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LA GRANDE ALLIANCE

VOLUME 6 - APPENDIX

SECTION 6.29 – Aquatic Survey Method

Feasibility Study Final Report Phase I

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1 Aquatic characterization methodology

In total, approximately 575 watercourses (streams and rivers) will potentially be crossed by the road and railway alignments proposed as part of Phase 1 of the Grande Alliance project. Of those, 76 were selected for a fish inventory and characterization of the fish habitat. Using the cartographic analysis in Quebec's hydrographic network database (Géobase du réseau hydrographique du Québec or GRHQ), the 76 water crossings were selected based on the following criteria:

- The watercourse had to have permanent water flow; and
- Of the permanent watercourses, those with the largest hydrographic networks upstream of the crossing site were selected;
- The final selection was based on the most even distribution possible across all the alignments.

In the case of the BDHR, two optional alignments were still being studied at the time of the field visits. For that reason, eight (8) sites specific to the "Optimized" alignment were added to the water crossings to be visited. The other crossings were located in the "Baseline" alignment. The final alignment that was ultimately chosen is an amalgamation of the two alignments. In total, 48 water crossings were visited for the BDHR, 10 for the Grevet-Chapais area and 18 for the Mistissini sector. In the latter case, a number of optional alignments were also being studied at the time of the field visits. The characterized watercourses were therefore evenly distributed among the various options. Table 1 provides details of the distribution of crossings inventoried for the three alignments.

For the BDHR and Mistissini sectors, the fish habitat characterization extended for 250 m on either side (upstream and downstream) of the crossings. As for the Grevet-Chapais line, the characterization was limited to a distance of 100 m upstream and downstream of the crossing, because the planned railway will lie on the bed of an old railroad. In this case, the potential impacts associated with construction and the presence of the railway are lower than for the BDHR and Mistissini alignments, which will consist almost entirely of new construction.

As outlined in the detailed work plan for the aquatic habitat study, three field campaigns were conducted. The first took place in fall 2021, from September 21 to 30, 2021 and again from October 13 to 25, 2021. The following year, a third campaign took place in late summer, from August 23 to September 2, 2022. The field inventory focused primarily on spawning and nursery habitats for the species of interest for subsistence and sport fishing.

All of the information was recorded in an electronic form using a Kalliope tablet and the Fulcrum software, which makes it possible to create alignments, both for the summary characterization of a zone and for the habitat-of-interest zones. In addition, photos can be taken directly using the software and every photo is geo-tagged. All other relevant information regarding the target habitat is also noted in the Kalliope tablet.

The fish inventory was carried out using fishing equipment suited to the habitats present (depth, current, plants communities or obstacles, etc.). Samples were thus collected using electro-fishing, fyke nets and bait traps, as well as experimental fishing using nets with a stretch measure of 1 to 4 inches. The fishing techniques were based on the Quebec government's standard guide for fish inventory methods in interior waters (*Guide de normalisation des méthodes d'inventaire ichtyologique en eaux intérieures*, SFA, 2011).

Tableau 1. Aquatic characterization stations along the study alignments

Alignment	Sequential No.	Type	Name	UTM 18 X	UTM 18 Y
Billy Diamond Baseline	1	River	Bell River	310829.6	5516433.3
	2	Watercourse	WC Matagami Lake (Dunlop Bay)	316030.9	5518156.7
40 sites	3	River	Waswanipi River	338360.5	5528496.4
	4	River	Canet River	348731.6	5530553.9
	5	Watercourse	Canet River tributary	348094.5	5534178.0
	6	Watercourse	Amphibolite Lake tributary	348313.9	5546502.2
	7	Watercourse	Amphibolite Lake tributary	348407.9	5549886.1
	8	Watercourse	Nottaway River tributary	350789.1	5557552.1
	9	Watercourse	Unknown lake tributary	347760.3	5561771.6
	10	River	Muskiki River	350329.6	5568978.2
	11	Watercourse	Muskiki River tributary	350308.7	5569918.1
	12	River	Muskiki River	351938.0	5577532.0
	13	Watercourse	Muskiki River Tributary	347906.6	5586628.8
	14	Watercourse	Muskiki River Tributary	344292.8	5591840.5
	15	Watercourse	Kakaskutatakuch Creek	325681.3	5597793.6
	16	Watercourse	Pisimwetach Kayspaich Creek	323070.2	5598503.9
	17	Watercourse	Pisimwetach Kayspaich Creek	319937.0	5600216.7
	18	Watercourse	Kawaseyapiskau Lake Tributary	318109.2	5608196.1
	19	Watercourse	Kawaseyapiskau Lake Tributary	318516.5	5610243.1
	20	Watercourse	Mouliers Lake tributary	313190.0	5627643.2
	21	Watercourse	Mouliers Lake tributary	313607.8	5628645.8
	22	Watercourse	Rodayer Lake tributary	315472.1	5639763.7
	23	Watercourse	Rodayer Lake tributary	314370.2	5641356.4
	24	Watercourse	Colomb Lake tributary	314004.6	5647142.5
	25	Watercourse	Colomb Lake tributary	314140.4	5648406.3
	26	Watercourse	Colomb Lake tributary	314558.2	5650609.9
	27	Watercourse	Colomb Lake tributary	316104.0	5652489.9
	28	Watercourse	Colomb Lake tributary	318088.4	5655497.9
	29	Watercourse	Colomb Lake tributary	319299.9	5657273.4
	30	Watercourse	Colomb Lake tributary	319456.5	5657994.1
	31	Watercourse	Colomb Lake tributary	320490.5	5659247.4
	32	Watercourse	Ouasouagami River tributary	321336.5	5661847.9
	33	River	Ouasouagami River	321660.3	5663717.4
	34	Watercourse	Broadback River tributary	324365.3	5668709.8
	35	River	Broadback River	327613.4	5673409.6
	36	Watercourse	Tordu Creek tributary	332396.9	5683237.7
	37	Watercourse	Tordu Creek	332511.8	5683613.7
	38	Watercourse	Kaumwakweyuch Creek tributary	336104.6	5687258.6

Alignment	Sequential No.	Type	Name	UTM 18 X	UTM 18 Y
	39	Watercourse	Kaumwakweyuch Creek	5688752.2	335958.4
	40	River	Rupert River	331185.3	5691895.9
Billy Diamond Optimized	41	River	Waswanipi River	342614.1	5525137.9
	42	Watercourse	Waswanipi River tributary	347442.4	5527915.8
8 sites	43	Watercourse	Unknown lake tributary	348376.6	5563284.6
	44	Watercourse	Muskiki River tributary	344548.7	5590782.7
	45	Watercourse	Muskiki River tributary	343928.7	5591576.3
	46	Watercourse	Nottaway River tributary	332320.9	5595817.6
	47	Watercourse	Colomb Lake tributary	315711.3	5652839.3
	48	Watercourse	Kaumwakweyuch Creek tributary	334528.4	5689167.1
Grevet-Chapais	49	River	O'Sullivan River	394086.1	5473374.7
	50	Watercourse	O'Sullivan River tributary	395898.7	5477065.3
10 sites	51	River	Bachelor River	405784.0	5483791.4
	52	River	Bachelor River	411709.4	5484796.0
	53	Lake	Opawica Lake	436779.4	5491303.7
	54	Lake	Opawica Lake	441059.6	5493429.2
	55	Watercourse	Opawica Lake tributary	446344.4	5495045.3
	56	Watercourse	Hancock Lake tributary	473438.0	5504377.3
	57	River	Obatogamau River	487079.4	5507070.7
	58	Watercourse	Cavan Creek	502133.1	5512108.0
Mistissini	W1	River	Mistissini Lake tributary	552 226.5	5 568 067
	W2	Watercourse	Mistissini Lake tributary	556 109.3	5 568 393
18 sites	W3	Watercourse	Mistago River tributary	558 710.5	5 569 003
	W4	Watercourse	Mistissini Lake tributary	557 331.3	5 571 129
	W5	Watercourse	Mistago River tributary	560 495.6	5 569 176
	W6	River	Mistissini Lake tributary	558 995.4	5 571 835
	W7	Watercourse	Mistissini Lake tributary	561 803.7	5 575 699
	W9	River	Pipounichouane River tributary	567 853.2	5 575 310
	W10	River	Pipounichouane River	564 846.3	5 573 415
	W12	River	Pipounichouane River	574 593.6	5 580 858
	W13	River	Pipounichouane River	575 654.8	5 584 717
	W14	River	Mistissini Lake tributary	578 301.5	5 586 363
	W16	Watercourse	Mistissini Lake tributary	559 415.8	5 573 493
	W17	Watercourse	Mistago River tributary	561 320.5	5 569 956
	W18	Watercourse	Pipounichouane River tributary	573 999.0	5 581 401
	W19	Watercourse	Mistissini Lake tributary	561 324.4	5 570 627
	W20	River	Pipounichouane River tributary	574 043.4	5 582 633
	W21	Watercourse	Mistissini Lake tributary	577 522.9	5 584 742

1.1 General watercourse characterization

A general characterization of the morphology of each water crossing was completed. The following information was collected:

- General condition
- Coordinates of start and end of zone
- Direction of flow
- Watercourse slope
- Average current velocity
- Minimum and maximum width
- Minimum and maximum depth
- Photos

1.2 Spawning habitat characterization

Each aquatic habitat (spawning ground and plant community) was identified and located. All habitats inventoried in the watercourse were fully characterized morphologically. The following information was collected:

- General condition
- Coordinates of start and end or contour of habitat identified
- Granulometry
- Average width
- Average depth
- Photos

Details of the grain size classes are provided in Table 2.

Tableau 2. Grain size classes used to characterize the substrate

Type of substrate	Abbreviation	Diameter (mm)
Bedrock	R	-
Large boulders	Bx	> 1,000
Boulders	B	250-1,000
Cobbles	G	80-250
Pebbles	C	40-80
Gravel	Gr	5-40
Sand	S	0.125-5
Clay/Silt	C	< 0.125
Organic matter	O	-

1.3 Data processing

The results analysis relied first on the data collected in the field by Synergis Group in the fall of 2021 and summer of 2022. In addition, information supplied by the Quebec Natural Heritage Data Centre (CDPNQ) and information on the Rupert and Broadback rivers taken from a few inventories completed by Hydro-Québec in 2001 were incorporated into the analyses.

In the results analysis, radii of one (1), two (2) and four (4) kilometres were used around the study stations, which made it possible to increase the detection capacity for species potentially present in the watercourses affected by the crossings. This approach also made it possible to address some gaps associated with the fall 2021 field inventories (see section 1.5 *Limitations* below).

Where CDPNQ data locations were not directly located at the sites of the water crossings studied or where no fish were caught on site, the presence or absence of fish could not be validated. The study radii (1-2-4 km) used therefore provide more of an indication of potential presence of the species, which complements the characterization of the morphology and substrate of the watercourse conducted in the field.

1.4 Identification of critical habitats

Each water crossing was classified based on the sensitivity of the surrounding habitats. Sensitivity is defined here as the importance of the habitat to the fish life cycle and the tolerance of the aquatic environment to disturbance. It is also a function of the fish species that use the environment. The exercise made it possible to identify the crossings that pose significant issues in terms of potential consequences of the road and rail construction, their long-term use and the presence of structures in the environment (bridges, culverts).

The results of this analysis are provided in tables 3, 4 and 5 below. The scale used for habitat sensitivity at the crossings is as follows:

Red: Potential or confirmed presence of lake sturgeon, a species of special concern identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

and/or

Potential presence of spawning grounds for a species of interest for subsistence or sport fishing (walleye and sauger, brook trout, northern pike, mooneye or goldeye and lake whitefish)

Yellow: Potential or confirmed presence of subsistence or sport fishing species (walleye and sauger, brook trout, northern pike, mooneye or goldeye and lake whitefish)

and/or

Presence of a plant community or potential nursery or feeding area for these species

Green: No sport fishing or subsistence species and/or no sensitive habitat observed

1.5 Limitations

In order to meet the schedule for the feasibility study for Phase 1 of the Grande Alliance project, the first two fish inventories were completed in early fall. However, this time of year is not optimal for obtaining a representative inventory of the environment. With the exception of lake whitefish and brook trout, a number of species have lower distribution concentrations at that time of year, compared with spring, for example, which is the spawning season for some of them (e.g.: lake sturgeon, pike and walleye). The end of summer is also a suitable time, when the warmer water is conducive to greater fish activity (movement).

Another limitation has to do with the duration of fishing equipment operation. In order to avoid mortality due to fish getting caught in nets, the nets were only put out for a few hours, rather than a 12-hour period or overnight as recommended by Quebec's aquatic wildlife department in 2011 (SFA, 2011). This significantly reduced the likelihood of catching fish, both in terms of the number of each species and of building a more comprehensive picture of the diversity of species present.