ANNEXE A : DOCUMENTS DE SOUTIEN PRÉLIMINAIRES

Shawinigan, August 12, 2022

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Subject: Technical note – Environmental, social and hydrological surveys
N/Folder : 151022002 (22-0095)

Dear Mr. Smith,

Here is a technical note following the field work that took place in July 2022 in the Corvette study area. The field work can be subdivided in two themes, the environmental surveys and the hydrological surveys.

1 Mandate and Objectives

1.1 Environmental and Social Survey

The mandate behind the environmental and social survey was to give an overview of the sensitive environmental component in the study area. The objectives were as follows:

- Fish habitat validation in the main lake (lake 01);
- Document divergence between mapped watercourse/wetland and field observations;
- Assess the connectivity between the watercourse/water body in the study area;
- Inventory the sensitive component in the potential tailings and waste rocks (TWR) disposal sites;
- Report wildlife observations, land use and human presence.

1.2 Hydrological Surveys

The mandate behind these surveys was to document the hydrology of lake 01, which is the main lake in the study area. The objectives were as follows:

- Bathymetric mapping of lake 01;
- Water flow gauging of the lake's outlet and tributaries;
- Implementation of water level monitoring station on lake 01, its tributaries and its outlet.

2 Methods

The preparations preceding the inventories on the field were realized by compiling various sources of information including data transmitted by BBA inc. and associated consultants, as well as data available in the open databases mentioned below:

- Geobase of Quebec Hydrographic System /Géobase du réseau hydrographique du Québec (GRHQ) (MERN, 2019);
- Hydrographic Basins Database /Base de données des bassins hydrographiques (MELCC, 2019);
- Online & interactive ecoforestry maps Forêt Ouverte /Cartes écoforestières interactives « Forêt ouverte » (https://www.foretouverte.gouv.qc.ca/);
- Satellite imagery from Google Earth Pro©.

2.1 Fish Habitat Validation

Fish habitat validation effort was concentrated on lake 01. In order to do so, the lake was travelled by boat, with a particular attention to the coastline. The following elements were noted and geo-referenced when observed:

- Shoals;
- Aquatic grass beds;
- Potential spawning ground;
- Nursery area;
- Feeding area.

Habitat functions were mainly determined based on water flow type, substrate particle size, and the presence of aquatic vegetation. The functions were attributed according to the professional judgment of the technicians and biologists on the field depending on (1) the fish species inventoried or potentially present and (2) the associated life stage (adult, juvenile, fry, breeder).

Furthermore, opportunistic fishing activities were sporadically conducted to validate the presence of fishes in the waterbody or watercourse. The fishing was done using a fishing rod according to recreational fishing regulation.

2.2 Watercourse Mapping and Connectivity Assessment

The watercourse mapping and connectivity assessment through the study area were done mainly by helicopter survey. The helicopter survey allowed to confirm the status and route of the watercourses that were obtained from cartographic sources. Furthermore, it allowed for a quick assessment of the connectivity between the different watercourse and waterbody. GPS coordinates and photos were taken for each watercourse or waterbody visited.

In some occasion the watercourse was visited on foot. When it occurred, the characterization was then conducted on the field by dividing watercourses in segments. Each segment represents a watercourse section where water flow characteristics remain constant. For the purpose of the present study, each segment's flow type is classified either as permanent, intermittent, or underground and according to facies flow.

2.3 Sensitive Component in the Potential Tailings and Waste Rock Disposal Sites

The sensitive component in the potential tailings and waste rocks (TWR) disposal sites were also documented by helicopter survey. During those survey, the technicians were cataloguing the following with GPS coordinates and photos:

- Watercourse;
- Waterbody;
- Wetland;
- Rock outcrop;
- Wildlife;
- Human presence;
- Land use.

2.4 Other Wildlife, Land Use and Human Presence Observations

During the field campaign, the team has noted any opportunistic observations or signs of presence of wildlife or humans. These could be direct sightings or observations of the use of the land from humans or animals.

2.5 Hydrological Survey

2.5.1 Bathymetric Surveys

2.5.1.1 Equipment and Precision

The bathymetric surveys were carried out from a motorized boat using a single beam echo sounder, model Echotrac CV100 from Odom Teledyne, whose optimum accuracy is 0.015 meters. The echo sounder was calibrated for substrate (gain, power) and water temperature (sound velocity) measured at the surface on the day of the surveys.

The data captured by the sonar was positioned in a terrestrial coordinate system using a high-precision GPS. The device used was a Trimble R12s operating in dual frequency mode. This device is compatible with GNSS satellite constellation. The optimal accuracy of this device is 0.010 meters in planimetry and 0.015 meters in altimetry.

The navigation system used was the Hypack hydrography software. This system recorded one (1) point per second, which allowed to draw an excellent picture of the riverbed. It should be noted that the bathymetric data was cross-checked on site during the surveys using a measuring tape.

2.5.1.2 Data Collection

The surveys were carried out following planned cross sections in three zones (map 5). The first zone (Z1) is the closest area from the Corvette project and from the outlet, thus the bathymetry was done along a tight transect pattern set 50 meters apart. The two other zones (Z2 and Z3) were following a looser pattern where the transects were set 100 meters apart. Longitudinal sections were also made in order to adequately grid the two areas.

2.5.1.3 Data Processing

Data processing was carried out on the ArcGis 10.8.1 geomatics platform using the Spatial and 3D Analyst extensions. It aimed to ensure the quality of the data as well as to eliminate erroneous or aberrant data. Specifically, the data were:

- Corrected to revised GPS elevation, where applicable;
- Manually cleaned to remove outliers;
- Checked at intersections.

A matrix called a “grid” was created from the cleaned bathymetric data for each of the datasets (before and after dredging). A grid is an interpolated surface formed by cells resulting from the intersection of columns and rows. A “Z-value” elevation is assigned to each cell by interpolating the sounding points collected during the bathymetric survey. The size of the cells is determined by the density of the bathymetric survey.

A thickness map of the dredged sediments was produced for each sector. This map is the result of the difference calculated between the grid area generated by the bathymetric survey before dredging and the one generated after dredging. This map provides a good visualization of the spatial distribution of dredged sediments.

2.5.2 Water Flow Gauging

Stream gauging is performed using a Swoffer 2100 current meter. A cross section of stream gauging will be conducted on each of the three (3) streams included in the study (the two tributaries and the outlet). Note that the section will be run at the location of the water-level probe. Between five (5) and ten (10) uniformly distributed measuring stations is run on each of the cross sections. At each station, the current velocity is measured at 20% and 80% of the stream depth. At the shoreline or at shallow depths (less than 1 m), the current velocity is measured at 60% of the stream depth. The average velocities will be related to the flow areas in order to calculate the discharge. The following figure shows the calculation method used to calculate the average stream flow.

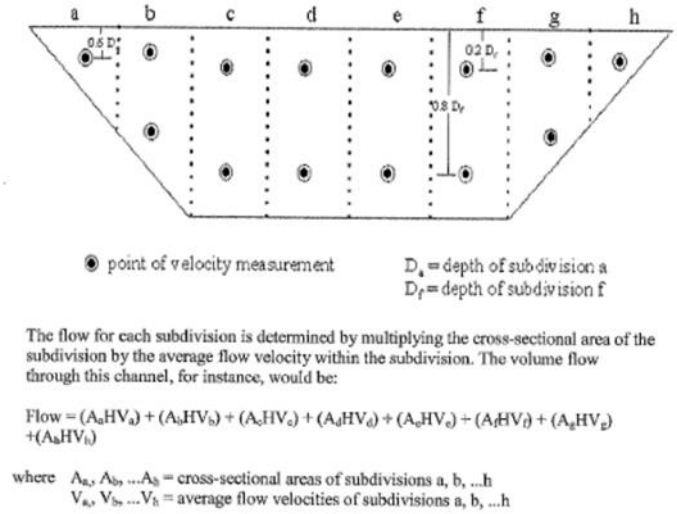

Figure 1. Calculate the average stream flow

2.5.3 Implementation of Water Level Monitoring Station

The water level probes that are installed in the study streams/water bodies are Levelogger 5 model 3001 manufactured by Solinst. These are highly reliable sensors for continuous, long-term water level recording. The Levelogger 5 sensors record water pressure, atmospheric pressure and temperature at the same time.

Each sensor is carefully installed at depths that ensure complete submersion during the data acquisition period. The probes are attached to concrete blocks (one square foot) and secured to the shoreline with a rope. The probes are implemented with an optical wire that enable data download from the shore. The rope and wire are buried in the streambed to avoid any breakage or malfunction due to uncontrollable factors (trees, debris, etc.). On the bank, the rope and wire are attached to a tree or an iron rod. The location is clearly marked to facilitate future field campaigns.

3 Results

3.1 Environmental Surveys

3.1.1 Fish habitat Validation

In order to document the diversity, quantity and quality of fish habitat in lake 01, the latter has been extensively travelled by boat. The effort has permitted to observe 35 shoals along the coastline of Lake 01, four (4) aquatic grass beds and two (2) potential spawning grounds for lithophile fish like brook trout (Salvelinus fontinalis) or white sucker (Catostomus commersonnii) (Map 1).

The shoals in lake 01 are characterized by outcrops of coarse substrate (pebble and bloc) close to the water surface. Fishes commonly use those habitats for shelter and feeding. They can also be used as a spawning ground by some lithophile fish species.

The aquatic grass beds are located in bays at the West and East extremities of lake 01 (Map 1). The vegetation is quite sparse and they do not show optimal condition as a spawning habitat for phytophiles fishes like Northern Pike (Esox lucius). The grass beds can still be used as a marginal spawning habitat or as a nursery or feeding ground.

The two potential spawning grounds for lithophiles fishes are located in the tributaries of lake 01 at the far east of the lake (Map 1). They are characterized by running water and a high proportion of gravel in the riverbed.

It’s also interesting to note that potential spawning grounds and aquatic riverbeds were also observed in the streams between lake 2 and lake 4 (streams 2-4), and between lakes 5 and 7 (Streams 5-6, 6-7).

3.1.2 Watercourse mapping and connectivity assessment

During the helicopter survey, around 40 different watercourses were mapped and a quick assessment of the connectivity was also made. The data regarding this survey is presented on map 1. A little less than half of the stream showed no visible barriers for fish movement and clear proof of connectivity between watercourse or waterbody. They are labelled as ‘’confirmed’’ on map 1. The other half didn’t show clear signs of connectivity or showed potential impassable obstacle for fish movement, they are labelled as ‘’uncertain’’ on map 1. Those streams will have to be visited on foot if it is required to have a more extensive idea of the connectivity between watercourse/waterbody in the study area.

The stream between lake 2 and lake 7 were travelled on foot. For those stream the data collected were more extensive (map 1). These data will be presented in a further note after the fall 2022 environmental surveys.

3.1.3 Sensitive Component in the Potential Failings and Waste Rock Disposal Sites

The intended potential TWR disposal sites at the time of the field work have been extensively travelled by helicopter (potential tailings and waste rocks disposal sites (old), map 1). Streams and many wetlands were observed at every potential TWR disposal sites. No sign of human activities was seen at these sites and no wildlife either. It should be noted that wild game like bears and moose have been seen in the study area (map 1) and there is no indication that they could not also use the potential TWR disposal sites.

A few waterbodies have been identified as being wetlands or lake since their connectivity was not determined. If they are connected, they could be lakes or riverine wetlands and if they are not, they could be ponds or other types of wetlands to be determined. This differentiation will need to be achieved eventually.

Since the field work, other potential TWR disposal sites had been considered (new site E), one of the original TWR disposal sites has been discarded (old site A, map 1) and one site has seen its area greatly reduced (old site C, new site B, map 1). Thus, the new site E hasn’t been travelled during this campaign.

Map 1

Hydrologic connectivity, fish habitat and wetland location overview

Hydrography

- Watercourse
- Waterbody

Characterized watercourse

- Connectivity confirmed / Presence confirmed
- Connectivity uncertain / Presence confirmed
- Connectivity none / Presence confirmed
- Connectivity uncertain / Presence uncertain

Tailings and waste rock disposal sites

- A — Revised outline (September 2022)
- Anterior outline (July 2022)

Elements of interest

- Rock Outcrop, Confirmed
- Wetland
- Wetland, Uncertain
- Lake
- Lake, Uncertain

Fish habitat and presence

Habitat

- Aquatic grass bed
- Potential spawning ground
- Shoal

Confirmed presence

- Brook trout
- Lake trout
- Northern pike

Wild game observation

- Bear
- Beaver
- Moose

Data sources :
Hydrography, RNCA, 2017
Inventory, Groupe Synergis, 2022
Orthophoto, Esri Satellite, 2018

0 250 500 m

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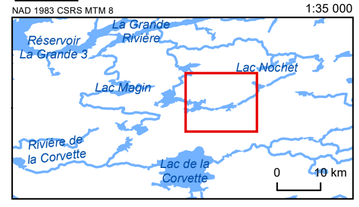

Preliminary environmental and social survey

NIIGAAN

Project : 151022002

August 31th, 2022
Approved by :
Pierre-Olivier Côté

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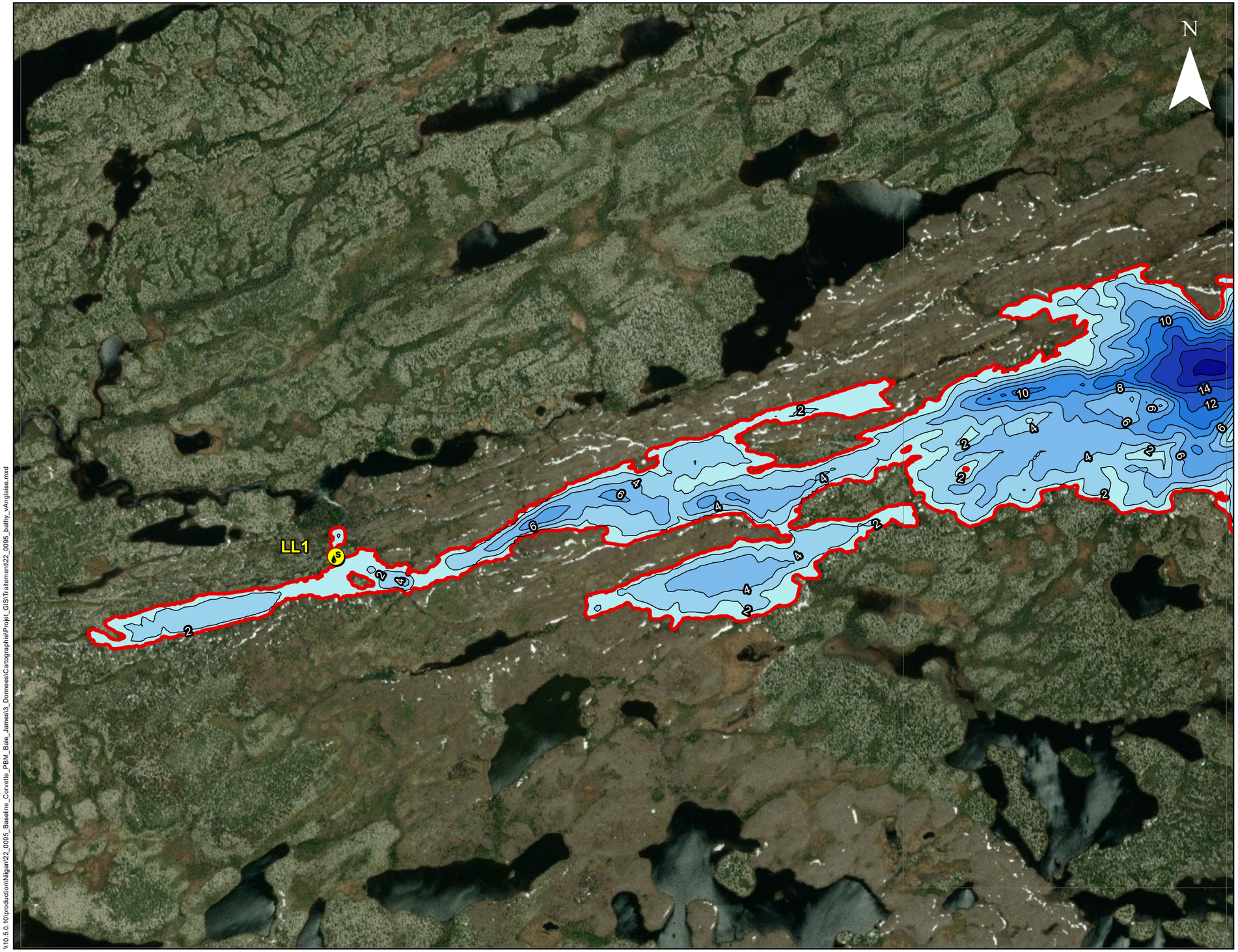
Note : Cette carte n'a aucune valeur légale, seul un arpentage géomètre peut se prononcer sur l'exactitude des informations géographiques.

3.2 Hydrological survey

3.2.1 Bathymetric survey

From the bathymetric survey conducted on lake 01, a complete bathymetric representation of the lake’s depth has been produced. The result is presented below on maps 2 to 4.



Map 2

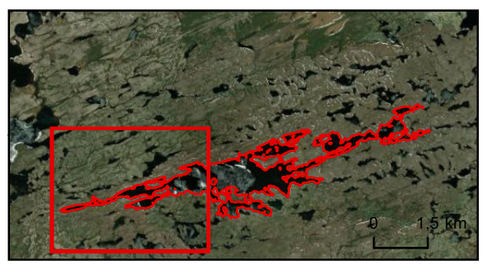
Bathymetric map - West sector

- Level logger and gauging
- Level logger
- Barometric logger
- Study area
- Isobath (2m)

Depth (meters)

- 0 to 2
- 2,01 to 4
- 4,01 to 6
- 6,01 to 8
- 8,01 to 10
- 10,01 to 12
- 12,01 to 14
- 14,01 to 16
- 16,01 to 18
- 18,01 to 20

Data sources :
Géobase du réseau hydrographique du Québec, MERN Québec, 2019
Orthophoto, World Imagery, Esri via the Community Maps Program, 2017-08
Project data, Groupe Synergis, 2022



Corvette baseline

Bathymetric survey

Niigaan
Project : 22-0095

August 17, 2022
Approved by :Patrice Ferron

GROUPE SYNERGIS

1:14 000

0 0,25 0,5 1 km

NAD 1983 CSRS MTM 8

Note: This map has no legal value, only a land surveyor can comment on the accuracy of the geographical information.

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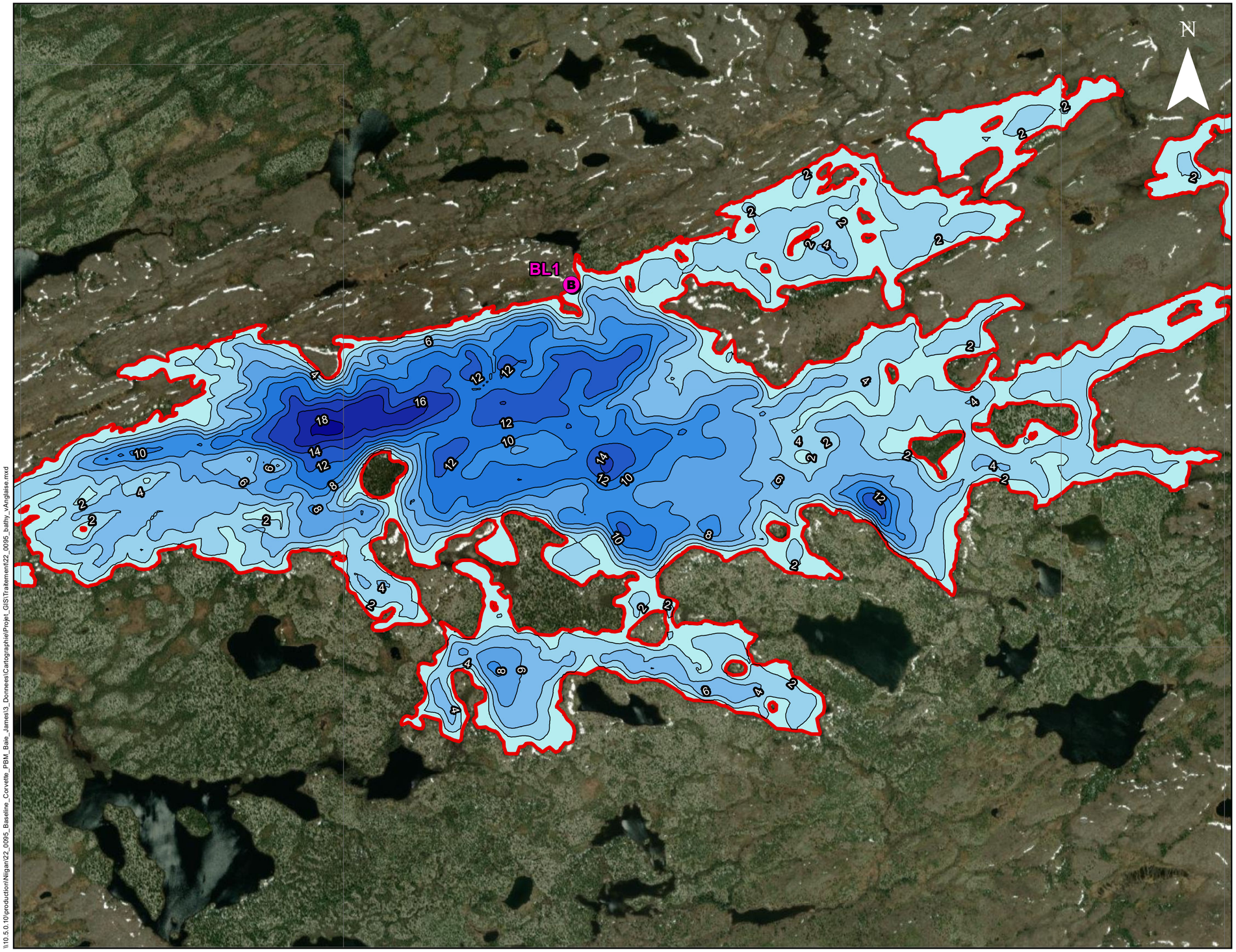
Map 3

Bathymetric map - Center sector



- Level logger and gauging
- Level logger
- Barometric logger
- Study area
- Isobath (2m)

Depth (meters)

- 0 to 2
- 2,01 to 4
- 4,01 to 6
- 6,01 to 8
- 8,01 to 10
- 10,01 to 12
- 12,01 to 14
- 14,01 to 16
- 16,01 to 18
- 18,01 to 20

Data sources :
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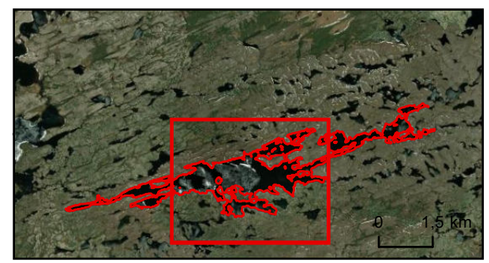
Project data, Groupe Synergis, 2022



Corvette baseline

Bathymetric survey

Niigaan
Project : 22-0095

August 17, 2022
Approved by :Patrice Ferron

GROUPE SYNERGIS

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NAD 1983 CSRS MTM 8

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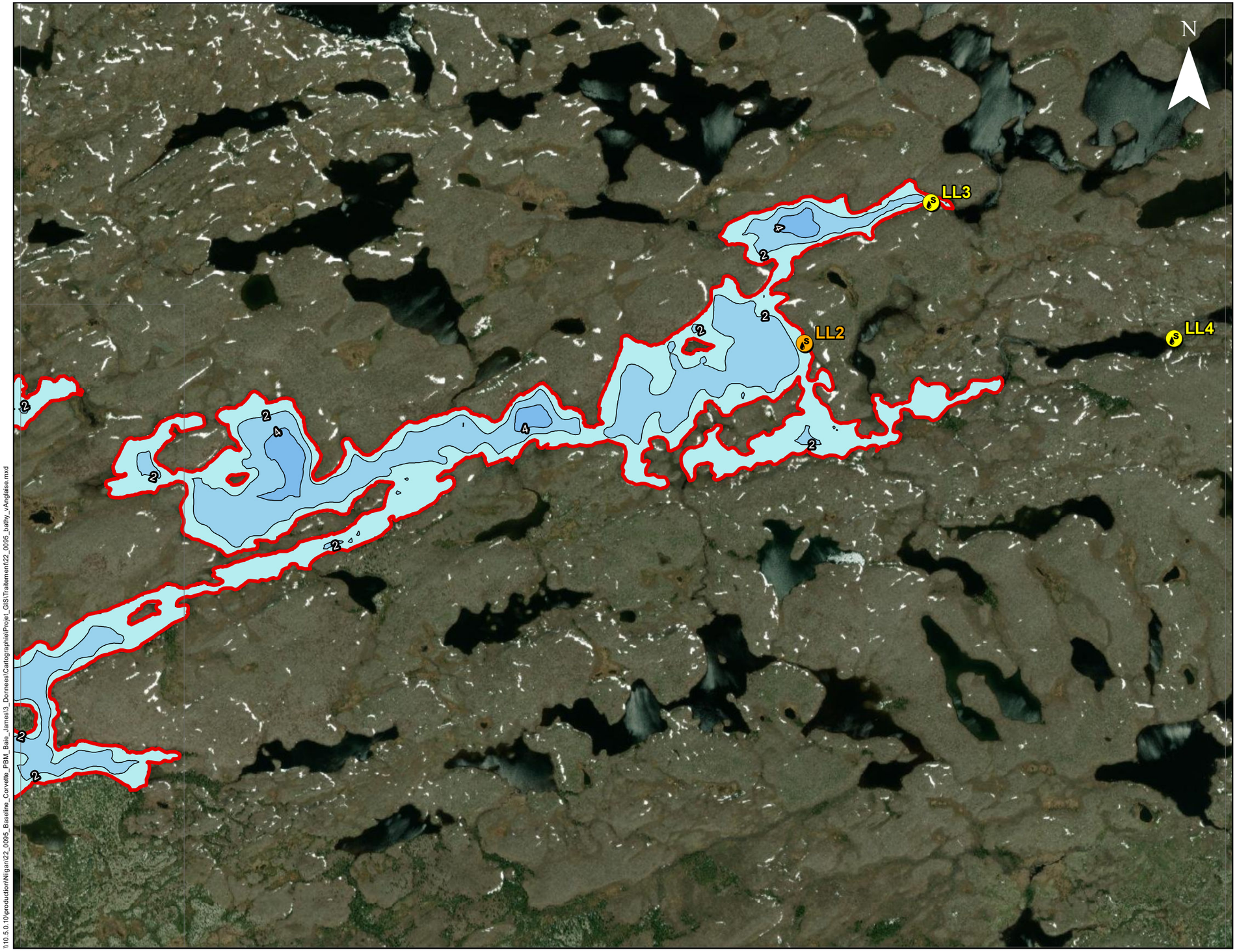


Map 4

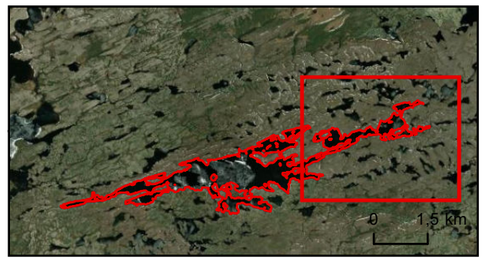
Bathymetric map - East sector

- Level logger and gauging
- Level logger
- Barometric logger
- Study area
- Isobath (2m)

Depth (meters)

- 0 to 2
- 2,01 to 4
- 4,01 to 6
- 6,01 to 8
- 8,01 to 10
- 10,01 to 12
- 12,01 to 14
- 14,01 to 16
- 16,01 to 18
- 18,01 to 20

Data sources :
Géobase du réseau hydrographique du Québec, MERN Québec, 2019
Orthophoto, World Imagery, Esri via the Community Maps Program, 2017-08
Project data, Groupe Synergis, 2022



Corvette baseline

Bathymetric survey

Niigaan
Project : 22-0095

August 17, 2022
Approved by :Patrice Ferron

GROUPE SYNERGIS

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NAD 1983 CSRS MTM 8

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3.2.2 Water flow and water level gauging

The water flow gauging results are presented in table 1 below. The location of the gauging stations and of the water level probes are shown on map 2, and 4.

Tableau 1. Water flow gauging of the outlet and tributaries of lake 01

Site	Flow rate (m^3/s)	Day water level (m)	Stream width (m)	Mean depth (m)	Mean velocity (m/s)	Number of reading
Lake 1 outlet	3,26	373,01	11,0	0,45	0,80	9
Lake 1 tributary probe 3	1.45	373,58	10,0	0,19	0,85	9
Lake 1 tributary probe 4	0,63	377,87	6,0	0,25	0,43	5

Sincerely,

<original signed by>

Jeff Goulet, Biologist

JG/jp