

5 IDENTIFICATION OF ENVIRONMENTAL EFFECTS AND MITIGATION

5.1 APPROACH TO THE ASSESSMENT

The proposed Project is considered an “Undertaking” under Schedule A of Regulation 87-83 of the *Clean Environment Act*, and therefore subject to the provincial EIA process. The EIA process for this Project followed the outline provided in “A Guide to Environmental Impact Assessment in New Brunswick” (Environment and Local Government, 2017) and the associated *Additional Information Requirements for Wind Turbines* document.

The purpose of the EIA is to gather information about the Project and assess potential interactions between the environment and Project activities. The approach considers how each project activity may interact with the existing environment and result in an environmental effect on one or more of the biophysical and socio-economic components of the environment. The assessment considers the Project description (Section 3) and the existing environment (Section 4).

The approach involves the consideration of how the Project may interact with valued environmental components (VECs) and result in an effect. Where potential adverse effects are identified, mitigation is applied to avoid or minimize (limit) the effects. The assessment includes the analysis of cumulative effects that could be a result of the Project in combination with other developments.

The steps to the assessment include the following:

- Identify VECs
- Define the spatial and temporal boundaries for the assessment
- Provide the description of existing conditions for each VEC.
- Identify all possible interactions and effects that the Project may have on VECs
- Describe plans to mitigate the potential effects from the Project
- Evaluate and determine the significance of any residual environmental impacts (i.e., effects that remain after mitigation)
- Discuss follow-up monitoring that may be required.

5.2 VALUED ENVIRONMENTAL COMPONENTS

Valued environmental components represent physical, biological, cultural, social, and economical properties of the environment determined to be important by the proponent, the public, community groups and stakeholders, the scientific community, First Nations and Métis communities, and government agencies. The value of a component not only relates to its role in the ecosystem, but also to the value placed on it by humans. Examples of physical properties that may be considered VECs include air quality, groundwater, and surface water. Aquatic and terrestrial habitats represent biological properties that may be considered VECs. Access to recreational opportunities and other biophysical properties (e.g., ecological services or resources) can be VECs of the socioeconomic environment. The VECs have been selected for the assessment because of their value and their potential sensitivity to effects from the Project.

The VECs selected for this assessment are:

- Terrain and Soils
- Surface Hydrology
- Fish and Fish Habitat
- Wetlands
- Terrestrial Vegetation
- Wildlife including Birds and Bats
- Species of Conservation Concern
- Noise
- Shadow Flicker
- Visual Aesthetics
- Electromagnetic Interference
- Heritage and Archaeological Resources
- Land Use
- Local Economy

Air quality was not selected as a VEC because air quality in the Project area is expected to be better than that recorded in Moncton given its remote location (Section 4.1). Construction and operation of the Project is expected to contribute a small amount of dust and vehicle emissions, however, through the use of mitigation (e.g., dust suppression and not idling vehicles), the Project is not expected to cause exceedances of emissions over guideline values. Wind projects are constructed to offset GHG emissions from other types of power generation. Therefore, air quality will not be carried through the assessment.

Environmentally sensitive and protected areas was not selected as a VEC because none of these areas are within the Project footprint and the nearest sensitive area is 3.8 km from the southernmost WTG (Section 4.9). Construction and operation of the Project is not expected to cause direct effects to environmentally sensitive and protected areas because of the distance from the features. Therefore, environmentally sensitive and protected areas will not be carried through the assessment.

5.3 SPATIAL AND TEMPORAL BOUNDARIES

The assessment boundaries define the geographic and temporal scope or limits of the analysis for the determination of significance of effects from the Project and other developments. The boundaries encompass the areas within (spatial boundaries) and time periods (temporal boundaries) that the Project and other developments is expected to interact with VECs.

5.3.1 SPATIAL BOUNDARIES

The selection of the spatial boundaries for the assessment is based on the physical and biological properties of VECs. The spatial boundaries have been defined to be large enough to encompass enough area to complete the evaluation of potential effects that all Project components and infrastructure may have on the environment (e.g., power lines, access roads, WTG pads). Effects from the Project on the environment are typically stronger at a local scale. For example, VECs with limited movement such as vegetation will likely be restricted to local changes from the Project footprint. For VECs that have larger distributions (e.g., a river system) or are mobile (e.g., wildlife), the Project effects have a higher likelihood to combine with effects with other developments or activities at a larger scale.

LOCAL ASSESSMENT AREA

For the purpose of this assessment, a Local Assessment Area is defined. For most of the identified VECs, Project effects will be limited to the Project footprint plus a 1 km buffer. The 1 km buffer is defined to encompass the maximum spatial extent of direct effects from within the Project footprint and small-scale indirect effects. The 1 km buffer is defined because it encompasses the majority of the minimum setback distances from Section 8 of the Allocation of Crown Lands for Wind Power Projects Policy (Section 3.5; NBDNR, 2012).

REGIONAL ASSESSMENT AREA

WTGs need to be spaced hundreds of metres apart to avoid interference between the turbulence wakes of adjacent WTGs resulting in large footprints even from projects with a small number of WTGs. Habitat loss or degradation from WTGs and associated infrastructure can impact all species in a Project area, not only those that are affected by

direct effects (i.e., mortality from collisions with WTGs or other structures) but also indirect effects through the loss of habitat. Construction of associated infrastructure (e.g., access roads, towers, WTG pads) can affect suitable habitat and/or displace species from otherwise suitable habitat near a wind energy project. Therefore, the Regional Assessment Area is defined as the Project footprint plus a 5 km buffer. The Regional Assessment Area is defined so that it encompasses an area large enough so that an analysis of incremental and cumulative effects from the Project and other developments can be completed and is also large enough so that it contains reference areas (i.e., areas not expected to be affected by the Project). In addition, the 5 km buffer that encompasses the maximum setback distance required for Wind Energy Projects on Crown land (Section 3.5; NBDNR, 2012).

5.3.2 TEMPORAL BOUNDARIES

The temporal bounds for this Project is based on the phases of the Project and include construction (2018 to 2019), operation (2019 to 2044), and decommissioning and abandonment (2044 and beyond). For all VECs, residual effects are assessed for all phases of the Project, and not for each specific phase. For example, effects on wildlife begin during the construction phase with the removal of habitat and continue through until a period after the decommissioning and abandonment phase until effects are reversed (i.e., until habitat is reclaimed), unless the effects are determined to be irreversible or permanent.

5.4 POTENTIAL EFFECTS AND MITIGATION

The first step is to identify all potential interactions between the Project and VECs. Identification of potential interactions is then followed by the identification of mitigation that can be incorporated into the Project to avoid or reduce potential effects of the Project on VECs. Mitigation has been developed for the Project according to the following hierarchy outlined in “A Guide to Environmental Impact Assessment in New Brunswick” (Environment and Local Government, 2017):

- Impact avoidance
- Impact reduction
- Impact compensation

Where a potential interaction between the Project and VECs was identified, mitigation is proposed. Where possible, mitigation measures are incorporated into the Project design and implemented to avoid or reduce potential adverse effects. The key mitigation options available for the Project were site selection, choice of construction techniques, and timing of construction activities. The Project siting avoids wetlands, drainages, steep terrain, and unique habitats to the extent practical, and follows existing disturbance corridors where feasible.

Interactions where mitigation can be used to avoid an effect are not considered further in the assessment because the mitigation will remove the interaction and result in no measureable change to a VEC. Interactions where mitigation reduces potential effects, but the changes to a VEC are small, are also not considered further because they are not expected to result in significant effects to a VEC. Where mitigation cannot remove an interaction and residual effects to a VEC are expected, further analysis is required to determine the significance of those Project effects on a VEC (Section 6). For interactions where positive effects are anticipated, opportunities were determined for maximizing the positive effects.

Table 5.4-1 Potential Interaction, Proposed Mitigation, and Predicted Residual Effects

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
Construction of the Project	Terrain and Soils	Construction on unstable lands may increase potential for erosion	<ul style="list-style-type: none"> – All necessary permits and approvals will be obtained and on-site. – The majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities, thereby minimizing the need to disturb new areas – Pre-project geotechnical surveys are being completed to identify locations for avoidance or mitigation. – When feasible, transporting equipment and material will be postponed during adverse weather or wet ground conditions to mitigate rutting, admixing, and compaction. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC
		Changes to soil quality through disturbance to soils (i.e., soil loss, admixing, compaction) from site clearing, excavation, and grading.	<ul style="list-style-type: none"> – Upper soil materials and organic material (containing seed bank and propagules) will be salvaged for replacement during reclamation. – Upper soil materials and organic material will be stripped carefully to a selected depth to reduce admixing. – Stripped soil materials will be stored separate from excavated or graded subsoils to mitigate admixing, loss, and changes to soil quality. – Soil material replacement will be completed when the soil condition is suitable (i.e., dry condition) to be evenly spread over disturbed areas. – During reclamation, if soil compaction has occurred, the areas may be deep ripped to alleviate compacted soils. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC
	Surface Hydrology Wetlands	On-site water withdrawal for pressure washing and dust control during construction	<ul style="list-style-type: none"> – Pre-project surveys will be completed to identify locations for avoidance. – All necessary permits and approvals will be obtained and on-site. – It is anticipated that most of the water will come from water trucks, however if required, an on-site water supply may be used. If an on-site water supply is determined to be required for the Project, a WAWA will be obtained prior to withdrawing any on-site water during Project construction. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to VECs

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
Construction of the Project (continued)	Surface Hydrology Fish and Fish Habitat Wetlands	Disturbance to natural drainage profiles and drainage patterns can cause effects to fish and fish habitat and wetlands	<ul style="list-style-type: none"> – Pre-project surveys will be completed to identify locations for avoidance or mitigation. – All necessary permits and approvals will be obtained and on-site. – To the extent practical, existing surface drainage patterns will be maintained in the Project area. – If alteration is required for the wetland that runs along the existing Crown Land Access road near WTGs 3 and 4, then a WAWA Permit application will be submitted. – Access roads that cross watercourses and wetlands will follow the guidelines from the Watercourse and Wetland Alteration Technical Guidelines and the conditions as listed on the WAWA. – Disturbances to wetland and drainage edges will be minimized to the extent possible. – To the extent practical, construction in wetlands will be scheduled to occur under dry or frozen ground conditions. – Any extra workspace required near drainage edges will be separated from the top of bank by a minimum of 30 m. – Culverts will be installed, as necessary, to maintain drainage – Use temporary diversion berms or other methods, as required, to regulate drainage from construction areas 	No significant residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to VECs

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
	Fish and Fish Habitat	Alteration to fish habitat from increased sediment loading from increases in erosion	<ul style="list-style-type: none"> – All necessary permits and approvals will be obtained and on-site. – The majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities, thereby minimizing the need to disturb new areas. – Prior to construction a Grading Plan, Storm Drainage Plan, and an Erosion and Sedimentation Control Plan will be developed, approved, and implemented for the Project. – The Erosion and Sediment Control Plan will be designed so that landscape features outside of the Project footprint will not be altered. – Salvaged materials and will be stored away from waterbodies and watercourses above the high water mark. – Erosion and sediment control measures including silt fence, straw bale check dams and diversion channels will be installed in accordance with manufactures specifications, as appropriate. – Erosion and sediment control measures shall be inspected and maintained during construction 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC
Construction of the Project (continued)	Wetlands Vegetation Wildlife Species of Conservation Concern Land Use	Alteration to wetlands, vegetation, wildlife habitat, SOCC, and land uses from increased erosion following construction	<ul style="list-style-type: none"> – Remove silt and other accumulated debris from site drainage ditches in order to keep them free-flowing at all times. Dispose of removed sediment as per an Erosion and Sedimentation Control Plan – Erosion and sediment control measures will not be removed until there is unlikely to be further erosion – Dust control methods (i.e., watering roads) will be employed during construction of the Project to limit wind erosion – Weather forecasts shall be regularly monitored for extreme weather conditions during the construction period when exposed soils have not been fully stabilized – A visual inspection of the worksite shall be conducted, during and after each significant rainfall event, for signs of erosion, and implement appropriate mitigation measures if required – Additional sediment control and erosion control materials must be on-site and readily available in the event of a sudden and significant rainfall event or the forecast of such event – Construction activities will be reduced or stopped during heavy precipitation events. Heavy precipitation events are those considered hindering access and clearing activities, causing rutting and compaction of soils and those which may cause a threat of local flooding. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to VECs

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
	Birds	Destruction of migratory bird nests can affect bird populations	<ul style="list-style-type: none"> – Clearing of vegetation will be completed outside of the breeding and nesting season for birds (i.e., April to August) where possible. If vegetation removal is proposed within the nesting season, a pre-construction nesting bird survey and mitigation plan would be required in order to avoid the inadvertent harming, killing, disturbance or destruction of migratory birds, nests and eggs. – If clearing of vegetation cannot be completed outside of the breeding bird window, pre-project surveys will be completed to identify locations for avoidance or mitigation. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC
Construction of the Project (continued)	Wetlands Vegetation Wildlife Species of Conservation Concern	Loss/alteration of vegetation and wildlife habitat from Project construction	<ul style="list-style-type: none"> – Pre-project surveys will be completed to identify sensitive habitat locations for avoidance or mitigation including a spring ephemeral and habitat survey will be completed in May/June 2018. – The majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities, thereby minimizing disturbance to undisturbed areas. – Siting and construction of the Project has been planned to avoid environmentally sensitive areas (e.g., critical wildlife habitat, listed plant species, wetlands, waterbodies, and watercourses, and other identified key habitat areas for bats, other SOCC, or sensitive wildlife species). – Construction will be scheduled to occur during periods of lowest sensitivity to wildlife, birds, bats and SOCC, where practical. – If a plant SOCC is encountered that was not expected, appropriate mitigation will be applied prior to further construction activities. – If a wildlife SOCC is encountered that was not expected, appropriate mitigation will be applied prior to further construction activities. – Disturbed areas not required for Project operation will be revegetated with an approved, weed free mix, as soon as practical following construction. 	No residual effect is anticipated because mitigation reduces potential effects, but the changes to VECs are predicted to be small and are not expected to result in significant effects to VECs

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
	Heritage and Archeological Resources	Destruction or alteration of heritage and/or archaeological sites	<ul style="list-style-type: none"> – A Heritage Resource Impact Assessment (HRIA) was completed for the Project (Appendix E). – None of the areas near the WTGs and the substation location are of high archaeological potential and archaeological monitoring during construction for these areas is not recommended. – New Ireland Road, crosses a number of high potential archaeological areas, therefore archaeological monitoring of ground disturbing activities within 80 m of a current or former watercourse location will be undertaken. – Archaeological monitoring for utility pole installation within 200 m of the location of the Anglican Church and cemetery (BkDf-2) will be undertaken. – If accidental discovery of heritage resources and/or archaeological materials are encountered, ASNBS will be notified and any ASNBS protocols related to accidental discovery will be followed. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC
Construction of the Project (continued)	Fish and Fish Habitat Wetlands Vegetation Wildlife Species of Conservation Concern	Use of explosives can cause changes to wetlands, vegetation, wildlife, SOCC, and land use	<ul style="list-style-type: none"> – If blasting is required for construction, a detailed Blasting Plan will be developed for the Project and will describe the type of explosives used and the method of detonation and follow activity restriction guidelines – The Project will follow industry standard Best Management Practices and applicable federal regulations for use of explosives – Surface blasting will be suspended temporarily if large mammals are observed within the danger zone identified by the blast supervisor – If blasting near fish bearing waterbodies, the approved Blasting Plan will follow Fisheries and Oceans Canada (DFO's) Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters to limit the potential for residual blasting interactions with downstream water quality 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to VECs

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
Construction and Operation of the Project	Noise Wildlife Land Use	Increased noise levels from construction and operation of the Project	<ul style="list-style-type: none"> – The predicted sound pressure for the Project are below the recommended sound criteria for wind turbines for all sensitive receptors within 1 km of the Project for all wind speeds (Appendix D) – The Project will conform to existing municipal, local, and regional by-laws and regulatory requirements – Construction will be scheduled to occur during daytime hours. – Machines will be kept in good working order and comply with applicable provincial and federal requirements – Heavy equipment will be outfitted with mufflers to dampen noise – Work will be conducted in a respectful manner using necessary notifications and communications regarding temporary and intermittent increases in noise during project construction – Construction activities will follow activity restriction guidelines and set-back distances for wildlife 	No residual effect is anticipated because mitigation reduces potential effects, but the changes to VECs are predicted to be small and are not expected to result in significant effects to VECs
	Wildlife Land Use	Sensory effects from the presence of the WTGs, lights, noise, blasting, and vehicles	<ul style="list-style-type: none"> – Construction will be scheduled to occur during daytime hours. – Project personnel will be instructed to keep a clean work area and to not harass animals encountered. – Firearms and dogs are prohibited on the Project. – Drivers instructed to be aware of wildlife and slow speed limits will be enforced on the Project, where appropriate. – Equipment and vehicles will yield the right-of-way to wildlife – Food wastes will be collected in suitable receptacles that limit attraction or impact to wildlife – Littering and feeding of wildlife will be prohibited – Recyclable and waste hazardous materials will be stored on-site in appropriate containers to prevent exposure and shipped off-site to an approved facility 	No residual effect is anticipated because mitigation reduces potential effects, but the changes to VECs are predicted to be small and are not expected to result in significant effects to VECs

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
Construction and Operation of the Project (continued)	Birds and Bats	Construction and operation of the Project may result in migratory birds and bats colliding with WTGs and other Project infrastructure	<ul style="list-style-type: none"> – Spring bird migrations surveys are being completed in April/May 2018 – The majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities, thereby minimizing disturbance to undisturbed areas. – Siting and construction of the Project has been planned to avoid environmentally sensitive areas (e.g., critical wildlife habitat, listed plant species, wetlands, waterbodies, and watercourses, and other identified key habitat areas for bats) – Clearing of vegetation will be completed outside of the breeding and nesting season for birds (i.e., April to August) and outside the calving and rearing period for bats (i.e., May to August) where possible. – Powerlines will avoid travelling over top of any high use habitat areas, such as wetlands and waterbodies, as much as practical. If these areas are unavoidable and risk of collisions is identified as high, collision mitigation (e.g., bird diverters) will be installed at and along these areas. – Because fog hinders the ability of birds to avoid collisions with obstacles, WTGs may cease operating under foggy conditions during periods of bird and bat migration throughout the Project area. – Prior to the dismantling of a building or other installation, an inspection will be completed to determine use as a maternity or a roosting site by bats. If necessary, protective measures will be taken to avoid disruption to the survival of bats. – A Post-construction Monitoring program for birds and bats will be implemented (Section 8). If the Project is found to be causing significant mortality during post-construction monitoring, additional mitigation will be evaluated. – If follow-up surveys indicate significant effects to birds and bats, additional mitigations may be required and may include the following <ul style="list-style-type: none"> – Application of emerging bat aversion technologies or other innovative measures – Selective shutdown of WTGs during periods of high bat activity/concentrations (e.g., swarming, late summer/fall migration) or under certain weather conditions (e.g., during periods of low wind when power generation is low and bat activity levels are high) – Selective shutdown of WTGs during periods of key times of year for bird activity or migration. – Changes to lighting on WTGs 	Potential residual effects are anticipated

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Construction and Operation of the Project (continued)	Birds and Bats	Construction and operation of the Project may cause birds to alter their migration flyways	<ul style="list-style-type: none"> – Construction will be scheduled to occur during daytime hours. – Spring bird migrations surveys are being completed in April/May 2018 – Where possible, placement of Project infrastructure in habitats significant to bird species will be avoided. These include wetlands, mature forests, and areas with large, hollow trees. – A Post-construction Monitoring program for birds and bats will be implemented (Section 8). If the Project is found to be causing significant mortality during post-construction monitoring, additional mitigation will be evaluated. 	Potential residual effects are anticipated
		Construction and operation of the Project may displace birds and bats from previously used habitats in the Project area		Potential residual effects are anticipated
	Visual Aesthetics	Construction and operation of the Project can cause changes to the visual landscape	<ul style="list-style-type: none"> – A Visual Impact Assessment was completed for the Project which includes a photomontage and a calculation of the Zone of Visual Influence is included in Appendix H. – The visibility analysis results in what can be considered a “worst case” viewshed area. – Several factors will limit the visibility of WTGs, including: obstructions (e.g., trees, buildings), atmospheric, weather and lighting conditions (e.g., clouds, low contrast lighting, haze), and relative size of the WTG at the viewing distance (e.g., WTGs farther away are smaller and harder to see or recognize) 	No residual effect is anticipated
Operation of the Project	Electromagnetic Interference	WTG operation may interfere with telecommunication and/or radar communication infrastructure	<ul style="list-style-type: none"> – An Electromagnetic Interference Study was completed for the Project in accordance with the Radio Advisory Board of Canada and the Canadian Wind Energy Association guidelines and is included in Appendix J. The results of the study indicated that the Project is not expected to interfere with any communication systems. – Consultation with Navigation Canada, Environment Canada Weather Radar, RCMP, and Transport Canada has been complete for the Project and approvals/clearances for the Project are included in Appendix A. – Other telecommunication and/or radar could be affected by the Project, therefore if other agencies are identified, they will be contacted to address any interference concerns as required. 	No residual effect is anticipated
	Shadow Flicker Land Use	Operation of the Project may cause nuisances from shadow flicker in the Project area	<ul style="list-style-type: none"> – A Shadow Flicker Assessment was completed for the Project is included in Appendix I. – The existing forest is considered mitigation for shadow flicker. – The Project is in a rural area where residences will not be affected. – If shadow flicker affects receptors, additional mitigations such as planting trees may be considered. 	No residual effect is anticipated

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
Operation of the Project (continued)	Birds, Bats and Other Wildlife Visual Aesthetics Land Use	Lighting on WTGs may be visible during night time hours	<ul style="list-style-type: none"> – Use of lighting during construction and on WTG hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada. – Lighting will be designed to limit off-site light disturbances 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC
Human Resources	Local Economy	Employment and business opportunities	<ul style="list-style-type: none"> – Local communities will benefit greatly from the development, construction, and operation of the Project as outlined in SWEB's Social and Economic Benefit Plan (Section 3.3.2). – Local and regional business communities and labour organizations will be informed of the opportunities arising from the construction, operation and maintenance of the Project. 	A positive residual effects is anticipated
	Land Use	Construction and operation of the Project can have effects on traditional land use	<ul style="list-style-type: none"> – Early and meaningful engagement with First Nations communities and all potential stakeholders was completed for the Project and will continue during the Project. – A preliminary traditional Indigenous Knowledge study was conducted for the Project (Appendix B). It was determined that no cultural heritage resources and no culturally significant plant/vegetation were identified during the study. – Based on previous historical knowledge, it is highly likely that no settlements would be in the area. However, there is still the possibility of discovery in regards to settlement or land use. – If discovery in regards to settlement or land use occurs during the Project, activities will cease in the immediate area and the appropriate regulatory agencies will be contacted, as appropriate. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
Human Resources (continued)	Land Use	Construction and operation of the Project can cause disruptions to current land use.	<ul style="list-style-type: none"> – Traffic flow provincial highways or forestry access roads may periodically be affected by construction activities. – Appropriate signage will be erected and traffic directing personnel will be used where required – Good housekeeping practices will be employed and maintained through the duration of the Project activities. – All litter, garbage, and other debris generated by the Project will be collected and transported to approved disposal locations or facilities. – Disturbed areas will be recontoured and reclaimed to a stable profile to permit existing land uses. – A traffic management program will be developed for the Project and will include a detailed schedule, detailing the volume, timing and density of construction traffic – Project activities will follow applicable local and provincial traffic regulations – Road cones may be placed at designated areas and warning signs posted in roadways as required – Heavy goods vehicles will not arrive or leave the Project except between agreed hours. – During construction, the approved traffic route will be kept free of mud and debris resulting from construction and operation of the Project. – A wheel wash system will be provided on the internal access road to remove debris from vehicles before they leave site. – Debris found on the local roads will be removed regularly using road brushes and vacuum road sweepers. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC

PROJECT ACTIVITY	VALUED ENVIRONMENTAL COMPONENT(S)	POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT	PROPOSED MITIGATION	PREDICTED RESIDUAL EFFECT
Accidents and Unplanned Events	Fish and Fish Habitat Wetlands Terrestrial Vegetation Wildlife including Birds and Bats Species of Conservation Concern Land Use	Contamination from spills and wastes from materials such a fuels and hydraulic fluids	<ul style="list-style-type: none"> – A Fuel and/or Hazardous Materials Spills Contingency Plan will be developed – Dangerous goods will be stored, handled, and transported according to the NB <i>Clean Environment Act</i> and the <i>Transportation of Dangerous Goods Act</i> – Appropriately sized spill kits will be available on-site for clean-up efforts – All work-site activities will be conducted in a manner that minimizes the potential for spills or leaks, including the regular inspection and maintenance of machinery and equipment, and providing spill containment structures for onsite fuel and oil storage, if applicable – No fueling and servicing of equipment will be completed within 50 m of any watercourse or wetland – In case of a spill, the Fuel and/or Hazardous Materials Spills Contingency Plan will be followed. 	No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to VECs

The majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities, thereby minimizing the need to disturb new areas. In areas of new disturbance, upper soil materials and organic matter will be salvaged and stored separately from subsoil materials for later use during reclamation. Pre-project geotechnical surveys are being completed to identify locations for avoidance or mitigation and appropriate mitigation measures will be used where necessary. Disturbed areas will be recontoured to a stable profile after construction is completed so that the land use is returned to its original state. Any disturbed or altered road or man-made drainage ditches will be recontoured to maintain existing drainage conditions and to avoid surface water pooling. As such, no residual effects to terrain and soils or surface hydrology from the Project are anticipated.

For areas disturbed by the Project, propagules contained in the salvaged soil materials are expected to assist in the re-establishment of vegetation cover through natural regeneration and recovery. Areas not required for operations will be recontoured to a stable profile and soil materials replaced. Site stabilization will be completed as soon as possible after construction. Banks at water crossing locations will be immediately recontoured, stabilized, and revegetated following road upgrade work as required. Erosion control measures will be left in place until revegetation of disturbed areas is achieved. No residual effects to fish and fish habitat, wetlands or vegetation from soil erosion are expected.

The Project is not anticipated to increase habitat fragmentation in a landscape already crossed by many roads and trails and modified by forestry activities. Prior to construction of the Project, surveys will be completed to identify listed plant and wildlife species, and nesting sites that may be present in areas to be disturbed. Surveys will be completed to determine if SOCC or other sensitive wildlife are in direct conflict with the Project or to identify those species that may not have been documented during previous surveys. Migratory species, including wildlife SOCC, may return and nest in or occupy new areas each year. Therefore, additional surveys prior to construction will reduce the uncertainty surrounding the presence of SOCC, and help to identify possible mitigation for constructing in areas that have high potential to support these species. As a result, residual effects to plant and wildlife SOCC (including bats) and other sensitive species are not expected.

Most of the potentially present bat species are arboreal (Tremblay and Jutras, 2010). Hoary bat prefers arboreal roosting habitats, while *Myotis* spp. and tri-colored bat use both buildings and trees (Tremblay and Jutras, 2010; ECCC, 2015). The big brown bat typically prefers buildings or rock structures but also uses mature trees with cavities (peak holes, cracks, etc.) (McAlpine et al., 2002; Willis et al., 2006; Tremblay and Jutras, 2010). Many bat species preferentially roost in older forest stands, compared to young forests (Barclay and Brigham, 1996). In addition, wetlands and waterbodies are key foraging areas for bats, because they usually support large amounts of prey (Grindal et al., 1999; Taylor, 2006). Vegetation clearing from Project construction may affect bats (Arnett et al., 2007). However, the majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities, thereby minimizing the need to disturb new areas. Siting and construction of the Project has been planned to avoid environmentally sensitive areas (e.g., wetlands, waterbodies, and watercourses, and other identified key habitat areas for bats). As a result, residual effects to bats from the loss and alteration of vegetation from Project construction is not expected.

Vegetation removal resulting from construction of the Project has the potential to affect local birds (Arnett et al. 2007). However, the majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities, thereby minimizing the need to disturb new areas and effects to birds are generally limited to the construction footprint (e.g., WTG pads, roads, associated buildings; Kuvlesky et al. 2007). Siting and construction of the Project has been planned to avoid environmentally sensitive areas that could provide specific habitats for particular bird species. As a result, residual effects to birds from the loss and alteration of vegetation from Project construction is not expected.

It is expected that potential noise effects would occur during the Project. Noise will be generated during the Project and is likely to be audible at times. There are no residences in close proximity to the Project, therefore it is not expected that changes in noise will result in residual effects to local residences. Changes in ambient noise levels also have the potential to affect wildlife in the Project area. Wildlife survival and reproduction can negatively be affected by increased noise levels during construction because animals may avoid or move more quickly through areas with human disturbance (Bayne et al. 2008). A number of mitigations can be used to control noise generated by the Project. The Project is located in a landscape that is currently traversed by many roads and trails and used for forestry operations. As such, wildlife in proximity to the Project are possibly habituated to the presence of humans and human activity on the landscape. Therefore, no residual effects to wildlife from noise is anticipated.

5.4.1 SUMMARY OF RESIDUAL EFFECTS

The following interactions are predicted to result in residual effects to VECs because mitigation cannot remove the Project-VEC interaction. Therefore, further analysis is required to determine the significance of these Project effects and is presented Section 6.

- Construction and operation of the Project may result in birds and bats colliding with WTGs
- Construction and operation of the Project may cause birds to alter their migration flyways
- Construction and operation of the Project may displace birds and bats from previously used habitats in the Project area
- Employment and business opportunities

5.5 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Several environmental factors could have adverse effects on the Project. This section examines the interactions between the surrounding environment and the main environmental conditions that can affect the Project. Mitigation, contingency plans, and Project design can reduce risks to the Project.

5.5.1 SEVERE WEATHER AND CLIMATE CHANGE

Severe weather events include extreme winds, extreme rainfall and flooding, extreme snowfall, ice storms, and lightning. In general, NB can experience anywhere between 10 to 20 days of severe weather events with the more severe events occur during the winter months. Winter storm events can result in strong winds with rain, freezing rain, and extreme snowfall. Severe weather in summer months can also result in strong winds, but also extreme rainfall and flooding, hail, and lightning. Effects of the environment on the Project would result in a short term delay in construction schedule, frequent short-term disruptions in service, and increased operating or maintenance costs. An environmental management plan will be developed to ensure mitigation measures are in place to ensure the protection of the environment and minimize delays. Contingency plans will be included in case of extreme weather events.

EXTREME WIND

WTGs are equipped with a high wind operation control feature. This feature allows the WTG to operate up to the extended cut-out wind species (27.5 m/s or 99.0 km/hr). In extreme wind conditions, the Project's WTG monitoring system will automatically ensure the WTG blades are feathered (i.e., pitched) such that the blade surface is no longer positioned to capture incoming wind. This change of pitch ensures the extreme winds cannot cause the rotor to rotate.

EXTREME RAINFALL AND FLOODING

Extreme rainfall of 179.1 mm was recorded at Alma in April 1962 and extreme rainfall of 131.8 mm recorded at Moncton in April 1962 (Government of Canada 2018). Heavy rain can result in stoppages of outdoor work, particularly during construction. If unusual wet periods or excessive rain do occur, this can result in Project delays and an associated delay in completion and additional cost. Heavy rainfall events may also cause erosion on-site. A potential exists for failure of erosion and sediment control structures due to extreme precipitation events. Such a failure could result in the release of a large quantity of sediment-laden runoff to receiving wetlands, waterbodies, or watercourses with potential adverse environmental effects on fish and fish habitat. Local flooding may occur at work sites during extreme precipitation events. Construction may temporarily be halted in the event of extreme rainfall and flooding. Appropriate erosion control measures will be used during the Project especially in areas where erosion potentials are high and are adjacent to sensitive habitats.

EXTREME SNOWFALL

Extreme snowfall of 54 cm was recorded in Alma in February 1988 and extreme snowfall of 83 cm was recorded at Moncton in February 1992. Severe snowfall can affect winter construction or contribute to unusual flooding during snowmelt. Exceptional snowfall in early fall or late spring could delay construction and result in additional work for snow clearing and removal and could increase Project costs. Early snow cover can minimize or prevent ground freezing and this may also affect winter construction intended at improving work progress and accessibility. Freezing rain, hail, ice and snow can interfere with the operation of vehicles on the highway, as it can cause hazardous driving conditions and limit visibility. Construction may temporarily be halted in the event of extreme snowfall events. Workers will follow project specific and relevant safe work practices as necessary.

ICE STORMS AND TURBINE ICING

Atmospheric data collected on-site has indicated that on average, there are 13 days of icing at the MET tower. Instances of icing at a MET tower do not imply that the WTGs will experience icing at the same frequency, but it can be expected that icing conditions can be expected at or near this frequency, particularly in the winter months. WTGs will be equipped with an anti-icing system. The ice-detection system is designed to shut down the WTGs in the case of ice build-up. When ice is detected on the blades, the WTG rotor is halted at a point where one of the three blades is pointing downward, perpendicular to the ground; the blade is then heated until the ice no longer remains. The rotor is then rotated until the next blade is in this downward position and the process is repeated until all icing has been removed.

LIGHTNING

WTGs are equipped with a lightning protection system that will help protect the WTG against physical damage cause by lightning strikes. The lightning protection system consists of the following:

- Lightning receptors - All lightning receptor surfaces on the blades are unpainted, excluding the Solid Metal Tips
- Down conducting system - a system to conduct the lightning current down through the WTG to help avoid or minimise damage to the lightning protection system itself or other parts of the WTG.
- Protection against overvoltage and overcurrent.
- Shielding against magnetic and electrical fields.
- Earthing system.

CLIMATE CHANGE

Climate change can affect the Project by increasing the frequency and intensity of extreme weather events. Changes to the frequency and intensity of extreme weather events are difficult to predict. Although many climate models have been developed to estimate changes to climate, the local changes to the magnitude and frequency of extreme weather events are unknown. Therefore, appropriate conservatism will be incorporated into the Project design to address these changes.