CHALEUR VENTUS WIND ENERGY PROJECT

APPENDIX I - AQUATIC RESOURCES REPORT

CHALEUR VENTUS LIMITED PARTNERSHIP

September 2019

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1 INTRODUCTION

This report provides a summary of the Aquatic Resources Studies completed in support of the Chaleur Ventus Wind Energy Project (Project) Registration Document that was submitted to with the Sustainable Development, Planning and Impact Evaluation Branch, Department of Environment and Local Government in September of 2019.

The purpose of this report is to present the methods and results of the aquatics field studies completed in support of this Project.

1.1 PROJECT OVERVIEW

Chaleur Ventus Limited Partnership (CVLP) is proposing the development of the Project. The Project is located on privately owned land south of route 303 in Gloucester County, New Brunswick, and will have an aggregate electrical capacity of 20 megawatts (MW). The Project will consist of five wind energy converters (WECs), access roads, collection system, substation, and associated temporary laydown areas required for construction. An approximate 9 kilometre (km) transmission line is proposed that runs south and southwest from the Project area to a proposed substation that will be located on Crown land approximately 2.8 km southeast of Saint-Leolin.

The Project is expected to consist of Enercon E-126 WECs with a nominal power of 4 MW. Each assembly will consist of the tower, hub, nacelle, rotor blades, and controller, with a total height of 179.5 to 194.5 metres (m) dependent on WEC availability from Enercon. The total WEC rotor diameter will be 127 m. It is anticipated that each WEC will be erected on a concrete foundation. The dimensions, depth, and type of foundation will depend on an evaluation of the local soil, surficial geology characteristics, wind forces at the location, and site-specific details of each location.

2 METHODS

Prior to field surveys, a review of available desktop data and mapping was conducted to identify potential watercourses in the Project area. Reconnaissance field surveys took place between Spring of 2018 and fall of 2019 to identify potential fish-bearing watercourses for aquatic habitat assessment. During field reconnaissance, no potential fish-bearing watercourses were identified in most of the Project area. Wetlands in the Project area are generally forested swamp, and no potentially fish bearing watercourses were identified. The wetlands located within the Project area did not appear to have consistent surface water connectivity suitable for fish. Due to the large amount of snow that accumulates at the Project area over the winter months, and the generally flat terrain at the site, pooled water is found covering the site nearly entirely for a short period during spring freshet. Most of this water is deposited into the large forested swamps that are found throughout the site, through non-confined overland flow, with no clearly incised channels noted during summer and fall when the topography is viewed free of obstruction.

Field reconnaissance of the tapline portion of the collection system completed between June 2018 and September 2019 identified two watercourses and were selected for the aquatic habitat assessment, water quality sampling, and fish presence surveys as described below.

2.1 AQUATIC HABITAT ASSESSMENT

The aquatic habitat assessment was completed on September 6, 2019. The assessment followed methods outlined by Department of Fisheries and Oceans and the United States Department of the Interior in association with the United States Fish and Wildlife Service for Atlantic salmon (*Salmo salar)* (Marshall et al, 2014) and brook trout (*Salvelinus fontinalis*) (Raleigh, 1982).

Salmonid species such as brook trout and Atlantic salmon are considered "indicator species" as they are sensitive to changes in water quality (normal ranges found in section 2.2) and prey abundance, meaning that the presence of either of these species can indicate that the watercourse they are found in is of "good" biological condition.

The aquatic habitat observations collected included the following:

- Stream morphology (i.e., sinuous, regular meandering, irregular meanders, tortuous meanders, braided, or straight).
- Watercourse type (i.e., large permanent, small permanent, intermittent, ephemeral, or a combination of these).
- Riparian vegetation identification.
- Habitat types encountered (i.e., riffle, run, pool, flat, rapid, snye).
- Bank type (i.e., vertical, sloped, undercut, man-made, eroded).
- Substrate size: Fines (<0.0625 mm), Sand and small gravel (0.065-3.0 cm), Large gravel (3.1-6.4 cm), Cobble (6.5-25.6 cm), Boulder (>25.6 cm), and Bedrock. These size classes generalized from the Wentworth scale of rock particulate sizes. Substrate matter is measured on its rolling edge.
- In-Stream cover (i.e., small woody debris, large woody debris, undercut banks, overhanging vegetation, unembedded boulder and cobble, and aquatic vegetation).
- Barrier observations: full, partial, temporary, or none.
- Water quality parameters: pH, water temperature, dissolved oxygen, total dissolved solids, salinity, and specific conductivity.
- Percent pools and pool quality.
- Transect measurements: Bank-full and wetted widths, wetted depth, bank height, and percent embeddedness.
- GPS information about where transect measurements were taken (UTM NAD83; Zone 20T).
- Weather information for the date assessed, and remarks on previous precipitation which may influence wetted widths and depths.
- Habitat suitability rationale based on the above parameters and general site information pertaining to spawning, rearing, overwintering, and overall habitat quality.
- Additional notes about the site.

2.2 WATER QUALITY

Data for water quality was collected during the aquatic habitat assessment in the two watercourses identified along the proposed transmission line. A field meter (YSI Pro-Plus) was used to measure dissolved oxygen (mg/L and DO%), pH, conductivity, total dissolved solids, and water temperature at each sampling location. Prior to field measurements, the field meter was calibrated and representative areas were selected for sampling (i.e., no samples were taken in white water riffles, or stagnant pools, as levels of dissolved oxygen and conductivity may not be representative of the watercourse). Run-type habitat was used for testing when available with sufficient depth. At each sample location the YSI was left in the watercourse for three to five minutes so that the field metre had time to stabilize prior to recording readings.

Water quality has an impact on the presence/absence of fish species. In general, there are six parameters that are analyzed: pH, dissolved oxygen, total dissolved solids, conductivity, water velocity, and temperature and are described in more detail below.

2.2.1 *pH*

This measures the amount of acidity or alkalinity found in a substance, a completely neutral pH is measured at 7.0, any value less than 7.0 is considered acidic, and any value above 7.0 is considered basic (alkaline). The optimal pH range for Atlantic salmon is between 5.6 and 8.0 (Raleigh, 1982). The optimal pH range for brook trout is between

4.5 and 8.0 (Raleigh, 1982). The type of acids found in a watercourse (natural or inorganic) may alter the level of pH each species can tolerate.

2.2.2 *DISSOLVED OXYGEN*

This parameter measures the amount of oxygen dissolved in the water, and can identify areas where salmonid species may prefer or avoid. Dissolved oxygen levels for salmonid species are considered adequate when levels of at least 9.5 milligrams per litre (mg/L) are achieved for early life stage salmonids and levels of at least 6.5 mg/L are achieved for all other life stage salmonids (Raleigh, 1982). Adult salmonid species can withstand lower levels of dissolved oxygen for brief periods, but excessive exposure to dissolved oxygen levels less than 5.0 mg/L is considered detrimental to their health.

2.2.3 *TOTAL DISSOLVED SOLIDS*

This is the calculation of the number of solids found flowing in water. Readings of 150 to 500 mg/L are considered acceptable for salmonid species, as levels lower than this may reflect poor productivity of benthic macro invertebrates, and levels higher than this are often linked to sediment-loading (Raleigh, 1982).

2.2.4 *CONDUCTIVITY*

This is the measurement of how easily electricity will pass through a substance, when referring to water, this parameter is often measured in micro-Siemens per centimetre (µS/cm). This measurement can be used to determine the amount of dissolved salts and inorganic materials present in water and can also be used as an indicator of the presence of metals. Further laboratory testing should be completed to fully understand the individual conductive elements present in a sample. High conductivity readings may be an indicator of high total dissolved solids in the water. Generally, conductivity readings of between 100 and 500 µS/cm are considered acceptable for salmonid species (Raleigh, 1982).

2.2.5 *WATER TEMPERATURE*

This is the measure of heat found in a watercourse, and is crucial for determining the suitability of a watercourse for aquatic species. Most salmonid species prefer cold, clear water, with areas of upwelling groundwater for spawning activities (Raleigh, 1982). Optimal temperature range for overall well-being of brook trout is believed to be between 11 and 16°C. The recognized maximum tolerable temperature limit for brook trout is measured at roughly 24°C, although brook trout will likely begin to seek out new habitat once water temperature hits 20°C.

2.3 FISH PRESENCE

Fish sampling was carried out on September 6, 2019 using a non-lethal sampling method, backpack electrofishing in the two watercourses identified along the proposed transmission line. Through correspondence with regulators, electrofishing was selected for fish sampling. Electrofishing followed the Canadian Rivers Institute methods. Both watercourses were fished at approximately 140 m at or near the proposed transmission line route crossing. Electrofishing was completed using a Smith-Root LR-24 back mounted electrofishing unit.

Prior to electrofishing, water quality was tested to confirm electrofishing could be safely completed (water temperature was below 22°C in each watercourse). Once water quality parameters were confirmed to be safe for electrofishing, the "quick setup" on the LR-24 unit was run, where the electrofishing unit automatically runs a water quality test, and sets voltage, duty cycle, output frequency, and other parameters to match the water it is submerged in. Electrofishing unit settings are presented in Table 1.

Table 1 Smith-Root LR-24 Electrofisher Parameters

Parameter	Setting
Output Voltage	235 volts
Duty Cycle	12%
Output Frequency	30 Hertz

While one field crew member operated the electrofishing unit, the second dip-netted incapacitated fish using a non-conductive, fiberglass handled dip net with a fine mesh and placed captured fish in a bucket with water from the watercourse being fished. Fish were assessed for injuries and recovery time after being caught.

Once electrofishing was completed at a site, the contents of the bucket were photographed, identified, and recorded into size classes before being released. The entire process from catch to release was no more than 15 minutes at each watercourse, and all fish were released to the same location where they had been captured.

It is important to note that fish were not handled by assessors, and that the maximum time the individuals were out of water was the time between netting and bucketing (approximately 5 to 10 seconds). No voucher specimens were taken as part of the program.

3 RESULTS

3.1 AQUATIC HABITAT ASSESSMENT

3.1.1 *WATERCOURSE 1*

Watercourse 1 (WC-1) is an intermittent stream found where the existing road Chemin des Boudreau intersects with the proposed transmission line (UTM coordinates 340709.54 E, 5293640.45 N, Zone 20T). This watercourse runs for approximately 3 km before reaching a confluence with Rivière du Nord. It is considered intermittent, with an average depth of approximately 8 cm at time of assessment. Bank-full width of this watercourse was averaged at roughly 2.5 m. Substrate in this watercourse was made up mostly of fine and organic materials, and was mostly absent of gravel or cobble sized material. This watercourse had little habitat variation, with only flat, and run habitat types identified in the assessed reach, with the exception of one large inflow pool upstream of a culvert crossing.

Spawning potential for brook trout was considered “high” at this watercourse due to the upwelling of ground water which was apparent along most of the assessed reach. This upwelling of groundwater is preferred for brook trout spawning, as they lay their eggs in areas where groundwater upwells to prevent their eggs from asphyxiation due to silt and fine organic materials covering them. The spawning potential is considered “low” for other salmonid species such as Atlantic salmon due to the absence of the preferred gravel substrate riffles in which Atlantic salmon spawn, the small size of the watercourse, the substrate makeup, the low flow, the absence of deep pool areas, and lack of defined foraging areas. Water quality measurements taken at this watercourse were considered within acceptable ranges for salmonid species, and are presented in Section 3.2.

3.1.2 *WATERCOURSE 2 (RIVIÈRE DU NORD)*

Watercourse 2 (WC-2; Rivière du Nord) is a large-permanent stream found in a wooded area approximately 2.5 km east of Village-Saint-Paul, and intersects with the proposed transmission line at UTM coordinates 340415.83 E, 5294766.33 N (Zone 20T). This watercourse had an average bank-full width of approximately 8 m, and had roughly 20 cm of depth on average. Pooled areas of this watercourse reached maximum depths of over 0.5 m. Habitat such as pools, riffles, run, and flat areas were identified within the assessed reach. Substrate in this watercourse was comprised mainly of cobble sized rocks, with boulders, and a mix of small and large gravels lightly interspersed. Substrate was mostly free of fine materials or mud.

Overall habitat suitability for salmonid species at this watercourse was considered "good" as an appropriate mix of habitat types, cover, and substrate were noted, along with water quality parameters which were all within the suitable range for salmonids. The assessed reach is approximately 3.5 km upstream of a brackish estuary and is likely accessed by anadromous fish (such as brook trout) for at least part of the year. A failing beaver structure was noted along the assessed reach, which impounded water upstream, creating a deep (>50 cm) pool area, with water flowing downstream at a point where the structure had washed out. This watercourse runs roughly 3.5 km from the transmission line cross point to a tidal estuary.

3.2 WATER QUALITY

Water quality measurements (pH, temperature, dissolved oxygen, total dissolved solids and conductivity) collected at each watercourse are presented in Table 2.

Table 2 Water Quality Parameters

Parameter	Watercourse 1	Watercourse 2 (Rivière du Nord)
pH	7.72	7.61
Dissolved Oxygen (mg/L)	6.74	9.97
Dissolved Oxygen (%)	57.1	93.2
Total Dissolved Solids (mg/L)	109.2	86.45
Conductivity (µs/cm)	113.8	101.7
Temperature (^{O}C)	8.1	12.6

While both watercourses we considered suitable for salmonid species, it appears that WC-2 had favorable conditions, while WC-1 had acceptable conditions. This is due mostly to the morphology of these two watercourses; WC-2 had much better constant flow and natural features such as rock-sills to help deposit oxygen into the water, where WC-1 was a slow moving, flatter, and smaller in stature without enough flow or appropriate structures to help buff the dissolved oxygen levels at time of assessment. Both watercourses were suitable for brook trout (see Section 3.3)

WC-1 had lower water temperature which can be partially attributed to upwelling groundwater which was noted along the assessed reach. Size of the watercourses also plays a role in water temperature, as WC-2 is much wider and more open, allowing for more sunlight to infiltrate the channel, which in turn may increase water temperature.

Total dissolved solids were lower in WC-2, which could be attributed to the higher flow rate, velocity, and substrate in the watercourse. The considerable amount of fine materials found in the substrate of WC-1, along with the low flow rate and lack of apparent velocity may contribute to the elevated amount of total dissolved solids at that location.

Dissolved oxygen levels were near optimal for salmonids at WC-2, while levels in WC-1 were far lower. This can be contributed to in part to the time of assessment, as field work was completed during the low flow season. The positive identification of brook trout at this location leads to the assumption that dissolved oxygen levels are greater at this location during other periods of the year.

The pH and conductivity readings were considered acceptable for fish at both watercourse locations.

3.3 FISH PRESENCE

3.3.1 *DESKTOP REVIEW*

No historical fishing or population data could be sourced for the two watercourses identified for detailed study along the tapline. It appears that no recreational Atlantic salmon fishery is found associated with these watercourses and

the Rivière du Nord is not mentioned in the fishing regulations for the Chaleur region of New Brunswick (NBDERD, 2019).

Fish species that have potential for presence in the two watercourses include:

- Three-spine stickleback (*Gasterosteus aculeatus*)
- Mummichog (*Fundulus heteroclitus*)
- Rainbow smelt (*Osmerus mordax*)
- Atlantic tomcod (*Microgadus tomcod*)
- Yellow perch (*Perca flavescens*)
- Common shiner (*Notropis cornutus*)
- White sucker (*Catostomus commersoni*)

Atlantic salmon and American eel (*Anguilla rostrata*) could potentially be present in WC-2 (Rivière du Nord) for at least part of the year, due to the proximity and accessibility of marine habitat.

3.3.2 *WATERCOURSE 1*

Electrofishing at WC-1 yielded one brook trout, which was in the 10 to 15 cm range, another brook trout of the same size class was observed but not captured. Several minnow-sized fish (likely dace, killifish, or chub species) were unaffected by the electrofishing unit; however, units were not adjusted to avoid harm to fish populations at this location.

3.3.3 *WATERCOURSE 2 (RIVIÈRE DU NORD)*

Electrofishing at WC-2 (Rivière du Nord) yielded one brook trout in the 5 to 10 cm range, along with two eastern blacknose dace (*Rhinichthys atratulus*), one measured 0 to 5cm, and the other measured 5 to 10cm. While no other fish were observed during the assessment of this watercourse, it is possible that additional fish were missed in areas of deep water, as shaded waters may have hidden individuals.

4 ADDITIONAL RECOMMENDED MITIGATIONS

As outlined in the Registration Document, the project will be sited on existing roads and disturbed areas as much as possible and watercourses will be avoided to the extent practical. All necessary permits and approvals will be obtained and on-site and a Watercourse and Wetland Alteration Permit will be obtained if required. An Erosion and Sediment Control Plan will be followed for the Project. However, the following mitigations have been identified, in addition to those in the Registration Document:

- Siting of transmission line structures will be planned to avoid waterbodies and watercourses as much as possible to reduce impacts to these areas. Planning should include setbacks from riparian areas.
- If placement of transmission line structures, temporary access, or temporary work areas cannot avoid waterbodies and watercourses, Authorization For Work that May Result in Serious Harm to Fish will be obtained.

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