STUDY FOR ACTION TO CONTROL EURASIAN WATERMILFOIL AT THE LAC DU POISSON RESERVOIR (BAIE NEWTON)

Comité du bassin versant de la rivière du Lièvre (COBALI)

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ABOUT COBALI

The Comité du bassin versant de la rivière du Lièvre (COBALI) has been designated by the ministère de l'Environnement, de la lutte contre le changement climatique, la Faune et Parcs (MELCCFP) as the organization responsible for one of the 40 integrated water management zones in Québec. The mission of the organization is to protect, improve and enhance the water resources of the Lièvre and Blanche River watersheds and Ruisseau Pagé watersheds, as well as the resources and habitats associated with them, within a framework of development and in consultation with the various water stakeholders.

This project is an initiative of the Association Bassin Versant du Poisson Blanc (ABVPB). It was made possible thanks to the financial contribution of the following partners, as well as the lake's residents:

A.B.V. du Poisson Blanc

Lac-Sainte-Marie

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NOTE: This document was not produced or reviewed by COBALI. It is a translation of COBALI's "Étude pour une action de contrôle du myriophylle à épi au réservoir lac du Poisson Blanc (secteur de la baie Newton)", which was done by the ABVPB for the benefit of its English-speaking members. Therefore, in the case of any discrepancy between this English version and the original French, the French version will prevail.

Also note that most of the titles and headings in "REFERENCES", "MAP APPENDIX" and "APPENDIX B - AQUATIC GRASS CHARACTERIZATION SHEETS" have been translated into English, however the text and maps in these sections are still in French.

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1. DESCRIPTION OF THE MANDATE

In the summer of 2022, COBALI was commissioned by the Association Bassin Versant du Poisson Blanc (ABVPB) to conduct a study of Eurasian watermilfoil, an invasive aquatic plant, in Baie Newton. The project includes a contextualization and description of the area under study, a characterization of the aquatic grass beds and their cartographic representation, as well as recommendations on possible control methods.

2. CONTEXT AND GENERAL DESCRIPTION

The Lac du Poisson Blanc reservoir (hereinafter also called Lac du Poisson Blanc) is a huge body of water whose territory is shared between two administrative regions and three municipalities, all parts of different regional county municipalities (RCMs). We thus find:

- Municipality of Notre-Dame-du-Laus (MRC of Antoine-Labelle, Laurentians region)
- Municipality of Bowman (MRC of Papineau, Outaouais region)
- Municipality of Lac-Sainte-Marie (MRC of La-Vallée-de-la-Gatineau, Outaouais region)

The reservoir is roughly divided into two large main basins (here referred to as North Basin and South Basin) interconnected by a long, relatively narrow section. The vast majority of the reservoir, including all of the northern basin and approximately half of the southern basin, is included in the Municipality of Notre-Dame-du-Laus. The part southeast of the south basin is in the Municipality of Bowman. Finally, the Municipality of Lac-Sainte Marie covers only a very small part of the reservoir, corresponding to Baie Newton (formerly called Baie à la vase (Mud Bay) on some maps). It is specifically this territory of Baie Newton, in the municipality of Lac-Sainte-Marie, that is covered by this study.

The reservoir is part of the integrated water management zone (ZGIE) by COBALI watershed. The Association Bassin Versant du Poisson Blanc brings together the residents of the entire reservoir and is particularly interested in the preservation of its quality through the realization of projects and awareness-raising activities.

2.1. Characteristics of the Lac du Poisson Blanc reservoir

The following table summarizes the main technical specificities of the Lac du Poisson Blanc reservoir

Table 1. Technical data for the Lac du Poisson Blanc reservoir

Altitude:	201.5m approx. according to level high median
Area:	52.85 km2
Perimeter including the islands:	238.26 km
Perimeter excluding the islands:	139 km
Maximum length:	23.93 km
Maximum depth:	124m
Watershed area:	7,587.29 km2
Drain ratio (upper watershed/upper lake):	143.56

Table 2. Baie Newton Data

Altitude:	201.5m approx. according to level high median
Area:	2 km2
Perimeter excluding the islands:	18 km
Maximum length:	5 km
Maximum depth:	Between 7.5 and 10 m
Shoreline Development Index:	3.59*

* The value of the shoreline development index is the ratio of the perimeter of the lake to the perimeter of a lake of circular with the same area = Perimeter/2*√(π*area). This value can give an indication of the abundance of riparian areas allowing, on the one hand, the growth of plants (primary production), and on the other hand, the availability of sites for the construction of riverside residences (Abrinord, 2008).

A lake whose shoreline development index is equal to 1 means that its shape is circular. A high index indicates that the body of water is irregular in shape and consequently a greater number of residences can theoretically occupy the perimeter of the lake compared to a circular lake of the same area. The higher the index, the more vulnerable the lake is to shoreline development, given that for the same area, the impact of shoreline development is theoretically greater.

According to qualitative classes for this index, Baie Newton has a “long” index, which means a relatively complex shoreline comprising several successions of deep bays and points. It is therefore vulnerable to more intensive development of its shores.

2.2. Bathymetry

Taken as a whole, the Lac du Poisson Blanc reservoir has a very significant depth during the summer, reaching a maximum depth of 124 metres in the southern basin and, in several places, depths of more than 80 metres. However, this depth is highly variable and greatly reduced in several bays, including Baie Newton. Bathymetric maps can be viewed on Maps 8 to 11 of the map appendix.

Baie Newton:

In the specific area of Baie Newton, the depth does not reach ten metres. The deepest parts, located in the eastern half of the bay, the main basin of the bay, and towards the southern basin of the reservoir, reach a maximum depth of between 7.5 and 10 metres. The western end of the bay, which is narrow and elongated, has a depth of less than five metres.

2.3. Hydrology and watershed

The Lac du Poisson Blanc reservoir is a tributary of the Lièvre River. Its outlet (discharge) is a wide channel connecting the northern basin to the river at Notre-Dame-du-Laus. Due to its use as a reservoir, the basin slope of Lac du Poisson Blanc theoretically covers an immense area of 7,587.29 km2, which corresponds to the entire watershed of the Lièvre River, located upstream of the Rapides-des-Cèdres dam. Nevertheless, the watershed of the lake itself, i.e., excluding the water from the Lièvre reservoir, is modest given the dimensions of the reservoir. Most of the reservoir's watershed feeds into the southern basin.

Baie Newton:

The bay is fed by several small streams, most of which constitute the outlets of neighbouring lakes. Gatineau Creek is by far the main tributary of the bay. This stream is the outlet of Lac Brochet and Lac Tucker, and drains the eastern slopes of Mont Sainte-Marie, emptying into Baie Newton at its west end. In this same sector, we also find the arrival of the outlet of Petit lac à la Truite. Thus, the vast majority of water that flows into Baie Newton comes from the tributaries at its western end. In fact, Baie Newton itself is essentially the widening of the course of Gatineau Creek following flooding of the reservoir.

The watersheds can be seen on maps 6 and 7 of the Map Appendix.

2.4. Reservoir water levels

Lac du Poison Blanc is a reservoir, and as such the water level is managed in a utilitarian way and varies enormously (the tidal range is significant). The reservoir was created by the construction of the Rapides-des-Cèdres dam in Notre-Dame-du-Laus, which controls the flows and levels of the Lièvre River, downstream from the outlet of Lac du Poisson Blanc. When the dam retains the water of the river, there is a backflow of water upstream, in the water retention territory of the dam, which includes Lac du Poisson Blanc but also the reservoir in Les Sables and upstream, many areas of the river up to the area around Saint-Aimé-du-Lac-des-Îles to the north.

The purpose of the reservoir is essentially to retain the waters of the spring flood in a safe manner, to limit the risk of flooding downstream of the dam, on the Basse-Lièvre and the Ottawa River. It is also to create a water reserve to supply in a constant and predictable way the numerous hydroelectric power stations located downstream from the dam on the Lièvre and the dam itself, during the entire year.

Levels are managed within the parameters of the water management plan adopted by the Ministry of the Environment, the Fight against Climate Change, Wildlife and Parks (MELCCFP).

In its annual cycle, water level management can be summed up as follows:

- End of winter: evacuation of water (emptying) from the reservoir in anticipation of the flood. The tank reaches its lowest level and the old waterways become apparent again.
- At the beginning of the summer period: the dam retains the water and there is backflow upstream. The reservoir gradually fills up to the level of the summer shoreline. This level then gradually decreases during the summer.
- Autumn: the water level continues to decrease until the end of October in anticipation of the autumn rains, which cause a rise in November. Then, the level subsequently lowers gradually during of the end of winter.

In the Baie Newton area as elsewhere, outside the winter period, the water level is therefore lower in the fall but especially and very clearly in the spring (April/early May). Baie Newton is thus supplied with water both by its direct tributaries, but also largely by the rising water in the reservoir in the spring from the Lièvre River.

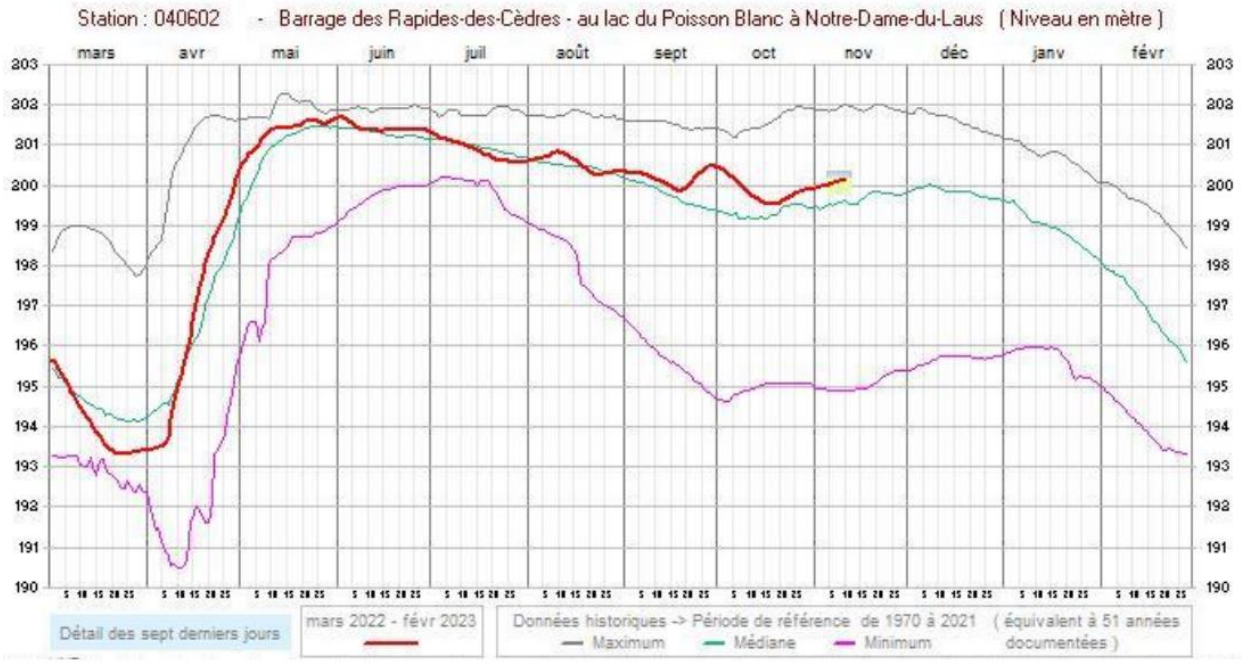

Figure 1. Annual water level graph for the Rapides-des-Cèdres Dam and Lac du Poisson Blanc reservoir

The graph illustrates that the median water levels at Lac du Poisson Blanc vary between 194.1m and 201.5 m, a median variation of 7 metres annually, with a very rapid change in levels between the end of March (minimum) and the beginning of June (maximum). However, comparing the minimum levels and maximum historically reached, the historical levels of the reservoir include an impressive range of about 12 metres between the historical minimum and maximum level.

As for Baie Newton, whose maximum depth is just over 7.5 metres, many shallow areas of the bay (where the aquatic grass beds are located) are exposed during part of the spring, particularly between mid-April and early May. This is essentially the case for areas with a depth of less than five metres, which includes, among other things, almost the entire western part of the bay, which is narrower and whose depth is less than five metres.

The following aerial photos illustrate the water level and the presence of partially exposed areas in the spring and fall, usually lighter in color. All photos are taken from the "history" feature of the Google Earth software.

Figure 2. West of Baie Newton on April 3, 2015. The bay is exposed, and the course of the old waterways is visible, particularly the Gatineau stream. The cutting of the photo does not allow to see the whole of the bay. However, we see that the stream continues inside the depth of 5 metres of the bathymetry and approaches the line of 7.5 metres, a sign that the bay is exposed to a depth greater than 5 metres.

Figure 3. Northeastern Baie Newton on May 7, 2015 (Aquatic Grass Beds 14-15)

Figure 4. West of Baie Newton on May 7, 2015

Figure 5. The center of Baie Newton on May 7, 2015 (private boat launch, Aquatic Grass Beds 11 and 12).

Figure 6. Northeastern Baie Newton on May 7, 2015 (Aquatic Grass Beds 14-15)

Figure 7. Aquatic Grass Bed 16 partially exposed, May 7, 2015

Figure 8. West of Baie Newton, September 20, 2009

Figure 9. Central Baie Newton, September 20, 2009 (private boat launch, top right)

2.5. Land cover and human uses

The occupation of the territory in the watershed of the reservoir itself is almost exclusively under forestry cover, mostly in public ownership. Some portions of public forest are affected by logging, but a significant part of the territory of the watershed is made up of protected areas.

Most of the area is in the proposed Mont-Sainte-Marie biodiversity reserve, located on the west and southwest side of the reservoir and includes most of the islands. This protected area will be expanded substantially in the next few years. There are also a remarkable number of outstanding forest eco-systems in the watershed. In general, steep slopes and escarpment rocks that surround the reservoir limit access to forestry operations around the lake.

❖ **Residential Sector**

The shores of the reservoir are occupied by a number of primary and secondary residences. The main residential sector is located in the northern basin at Notre-Dame-du-Laus. The second in size is that of Baie Newton, in Lac-Sainte-Marie. Finally, a few residences are located in Bowman, at the southeastern end of the reservoir.

In the Baie Newton area, an approximate aerial photography survey reported at least 70 residences built with access to the body of water, distributed in clusters of dwellings on either side of the perimeter of the bay.

❖ **Recreational tourism sector**

Several outfitters conduct fishing and cabin rental activities on Lac du Poisson Blanc, particularly in the area of Notre-Dame-du-Laus.

In Bowman, the Air-Eau-Bois camp offers cabin and boat rental activities, as well as summer camps for young people, including canoe-camping excursions on the reservoir.

Finally, the Poisson Blanc Regional Park offers canoe camping sites on the islands and around the Reservoir, as well as boat rentals, in addition to having developed several trails. The park manages the territory and offers its activities exclusively on the territory of the Municipality of Notre-Dame-du-Laus.

❖ **Public access to the lake and navigation**

Baie Newton:

A municipal public boat ramp is present on the south channel of the bay, in its narrowest portion, on Montée Jean-Marc Road (see maps 1 to 5 in appendix).

A private, group-owned boat ramp is located on the north shore of the main basin of the bay, off Kelly-Newton Road. Its use is restricted to members of the group.

Figure 10. Public boat ramp at Montée Jean-Marc Road

Figure 11. Private boat ramp at Kelly-Newton Road

Other public access

Public access is available for boat launching at the Air-Eau-Bois Camp in Bowman. In addition, there is another very busy access point at Notre-Dame-du-Laus, from Lake Campion (part of the reservoir in Les Sables), which allows easy access to Lac du Poisson Blanc. All things considered, the Baie Newton area has relatively few tourists from recreational tourism businesses or organizations.

Boat Washing

Without going into the details of the operating modes, here is a summary of the boat washing stations in connection with access to the reservoir. In 2023, for the first year, the three main accesses to the reservoir for boaters coming from outside will be served by a boat washing station:

- The Municipality of Lac-Sainte-Marie has a new free boat washing station, located on the shores of Lac Sainte Marie, in the village. It is located on the road leading to Poisson Blanc from Highway 105.

- The Municipality of Denholm installed a new boat washing station in the summer of 2022 free use at its municipal office, which is located on the road allowing access to the Poisson White in the Bowman sector and the Air-Eau-Bois camp.

- The Municipality of Notre-Dame-du-Laus has built a new free boat washing station next to the Lake Campion boat launch (Sables Reservoir). It will be in operation from summer 2023.

2.6. Biological Medium

Note: aquatic grass beds will be dealt with in detail in Section 4.

❖ Fish

Many species of fish are listed at the Lac du Poisson Blanc reservoir. The following table lists these species.

Table 3: Main types of fish identified in the Lac du Poisson Blanc reservoir

Main species of fish in Lac du Poisson Blanc

Common Name	Latin Name
Lake Trout	Salvelinus namaycush
Walleye Sander	Vitreus
White Sucker	Catostomus commersonii
Smallmouth Bass	Micropterus dolomieu
Largemouth Bass	Micropterus salmoides
Perch	Perca flavescens
Pumpkinseed	Lepomis gibbosus
Lake Whitefish	Coregonus clupeaformis
Lake Cisco	Coregonus artedi
Monkfish	Lota lota
Northern Pike	Esox lucius
Cyprinid (several species)	

Among these fish species of sporting interest, the lake trout is the one that attracts the most attention at Lac du Poisson Blanc given the fragility of its population in a reservoir context. Indeed, although an indigenous population supported by the seeding is there, the large variation in the water levels can weaken its reproduction since eggs laid on shoals in the fall can be exposed (dried out) during the significant drop in water levels at the end of winter. However, lake trout use rocky shoals as spawning grounds, a habitat unlikely to coincide with the Eurasian watermilfoil beds targeted by this project.

❖ **Status species**

As of November 11, 2022, the Quebec Natural Heritage Data Center (CDPNQ) did not identify any species with status associated with the aquatic or wetland environment in Baie Newton/Lac du Poisson Blanc or at least one kilometre from its shores (CDPNQ, 2022). The characterization of the aquatic grass beds in this body of water did not identify any species with status under Quebec law.

However, one occurrence of the water snake (Nerodia sipedon), a species likely to be designated as threatened or vulnerable in Quebec, is a little over a kilometer north of Baie Newton, on an unnamed lake located north of Lac du Moulin. A little further, still north of Baie Newton, another occurrence found at Green Lake. These two lakes are located slightly outside the watershed. Other occurrences of the species are reported from Bowman and Notre-Dame-du-Laus on or near the shores of the reservoir. This information suggests that the species could frequent the Baie Newton area.

Two other species with relevant status within the framework of this project are listed elsewhere on Lac du Poisson Blanc. Let us first mention the White-headed Sea Eagle (Haliaeetus leucocephalus), a vulnerable species in Quebec, whose nesting has been confirmed on the northern basin. This species nests in large trees, often white pines, bordering large bodies of water. Finally, the nesting of the Peregrine Falcon (Falco peregrinus anatum), a vulnerable species in Quebec, was also confirmed closer, on an island in the southern basin of the reservoir. This species nests on steep cliffs. In both cases, such nesting habitats are available in the areas of Baie Newton, although these species have not been reported there. It would be important to ensure that a nest of these species is not too close to the control work during the nesting period to avoid disturbing them.

2.7. Monitoring of water quality, physio-chemistry, and shoreline condition

❖ Trophic State

The Lac du Poisson Blanc reservoir is registered with the Voluntary Lake Monitoring Network (RSVL), a program coordinated by the MELCCFP. The station number is 771A and water is drawn from the lake bottom, located in the southern basin, near the entrance to Baie Newton. Table 4 summarizes the data obtained. To get a complete trophic state, all the parameters must be available for the same year (here 2014 and 2015). However, the transparency test only was also done in 2016 and 2020.

Table 4. RSVL results for Station A (south basin) of Lac du Poisson Blanc from 2014 to 2020

Lake	Station	Year	Average of Measurements (number of samples)				Trophic State of the Lake
			Transparency (m)	Phosphorus Total (µg/l)	Chlorophyll (µg/l)	Dissolved Organic Carbon (mg/l)	
du Poisson Blanc	771A (South basin)	2014	4.1 (7)	6.1 (3)	2.9 (3)	3.9	Oligo-mesotrophic
		2015	4.3 (8)	3.7 (3)	3.9 (3)	4 (3)	Oligo-mesotrophic
		2016	3.5 (5)				Mesotrophic
		2020	3.9 (7)				Mesotrophic

(MELCCFP, 2022b) * Partial results (transparency only)

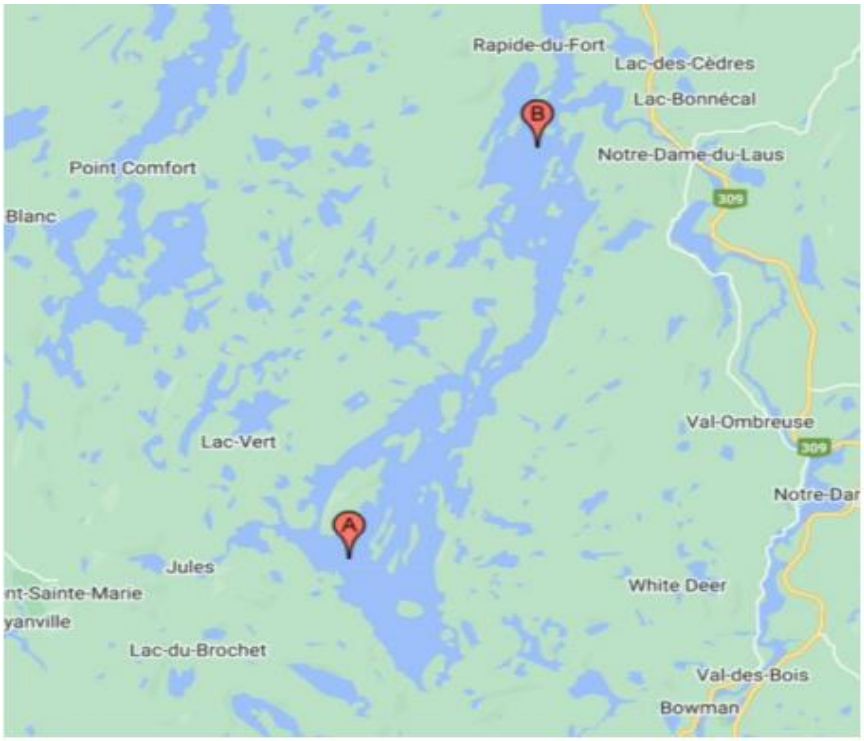

Figure 12. RSVL stations on Lac du Poisson Blanc reservoir (MELCCFP, 2022b)

The results available here are limited to the station in the southern basin; another station also exists in the northern basin of the reservoir, far from Baie Newton. In light of these results taken at the lake bottom near Baie Newton, the lake would be in the oligo-mesotrophic class, i.e., a lake relatively unenriched in nutrient elements, but still showing some signs of eutrophication. In fact, in the case of such a large and deep lake, draining a relatively small watershed compared to its size, the expected result would be more the oligotrophic class. However, the effect of the drawdown can influence the results downwards given the influence of the Lièvre River and the erosion generated by the variation in water levels. It remains that these results for the entire lake can hardly be considered representative of Baie Newton, especially for the most western part, which is very shallow and exposed during part of the year.

❖ ***Riparian Buffer Strips***

The vegetation observed in the riparian buffer strips is variable on Baie Newton. It is estimated that more than half of the shoreline area can be considered to be in a fairly natural state. It remains that several properties have little vegetation and maintain grassy or landscaped shorelines. Several ripraps (breakwaters) were also made by owners.

3. EURASION MILFOIL AND ITS INTRODUCTION TO LAC POISSON BLANC

3.1. Description of Eurasian watermilfoil and its general impact

Eurasian watermilfoil is a tall, submerged aquatic plant. Native to Eurasia, it is considered invasive in Quebec. It has undoubtedly been one of the most common better-known, and better-publicized invasive aquatic plant species for several years. Its introduction to Quebec probably came from ballast water of ocean-going vessels using the St. Lawrence Seaway, as well as through discharges of aquarium water, since the plant has been heavily used as a decorative plant in aquariums. The plant was subsequently disseminated in many lakes and streams by the transport of fragments of the plant by boaters and other users of bodies of water. Eurasian watermilfoil widely listed in most regions of Quebec. The most affected regions, however, are the Estrie, the Laurentians and the Outaouais. This plant reproduces by means of spikes floating on the surface of water at the end of the season and can thus produce seeds. However, its main mode of reproduction is asexual, by fragmentation and cuttings since a single fragment 1 cm long can give rise to a new colony. Eurasian watermilfoil largely fragments on its own, particularly at the end of the season, and thus ensures its propagation. However, the passage of boats or the action of the waves in the aquatic grass can also increase the number of fragments available for its reproduction.

Eurasian watermilfoil is particularly effective in growing rapidly at the start of the season, even in nutrient-poor oligotrophic lakes. Indeed, unlike most native species of aquatic plants that mainly draw their nutrients from the water, Eurasian watermilfoil can also draw its nutrients from the sediments using its root network and extensive rhizomes.

This competitive advantage and its ability to grow in depths of up to ten metres if the conditions are favourable, allow it to colonize bodies of water hitherto free of aquatic plants, and compete effectively with native aquatic plants already present.

In addition to having a significant impact on plant and animal communities, Eurasian watermilfoil can accelerate the overall eutrophication process of a body of water by increasing plant biomass and the amount of organic matter on the substrate, which also amplifies the phenomenon of decomposition and the demand in dissolved oxygen. Through the decomposition of grass beds in winter, Eurasian watermilfoil also releases a lot of nutrients it has taken from the sediments in the water, which then become available to other aquatic plants and algae. This characteristic amplifies, through this role of "nutrient pump", more eutrophication.

Studies demonstrate that the presence and growth of Eurasian watermilfoil is more limited by the availability of nitrogen than phosphorus. In addition to the impact on aquatic communities and habitat quality, dense beds of Eurasian watermilfoil can significantly negatively affect recreational activities such as swimming, boating, fishing, and landscapes. However, it is observed in several places that the densities and Eurasian watermilfoil areas may decrease in an infested sector after about ten years, without the reason for this being confirmed (Lavoie and Lelong, 2017; MELCC, 2022c).

3.2. History of the spread of Eurasian watermilfoil in Lac du Poisson Blanc reservoir

The first mention of the presence of the species reported to COBALI date from 2019, but with supporting photos dating from 2018. They concerned Baie Newton following photos taken by members of the lake association. That same year, the Poisson Blanc Regional Park mentioned the presence of the Eurasian watermilfoil in the northern basin of the lake. In August 2019, COBALI carried out a summary survey of the infested areas with the lake association. The species has thus been confirmed in all areas of Baie Newton, but also near the Air-Eau-Bois Camp in Bowman, as well as at Creuse Bay in Notre-Dame-du-Laus. A report with summary mapping of mentions was produced (COBALI, 2019). An employee of the Rouge Watershed Organization, Petite Nation Saumon (OBV RPNS) also accidentally discovered an aquatic grass bed in the north (Lac Cuillèrier) in 2020 and reported it to COBALI. We can therefore determine that Eurasian watermilfoil has been present at least since 2018 and was certainly around for a few years before that.

Regarding the presence of Eurasian watermilfoil in other bodies of water in the Baie Newton watershed, COBALI conducted a survey in 2019 in the largest tributary lake of the bay, Lac du Brochet. The species was not present there. There are no data for the other lakes. Otherwise, Eurasian watermilfoil is present in the Rivière du Lièvre upstream of the Poisson Blanc reservoir and in many lakes in its watershed.

4. CHARACTERIZATION OF AQUATIC GRASS BEDS AND HABITATS

4.1. Material and method

COBALI has conducted a characterization study of all the aquatic grass beds in Baie Newton in order to identify the characteristics and plant components, as well as the relative abundance of different species and in particular, that of Eurasian watermilfoil. For the realization of the field work, two COBALI employees were present, the project manager Pierre-Étienne Drolet, biologist and project coordinator, and Mariève Charrette, wildlife technician and project manager. The characterization was done August 31 and September 1, 2022.

Methodology used for the characterization:

- The characterization was done from a boat driven by a member of the association. Besides the visual observations from the boat, all of the detailed characterization was done using an aquascope and by collecting, if necessary, specimens using a rake. Taking single points or to indicate the coordinates for the beginning and the end of the homogeneous zones was conducted by means of a GPS (Garmin GPSMAP 60 Cx, accuracy ± 3 metres). Photographs were taken all around the bay, shore, and aquatic grass beds, as well as some underwater photos and videos using a camera GoPro. The weather was mostly cloudy and visibility from the boat was average.

- **The characterized aquatic grass beds are represented on maps 1 to 5 of the Map Appendix.**
  Four classes of cover by Eurasian watermilfoil in aquatic grass beds have been established:
  - **Green**: 0% to 29%
  - **Yellow**: 30% to 49%
  - **Orange**: 50% to 79%

- **Red**: 80% and more (aquatic grasses considered monospecific by the MELCCFP)
- A few small monospecific Eurasian Watermilfoil tillers/shoots (80% or more) were identified by means of a pictogram when they were large enough to justify isolating them in relation to the aquatic grass bed in which they were found. The exact GPS points are provided in the characterization sheets in the appendix.

Since the project is related to the control of Eurasian watermilfoil, the characterization study was conducted with this in mind. Therefore, the main criterion evaluated was the estimation of the percentage of Eurasian watermilfoil in each of the areas, compared to native vegetation. As far as native species are concerned, the project obviously did not require an identification of the species of each plant individually; therefore, the results should not be considered as an exhaustive botanical survey.

However, the species were noted as well as their relative abundance. In some cases, especially for pondweeds that are more difficult to identify, groupings have been made according to the categories used in the identification document of the main native plants present in the lakes of the Laurentians (CRE Laurentides, 2018). Particular attention has also been paid to the detection of other invasive alien species identified by the RSVL detection protocol.

4.2. Results

In general, Baie Newton includes small areas of aquatic grass beds separated by rocky areas. The main beds are in the southwestern end of the bay and north of the main basin of the bay, in depths less than five metres.

Table 5. Plant species observed in the Baie Newton aquatic grass beds

Common Name	Latin Name	Occurrences in the Aquatic Beds
Nitella Algae	Nitella spp.	01
Chara Algae	Chara spp.	01-02-03-10-11-15-06-17-18
Canadian Elodia	Elodea canadensis	01-02-04-05-07-08-09-10-11-15-16-17-18-19-20-21-22
Eurasian Milfoil	Myriophyllum spicatum	01-02-03-04-05-06-07-08-09-10-11-12-13-14-15-16-17-18-19-20-21-22
Flexible Naiade	Najas flexilis	01-02-03-08-10-16-18-20-21-22
Robbins' Pondweed	Potamogeton Robbinsii	07
Emerged Pondweed	Potamogeton epihydrus	22
Richardson's Pondweed	Potamogeton Richardsonii	01-02-03-04-07-09-11-12-13-14-16-17-18-19-20-21-22
Type 3 Pondweed	Potamogeton	01-02-03-04-06-07-09-10-11-12-13-15-16-17-18-19-20-21-22
Type 4 Pondweed	Potamogeton	01-03-04-06-07-09-10-11-12-18-20-22
Amphibious Knotweed	Persicaria amphibia	15
Ribbon Plant sp.	Sparganium spp.	02
Intermediate Bladderwort	Utricularia intermedia	01
Common Bladderwort	Utricularia vulgaris	01
Vallisneria of America	Vallisneria americana	12

❖ Maps of Aquatic Grass Beds and Areas

Maps 1 to 5 in the Map Appendix illustrate the results of the characterization study. They are colour-coded to illustrate the classes of Eurasian watermilfoil in relation to native plants (not in relation to the total area of the aquatic grass beds).

A detailed summary for each bed is provided in Appendix B of the report. Each bed also has an assigned percentage of all-species cover relative to the total area.

The aquatic grass beds total 278,417 m2 or 27.84 hectares. This represents approximately 3.6% of the area of Baie Newton.

All of the aquatic beds in the bay are colonized to varying degrees by Eurasian watermilfoil and no bed was composed exclusively of native plants. However, more than half of the beds are dominated by native plants (green and yellow classes). Seven beds are dominated by Eurasian watermilfoil, six are in the orange class (50% to 79%) and only one small bed reaches the level of mono-specificity (red class): aquatic grass bed #5.

Finally, four small monospecific tillers/shoots have been identified: the GPS coordinates of these areas and the estimated radius for each one is provided on the map of the relevant aquatic grass bed.

Table 6. Aquatic grass beds according to cover by Eurasian watermilfoil (2022)

Aquatic Bed	Percentage of Eurasian Milfoil in Aquatic Grass Bed (%)	Total Area of Aquatic Bed (m2)	Areas of Monospecific Sites (m2)	Area of the Site in Relation to Total Aquatic Grass Bed (%)
Aquatic Bed 1	1	69,570		25
Aquatic Bed 2	5	29,951		11
Aquatic Bed 3	60	2,847		1
Aquatic Bed 4	10	8,793		3
Aquatic Bed 5	80	3,525		1
Aquatic Bed 6	50	4,644		2
Aquatic Bed 7	60	29,455		11
Aquatic Bed 8	30	8,164		3
Aquatic Bed 9	60	11,822		4
Aquatic Bed 10	60	3,458		1
Aquatic Bed 11	5	13,983		5
Aquatic Bed 12	30	12,296		4
Aquatic Bed 13	30	5,892		2
Aquatic Bed 14	5	17,394		6
Aquatic Bed 15	15	14,005	314	5
Aquatic Bed 16	30	10,761	79	4
Aquatic Bed 17	40	1,319		0.5
Aquatic Bed 18	40	4,366		2
Aquatic Bed 19	30	6,460	79	2
Aquatic Bed 20	50	7,124		3
Aquatic Bed 21	30	5,140	314	2
Aquatic Bed 22	50	7,488		3
	Total Area Where Milfoil is > 80% (Sum of cells in red)		4,311 (2%)	
	Total Area of Aquatic Grass Beds	278,417		100

Figure 13. Eurasian Watermilfoil, right, and native plants (mainly Flexible Naäid), in Aquatic Grass Bed 1.

Figure 14. Eurasian watermilfoil (one plant on the left), and native plants (Water Nymph and Richardson's Pondweed, in the foreground), in Aquatic Grass Bed 1.

Figure 15. Native portion of Aquatic Bed 1 (Richardson's Pondweed & Water Naiad, in light green)

Figure 16. Dense Naiad aquatic grass near the surface, in Aquatic Grass Bed 1.

Figure 17. Dense Naiad aquatic grass near the surface in Aquatic Grass Bed 2.

Figure 18. Dense aquatic grass composed mainly of waterweed, in Aquatic Grass Bed 4.

Figure 19. Overview of the monospecific Eurasian watermilfoil in Aquatic Grass Bed 5

Figure 20. Monospecific tillers/shoots of Eurasian Watermilfoil in Aquatic Grass Bed 15

Figure 21. Monospecific tillers/shoots of Eurasian Watermilfoil in Aquatic Grass Bed 15

Figure 22. Mixed bed of watermilfoil and pondweed (Type 4) in Aquatic Grass Bed 2

❖ *Detection of invasive alien species*

No other invasive alien plants have been identified.

❖ *Status species*

No status species were detected during the characterization study.

5. OVERALL DIAGNOSIS

The characterization study confirms the presence of Eurasian watermilfoil in all Baie Newton aquatic grass beds. However, the beds are mostly mixed and Eurasian watermilfoil is found in the presence of native plants.

The percentage cover of Eurasian watermilfoil is below 50% in most beds and only exceptionally reaches levels of 80% or more. Since it appears to have been present only for a few years, it is likely that Eurasian watermilfoil has not yet reached its maximum level of invasion in terms of biomass.

The most densely colonized area is the area between the southwestern bottom of the bay and the narrow channel leading to the main basin of the bay (Aquatic grass Beds 3 to 9). In general, Eurasian watermilfoil has certainly increased the density of plants in the existing aquatic beds but does not appear to have increased noticeably the net areas of aquatic grass in Baie Newton, as seen in other lakes.

Fortunately, aquatic grass and Eurasian watermilfoil are not found in the narrow navigation areas where boats are forced to pass. The central portions of the navigation channels are always deep enough to ensure that boats do not encounter Eurasian watermilfoil beds, which would be very risky for the export of fragments to other parts of the lake or even to other bodies of water. Therefore, it is only when boats travel along the shoreline or enter shallow bays that they are likely to pass through such beds.

With respect to the boat ramps specifically, the municipality's public boat launch is in a deep area where there is no aquatic grass. From there, boaters can reach the rest of the reservoir without passing through a weed bed, as long as they stay in the center of the channels. On the other hand, the privately-owned landing on the north-west shore of the main basin of Baie Newton is in a relatively shallow grassy area where Eurasian watermilfoil is abundant, although the bed remains primarily native (yellow class). Additional caution is therefore required in this area when launching or leaving the water.

Finally, it should be noted that Eurasian watermilfoil is one of the easiest species to observe from the surface when the water does not reach a great transparency. This is due to its large size, which it shares with certain pondweeds. In some aquatic grass beds where the species cohabits with native plants of lesser size, the impression is that there is only Eurasian watermilfoil present. However, when we observe with an aquascope, you can see that there are often many native plants, but they are less noticeable because they are smaller. There is also the possibility of misidentification by boaters, especially when the presence of milfoil is known. There may be a tendency to assume that most dense beds are Eurasian watermilfoil, which is not the case. Some native species such as Canadian watermilfoil, flexible naiad and pondweeds can also form dense beds.

6. OVERVIEW OF POSSIBLE CONTROL METHODS

6.1. Authorized control methods

Prior to any control project, an application for a certificate of authorization must be issued by the MELCCFP and meet the required conditions. Currently, three main methods are used in Quebec for the control of Eurasian watermilfoil and could be considered under certain conditions. This information is given as an indication but must be confirmed with the authorities.

1. **Biodegradable burlap:** covering is only permitted for monospecific (80% and more) grass beds or tillers/shoots, and tillers must be treated over their entire surface area. The covers must be fixed to the lake bottom by means of movable anchors that must be removed no later than three years after the installation of the cover. The work must be done in the spring. A follow-up report in years 1, 3 and 5 is required, between July 15 and September 30 when Eurasian watermilfoil is at its peak growth. A 2-3 year follow-up is also required for sediment accumulation, regrowth, and burlap movement.

2. **Reusable Aqua-screen type covers**: covering is only permitted for monospecific (80% and more) aquatic grass beds or tillers/shoots, and tillers must be treated over their entire surface area. The canvases must be fixed to the lake bottom by means of mobile anchors. The covers and the anchors must remain in place for eight weeks to allow native plants to regrow afterwards. The tarps and anchors must be removed every year thereafter, which takes more time than jute, but can be reused for several years and are more resistant. The work should be done in the spring. A follow-up report in years 1, 3 and 5 is required between July 15 and September 30 when Eurasian watermilfoil is at its peak growth.

3. **Manual removal:** plants should be carefully removed completely, including roots and rhizomes. A monospecific (80% and more) tiller/shoot must be treated over its entire surface area. Measures are required to prevent cuttings that come to the surface from colonizing other areas (e.g., turbidity curtains, collection of fragments with nets, etc.). **Manual removal is the only method permitted for Eurasian watermilfoil control in non-monospecific beds.**

7. SUGGESTED CONTROL METHODS AND STRATEGIES

Overall, the control of Eurasian watermilfoil in the Lac du Poisson Blanc reservoir must take into account the following contextual elements:

- Watermilfoil is already present in all of the aquatic grass beds of Baie Newton, and also in various places in the rest of the reservoir.

- No control method can realistically completely eradicate the plant when it is already well-established, as is the case in Baie Newton. Moreover, given the presence of watermilfoil in the rest of the reservoir and in the Lièvre watershed, it is impossible to prevent a reintroduction from the rest of the reservoir, even if Eurasian Watermilfoil was completely eradicated in Baie Newton. We therefore speak in all cases of a control of the level of invasion.

- A single monospecific aquatic grass bed with more than 80% Eurasian watermilfoil is present, in addition to four small individual tillers/shoots.

- The fact that some aquatic grass areas are exposed (dry) at certain times of the year, particularly in April and early May, would make it possible to consider, with authorization, a "dry" control method or in very shallow water, without having to systematically resort to divers. However, this possibility depends on the water levels specific to the current year and the weather conditions (persistence of ice or frost in April). The work must also be done without machinery and vehicles on the shore.

7.1. Proposed control methods

In the current context where Eurasian watermilfoil is usually found in mixed aquatic grass beds with native species (less than 80% cover of Eurasian watermilfoil), control of the majority of beds will have to be selective in order to target only Eurasian watermilfoil plants. The proposed control method is primarily **manual uprooting** of most aquatic grasses (green, yellow, and orange). However, specifically for monospecific Aquatic Bed Number 5 and small monospecific tillers/shoots identified on the maps**, the use of canvas** (jute or aqua screen of your choice) to cover the Eurasian watermilfoil could be considered.

7.2. Control of Eurasian watermilfoil by manual uprooting

Manual uprooting is a tedious method and requires a lot of time and attention to detail. However, it has several advantages:

- This is likely to be the most effective method in the long term if the required work is authorized. Projects that have so far drastically reduced watermilfoil on the scale of an entire lake used this method. Two cases of complete eradication have been documented. This is the most recommended method and deemed the most effective in reviews of literature by the MELCCFP.

- This is a selective method well suited to the reality observed at Lac du Poisson Blanc, where there are no large single-species aquatic grass beds.

- This is the simplest method from a technical and material preparation point of view.

- This is the least costly method in monetary terms for the purchase of equipment.

- This is the simplest method in terms of the post-control monitoring required by the ministries.

- This is the only method that completely removes Eurasian watermilfoil biomass outside the lake, thereby removing the nutrients stored in the plants from the lake. This method can slow down the phenomenon of eutrophication of the water body. The effect of manual uprooting to maintain the oligotrophic conditions of a lake would therefore be more direct compared to mats that kill the plant but lead to its decomposition and the release of nutrients.

- Manual uprooting using native species promotes the recolonization of the site by the species' neighbouring native plants.

- Manual uprooting reduces the risk of unwanted impacts on benthic fauna (from the bottom of the lake) and fish.

- The quantity of watermilfoil, the year following the first uprooting, decreases by 30 to 80% (Lavoie and Lelong, 2017)

- Two consecutive years of intensive uprooting (twice a year, end of June and beginning of August) cause a decrease the amount of watermilfoil by 97% in the third year (Lavoie and Lelong, 2017)

- A maintenance or follow-up uprooting (once a year) would be sufficient to maintain the Eurasian watermilfoil at an acceptable level of invasion (Lavoie and Lelong, 2017)

The main disadvantages of this method for the ecosystem are the resuspension of sediments during the uprooting and destruction of the grass beds used by the fauna associated with these habitats. Moreover, it allows the production of Eurasian watermilfoil fragments during handling.

At the human level, the costs are significant in terms of labour time. It is indeed a slow technique that requires a lot of time and manpower. It involves intensive and tedious work over several years. When it is carried out with divers, this is work in an environment with little visibility due to the low water transparency when sediments are suspended (Ministry of Sustainable Development, Environment and Parks (MDDEP), 2007).

❖ *Method details (with divers) and recommendations*

The uprooting must be carried out by divers or people trained by a professional in biology and must be done in such a way as to remove the stem and the root system from the body of water to prevent the regrowth of seedlings. This must be done delicately to limit the resuspension of sediments and the fragmentation of stems. An aquatic grass bed must be treated over its entire area during a given season to avoid rapid recolonization. In addition, all Eurasian watermilfoil fragments must be collected from the water column and on the surface, if necessary, to prevent them from colonizing other areas.

- Divers, always in teams of two, gently tear off the stems, as well as the root system of the Eurasian watermilfoil plant in the identified areas. This uprooting must be done meticulously so as not to harm native vegetation and to create as little sediment as possible. All the divers must have had prior training in the identification of Eurasian watermilfoil and the uprooting method.

- Certified divers are supervised at all times by people on board boats on the surface and in close proximity to the team. Equipment needed to rescue people in distress must be available in the boat. In addition, a first aid kit and at least a person qualified to give appropriate first aid must be available at all times (ex: first responder).

- Appropriate buoys and flags must be installed to signal the presence of divers.

- Measures must be proposed to the MELCCFP to ensure that the dispersion of the fragments is prevented that will be produced during uprooting. However, the MELCCFP no longer automatically requires the use of a turbidity curtain, which was expensive and complex to use. Fragments can be harvested by people on the surface or divers, for example using pool draw-outs (Carolane Riopel Leduc, (MFFP) 2021).

- It is strongly suggested to place the Eurasian watermilfoil plants in boilers or containers and not directly in the bottom of the boat (rowboat or pontoon), given the difficulty of cleaning them to remove the plant fragments.

- In parallel with the uprooting chores, local residents and boaters are continuously invited to remove Eurasian watermilfoil fragments that are floating or could run aground.

- In very shallow areas where scuba gear is not required, trained volunteers can uproot Eurasian watermilfoil plants. This approach can significantly increase the uprooting effort if several trained residents carry out the uprooting.

❖ **Possibility of uprooting on dry land or shallow water, without using divers**

The particular situation in Baie Newton with the significant water level range means that certain aquatic grasses are more easily accessible in the fall and especially in the spring when the levels are very low and much of the bay is almost dry. It would therefore be possible in several areas to remove the roots without divers, but simply to work dry and to dig, for example, with a shovel, to remove the root system.

It could also be done in very shallow water. On the other hand, it could be difficult in the spring, after the decomposition of the plants and the effects of winter, to be able to distinguish Eurasian watermilfoil correctly from other plants and uprooting the correct plant. Moreover, one should concentrate on removing only the root as much as possible to prevent the work from causing excavation (remove lakeshore soil). Feasibility is therefore to be confirmed at this level according to ministerial requirements.

Finally, the work should then be conducted without the passage of machinery and vehicles on the shoreline.

7.3. Eurasian Watermilfoil Control by Laying Tarps

Only for Aquatic Grass Bed 5 and the other small monospecific sites would it be possible to lay jute canvases or aqua screen. The advantage of this method is obviously the greater speed since we only cover the bed. However, it is then necessary to obtain the equipment (tarps and anchors). For anchors to keep the canvas in place, for example, concrete blocks can be used, or where these are no longer used, iron bars inserted into a sewn fold in the ends of the tarps. If this involves divers, the same safety instructions apply as for manual uprooting.

Again, in the case of Baie Newton, this method could possibly be done dry or in shallow water. Aquatic Grass Bed 5, for example, is practically dry between mid-April and the end of April - given that it is considered entirely monospecific, the laying of the tarp could be done quite easily. On the other hand, in the case of small monospecific sites, it is necessary to be able to distinguish them clearly from the rest of the aquatic grass bed even after the decomposition of the plants and the marling. The feasibility of this method in the spring is therefore uncertain unless the location has been well-marked in the field beforehand.

The work should then be done without machinery and vehicles on the shoreline.

7.4. Proposed control strategy

Priority sequence

The control techniques having been proposed, the following priority sequence is suggested:

1. Aquatic Grass Bed 12 – First, clear the and nearby in order to limit the spread from this more frequented site. This grass bed should be the highest priority due to the presence of the boat launch.
2. Aquatic Grass Beds 8 to 10
3. Aquatic Grass Beds 3 to 7; 11; 13 to 15; 17 to 19
4. Aquatic Grass Beds 1 and 2; 16; 20 to 22.

This general sequence should be repeated in this order for the maintenance years following the first year of uprooting, to maintain gains and avoid regrowth.

Sequence rationale

The very first control action to be taken is to clear the area around the private group-owned landing in Aquatic Grass Bed 12 and create a navigation corridor from it. The aim is to reduce the risk that boaters who take their boats out of the lake do not transport Eurasian watermilfoil to another body of water and increase the overall problem.

This first action will also reduce the risk of transporting fragments to other areas of the lake. This area in front of the boat launch remains the priority in terms of control and should be the priority each year.

Although the public boat ramp located on the south side was not affected by Eurasian watermilfoil during the characterization study, it would be important to take care to control the watermilfoil in front of the launching ramp if in the future, watermilfoil establishes itself there.

For the other aquatic grass beds, the principle is to control where the Eurasian watermilfoil has the most impact on activities, either in areas where there are several properties or in the narrower and densely colonized aquatic grass areas (H3 to H7).

Finally, priority 4: aquatic grass beds are unsuitable for navigation because they are very shallow, located at the bottom of bays that have few or no residences and are outside travel corridors. Their priority is therefore lower.

Other elements of the control strategy

Local residents and boaters will be able to remove the stems and leaves of Eurasian watermilfoil floating on the surface or which wash up on the shore, on an ongoing basis, in order to limit its spread.

When control work is done with divers, Eurasian watermilfoil should preferably be pulled out at the start of summer, when the plants are developed enough to be easily identified, but before they are full height (around the end of August). In this way the mass of the plants to be removed is less, as well as the number of fragments generated.

In terms of collective action, it is more effective to focus on meaningfully addressing certain areas than to disperse the efforts. This also greatly facilitates the effectiveness of follow-up in subsequent years and the measurement of the progress made.

If the control measures are carried out over several years or if several weeks separate the uprooting sessions, it is recommended to start the sequence again to ensure that the knowledge acquired of the aquatic grass already controlled is consolidated, and to avoid a recolonization of the first areas while we attack the last areas. It is indeed much more effective to maintain the aquatic grass beds already treated rather than to leave them to be recolonized, which is almost inevitable given that it is very difficult to completely uproot the plants and collect all the fragments. During the years following the control of the aquatic grass beds, it is essential to ensure maintenance by ironing in the order of the sequence to remove as quickly as possible the plants that recolonize the meadow.

8. WASTE MANAGEMENT METHOD

Being an aquatic plant, the management of Eurasian watermilfoil residues during manual uprooting should not pose any particular problem in terms of risk of propagation in earth. Residues should ideally be composted more than 30 metres from a lake, stream or source of runoff that could carry fragments to a lake or stream. The same regulations apply for the spreading of compost. Alternatively, the seedlings can be thrown into the rubbish or burnt, according to the prescriptions of the MELCCFP.

9. FOLLOW-UP OF THE SITES AFTER THE WORK

For each aquatic grass bed checked as part of the project, a summary evaluation of the effectiveness of the check and the impact on the environment should normally be carried out according to MELCCFP monitoring requirements. This periodic monitoring must be conducted by a person qualified or recognized for their knowledge in biology by the MELCCFP.

This monitoring must assess the controlled grass beds, the densities of Eurasian watermilfoil compared to the native vegetation and include an analysis of the effectiveness of the control, indicating the date, the method used to ensure the control of Eurasian watermilfoil and the area of the aquatic grass bed that has been controlled. It is important to take note of the exact locations and the controlled areas, and to bank on a concentration of efforts because this greatly facilitates the monitoring and updating of the situation in the aquatic grass beds.

10. RECOMMENDATIONS FOR FURTHER ACTION

- Raising awareness of good practices for boaters

  Ensure that residents and lake users are aware of the problem of Eurasian watermilfoil and adopt the appropriate behaviors, namely:

  - Upon entering and exiting the lake, visually inspect boats, trailers, and equipment to remove any plant fragments or organisms that may be attached, in addition to emptying the fish tanks.

    Then, clean the boats at the municipal station. As the lake is already affected by Eurasian watermilfoil, it is all the more important to clean up when leaving to avoid spread to other bodies of water.

  - Avoid driving boats and fishing in the affected aquatic grass beds.

- Distributing a code of ethics to all local residents and displaying it at boat ramps is a good way to convey important information. The aquatic grass map can be used to inform residents of places to avoid. In addition, the installation of buoys to identify the affected areas is useful.

  During the characterization study, some buoys were located in the grass beds. Instead, they should be located at the entrances to warn boaters to avoid entering the affected areas.

- Raising awareness of good local practices

  The characterization study revealed that several residences had little vegetation on the shore of 10 or 15 metres depending on the slope, and several have different layouts. It is therefore suggested to raise awareness residents to:

  - Revegetate riparian strips with species native to Quebec, ideally including the three layers of vegetation (herbaceous, shrubs, trees). When there is a low wall or riprap, native vines can be used to cover them to prevent the stones from being heated by the sun then warming the water. In the case of riprap, shrubs can be inserted between the rocks located above the high-water mark by means of jute bags containing soil and roots.

  - Avoid sources of erosion in the shoreline and bare soil on shoreline properties.

  - Manage runoff water to prevent nutrients and sediments from flowing into the lake (private roads, parking lots, roof gutters, etc.).

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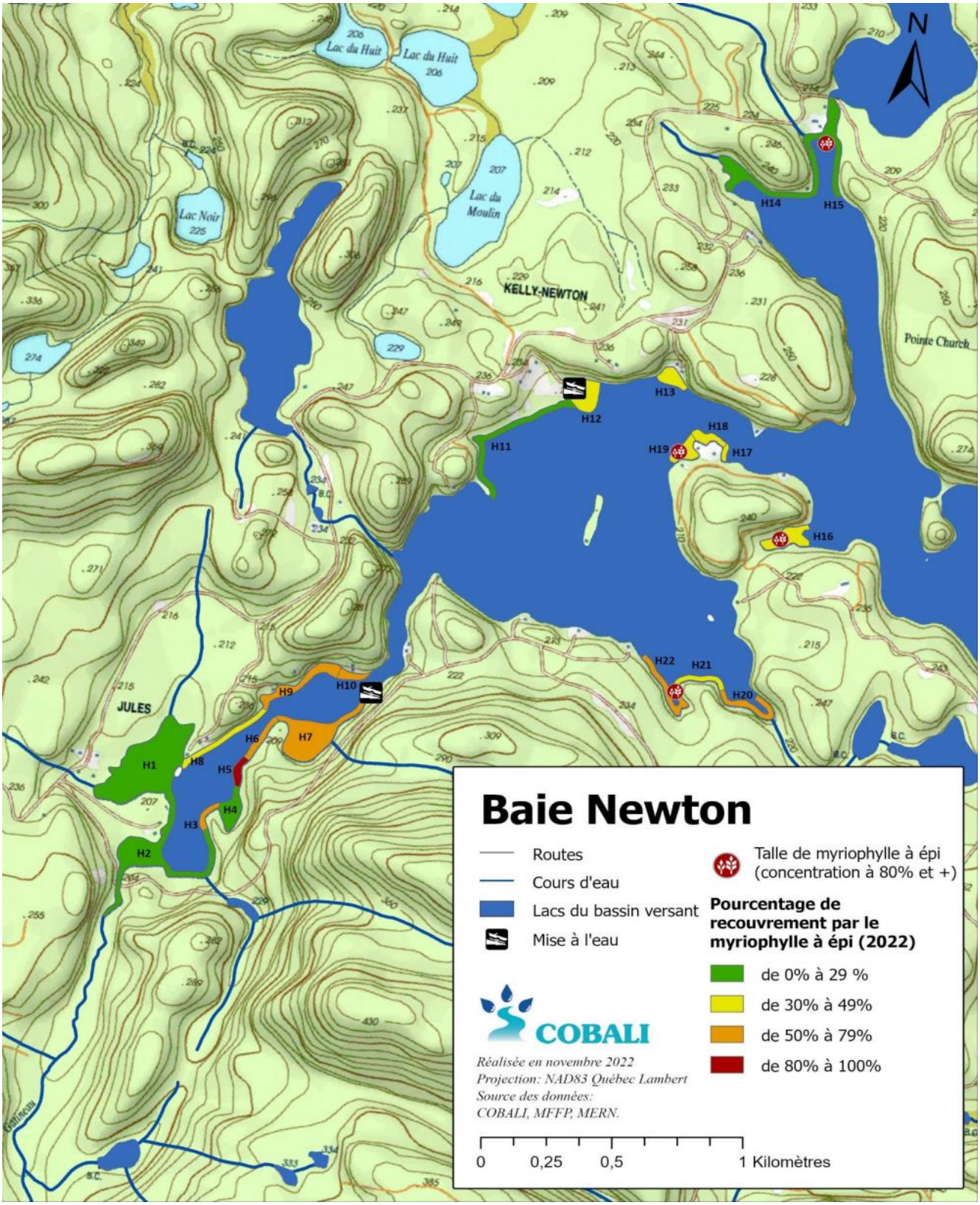
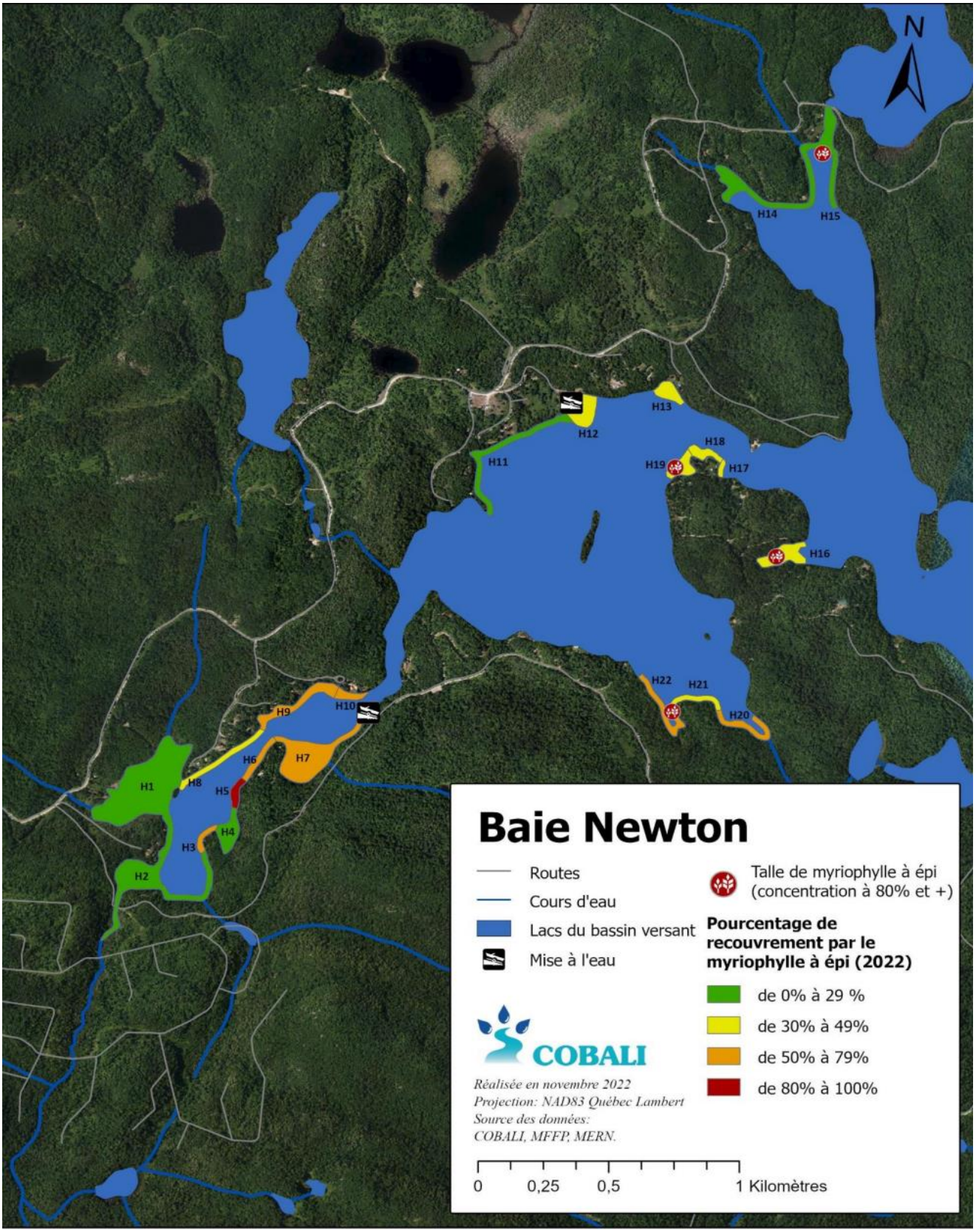
MAP APPENDIX

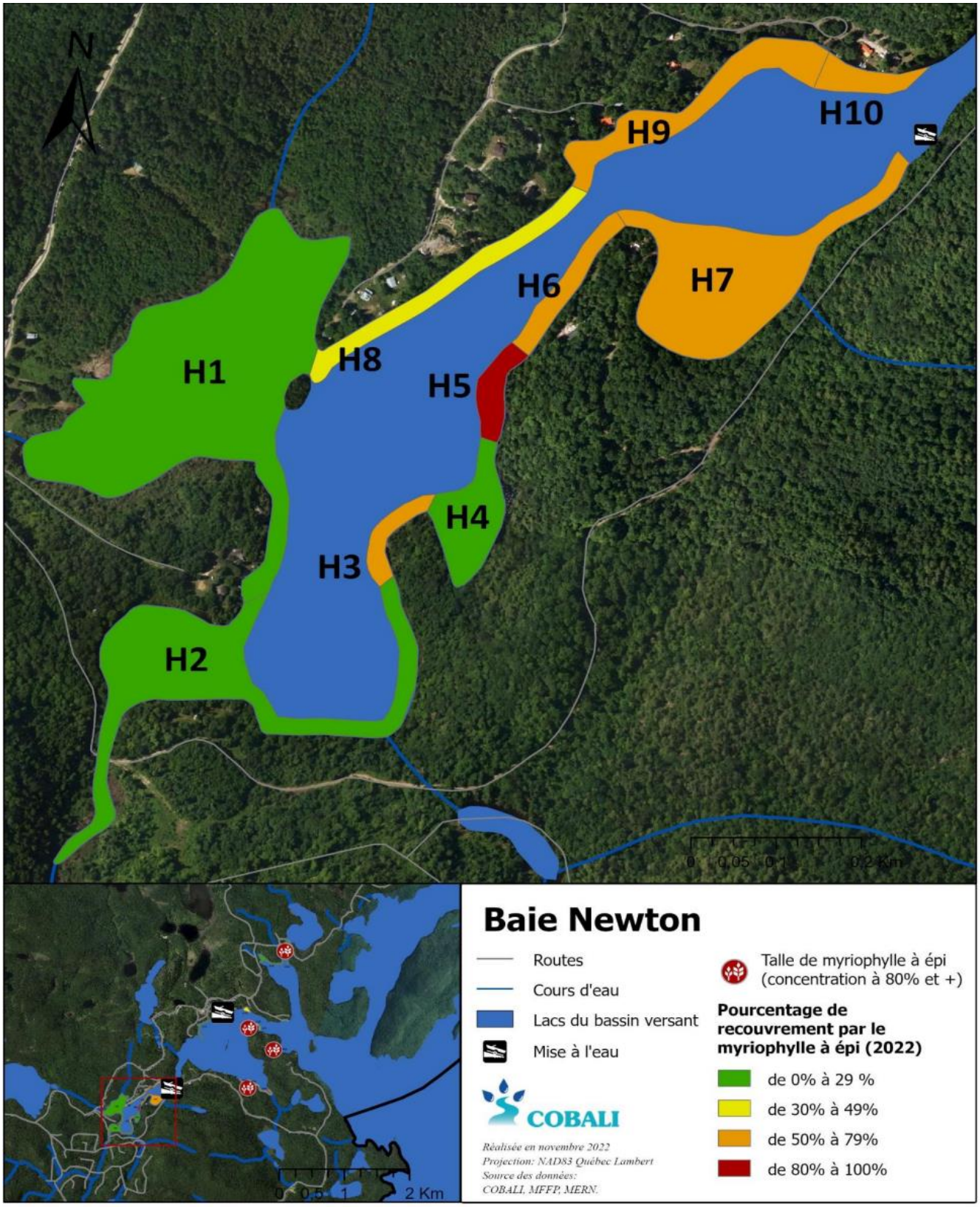
MAP 1. CHARACTERIZATION OF BAIE NEWTON AQUATIC GRASS (2022) – TOPOGRAPHY



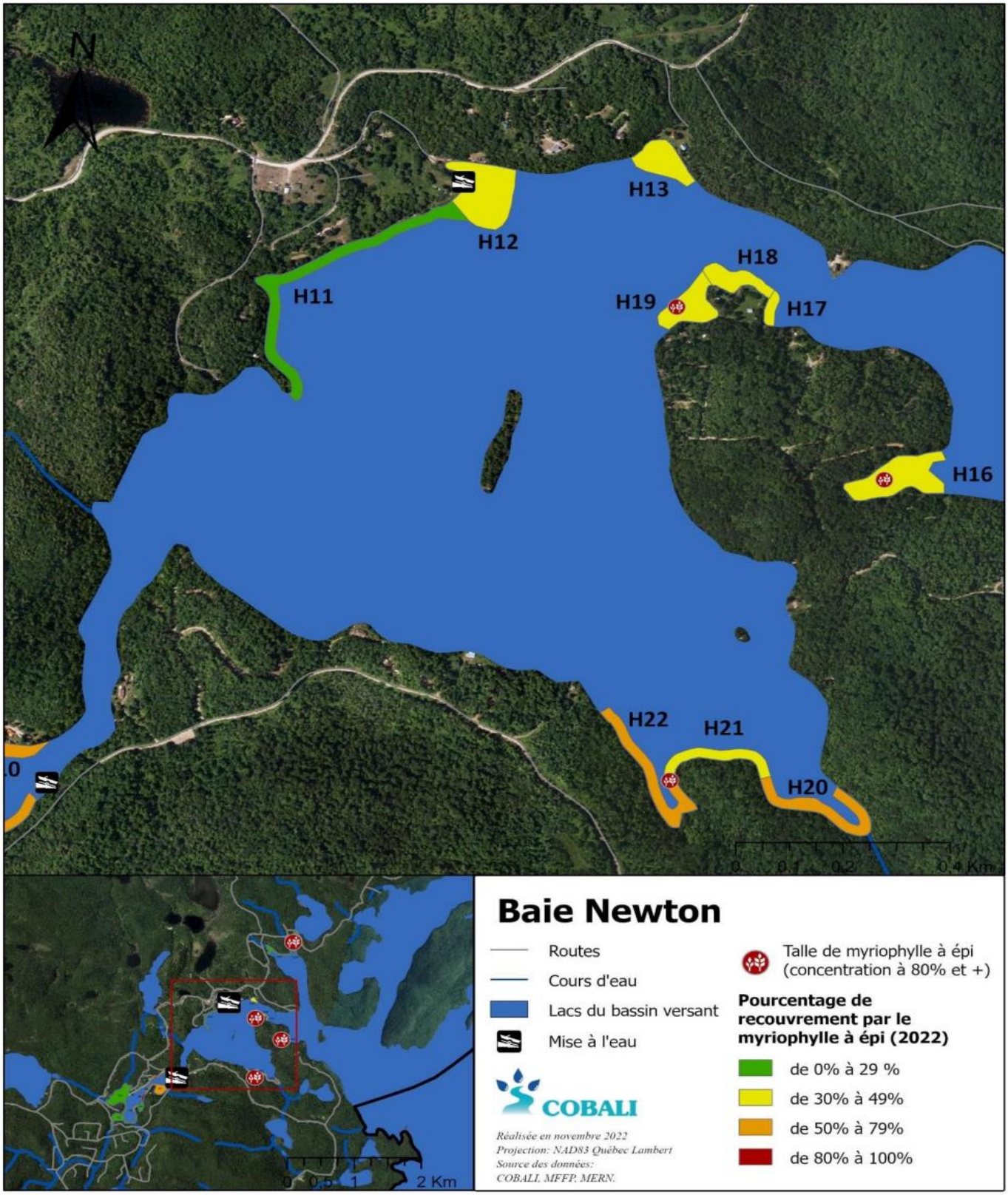
MAP 2. CHARACTERIZATION OF BAIE NEWTON AQUATIC GRASS (2022) - ORTOPHOTO



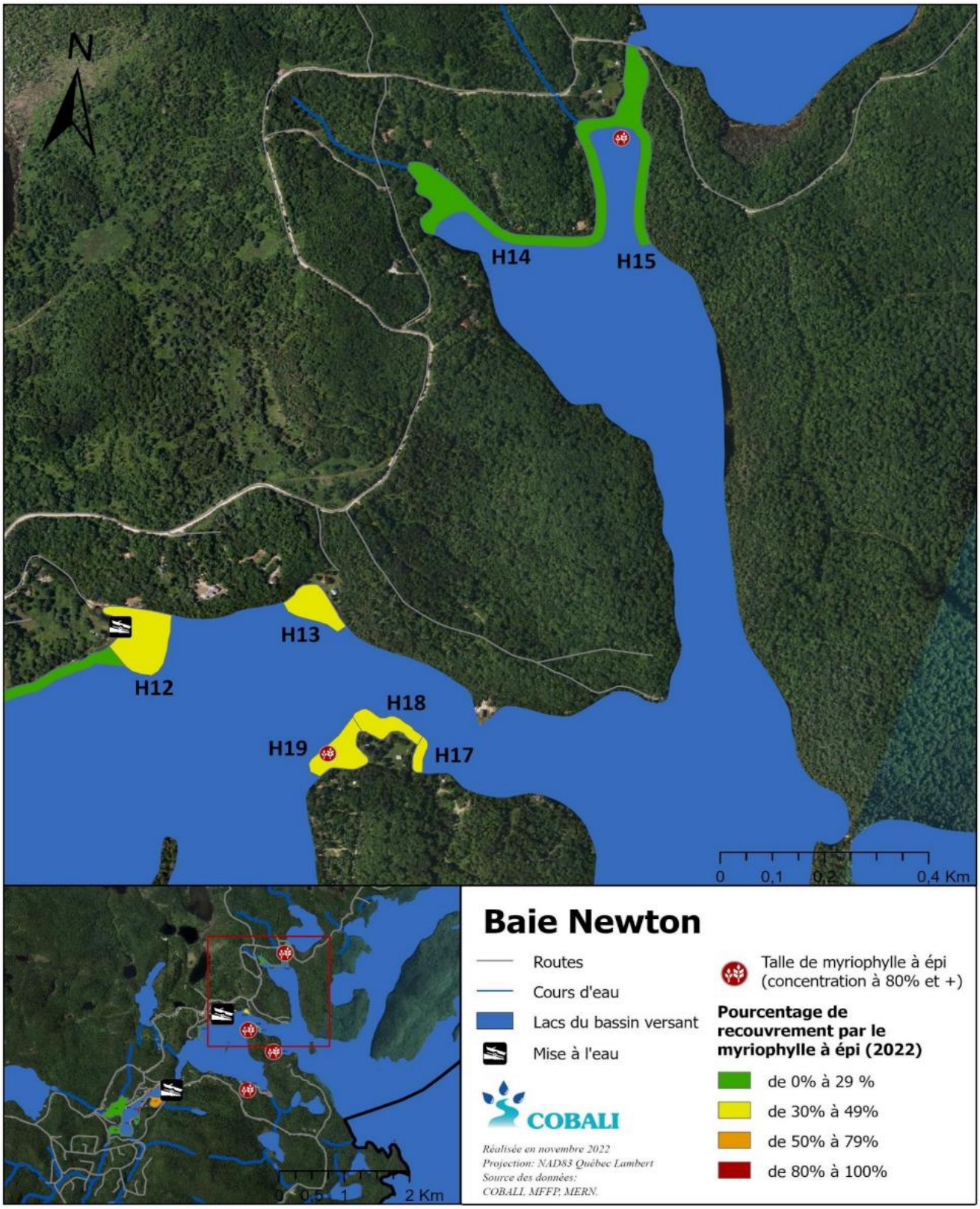
MAP 3. CHARACTERIZATION OF BAIE NEWTON AQUATIC GRASS (2022) – SOUTHWEST SECTOR



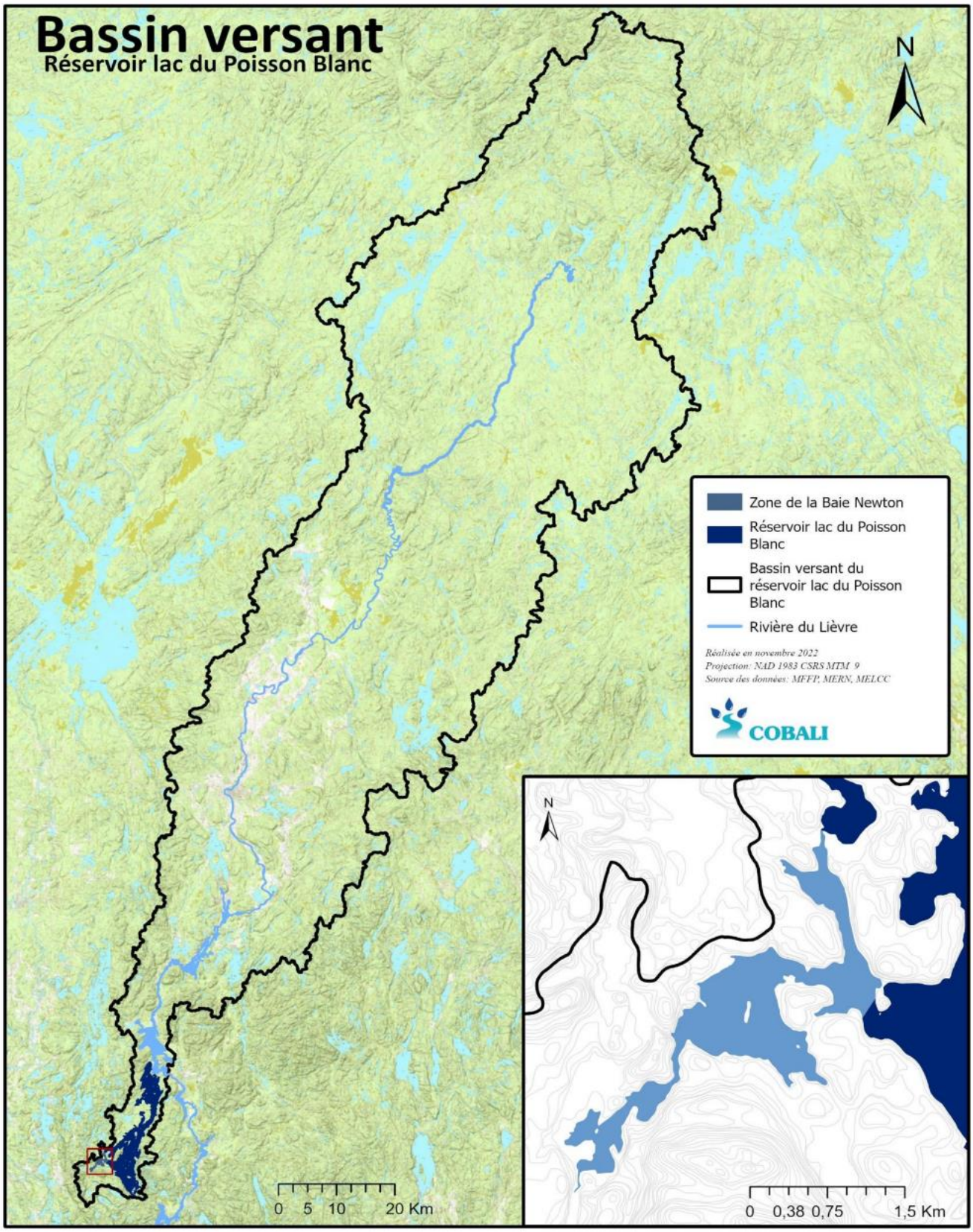
MAP 4. CHARACTERIZATION OF BAIE NEWTON AQUATIC GRASS (2022) – CENTRAL SECTOR



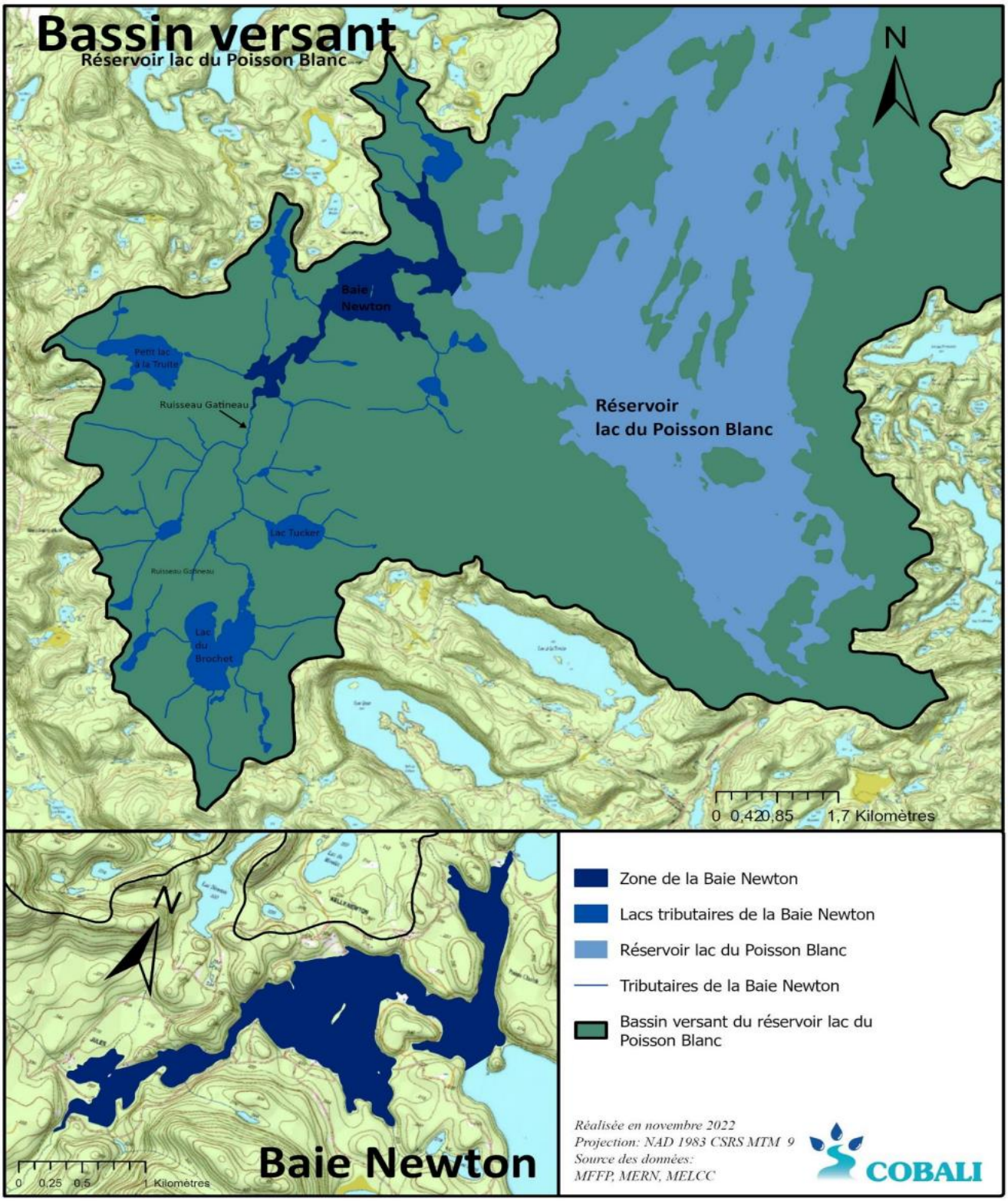
MAP 5. CHARACTERIZATION OF BAIE NEWTON AQUATIC GRASS (2022) – NORTHEAST SECTOR



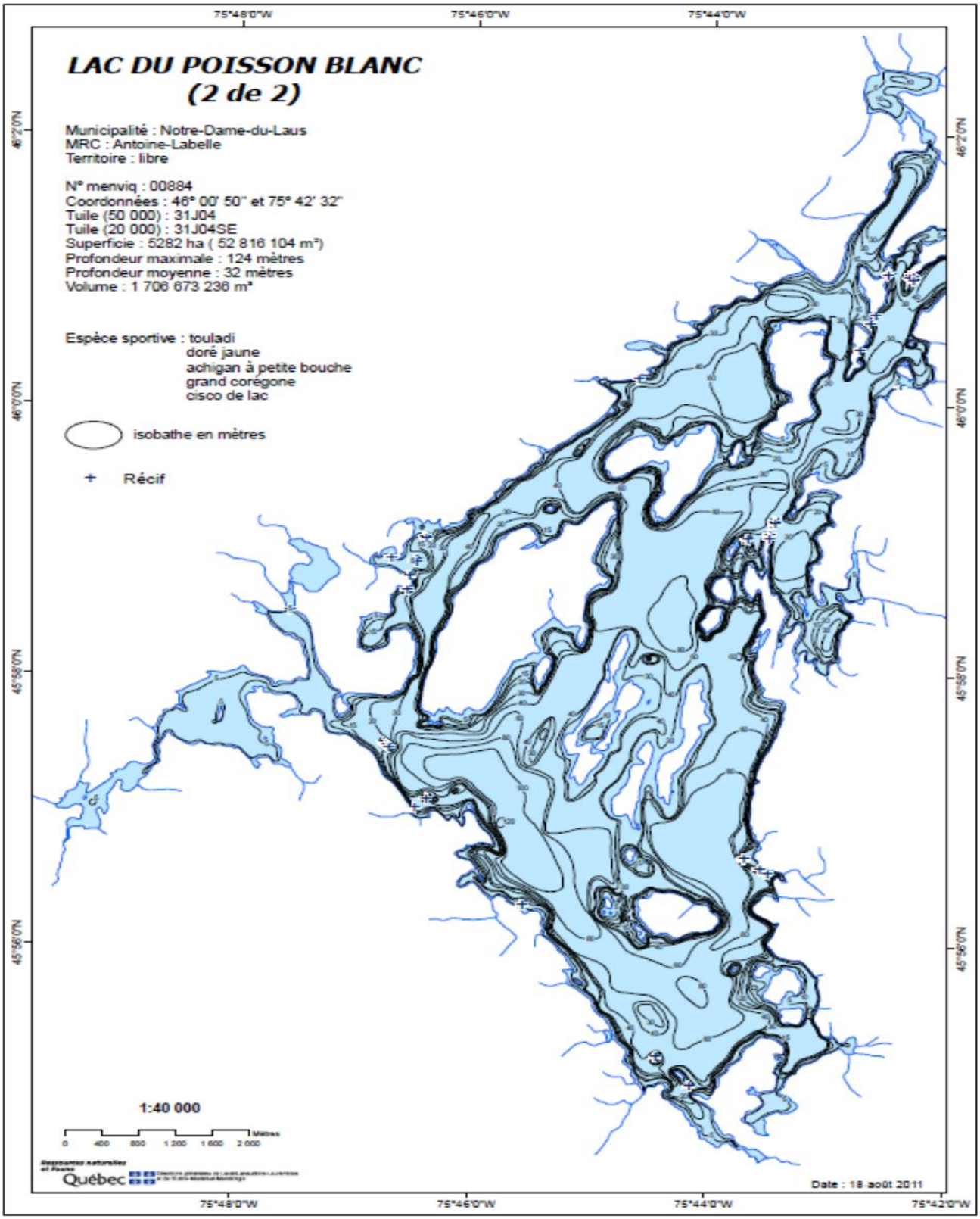
MAP 6. WATERSHED OF THE LAC DU POISSON BLANC RESERVOIR



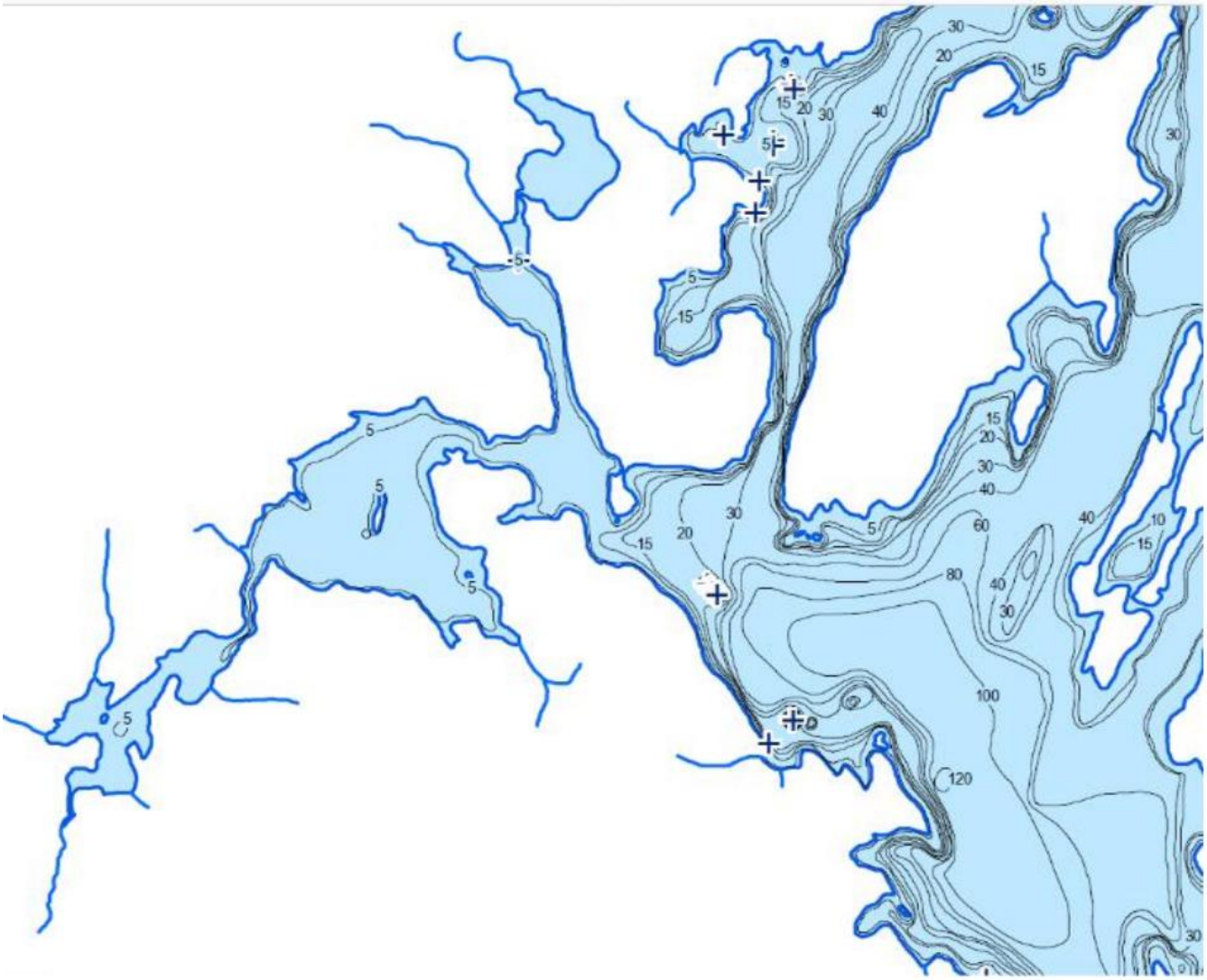
MAP 7. WATERSHED OF THE LAC DU POISSON BLANC RESERVOIR – BAIE NEWTON SECTOR



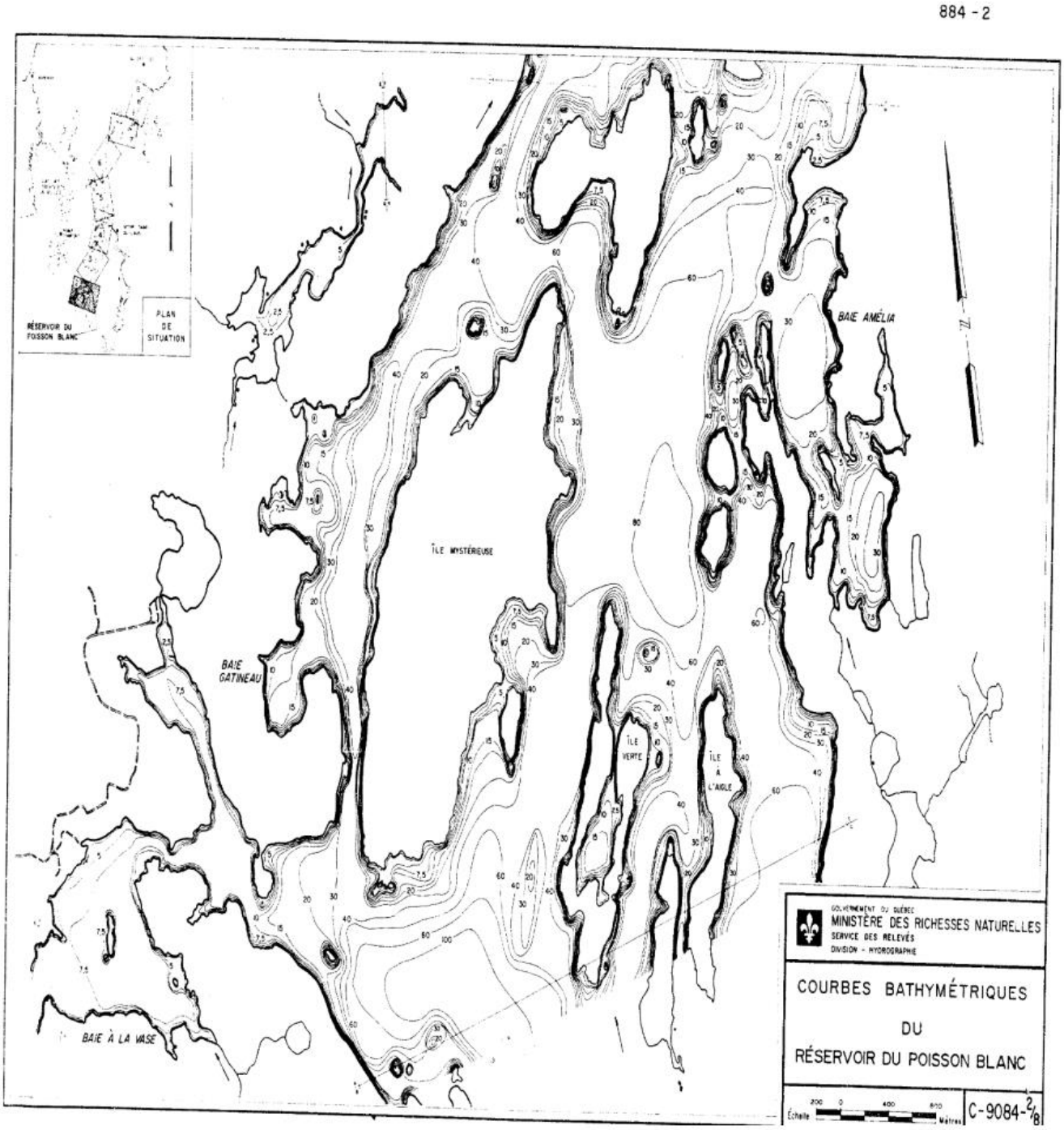
MAP 8. BATHYMETRY OF THE LAC DU POISSON BLANC RESERVOIR – SOUTH BASIN



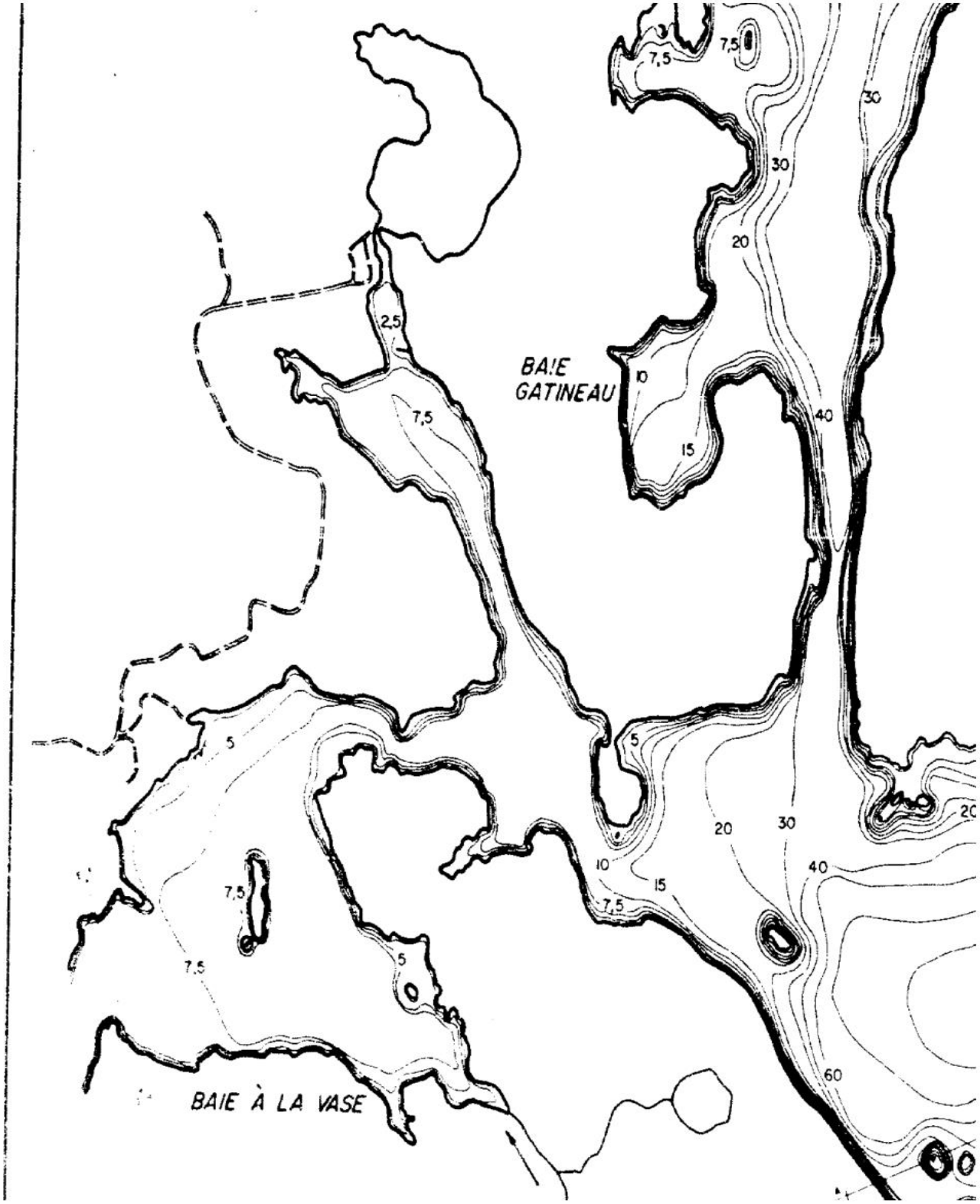
MAP 9. BATHYMETRY OF LAC DU POISSON BLANC RESERVOIR (EXTRACT OF BAIE NEWTON SECTOR)



MAP 10. BATHYMETRY # 2 OF THE LAC DU POISSON BLANC RESERVOIR



MAP 11. BATHYMETRY # 2 OF LAC DU POISSON BLANC RESERVOIR (EXTRACT OF BAIE NEWTON)



APPENDIX B – AQUATIC GRASS CHARACTERIZATION SHEETS

Aquatic Grass Characterization Sheet
Aquatic Grass Bed number: 01
Date: August 31, 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 001	Fin: 007		
Repères visuels	Cap de roche à l'entrée de la baie			4098
Profondeur maximale de l'herbier	1 à 2,5 m.			
Superficie (m^2)	69 570			
Substrat				**Photo #**
Type de substrat, état		Vase		
Pente		Faible		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	100			4101 4102 4103
Espèce dominante 1	70	Naïade flexible		Vidéo Herbier_01
Espèce dominante 2	10	Potamot de Richardson		
Espèce dominante 3	10	Potamot type 4 GPS 004		
Autres espèces	Élodée du Canada Myriophylle à épi Algues chara GPS 003 Algue Nitella sp.			
Herbier riverain	Quenouilles Carex sp.			4104 4105
Détails / description	Vaste baie très peu profonde avec herbier dense ceinturée de végétation émergente 005 = sortie de la baie			
Faune				**Photo #**
Poissons				
Autres	Canard noir			
Notes				**Photo #**
	Bouée à l'entrée de la baie Revenu le 1 sept pour prendre un échantillon de naïade sp. GPS 1226			4203 4204 4208

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 02
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 007	Fin: 009		
Repères visuels	Regroupement de bouées jaunes			4106
Profondeur maximale de l'herbier	1 à 2 m.			
Superficie (m^2)	29 951			
Substrat				**Photo #**
Type de substrat, état		Roche, sable, souche exondée		
Pente		Cap de roche/douce à moyenne		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	100		Petite baie parsemée de roches émergentes	4107 4110
Espèce dominante 1	30	Potamot type 3		
Espèce dominante 2	30	Naïade flexible		
Espèce dominante 3	25	Potamot type 4		
Autres espèces	5% Myriophylle à épi GPS 008 010 5% Élodée du Canada 5% Potamot de Richardson Rubanier sp. Algues chara			
Herbier riverain	Aucun			
Détails / description	Arrivée de deux tributaires au fond des deux baies			
Faune				**Photo #**
Poissons				
Autres	Martin-pêcheur			
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 03
Date : 31 août

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 016	Fin: 018	012 013 015 016	
Repères visuels	Petite baie à travers la roche			
Profondeur maximale de l'herbier	1 à 2 m, eau très peu profonde			
Superficie (m^2)	2 847			
Substrat				**Photo #**
Type de substrat, état				
Pente				
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	100			
Espèce dominante 1	60	Myriophylle à épi		4108
Espèce dominante 2	30	Naïade flexible		
Espèce dominante 3	10	Potamot type 4		
Autres espèces	Élodée du Canada Potamot de Richardson Potamot type 3 Rubanier sp. Algues chara			
Herbier riverain	Aucun			
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 04
Date : 31 août

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 019	Fin: 025		4112 4113
Repères visuels	GPS 020 = Gros pin			4111
Profondeur maximale de l'herbier				
Superficie (m^2)	8 793			
Substrat				**Photo #**
Type de substrat, état		Vase		
Pente	Douce	Roche		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	100		Dans la baie en général	
Espèce dominante 1	60	Élodée du Canada		
Espèce dominante 2	20	Potamot type 3		
Espèce dominante 3	10	Potamot type 4		
Autres espèces	10 % Myriophylle à épi GPS 022-023-024-025 Potamot de Richardson			
Herbier riverain				
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 05
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 027	Fin: 032	Bordure extérieure de l'herbier GPS 033-031-032	
Repères visuels				
Profondeur maximale de l'herbier				
Superficie (m^2)	3 525			
Substrat				**Photo #**
Type de substrat, état		Non visible		
Pente				
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	100			
Espèce dominante 1	80	Myriophylle à épi		
Espèce dominante 2	10	Élodée du Canada		
Espèce dominante 3	10	Potamot type 4		
Autres espèces				
Herbier riverain	Aucun, rive rocheuse			
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 06
Date : 21 août 2022 12h00

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 035	Fin: 039		
Repères visuels	GPS 040-041			4114 4115
Profondeur maximale de l'herbier				
Superficie (m^2)	4 644			
Substrat				**Photo #**
Type de substrat, état				
Pente				
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	80			
Espèce dominante 1	50	Myriophylle à épi		
Espèce dominante 2	30	Potamot type 4		
Espèce dominante 3	20	Élodée du Canada		
Autres espèces				
Herbier riverain				
Détails / description	Continuité de l'herbier 05, devient plus sporadique à partir de GPS 036 Coupure entre les 2 herbiers par une pointe de roche.			
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 07
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 042	Fin: 049	Baie avant le chenal	4116
Repères visuels	Petite pointe de roche			
Profondeur maximale de l'herbier	3 m			
Superficie (m^2)	29 455			
Substrat				**Photo #**
Type de substrat, état	Vase	Petite plage de roche		
Pente				
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	90			
Espèce dominante 1	60	Myriophylle à épi	GPS 043-046-047-048-050 Limite extérieure GPS 051	
Espèce dominante 2	20	Potamot type 3		
Espèce dominante 3	10	Élodée du Canada		
Autres espèces	10 % Potamot type 4 Potamot de Robbins Potamot de Richardson			
Herbier riverain	Aucun, rive rocheuse			4118
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**
Fin 12h45	Mise à l'eau GPS 052 GPS 044-047 = bouée			4120 4121

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 08
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 053	Fin: 056	Limite extérieure GPS 057	
Repères visuels	À partir de la baie de l'herbier1			
Profondeur maximale de l'herbier	5 m.			
Superficie (m^2)	8 164			
Substrat				**Photo #**
Type de substrat, état	Vase			
Pente		Berge de roche		4125
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	80			
Espèce dominante 1	30	Naïade flexible		
Espèce dominante 2	30	Myriophylle à épi		
Espèce dominante 3	30	Élodée du Canada		
Autres espèces	Potamot type 3 Potamot type 4 Potamot de Richardson Algues chara			
Herbier riverain	Aucun, rive rocheuse			
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 09
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 058	Fin: 067		4126
Repères visuels				
Profondeur maximale de l'herbier	3-4 m.			
Superficie (m^2)	11822			
Substrat				**Photo #**
Type de substrat, état				
Pente	Roche	Cap rocheux à plusieurs endroits		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	90		GPS 065/066 fin	4130 4131 4132
Espèce dominante 1	60	Myriophylle à épi	Surtout aux points GPS 059/060/061	
Espèce dominante 2	30	Potamot type 3		
Espèce dominante 3	10	Élodée du Canada		
Autres espèces	Potamot type 4 Potamot de Richardson			4127 4128 4130
Herbier riverain	Aucun, rive rocheuse			
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**
	Fin de l'herbier principal GPS 064			

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 10
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 067	Fin: 068	Limite extérieur GPS 070	4133
Repères visuels	Drapeau Québec et Canada			
Profondeur maximale de l'herbier				
Superficie (m^2)	3 458			
Substrat				**Photo #**
Type de substrat, état		Sable et gravier, roche		
Pente	Douce	Cap de roche et enrochement artificiel		4134
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	50		Beaucoup plus clairsemé que les autres.	
Espèce dominante 1	60	Myriophylle à épi		
Espèce dominante 2	30	Potamot type 3		
Espèce dominante 3	10	Élodée du Canada		
Autres espèces	Naïade flexible *Photos Potamot type 4 Algues chara			4136 4137 4138 4139 4140
Herbier riverain	Forêt de pin blanc, thuya, aulne rugueux , chêne			
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**
	GPS 070 Bateau-maison			

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 11
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 073	Fin: 074		4150 4151
Repères visuels	Baie à la vase, près de chez Carla			
Profondeur maximale de l'herbier	5 m			
Superficie (m^2)	13 983			
Substrat				**Photo #**
Type de substrat, état		Vase, sable		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	40		Tapis d'algues chara	4146 4147 4148 4149
Espèce dominante 1	60	Potamot type 3		
Espèce dominante 2	30	Potamot de Richardson		
Espèce dominante 3	5	Myriophylle à épi		
Autres espèces	5% Élodée du Canada			
Herbier riverain	Plantes herbacées Plantes aquatiques exondée			
Détails / description				
Faune				**Photo #**
Poissons				
Autres	Bernaches, canard barbotteur (noir ou fem. colvert)			
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 12
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 075	Fin: 078	Limite extérieure 077 Limite 079	4153
Repères visuels	Lieu de la mise à l'eau de l'association			
Profondeur maximale de l'herbier	5 m			
Superficie (m^2)	12 296			
Substrat				**Photo #**
Type de substrat, état		Vase, sable		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	80			
Espèce dominante 1	30	Myriophylle à épi		
Espèce dominante 2	30	Potamot de Richardson		
Espèce dominante 3	30	Potamot type 3		
Autres espèces	Potamot type 4 Élodée du Canada Vallisnérie d'Amérique			
Herbier riverain	Baie sablonneuse, herbacées			
Détails / description	GPS 080 = creux de baie, algues Chara tapisse le substrat avec quelques myriophylles à épi isolés			
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**
	Bouée			

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 13
Date : 31 août 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 080	Fin: 081		4154
Repères visuels				
Profondeur maximale de l'herbier	5-6 m			
Superficie (m^2)	5 892			
Substrat				**Photo #**
Type de substrat, état		Sablonneux		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	80			
Espèce dominante 1	50	Potamot type 3		
Espèce dominante 2	30	Myriophylle à épi		
Espèce dominante 3	10	Potamot de Richardson		
Autres espèces	10%			
Herbier riverain	Roche et plage de roche			
Détails / description	Herbier plus clairsemé			
Faune				**Photo #**
Poissons				
Autres	Cormoran à aigrettes			
Notes				**Photo #**
17h07	Bouée Falaise rocheuse, enrochements Tuyaux écoulement 10 pouces plastique noir, GPS 083			

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 14
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 085	Fin: 088		4159
Repères visuels				
Profondeur maximale de l'herbier	5 m			
Superficie (m^2)	17 394			
Substrat				**Photo #**
Type de substrat, état		Gravier et sable		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	10			
Espèce dominante 1	60	Potamot type 3	GPS 086-087	4161 4160
Espèce dominante 2	25	Algues chara		
Espèce dominante 3	10	Naïade sp.		4163 4164
Autres espèces	5% Myriophylle à épi Potamot de Richardson			
Herbier riverain	Forêt habituelle, sauf la zone du tributaire = plantes herbacées			
Détails / description	Eau basse			
Faune				**Photo #**
Poissons				
Autres	Hutte castor			
Notes				**Photo #**
				4165

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 15
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 089	Fin: 093		4167
Repères visuels	Extrémité nord-est de la baie			4166
Profondeur maximale de l'herbier	5 m			
Superficie (m^2)	14 005			
Substrat				**Photo #**
Type de substrat, état		Sable, vase		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	50			
Espèce dominante 1	60	Potamot type 3		
Espèce dominante 2	25	Algues chara		
Espèce dominante 3	15	Myriophylle à épi	GPS 090 rayon 10 m. monospécifique	GPS 090
Autres espèces	Élodée du Canada Potamot type 3 GPS 092 talle rayon 15 m. Renouée amphibie			4169
Herbier riverain				
Détails / description				4168 4172
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**
9h à 9h35	Bouée GPS 090			4171

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 16
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 096	Fin: 102	Début baie	4177
Repères visuels				
Profondeur maximale de l'herbier	5 m			
Superficie (m^2)	10 761			
Substrat				**Photo #**
Type de substrat, état		Vase et sable		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	80	Algues chara	Tapis	
Espèce dominante 1	30	Myriophylle à épi	Talle GPS 097 rayon 5 m. Talle monospécifique	4179 4180
Espèce dominante 2	30	Élodée du Canada		
Espèce dominante 3	30	Potamot type 3		
Autres espèces	Potamot de Richardson Naïade flexible			
Herbier riverain	Herbacées			
Détails / description	Talle monospécifique au bout de la baie.			
Faune				**Photo #**
Poissons	Perchaude			
Autres				
Notes				**Photo #**
9h52	Bouée Rive très enrochée près du chalet			4181 4182 4175 4176

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 17
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 103	Fin: 105		4183
Repères visuels				
Profondeur maximale de l'herbier	3 m			
Superficie (m^2)	1 319			
Substrat				**Photo #**
Type de substrat, état		Vase et sable		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	75			
Espèce dominante 1	40	Myriophylle à épi	Limite extérieure GPS 104	
Espèce dominante 2	25	Potamot type 3		
Espèce dominante 3	15	Élodée du Canada		
Autres espèces	Potamot de Richardson Naïade flexible Algues Chara			
Herbier riverain	Plage et forêt			
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 18
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 105	Fin: 110		4184
Repères visuels				
Profondeur maximale de l'herbier	4 - 5 m			
Superficie (m^2)	4 366			
Substrat				**Photo #**
Type de substrat, état		Sable et vase		
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	75			
Espèce dominante 1	40	Myriophylle à épi	GPS 108	
Espèce dominante 2	20	Élodée du Canada		
Espèce dominante 3	20	Potamot type 3		
Autres espèces	20% Naïade flexible Potamot type 4 Algues chara Potamot de Richardson			
Herbier riverain	Herbacée			
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**
	GPS 105-106-111 bouée			

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 19
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 111	Fin: 114		4185
Repères visuels				4186
Profondeur maximale de l'herbier	3 m			
Superficie (m^2)	6 460			
Substrat				**Photo #**
Type de substrat, état				
Pente		Douce		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	80			
Espèce dominante 1	40	Élodée du Canada		
Espèce dominante 2	30	Myriophylle à épi	GPS 113 rayon 5 m, talle monospécifique	
Espèce dominante 3	15	Potamot de Richardson		
Autres espèces	10% Potamot type 3 5% Potamot type 4 Naïade flexible Algues Chara tapisse le substrat			
Herbier riverain				
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 20
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 116	Fin: 118		4189
Repères visuels				
Profondeur maximale de l'herbier	3-4 m au milieu de la baie			
Superficie (m^2)	7 124			
Substrat				**Photo #**
Type de substrat, état				
Pente		Roche, abrute		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	50			4190 4191
Espèce dominante 1	50	Myriophylle à épi		4193 4194
Espèce dominante 2	30	Potamot type 3		
Espèce dominante 3	10	Naïade flexible		
Autres espèces	10 % Élodée du Canada Potamot de Richardson Potamot type 4			
Herbier riverain	Roche et forêt			
Détails / description	Beaucoup de souches exondées et sous l'eau			
Faune				**Photo #**
Poissons				
Autres	Urubu à tête rouge, grand harle (femelle).			
Notes				**Photo #**
11h45	Bouée			4192

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 21
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 120	Fin: 121		
Repères visuels				
Profondeur maximale de l'herbier	5 m			
Superficie (m^2)	5 140			
Substrat				**Photo #**
Type de substrat, état				
Pente				
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	Îlot		Rayon 10 m.	4195
Espèce dominante 1	30	Myriophylle à épi		
Espèce dominante 2	30	Potamot de Richardson		
Espèce dominante 3	30	Potamot type 3		
Autres espèces	5% Naïade flexible 5% Élodée du Canada			
Herbier riverain				
Détails / description				
Faune				**Photo #**
Poissons				
Autres				
Notes				**Photo #**

Fiche de caractérisation d'herbier aquatique
Numéro d'herbier : 22
Date : 1er septembre 2022

Localisation				**Photo #**
Points (début et fin ou polygone)	Début: 122	Fin: 124		4197
Repères visuels	Bouée au fond de la baie GPS 123			4196
Profondeur maximale de l'herbier				
Superficie (m^2)	7 448			
Substrat				**Photo #**
Type de substrat, état		Vase et sable		
Pente		Faible		
Flore				
	%	Espèce	Détails	**Photo #**
% recouvrement du substrat par l'herbier	80			
Espèce dominante 1	50	Myriophylle à épi		4200 4202
Espèce dominante 2	20	Potamot type 3		
Espèce dominante 3	20	Potamot type 4		
Autres espèces	5% Élodée du Canada 5% Potamot de Richardson Potamot émergé Naïade flexible Algues Chara tapisse le substrat			4198 4199
Herbier riverain	Herbacées, forêt, roche			
Détails / description	Souche exondée			
Faune				**Photo #**
Poissons	Ménés et perchaudes			
Autres				
Notes				**Photo #**
	Arrivée d'un petit tributaire dans la baie			