 deg. C. Larval drift in the Ottawa River will likely start at a higher temperature as spawning doesn't typically occur until 16 deg. C. The larvae, which at this stage still have a yolk sac, emerge at night from the interstitial spaces between the rock and rubble. Peak larval drifting occurred 8 - 14 days post hatch, and between the hours of 2100 and 0200 (Kempinger, 1988). Drifting larvae have been found 45 km downstream of where they hatched, 25 - 40 days post hatch (Auer and Baker, 2002). Lake sturgeon larvae in this study ranged in size from 20 mm 14 km downstream of the hatching area to 22 mm average 45 km downstream of the hatching area. While drifting larvae are vulnerable to predators during this life stage, not a lot of evidence of predation of this life stage has been reported. Despite the high rate of mortality during the egg stage and the infrequent spawning by lake sturgeon, high fecundity rates spread out over several years has allowed lake sturgeon populations to persist.

5.0 Current Status of Lake Sturgeon in the Ottawa River

Lake Sturgeon were first added to the species at risk list when the Endangered Species Act took effect in 2008. On September 10, 2009 the species was divided into three distinct populations and listed as threatened (Great Lakes - Upper St. Lawrence and Northwestern Ontario populations) and special concern (Hudson Bay - James Bay population). The Great Lakes - Upper St. Lawrence populations were reassessed as endangered in November 2017. In the context of how levels of threat are defined, 'endangered means' that the population faces imminent extirpation or extinction if efforts are not made to slow or stop the decline in population numbers.

Lake Sturgeon are native to, and were once considered abundant in the Ottawa River. Unfortunately, historical records don't indicate what the absolute population numbers may have been during this period of abundance. There is no doubt, however, that there has been a drastic decline in the numbers of Lake Sturgeon in this watercourse. Studies that looked at other Great Lake populations of Lake sturgeon estimate current populations at only 1% - 2% of historical numbers (Haxton et al., 2014).

A comprehensive study of the current status of Lake Sturgeon in the Ottawa River was conducted by the Ministry of Natural Resources and Forestry in Ontario between 1997 and 2001 (Haxton, 2002) (fig. 1). The study examined the nine reaches of the river between Lake Temiskaming and the Carillon Dam (approximately 140 km downstream of Ottawa). They found significant variation in Lake Sturgeon abundance between reaches, with the greatest abundances observed in unimpounded lengths of the river. Lake Sturgeon numbers are lowest in reaches with extreme water drawdowns and highest in reaches where more natural flow regimes are maintained (OMNRF and MFFPQ, 2008).

The areas of greatest relative abundance of sturgeon were found in Upper and Lower Alumette lakes and Lac Coulonge, while lowest abundance was found in Lac La Cave (below the Temiskaming Dam), Holden Lake, (below the Otto - Holden dam) and Lac Dechesnes. During the study,which included a combination of Fall Walleye Index Netting (FWIN) and Nearshore Community Index Netting (NSCIN), both of which are standard MNRF protocols, a high of 263 Lake Sturgeon were caught in Upper Alumette lake, and a low of only one individual was caught in Lac La Cav, below the Temiskaming dam.

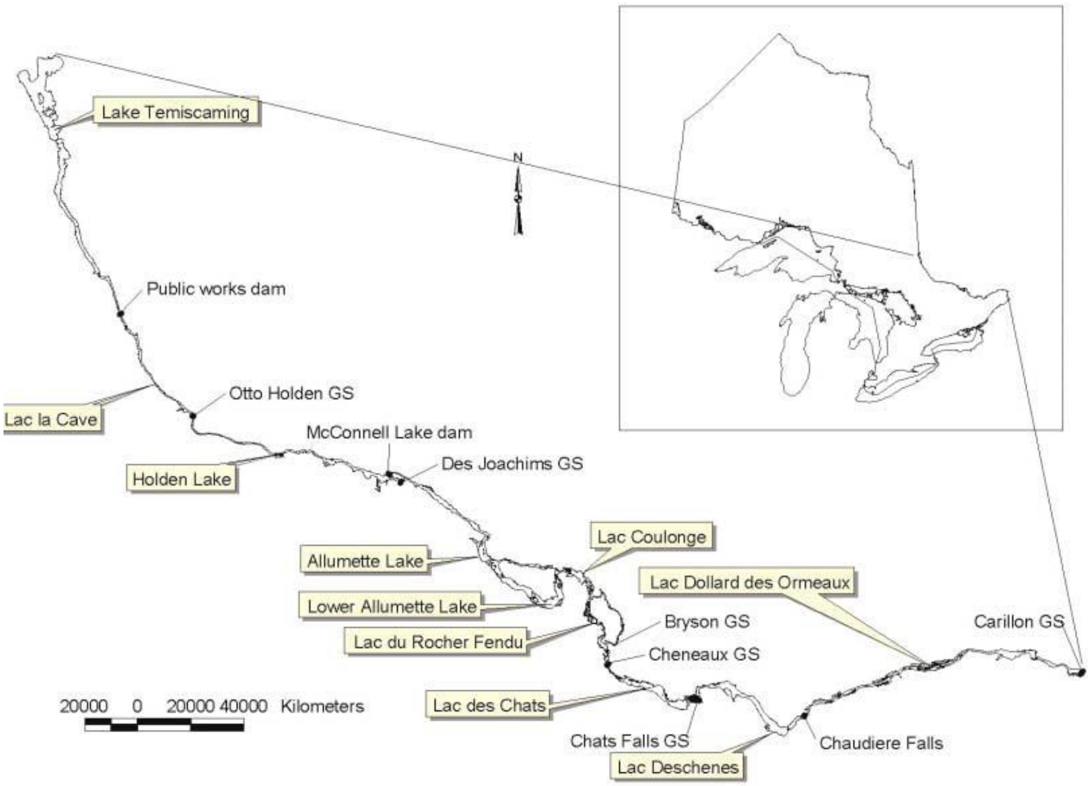

Figure 1. The Nine reaches of the Ottawa river assessed for Lake Sturgeon population by the MNRF between 1997 and 2001. From Haxton (2002).

Haxton (2008) also assessed tissue contaminant levels for 21 different potentially toxic chemicals in lake sturgeon in the Ottawa river. Only three of the 21 chemicals tested had at least one sample above the detection limits. Polychlorinated Biphenyls (PCB's) ranged from 20 - 120 nanograms/gram (ng/g); DDT and metabolites ranged from 2 - 170 ng/g with mercury being the most commonly detected contaminant with concentrations ranging from 0.06 - 0.69 micrograms/gram of tissue. The total mercury concentration of lake sturgeon tissue was positively correlated with length of the fish (Haxton, 2008). Despite an increased level of mercury in tissues of lake sturgeon in the Ottawa River, this heavy metal does not appear to have had a noticeable effect on growth or health of the fish (Haxton, 2007).

Examination of the lake sturgeon of the Ottawa River suggest they are genetically similar throughout the watercourse. There is some evidence that they may be genetically unique from the St. Lawrence River population (Guenette et. al., 1993).

All commercial fisheries for Lake Sturgeon were closed in Ontario in the 1980's with recreational fisheries closed in 2009. All commercial fishing for lake sturgeon in Quebec was closed in 2013 with the closure of recreational fishing for the species under consideration as of 2018 (OMNRF and MFFPQ, 2018). At the time of this writing (April 2022), angling for lake sturgeon remains legal, with one fish 106 cm or less allowed to be taken.

6.0 Limiting Factors to Recovery of Lake Sturgeon in the Ottawa River

6.1 The Temiskaming Dam

The Timiskaming Dam is a water level control dam, controlling the level of the water upstream of the dam in Lake Temiskaming and the flow of the Ottawa River downstream. The dam is located approximately 65 km Northeast of North Bay, and is the last dam on the Ottawa River upstream of the St. Lawrence River and is a part of a network of seven dams used to manage water levels in the upper Ottawa River. The dam complex is comprised of two separate dams that connect on either side of the river to Long Sault Island in the middle. The portion of the dam on the west side of the island is the Ontario dam; the dam on the East side of the island is the Quebec dam. Highway 63 on the Ontario side becomes highway 101 on the Quebec side, providing an important interprovincial transportation route. The dam also accommodates a natural gas pipeline.

The dam is located on unceded Alqonquin - Anishinaabeg lands as well as federal lands as claimed by Public Works and Government Services of Canada. Currently the flow rate over the dam is controlled by stop logs that are moved by a custom log - lifting machine.

Figure 2. the Timiskaming Dam complex viewed from the Northwest, looking Southeast. The Ontario dam is on the right (west) of Long Sault Island. The Quebec dam is on the left (East) of the island. (photo credit Public Services and Procurement Canada website, 2020).

6.11 History of the Timiskaming Dam

The original Timiskaming dam complex was built between 1909 and 1913. The Quebec side was rebuilt in the 1930's following a foundation failure. Between 2014 and 2017, the Ontario side of the dam was replaced as the dam was deemed to be at the end of its useful life.

6.12 New Dam Construction

The new dam on the Quebec side of the dam complex will be built 25 meters downstream of the existing dam. Although the old dam is still functional, it is nearing what is deemed to be the end of its serviceable life. Once the new structure is built, only then will the old dam be demolished and removed (PSPC, 2020).

The new dam will be 75 meters in length and will incorporate 10 bays with sluice gates that will be used to control the water level. This is a more efficient system of managing the water level than the old log lift system, allowing a much faster response to changing conditions due to weather events. A two lane highway across the dam will continue to connect Hwy 63 on the Ontario side to Hwy 101 on the Quebec side.

A fish passage is being proposed as part of the design of the new dam. The fish passage will allow fish to move freely between the Ottawa River and Lake Timiskaming, bypassing the dam. The proposed fish passage will cross Long Sault Island and will have a total length of 140 meters. Details of the design and the species the passage will attempt to accommodate have yet to be clarified.

The construction of the Quebec side of the dam is currently under environmental review at the time of this writing. Tetra Tech QI has been awarded the contract to design the new dam. The design work will not begin until an Environmental Assessment has been completed. Construction is slated to begin in 2026 with a completion date of 2026 (PSPC, 2022).

Pursuant to the Canadian Environmental Assessment Act, an environmental assessment of the Quebec dam construction project was started on June 20, 2018 by the Impact Assessment Agency of Canada (formerly the Canadian Environmental Assessment Agency). Final Environmental Impact Statement Guidelines were issued by the Impact Assessment Agency to Public Services and Procurement Canada (PSPC) on August 21, 2018 for the preparation of an environmental impact statement.

6.13 First Nations Communities and Dam Construction

The dam is located on unceded Algonquin territory, the Algonquin First Nations people having a long history of cultural and spiritual connection to the Ottawa River. It is important that local First Nations communities are involved in the planning and construction process for the new dam. The new dam will be built near historical spawning grounds of Lake Sturgeon and will most likely have an impact on these fish of great historical significance to the Algonquins of the area.

The PSPC have been in active consultation with Indigenous communities that could potentially be affected by the new dam construction. It is important that these consultations recognize and make accommodations for the possible impacts of changes to the environment, and how these changes may impact Indigenous communities, as well as how the project may adversely impact on potential or established rights of First Nations.

6.14 Impacts of dams on Lake Sturgeon populations

Declines in lake sturgeon populations that were historically once abundant can at least in part be attributed to the construction of dams and hydroelectric facilities (Hrenchuk et al., 2017; Kerr et al. 2011). Negative impacts on sturgeon from barrier construction include impediments to migration, fragmented habitats, changes in flow regime, changes in water quality and impacts to spawning grounds. Downstream migrants can be entrained at hydroelectric dams or damaged as a result of impacts when going over dams at high flow or mechanical damage from turbines. As a result of dams, changes in flow regime and water chemistry, community structure, and diversity of organisms, especially prey items, can have a detrimental effect on diet and nutrition of sturgeon (Kerr et al., 2010). Haxton and Finlay (2008) report that water power management was the primary factor in preventing the recovery of lake sturgeon in the Ottawa river. Aquatic habitat upstream of a dam or hydroelectric facility will also be impacted as a result of a barrier which alters flow regime resulting in consequent changes to water quality and chemistry as well as the ecology of the system.

Juvenile lake sturgeon in large riverine systems have been reported to exhibit restricted movement patterns. This lack of movement is thought to be attributable to a general unwillingness to move up or downstream through narrow areas that are either natural or artificially altered falls and rapids (Barth et al., 2011; McDougall et al., 2013).

Regarding water release from dams there are two basic modes of operation - 'peaking' and 'run of river'. In the peaking system, water is stored upstream (the dam is closed) for a period and then released through turbines to capture the energy of the moving water. This system results in periods of dramatic reduction in flow for many hours with a sudden rapid release of water. Peaking is believed to impair recruitment of young lake sturgeon into the population by negatively impacting eggs and larvae in spawning areas (Haxton and Findlay, 2008). The 'run of river' regime sees a constant flow through a dam or hydroelectric facility that emulate natural flows. This system of dam operation is considered to have less impact on aquatic biota (Prosser, 1986).

Conversion from a peaking system to run-of-river system at the Prickett hydroelectric facility on the Sturgeon river in Wisconsin, resulted in an increase in the number of lake sturgeon spawning below the dam (Auer, 1996). Alteration of flow regimes outside of natural variability has a pronounced impact on lake sturgeon. Constant water flows can trigger reproductive cues in sturgeon thus altering their behaviour outside their usual timing (Kerr et al., 2010).

Conversely, a reduction in water levels and flow rate in spring can delay upstream migration to spawning areas (Friday and Chase, 2005). Both climate and water flow during spawning and incubation are widely believed to influence year class strength in lake sturgeon (Votinov and Kasyanov, 1978; Nilo et al., 1997; Randall and Sulak, 2007). Sudden changes in flow (increases) are known to dislodge eggs and larvae from the protection of spawning substrate (Swanson et al., 1990).

One of the major impacts of dams on river systems is on the success of spawning by lake sturgeon. Shifts in the timing of peak flows and reduction in flows from the natural regime are directly related to sturgeon spawning success and year class strength (Kerr et al., 2010).

The impoundment of rivers unquestionably impacts lake sturgeon populations and the Ottawa river is no exception. A thorough investigation of flow regime at both the Temiscaming Dam and the Otto - Holden dam, at the downstream end of Lac la Cav, will be required as part of the assessment and management program in efforts to restore the sturgeon population in this area. Flow enhancement strategies will be required, especially during spawning, incubation and the largely nocturnal larval drift periods (Schilt, 2007).

7.0 Monitoring and Assessment of the Lake Sturgeon Population

An assessment and monitoring program for Lake Sturgeon in the Ottawa River below the Timiskaming dam is a tool that will be most useful only if it is done over a long period of time, namely years, and ideally, decades. Sturgeon are a long - lived species that take up to two decades to reach reproductive maturity. As a result, it can take years to see any substantial change in numbers of adult sturgeon.

A monitoring and assessment program will not only focus on the population numbers of sturgeon, but will also rely on monitoring numbers of spawning sturgeon at known spawning habitats, assessing spawning success through the detection of eggs and larvae post - spawn, assessing the availability of critical spawning habitat, and assessment of any deleterious anthropogenic impacts that may affect critical habitat or affect fish health directly.

7.1 Sturgeon population assessment

Monitoring and assessment methods carried out to date on the Ottawa River have been able to give some measure of the relative abundance of Lake Sturgeon in various reaches of the Ottawa River, however, absolute numbers of fish are much more difficult to determine (Haxton, 2008). To determine absolute numbers of sturgeon in a given reach or location of the river, a mark-recapture program is recommended. The low numbers of fish caught in some regions would mean that the mark-recapture program would have to be relatively intense in order to catch enough individuals to determine population size. It must be kept in mind that individual Lake Sturgeon do not spawn every year, with gaps as long as 3 - 4 years between spawning events for individuals. This will have a bearing on the success of a mark-recapture program.

The mark-recapture technique works by initially tagging a number of fish within a specified location and timeframe. After a period of time has passed, a second attempt at capturing the fish is made. From this subsequent capture, the number of tagged fish vs. non-tagged fish is recorded. The ratio of the tagged to untagged fish can then be used to estimate the population size at that location.

For a mark-recapture program to estimate a population with any accuracy, there are a number of assumptions that must be made. In reality, these assumptions are often not met, and must be taken into account when estimating population size. Some of the assumptions that are made are as follows:

- there is no input (birth or immigration) or output (death or emigration) from the population of interest.
- all individuals are equally susceptible to being captured.
- the population is randomly distributed throughout the area of assessment.
- no tags are lost from individuals.

A long-term monitoring and assessment program for Lake Sturgeon in the reach below the Temiskaming dam to the Otto-Holden dam (Lac La Cav) is recommended. Monitoring Lake Sturgeon in this area of the Ottawa River over a number of years (10 - 15 minimum) is the only way to determine long term trends in population numbers as well as absolute numbers through mark-recapture methods. The length of time for Lake Sturgeon to reach maturity (up to 20 years) necessitates a decades long monitoring program to see changes in numbers of adult sturgeon.

Assessment of adult and juvenile lake sturgeon should follow established protocols for various methods of gill netting that are currently in use by the Ministry of Northern Development, Natural Resources and Forestry (MNDNRF) The established methods are the Fall Walleye Index Netting (FWIN) method and the Near Shore Community Index (NSCIN) method, the protocols for which should be available through the MNDNRF.

While the FWIN and NSCIN methods will target all size and age classes of Lake Sturgeon, the most productive time to capture adult sturgeon is during the spawning period in the spring. At this time the adult sturgeon will be congregating, making them easier to catch. Gill nets used during the spawn will have a mesh size that will target only large sturgeon (see monitoring protocols below).

Assessment of the juvenile lake sturgeon population is another important indicator of the success of rehabilitation efforts. Little is currently known about the habitat requirements for the juvenile phase (Haxton, 2011). Another advantage of examining the juvenile stage is that it can provide information on a more realistic timeline than assessing the adult population, which can represent a lag time of 25 - 30 years due to their delayed maturity. Targeting the juvenile population as part of a monitoring program will help to provide much needed information on where and when these fish are caught, as well as their preferred habitat. Work done by Haxton (2011) in the Ottawa River found that juvenile lake sturgeon were most likely to be captured in gill nets between 12 and 20 meters depth. Mesh size used in the Ottawa River study was 38 - 127 mm, stretched panel measurement. Nets were set for a minimum of 18 hours and maximum of 22 hours, when temperatures were greater than 18 deg. C.

The greatest number of juvenile lake sturgeon caught by Haxton (2011) in the Ottawa River were in Upper and lower Alumette Lakes and Lake Coulonge. Only one juvenile lake sturgeon was caught in Lac la Cave in 28 net sets.

7.2 Tagging for population analysis

Tagging sturgeon with a unique identification number will make it possible to estimate the number of the species in that population or localized area, in this case, Lac La Cav. It is likely that the greatest catches of sturgeon will be captured during the spring spawn, providing an excellent opportunity to tag the fish. It is important that a method of tagging is used that does little harm to the fish and can be applied in a fast and efficient manner. Since sturgeon are long-lived fish, it is important that the tag selected will remain with the fish for many years. Methods for tagging lake sturgeon are outlined in section 7.7.

Tagging lake sturgeon with a unique identifier will allow for the collection of a variety of information. Growth rate of fish can be determined by measuring fish each time they are subsequently caught; an estimate of age can also be made if the program runs long enough; tagging can provide information on fish movements if the netting program spans a wide area and an estimate of the population size can be made by comparing the ratio of tagged to untagged individuals during subsequent netting operations.

7.3 Spawning success

Measuring spawning success can provide an indication of the quality of the habitat conditions to allow successful recruitment of young fish into the population. It can also provide clues as to the number of adult fish spawning in a particular season. Spawning success is notoriously difficult to measure however, due to the difficulty of making accurate observations of the initial stages of the lake sturgeon life history, namely, eggs and larvae.

Under ideal circumstances, sturgeon spawning can be observed visually from shore and can be a method to determine numbers of fish spawning from year to year. Such studies have been conducted in the Winnebago system in East Central Wisconsin (Bruch and Binkowski, 2002). On the Ottawa River, approximately 20 km east of Cobden, the Chenaux generating station provides an ideal viewing platform to observe sturgeon spawning. Observations of spawning lake sturgeon have been made at this location for several years (Haxton, 2008).

Measurements of spawning success can be achieved by observing the relative number of eggs laid and the numbers of larvae that are drifting in the water column after they emerge from interstitial spaces in the spawning beds. It must be kept in mind that mortality in the egg stage is typically around 99%, due to a variety of stressors including predation, sedimentation, fluctuations in water flow and water quality.

7.4 Visual spawning surveys

Currently there is little information, if any, regarding the potential to view lake sturgeon spawning below the Temiskaming dam. A dedicated effort during the spawning season to examine potential spawning areas from shore is recommended in the area below the Temiskaming dam as well as in the nearby Ruisseau Gordon (Gordon Creek). There are a number of spawning areas that have been identified in previous studies that would be worth examining visually. If it is verified that lake sturgeon can be observed from shore at easily accessible sites from the shores of Lac la Cav, it would be valuable to incorporate visual surveys into the yearly monitoring program.

7.5 Egg and larval assessment

Assessment of egg deposition and larval abundance during the pelagic drift phase of lake sturgeon life can be valuable tools in determining the reproductive biology and success of a lake sturgeon population.

Monitoring of egg deposition during spawning can provide evidence that allows identification of critical spawning habitat and its key characteristics (Thiem et. al., 2013). Relying solely on the presence or absence of fish on a spawning ground provides little direct information regarding spawning success. Identification of critical spawning habitat can be crucial for the protection of essential habitat and to make effective management decisions (Thiem et. al., 2013).

The easiest and most often used method of egg collection is to deploy egg mats on the river bottom in suspected spawning areas. The mats act as a collection device that the adhesive eggs will stick to when sturgeon deposit their eggs over top of them. These mats can be a variety of designs and materials, ranging from furnace filters (Roseman et. al., 2011) to latex - coated synthetic animal hair (Thiem et. al., 2013; McCabe and Beckman, 1990). Placement of the mats is critical to optimize the chances of egg collection. They must be deployed on the river bottom in appropriate habitat which means in areas of suitable substrate such as gravel or cobble that provides interstitial spaces that will protect the eggs and larvae; the water velocity should be between 0.4 and 1.39 m/s (Thiem et. al. 2013). The mats should be checked at minimum every 6 days to ensure that the period of collection is less than the incubation period which can be as short as 8 days. Once checked, the eggs should be removed and preserved in 70% ethanol and the egg mats pressure washed before being deployed. Location, depth, temperature, water velocity at the egg mat and substrate should all be recorded for each egg mat.

Quantification of lake sturgeon larval abundance may be useful in the rehabilitation of the population as it may provide some understanding of recruitment rates. Assessment of larval abundance in the water column at various sampling locations may provide information on where it is best to focus rehabilitation efforts to increase recruitment of lake sturgeon (Smith and King, 2005). Adult mortality of sturgeon is typically low. It is important to focus rehabilitation efforts to increase the survival and recruitment rates of young sturgeon as this stage of life is where mortality rates are the highest. Reduced habitat availability and quality will likely have more of an impact on the early life stages of the population than the adult stages (Smith and Baker, 2005).

When monitoring larval abundance, it is important to focus efforts at a time and location where you are most likely to capture sturgeon during this pelagic life stage. Larval drift is not uniform throughout the water column (Smith and King, 2005) with most larvae being caught in the middle of the river channel, or 'thalweg'. Temperature is an important environmental cue for larvae to start the drift phase, with 16 deg. C. being reported as an important temperature to cue the drifting phase (Smith and baker, 2005).

Vertical depth distribution of lake sturgeon larvae varies as well. In the Peshtigo River, Wisconsin, in studies at a depth of 1.4 m, the greatest number of larvae were caught between 40 cm above the bottom to the surface, indicating that in shallow areas, the distribution of the larvae was not benthic (near the bottom) (Caroffino et. al., 2009). Work in the Upper Black River, Wisconsin by Smith and King (2005), observed best catches of larvae at mid-depth and near the bottom in deeper rivers. Their work is corroborated by D'Amours et al. (2000) who found that larvae were distributed throughout the water column with a tendency to be concentrated at mid-depth and near the bottom.

Larval abundance can be calculated using the following formula from Veshchev et. al. (1994).

$$P = (q \times N)/O \times K$$

Where P is the number of larvae passing the sample site

q is the volume passing the stie(cubic meters/hour)

N is number of larvae collected in the net after one hour

O is volume of water sampled (cubic meters) where O = V x S;

V is current velocity in the net; S is sectional area of the net (square meters)

K is a collection coefficient - the difference in velocities in front of the net and beside the net.

7.6 Recommendations for population monitoring and assessment

- establish a long - term assessment and monitoring program for lake sturgeon below the Temiskaming dam that will include spawning surveys in spring, egg and larval assessment and monitoring of juvenile populations in Lac La Cav.
- tagging of adult and juvenile fish to determine population estimate, number of fish spawning, spawning frequency and movement patterns of fish throughout the portion of Ottawa river below the Temiskaming dam.
- thorough assessment of lake sturgeon in Lac La Cav, determine those habitat features that are most closely associated with the different life stages including: habitat requirements for larval

sturgeon; nursery habitat post - larval stage; habitat preferences of juvenile sturgeon and seasonal habitat preferences of adult lake sturgeon.

7.7 Lake Sturgeon Monitoring and Handling Protocols

8.0 Habitat Assessment and Restoration

Prior to creating and implementing a successful habitat management and restoration strategy, an assessment of the current habitat must be undertaken. When assessing habitat needs, the requirements of each life stage of the lake sturgeon must be taken into consideration. Lake sturgeon will utilize different habitat types depending on their life - history stage and will display seasonal movements between habitats depending on seasonal needs. Different habitat types are required by lake sturgeon to fulfill various life functions including reproduction, egg and larval development, feeding and growth, refugia and movement. An open connection between habitats is paramount to survival of this long - lived fish species (Golder Associates Ltd. 2022).

8.1 Identification of critical Lake Sturgeon habitat

Reproduction is fundamental to the maintenance and diversity of a population. Although habitat requirements for lake sturgeon will change depending on life history stage and season, it is critical that the habitat requirements for spawning are met, otherwise the population will not propagate.

Lake sturgeon typically choose high gradient reaches of large rivers to spawn, typically below waterfalls, or dams where current velocities range from 0.5 - 1.3 m/s, at water depths of 0.10 to 2.0 meters. The substrate most suitable for spawning is coarse gravel, cobble, boulders and hardpan sand (Golder and Associates, 2011). It is important for the eggs to have 'interstitial' spaces within the spawning substrate to allow protection of the eggs from predators and fluctuations in flow rate. As always, there is variation between populations in their ecology. In connecting waters of the great lakes and St. Lawrence River, lake sturgeon have been observed spawning at depths of 9 - 12 meters, although at similar flow rates as noted above.

Strong site fidelity to spawning habitat is shown by lake sturgeon, meaning they will return, as many species do, to the precise location where they have spawned in previous years. In the Groundhog River in Northern Ontario, sturgeon used the same 30 x 50 m patch of spawning habitat despite suitable habitat close by (Golder, 2010a).

Highly critical to healthy lake sturgeon populations are non - fragmented habitats. Many authors have reported that lake sturgeon will move upstream to the farthest impassable barrier to spawn (Auer, 1996). It is important that management strategies make every effort to allow sturgeon unobstructed passage to areas for feeding, overwintering and reproduction (Auer, 1996).

At this point, it is unclear whether the larval stage of lake sturgeon has a specific habitat preference. This area represents a knowledge gap where larval and young sturgeon monitoring studies below the Temiskaming dam can help to provide needed information.

Young of the year (YOY) sturgeon have been reported using a variety of substrates including sand, pea size gravel and organic material (Kempinger, 199; Holtgren and Auer, 2004). Young of year lake sturgeon are reported to feed at night, and are most commonly reported in shallow water (less than two meters) of low velocity. There is some indication that YOY sturgeon may be attracted to particular substrates due to their camouflaging abilities (Benson et al., 2005). Auer and Baker (2002) note that in lower sections of the Sturgeon River in Michigan, deeper flowing areas were important habitat for YOY sturgeon. During high flows in the Groundhog river, yearling, juvenile and sub - adult sturgeon occupied discrete pools, however, during times of low flow, they were evenly distributed, exhibiting no depth preference (Seyler, 1997). In the Winnipeg River, juvenile lake sturgeon preferred deep areas, greater than 13.7 m over a variety of substrates during spring, summer and autumn. In the Pic river, which flows into Lake Superior,, adult lake sturgeon retreat down river after spawning, utilizing the deep pools of the lower river in summer..

Prey availability appears to have some bearing on habitat selection by young sturgeon. This is unsurprising as there must be an adequate food supply to satisfy the requirements of rapid growth characteristic of sub - adult lake sturgeon. In both the Groundhog and Mattagami Rivers of Northern Ontario, juvenile and sub - adult lake sturgeon were most commonly associated with clay substrates where macro - invertebrates were most abundant (Chiasson et al., 1997). Dipteran (two - winged flies) larval abundance was related to abundance of juvenile lake sturgeon in the Peshtigo River in Wisconsin.

Specific to the Ottawa River, work by Haxton (2002) suggests that lake sturgeon are generally more abundant in reaches of the river that are unimpounded. He also notes that changes in natural water flows and water levels in the Ottawa River can impact spawning, which will have an effect on recruitment. Fluctuation in water levels can also eliminate backwater areas that are used for feeding and nursery areas for young sturgeon.

Work conducted by Biophilia in 2917 identified 10 potential spawning areas downstream of the Temiskaming dam (Biophilia, 2019). Eight of these spawning areas are in the Ottawa River itself, with two in Ruisseau Gordon (Gordon Creek). The area of spawning habitat in the Ottawa River covers a total of 3.3 Ha, while that in Ruisseau Gorond covers 0.4 Ha. These areas were assessed as spawning grounds based largely on substrate characteristics. They noted that flow varied greatly from year to year and even within a given spawning season. Attempts to collect larvae and eggs as evidence of spawning at the identified spawning areas met with low success rates. Larvae or adult sturgeon were only caught in three of the ten areas during studies in 2017.

Biophilia (2019) concluded that management of the dam does affect spawning success of lake sturgeon, as well as other fish species they assessed at the time. It is imperative to thoroughly investigate the timing and determination of how water levels are managed at the Temiskaming Dam during spawning season, and to work with dam management to ensure that water levels remain at a level that is optimal for lake sturgeon reproduction. All stages of lake sturgeon spawning that will determine recruitment of young fish to the population must be considered when determining water levels and flow rates. These stages of lake sturgeon reproduction include: spawning and egg laying; incubation of the eggs as well as the pelagic larval drift phase. Efforts should also be made to determine habitat used by young lake sturgeon as a ‘nursery’, the stage of life after the larval drift phase.

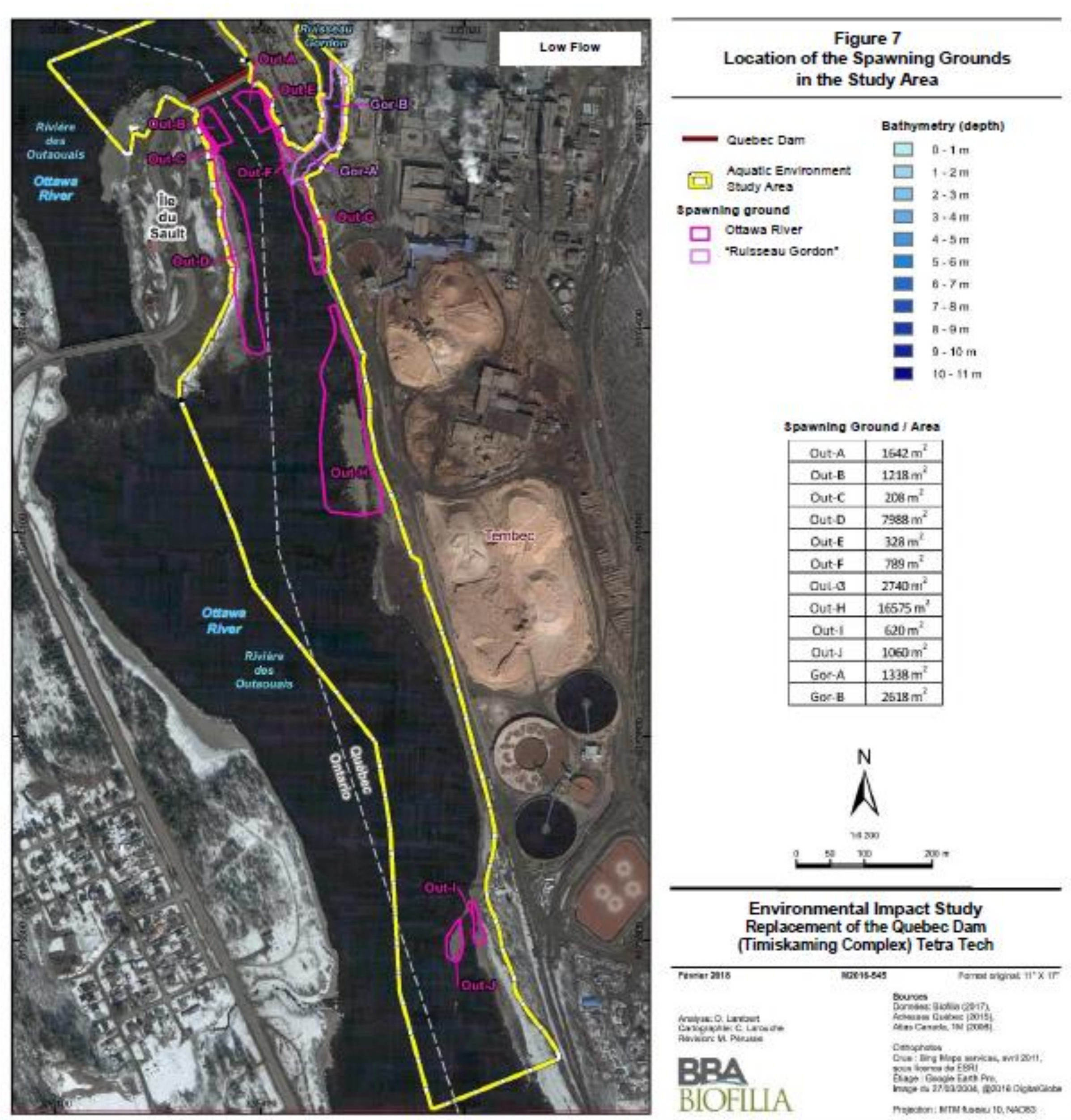

Figure 3. Location of spawning grounds determined to be suitable for Lake Sturgeon by Biophilia in a 2017 study below the Temiskaming dam (Biophilia, 2019).

8.2 Examination of methods to allow uninhibited movement of Lake Sturgeon (fish passage).

Dams and hydroelectric facilities on rivers that traditionally support Lake Sturgeon populations alter the normal patterns of water temperature fluctuation, alter flow regime, water chemistry, nutrient transport, fish movement and community structure (Kerr et al., 2011). Haxton and Findlay (2008) suggest that power management on the Ottawa River was the primary factor preventing Lake Sturgeon population recovery.

The construction of the new dam that is proposed on the Quebec side of the Temiskaming dam site is supposed to include a fish passage component to allow fish free movement around the dam. Unfortunately, developing an appropriate fish passage design for large - bodied fish has proven difficult (Kerr et al., 2011), with further research being required. Work with juvenile sturgeon found that these younger fish restricted their movements in large riverine systems. This was thought to be attributable to a general unwillingness to pass through shallow river narrows (natural or inundated falls or rapids) (Hrenchuk et al., 2017).

A literature review of fish passage systems for Lake Sturgeon by Pandit et al. (2016) report that passage design criteria for migration upstream and downstream is not well established at this point. They confirm that fragmentation of river ecosystems by dams alters migration patterns of sturgeon, and changes riverine systems to reservoir systems, having an overall detrimental effect on the natural fish populations. The several fishway types that currently do exist are designed for strong swimming fish species such as salmonids. These passageways are not nearly as effective for the large-bodied lake sturgeon which exhibit poor overall swimming performance relative to many other species.

Another important consideration to the health of the fish population downstream of a dam is the regulation of water flow at the dam. Low water flows in spring can delay upstream migration to spawning grounds by sturgeon as these large fish cue in on water flow rate for spawning (Friday and Chase, 2005). Climate and water flow during spawning and incubation is widely believed to influence year class strength (Votinov and Kasyanov, 1978; Nilo et al., 1997, Jager et al., 2002, Randall and Sulak, 2007). Changes in flow (sudden increase) shortly after spawning can dislodge eggs and larvae (Swanson et al., 1990). The larval drift phase occurs shortly after spawning and is another important life stage of lake sturgeon which must be given consideration when managing water flow rates below a dam. Larvae drift primarily at night. Flow enhancement strategies during the spawning period must be developed for spawning, incubation and larval drift (Schilt, 2007).

When considering various options for fish passage over a dam, attention must be given to water quality and habitat suitability upstream of the dam. Measures to prevent mortality during downstream migration back over the dam must be given consideration as well. The Temiskaming dam is not a hydroelectric facility, and therefore fish are not at risk of entrainment by turbines (being pulled in by the pressure of the blades), or physical damage due to contact with turbine blades. However, injury and mortality can still result from shear forces and turbulence which could potentially occur at the Temiskaming Dam (Cada, 1990 in Kerr et al., 2010).

There are typically three options available when considering movement of fish across a dam. These are: trap and transfer, fishways and fish lifts. Trap and transfer involves physically capturing and transporting fish across a dam. Although this method can be successful, it is very labour intensive. Fish lifts have been used with success in the past however, again this is a labour intensive and time - consuming method of moving fish. Fish locks designed for use by salmon and steelhead at the Bonneville dam on the Columbia River were used by Lake Sturgeon incidentally (Warren and Beckman, 1993). During a 31 year period, 4,711 white sturgeon were move upstream by the fish locks at Bonneville. Fishways, of which there are a multitude of designs, are the most common method of moving fish across artificial barriers. Fishways are typically designed for salmonids and often require the fish to jump from one level to the next. Sturgeon, being a large - bodied and slower swimming fish are not well - suited for using fish ladders where jumping from one level to the next is required. Ideally, uninhibited movement of lake sturgeon across the Temiskaming dam will be via a fish passage (fishway) that will accommodate the biology and swimming behaviour of sturgeon.

Design of fishways for sturgeon must take into consideration a number of factors, including entrance to the fishway, slope of the fishway, water velocity in the fishway, weirs and pool placement, slots and orifice and some other miscellaneous considerations. Kerr et al. (2010) provides a good summary of each of these features of fishway design for sturgeon.

All three options for the proposed new dam construction include the creation of a fishway across the dam (which is currently not passable in its entirety on either the Quebec or Ontario side). The construction of this fishway near the dam on the Quebec side is one of the conditions of the authorization from Fisheries and Oceans for the work on the dam on the Ontario side that has been done in the last few years. In fact, the positioning of a fishway near the dam on the Quebec side is technically more favorable than near the Ontario side. The Quebec side of the river, which is narrower and deeper, would encourage fish to swim toward a fish passage. Input from Indigenous communities has led PSPC to consider designing a passage for other species (Section 7.6, Tetratech,). The positioning of the fishway will vary slightly depending on the options.

The fish passage channel that is currently proposed for the new dam construction that is scheduled to commence in 2023 will be designed strictly for the American eel (*Anguilla rostrata*). The Department of Fisheries and Oceans has only authorized construction of a fish passage for the American eel to date.

Public Services and Procurement Canada are considering four different options for fish passage during construction of the new dam that may or may not include multiple species including lake sturgeon. the four options being considered are as follows (from TetraTech, 2022):

1) A passage for eel only (as mentioned in DFO’s authorization for the Ontario dam);

2) A multi-species fish passage;

3) No fish passage;

4) Delaying the construction of a potential fish passage until a more detailed impact assessment has been carried out as part of the Fisheries Management Plan for the Ottawa River.

Stakeholders including DFO, PSPC and local First Nations must be consulted to determine a fish passage design that will maximize the health of fish populations on a broad scale examining the impacts on multiple species and not only lake sturgeon. There has been concern expressed by some stakeholders that designing a fishway without the science to determine the ecological impacts of allowing multiple species to move up or downstream, may result in unwanted outcomes (TetraTech, 2022).

Pandit et al. (2016) report on two case studies examining the success of fishways for lake sturgeon. A side-baffle fishway at Turner Falls, Massachusetts with a 6.3% slope (30.5 cm rise over 487.7 cm), 1 meter deep on a 6.1 meter diameter circle accommodated both juvenile (mean length 87cm) and adult (mean length 140 cm). For juveniles, 46-73% ascended the fishway while 91% of adults moved to the top. Side baffles which alternated on the inside and outside of the channel walls created a large eddy behind each baffle allowing sturgeon areas to rest.

A vertical slot fishway on the Richelieu River at the St. Ours dam provides access to approximately 50 km of unimpounded river upstream. Of 43 radiotagged individual lake sturgeon (out of a total of 334 caught), none were documented approaching or entering the fishway after they had been tagged and released (Thiem et al., 2013). In another study by Thieme et al., (2016) that was also conducted at the Vianney - Legendre Fishway, 44 lake sturgeon were outfitted with electronic tags as well as accelerometers to determine swimming energetics required to successfully make passage upstream. Only seven sturgeon successfully negotiated the 85 meter channel and that was after 16 attempts. Twenty three of the fish failed to successfully negotiate the fishway and 14 of the fish didn't attempt passage. The accelerometers indicated that during passage attempts, fish swim at a rather leisurely rate of less than 1.25 m/s. High speed or hyperactivity was rarely observed in the sturgeon. This led the study authors to conclude that swimming performance is an unlikely limiting factor in negotiating the fishway. The two turns in the fishway (figure 4) significantly increased energy consumption as the sturgeon tried to negotiate the turns. They suggested that removal of the turn structures would greatly increase the likelihood of passage as it would reduce passage time and energy expenditure by the fish.

Fish ladders that were constructed on the Columbia river with salmonids in mind were thought to be inadequate for sturgeon passage. However, annual reports from the U.S. Army Corps of Engineers indicated to the surprise of biologists that lake sturgeon were observed using the fish ladders at five of the dams on the Columbia river in Washington State (Warren and Beckman, 1993). The fish ladders on the Columbia river are primarily over - flow weir types that ascend from the tailrace to the forebay with a minimum one foot drop between pools. The weirs are typically 24 - 30 feet wide and 6 feet in height, spaced 10 to 16 feet apart. Although it is commonly thought that salmonids prefer to jump from one pool to the next, it was found that they would actually rather stay under water while moving upstream from one pool to the next. With this discovery in mind, the weirs were constructed with orifices at the bottom of each weir ranging from 18 to 24 inches square. It is these orifices that have allowed the white sturgeon on the Columbia river to move through the fish ladders, as sturgeon are a bottom -dwelling fish. On the Columbia river, the small size of the orifices would prevent large sturgeon from using the fish ladders. This is a design that may be appropriate for lake sturgeon being of a smaller size than white sturgeon.

Fish locks were also used at the Bonneville dam on the Columbia river, again, largely with the notion of moving salmon and steelhead upstream during the spring spawning period. White sturgeon also entered the locks and were moved upstream with the salmonids. The locks required someone to operate the fish locks which was done to coincide with the peak of the salmonid spawning run.

Figure 4. Vianney - Legendre Fishway at St. Ours Dam on the Richelieu River in Quebec. A vertical slot fishway design.

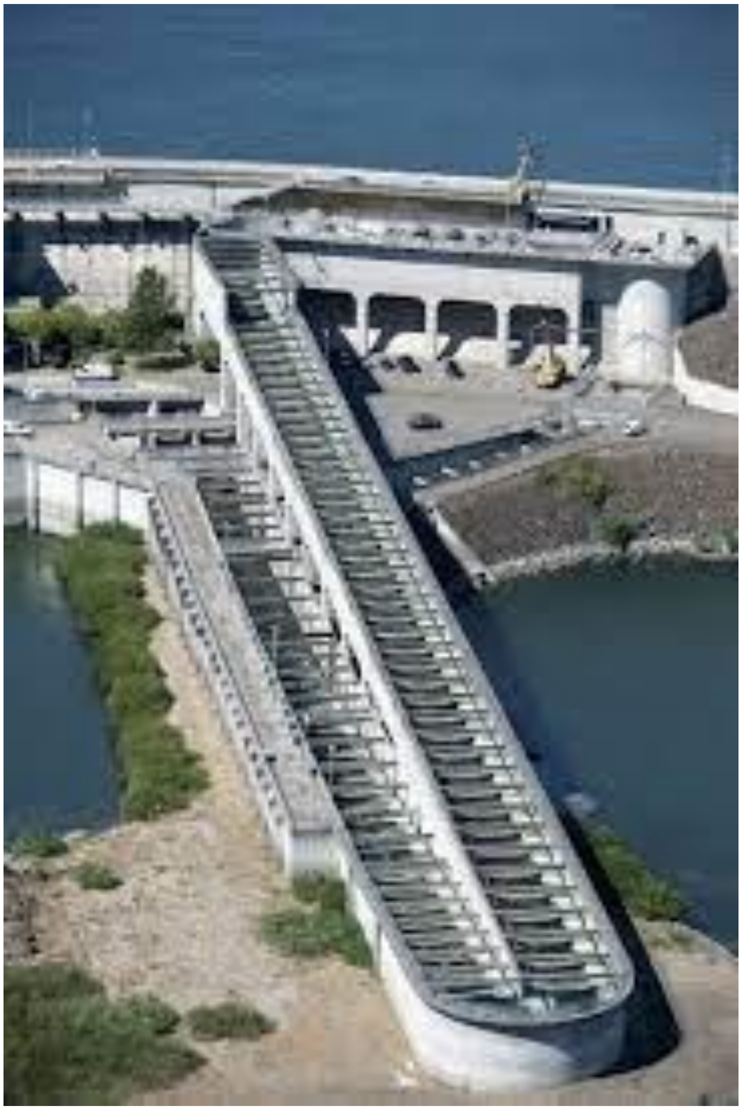

Figure 6. Dalles Dam East fishway used by White Sturgeon on the Columbia River.

Kynard et al. (2003) looked at passage of juvenile lake sturgeon using a spiral-side baffle fish ladder. Water velocity was controlled so that it didn't change from top to bottom. The slope of the ladder was 6% with side baffles alternating from the inside and outside of the walls. Lake sturgeon were able to negotiate the fish ladder, however there was great variability among individual fish in their ability to make passage.

Fish passages for sturgeon must take into account swimming performance and accommodate their poor jumping ability. Velocities in the fish passage must be lower than the maximum sustained swimming velocity of lake sturgeon which is reported to be around 0.57 m/s (TetraTech, 2022.)

8.3 Examination of methods of habitat restoration

Fragmentation of rivers, such as what has happened to the Ottawa river by the placement of dams and hydro-electric facilities over the past century has resulted in the loss of critical spawning habitat for Lake Sturgeon. Sturgeon spawn mostly at the base of rapids, the same places that are desirable for placement of barriers by humans. Habitat fragmentation places limits on the ability of sturgeon populations to recover when they have been decimated by years of overharvest. Creation of new spawning grounds, or expansion of existing spawning grounds, holds promise for the recovery of a species when suitable spawning habitat is limited (Thiem et al., 2013). Important Lake Sturgeon habitat is not limited to spawning areas. Habitat for all life stages of lake sturgeon must be taken into consideration when planning artificial habitat enhancement. Important habitat features include spawning areas, nursery areas, overwintering areas, staging areas and the migration corridors connecting them (Lake Sturgeon Recovery Strategy).

Prior to establishing a habitat enhancement program, an assessment and identification of available habitat for different life stages of sturgeon must first be established. This will require efforts in the field to determine the location of all spawning areas; staging areas prior to spawning and nursery areas for young fish. This kind of data can only be collected through a reasonably intensive monitoring program for the young, juveniles and adult sturgeon. The use of geolocators may be useful to determine which areas of the river the different life stages prefer.

The creation of artificial spawning grounds for sturgeon has met with some success (Kerr et. al., 2011). When substrates are poor, or when egg densities are high, creation or enhancement of spawning beds increases reproductive success of lake sturgeon (Daugherty et el., 2008). Although spawning bed enhancement has met with some success, efforts my be better spent maintaining existing habitat (Kerr et all, 2011). Several spawning site creation projects have been undertaken on a number of different rivers. Kerr et al., (2011) provide a good overview of various spawning bed creation and enhancement projects.

When proposing construction of new spawning grounds for lake sturgeon, a range of suitable conditions for spawning under varying seasonal conditions of water discharge must be built into the plan. Kerr et al. (2011) identify some key considerations for the construction of new spawning grounds for lake sturgeon as follows:

- Current velocities ranging from 0.1 - 1.5 m/s
- Substrate composed of coarse cobble and rubble
- Water depths ranging from 0.1 - 5.0 meters
- Substrate thickness of at least 0.3 meters
- Maintenance of sediment-free interstitial spaces
- Distance of staging areas from spawning site should be minimized (e.g., < 3 km)
- Current breaks (e. g. boulders) are important

Artificial spawning habitat at Riviere de Prairies by Hydro Quebec approximately 250 m downstream of a hydroelectric facility were constructed in 1985. Gravel and cobble (20 - 30 cm diameter) was deposited at a water depth of 15 - 3.0 m, in current velocity of 1.0 m/sec. This project met with great success with egg-larval survival increasing five-fold whild larval production almost doubled in about five years. The results from this project indicated that the best egg-larval survival rates corresponded to a spawning bed area of 13 square meters per female (Kerr et al., 2011).

As indicated above, a habitat enhancement program should consider all life stages of lake sturgeon including eggs, larvae, yearlings, juveniles, sub-adults and adults. There appears to be considerable variation in habitat preference of various life stages of sturgeon from one water body to another.

Once larval lake sturgeon have completed their downstream drift, it is unclear whether or not they prefer a specific habitat type. This is a significant knowledge gap that needs to be filled prior to considering habitat enhancement or mitigation for this young stage (Golder Assoc. 2011).

Young of year (YOY) lake sturgeon have been documented over a variety of substrates, including sand, pea size gravel and organic substrate. The most commonly reported habitat features associated with YOY lake sturgeon are shallow water, less than two meters in depth and low velocities. In contrast, Auer and Baker (2002), found that deep slower moving areas of the Sturgeon River represented important habitat for YOY lake sturgeon.

Prey availability is a potentially important driver for habitat preference for young sturgeon, and for later life stages as well. Young sturgeon are fast - growing and therefore need an abundant food supply to meet their metabolic needs. In the St. Clair River, the smallest individuals showed a preference for habitats with an abundance of amphipods and chironomids that are associated with soft sediments (Golder Assoc. 2011). Juvenile and sub - adult sturgeon in the Mattagami and Groundhog rivers in Northeastern Ontario were most highly associated with clay substrates where macroinvertebrates were most abundant.

During periods of high flow in the Groundhog river, juveniles, sub - adults and adults occupied discrete pods. As water flows slowed in the summer and autumn, the different life stages became more evenly distributed throughout habitat features (Seyler, 1997b). Adult sturgeon in the St. Clair River preferred rock and cobble substrates where molluscs were abundant

The stretch of the Ottawa river below the Temiskaming dam offers a variety of habitat types. The only way to determine the importance of the various habitats to the different life stages of lake sturgeon in this area is through an intensive monitoring program. Targeting of different life stages that are suspected of using specific habitat types along with an analysis of the parameters that define those habitats (i.e. substrate type and size, water depth and flow velocity, macroinvertebrate abundance) will reveal which habitats are most important to each life stage. Once the association of life stage to habitat type has been determined, only then can habitat and mitigation strategies be implemented.

8.4 Recommendations for habitat assessment, restoration and fish passage

- Lake Sturgeon spawning areas below the Temiskaming dam and throughout Lac La Cav need to be located and mapped in greater detail than they are currently. This need is greatest in those areas where lake sturgeon populations are depressed, which includes Lac la Cave.
- a thorough assessment of critical habitat will examine substrate features of the river where feasible as well as determination of flow regime and thermal stability of the river.

- a thorough examination of water quality, focused on contaminants from pulp mill effluent and potential changes due to climate change. Analysis should include an assessment of debris build up that has resulted from historical logging practises on the Ottawa river.
- critical to spawning success of lake sturgeon is a thorough evaluation of water level fluctuations during spawning, incubation and larval drift periods below the dam. This will require collaboration with PSPC?, who determine regulation of water levels at the Temiskaming dam.
- the feasibility of designing a fishway that will accommodate lake sturgeon is recommended to determine if there is any suitable habitat for sturgeon above the dam that was accessed historically.
- Work with PSPC to design a fishway that could potentially accommodate lake sturgeon based on the success of fishways at other dams on rivers inhabited by sturgeon.

9.0 Potential for Artificial Propagation and Stocking of Lake Sturgeon in the Ottawa River

Culture and stocking of lake sturgeon can be an essential too in the rehabilitation of sturgeon populations where they have been diminished through commercial fishing and other threats due to human activity (Golder Assoc. Ltd. 2011). Stocking of lake sturgeon can be used as either a short term or long term management strategy, the use of which will depend on the goals of the management program. Each waterbody must be assessed individually when considering stocking program, with realistic and achievable goals in place prior to any fish being released.

Supplemental stocking is the addition of individual fish to an already established, but diminished, or threatened population (Golder Assoc. Ltd, 2011). This is the case for Lac La Cav, or the Ottawa river below the Temiskaming dam. Although the population has been assessed as ‘stable’ (Haxton, 2008), the overall numbers of sturgeon are miniscule now relative to abundances that have been reported historically for the Ottawa river.

Assessment of the success of a lake sturgeon program must cover at least one generation in the life history of lake sturgeon which is 15 - 20 years. As a result of this time frame, many sturgeon stocking programs lack effective evaluation.

The largest sturgeon stocking programs are currently in Wisconsin and Michigan (Smith and Hobden, 2011). In Manitoba, Saskatchewan and Quebec, stewardship groups in combination with industry have implemented stocking programs for lake sturgeon (Smith 2009). Lake sturgeon have been cultured for stocking programs for Rainy river and Dalles First Nation in Northwestern Ontario by the Mantou rapids fish hatchery (auer and Baker, 2009). Despite the preponderance of lake sturgeon stocking programs in other jurisdictions, stocking of lake sturgeon is currently not endorsed in the Ontario fish stocking guidelines (OMNR, 2002b).

It may be deemed through the lake sturgeon assessment and monitoring program that the portion of the Ottawa river below the Temiskaming dam may benefit from a stocking program. If the population suffers from a problem of low recruitment, then a stocking program may help to overcome the obstacle of low recruitment, if combined with mitigation strategies to increase recruitment success. If the cause of population decline is due to fishing pressure, changes in habitat, including flow regime, or an abundance of predatory fish, these issues must be addressed before a stocking progam can be considered. Essential habitat and appropriate water quality must also be present if stocked fish are to have any chance of survival to reproductive age.

Prior to undertaking a stocking program, there are a number of factors to consider. First and foremost, a stocking plan must be created that outlines objective goals of the program. Stocking duration, strain/source, age/size, stocking rate, marking, disease/invasive species transfer prevention, stocking methods, assessment and evaluation of project success must all be put in place prior to starting the stocking program (OMNR, 2002b). Stocking rates, appropriate sizes and numbers of fish stocked must be based on modeling of annual survival rates of all life stages of lake sturgeon in a given population. Stocking has yet to be proven 'successful' (Galarowicz, 2003). As a result, appropriate stocking rates have yet to be determined.

When stocking fish of any species, caution must be exercised regarding the genetic consequences of broodstock used to create new young. Ideally, genetic strains that are similar to, or from within the same basin should be used (Galarowicz, 2003). Welsh et al. (2010) provide a good synopsis of genetic guidelines for stocking lake sturgeon.

10. Lake Sturgeon and Hickorynut mussels in the Ottawa River.

The Hickorynut mussel is a long-term brooder. After sperm is released into the water by a male mussel, the gametes are taken up by the female mussel to form 'glochidia', the larval stage of the mussel. Spawning occurs in the fall, however, the glochidia are not released from the female until the following summer (Gov. Canada, Species At Risk https://wildlife-species.canada.ca/species-risk-registry/species/speciesDetails_e.cfm?sid=1150)

The Hickorynut mussel (*Obovaria olivaria* Rafinesque, 1820) was assessed as 'endangered' in 2011 by COSEWIC. Measures to rehabilitate the Hickorynut population will depend on extent of suitable habitat. Suitable habitat includes a silty/sandy to sandy/gravelly substrate, from three to four meters in depth with moderate flows. Threats from invasive species including the zebra mussel and Quagga mussel must be low or non-existent, and the area must be free of chemical contaminants. The other characteristic that will determine the feasibility of recovering Hickorynut populations is the presence in suitable numbers of the host fish species that the mussel relies on for early stages of its life - history.

It is presumed that the Lake Sturgeon is the host fish which the Hickorynut depends on to host its glochidia when they are first released from the female Hickorynut. However, most of the evidence that points to the lake sturgeon as the fish host is largely circumstantial. In the few remaining pockets of high abundance of Hickorynut, such as the Coulonge River and the area near Fitzpatrick Island in the Ottawa River, there are relatively high numbers of Lake Sturgeon found as well. There is a great deal of overlap in habitat between the two species, including the depth and flow at which the mussels are typically found. The Hickorynut typically resides deeper than most unionid mussels (Andre Martel, Pers. Comm).

Glochidia have been found on the gills of Lake Sturgeon, during recent work on the Ottawa River near Lake Coulonge. The glochidia were extracted and have been sent for genetic analysis to confirm if they are Hickorynut. Glochidia can't be identified to species visually. The glochidia that have been found on the gills of Lake Sturgeon were found in juvenile fish. If indeed the Lake Sturgeon is confirmed to be the host fish for the Hickorynut, future work will need to address the most likely life stage (age and size) of the sturgeon that are most important to the life - history of the mussel. Laboratory studies by Brady et. al. (2004) have confirmed Lake Sturgeon as a suitable host for the Hickorynut.

10.0 The Role of First Nations in the Restoration and Stewardship of Lake Sturgeon in the Ottawa River

Kebaowek and Wolf Lake First Nations will be intimately involved in the restoration and stewardship of lake sturgeon in the Ottawa river. Lake sturgeon have been and continue to be of great cultural and spiritual importance to the First Nations people with their long association with the Ottawa river.

This conservation plan is a first step in providing a framework within which Kebaowek and Wolf lake with work with stakeholders and industry in consultation with their communities with the goal of restoring the Ottawa river and its lake sturgeon closer to pre - industrial levels. The importance of using Aboriginal Traditional Knowledge (ATK) in the development and implementation of lake sturgeon management strategies is stressed in the Recovery Strategy of Lake Sturgeon in Ontario (Golder Assoc., 2011).

First Nations communities that have been relying on the Ottawa river for sustenance and cultural value, have en-massed large amounts of information related to lake sturgeon distribution, habitat use and status of sub-populations. This information is extremely important to fully understand current distributions and habitat features of lake sturgeon in the Ottawa river (Golder Assoc., 2011). Kebaowek and Wolf Lake First Nations have an excellent opportunity to use this ATK as they move forward with their assessment, management and restoration efforts of lake sturgeon sub-populations within their traditional lands.

Preliminary assessment of the lake sturgeon population below the Temiskaming dam commenced in the spring of 2022. This assessment program is being carried out by Kebaowek and Wolf Lake individuals with the goal of determining numbers of lake sturgeon spawning; determination of spawning area; spawning success and movement patterns of these culturally important fish. The lake sturgeon assessment and monitoring program by First Nations is a long - term project, the success of which will be determined optimally over two or more decades of research due to the life - history characteristics of lake sturgeon.

11.0 Literature cited

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Appendix A