WISOKOLAMSON ENERGY LP

WISOKOLAMSON ENERGY PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT

April 16, 2018

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ENVIRONMENTAL IMPACT ASSESSMENT

WISOKOLAMSON ENERGY LP

FINAL

PROJECT NO.: 161-08790-00
DATE: APRIL 16, 2018

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WSP Canada Inc.

April 16, 2018

New Brunswick Department of Environment and Local Government, Environmental Assessment (Section)
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To Whom it May Concern,

Wisokolamson Energy LP is proposing the development of the Wisokolamson Energy Project. The proposed Project is located on Crown land south of New Ireland Road, in Albert County, New Brunswick, and will have an aggregate electrical capacity of 18 megawatts. In addition, the Project's electrical substation will be located on a private parcel adjacent to a section of New Brunswick Power's 69 kilovolt circuit which ends at the Albert substation, south of Riverside-Albert. The Project will consist of five (5) wind turbine generators, access roads, collector system, substation, and associated temporary laydown areas required for construction. Construction of the Project is scheduled to begin in 2018, with wind turbine generator delivery and commissioning commencing in June 2019.

This Project is considered to be an "Undertaking" as defined in Schedule A of *Environmental Impact Assessment Regulation 87-83*, as described by item (b) of Schedule "A" ("all electric power generating facilities with a production rating of three megawatts or more").

The following report is an Environmental Impact Assessment to determine if the Project will cause significant negative effects to biophysical and human components that may be influenced by the Project. Based on the results of this assessment, WSP is of the opinion that, with the use of the mitigation measures described in this report, there will be no significant residual effects to the environment. In addition, it is believed that the Project will have a positive effect on employment and business opportunities in the region and the Province of New Brunswick.

Yours sincerely,

Christina LaFlamme, M.Sc, EP
Project Manager| Environment (NB)

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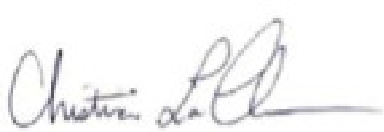

Christina LaFlamme, M.Sc., EP
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This report was prepared by WSP Canada Inc. for the account of WISOKOLAMSON ENERGY LP, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSPs's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

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EXECUTIVE SUMMARY

Wisokolamson Energy LP (WISK) is proposing the development of the Wisokolamson Energy Project (Project). WISK is a limited partnership between SWEB Development LP and Woodstock First Nation (WFN). The Project is located on Crown land south of New Ireland Road, in Albert County, New Brunswick, and will have an aggregate electrical capacity of 18 megawatts (MW). This Project is considered to be an "Undertaking" as defined in Schedule A of *Environmental Impact Assessment Regulation 87-83*. Schedule A of the Regulation identifies the types of undertakings that must be submitted for registration. Because the Project is an electric power generating facility with a production rating of 3 MW or more it is an Undertaking for the purposes of the Regulation and must be registered with the Sustainable Development, Planning and Impact Evaluation Branch, Department of Environment and Local Government

The Project will consist of five (5) Wind Turbine Generators (WTG), access roads, collector system, substation, and associated temporary laydown areas required for construction. The Project is expected to consist of Vestas V126 wind turbines with a nominal power of 3.6 MW. Each assembly will consist of the tower, hub, nacelle, rotor blades, andcontroller, with a total height of 180 metres (m). The total WTG rotor diameter will be 126 m. It is anticipated that each WTG 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. The proposed substation location is near New Ireland Road and Highway 114. The substation area will be approximately 40 m x by 40 m.

The proposed schedule for the Project is dependent on receiving all necessary approvals. It is expected that site preparation and construction will being in late summer/early fall of 2018, and take approximately 14 to 16 months to complete. Construction will be scheduled to occur during daytime hours. It is expected the Project will be in operation by late 2019. The anticipated life of the Project is estimated to be 25 years, which is consistent with the WTG life expectancy.

WISK has and will continue to engage First Nations communities in proximity to the Project site throughout its development, construction, and operation to ensure that all questions and concerns are addressed in an appropriate fashion. In addition, WISK intends to include First Nation community members with applicable traditional knowledge to assist the Partners during the EIA process, Project development and construction.

To date, WISK has commenced engagement with a number of stakeholders. Throughout the Project's life, WISK will continue to engage community members regarding Project construction information and safety measures, as well as educational sessions that familiarize community members with the operation of a wind energy project. In addition, WISK will engage the appropriate local authorities and agencies regarding construction timing and important road use information to ensure the Project's construction and operation meet the highest safety standards.

WISK has and will continue to hold focused meetings with government representatives and key stakeholders to ensure that they are kept apprised of all Project-specific information and planning. WISK has been proactive by engaging NB members of parliament, members of the legislative assembly, and other government officials to inform them of the potential development in the Fundy region. In addition, consultation with federal agencies including Navigation Canada (NAV Canada), Transport Canada, the Royal Canadian Mounted Police (RCMP), Environment Canada Radar, Canadian Coast Guard (CCG), and the Department of National Defence (DND) has also been completed.

The majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities and has been sited to avoid environmentally sensitive areas. Fifteen (15) vascular plant Species of Conservation Concern (SOCC) have been historically and recently observed within 5 km of the Project; the majority of which have been documented in Shepody National Wildlife Area. No records of nonvascular plant SOCC have been documented within 5 km. A total of 60 wildlife SOCC have been previously detected within 5 km of the Project. Of these, 4 are mammals, 50 are birds, and 5 are invertebrates. Although many SOCC ranked by the Atlantic Canada Conservation Data Centre (ACCDC) are considered rare in New Brunswick (NB), those protected or designated by federal and provincial legislation are of particular concern. These included six (6) mammals (which include three (3) bat species), fourteen (14) bird species, and one (1) invertebrate. Of these, fourteen (14) are listed under the federal

Species at Risk Act (SARA), fourteen (14) are listed under New Brunswick Species at Risk Act (NB SARA), and fifteen (15) designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Five (5) bird SOCC were observed during the field surveys. These included pine siskin (*Carduelis pinus*), turkey vulture (*Cathartes aura*), common nighthawk (*Chordeiles minor*), eastern wood-pewee (*Contopus virens*), and evening grosbeak (*Coccothraustes vespertinus*).

There are three (3) managed areas within 5 km of the Project and include the Caledonia Gorge Protected Natural Area, Shepody National Wildlife Area, and Fundy National Park. A biologically significant site area is within 5 km of the Project, Shepody Bay West Important Birding Areas (IBA). There are no IBA or RAMSAR sites (wetlands of international importance) within the Project footprint. There is a Deer Wintering Area 3.8 km of the southern-most WTG. There are no Provincial Parks, operational quarries and mine sites, economically viable peatlands, Old Forest Communities and Habitats, Eastern Habitat Joint Venture sites, International Shorebird Reserves, or conservation areas managed by Ducks Unlimited within 5 km of the Project.

A review of Project activities, applicable legislation, and previous assessment experience identified Valued Environmental Components (VECs) because of 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

The majority of Project-VEC interactions were determined to not result in residual effects. The Project can incorporate mitigation to remove or reduce potential effects and therefore are not expected to result in significant effects to VECs. The following interactions are predicted to result in residual effects to VECs because mitigation cannot remove the Project-VEC interaction. Therefore, further analysis was completed to determine the significance of these Project effects.

- 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

The collision of birds with WTGs and other Project infrastructure and displacement of birds from the Project was determined to be moderate in magnitude because it is unknown what the effects would be at the population level. The Project consists of 5 WTGs in an area that appears to have highly variable distribution of birds based on habitat availability. Similar observations were recorded at the Kent Hills wind farm about 5 km north of the Project. The incremental effects from the Project are predicted to be local in geographic extent and the effects are expected to be reversible following decommissioning and reclamation (long-term). The incremental contribution of the Project to existing conditions is not likely to decrease the resilience and increase the risk to local or sub-regional bird populations in the area. Therefore, the Project was given an overall significance rating of medium and is predicted to not have significant adverse effects on birds. Confidence in this prediction is moderate because of limited knowledge about the resilience of bird populations in the area. To test the prediction of significance presented in this EIA and to reduce uncertainty, a Post-construction Monitoring program will be implemented. If the Project is found to be causing significant mortality during post-construction monitoring, additional mitigation will be evaluated.

The collision of bats with WTGs and other Project infrastructure and displacement of bats was determined to be moderate in magnitude because it is unknown what the effects would be at the population level given the other pressures on bat populations (i.e., white-nose syndrome). The Project consists of 5 WTGs in an area that appears to have relatively low bat activity (i.e., approximately 0.15 calls per night) when compared to other areas with 1.4 calls per night. Similar observations of low bat activity were recorded at the Kent Hills wind farm about 5 km north of the

Project. The incremental effects from the Project are predicted to be local in geographic extent and the effects are expected to be reversible following decommissioning and reclamation (long-term). The incremental contribution of the Project to existing conditions is not likely to decrease the resilience and increase the risk to remaining local or sub-regional bat populations in the area. Therefore, the Project was given an overall significance rating of medium and is predicted to not have significant adverse effects on bats. Confidence in this prediction is moderate because of limited knowledge about the resilience of the remaining bat populations in the area. To test the prediction of significance presented in this EIA and to reduce uncertainty, a Post-construction Monitoring program will be implemented. If the Project is found to be causing significant mortality during post-construction monitoring, additional mitigation will be evaluated.

The Project will have a significant positive residual effect on the social environment in relation to employment and business opportunities. Project construction and operations will create jobs and generate income, although much of the construction workforce may not be hired locally, which will reduce the benefits of job creation and income during Project construction. The Project will result in increased training and experience in the labour force, which will affect future opportunities. Project spending will result in increased gross domestic product and Project operations will generate tax revenue for municipal, provincial, and federal governments. WISK will attempt to source as much of the labour and materials locally when possible.

The Project will implement mitigation practices to limit incremental environmental effects from the Project that will occur. Implementation of the mitigation practices is expected to result in minor changes to the biophysical and socio-economic environments from the Project relative to baseline conditions. The Project is located in an area that contains a large amount of forestry activity that will likely continue for the duration of the Project. Effects on VECs from the Kent Hills wind farm are not expected to overlap with effects on VECs in the local area. As such, no cumulative residual environmental effects are expected. As the Project progresses where necessary, SWEB will develop site-specific mitigation to further reduce the potential for cumulative environmental effects as required.

Effects of the environment on the Project was also reviewed. Severe weather and climate change were the two environmental effects that could potentially effect the Project. Mitigation, contingency plans, and Project design can reduce risks of environmental conditions to the Project.

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1 INTRODUCTION

Wisokolamson Energy LP (WISK) is proposing the development of the Wisokolamson Energy Project (Project). WISK is a limited partnership between SWEB Development LP and Woodstock First Nation (WFN). WFN will have a 51% interest in the Project and SWEB Development LP will have a 49% interest. The WFN will be responsible for supporting the development, construction, and operation of the Project as well as continuing to be involved in all First Nations engagement and stakeholder consultation.

SWEB Development (SWEB) is a team of renewable energy professionals who are passionate about community, the environment, and shared social values. SWEB is the North American subsidiary of W.E.B. Group, an Austrian, community-owned renewable energy development company. W.E.B operates wind energy, photovoltaic, and small-scale hydroelectric power plants throughout Europe and North America. SWEB has over 500 megawatt (MW) in development throughout North America. Given SWEB's experience in the renewable energy sector, it will lead and manage all development, construction, and operation activities associated with the Project.

1.1 THE PROPONENT

1.1.1 NAME AND ADDRESS OF PROPONENT

The proponent is as follows:

Wisokolamson Energy LP (WISK)
44 Chipman Hill Suite 1000
Saint John, New Brunswick (NB), E2L 2A9

1.1.2 PRINCIPAL PROPONENT CONTACT

The principal proponent contact for the Project is as follows:

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1.1.3 ENVIRONMENTAL ASSESSMENT CONTACT

The consultant contact for the Project is as follows:

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1.1.4 PROPERTY OWNERSHIP

The Project will be located on Crown Land. The acknowledgement of the application from the New Brunswick Department of Energy and Resource Development (NBDERD) and confirmation from NBDERD that the subject

Crown Lands can be made available for Project development is provided in Appendix A. The Option Agreement is also included in Appendix A. In addition, the Project's electrical substation will be located on a private parcel adjacent to a section of NB Power's 69 kilovolt (kV) circuit which ends at the Albert substation, south of Riverside-Albert, NB.

1.2 REGULATORY FRAMEWORK

There are a number of federal and provincial regulations and local municipal by-laws, that renewable energy developers should be aware of for the planning and execution of their projects. This section is intended to describe the regulatory framework within which the Environmental Impact Assessment (EIA) for the Project will be completed.

1.2.1 FEDERAL

The federal Environmental Assessment process and requirements are outlined in the *Canadian Environmental Assessment Act* (CEAA). The federal process is triggered if the project is a "designated project" as defined by the Regulations Designating Physical Activities. Based on the current understanding of the Project, the federal process will not be triggered because this type of project is not listed in the Regulations Designating Physical Activities.

Other federal legislation, such as the *Fisheries Act*, *Species at Risk Act* (SARA), and *Migratory Bird Conventions Act* may apply to the Project. Federal agencies such as Transport Canada, Environment Canada, Canadian Coast Guard (CCG), and the Department of National Defense (DND) were consulted during the early stages of planning.

1.2.2 PROVINCIAL

The NB EIA process involves three primary steps; a registration document, a Determination Review, and a Comprehensive Review that requires the submission of an EIA Report.

The first step in the EIA process is to determine whether a project is likely to be an "Undertaking" as defined in Schedule A of *Environmental Impact Assessment Regulation 87-83*. Schedule A of the Regulation identifies the types of undertakings that must be submitted for registration. Because the Project is an electric power generating facility with a production rating of 3 MW or more it is an Undertaking for the purposes of the Regulation and must be registered with the Sustainable Development, Planning and Impact Evaluation Branch, Department of Environment and Local Government.

Section 5 (2) of the Regulation requires that proponents deliver a completed registration document to the Minister. It is understood that final engineering details of a project will typically not be available at the time of project registration, however, full and accurate descriptions of the project location, proposed activities, the existing environment, potential impacts, and proposed mitigation are required. This can partially be completed for the Project using a high level desktop review of potential environmental and socio-economic effects for the Project location. It is recommended that the registration document be submitted early in the planning process so that the ability to modify the project to address government and stakeholder concerns is maintained.

Once the Project is registered, it must undergo a Determination Review. The Determination Review is used to identify and evaluate the environmental issues surrounding the proposed Project. The review is coordinated by the Sustainable Development, Planning and Impact Evaluation Branch of the Department of Environment and Local Government. A specially constituted Technical Review Committee comprised of experts and specialists from federal agencies, various departments of the NB Government and the rural district planning commission or municipality having jurisdiction over the project location will assist in the review. The purpose of this Review is to determine whether or not a Comprehensive Review is required.

If the Minister decides that a Comprehensive Review is required, the following would be required prior to proceeding with the Undertaking.

— Review Committee formulates draft guidelines for the Comprehensive Review

— Completion of an EIA study and the preparation of a report describing the results
— Technical Review Committee completes detailed examination of the draft EIA Report
— Public Review and Comment on the EIA Report
— Ministry issues or denies an approval for the Undertaking

It is important to note that if the Minister determines that a Comprehensive Review is not required, all relevant environmental regulations such as the *Clean Environment Act*, *Clean Air Act*, or any other relevant provincial or federal legislation must be complied with, and all required permits and approvals must be obtained. In addition, the Minister may attach conditions to the Project, aimed at addressing or mitigating concerns raised during the Determination Review. The Lieutenant-Governor in Council may suspend or revoke an approval if the proponent violates the terms and conditions imposed for the Project.

1.2.3 MUNICIPAL

It is not expected any municipal by-laws and policies apply to this Project.

1.2.4 APPROVALS AND PERMITTING

Like any project in NB, provincial, and federal approvals and permits are required before the Project can proceed. Permitting occurs after ministerial determination or approval of the EIA report. Permitting can include submission of applications to obtain specific construction and operating approvals. All supporting infrastructure will likely require specific permits for construction (e.g., temporary and permanent roads and the collector system may require a provincial permit such as a Watercourse and Wetland Alteration [WAWA] permit and federal review if crossing fish bearing watercourses).

Table 1.2-1 presents the Acts, Regulations, permits, and approvals are expected to apply to the Project. Many of these requirements are site specific and are dependent upon existing environmental and socio-economic conditions in the proposed Project area and existing infrastructure.

Table 1.2-1 Federal and Provincial Acts, Regulations, Permits, and Approvals That May be Required for the Project

ACTS	RELATED REGULATIONS	APPROVALS OR PERMITS REQUIRED
Federal		
Canadian Environmental Protection Act	No specific regulations related to this *Act*	Release of toxic substances, Air pollutants, Water pollutants
Fisheries Act	Applications for Authorization under Paragraph 35(2)(b) of the Fisheries Act Regulations	It is anticipated that no in water work will be required. If any destruction to fish or fish habitat will occur as a result of the Project, Authorization For Work that May Result in Serious Harm to Fish is required
Species At Risk Act	No specific regulations related to this Act	No specific permit required. Adhere to species specific activity restrictions and recovery initiatives
Migratory Bird Conventions Act	Migratory Birds Regulations	No specific permit required. Notification only
Aeronautics Act	Canadian Aviation Regulations	No specific permit, but must comply with lighting and marking requirements specified by Transport Canada
National Energy Board Act	National Energy Board Export and Import Reporting Regulations National Energy Board Electricity Regulations	Licence or permit for the exportation of electricity

ACTS	RELATED REGULATIONS	APPROVALS OR PERMITS REQUIRED
Provincial		
Clean Environment Act	Environmental Impact Assessment Regulation	Registration with the Sustainable Development, Planning and Impact Evaluation Branch, Department of Environment Authority of permission to discharge contaminant into waters during construction (i.e., site run-off)
Clean Environment Act	Water Quality Regulation	Permit for a WAWA if within 30 metres (m) of a watercourse or wetland
Protected Natural Areas Act	No specific regulations related to this *Act*	Permits for Activity in Protected Natural Areas
Electricity Act	Electricity from Renewable Resources Regulation	Approval for construction of a new energy generation facility
Crown Lands and Forests Act	No specific regulations related to this *Act*	A Wind Farm Lease and Licence of Occupation for Access and Distribution authorizing the construction and operation of a wind farm is required from NBDERD.
Occupational Health and Safety Act	Occupational Health and Safety Regulations	No specific permit required
Community Planning Act	Provincial Building Regulation	Building permits for construction and operation of the Project
Species at Risk Act	No specific regulations related to this *Act*	Notification to NBDERD, authorization may be required for clearing and site preparation
Heritage Conservation Act	General Regulation - Heritage Conservation Act	Site alteration permit and Heritage Impact Assessment
Electrical Installation and Inspection Act	Electrical Installation and Inspection Regulations	Approval for electrical installation
Motor Vehicle Act	Vehicle Dimensions and Mass Regulation	Permits for moving large structures on provincial highways
Highway Act	Highway Usage Regulation	Application for public property easements for installation of utilities along public highways
Topsoil Preservation Act	General Regulation - Topsoil Preservation Act (N.B. Reg. 95-66)	Permit required for removal of topsoil from a site
Transportation of Primary Forest Products Act	No specific regulations related to this *Act*	Compliance with specified documentation requirements for the transportation of primary forest products within NB
Transportation of Dangerous Goods Act	No specific regulations related to this *Act*	Permit required for the transportation of dangerous goods
Clean Environment Act	Petroleum Product Storage and Handling Regulation	Permit required for the storage of two thousand litres or more of petroleum products onsite

Federal agencies including Navigation Canada (NAV Canada), Transport Canada, CCG, Environment Canada, DND, and Royal Canadian Mounted Police (RCMP) have been consulted for the Project and correspondence is included in Appendix A. No concerns related to the Project were identified.

1.3 DOCUMENT STRUCTURE

The scope of this report includes a Project and the proposed construction and reclamation activities. The intent of this report is to support SWEB's registration to provincial agencies. A summary of the content of this report is as follows:

- Section 1 – Introduction;
- Section 2 – First Nations and Public Involvement
- Section 3 – Project Description
- Section 4 – Description of the Existing Environment
- Section 5 – Identification of Environmental Effects and Mitigation
- Section 6 – Residual Environmental Effects and Determination of Significance
- Section 6.3 – Summary of Proposed Mitigation
- Section 8 – Follow-up Monitoring
- Section 9 - References
- Appendix A – Clearances And Approvals
- Appendix B – Preliminary Indigenous Knowledge Study
- Appendix C – Letter of Support
- Appendix D – Noise Impact Assessment
- Appendix E – Bird Inventory Report
- Appendix F – Bat Inventory Report
- Appendix G – Archaeology Report
- Appendix H – Visual Impact Assessment
- Appendix I – Shadow Flicker Assessment
- Appendix J – Electromagnetic Interference Study

2 FIRST NATIONS AND PUBLIC INVOLVEMENT

The NB EIA process requires First Nations and public engagement as outlined in Section 6 of the Guide to Environmental Impact Assessment in NB (GNB, 2018a). The overall goal of involvement during the EIA process is to inform those potentially affected by the Project are aware of the proposal and to provide them with information about the Project so that they are able to express any concerns they may have.

WISK is committed to effective stakeholder consultation and gaining ongoing acceptance and approval of the Project by local community members and other stakeholders to maximize support of the Project. WISK will engage in several activities to ensure that this goal is achieved, and the details of these activities are explained below. All First Nations and public engagement completed for the Project will be summarized in a Public Consultation Report and submitted at a later date.

2.1 FIRST NATIONS ENAGAGEMENT

WISK has and will continue to engage First Nations communities in proximity to the Project site throughout its development, construction, and operation to ensure that all questions and concerns are addressed in an appropriate fashion. In addition, WISK intends to include First Nation community members with applicable traditional knowledge to assist the Partners during the EIA process, Project development and construction. WISK has completed a preliminary traditional Indigenous Knowledge study as described below and included in Appendix B. SWEB has engaged the NB Aboriginal Affairs Secretariat regarding the Project and has commenced engagement activities with the following First Nation's communities:

- Woodstock First Nation
- Fort Folly First Nation
- Elsipogtog First Nation
- Indian Island First Nation
- Pabineau First Nation
- Eel River Bar First Nation
- Bouctouche First Nation
- St. Mary's First Nation
- Oromocto First Nation

2.1.1 TRADITIONAL LAND USE

A preliminary traditional Indigenous Knowledge study was conducted for the proposed Project on November 17, 2017. The full report is included in Appendix B. The following is a brief summary of the report.

The study was carried out under the direction of Elder Gilbert Sewell of Pabineau First Nation, with assistance of Laura Buck (Fort Folly First Nation), Christina LaFlamme (WSP), and Grant Aylesworth (Stratis Consulting). The study focused on the proposed Wind Turbine Generators (WTG) locations and at an additional seven (7) sites along the New Ireland Road.

Mr. Sewell and Ms. Buck 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.

2.2 PUBLIC CONSULTATION

As outlined in Section 6 of the Guide, "public" includes all stakeholders (individuals, companies, agencies, organizations, and interest groups) who may be affected by the proposed Project and includes those who may have local knowledge of the location that may assist in siting or design.

To date, WISK has commenced engagement with a number of stakeholders including:

— The Mayor of Riverside-Albert
— The Mayor of Alma
— Local snowmobile clubs

Of note, the Mayor of Riverside-Albert has expressed strong support for the Project; a letter of support is included in Appendix C. The WISK team also intends to engage other stakeholders near the Project area including community members, environmental groups, and recreational users.

Throughout the construction and operation of the Project, WISK will continue to engage community members regarding Project construction information and safety measures, as well as educational sessions that familiarize community members with the operation of a wind energy project. In addition, WISK will engage the appropriate local authorities and agencies regarding construction timing and important road use information to ensure the Project's construction and operation meet the highest safety standards.

2.2.1 PUBLIC MEETINGS AND INFORMATION SESSIONS

A public open house will be held in May 2018 to invite members of the public, First Nations communities, and other stakeholder groups to meet the Project staff, learn more about the Project, and provide comments and feedback on the Project and EIA documentation. Additional public information meetings will be held in the local community to share accurate information about the project, gather useful ideas from knowledgeable community members, and to respond to questions and concerns of local citizens.

2.2.2 NOTIFICATIONS

Notifications for the Project will be placed in local newsletters and/or papers to offer information regarding the Project. Notifications may also be posted on the Riverside-Albert website and Alma website. Notification letters will be sent to First Nations, residents of Riverside-Albert and Alma, and other key stakeholders.

2.2.3 DEVELOPMENT OF A LOCAL COMMUNITY LIAISON COMMITTEE:

WISK will allocate a portion of the Project revenue to ensure that the Project's benefits contribute to local community planning initiatives. WISK will support the organizing a local community liaison committee that is comprised of community members interested in participating in organizing local capital projects or community-specific programming. The committee will serve to identify and prioritize spending on projects and/or community programming that requires funding.

2.3 REGULATORY CONSULTATION

WISK has and will continue to hold focused meetings with government representatives and key stakeholders to ensure that they are kept apprised of all Project-specific information and planning. WISK has been proactive by engaging members of parliament, members of the legislative assembly, and other government officials to inform them of the potential development in the Fundy region. In addition, consultation with federal agencies including NAV Canada, Transport Canada, the RCMP, Environment Canada Radar, CCG, and the DND has also been completed (Appendix A).

3 PROJECT DESCRIPTION

3.1 PROJECT NAME

The name of the Project is the Wisokolamson Energy Project (Project).

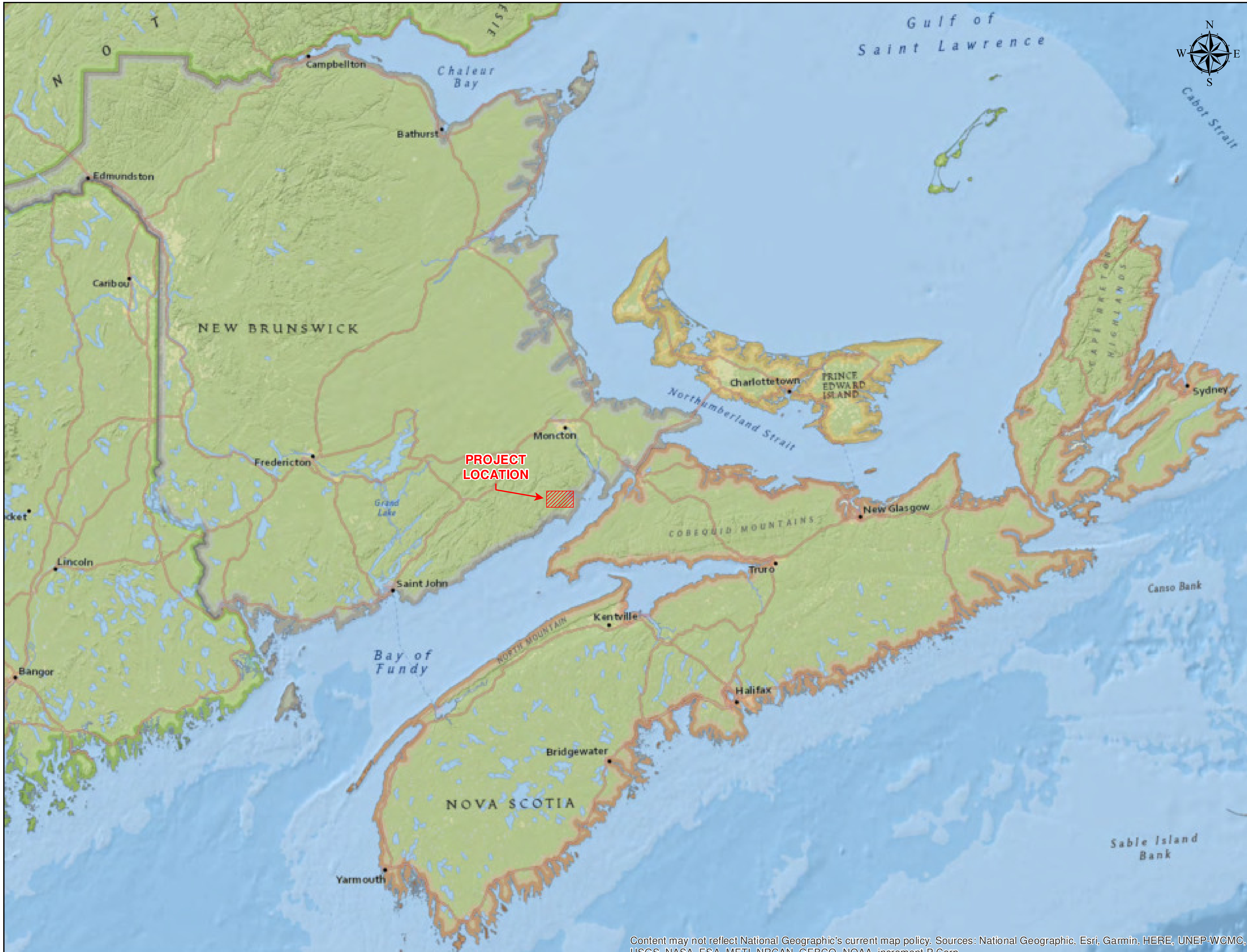
3.2 PROJECT OVERVIEW

The Project is located on Crown land south of New Ireland Road, in Albert County, New Brunswick, and will have an aggregate electrical capacity of 18 MW (Figure 3.2-1). In addition, the Project's electrical substation will be located on a private parcel adjacent to a section of NB Power's 69 kilovolt (kV) circuit which ends at the Albert substation, south of Riverside-Albert, NB. The Project will consist of five (5) WTG, access roads, collector system, substation, and associated temporary laydown areas required for construction (Figure 3.2 2 and Figure 3.2 3). Construction of the Project is scheduled to begin in late summer/early fall 2018, with WTG delivery and commissioning commencing in June 2019.

The Project is expected to consist of Vestas V126 WTGs with a nominal power of 3.6 MW. Each assembly will consist of the tower, hub, nacelle, rotor blades, and controller, with a total height of 180 m. The total WTG rotor diameter will be 126 m. It is anticipated that each WTG 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. The proposed substation location is near New Ireland Road and Highway 114. The substation area will be approximately 40 m by 40 m.

The Vestas V126 will be equipped with Vestas' de-icing system, can be used on low- medium- and high-wind sites, and are capable of low temperature operation (-30ºC). The can also be fitted with aviation lights and markings on the blades with an Obstacle Collision Avoidance System which is a low-energy radar system that detects aircraft to switch the aviation lights on and off as needed.

The proposed schedule for the Project is dependent on receiving all necessary approvals. It is expected that site preparation and construction will begin in late summer/early fall of 2018, and take approximately 14 to 16 months to complete. Construction will be scheduled to occur during daytime hours. It is expected the Project will be in operation by late 2019. The anticipated life of the Project is estimated to be 25 years, which is consistent with the WTG life expectancy.



KEY MAP:

LEGEND:

PROJECT LOCATION

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PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY LP**

FIGURE:

TITLE:
PROJECT LOCATION

FIGURE NO.: **3.2-1**	REVISION NO.: **0**
SCALE: 1:2,100,000 — 0 25 50 100 Kilometres	
DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/05

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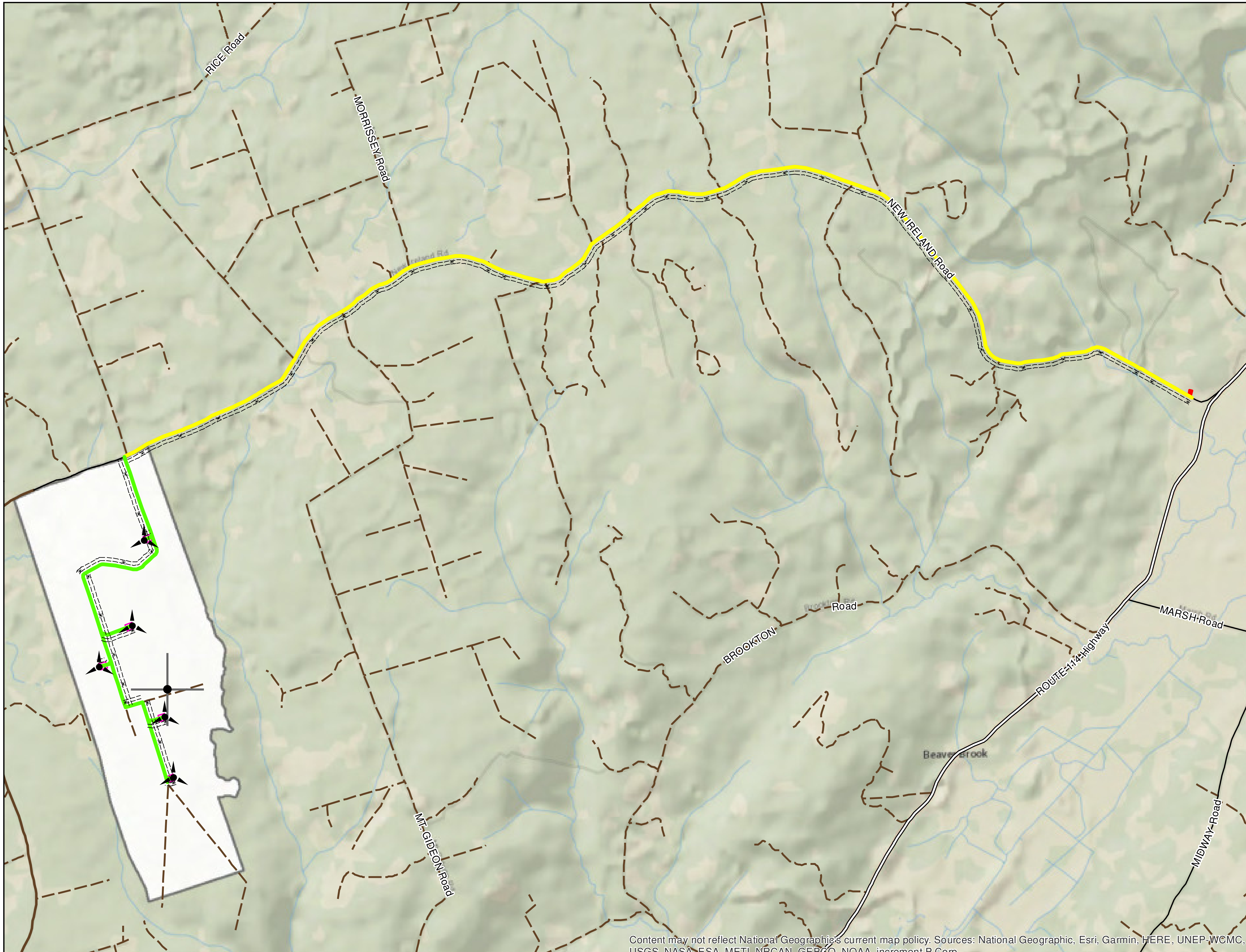
Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180405_161_08790_Phase19_FIG3_2_1_ProjectLocation.mxd



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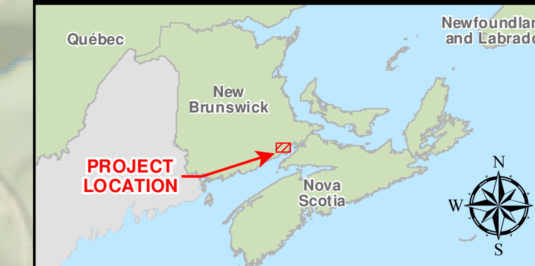

LEGEND:

- TRANSMISSION LINE
- NEW IRELAND ROAD (EXISTING)
- CROWN LAND ACCESS ROAD (EXISTING)
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- SUBSTATION FOOTPRINT
- WTG ERECTION FOOTPRINT
- LAND LEASE AREA (1252 ha)
- MET TOWER
- WTG

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PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY LP**

FIGURE:

TITLE:
PROJECT FOOTPRINT

FIGURE NO.: 3.2-2	REVISION NO.: 0

SCALE: 1:35,000
0 500 1,000 2,000 Metres

DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/12

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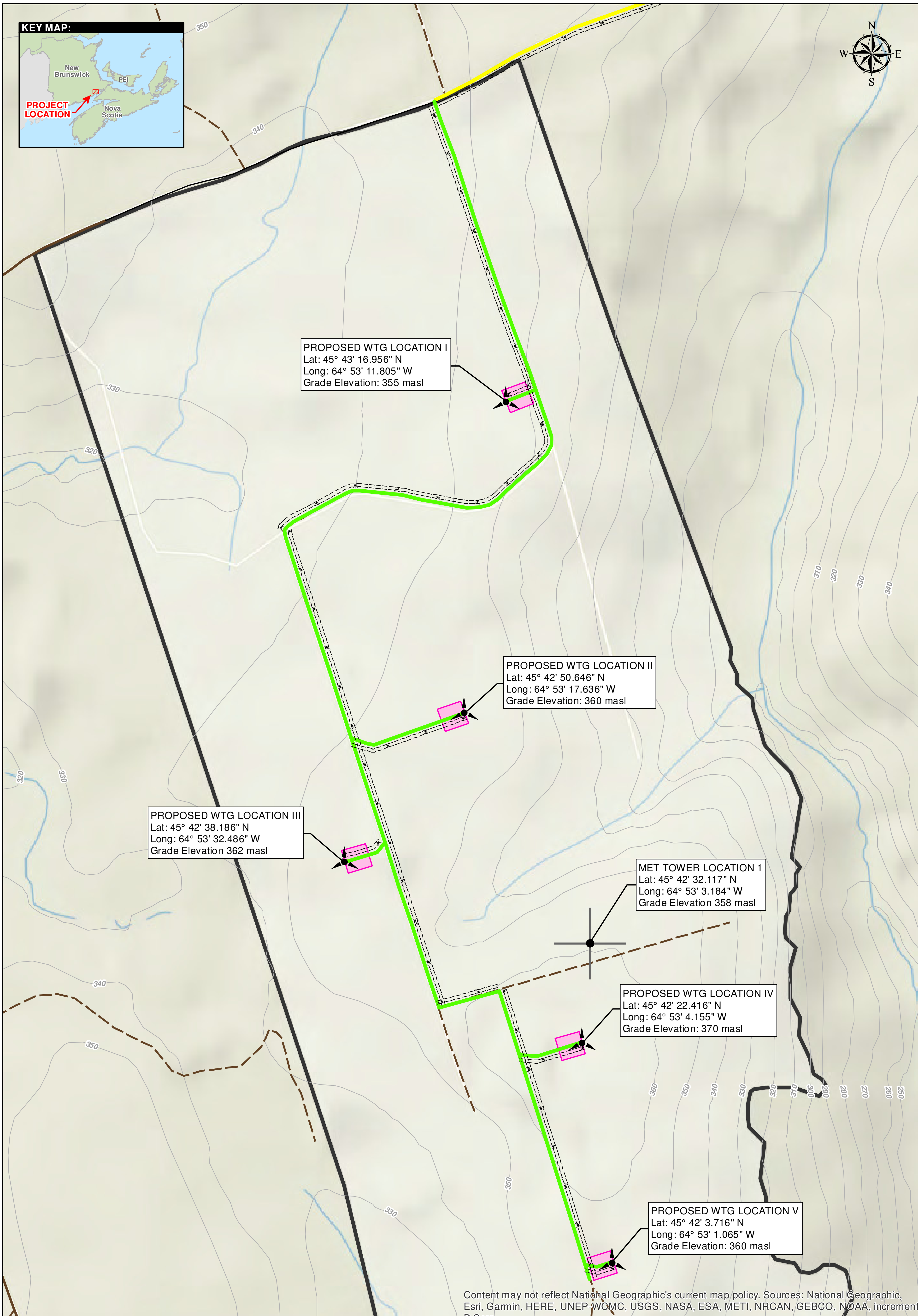
Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180405_161_08790_Phase19_FIG3_2_2_ProjectFootprint.mxd



PROJECT:

PROJECT:

WISOKOLAMSON ENERGY PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY LP**

FIGURE:

TITLE:

WIND TURBINE GENERATORS
SITE PLAN

FIGURE NO.: **3.2-3**

REVISION NO.: **0**

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DATUM: NAD 83 CSRS

PROJECTION: NB STEREOGRAPHIC

DRAWN BY: T. MOREHOUSE

CHECKED BY: J. FERNET

CREATED DATE: (YYYY-MM-DD) 2018-04-05

REVISION DATE: (YYYY-MM-DD) 2018-04-12

LEGEND:

- TRANSMISSION LINE
- CROWN LAND ACCESS ROAD (EXISTING)
- NEW IRELAND ROAD (EXISTING)
- ELEVATION CONTOUR (10 metre Interval)
- WTG ERECTION FOOTPRINT
- LAND LEASE AREA (1252 ha)
- MET TOWER
- WTG

SCALE: 1:9,500

0 50 100 200 300 400 500 Metres

Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180405_161_08790_Phase19_FIG3_2_3_WTG_SitePlan.mxd

3.3 PURPOSE, RATIONALE, AND NEED FOR THE UNDERTAKING

3.3.1 NEED FOR THE PROJECT

In 2016, NB Power released a solicitation for 40 MW of transmission-connected renewable energy projects to be majority owned by Aboriginal businesses. The solicitation, otherwise known as the Locally Owned Renewable Energy Projects that are Small Scale (LORESS) program, was developed with the intent of contributing to NB Power's obligation to produce 40% of its electricity with renewable energy sources by the year 2020. As such, a project submission detailing the Project was submitted to NB Power in response the LORESS solicitation.

3.3.2 SOCIAL AND ECONOMIC BENEFIT PLAN

The WISK team intends to implement a similar approach to what has been employed in previous projects developed by SWEB to ensure that social license is gained from the local community and that First Nations communities and companies are well represented and involved in the execution of the Project. Provided that adequate attention is paid to this goal, New Brunswick's local communities will benefit greatly from the development, construction, and operation of the Project.

COMMUNITY INVOLVEMENT

DEVELOPMENT OF A LOCAL COMMUNITY LIAISON COMMITTEE

A portion of the Project revenue will be allocated to the hosting community to ensure that the Project's benefits contribute to local community planning initiatives. To assist with the allocation of these community-specific funds, WISK will support the community with organizing a local community liaison committee that is comprised of community members interested in participating in organizing local capital projects or community-specific programming that contributes to the wellbeing of Riverside-Albert's residents. The committee will serve to identify and prioritize spending on projects and/or community programming that requires funding. This will ensure that the Project benefit is shared with all community stakeholders.

MAXIMIZING FIRST NATION AND LOCAL PARTICIPATION

Although gaining Project acceptance from all stakeholders will be essential throughout the Project's lifecycle, the WISK team is also driven to maximize Aboriginal and local participation throughout the Project. This guiding principle is reflected throughout Section 2, and the approach to maximizing participation is described below.

ASSESSING LOCAL BUSINESS CAPABILITIES

The WISK team will engage other Aboriginal businesses, as well as local stakeholders to assess their capacity to participate in the Project (e.g., local contractors, other Aboriginal businesses, hiring/training agencies). This consultation process will increase the understanding of the available labour force and support in the surrounding area.

EARLY ADVERTISING

The WISK team will ensure that contracting opportunities are shared throughout the Project region to ensure local contractors are kept apprised of these opportunities early in the development and construction phases.

PRIORITIZING LOCAL HIRING AND SKILLS DEVELOPMENT

The WISK team will work with major project contractors to ensure that local expertise is prioritized before extending any Project-specific tendering beyond the province. For long-term jobs (e.g., operations staff, maintenance technicians) which require specialized training, a similar approach will be implemented whereby local citizens are trained to fill these positions when possible; in some instances, WISK may engage specialists to train local people to take over these positions throughout the operation of the Project.

EMPLOYMENT

ESTIMATED NUMBER OF NEW JOBS

New jobs will be created during both the construction and commercial operation phases of the Project. To estimate the number of new jobs during the construction phase, the WISK team used the Jobs and Economic Development Impact (JEDI) Land Based Wind Model provided by the National Renewable Energy Laboratory. This model allows for various Project-related data to be inputted, and the output produces employment and economic-related information specific to a project in a given region. Based upon the JEDI model, up to 25 full-time equivalent jobs will be created during construction from civil contracts, telecommunications installation, WTG foundation construction, and electrical infrastructure design and construction (Table 3.3-1). Once construction is complete, an additional 3 full-time equivalent jobs are expected to be created from onsite labour, site security, and WTG service technicians.

Table 3.3-1 Estimated Number of Full-Time Equivalent Jobs Created

PROJECT PHASE	NUMBER OF ESTIMATED JOBS CREATED (FULL-TIME EQUIVALENT)[(a)]
Construction	25
Operation	3

(a) The actual number of jobs created may fluctuate slightly above or below the estimated values above, based upon project-specific requirements at the time of staffing these positions.

OPPORTUNITIES FOR LOCAL EMPLOYMENT

WISK's goal is to maximize local contracting and other employment opportunities for those jobs that can reasonably be filled locally, generating sustainable business development opportunities for NB. When possible, WISK will prioritize hiring Aboriginal labour and local expertise during the construction and operation of the project. Often these are common trades such as:

- Logging and brush clearing
- Road construction
- Blasting
- Security
- Equipment operators
- General laborers
- Gravel supply and installation
- Fencing
- Electrical installation
- Transmission line installation
- Fiber cable installation
- Transport and logistics
- Foundation rebar installation
- Building trades (carpentry & plumbing)
- First aid
- Hospitality

ECONOMIC IMPACTS

COST ESTIMATES FOR SERVICES AND EQUIPMENT

The Project will have a significant amount of spending on services and equipment that are sourced throughout NB, and local contractors will be contacted early to determine their capacity to provide the materials and services required to complete the Project.

INDIRECT BENEFITS

There are several ways that this Project will provide indirect benefits to communities in NB. The WISK team will ensure that local community centers are used for Public Community Meetings regarding Project-specific details and that meeting materials, food & beverages, and other related items are sourced from local service providers. Other indirect benefits will result from the use of establishments such as hotels, restaurants, gasoline stations, and other businesses in the area. Further, during construction, building materials will be sourced locally where possible. The total amount of indirect benefits will range significantly depending on the availability of these services in the vicinity of the Project area.

PRODUCT AND SERVICE PROCUREMENT

WISK is committed to procuring products and services from within the Fundy region, directly from WFN, and from NB's workforce. If pertinent products and services cannot be sourced within the province of NB, they will be procured from the appropriate purveyors throughout the Project's development, construction, and operation. Examples of out-of-province materials typically include WTG-specific components such as: blades, nacelles, towers, and cranes.

To ensure employment and revenue benefits are maximized for the province of NB and its communities, WISK has contacted construction, concrete, and equipment companies to secure local service options for the development, construction, and operation of the Project.

EDUCATIONAL OUTREACH PROGRAM

SWEB has experience with educating youth on wind energy through interactive in-class sessions and field trips to projects that it operates throughout the province of Nova Scotia. Once the Project begins operation, the Partners will design and deliver a region-specific education and outreach program that will include:

- field trips to the Wisokolamson Wind Energy Project site
- an in-class, interactive learning workshop that is tailored to levels that are appropriate to the education level
- community-specific Project site tours

This program will be designed to introduce concepts of electricity and renewable energy to youth, local community members, and local First Nations communities. The education sessions will be designed to foster interest in renewable energy, and to teach stakeholders about the benefits that renewable energy has in their community its impact on climate change initiatives. The youth component of the program will be delivered to different age levels depending on which institutions express interest in the programming.

3.3.3 ENVIRONMENTAL BENEFITS

From an environmental perspective, the Project will serve as a partial replacement of other NB Power energy resources. In cases where the Project offsets energy generation from NB Power's thermal and combustion energy fleet (i.e. coal-fired, natural gas, and heavy fuel oil plants), it can offset up to 55,000 to 65,000 metric tons of carbon dioxiode (CO_2) emissions. The Project will also further diversify NB Power's electrical generation base and contribute to the local grid system in Albert County.

3.4 PROJECT LOCATION

The Project is located on Crown land south of New Ireland Road, in Albert County, NB, approximately 5 kilometres (km) east of Teahans Corner (Figure 3.2-1). In addition, the Project's electrical substation will be located on a private parcel adjacent to a section of NB Power's 69 kilovolt (kV) circuit which ends at the Albert substation, south of Riverside-Albert, NB. The WTG locations are summarized in Table 3.4-1 and presented on Figure 3.2-2.

Table 3.4-1 Wind Turbine Generator Locations (dd° mm' ss") (NAD 83 CSRS)

WIND TURBINE GENERATOR NUMBER	LATITUDE	LONGITUDE
1	45° 43' 16.956" N	64° 53' 11.805" W
2	45° 42' 50.646" N	64° 53' 17.636" W
3	45° 42' 38.186" N	64° 53' 32.486" W
4	45° 42' 22.416" N	64° 53' 4.155" W
5	45° 42' 3.716" N	64° 53' 1.065" W

3.5 SITING CONSIDERATIONS

3.5.1 ENVIRONMENTAL AND LAND USE CONSIDERATIONS

Many environmental impacts associated with wind projects can be avoided or reduced through proper planning. As such, SWEB completed a preliminary evaluation as part of the initial screening when siting the WTGs for the Project. The minimum setback distances from Section 8 of the *Allocation of Crown Lands for Wind Power Projects Policy* applies to the Project (Table 3.5-1; NBDNR, 2012). Wind power development is not allowed in National or Provincial Parks, operational quarries and mine sites, economically viable peatlands, Deer Wintering Areas, Old Forest Communities and Habitats, Eastern Habitat Joint Venture sites, RAMSAR sites and International Shorebird Reserves and any other site-specific fish, wildlife and environmental areas identified during the review process or during the EIA. It is important to note that where wildlife or other concerns are identified, a site-specific setback buffer may be applied.

Table 3.5-1 Setbacks for Wind Turbines on Crown Lands

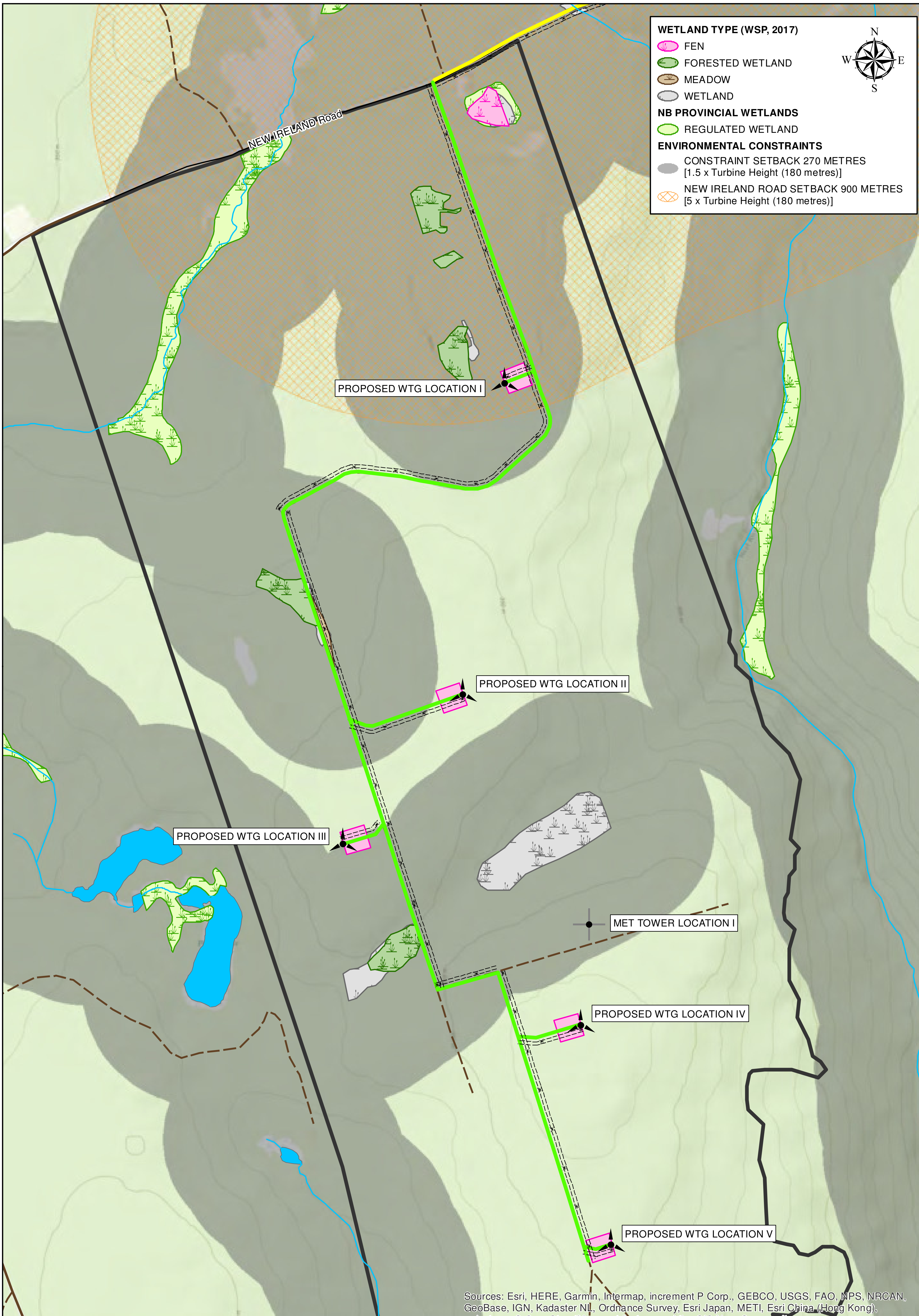
LAND USE/COVER	SETBACK
– Crown lands boundaries, lakes, watercourses, and wetlands – Protected Natural Areas and candidate Protected Natural Areas	A minimum of 150 m, or 1.5 x height of turbine, **whichever is greatest**
– Industrial areas (e.g., industrial parks, mines, quarries, etc.) – Crown woods access roads	Assessed on a case-by-case basis, typically 150 m, or 1.5 x height of turbine, **whichever is greatest**
– Public highways, roads and streets (including roads and streets within the boundaries of a city, town, or village), designated as highways under the Highways Act; and areas designated for those purposes in a plan adopted under the *Community Planning Act* – Telecommunication, fire, airport and other tower structures, – Archaeological and Historical Sites listed by the Department of Wellness, Culture and Sport – Other wind exploration area boundaries, meteorological test towers, wind turbines and associated infrastructure either existing or under application review	500 m, or 5 x height of turbine, **whichever is greatest**
Existing recreational, institutional and residential areas, and areas designated for those purposes in a plan adopted under the *Community Planning Act*	A minimum of 500 m

LAND USE/COVER	SETBACK
Coastal features (e.g., coastal wetlands, estuaries, beaches and dunes) Endangered species habitat (*Endangered Species Act*) National Wildlife Areas and Migratory Bird Sanctuaries	500 m
Important migratory bird nesting sites and migration routes (*Migratory Birds Convention Act*) Important water-bird breeding colonies (*Fish and Wildlife Act*)	1,000 m
Known bat migration routes and hibernacula	5 km

The Environmental Constraint Setback Areas (Figure 3.5-1) shows the setback distances as recommended in the Allocation of Crown Lands for Wind Power Projects Policy (NBDNR, 2012) in relation to the proposed WTG locations. All the proposed WTG locations fall outside the recommended setback distances, with the exception of WTG I. WTG I is located 800 m from the New Ireland Road, which is classified as a secondary public road. The recommended setback distance from public roads is 900 m (i.e., 5 x 180 m turbine height). WSP believes the proposed placement of WTG I is of sufficient distance to ensure public safety. A de-icing system will be used for each of the five (5) WTGs to minimize the potential and distance of ice throw. In addition it should be noted that New Ireland Road is not frequently used and serves mostly as a resource/recreation road. WTG I is also located 100 m from an unmapped forested wetland. The recommended setback distance from wetlands is 270 m (i.e., 1.5 x 180 m turbine height). WSP believes the proposed placement of the WTG I is of sufficient distance from the wetland as to not impact wetland function. Forested wetlands do not provide adequate habitat to allow for staging of large flocks of waterfowl or shorebirds during migration which would be the main reason for requiring a 270 m setback distance.

Fifteen (15) vascular plant Species of Conservation Concern (SOCC) have been historically and recently observed within 5 km of the Project; the majority of which have been documented in Shepody National Wildlife Area (Section 4.7.9). No records of nonvascular plant SOCC have been documented within 5 km. The site visit completed in July 2016 did not document any plant SOCC. Although no plant SOCC were recorded during the site visit, it does not preclude the potential for plant SOCC to be present. It was determined that the majority of the habitats immediately around the proposed WTG locations and Crown Access Road were of low potential to support these species. The fen was determined to be of high potential.

Within the Project area, 60 wildlife SOCC have been previously detected within 5 km of the Project (Section 4.8.3). Of these, 4 are mammals, 50 are birds, and 5 are invertebrates. Although many SOCC ranked by the Atlantic Canada Conservation Data Centre (ACCDC) are considered rare in NB, those protected or designated by federal and provincial legislation are of particular concern. These included six (6) mammals (which include three (3) bat species), fourteen (14) bird species, and one (1) invertebrate. Of these, fourteen (14) are listed under the federal SARA, fourteen (14) are listed under *New Brunswick Species at Risk Act* (NB SARA), and fifteen (15) designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and are described in Section 4.8.3. Five (5) bird SOCC were observed during the field surveys (Section 4.8.1). These included pine siskin (*Carduelis pinus*), turkey vulture (*Cathartes aura*), common nighthawk (*Chordeiles minor*), eastern wood-pewee (*Contopus virens*), and evening grosbeak (*Coccothraustes vespertinus*). Pine siskin and turkey vulture are ranked by the ACCDC as S3 and S3B,S3M respectively; however, both are listed as Secure by the ACCDC, and not listed under the NB SARA, designated by COSEWIC, or listed under SARA. Common nighthawk and eastern wood-pewee are protected under Schedule 1 of SARA. Evening Grosbeak is designated by COSEWIC as Special Concern, but is not listed under the NB SARA or listed under SARA.



PROJECT:	FIGURE:		LEGEND:
PROJECT: WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT	TITLE: ENVIRONMENTAL CONSTRAINT SETBACK AREAS	DATUM: NAD 83 CSRS PROJECTION: NB STEREOGRAPHIC	WATERCOURSE TRANSMISSION LINE CROWN LAND ACCESS ROAD (EXISTING) NEW IRELAND ROAD (EXISTING) WATERBODY WTG ERECTION FOOTPRINT LAND LEASE AREA (1252 ha) MET TOWER WTG
PROJECT NO.: 161-08790 PHASE 19	FIGURE NO.: 3.5-1 / REVISION NO.: 0	DRAWN BY: T. MOREHOUSE	
CLIENT: WISOKOLAMSON ENERGY LP	WSP Canada Inc. 1 Spectacle Lake Drive, Dartmouth, Nova Scotia www.wsp.com	CHECKED BY: J. FERNET CREATED DATE: (YYYY-MM-DD) 2018-04-05	
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Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180412_161_08790_Phase19_FIG3_5_1_EnviroConstraints.mxd

There are three (3) managed areas within 5 km of the Project and include the Caledonia Gorge Protected Natural Area, Shepody National Wildlife Area, and Fundy National Park. A biologically significant site area is within 5 km of the Project, Shepody Bay West Important Birding Areas (IBA). Although there are no IBA or RAMSAR sites (wetlands of international importance) within the Project footprint, there are IBAs and RAMSAR sites along the Bay of Fundy, the nearest, Shepody Bay West NB009, is located southeast of the Project. Identifying these areas is important when considering flight paths of birds that may be moving to and from these sites during migration as they will have potential to interact with the Project. There is a Deer Wintering Area 3.8 km of the southern-most WTG. There are no Provincial Parks, operational quarries and mine sites, economically viable peatlands, Old Forest Communities and Habitats, Eastern Habitat Joint Venture sites, International Shorebird Reserves, or conservation areas managed by Ducks Unlimited within 5 km of the Project.

The majority of the Project footprint was determined to have low archaeological potential. New Ireland Road, however, crosses a number of high potential archaeological areas that are associated with watercourses, therefore it is recommended that archaeological monitoring of ground disturbing activities within 80 m of a current or former watercourse location and archaeological monitoring for utility pole installation within 200 m of the location of the Anglican Church and cemetery (BkDf-2) should be undertaken.

The Project will be located on Crown Land and the predominant land use is forestry. Existing forestry road corridors will be used for the Project. It is anticipated that the existing land use in the area would be continued. The Kent Hills wind farm is approximately 5 km to the north of the Project.

3.5.2 ALTERNATIVE LOCATIONS

The Project location was selected based on a number of factors including but not limited to:

- Proximity to the NB Power transmission grid and available capacity on the electrical circuit
- Indicative wind speeds within the region based on atmospheric model data
- Mapped environmental features procured from Geo NB's GIS data repository
- Available Crown land for wind energy development, and
- Existing forestry roads to serve as project access roads
- Potential archeological areas
- Potential important bat habitat
- Important bird areas

In general, the Project was designed to use existing forestry roads as access roads to minimize the need for additional clearing and road construction. Other potential locations were considered for this project; however, the proposed site represented an optimal balance between project economics and potential impacts on the environment, thus resulting in a net benefit from the commissioning of the Project.

Throughout the Project site, additional WTG locations were considered throughout the development process. However, based on mapped and site-verified environmental features, the locations presented in Figure 3.2 2 proved to be the most suitable.

3.6 PHYSICAL COMPONENTS AND DIMENSIONS OF THE PROJECT

3.6.1 PROJECT INFRASTRUCTURE

The various Project features required to support the Project is summarized in Table 3.6-1. The area of clearing required for Project features is summarized in Table 3.6 2 and presented on Figure 3.2 2 and Figure 3.2 3.

Table 3.6-1 Length of Project Roads and Proposed Powerline

PROJECT FEATURE	LENGTH	ADDITIONAL INFORMATION
Existing New Ireland Road from location of substation to Project area	12 km	Minor filling where slope of road exceeds allowable level for WTG delivery
Access Roads (existing Crown Land Access road)	4.26 km	Minor upgrades and widening of road top (up to 6 m wide)
Access Roads (new construction from existing Crown Land Access roads)	1 km	Tree clearing required in some instances. 6 m roadway to WTG crane pad
Overhead powerline	17.26 km	May vary based on final pole line design
Overhead powerline from substation to interconnection point	40 m	May vary based on substation design

Table 3.6-2 Area of Clearing Required for Project Features

PROJECT FEATURE	AREA OF CLEARING	ADDITIONAL INFORMATION
Crane Pads/ Erection Footprints	1.44 hectares (ha) (0.288 ha per WTG)	In some instances, crane pad areas and/or road construction areas have previously been harvested through forestry activity
New Road Construction	0.8 ha	In some instances, road construction areas and/or improvement areas have previously been harvested through forestry activity
Upgrades to existing Crown Land Access roads	2.13 ha	In some instances, road construction areas and/or improvement areas have previously been harvested through forestry activity

3.6.2 BLASTING

It is likely that very little or no blasting will be required. However, blasting may be required for both the WTG foundations and the overhead powerline in order to complete construction in a cost and time efficient manner. If blasting is required, it would be performed in very small amounts as the depths of the WTG foundations would not require mass quantity removals as with a gravel pit/processing scenario.

3.6.3 WATER SUPPLY

It is anticipated that most of the water will come from water trucks, however if required, an on-site water supply may be used. There is no current plan for an on-site concrete batch plant so the use of on-site water for that process will not be needed. The daily estimated amount would be around 7,500 to 11,500 liters (L).

3.6.4 ELECTRICAL WORKS AND INTERCONNECTION TO GRID

All electrical power lines will be overhead from the proposed substation location (near New Ireland Road and Highway 114) to the WTGs at which point the last 70 to 90 m between the riser poles to each WTG will switch to underground buried cable for safety and clearance reasons.

Approximately 5.26 km of overhead 34.5 kV electrical lines will be located within the Project footprint with an additional 12 km running eastward in the right-of-way (ROW) along the existing New Ireland Road to the proposed substation. The overhead line will then be connected to a main power step-up transformer (20 MVA) at the substation to raise the voltage to the 69 kV transmission line voltage. Finally, a 69 kV line will extend 40 to 50 m from the substation to the tap point on NB Power's Line 0067.

3.6.5 *WIND TURBINE GENERATORS AND METEOROLOGICAL TOWER*

The WTG specifications are summarised in Table 3.6-3 and details about the meteorological tower is summarized in Table 3.6 4.

Table 3.6-3 Proposed Wind Turbine Generator Specifications

WIND TURBINE GENERATOR INFORMATION	MEASUREMENT
Rotor Diameter	126 m
Hub Height	117 m
Tip Height (ground level to maximum height at blade tip)	180 m
Sound Power Level at Hub Height at Maximum Output	107.4 A-weighted decibels (dBA)

Table 3.6-4 Project Meteorological Tower Summary

DESCRIPTION	CONFIGURATION
Commissioned	May 11, 2017
Meteorological Tower Height	60 m
Elevation (ground level)	360 m
Location (Latitude, Longitude)	45° 42' 32.117" N, 64° 53' 3.184" W
Guy Wire Placement	Approximately 35 m from the tower base, secured to ground with anchors at the following positions from the tower base: NW, NE, SE, SW
Sound	Not Applicable

To ensure the Project is operated in a safe manner, WISK has procured a Vestas de-icing system for each of the five (5) WTGs which will detect whether the blades are collecting ice. In the event that icing is detected, 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 icing 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.

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.

Based on Transport Canada's Standard 621, WTG's that have an overall height of more than 150 m must have two (2) CL-864 lights mounted to the top of the nacelle, in addition to at least three (3) CL-810 lights mounted at half of the nacelle height up the WTG tower. Only one of the nacelle-mounted lights is to be operating for a single period while the second light remains on standby. All lights mounted on the WTG must flash at the same rate.

3.7 CONSTRUCTION ACTIVITIES

3.7.1 SITE CLEARING AND CONSTRUCTION OF ACCESS ROADS

Clearing includes the removal of all trees, brush, stumps, or other obstacles lying within the construction area that may potentially impair construction activities, vehicle movement, and/or threaten the safety of construction personnel.

The resulting material will be salvaged and stored in piles or windrows. No material will be pushed into or against standing live trees adjacent to construction areas. Likewise, no material will be placed or stored in any wetland or watercourse.

Where safe to do so, low shrub stands and small or regenerating trees will not be cleared. Rather, heavy equipment and trucks will simply drive over or "walk down" this woody growth to limit disturbance to the roots, sod layer, and associated grass/forb cover. Any trees that are cleared will be removed following standard forestry practices using equipment such as fellers. Bulldozers and excavators will be used for grubbing and to clear smaller vegetation.

Existing roads will be upgraded and new access roads will be constructed to transport equipment to the construction sites. There will be a 45 m wide area for construction of the site-specific access roads. The access road will be sited within this area of disturbance in consultation with landowners and taking into consideration potential environmental effects. Typically the access roads will be 4 m wide during the construction phase to accommodate the large cranes (with an additional 1 m clearance on each side for ROW and clearance). The road length will be different for each WTG according to its location.

The construction of the access road will typically require clearing and grubbing of any vegetation, excavation of the topsoil layer and adding a layer of compacted material to a typical thickness of 300 to 600 millimetres (mm), depending upon site specific geotechnical conditions. Clean granular material (typically "A" or "B" gravel) will be brought to the site as needed and will not be stockpiled onsite. The topsoil will be kept and re-used on site and appropriate mitigations will be applied as per the Erosion and Sedimentation Control Plan that will be implemented for the Project. The access road to each WTG will typically require one to three days of construction time. Depending on the length of the access roads, construction may require approximately 50 truckloads of gravel for each location.

New culverts may be required to maintain drainage in ditches at junctions with roadways and these will be constructed to support the construction equipment and delivery trucks. The exact details of culverts and their installation in addition to erosion control measures will be determined in conjunction with the appropriate regulatory authorities as part of their permitting process.

Equipment will include, at a minimum, trucks, graders, and bulldozers. Municipal and provincial roads will also be used for transporting equipment, and minor modifications may be required to some of the existing roads (e.g., widening the turning radius) to handle the oversized loads. Any road damages will be repaired prior to the completion of the construction phase. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.2 GRADING

In general terms, grading includes topsoil removal, installation of ramps, two-toning, and other work required to facilitate the movement of equipment onto and within construction areas.

Topsoil stripping is the most important step in maintaining the growth medium for successful reclamation and post disturbance land use. Topsoil will be stripped to a predetermined depth and stored for use during clean-up and reclamation. Where the Project crosses sensitive habitats, only the areas required for the Project width will be stripped to minimize disturbance to the plant communities and limit the creation of suitable growing sites for non-endemic, weedy species.

Grading of subsoil may be required to establish a level and safe working surface for equipment operation and travel. It is anticipated that localized grading will be required where site-specific micro-relief variations (e.g., side slopes or low knolls) are traversed by the Project.

3.7.3 INSTALLATION OF TEMPORARY FACILITIES

A construction laydown area will be constructed for the temporary storage of construction material. The construction laydown area will include staging areas for construction materials, construction trailers and associated facilities and a temporary electrical service line to provide power to the construction trailers. Following clearing and grubbing of any vegetation, the topsoil at the construction laydown area will be removed and approximately 600 mm of clean compacted crushed gravel will be imported as needed. The excavated topsoil will be re-used on site as feasible. Following the construction phase, the gravel will be removed from the site or re-used, to be determined in consultation with the landowner. The stockpiled topsoil will then be redistributed throughout the Temporary Laydown Area.

Equipment will include, at a minimum, trucks, graders, and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.4 CONSTRUCTION OF TURBINE SITES AND CRANE PADS

Prior to construction, the construction area will be cleared and grubbed. In order to provide sufficient space for the laydown of the WTG components and its assembly, a 122 m by 122 m area must be cleared, levelled, and be accessible during the construction phase. The topsoil is generally removed with some soil stabilizing material (i.e., crushed gravel or clean back fill) added depending upon site specific geotechnical conditions. Where the site laydown areas are close to watercourses, erosion control measures will be implemented, as described in the Erosion and Sedimentation Control Plan.

Crane pads will be constructed at the same time as the road, and will be located adjacent to WTG locations. The crane pads will typically 15 m by 35 m in area. The topsoil at the crane pad will be removed and approximately 600 mm of clean compacted crushed gravel will be imported as needed. The excavated topsoil will be re-used on site as feasible. Once the WTG erection is complete, the crane pad will be removed and will be restored to prior use.

Equipment will include, at a minimum, trucks, graders, and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.5 DELIVERY OF EQUIPMENT

Equipment will be delivered by truck and trailer throughout the construction phase and stored at the temporary lay-down sites surrounding each WTG. A Traffic Management Plan will be developed and discussed with NBDERD and NB Department of Transportation and Infrastructure (NBDTI). Alternative traffic routes will be prepared to address traffic congestion, as needed. NBDTI has already been engaged and has provided a list of reuqiments that will be fulfilled.

3.7.6 CONSTRUCTION OF TURBINE FOUNDATIONS

Excavators will be used to excavate an area approximately 3 m deep by 20 m by 20 m (the precise size of excavation area to be determined by geotechnical analysis of the soil) with the material being stockpiled for future backfilling. Stockpiled material will have topsoil and subsoil separated out and surplus excavated material will be used on site as aggregate to further reinforce and bury WTG foundations once they have been completed. The foundation, with an approximate footprint of 400 square metres (m^2), will be constructed of poured concrete and reinforced with steel rebar to provide strength. After construction the foundation will be backfilled and the surface will be landscaped for drainage. Any wood-waste generated will be removed from the site and recycled. Spent welding rods will be disposed of as hazardous waste by a licensed contractor.

Typical construction equipment, on a per turbine basis, will include:

- Excavator for removing material
- Flatbed trucks (four to six) for delivery of rebar, turbine mounting assembly and forms
- Truck mounted crane or rough terrain forklift for unloading and placement of rebar and forms
- Concrete trucks for delivery of concrete (30 to 40 loads)
- Construction trucks (three to four vehicles with multiple visits), and
- Dozer, loader and trucks to backfill and compact foundation and remove surplus excavated materials

The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.7 WIND TURBINE ASSEMBLY AND INSTALLATION

Turbine components will arrive on-site using flat bed and other trucks and will be temporarily stored on-site in the immediate vicinity of the base prior to assembly. Typically, two cranes will be used to install the WTGs. The larger crane is usually a crawler type with a capacity of 400 tonnes or larger, and is used for the higher lifts.

Clearing and grubbing will be required for the erection area. The erection cranes and crew will follow the foundation crew and erect the WTGs once the foundations are completed and the concrete has set. This will typically be in five lifts (three for the towers, one for the nacelle and one for the rotor) over a period of two to three days. The lower tower sections may be installed several days before the upper tower sections and the turbine to optimize installation sequence. The lower tower section will also include electrical and communications equipment. Total WTG assembly and installation will typically require four to five days for each WTG.

Packing frames for the WTG components are returned to the turbine vendor. Following commissioning, the surrounding area will be returned to its original use.

Equipment will include, at a minimum, trucks, two cranes, graders, and bulldozers. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The larger track mounted crane can move from WTG site to WTG site; however, it will need to be disassembled to move it along roadways and from the Project site. Alternatively, cranes may be moved between WTG sites without disassembly along crane paths. The only chemicals required for this phase are oils, gasoline, hydraulic fluid, and grease used to operate construction equipment. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.8 CONSTRUCTION OF THE ELECTRICAL COLLECTOR SYSTEM

The electrical collector system will consist of underground cabling and a buried collection system running along WTG access roads and ROW. Cables and communication lines from each WTG to the transformer substation will be buried and will be located adjacent to the WTG access roads, where feasible and in the municipal road ROW when necessary. Above ground electrical junction boxes will be installed where necessary to connect sections of the underground cabling. The excavated soil will be stored temporarily and then reused as backfill. Power conductors will be approximately 0.9 m below grade and the location will be marked. Equipment will include trenchers or diggers (depending on soil type) and construction will require a crew of six people. The construction timeframe is dependent upon the required length of the lines.

The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment, and the polymer used for directional drilling. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.9 CONSTRUCTION OF THE ELECTRICAL INTERCONNECTION

Three overhead electrical lines of approximately 40 m to 50 m will connect the transformer substation to the existing 69 kV transmission line. An overhead 3-phase 34.5 kV circuit will extend south of the substation, crossing New Ireland Road and continuing westward approximately 12 km to the Project area along the south side of the existing New Ireland Road ROW. This electrical line will include the installation of a number of poles to support the circuit within the New Ireland Road ROW. The poles are proposed to be constructed of wood, concrete or steel and will be typically be between 18 m and 30 m tall.

Holes for new hydro poles are typically augured into the ground using a truck mounted auger device. The poles will then be inserted using cranes to a typical depth of 2 m to 3 m below grade. The poles are typically “dressed” (made ready to accept conductors) on the ground prior to installation. Typically, one crew will install the poles dress them in one day. Once the poles are in place and dressed, cables will be strung in place using boom trucks and special cable reel trucks. Some packing-material waste may be generated. All recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licensed facility.

Equipment will include, at a minimum, a truck mounted crane, flatbed trailers and a truck mounted auger. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment. A lubricant is likely to be used when the cables are pulled in through the conduit. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.10 CONSTRUCTION OF THE TRANSFORMER SUBSTATION

Generally, less than 0.05 ha, the transformer substation will include equipment such as an isolation switch, a circuit breaker, a step-up power transformer, transmission switch gear, instrument transformers, grounding and metering equipment as well as a control housing (“E-House”) which will be supplied with power from the local distribution line. Substation grounding will meet the local electrical codes. The substation area will be gravelled with clean material imported to the site on an as needed basis and sloped to facilitate drainage. A secondary containment system will be installed around the transformer in the event of an oil leak to prevent any soil, groundwater, or surface water contamination.

During construction of the substation, topsoil and subsoils will be stripped and stockpiled separately. Stripped topsoil and subsoil will be placed in a temporary storage facility area and topsoil stripped from the substation area will be distributed on other Project properties. An electrical service line and associated poles will likely be connected to the existing distribution line adjacent to the substation for the purpose of providing house service power to the substation control building. Some packing-material waste may be generated. All recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licensed facility.

Construction equipment will include small trenchers, a small crane, forklifts, concrete trucks and a bulldozer. The trucks and graders will be driven to the site and the bulldozers will be transported via trailers. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment and transformer oil. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.11 METEOROLOGICAL TOWERS

SWEB installed a 60 m NRG HXD meteorological tower (MET tower) at the Project site at 45°42'32.15"N, 64°53'3.19"W to collect raw meteorological data (Section 4.1.3). The tower included six anemometers at three different vertical heights, as well as two wind veins, a thermometer, and a communications device. Four tubular anchors (0.5 m in length) were screwed into the ground approximately 30 m from the base of the tower in the northwest, northeast, southeast, and southwest directions and are used to anchor the tower via four sets of guy-wires. The base of the tower is fastened to a 0.75 m by 0.75 m steel plate that rests on the ground surface and fastened with two rebar pins. The installation of the tower did not require tree clearing or the placement of a foundation.

3.7.12 CLEAN-UP AND RECLAMATION

Site clean-up will occur throughout the construction phase and site reclamation will occur after construction has been completed. Waste and debris generated during the construction activities will be collected by a licensed operator and disposed of at an approved facility. Reasonable efforts will be made to minimize waste generated and to recycle materials including returning packaging material to suppliers for reuse/recycling.

Stripped soil will be replaced and re-contoured in the construction areas and disturbed areas will be re-seeded, as appropriate. Erosion control equipment will be removed once inspections have determined that the threat of erosion has diminished to the original land use level or lower. High voltage warning signs will be installed at the transformer substation and elsewhere, as appropriate. At the conclusion of construction, vehicles and construction equipment will be removed from the site.

3.7.13 TURBINE COMMISSIONING

Turbine commissioning will occur once the WTGs and substation are fully installed and regulatory authorities are ready to accept grid interconnection. The commissioning activities will consist of testing and inspection of electrical, mechanical and communications systems. Some packing-material waste may be generated. All recyclable materials will be separated from non-recyclable materials and both streams will be removed from the site and disposed of at an approved and licensed facility.

Temporary portable generator sets may be used to electrically commission the WTGs prior to connection to the grid. The generators are required for approximately one day per WTG. The generators are supplied with a Certificate of Approval to the owners. Following the commissioning phase, the portable generators will be removed from the site and returned to the owners.

Equipment will include support trucks which will be driven to the construction site. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment and portable generators, gearbox oil, and lubricants. Fuel-handling will be conducted in compliance with the mitigation measures outlined in Section 3.7.14.

3.7.14 FUEL HANDLING

Should it be necessary to do so, the contractor will set-up temporary fuel storage tanks at designated staging areas or their temporary office/storage yards. The storage facilities will be subject to provincial environmental and health and safety regulations. Fuel would be transported to machinery using a standard tank truck. Spill response plans will be filed with local authorities, as required.

Alternatively, local bulk dealers would be employed to transport fuel to Project equipment. These persons and/or firms are subject to provincial legislation respecting these activities. The majority of the equipment is refuelled at the Project site, with light vehicles typically obtaining fuel in nearby cities and towns.

All fuelling, particularly at watercourse/wetland crossings, will take place a minimum of 50 m from the edge of the delineated feature, with particular attention being paid to avoiding the inadvertent release of fluids.

3.7.15 WASTE MANAGEMENT

Contractors are required to comply with all applicable legislation in the handling, storage, transport, and disposal of wastes. Construction is expected to result in relatively little waste material. Typically, refuse and other non-hazardous waste (e.g., packaging) is collected and disposed of in local landfills. All wastes (i.e., engine gas, waste gas, grease, etc.) will be collected in containers and transported to an approved disposal sites. Fuel barrels or other liquid containers will be stored on level sites (expected to be located in the lay-down area) and all drilling chemicals will be clearly marked as per Workplace Hazardous Materials Information Systems requirements, and stored in a dry, secure place prior to use.

Waste requiring greater attention would include used or surplus primer, epoxy coating, oil and lubricants, and associated empty product containers. All such waste would be collected and disposed of in accordance with applicable legislation. Generally, these functions would be subcontracted to waste management firms.

Good housekeeping practices will be maintained during all phases of the construction program. The construction areas will be kept free of trash and litter, and all Project related garbage will be collected in secure containers for eventual transfer to the nearest landfill or other approved disposal facility.

3.8 OPERATION AND MAINTENANCE

The following section describes the Facility Operations Plan; including daily operations activities and routine/ unplanned maintenance activities.

3.8.1 WIND TURBINE OPERATION

The wind energy centre will require full time technical and administrative staff to maintain and operate the facility. The primary workers will be wind technicians (i.e., technicians who carry out maintenance on the WTGs) along with a site supervisor. The Project will be operated by a staff of two to three people who will work out of the offsite Operations and Maintenance Building.

The WTGs will be operating (i.e., in “Run” mode and generating electricity) when the wind speed is within the operating range for the WTG and there are no component malfunctions. Each WTG has a comprehensive control system that monitors the subsystems within the WTG and the local wind conditions to determine whether the conditions are suitable for operation. If an event occurs which is considered to be outside the normal operating range of the WTG (such as low hydraulic pressures, unusual vibrations or high generator temperatures), the WTG will immediately take itself out of service and report the condition to the Operations Centre, located in the off-site Operations and Maintenance Building. A communication line connects each WTG to the Operations Centre, which closely monitors and, as required, controls the operation of each WTG. The WTG system will be integrated with the electric interconnection Supervisory Control and Data Acquisition to ensure that critical controls, alarms and functions are properly co-ordinated for safe, secure and reliable operation. The WTG will also report to SWEB’s Operations Facility during non-working hours.

3.8.2 ROUTINE TURBINE MAINTENANCE

Routine preventative maintenance activities will be scheduled at six-month intervals with specific maintenance tasks scheduled for each interval. Maintenance involves removing the WTG from service and having two to three wind technicians climb the tower to spend a full day carrying out maintenance activities.

Consumables such as the various greases used to keep the mechanical components operating and oil filters for gearboxes and hydraulic systems will be used for routine maintenance tasks. Following all maintenance work on the WTG, the area is cleaned up. All surplus lubricants and grease-soaked rags are removed and disposed of as required by applicable regulations. All maintenance activities will adhere to the same spill prevention protocols undertaken during the construction phase.

3.8.3 UNPLANNED TURBINE MAINTENANCE

Modern WTGs are very reliable and the major components are designed to operate for approximately 25 years. However, there is a possibility that certain component failures may occur despite the high reliability of the WTG fleet-wide. Most commonly, the failure of small components such as switches, fans, or sensors will take the WTG out of service until the faulty component is replaced. These repairs can usually be carried out by a single crew visiting the WTG for several hours.

Events involving the replacement of a major component such as a gearbox or rotor are rare. If they do occur, the use of large equipment, sometimes as large as that used to install the WTGs, may be required.

It is possible that an access road, built for construction and returned to previous existing conditions when the construction phase is completed, will need to be rebuilt to carry out repairs to a damaged WTG. Typically only a small percentage of WTGs will need to be accessed with large equipment during their operating life.

3.8.4 ELECTRICAL SYSTEM MAINTENANCE

The collector lines and substation will require periodic preventative maintenance activities. Routine maintenance will include condition assessment for above-ground infrastructure and protective relay maintenance of the substation, in addition to monitoring of the secondary containment system for traces of oil. Finally, vegetation control will be required around the transmission line to prevent any damage to the line and ensure safe operation.

3.8.5 WASTE MANAGEMENT

Waste generated during the operations phase will be removed by a licensed operator and disposed of at an approved facility. Any lubricants or oils resulting from WTG maintenance will be drummed on site and disposed of in accordance with applicable Provincial regulations. All reasonable efforts will be made to minimize waste generated and to recycle materials including returning packaging material to suppliers for reuse/recycling. The spill prevention protocols followed during construction will continue to be observed throughout the facility's operations and maintenance activities.

3.8.6 ENVIRONMENTAL MONITORING

Monitoring activities including post-construction bird and bat mortality monitoring will be carried out at the wind project during its operation. The specific monitoring activities will be developed with NBDERD as part of the overall permitting and approvals phase of the project.

3.9 DECOMMISSIONING

The anticipated life of the Project is estimated to be 25 years. The following describes how the Project will be decommissioned. The decommissioning process will involve removing the WTG, including the tower, generator, auxiliary equipment, above ground cables/poles, fixtures, all other personal property and otherwise restoring the premises to its original condition. If it is agreed upon with NBDERD, access roads and underground cables may be left in place. Foundations shall be removed to original soil depth or 1.2 m below grade, whichever is the lesser, and replaced with topsoil. Within 12 months of initiating the decommissioning process, the Project owner will have removed the relevant components from the leased land.

The decommissioning of the Project will be undertaken in compliance with the appropriate Health and Safety regulation. As with construction, a manager responsible for safety will be present on site for the duration of the work.

3.9.1 DECOMMISSIONING AFTER CEASING OPERATIONS

Properly maintained WTGs have an expected life of at least 25 years. At the end of the project life, depending on market conditions and project viability, the WTGs may be 're-powered' with new nacelles, towers, and/or blades, thus extending the useful life of the project and delaying any decommissioning activities. Alternatively, the WTGs may be decommissioned.

The following activities for the removal of the components will be undertaken once decommissioning is initiated:

- Remove above-ground collection system including substation and point of connection
- Remove WTGs
- Partial removal of WTG foundations, and
- Remove WTG access roads, if required by landowners

The following anticipated decommissioning plan is based on current procedures and experience. The specifics of these procedures may be adjusted to reflect additional decommissioning experience in the future.

WIND TURBINES

The first stage of the disassembly will be to have wiring crews disconnect the tower from the collection system and disconnect the wiring between WTG sections. A disassembly crew will then use a crane to remove the blades, the rotor, nacelle and then the towers section by section. The lubricating oil will be drained from the gearbox once it has been placed on the ground, and the oil will be disposed of in accordance with applicable regulations. As the WTG is being disassembled, the various components will be transported off-site.

WIND TURBINE FOUNDATIONS

Once all the WTG components have been cleared from a site, the top metre of overburden around the foundation will be excavated and stockpiled. Once cleared, the top 1.2 m of the foundation (or to bedrock) will be demolished. The resulting concrete and rebar will be hauled off-site and disposed of at a licensed facility. Afterwards, the stockpiled soil will be used to replace the now cleared area. The disturbed area will be feathered out and graded. No off-site soil is predicted to be needed.

ACCESS ROAD REMOVAL

New access roads will be left at NBDERD's request or graded to restore terrain profiles (as much as possible), and re-vegetated. Upgraded access roads will not be removed.

CABLE WIRE DECOMMISSIONING

At the time of decommissioning, if appropriate, the underground cables will be left in place. The lines will be cut and the ends buried to 1.2 m below grade. Above ground junction boxes will be removed.

ELECTRICAL SUBSTATION DECOMMISSIONING

The substation electrical components will be either removed as a whole or disassembled, pending reuse or recycling. Once cleared, the gravel around the yard will be reclaimed (unless the landowner wishes to keep the area as is) and the fence removed. As with the WTG foundation, the substation foundation will be excavated and the top 1.2 m of concrete (or to bedrock) will be demolished and hauled off-site to be disposed of at a licensed facility. The excavated area will then be filled in with native soil and re-graded. Any material that has been used as a sound attenuating berm will be levelled and replanted to the requirements of the landowner.

CRANE PAD DECOMMISSIONING

The crane pad aggregate will be removed and areas will be filled unless the landowner requests it to remain.

3.9.2 PROCEDURES FOR DECOMMISSIONING

Decommissioning procedures will be similar to the construction phase and will include:

— The creation of temporary work areas. In order to provide sufficient area for the lay-down of the disassembled WTG components and loading onto trucks, an area must be cleared, levelled and made accessible. The topsoil will be removed and some material may need to be added.

— The creation of crane pads. The crane pads will typically be 15 m by 35 m in size and will be located within the temporary work area around each WTG. The topsoil at the crane pad will be removed and approximately 600 mm of compacted crushed gravel will be added. Once the WTG disassembly is complete, the gravel area around each WTG will be removed and the area will be restored to prior use using stockpiled topsoil.

— The use of cranes to remove the blades, hub and tower segments.

— The use of trucks for the removal of WTGs, towers and associated equipment.

- The removal of the top 1.2 m of the WTG foundations and replacement with clean fill and stockpiled topsoil. The fill and topsoil will be contoured to allow cultivation in the case of agricultural lands.
- Road bedding material will be removed and replaced with clean subsoil and topsoil for reuse by the landowner for agricultural purposes. It is proposed to leave culverts in place following the operations phase.
- Cutting underground electrical lines, burying the ends to 1.2 m below grade, and leaving the lines in place. Above-ground lines and poles will be removed and the holes will be filled with clean fill.
- The substation will be demolished. This will be decommissioned in a manner appropriate to and in accordance with the standards of the day. All materials will be recycled, where possible, or disposed off-site at an approved and appropriate facility.

3.9.3 RESTORATION OF LAND AND WATER NEGATIVELY AFFECTED BY THE FACILITY

Once all of the WTGs and ancillary facilities are removed, the remaining decommissioning work will consist of shaping and grading the areas to, as near as practicable, the original contour prior to construction of the WTGs and access roads. All areas, including the access roads, transformer pads and crane pads will be restored to, as near as practical, their original condition with native soils and seeding. If there is insufficient material onsite, topsoil and/or subsoil will be imported from a source acceptable to the landowner.

3.10 FUTURE MODIFICATIONS, EXTENSIONS, OR ABANDONMENT

There are no future phases planned for the Project. The Project will be in operation for 25 years, which is consistent with the WTG life expectancy. Prior to the end of the Wind Farm Lease and Licence of Occupation for Access and Distribution, decommissioning and site reclamation plans will begin or a new registration may be obtained to extend the life of the Project.

3.11 DOCUMENTS RELATED TO THE UNDERTAKING

All Project related documents are included in the Appendices of this report as follows:

- Appendix A – Clearances And Approvals
- Appendix B – Preliminary Indigenous Knowledge Study
- Appendix C – Letter of Support
- Appendix D – Noise Impact Assessment
- Appendix E – Bird Inventory Report
- Appendix F – Bat Inventory Report
- Appendix G – Archaeology Report
- Appendix H – Visual Impact Assessment
- Appendix I – Shadow Flicker Assessment
- Appendix J – Electromagnetic Interference Study

The following list of applications have been submitted to any municipal, provincial or federal agency concurrently with the EIA registration and are included in Appendix A. Upon completion of the final Project design, WISK will resubmit all Federal-specific WTG permit applications as required.

- Harvesting Permit for Crown Land P70034280 to SWEB Development by the Minister of Natural Resources, with the effective date 2018-01-11 for tree clearing to conduct borehole sampling.
- Harvesting Permit for Crown Land P70029174 to SWEB Development by the Minister of Natural Resources, with the effective date 2016-08-19 for tree clearing to install a 60 m meteorological tower.

- NBDERD – Licence of Occupation for Wind Exploration with Option Agreement, dated June 30, 2016 for SWEB Development.
- NAV Canada – Clearance for Meteorological Tower, dated June 17, 2016 for SWEB Development.
- NAV Canada – Clearance for 5 Wind Turbines, dated December 2, 2017 for SWEB Development.
- Environment Canada Weather Radar - Clearance for Albert Wind Project received October 18, 2016 for SWEB Development.
- CCG - Clearance received for Wind Farm – Riverside-Albert, NB, dated October 13, 2016 for SWEB Development.
- RCMP - Clearance received regarding Riverside-Albert Wind Project, dated October 31, 2016 for SWEB Development, GV 1620-7-3.
- Transport Canada – Aeronautical Assessment Form for Obstruction Evaluation for five wind turbines, dated 2017-10-25, TC # 2017-265 for SWEB Development.
- Transport Canada – Aeronautical Assessment Form for Obstruction Evaluation for meteorological test tower, dated 2016-04-12, TC # 2016-047 for SWEB Development.

It is not anticipated at this time that any work within 30 m of a watercourse or wetlands is required for the Project. However, 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 as it will be required for the Project. 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 water on-site during Project construction.

4 DESCRIPTION OF THE EXISTING ENVIRONMENT

This section provides a description of the existing environmental conditions for the biophysical and human components that may be influenced by the Project. The information provided in this section is based on field surveys, existing data sources, data bases, and mapping available for the location. Information presented in this section pertains to the Project footprint and the surrounding biophysical environment. The Project footprint includes the five (5) proposed WTG locations, access to WTGs from the existing Crown Land Access road, and access to the site from the existing New Ireland Road.

For the purposes of this report, SOCC are identified as floral or faunal species that are ranked by the ACCDC, protected by the NB SARA, designated by COSEWIC as threatened, endangered, or special concern or protected by the federal SARA. Although many SOCC ranked by the ACCDC are considered rare in NB, those protected or listed by federal and provincial legislation are of particular concern.

4.1 ATMOSPHERIC ENVIRONMENT

4.1.1 CLIMATE

Most of the climate in NB is considered to be continental as a result of westerly air flows passing over the interior of the continent, as opposed to a Maritime Climate that is impacted by flows over a temperature-moderating ocean.

The Project is within in the Caledonia Uplands of the Central Uplands Ecoregion in southeastern NB (Zelzany, 2007). The Caledonia Uplands encompasses a broad plateau adjacent and parallel to the Bay of Fundy and is characterized by a cool and wet climate that is influenced by the uplands high elevation and the influence of the Bay of Fundy. It is characterized by warm summers, however, because of proximity of the Bay of Fundy, the area receives high precipitation.

The closest Canadian Climate Station that meets the United Nations' World Meteorological Organization (WMO) standard is at the Moncton Airport and is approximately 45 km northeast of the Project (46°06'19.10" N, 64°41'01.70" W). The nearest climate station to the Project is Alma (45°36'00.00" N, 64°57'00.00" W), approximately 13 km to the southwest. Although Alma is not a station that meets WMO standard, data from this station is also considered as it is adjacent to the Caledonia Uplands. No stations are within the Project area, therefore no site-specific data are available. Climate data from Moncton and Alma are expected to be representative of the conditions in the Project area. The climate normals are calculated from data between 1981 and 2010.

The climate normals station data at Moncton A is presented in Table 4.1 1. The warmest month is July with an average temperature of 18.8 °C and the coldest is January with an average temperature of -8.9°C (Government of Canada, 2018). The mean annual precipitation is approximately 1,200 mm with approximately 876 mm falling as rain.

The climate normals station data at Alma is presented in Table 4.1-2. The warmest month is August with an average temperature of 17.2 °C and the coldest is January with an average temperature of -7.4°C (Government of Canada 2018). The mean annual precipitation is approximately 1,510 mm with approximately 1,227 mm falling as rain.

Table 4.1-1 1981 to 2010 Canadian Climate Normals Station Data – Moncton A, New Brunswick

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Daily Average (°C)	-8.9	-7.6	-2.9	3.5	10	15.2	18.8	18.2	13.6	7.6	1.9	-4.8	5.4
Rainfall (mm)	28.8	28.4	49.2	62.3	92.5	94.6	92.1	80.8	93.5	112.1	87.3	54.2	875.7
Snowfall (cm)	78.1	64.7	64.5	31.2	3.8	0	0	0	0	1.2	19.4	62.4	325.3
Precipitation (mm)	103.3	90.9	115.6	97.6	96.9	94.6	92.1	80.8	93.5	113.4	107.2	114.4	1200.4

Source: Government of Canada, 2018

Table 4.1-2 1981 to 2010 Canadian Climate Normals Station Data - Alma, New Brunswick

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Daily Average (°C)	-7.4	-6.1	-1.7	4.1	9.5	13.8	17.1	17.2	13.7	8.2	3	-3.3	5.7
Rainfall (mm)	67	47.1	89.6	101.4	124.8	110	99.4	93.9	122.7	132.9	147.4	90.4	1226.6
Snowfall (cm)	79.2	55.1	54	18.2	1.7	0	0	0	0	0	11.7	55.3	275.1
Precipitation (mm)	144.9	107.8	145.8	120.7	126.5	110	99.4	93.9	122.7	132.9	158.9	146.6	1510.1

Source: Government of Canada, 2018

4.1.2 VISIBILITY AND FOG

In general, autumn is the foggiest season in NB with occurrences on four or five days of each month (ECCC, 1990). However, the foggiest times in the Fundy Region of NB is in the spring and summer (Robichaud and Mullock, 2001). This results when moist air from the interior of the Province meets the cold waters of the bay. Fog can occur on more than 185 days of the year with most of the fog occurring in July in Saint John and approximately 50 days in Moncton. Sea fog most commonly occurs at night and the early morning with it burning off by the afternoon (ECCC, 1990).

No specific data are available for the Project area, however it is anticipated that the number of fog days is approximately 50 days because the foothills can act as a barrier preventing fog from moving further inland.

4.1.3 WIND RESOURCE

The nearest weather station with wind data is Moncton A. Wind speed, most frequent direction and maximum hourly speed data are available between 1981 and 2010 (Government of Canada 2018). The average annual wind speed is 16.8 km/h. Average wind speeds drop below average from May through October where the prevailing wind direction is from the southwest. Wind speeds are 17.8 km/hr and higher from November to April, with peak winds occurring in December through March and the prevailing wind direction is from the west. On average, there are 23.6 days per year with wind speeds greater than 52 km/h and the maximum gust recorded was 161 km/h.

SWEB installed a MET tower at the Project site at 45°42'32.15"N, 64°53'3.19"W in October 2016. Wind speed at 60 m, 50 m, and 40 m were collected as part of the data set. Data up to January 2018 was reviewed. The average monthly wind speeds recorded were between 20 kilometres per hour (km/hr) to 29 km/hr and the prevailing wind direction is from the southwest. Wind speeds are typically higher from October through January, with peak winds occurring in October.

The assessment of the wind resource data from the MET and WindCube LiDAR unit at the Project site has illustrated that the wind resource may be classified as an IEC 61400-12-1 Class IIA site. In general, the site wind characteristics give confidence that the Project will be highly productive and consistent.

4.1.4 AMBIENT AIR QUALITY

The Air Quality Regulation in NB's *Clean Air Act*, details the maximum permissible ground level concentrations of several parameters for air quality in NB. The Air Quality Regulation states that a stationary "source" that releases air contaminants to the environment must obtain approvals to release those air contaminants.

The ambient air quality is monitored by the NB Department of Environment and Local Government at established monitoring stations throughout the province. The closest air quality monitoring station to the Project Area is located in Moncton, approximately 40 km north of the Project. The air quality monitoring station in Moncton measures ozone, fine particulate matter, carbon dioxide, and nitrogen dioxide as part of the ambient air monitoring network. The most recent annual report for Moncton is 2015, which provides the current data summarized below (GNB, 2015).

The Project is about 5 km east of Teahans Corner. There are no major industrial facilities in the area. Forestry is a common activity in the area. The Kent Hills wind farm is about 5 km north of the Project. Air emissions would principally be generated from transportation related activities including gravel surfaced roads and emissions from vehicles used for transporting lumber. Given the remote location of the Project, air quality is expected to be better than that recorded in Moncton.

OZONE

In 2015, the ground level ozone concentration measured over an 8-hour averaging time, was 52 parts per billion (ppb), which is below the Canadian Ambient Air Quality Standards (CAAQS) value of 63 ppb.

FINE PARTICULATE MATTER

The daily value for Moncton in 2015 was 14 micrograms per cubic metre ($\mu g/m^3$), which is below the CAAQS of 28 $\mu g/m^3$. The annual average concentration was 5.8 $\mu g/m^3$, which is below the CAAQS of 10 $\mu g/m^3$.

CARBON MONOXIDE

In 2015 there were no exceedances of the 1-hour (30 parts per million [ppm]) NB Air Quality Objectives (NBAQO) standard recorded at the Moncton monitoring station. All recorded values were less than 5 ppm.

NITROGEN DIOXIDE

In 2015 there were no exceedances of the 1-hour (210 ppb) NBAQO standard recorded at the Moncton monitoring station.

AIR QUALITY HEALTH INDEX

The Air Quality Heath Index (AQHI) is provided by Environment and Climate Change Canada (Government of Canada, 2016). This tool is an indexed scale to help Canadians understand how air quality effects health. The AQHI scale is separated into four categories; Low Risk (1-3); Moderate Risk (4-6); High Risk (7-10); and Very High Risk (above 10). Average monthly AQHI for Moncton are summarized in Table 4.1 3 for the period November 2015 to November 2016 (ECCC, 2018a). The yearly average AQHI of 1.71 corresponds to a 'Low Risk' AQHI rating.

Table 4.1-3 Moncton AQHI monthly averages (January 2017 to January 2018)

MONTH	MINIMUM	MAXIMUM	MEAN
Jan 2017	1.4	4.3	2.0
Feb 2017	1.6	4.6	2.4
Mar 2017	1.2	3.3	2.2
Apr 2017	1.1	3.7	2.1
May 2017	1.0	3.6	1.8
Jun 2017	1.0	3.6	1.6
Jul 2017	1.0	2.9	1.4
Aug 2017	1.0	3.9	1.4
Sep 2017	1.0	2.8	1.3
Oct 2017	1.0	3.6	1.4
Nov 2017	1.0	2.8	1.5
Dec 2017	1.0	2.5	1.5
Jan 2018	1.0	3.2	1.7

Source: (ECCC, 2018a)

GREENHOUSE GAS EMISSIONS

Greenhouse gases (GHGs) include CO_2, methane (CH_4), and nitrous oxide (N_2O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) and can be emitted from a variety of natural and anthropogenic sources. GHGs emitted from natural sources generally exhibit little variation from one year to the next, and are considered to be nominal when compared to those resulting from the combustion of fossil fuels. Total GHG emissions are normally reported as CO_2-equivalents (CO_2e) which considers the global warming potential of the GHGs.

Emissions vary by province, because of factors such as population, energy sources and economic base. In 2015, NB released its "Guidelines for Greenhouse Gas Management for Industrial Emitters in New Brunswick". NB's goal is to reduce greenhouse gas emissions to 10% below 1990 levels by 2020 and 75% to 85% below 2001 levels by 2050. In 1990, NB's GHG emissions were 16.3 megatonnes of CO_2e. In 2015, NB's GHG emissions were 14.1 megatonnes of CO_2e (ECCC, 2018b). The majority (88%) of NB's GHG emissions are from the energy sector, of which stationary combustion sources (58%) was the main source; transport (29%) and fugitive sources (1%) were also contributors to the energy sector emissions. The remainder of the emission sources are from industrial processes and product use (4%), agriculture (4%) and waste (5%) (ECCC, 2018b).

4.1.5 AMBIENT NOISE LEVELS

Sound is what we hear, while noise is unwanted sound. The difference between the two is dependent on the listener and the circumstance. Outdoor ambient noise is produced and influenced by a variety of natural and anthropogenic factors. The noise can be continuous, variable, intermittent or impulsive. The loudness and type of noise heard can lead to annoyance, stress and interference with speech communication. Some research suggests that the adverse effects described above may also cause sufficient stress on the body to increase the risk of developing stress-related illnesses (Health Canada, 2014).

WSP completed a Noise Impact Assessment (NIA) for the Project. The full report is included in Appendix D. The following is a brief summary of the existing acoustic environment for the Project.

Ambient sound levels were measured at four (4) receptor points, over a 24-hour period. Data was collected on November 1st, 2017, from midnight to midnight the following day. The receptor points were located at the three (3) noise sensitive receptors located within 1 km of the proposed WTGs and at the proposed substation location as follows:

- Receptor R1: cabin located south of New Ireland Road at 45°43’45’’N, 64°52’47’’W;
- Receptor R2: warming shack located next to Kent Road intersection at 45°43’43’’N, 64°53’16’’W;
- Receptor R3: located by Priest Lake at 45°42’25’’N, 64°53’47’’W;
- Receptor R4: located by New Ireland Road, next to the substation location at 45°43’56’’N, 64°45’30’’W.

The microphones were located away from any large reflecting surfaces and approximately 1.5 m above ground. Sound measurements were performed using Larson Davis sound level meters, models LXT, SN: 2611, 4823, 4824 and 4826 and Larson Davis precision acoustic calibrator, model CAL200. Sound measurements were analyzed and extraordinary events (e.g., people speaking and animal noises close to the microphone or helicopters flying overhead) were excluded from the analysis.

The existing acoustic environment surrounding the Project site is typical of a rural/natural environment due to its remote location, with sounds of nature (e.g., wind and birds) dominating and occasional contributions from local road traffic.

4.2 GEOLOGY, TERRAIN, AND SOILS

Bedrock geology is predominantly of the Broad River Group and Intrusive Rocks of the Middle Neoproterozoic age (GeoNB, 2015). The Broad River Group underlying the Project includes the Teahans Corner formation which is composed of mixed volcanic and sedimentary rocks. The Intrusive Rocks are composed of Forty Five River Grandorite which are intermediate intrusive rocks. Surficial geology in the Project area is predominantly compact till that is sometimes carbonated (Foisy, 1989). There are substantial areas of till veneers overlying bedrock and are interspersed with bedrock outcrops.

The terrain within the Project area is mapped as predominantly level to gently rolling (slope gradients of less than 2% to 8%) (GeoNB, 2015). The soils within the Project area are dominantly within the Lomond Forest Soil Unit (GeoNB, 2015). Lomond soils are predominantly Orthic Humo-Ferric Podzolic soils developed on till materials deposited on felsic volcanic or mixed igneous rocks and/or felsic pebble conglomerates.

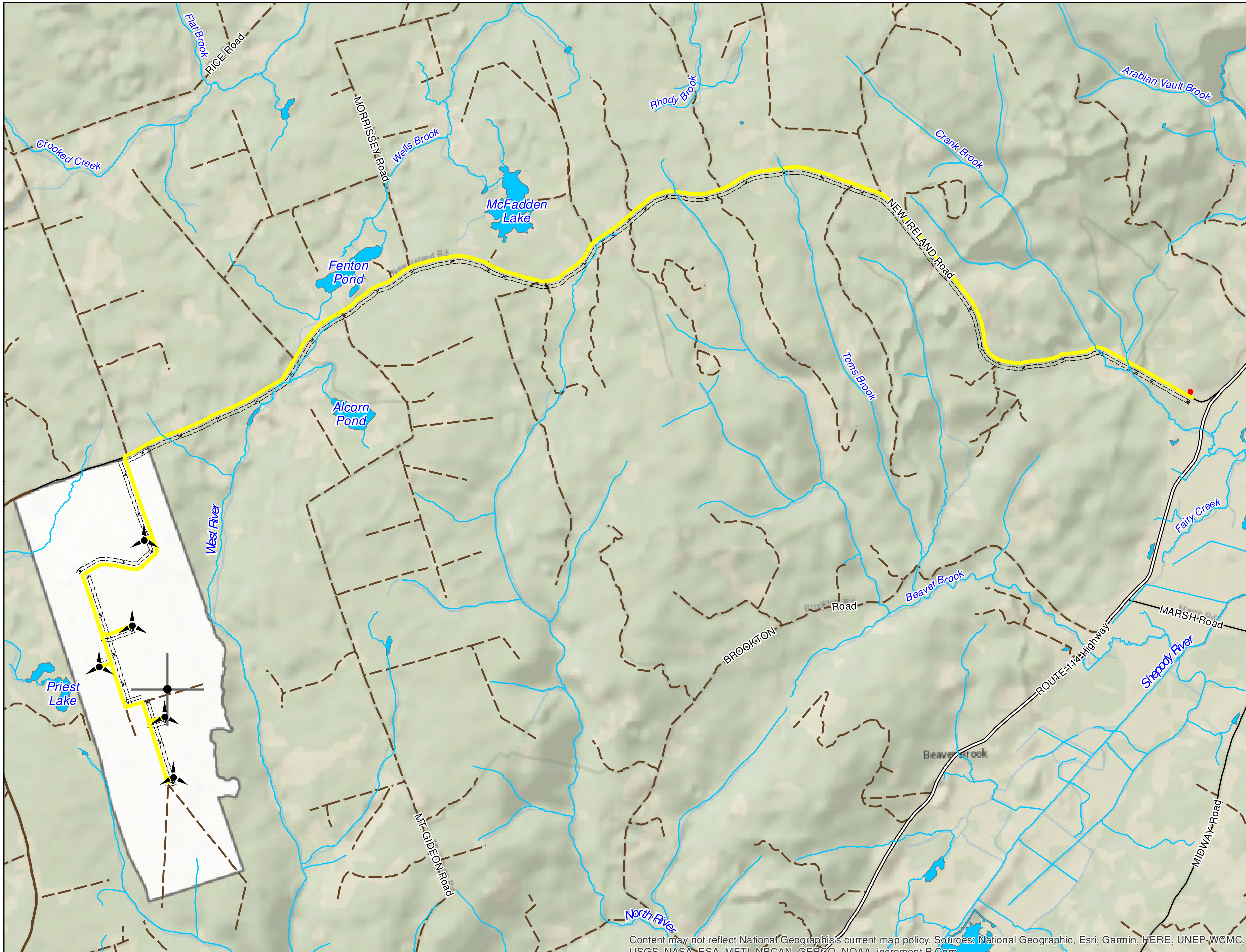
4.3 GROUNDWATER RESOURCES

No municipal potable water well fields are in the Project area. A query of the NB Online Well Log System did not identify any water wells or groundwater chemistry data within 1 km of the Project (NB Department of Environment and Local Government, 2018). There are no protected wellfields within the vicinity of the Project. The Riverside-Albert wellfield is 9 km northeast of the WTG locations, and Approximately 1.7 km north of the existing New Ireland Road. The Riverside-Albert wellfield is protected under the Wellfield Protection Area Designation Order, however, it is outside of the Project footprint and will not be affected by Project construction.

4.4 SURFACE HYDROLOGY

The Project crosses two watersheds; the Chignecto Bay Composite Level 2 watershed in the East Fundy Composite Level 1 watershed to the west and the South Channel Level 2 watershed within the Petitcodiac River Basin Level 1 watershed to the east. The Chignecto Bay Composite watershed has a drainage area of approximately 651 square kilometres (km^2) and the East Fundy Composite watershed has a drainage area of approximately 1,515 km^2. The South Channel watershed has a drainage area of approximately 459.61 km^2 and the Petitcodiac River Basin watershed has a drainage area of approximately 2,832 km^2.

There are numerous small lakes, brooks, creeks, and streams that traverse the area and are shown on Figure 4.4-1. The location of the WTGs and access road does not cross any watercourses or waterbodies. Several watercourses are in close proximity to the existing New Ireland Road. All of the watercourses within 1 km of the Project are first- and second-order streams. Duffy Brook and West River are within 1 km of the proposed WTGs and Crown Access



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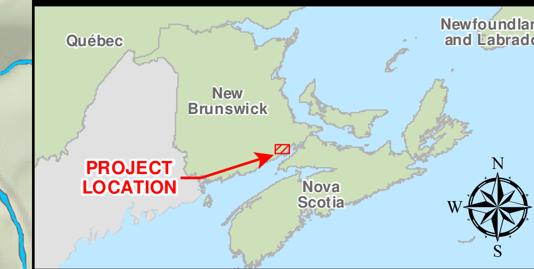

LEGEND:

- WTG
- MET TOWER
- TRANSMISSION LINE
- PROJECT FOOTPRINT
- WATERCOURSE
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- SUBSTATION FOOTPRINT
- WATERBODY
- LAND LEASE AREA (1252 ha)

PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: 161-08790 PHASE 19

CLIENT: WISOKOLAMSON ENERGY LP

FIGURE:

TITLE:
SURFACE WATER FEATURES

FIGURE NO.: 4.4-1
REVISION NO.: 0

SCALE: 1:35,000
0 500 1,000 2,000 Metres

DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/12

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Road. Beaver brook, Tom's Brook, Crank brook, and Rhody Brook are near New Ireland Road. Four named waterbodies were identified near New Ireland Road and include Alcorn pond, Fenton Pond, Priest Lake, and McFadden Lake. McFadden Lake is the headwater of McFadden brook, which flows to the north away from the Project area. Of all the waterbodies found in the area, Priest Lake is the closest to the Project, and is approximately 280 m west of the proposed WTGs. Powerlines are planned to run parallel along the New Ireland Road and construction of the powerlines is planned to take place be inside the existing ROW.

4.5 FISH AND FISH HABITAT

The Project is within the Inner Bay of Fundy Recreational Fishery Area (ERD, 2017). Recreational fish species that may be present in waterbodies and watercourses in the Fishery Area include brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), arctic char (*Salvelinus alpinus,* found in historically stocked areas of southern NB), rainbow trout (*Oncorhynchus mykiss*), and smallmouth bass (*Micropterus dolomieu*). Non-sport fish species that may be present include burbot (*Lota lota*), chain pickerel (*Esox niger*), American eel (*Anguilla rostrata*), gaspereau (*Alosa pseudoharengus*), rainbow smelt (*Osmerus mordax*), shad (*Alosa* spp.), striped bass (*Morone saxatilis*), sturgeon (*Acipenser* spp.), whitefish (*Coregonus clupeaformis*), white perch (*Morone americana*), and yellow perch (*Perca flavescens*).

There are at least fourteen (14) fish species in the Petitcodiac Watershed (GNB, 2007). These include: gaspereau, American eel, American shad (*Alosa sapidissima*), Atlantic salmon (*Salmo salar*), Atlantic tomcod (*Microgadus tomcod*), blueback herring (*Alosa aestivalis*), brook trout, brown bullhead (*Ameiurus nebulosus*), chain pickerel, rainbow smelt, smallmouth bass, striped bass, white perch and white sucker (*Catostomus commersonii*). There was no information on fish species in the East Fundy Composite watershed.

A search of the ACCDC was completed to compile a list of fish species that have either been previously detected in the Project area or have been observed in the surrounding area. One fish SOCC, Atlantic Salmon – Inner Bay of Fundy population was historically documented in West River and in Beaver Brook; however, the observation locations are greater than 5 km from the Project.

It should be noted that published information on fish occupancy is limited for waterbodies and watercourses in NB. All GeoNB watercourses are assumed fish bearing unless proven otherwise (Lambert, pers. comm., 2017). All unmapped watercourses with channel width greater than 0.5 m with an incised channel and mineral bed are considered fish bearing unless proven otherwise.

4.6 WETLANDS

Wetland ecosystems provide important habitat for a variety of SOCC and important ecological services for the environment and people. Regionally, the Caledonia Uplands contains a number of wetland types including peatlands, streamside alder swamps, marshes, and shallow open water communities. Peatlands are more common in the western portion and marshes are more common along the eastern portion of the region.

There are a number of wetlands within 1 km of the Project and are classified as shrub wetland, fen, and freshwater marsh (GeoNB, 2011; Figure 4.6-1). Shrub wetlands are associated with Duffy Brook, West River, and Beaver Book. The freshwater marsh is near Priest Lake and is approximately 270 m west of a proposed WTG. A fen is located 75 m east of the Project access road (New Ireland Road); this wetland is approximately 625 m from the nearest proposed WTG. A provincially significant wetland is associated with the Shepody River approximately 7 km to the southeast of the Project.

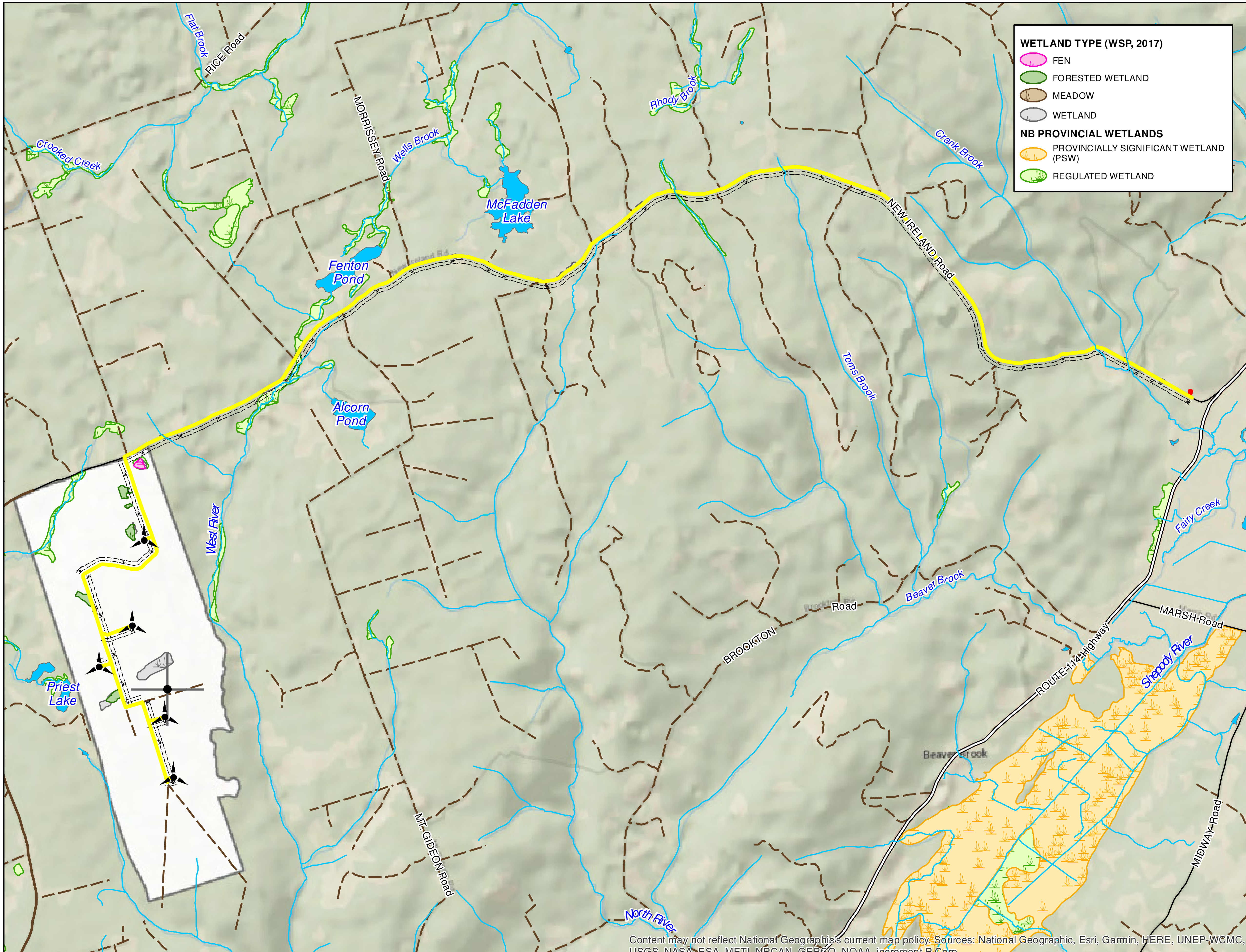
A site visit was completed in July 2016 to ground truth wetlands within a 150 m buffer along the existing Crown Land Access road and around the proposed WTGs locations known at the time of the site visit. The fen was confirmed and a number of areas of forested wetland were also identified that are not on existing provincial mapping (Figure 4.6-1).

4.6.1 FORESTED WETLAND

Forested wetland included area where tree cover amounts to greater than 15% crown closure and drainage was poor to very poor. Tree species observed included black spruce (*Picea mariana*), balsam fir (*Abies balsamea*), and red spruce (*Picea rubens*). The dominant shrub species observed was mountain holly (*Nemopanthus mucronatus*). Dominant forbs observed included dwarf red raspberry (*Rubus pubescens*), cinnamon fern (*Osmunda cinnamomea*), common lady fern (*Athyrium filix-femina*), sensitive fern (*Onoclea sensibilis*), crested wood fern (*Dryopteris cristata*), and white bog orchid (*Platanthera dilatata*). The dominant graminoid was three-seeded sedge (*Carex trisperma*). The bryophyte layer was dominated by Sphagnum moss (*Sphagnum* spp.).

4.6.2 FEN

The graminoid fen was characterized by a dominance of graminoids in the central part of the wetland and shrub cover around the margin of the fen and drainage was poor to very poor. Dominant graminoids observed included boreal bog sedge (*Carex magellanica*), thread rush (*Juncus filiformis*), rough cottongrass (*Eriophorum tenellum*), and three-way sedge (*Dulichium arundinaceum*). The forb observed included harlequin blue flag (*Iris versicolor*). Dominant shrubs observed around the margin of the fen included large cranberry (*Vaccinium macrocarpon*), white meadowsweet (*Spiraea alba*), leatherleaf (*Chamaedaphne calyculata*), and black huckleberry (*Gaylussacia baccata*).



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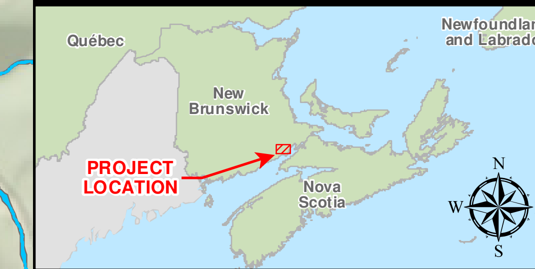
KEY MAP:



LEGEND:

- WTG
- MET TOWER
- TRANSMISSION LINE
- PROJECT FOOTPRINT
- WATERCOURSE
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- SUBSTATION FOOTPRINT
- WATERBODY
- LAND LEASE AREA (1252 ha)

PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY LP**

FIGURE:

TITLE:
WETLAND DISTRIBUTION

FIGURE NO.: 4.6-1	REVISION NO.: 0

SCALE: 1:35,000
0 500 1,000 2,000 Metres

DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/12

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4.7 TERRESTRIAL VEGETATION

The Project is within in the Caledonia Uplands of the Central Uplands Ecoregion in southeastern NB (Zelzany, 2007). Regionally, this Upland is characterised by tolerant hardwood forest. Ridges and upper slopes with well-drained soils support forest dominated by sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*), beech (*Fagus* spp.), and red spruce. Upland areas with level to gently sloping terrain are typically dominated by mixed forests of red spruce, yellow birch, and red maple (*Acer rubrum*) with some balsam fir. Valley bottoms and flatlands with poor soil drainage often contain forests of spruce (*Picea* spp.) and balsam fir. Pine (*Pinus* spp.) and poplar (*Populus* spp.) are uncommon because of the low fire frequency, a result of the cool, wet climate. In areas that have been harvested, an early successional community of intolerant hardwoods is present and dominated by species such as white birch, yellow birch, and balsam fir.

The forest cover polygon land cover product was obtained from GeoNB as a preliminary data source for vegetation identification (GeoNB, 2016). The land cover classification is interpreted from aerial imagery on a 10 year cycle for the province of NB and describes the stand characteristics for that polygon area. In addition, a search of provincial and federal databases was completed to identify any vascular and non-vascular plant SOCC that are present or have potential to be present in the Project area. The occurrence of SOCC informs on potential avoidance areas, additional mitigation requirements or permitting and additional site management requirements during construction.

The majority of the area is mapped as forest cover or where forestry activities are occurring. The dominant forest cover types mapped are Balsam fir (BFIR), Black spruce (BSPR), Red spruce (RSPR), Spruce (SPRC), Tolerant hardwood and intolerant hardwood (THIH), and Tolerant hardwood (TOHW) forest cover types (GeoNB, 2016). Softwood cover types are dominated by species such as black spruce, red spruce, white spruce (*Picea glauca*), and balsam fir (BFIR, BSPR, RSPR, SPRC). Red spruce and Spruce forest cover types in the area may also contain mature sugar maple and yellow birch. Hardwood cover types are dominated by tree species such as red maple, sugar maple, and yellow birch (THIH, TOHW). There are substantial areas where the forest cover has been harvested, either partially or completely in the early-1990s to mid-2000s. Replanting activities have occurred in some areas during the mid-1970s.

A site visit was completed in July 2016 to ground truth vegetation cover within a 150 m buffer along the existing Crown Land Access road and around the proposed WTGs locations known at the time of the site visit (Figure 4.7-1 and Figure 4.7-2). Vegetation cover identified includes regenerating balsam fir, regenerating TOHW, regenerating mixedwood, partially cleared TOHW, balsam fir forest, mixedwood forest, and intervale mixed mature forest. Roadsides and clear-cuts were also observed. These cover types are described in the following sections.

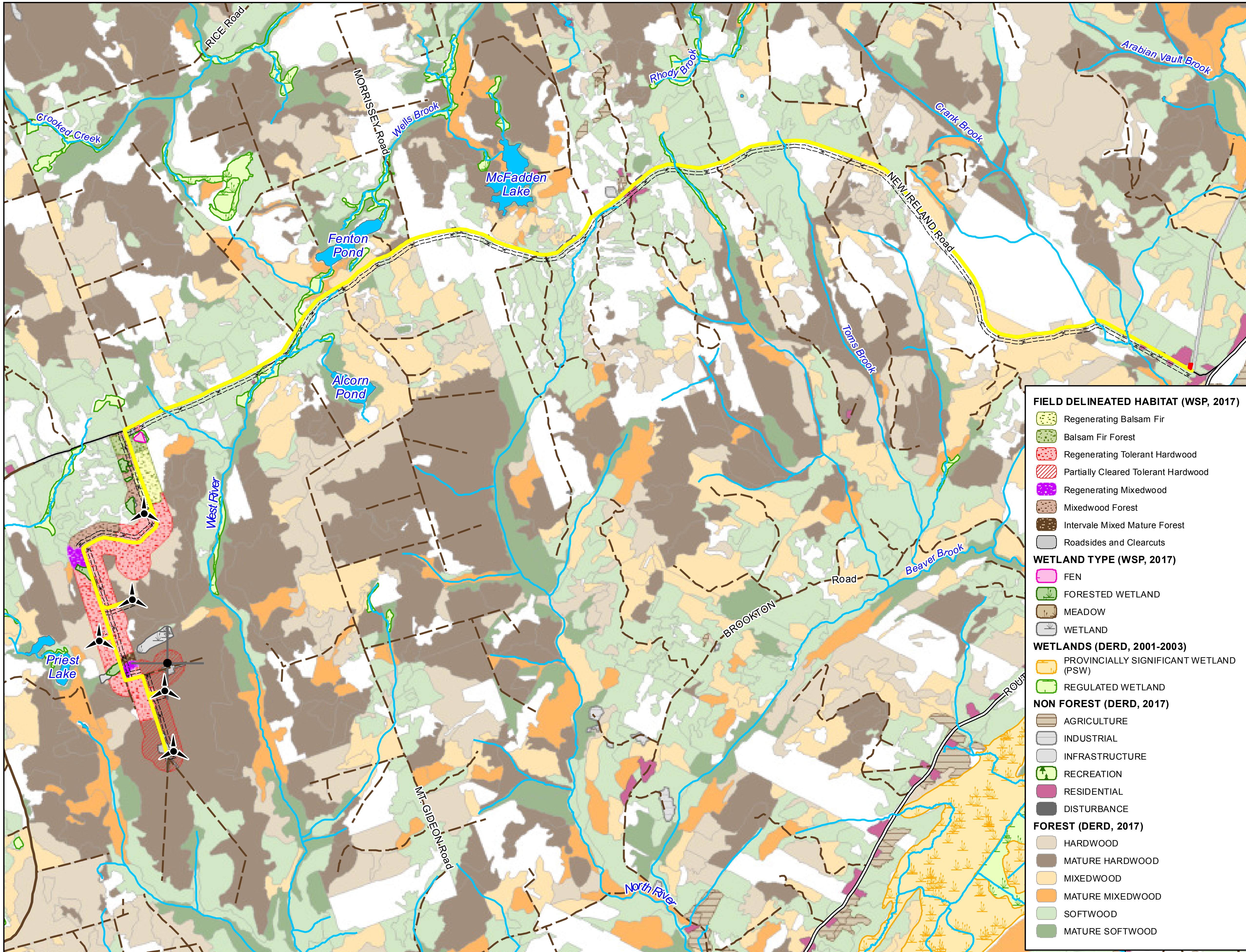
4.7.1 REGENERATING BALSAM FIR

Regenerating balsam fir is characterized by young forest where no active forestry is taking place. This cover type was dominated by stands of young balsam fir and gray birch (*Betula populifolia*). Other common species observed included sheep laurel (*Kalmia angustifolia*), velvet-leaved blueberry (*Vaccinium myrtilloides*) and Alleghaney blackberry (*Rubus allegheniensis*).

4.7.2 REGENERATING TOLERANT HARDWOOD

Regenerating tolerant hardwood is characterized by young forest where no active forestry was taking place. This cover type was dominated by stands of young yellow birch and American beech (*Fagus grandifolia*). Other common species observed included wild lily-of-the-valley (*Maianthemum canadense*), mountain wood fern (*Dryopteris campyloptera*), and Indian pipe (*Monotropa uniflora*).

KEY MAP:



LEGEND:

- WTG
- MET TOWER
- TRANSMISSION LINE
- PROJECT FOOTPRINT
- SUBSTATION FOOTPRINT
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- WATERCOURSE
- WATERBODY

PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY LP**

FIGURE:

TITLE:
VEGETATION COVER

FIGURE NO.: 4.7-1	REVISION NO.: 0
SCALE: 1:35,000 (0, 500, 1,000, 2,000 Metres)	
DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/12

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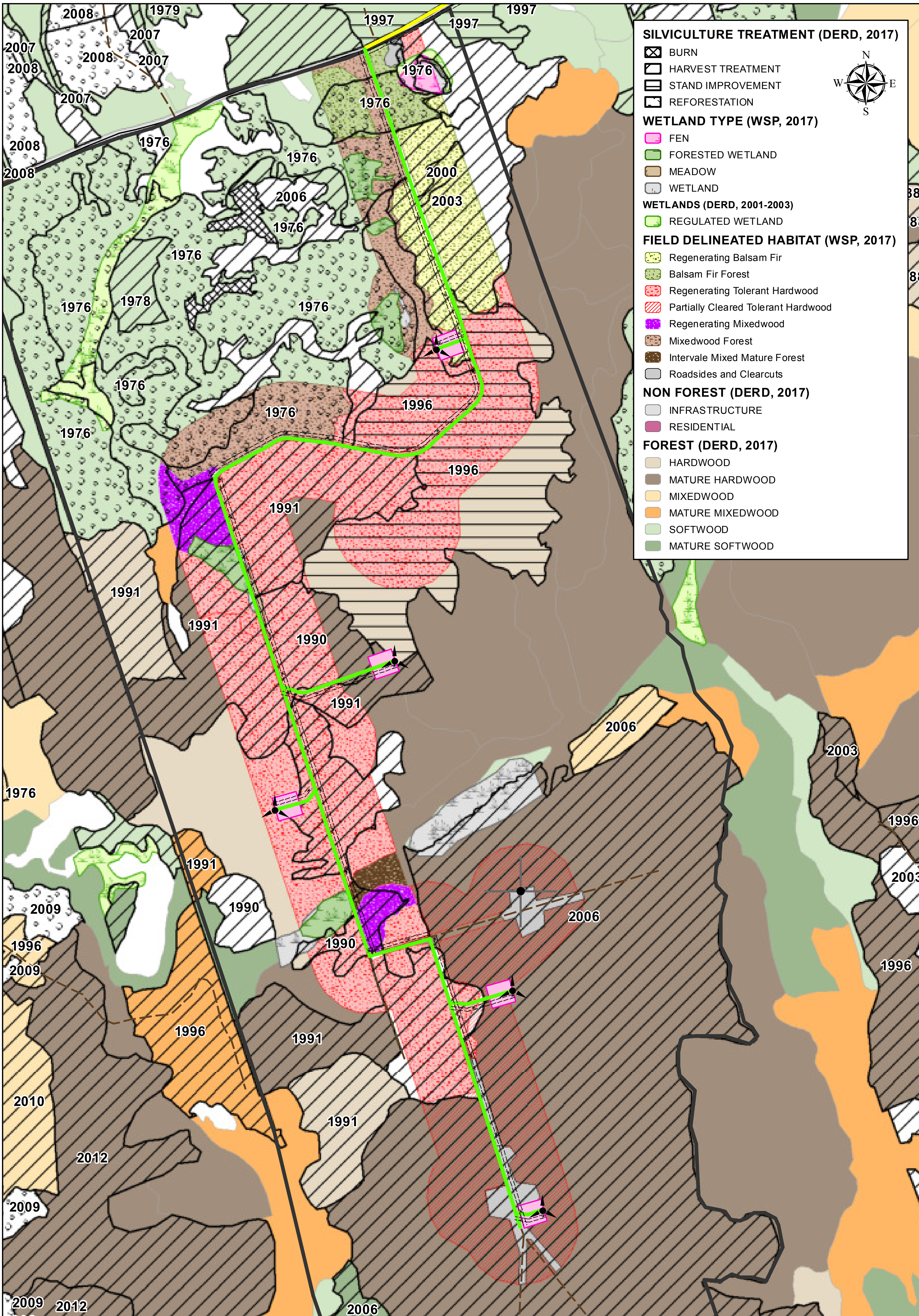
Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180405_161_08790_Phase19_FIG4_7_1_VegetationCover.mxd



PROJECT:	FIGURE:		LEGEND:
PROJECT: WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT	TITLE: VEGETATION COVER AND FORESTRY SILVICULTURE TREATMENTS	DATUM: NAD 83 CSRS	TRANSMISSION LINE; CROWN LAND ACCESS ROAD (EXISTING); NEW IRELAND ROAD (EXISTING); WTG ERECTION FOOTPRINT; LAND LEASE AREA (1252 ha); MET TOWER; WTG
		PROJECTION: NB STEREOGRAPHIC	
PROJECT NO.: 161-08790 PHASE 19	FIGURE NO.: 4.7-2 / REVISION NO.: 0	DRAWN BY: T. MOREHOUSE	
CLIENT: WISOKOLAMSON ENERGY LP	WSP Canada Inc. 1 Spectacle Lake Drive, Dartmouth, Nova Scotia www.wsp.com	CHECKED BY: J. FERNET	
		CREATED DATE: (YYYY-MM-DD) 2018-04-05	
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Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180405_161_08790_Phase19_FIG4_7_2_VegetationCover.mxd

4.7.3 REGENERATING MIXEDWOOD FOREST

This cover type was dominated by stands of young red maple, red spruce, and balsam fir. Other common species observed included Allegheny blackberry, red osier dogwood (*Cornus sericea*), flat top white aster (*Doellingeria umbellatum*), and fireweed (*Chamerion angustifolium*).

4.7.4 PARTIALLY CLEARED TOLERANT HARDWOOD

This cover type was dominated by stands of yellow birch and American beech. Other common species observed included red spruce, sugar maple, yellow bluebead lily (*Clintonia borealis*), and northern starflower (*Trientalis borealis*). This cover type was characterized by large cut areas 30 m or wider. No vegetation remained in the cleared areas.

4.7.5 BALSAM FIR FOREST

This small area of undisturbed forest near New Ireland Road was characterized by an overstory of balsam fir. Very few understory species were observed.

4.7.6 MIXEDWOOD FOREST

Mixedwood forest was observed in several different areas and were characterized by very few understory species. The most common understory species observed was bracken fern (*Pteridium aquilinum*). The overstory included both coniferous and deciduous species, however, this vegetation types was dominated by coniferous species. Dominant overstory species observed included balsam fir, white spruce, red spruce, red maple, yellow birch, and gray birch.

4.7.7 INTERVALE MIXED MATURE FOREST

This vegetation type occurred on a south-facing seepy slope. It was characterized by rich conditions. Dominant overstory species included yellow birch. Common understory species observed included Maryland sanicle (*Sanicula marilandica*), kidney leaved buttercup (*Ranunculus abortivus*), silvery glade fern (*Deparia acrostichoides*), and tall meadow rue (*Thalictrum pubescens*).

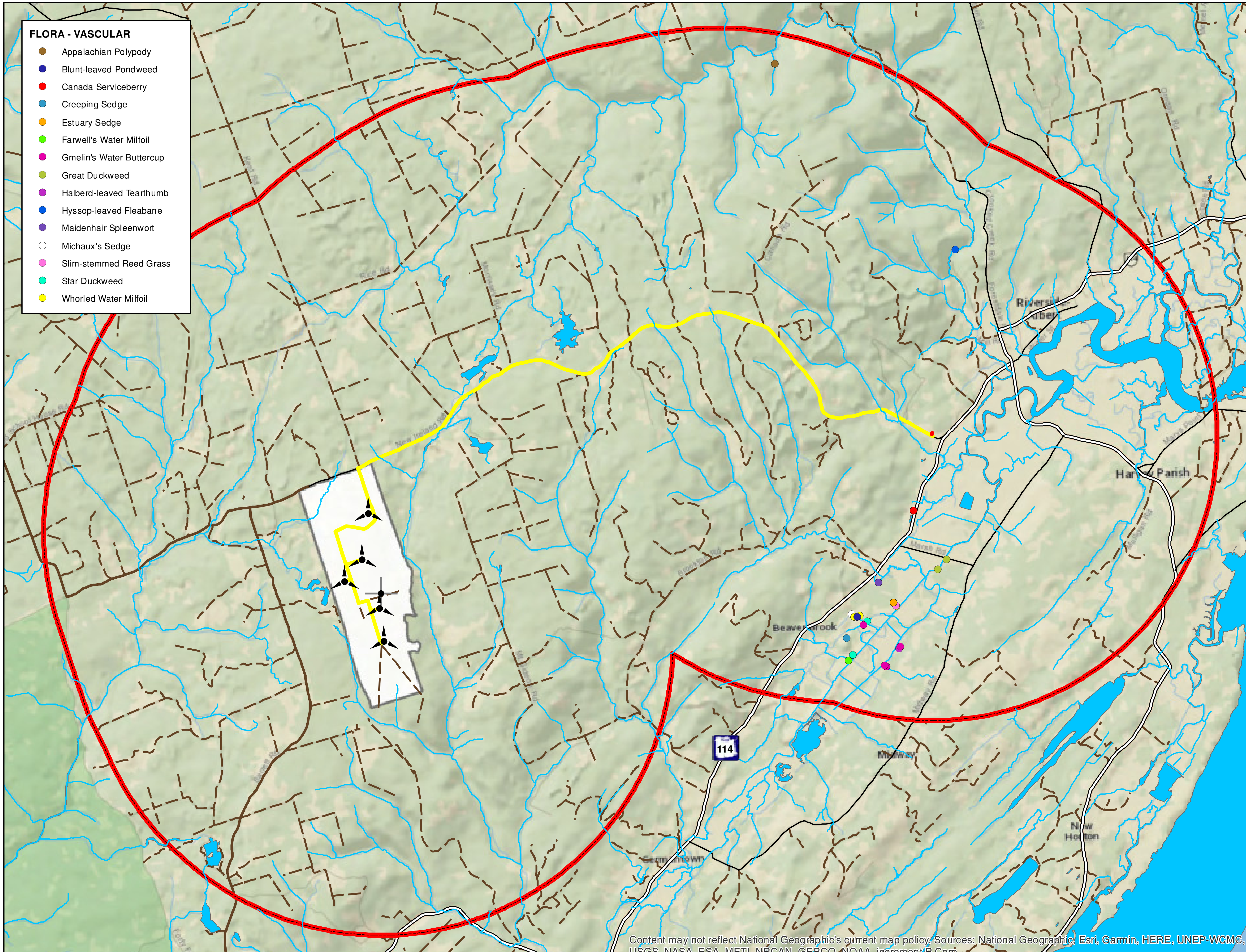
4.7.8 ROADSIDES AND CLEAR-CUTS

This is the result of roads and recent clearcuts with little to no vegetation. Non-native species such as mouse-ear hawkweed (*Hieracium pilosella*), coltsfoot (*Tussilago farfara*), and common dandelion (*Taraxacum officinale*) occurred along the entire length of the crown access road. Other common species observed regenerating in these areas included yellow birch, white spruce, pussy willow (*Salix discolor*), fireweed, evergreen wood fern (*Dryopteris intermedia*), grass-leaved goldenrod (*Euthamia graminifolia*), and small-fruited bulrush (*Scirpus microcarpus*).

4.7.9 SPECIES OF CONSERVATION CONCERN

Fifteen (15) vascular plant SOCC have been historically and recently observed within 5 km of the Project; the majority of which have been documented in Shepody National Wildlife Area (ACCDC, 2018; Figure 4.7-3; Table 4.7-1). No records of nonvascular plant SOCC have been documented within 5 km. A total of 180 provincially tracked non-vascular plants have ranges that overlap the Project, and two (2) of these are protected under the federal SARA and three (3) under the provincial SARA. A total of 317 provincially tracked vascular plants have ranges that overlap the Project, three (3) of which are protected under the federal SARA and four (4) under the provincial SARA.

The site visit completed in July 2016 did not document any plant SOCC. Although no plant SOCC were recorded during the site visit, it does not preclude the potential for plant SOCC to be present. Listed plants occurrences can be missed due to timing of surveys because plant SOCC presence can vary annually and locally. Climatic fluctuations (e.g., abnormal temperatures or precipitation) might affect flowering patterns, making plant SOCC more difficult to spot and identify. Available microhabitats can vary over time and space. Therefore, a site visit and database search cannot confirm the absence of plant SOCC; it can only confirm their presence. Because of these limitations, field survey results and habitat preferences of plant SOCC are used to determine potential for occurrence (Table 4.7-1). It was determined that the majority of the habitats immediately around the proposed WTG locations and Crown Access Road were of low potential to support these species. The fen was determined to be of high potential.



KEY MAP:

LEGEND:

- WTG
- MET TOWER
- PROJECT FOOTPRINT
- SUBSTATION FOOTPRINT
- 5 km BUFFER
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- WATERCOURSE
- WATERBODY
- LAND LEASE AREA (1252 ha)

PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: 161-08790 PHASE 19

CLIENT: WISOKOLAMSON ENERGY LP

FIGURE:

TITLE:
VEGETATION SPECIES OF CONSERVATION CONCERN

FIGURE NO.: 4.7-3	REVISION NO.: 0
SCALE: 1:65,000 (0 500 1,000 2,000 3,000 Metres)	
DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/13

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Table 4.7-1 Vegetation Species of Conservation Concern Previously Documented and Reported within 5 km of the Project

Common Name	Scientific Name	Provincial Rarity Rank	Provincial General Status Rank	Number of Records	Habitat Preference; Location Sighting
Trees and Shrubs					
Canada Serviceberry	*Amelanchier canadensis*	S3	Secure	2	Damp soil of swamps, wet streamheads, bogs, moist to wet thickets, and woods; Observed by Highway, 3 km southwest of Albert
Forbs					
Appalachian Polypody	*Polypodium appalachianum*	S3	Secure	1	Cliffs and rocky slopes; on a variety of substrates; Observed in Caledonia Gorge Protected Natural Area ~1.55 km west-southwest of the mouth of Caledonia Brook in gulley
Blunt-leaved Pondweed	*Potamogeton obtusifolius*	S3	Secure	1	Submersed aquatics in shallow water of protected lake bays, ponds and quiet streams; Observed in Germantown Marsh in Beaver Brook Marsh ~0.9 km southeast of Beaver Brook bridge on Highway 114
Farwell's Water Milfoil	*Myriophyllum farwellii*	S3	Secure	1	Oligotrophic to mesotrophic waters of lakes, ponds, and marshes; Observed in Germantown Marsh along north side of Shepody River 2.5 km upstream from north end of NWA
Gmelin's Water Buttercup	*Ranunculus gmelinii*	S3	Secure	4	Shallow water or drying mud, wet meadows, swamps, marshes, ponds, shores of rivers; Observed near Beaver Brook Marsh ~0.9 km southeast of Beaver Brook bridge on Highway 114, along stream near east edge of Germantown Marsh ~2.2 km southwest of Marsh Road bridge, and near east edge of Germantown Marsh ~1.75 km southwest of Marsh Road bridge
Great Duckweed	*Spirodela polyrrhiza*	S3S4	Secure	3	Eutrophic, quiet waters; Observed in Germantown Marsh in Shepody River 0.2 km upstream from bridge at north end of NWA, north of Shepody River 1.0 km upstream from bridge at north end of NWA, and at Marsh Road bridge over dyked stream.
Halberd-leaved Tearthumb	*Polygonum arifolium*	S3	Secure	1	Shaded swamps, ponds, tidal marshes along rivers, wet ravines in forests; Observed near east edge of Germantown Marsh ~1.8km southwest of Marsh Road bridge
Hyssop-leaved Fleabane	*Erigeron hyssopifolius*	S3	Secure	1	Bogs, muskegs and fens; Observed at falls at Crooked Creek below lookout at Albert
Maidenhair Spleenwort	*Asplenium trichomanes*	S2	Sensitive	1	Sandstone, basalt, and granite; Observed in Germantown Marsh along Beaver Brook ~130 m south of Highway 114 at bridge over brook
Star Duckweed	*Lemna trisulca*	S3	Secure	2	Mesotrophic, quiet waters rich in calcium; Observed in Germantown Marsh in Beaver Brook Marsh ~0.9 km south-southeast of Beaver Brook bridge on Highway 114, and north side of Shepody Road 2.3 km upstream from north end of NWA
Whorled Water Milfoil	*Myriophyllum verticillatum*	S3	Secure	2	Streams, rivers, ponds, lakes, and sloughs; Observed in Germantown Marsh in Beaver Brook Marsh ~0.9 km southeast and ~0.9 km south-southeast of Beaver Brook bridge on Highway 114

Common Name	Scientific Name	Provincial Rarity Rank	Provincial General Status Rank	Number of Records	Habitat Preference; Location Sighting
Graminoids					
Creeping Sedge	*Carex chordorrhiza*	S3	Secure	1	Fens, bogs, floating mats on lakeshores, emergent sedge marshes, usually in very wet sites, often in shallow water; Observed in Germantown Marsh at Beaver Brook Marsh ~1.2 km southeast of Beaver Brook bridge on Highway 115
Estuary Sedge	*Carex recta*	S3	Secure	2	Saline, brackish shores, swales, intertidal marshes, river estuaries; Observed in Germantown Marsh north of Shepody Road 1.0 km upstream from bridge at north end of NWA
Michaux's Sedge	*Carex michauxiana*	S3	Secure	1	Wet sedge fens, open and treed bogs; Observed in Germantown Marsh at Beaver Brook Marsh ~0.9 km south-southeast of Beaver Brook bridge on Highway 114
Slim-stemmed Reed Grass	*Calamagrostis stricta*	S3S4	Secure	1	Mesic to wet meadows, gravel bars, fens, marshes, lakeshores and open forests; Observed in Germantown Marsh north of Shepody River 1.0 km upstream from bridge at north end of NWA

Notes:
Data retrieved from ACCDC Report 6038: Riverside Albert, NB
Data is accurate as of 23 February, 2018.
None of these species are designated under COSEWIC, listed under SARA, or are protected under the NB SARA.

4.8 TERRESTRIAL WILDLIFE

Fifty seven (57) native species of mammals (Dilworth, 1984), over three hundred and fifty (350) resident and migratory bird species (Squires, 1976), and approximately twenty five (25) species of reptiles and amphibians (herptiles) (Gorham, 1970) are known to inhabit NB. A variety of these species frequent the Shediac Bay watershed, including several species of mammals, birds, herptiles and invertebrates (Leblanc, 2009).

The forests of NB provides habitat for moose (*Alces alces*), black bear (*Ursus americanus*), red fox (*Vulpes vulpes*), porcupine (*Erthizon dorsatum*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*) and beaver (*Castor canadensis*) (Leblanc, 2009). The habitat located in the Project area provides suitable habitat for many common mammal species.

Several common varieties of reptiles and amphibians, such as the maritime garter snake (*Thamnophis sirtalis pallidulus*), wood frog (*Lithobates sylvaticus*), and American toad (*Anaxyrus americanus*), may frequent the area. Salamander species could potentially also be present in the damper areas, such as wetlands and other low lying areas.

4.8.1 BIRDS

Timing and patterns of migration will typically vary on an annual basis and be species-specific, but generally peak migration for birds would likely be expected during May and September. Many individuals of certain species will also remain in the Project area to breed during the summer, including numerous songbird species such as those identified in Section 4.8.3. Although there are no IBA or RAMSAR sites (wetlands of international importance) within the Project area, there is an IBA located within 5 km of the Project (Shepody Bay West NB009). There are a number further east along the Bay of Fundy (Dorchester Cape and Grand Anse NB038 and Upper Cumberland Basin NS002) and one located approximately 86 km to the west (Lower St. John River NB010). The Shepody National Wildlife Area is also designated as part of a RAMSAR site (Section 4.9). Identifying these areas are important when considering flight paths of birds that may be moving to and from these sites during migration as they will have potential to interact with the Project.

WSP completed a Bird Inventory for the Project. The full report is included in Appendix E. The following is a brief summary of the report.

A field program was initiated in 2016 to collect data on birds in the Project area, with emphasis on migrating, wintering and breeding birds. Migration surveys were conducted within the area in the fall of 2016, breeding bird surveys were performed in 2016 and 2017, and wintering bird surveys were conducted in 2017

A fall migratory bird survey was conducted between September 13 and October 20, 2016. Seven (7) transects and two (2) observation stations were selected to reflect habitat availability in the study area (Appendix E). Transects were 325 m to 580 m in length and each transect was surveyed ten times. Bird data collected included distance and direction from the observer, bird behaviour, flight height, and direction. The duration of each transect survey was of 10 minutes on average, and the observation stations surveys were of a duration a 1 hour per visit. A total of 29 species, comprising 214 individual birds, were recorded during the field survey at heights generally less than 100 m (Appendix E). Dark-eyed junco (*Junco hyemalis*) and black-capped chickadee (*Poecile atricapillus*) were the most common species detected.

Breeding bird surveys were conducted on June 24 and July 6 2016 and May 5 to July 3 2017. The bird surveys included ten minute point counts from eleven (11) point count survey stations in 2016 and the seven (7) transect locations in 2017. A nocturnal nighthawk survey was also conducted during the night of July 2/3, 2017. A total of 55 bird species, comprising 227 individual birds, were observed during the 2016 and 2017 field surveys (Appendix E). American robin (*Turdus migratorius*), white-throated sparrow (*Zonotrichia albicollis*), and dark-eyed junco were the most common species observed.

Winter bird surveys were conducted on January 10, February 21, and March 30, 2017 along the seven (7) transects established for the fall migratory bird survey. According to the Christmas Bird Count data, from the Village of Riverside-Albert in Albert County for the 2010 to 2015 period, more than 80 species occur in the Project area during winter. Only ten (10) bird species were observed during the 2017 winter surveys (Appendix E). American crow (*Corvus brachyrhynchos*), white-throated sparrow, black-capped chickadee, and red-breasted nuthatch (*Sitta canadensis*) were the most common species observed.

Five (5) bird SOCC were observed during the field surveys (Appendix E; Section 4.8.3). These included pine siskin (*Carduelis pinus*), turkey vulture (*Cathartes aura*), common nighthawk (*Chordeiles minor*), eastern wood-pewee (*Contopus virens*), and evening grosbeak (*Coccothraustes vespertinus*).

4.8.2 BATS

In NB, seven (7) bat species have been documented and have ranges that overlap the Project area. These include big brown bat (*Eptesicus fuscus*), eastern pipistrelle or tri-colored bat (*Perimyotis subflavus*), hoary bat (*Lasiurus cinereus*), little brown myotis or little brown bat (*Myotis lucifugus*), northern myotis or northern long-eared bat (*Myotis septentrionalis*), eastern red bat (*Lasiurus borealis*), and silver-haired bat (*Lasionycteris noctivagans*) (GNB, n.d.). The hoary bat, eastern red bat, silver-haired bat are considered migratory species because they migrate north in the spring to breed and return to the south for the winter months. The little brown bat, northern long-eared bat, tri-colored bat, and big brown bat are primarily non-migratory, resident species that shift habitat seasonally moving between summer nursery areas and winter hibernation/mating sites.

The little brown bat, northern long-eared bat, tri-colored bat, and big brown bat have been documented within 20 km of the Project (ACCDC, 2018) and a known bat hibernaculum (overwintering site) is approximately 18 km north of the Project (Vanderwolf et al., 2012). Other critical habitats for little brown bat, northern long-eared bat, and tri-colored bat exist within 50 km of the Project Area according to the Recovery Strategy for these species (ECCC, 2015).

WSP completed a Bat Inventory for the Project. The full report is included in Appendix F. The following is a brief summary of the report.

The bat inventory was conducted during the reproduction and the fall bat migration periods (late summer/early fall) 2016, and during the reproduction period (spring) 2017 using a stationary acoustic inventory technique. Acoustic survey stations (AnaBat® II Bat Detector) were installed in representative habitats (Appendix F). Stations were equipped with an automated system and were set to record between 8:00 p.m. and 6:00 a.m. All the stations were installed in trees approximately 4 m to 6 m above ground, except for one station that was installed on the MET tower at approximately 30 m.

Three bat species and one genus of bats were identified during this survey among the 20 bat sonograms recorded, including:

- Hoary Bat
- Species in the genus Myotis (*Myotis* spp.)
- Big Brown Bat
- Tri-colored Bat

The hoary bat represented approximately 45% of the sonograms, and had the highest percent of sonograms out of all the species identified. The tri-colored bat represents approximately 20% of the sonograms. *Myotis* spp. represent approximately 20% of the sonograms but, due to limitations of survey methods, the relative proportion of the sonograms belonging to each species of *Myotis* cannot be determined. Only one sonogram of the big brown bat was collected, representing approximately 5% of the recordings. Unidentified bat species were documented for 10% of the recorded sonograms that could not be identified to genus or species because the recordings were too short to recognize key characteristics.

Both resident and migratory species were encountered during this survey, with most of the sonograms collected during early migration (August 9 to 14 2016) and migration (September 17 to 21 2016). Early migration bat activity in August was mostly due to hoary bat. September bat activity was mostly due to *Myotis* sp. and tri-colored bat. The only sonogram of big brown bat was collected in September 2016. Only one sonogram from hoary bat was collected during the 2017 survey period.

During this survey, all the recordings for hoary bat were collected between 11:30 p.m. and 02:40 a.m., recordings from *Myotis* spp. between 08:00 p.m. and 00:30 a.m., and recordings for tri-colored bat between 09:30 pm and 05:30 am. The recording from big brown bat was collected around 01 00 p.m. Bats typically forage in several different locations each night and display dynamic movements across the landscape (Kunz et al. 2007). However, the method does not control the action of whether several calls of a given species recorded during a single night or even different nights came from one or several individuals. Therefore, some of the recorded calls could originate from a single bat repeatedly calling near the same station during the night, or even for several nights.

Overall, the average bat passes recorded is approximately 0.15 calls per night. When comparing this result to the bat acoustic survey of the Richibucto Wind Project approximately 100 km north of the Project that had an average bat passes of 1.4 calls per night (Natural Forces, 2017), the bat activity within the Project area appears to be low. Similar observations of low bat activity were recorded at the Kent Hills wind farm about 5 km north of the Project (Stantec, 2017).

All the habitats selected for survey stations were suitable for bats, including forest patches with some mature trees alternating with clearings, and sometimes wetlands. These habitats can provide both resting and foraging sites for bats. The valley of the West River east of the project footprint, is likely the most suitable moving/migrating corridor for bats near the Project. No potential hibernaculum or other critical habitat (maternal sites) for bats was identified during field surveys.

4.8.3 SPECIES OF CONSERVATION CONCERN

A comprehensive search of the ACCDC was completed to compile a list of wildlife species that have either been previously detected in the Project area or have been observed in the surrounding area and thus have the potential to occur in the Project area (ACCDC, 2018). Of particular concern, are sensitive, rare, at-risk, and legally listed species, in addition to special areas such as managed areas and environmentally significant areas (discussed in Section 4.9). Records found within 5 km of the Project were identified as in the Project area and a standardized 100 km search radius from the centre of the Project site was used to compile and summarize data for the surrounding area.

Based on the screening for wildlife in a 100 km radius around the Project site, numerous records were found totalling 28,553 records of 138 vertebrate species and 702 records of 64 invertebrate species. However, a number of the species were not applicable to the Project area given they were marine or coastal species. A number of these species have potential to occur in the Project area, and include species upland birds, waterbirds, raptors, amphibians, reptiles, small mammals, furbearers, carnivores, and ungulates. A number of the species in these wildlife groups are provincially and/or federally listed while others are sensitive or of conservation concern.

Within the Project area, 60 SOCC were found that have been previously detected and reported to the ACCDC (Table 4.8-1; Figure 4.8-1). Of these, four (4) are mammals, fifty (50) are birds, and five (5) are invertebrates. Although many SOCC ranked by the ACCDC are considered rare in NB, those protected or designated by federal and provincial legislation are of particular concern and are discussed in further detail below. In addition to those identified by the ACCDC, a number of bat species were detected during field surveys in 2016.

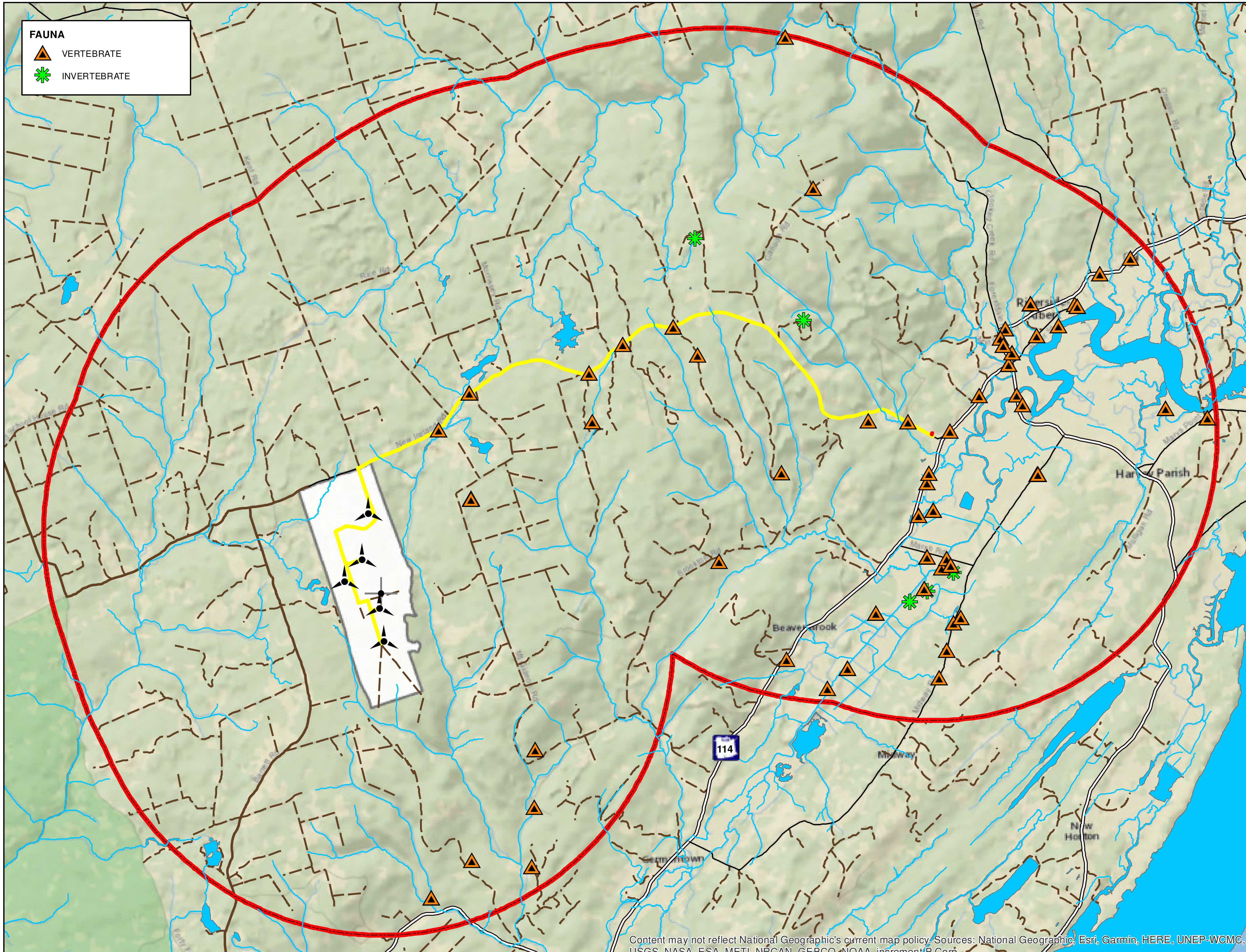
Table 4.8-1 Wildlife Species of Conservation Concern Previously Documented and Reported within 5 km of the Project

Common Name	Scientific Name	Provincial General Status Rank	Provincial Rarity Rank	NB SARA Status	COSEWIC Designation	SARA Status	Number of Records
Mammals							
Canadian Lynx	*Lynx canadensis*	At Risk	S3	Endangered	Not At Risk	-	1
Eastern Cougar[(a)]	*Puma concolor*	Undetermined	SU	Endangered	Data Deficient	-	8
Long-tailed Shrew	*Sorex dispar*	Sensitive	S2	-	Not At Risk	Special Concern, Schedule 3	2
Southern Bog Lemming	*Synaptomys cooperi*	Secure	S3S4	-	-	-	14
Birds							
American Coot	*Fulica americana*	Sensitive	S1S2B,S1S2M	-	Not At Risk	-	4
Bald Eagle**	*Haliaeetus leucocephalus*	At Risk	S4	Endangered	Not At Risk	-	n/a
Bank Swallow	*Riparia riparia*	Sensitive	S2S3B,S2S3M	-	Threatened	Threatened, Schedule 1	7
Barn Swallow	*Hirundo rustica*	Sensitive	S2B, S2M	Threatened	Threatened	Threatened, Schedule 1	16
Black-bellied Plover	*Pluvialis squatarola*	Secure	S3S4M	-	-	-	1
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Secure	S3B,S3M	-	-	-	1
Black Guillemot	*Cepphus grylle*	Secure	S3	-	-	-	1
Black Scoter	*Melanitta nigra*	Sensitive	S3M,S1S2N	-	-	-	5
Black Tern	*Chlidonias niger*	Sensitive	S2B,S2M		Not At Risk	-	2
Bobolink	*Dolichonyx oryzivorus*	Sensitive	S3B,S3M	Threatened	Threatened	Threatened, Schedule 1	17
Brown-headed Cowbird	*Molothrus ater*	May Be At Risk	S3B,S3M	-	-	-	3
Brown Thrasher	*Toxostoma rufum*	Sensitive	S2B,S2M	-	-	-	1
Bufflehead	*Bucephala albeola*	Sensitive	S3M,S2N	-	-	-	7
Canada Warbler	*Wilsonia canadensis*	At Risk	S3B, S3M	Threatened	Threatened	Threatened, Schedule 1	
Cape May Warbler	*Dendroica tigrina*	Secure	S3B, S4S5M	-	-	-	10
Chimney Swift	*Chaetura pelagica*	At Risk	S2S3B,S2M	Threatened	Threatened	Threatened, Schedule 1	13
Cliff Swallow	*Petrochelidon pyrrhonota*	Sensitive	S2S3B,S2S3M	-	-	-	16

Common Name	Scientific Name	Provincial General Status Rank	Provincial Rarity Rank	NB SARA Status	COSEWIC Designation	SARA Status	Number of Records
Common Eider	*Somateria mollissima*	Secure	S3B,S4M,S3N	-	-	-	1
Common Moorhen	*Gallinula chloropus*	Secure	S1B,S2S3M	-	-	-	4
Common Nighthawk	*Chordeiles minor*	At Risk	S3B, S4M	Threatened	Threatened	Threatened, Schedule 1	5
Eastern Kingbird	*Tyrannus tyrannus*	Sensitive	S3S4B, S3S4M	-	-	-	8
Eastern Wood-Pewee	*Contopus virens*	Secure	S4B, S4M	Special Concern	Special Concern	Special Concern, Schedule 1	2
Evening Grosbeak	*Coccothraustes vespertinus*	Sensitive	S3B,S3S4N,SUM	-	Special Concern	-	3
Gadwall	*Anas strepera*	Secure	S2B,S3M	-	-	-	2
Great Cormorant	*Phalacrocorax carbo*	Secure	S2N,S2M	-	-	-	1
Greater Scaup	*Aythya marila*	Secure	S1B,S4M,S2N	-	-	-	1
Horned Lark	*Eremophila alpestris*	May Be At Risk	S1B,S4N,S5M	-	-	-	1
Killdeer	*Charadrius vociferus*	Sensitive	S3B,S3M	-	-	-	6
Least Bittern	*Ixobrychus exilis*	At Risk	S1S2B,S1S2M	Threatened	Threatened	Threatened, Schedule 1	5
Lesser Scaup	*Aythya affinis*	Secure	S1B,S4M	-	-	-	6
Marsh Wren	*Cistothorus palustris*	Sensitive	S2B,S2M	-	-	-	10
Northern Mockingbird	*Mimus polyglottos*	Sensitive	S2B,S2M	-	-	-	8
Northern pintail	*Anas acuta*	Sensitive	S3B,S5M	-	-	-	6
Northern Shoveler	*Anas clypeata*	Secure	S2S3B,S2S3M	-	-	-	13
Olive-sided Flycatcher	*Contopus cooperi*	At Risk	S3B, S3M	Threatened	Threatened	Threatened, Schedule 1	9
Pectoral Sandpiper	*Calidris melanotos*	Secure	S3S4M	-	-	-	1
Peregrine Falcon anatum/tundrius pop.[(b)]	*Falco peregrinus*	At Risk	S1B, S3M	Endangered	Special Concern	Special Concern, Schedule 1	n/a
Pine Grosbeak	*Pinicola enucleator*	Sensitive	S2B,S4S5N,S4S5M	-	-	-	1
Pine Siskin	*Carduelis pinus*	Secure	S3	-	-	-	11
Red Crossbill	*Loxia curvirostra*	Secure	S3	-	-	-	1

Common Name	Scientific Name	Provincial General Status Rank	Provincial Rarity Rank	NB SARA Status	COSEWIC Designation	SARA Status	Number of Records
Red-breasted Merganser	*Mergus serrator*	Secure	S3B,S5M,S4S5N	-	-	-	1
Red-headed Woodpecker[(c)]	*Melanerpes erythrocephalus*	Accidental	SNA	-	Threatened	Threatened, Schedule 1	3
Ruddy Duck	*Oxyura jamaicensis*	Secure	S1B,S4M	-	-	-	6
Ruddy Turnstone	*Arenaria interpres*	Secure	S3M	-	-	-	1
Rusty Blackbird	*Euphagus carolinus*	May Be At Risk	S3B, S3M	Special Concern	Special Concern	Special Concern, Schedule 1	2
Sanderling	*Calidris alba*	Sensitive	S3S4M,S1N	-	-	-	2
Semipalmated Sandpiper	*Calidris pusilla*	Secure	S3S4M	-	-	-	3
Short-eared Owl	*Asio flammeus*	Sensitive	S2B,S2M	Special Concern	Special Concern	Special Concern, Schedule 1	4
Spotted Sandpiper	*Actitis macularius*	Secure	S3S4B,S5M	-	-	-	4
Turkey Vulture	*Cathartes aura*	Secure	S3B,S3M	-	-	-	11
Virginia Rail	*Rallus limicola*	Sensitive	S3B,S3M	-	-	-	10
Wilson's Snipe	*Gallinago delicata*	Secure	S3S4B, S5M	-	-	-	14
Invertebrates							
a Ground Beetle	*Elaphrus americanus*	Secure	S3	-	-	-	1
a Ground Beetle	*Harpalus fulvilabris*	Secure	S3	-	-	-	1
Bronze Copper	*Lycaena hyllus*	Sensitive	S3	-	-	-	3
Eastern Tailed Blue	*Cupido comyntas*	Secure	S3S4	-	-	-	1
Yellow-banded Bumblebee	*Bombus terricola*	Sensitive	S3?	-	Special Concern	-	1

Notes: Data retrieved from ACCDC Report 6038: Riverside Albert, NB
Data is accurate as of 23 February, 2018, All species listed were sighted within 5 km of Project area
(a) = The last confirmed Eastern Cougar sighting in NB was in the winter of 1932, Kent County NB. All recent sightings are unsubstantiated. Hairs from two individuals were found at Fundy National Park in 2003, however one sample was determined to be a South American Cougar (*Puma concolor concolor*).
(b) = This species is location sensitive and because of concern about exploitation of location sensitive species, the precise location of this observation is not known; however, the range for this species overlaps the Project area.
(c) = This species occurs only as a vagrant in the Maritimes and was observed at one location in the Province.



KEY MAP:

LEGEND:

- WTG
- MET TOWER
- PROJECT FOOTPRINT
- SUBSTATION FOOTPRINT
- 5 km BUFFER
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- WATERCOURSE
- WATERBODY
- LAND LEASE AREA (1252 ha)

PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY LP**

FIGURE:

TITLE:
WILDLIFE SPECIES OF CONSERVATION CONCERN

FIGURE NO.: **4.8-1**	REVISION NO.: **0**
SCALE: 1:65,000 (0, 500, 1,000, 2,000, 3,000 Metres)	
DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/13

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MAMMALS

CANADIAN LYNX

Canada lynx (*Lynx canadensis*) is listed as Endangered under the NB SARA and is ranked as S3, Sensitive by the ACCDC. Canada lynx has a range that extends from Alaska to Nova Scotia, and possibly as far south as New Mexico (Vashon, 2016). Preferred habitat for this species includes multi-layered forest stands and younger regenerating stands. These habitat types are also preferred by snowshoe hare, which is the main prey species for the lynx. Canada lynx gives birth once per year with an average litter size of one to five kittens and uses available existing features such as downed logs, root masses, or ground depressions to hide their young as opposed to building dens (Fox and Murphy, 2002). Litter size is thought to be dependent on snowshoe hare populations in the area. Areas of uneven aged and regenerating forest habitat are found within the Project area, and as so, the Canada lynx potential to be present. Sightings of the Canada lynx have been documented within 5.7 km of the Project (ACCDC 2018), which may further indicate the possibility of this species occurring in the Project area.

EASTERN COUGAR

The Eastern cougar (*Puma concolor*) is listed as Endangered by NB SARA and ranked as SU, Undetermined by the ACCDC. Little is known about the eastern cougar, and consensus has not been met regarding their inhabitation of the eastern provinces of Canada (Nature Canada, 2018). This species native habitat is thought to be dense hardwood forests associated with hills or mountains, and swampy areas surrounding this type of habitat. Eastern cougars are assumed to be top predators in the areas they may inhabit, second only to the Black Bear in size on the east coast. Prey includes most animals including moose. While some evidence in the form of unsubstantiated sightings and inconclusive DNA material is available, the last confirmed eastern cougar sighting in NB was in the winter of 1932, Kent County. Hairs from two individuals were found at Fundy National Park in 2003, however one sample was determined to be a South American Cougar (*Puma concolor concolor*). It is highly unlikely this species would be present in the Project area.

LONG-TAILED SHREW

Long-tailed shrew (*Sorex dispar*) is listed as Special Concern under Schedule 3 of SARA and ranked as S3, Sensitive by the ACCDC. Long-tailed shrew appear to prefer mountainous forested areas with an abundance of loose rock and damp areas (Whittaker et. al, 2016). It is believed that this species spends much of its time navigating between rocks and crevices roughly 30 centimetre (cm) below the surface. The diet of the long-tailed shrew consists of terrestrial invertebrates, and lifespan for this species is thought to be 2 years or less (Burian, 2002). Mating season for this species is April through August, and several litters of between four to seven individuals are realized per year (Burian, 2002). This species was documented in the Caledonia Gorge Protected Natural Area in 1979 (ACCDC, 2018) and their preferred habitat is not likely abundant within the Project area.

BATS

Little brown bat, northern long-eared bat, and tri-colored bat are all listed as Endangered under Schedule 1 of SARA and listed as Endangered under NB SARA. The listing of these species under Schedule 1 of SARA in 2014 was in response to sudden and dramatic declines of little brown bat and northern long-eared bat across the eastern portions of their range, and declines of tri-colored bat across their entire range in Canada. These declines are the result of white-nose syndrome, which is responsible for large numbers of mortality in hibernating bats through much of eastern North America (Blehert et al., 2009; CBC News, 2014; Burns and Broders, 2013, ECCC, 2015). In Quebec, NB, and NS, some hibernacula no longer have these bat species present (ECCC, 2015). In March of 2011, white-nose-syndrome was detected in a cave, one of NB's most important bat hibernaculum, in Albert County (GNB, 2018).

All three species overwinter in caves. Northern long-eared bat may hibernate in cooler sections of a cave, compared to little brown bat whereas tri-colored bat often roost in the deepest and warmest part of caves (COSEWIC, 2013a). In spring, females of each species leave winter hibernacula and give birth and raise pups in maternity colonies. For example, little brown bat maternity colonies often exist in warm sites that facilitate pup growth rates, such as attics of buildings and under bridges, in rock crevices, or in cavities of canopy trees in forests. Little brown bat, northern long-eared bat, and tri-colored bat were all detected in during field surveys (Section 4.8.2; Appendix F).

LITTLE BROWN BAT AND NORTHERN LONG-EARED BAT

Until the onset of white-nose syndrome, *Myotis* was the most common genus in eastern Canada (Broders et al., 2003; Jutras et al., 2012). In NB, *Myotis* includes the species little brown bat and northern long-eared bat both of which are resident bat species. They remain in their feeding and breeding areas until the fall (Brunet et al., 1998; ECCC, 2015) before joining their hibernacula, usually located in caves or old mine openings (Banfield, 1977; McDuff et al., 2001; ECCC, 2015). In the eastern part of their range, bat populations of the genus *Myotis* have been devastated by white-nose syndrome. To date, this syndrome has caused a 94% overall decline in known numbers of hibernating *Myotis* bats in NS, NB, Ontario, and Québec (ECCC, 2015).

Both species feed nocturnally on insects and spiders (Thomas et al., 2012). The northern long-eared bat is generally closely associated with the boreal forest (Broders et al., 2003; Owen et al., 2003), while the little brown bat frequents a wider variety of habitats, including riparian, forest, or anthropogenic areas (Broders et al., 2003; ECCC, 2015). During the summer, both the little brown bat and northern long-eared bat may use tree structures (e.g., natural cavities or cracks under the bark), building structure, or rock structures as resting or maternity roosting habitats (Moseley, 2007; Tremblay and Jutras, 2010; ECCC, 2015).

TRI-COLORED BAT

Tri-colored bat is considered to have the most specific overwintering habitat requirements than *Myotis* spp. (COSEWIC 2013a; ECCC, 2015). They often roost in the deepest part of caves or mines where temperature is the least variable, have strong humidity level preferences, and use warmer walls than other species (Briggler and Prather, 2003; COSEWIC 2013a; Kurta and Smith, 2014). A study of hibernacula in NB noted tri-colored bats hibernating low on cave walls (Vanderwolf et al., 2012). Although tri-colored bats tend to use the same hibernacula as little brown bat and northern long-eared bat, relatively few tri-colored bats have been recorded within any one hibernacula in Canada, possibly because they tend to hibernate solitarily (i.e., not in clusters) in the deepest sections of the caves/mines (ECCC, 2015). The tri-colored bat population declines in areas affected by white-nose syndrome in Canada are likely similar to that observed in little brown bat and northern long-eared bat, though the declines observed in this species are less straightforward (ECCC, 2015). In NB, declines at individual hibernacula have ranged from 30% to more than 75% (ECCC, 2015).

Tri-colored bats feed on insects after dusk and before dawn using echolocation (Naughton, 2012), predominately in forested riparian areas, over water (e.g., ponds and rivers), and in relatively open areas (Ethier and Fahrig, 2011). Little is known about roosts of tri-colored bats. Most known roost sites are found within forested habitats, where this species also forages. Tri-colored bats may roost in clumps of dead foliage and lichens (Veilleux et al., 2003; Perry and Thill, 2007; Poissant et al., 2010). In Nova Scotia, 30 radio-tagged bats had roosts in large clumps of arboreal lichens that grew on coniferous or deciduous trees relatively close to water features (Poissant et al., 2010).

BIRDS

BALD EAGLE

Bald eagle (*Haliaeetus leucocephalus*) is listed as Endangered by NB SARA and ranked as S4, At Risk by the ACCDC. The bald eagle is a diurnal raptor, typically found in forested areas near large fish-bearing water bodies (Cornell University, 2017a). In the Maritimes, it is most strongly associated with open water habitats, including freshwater rivers, lakes, and ponds, and saltwater estuaries and bays (Bird Studies Canada, 2018). This species is tolerant of human activity when feeding, and may be sighted near fish processing plants, landfills, and aqua-cultural operations. Bald eagle prefers to perch in tall trees with clear visibility of its surrounding area and typically nest in trees that protrude above the forest canopy; however, they will also nest on cliffs, telephone poles, or on the ground in areas where no trees are available. This species may also use abandoned osprey nests, as the bald eagle nests earlier in the year than the Osprey (Pepper, pers. comm., 2018). While some ponded waterbodies were found within the Project area, nesting habitat for bald eagle more closely associated with sizeable lakes, harbours, or bays, all of which are not found within 5 km of the Project. Bald eagle was recorded during spring migration field surveys near the Kent Hills wind farm in 2017 (Stantec, 2017), however bald eagle was not recorded during field surveys completed in 2016 and 2017.

BANK SWALLOW

Bank swallow (*Riparia riparia*) is listed as Threatened under Schedule 1 of SARA, designated as Threatened by COSEWIC and S2S3B, S2S3M, Sensitive by the ACCDC. This species has been documented in every province and territory except Nunavut (COSEWIC, 2013b). Like their name suggests, the bank swallow nests in sandy banks and cliffs along watercourses and coastlines but it will also take advantage of man-made habitats, such as sand and gravel pits, roadcuts, or sand piles, sawdust, coal ash, and other materials (COSEWIC, 2013b; Bird Studies Canada, 2018). Nesting occurs between mid-April and August, and vertical banks are required for nest burrows and nesting areas are always close to open habitats where the birds can forage such as grasslands, meadows, and pastures (COSEWIC, 2013b; BirdLife International, 2016). In the Maritimes, the species is strongly associated with coastal habitats such as beaches and dunes and with other open foraging areas, such as agricultural areas, grasslands, barelands, and bogs (Bird Studies Canada, 2018). Nesting habitat is not likely present in the Project area, however, they may forage in some open areas present in the area.

BARN SWALLOW

Barn swallow (*Hirundo rustica*) is listed as Threatened under Schedule 1 of SARA, listed as Threatened under NB SARA, designated as Threatened by COSEWIC, and ranked as S2B, S2M, Sensitive by the ACCDC. Barn swallows are found throughout Canada during the breeding season (Cornell University, 2017b). In the Maritimes, the barn swallow occurs mostly in agricultural areas close to aquatic habitats and is a possible breeder in the Project area (Bird Studies Canada, 2018). Barn swallows typically select nesting and foraging sites close to open habitats including parks, sports fields, agricultural areas, wetlands, large forest clearings, road ROW, and beaches (Cornell University, 2017; COSEWIC, 2011). Nesting sites typically include human-made structures; however, they will nest on natural areas with a vertical substrate (Cornell University, 2017; Bird Studies Canada, 2018). Foraging habitat for this species is within the Project area. There are 3 human-made structures within 2 km of the Project, which could provide nesting habitat for barn swallow. Barn swallow was not recorded during field surveys completed in 2016 and 2017.

BOBOLINK

Bobolink (*Dolichonyx oryzivorus*) is listed as Threatened under Schedule 1 of SARA, listed as Threatened under NB SARA, designated as Threatened by COSEWIC, and ranked as S3B, S3M, Sensitive by the ACCDC. Bobolink may be one of the most agriculture-dependent species in the Maritimes; it has a strong preference for forage crops (COSEWIC, 2010; Bird Studies Canada, 2018). Nesting begins in mid-May and nests are built on the ground (COSEWIC, 2010).The bobolink also occurs in wet prairie, graminoid peatlands and abandoned fields dominated by tall grasses, remnants of uncultivated virgin prairie (tall-grass prairie), no-till cropland, small-grain fields, reed beds and irrigated fields in arid regions (COSEWIC, 2010). Its abundance is lowest within heavily forested areas is not recorded as having breeding evidence in the Project area (Bird Studies Canada, 2018).

CANADA WARBLER

Canada warbler (*Wilsonia canadensis*) is listed as Threatened under Schedule 1 of SARA, listed as Threatened under NB SARA, designated as Threatened by COSEWIC, and ranked as S3B, S3M, At Risk by the ACCDC. Canada warblers are found in lower central and eastern Canada, and across the northern forests during the breeding season (Cornell University, 2017c; Bird Studies Canada, 2018). In the Maritimes, the Canada warbler is associated with mature cedar swamps, forested wetlands, and with complex, mature or regenerating mixed forests, partial cuts, and shrublands; however this species is not recorded as having breeding evidence in the Project area (Bird Studies Canada, 2018). Nests are often built in treed swamps or the fringes of other types of wetland habitat on or very close to the ground, often in dense ferns or fallen logs (COSEWIC, 2008a; Cornell University, 2017c). The Canada warbler prefers to forage in areas where vegetation is at a low height, such as shrubby forest edge, regenerating woodland areas that have been previously harvested, and shrubby wetlands. Canada warbler nesting habitat and foraging habitat are found within the Project area. This species was incidentally documented near the Kent Hills wind farm in 2017 (Stantec, 2017), however Canada warbler was not recorded during field surveys completed in 2016 and 2017.

CHIMNEY SWIFT

Chimney swift (*Chaetura pelagica*) is listed as Threatened under Schedule 1 of SARA, listed as Threatened under NB SARA, designated by COSEWIC as Threatened, and ranked S2S3B, S2M, At Risk by the ACCDC. During the breeding season, chimney swifts can be found throughout southern parts of eastern and central Canada, as well as much of the United States. Before European settlement, this was associated with old growth forests where their nesting and roosting sites were primarily large hollow trees, however in present times, the chimney swift uses man-made structures including open chimneys air shafts, silos, wells, inside barns, and abandoned buildings; chimneys are most frequently used (COSEWIC, 2007a; Bird Studies Canada, 2018). The chimney swift is now highly dependent upon humans for nesting sites. The chimney swift preys upon flying insects, and hunts mostly in daylight near bodies of water because of the abundance of insects (COSEWIC, 2007a; Cornell University 2017d). Buildings are scarce within the Project area; there are three (3) human-made structures within 2 km of the Project; however, there is low potential for this species to be present within the area.

COMMON NIGHTHAWK

Common nighthawk (*Chordeiles minor*) is listed as Threatened under Schedule 1 of SARA, listed as Threatened under the NB SARA, designated by COSEWIC as threatened, and ranked as S3B, S4M, At Risk by the ACCDC. This species is found in all of the Canadian provinces and territories with the exception of Nunavut (COSEWIC, 2007b). The breeding habitat of the common nighthawk includes open habitats, such as sand dunes, beaches, recently logged areas, recently burned-over areas, forest clearings, short-grass prairies, pastures, open forests, peatbogs, marshes, lakeshores, gravel roads, river banks, rocky outcrops, rock barrens, railways, mine tailings, quarries, urban parks, military bases, airports, mines and commercial blueberry fields (COSEWIC, 2007b). In the Maritimes, its habitat associations include open areas such as regenerating forests and some types of wetlands (Bird Studies Canada, 2018). The common nighthawk nests on the ground in a variety of unsheltered habitat conditions, such as rocky outcrops, gravel beaches, and forest floor, as long as there are gravel or littered substrates for nesting and open areas for foraging (Bird Studies Canada, 2018; Cornell University, 2017e). When found in urban areas, the common nighthawk is known to nest on flat roofs of buildings which have gravel on them. This species was documented at two locations during nightjar and breeding bird surveys near the Kent Hills wind farm in 2017 (Stantec, 2017). Two (2) common nighthawks were observed during the field surveys. These birds were observed during the breeding season, indicating that they are "probable" breeders in the Project area. It is likely that this species is using exposed forest floors in clear cut areas or the logging roads as roost or nest locations.

EASTERN WOOD-PEWEE

The eastern wood-pewee (*Contopus virens*) is listed as Special Concern under Schedule 1 of SARA, listed as Special Concern under NB SARA, designated as Special Concern by COSEWIC and ranked as S4B, S4M, At Risk by the ACCDC. This species is found in eastern Canada during the breeding season usually from May to August (Cornell University, 2017f). Eastern wood-pewee is mostly associated with the mid-canopy layer of forest clearings and edges of deciduous and mixed forests (COSEWIC, 2012). It is most abundant in forest stands of intermediate age and in mature stands with little understory vegetation. In the Maritimes it is found in older, predominantly deciduous forests, often mixed with mature hemlock or pine (Bird Studies Canada, 2018). This species preys upon flying insects, and may also eat small amounts of vegetation such as berries and seeds from dogwood trees, blueberries, raspberries, and even poison ivy (Cornell University, 2017f). Foraging and nesting habitat are present in the Project area and eastern wood-pewee was documented once during the field surveys. Given that the species was detected during the breeding season, eastern wood-pewee should be considered a "possible" breeder within the Project area.

EVENING GROSBEAK

The evening grosbeak (*Coccothraustes vespertinus*) is designated by COEWIC as Special Concern and ranked as S3B, S3S4N, SUM, Sensitive by the ACCDC. The evening grosbeak can be found in every province and territory of Canada except Nunavut during their breeding season (COSEWIC, 2016). Nesting occurs between mid-May and early September and nesting habitat for this species consists of open, old mixed-wood forests where Fir species and White Spruce are abundant or dominant (COSEWIC, 2016). In the Maritimes, the evening grosbeak is generally associated with older coniferous and mixed forests, but it may take advantage of other habitats, especially if insects such as beetles and moth larvae are abundant (Bird Studies Canada, 2018). Nest sites are often located high in trees and a complete nests are roughly 10 cm to 15 cm in diameter (Cornell University, 2017g). The abundance of softwood forest stands in and near the Project area increase potential for this species to be present. Evening grosbeak was observed once during the field surveys. The evening grosbeak's spatial distribution varies considerably from one year to the next, therefore may not be a regular breeder within the Project area.

LEAST BITTERN

The least bittern (*Ixobrychus exilis*) is listed as Threatened under Schedule 1 of SARA, listed as Threatened under NB SARA, designated as Threatened by COSEWIC, and ranked as S1S2B, S1S2M, At Risk by the ACCDC. This species is the smallest of the herons found in North America (Cornell University, 2017h; Bird Studies Canada, 2018). Least bittern can be found in Lower Canada during its breeding season, which begins in late April, with nesting occurring in mid-May (COSEWIC, 2009). Least bitterns preferentially breed in marshes with tall robust emergent vegetation (usually cattails), relatively stable water levels, and about 50% open water interspersed in small pockets throughout the vegetated areas. The least bittern also uses emergent vegetation for foraging purposes, by latching on to the plants and waiting for prey (Kaufmann, 2018). Least bitterns are thought to prey mainly on small vertebrates including fish, snakes, frogs, tadpoles, salamanders, and occasionally small mammals and songbird eggs or nestlings (COSEWIC, 2009). They may also prey on large insects, leeches, slugs, crayfish, and some vegetation. While some wetland areas are present within the Project area, only one freshwater marsh is near Priest Lake, approximately 270 m west of the proposed WTGs. It is not known if this marsh is preferential breeding habitat for least bittern because it was not surveyed during the baseline surveys. However based on aerial imagery of the marsh, it does not appear to be characteristic preferential breeding habitat because there is not emergent vegetation apparent throughout the center of the wetland basin with open water interspersed throughout the vegetated areas.

OLIVE-SIDED FLYCATCHER

The olive-sided flycatcher (*Contopus cooperi*) is listed as Threatened under Schedule 1 of SARA, listed as Threatened under the NB SARA, designated as Threatened by COSEWIC, and ranked as S3B, S3M, At Risk by the ACCDC. In the Maritimes, olive-sided flycatcher is typically found in open woodland and other forested areas with both mature and regenerating components, adjacent to shrubby forested wetlands, bogs, fens, beaver ponds, or clear-cuts where scattered trees remain and is a possible breeder in the Project area (COSEWIC, 2008b; Cornell University, 2017i; Bird Studies Canada, 2018). The species will use early successional forest, although the presence of tall snags and residual live trees for foraging and nesting is essential (COSEWIC, 2008b). Foraging and nesting habitat are present in the Project area and was observed during field surveys at the Kent Hills wind farm in 2017 (Stantec, 2017), however olive-sided flycatcher was not recorded during field surveys completed in 2016/2017.

PEREGRINE FALCON

Peregrine falcon anatum/tundrius population (*Falco peregrinus*) is listed as Special Concern under Schedule 1 of SARA, listed as Endangered under the NB SARA, designated as Special Concern by COSEWIC and ranked as S1B, S3M, At Risk by the ACCDC. The peregrine falcon is found year-round in various areas of Canada with preference given to open areas, barrier islands, mudflats, cliffs, riparian areas, or coastlines (Cornell University, 2017j). In NB, the peregrine falcon is found primarily along the Fundy Coast, which provides appropriate nesting habitat on shoreline cliff faces and an abundance of migrating shorebirds as a prey source during brooding and fledging (Bird Studies Canada, 2018). Most peregrine falcons nest on cliff ledges or crevices near good foraging areas and cliff elevations of 50 m to 200 m high are preferred (COSEWIC, 2007c). Although cliffs are preferred, this species will also nest on sky-scrapers, electrical towers, silos, and bridges (Cornell University, 2017j). Suitable nesting habitat is not found within the Project area.

RUSTY BLACKBIRD

Rusty blackbird (*Euphagus carolinus*) is listed as Special Concern under Schedule 1 of SARA, listed as Special Concern under NB SARA, designated as Special Concern by COSEWIC and ranked as S3B, S3M, May Be at Risk by the ACCDC. Rusty blackbird uses several different types of wet-areas for breeding and foraging habitat, including swamps, bogs, fens, beaver ponds, and other wet woodlands (Cornell University, 2017k). In the Maritimes, rusty blackbird is associated with forested wetlands and beaver ponds that are surrounded by regenerating coniferous and mixed forest (Bird Studies Canada, 2018). Regenerating clear-cuts and plantations are also used. This species forages in shallow water where they obtain aquatic prey in leaf litter (COSEWIC, 2017). In nesting and breeding areas, rusty blackbird feed mostly on invertebrates, with a preference for dragonfly nymphs. They also eat salamanders, water beetles, spiders, small fish, crustaceans, snails, and mosquitoes. Rusty Blackbirds nest in trees near or in wetland areas sometimes on trees overhanging a waterbody (Cornell University, 2017k). Habitat for the rusty blackbird is present within the Project area, however rusty blackbird was not recorded during field surveys completed in 2016/2017.

SHORT-EARED OWL

The short-eared owl (*Asio flammeus*) is listed as Special Concern under Schedule 1 of SARA, listed as Special Concern under NB SARA, designated as Special Concern by COSEWIC, and ranked as S2B, S2M, Sensitive by the ACCDC. Short-eared owl is found throughout Canada, with records of the species in every province and territory (COSEWIC, 2008c). This species prefers to nest in open areas, including grasslands, arctic tundra, peat bogs, old pastures, and marshland (Cornell University, 2017l). These areas also coincide with preferred prey of the short-eared owl, such as voles and other small rodents. In the Maritimes, the short-eared owl is strongly associated with shrublands, which include open, tundra-like barrens, and uncultivated grasslands (Bird Studies Canada, 2018). They have also been documented in grassy fields associated with marshlands or other wet areas, often adjacent to woodlands (Bird Studies Canada, 2018l). Short-eared owls breed primarily in well-drained grasslands near coastal wetlands (COSEWIC, 2008c). Suitable nesting habitat is not found within the Project area.

INVERTEBRATES

YELLOW-BANDED BUMBLEBEE

The yellow-banded bumblebee (*Bombus terricola*) is listed as Special Concern by COSEWIC and ranked as S3, Sensitive by the ACCDC. Yellow-banded bumblebees live in annual colonies, and only the new mated queens overwinter (Hatfield et al., 2015). After hibernation the queen begin to search a new nest site and foraging for nectar until the first worker bees emerge and are available to aid in these tasks. Yellow-banded bumble bees typically nest underground often in abandoned rodent burrows (COSEWIC, 2015). This species is a habitat generalist and are found in a variety of habitats such as open coniferous, deciduous and mixed-wood forests, agricultural areas, urban areas, along roadsides, meadows, grasslands, and wetlands (Hatfield et al., 2015; COSEWIC, 2015). Like other bumble bees, the yellow-banded bumblebees are a generalist pollen forager and collect pollen and nectar from a variety of plant species. They are pollinators of the plants they forage on. Several areas of suitable habitat are found within the Project area, and therefore there is potential for yellow-banded bumblebee to be present.

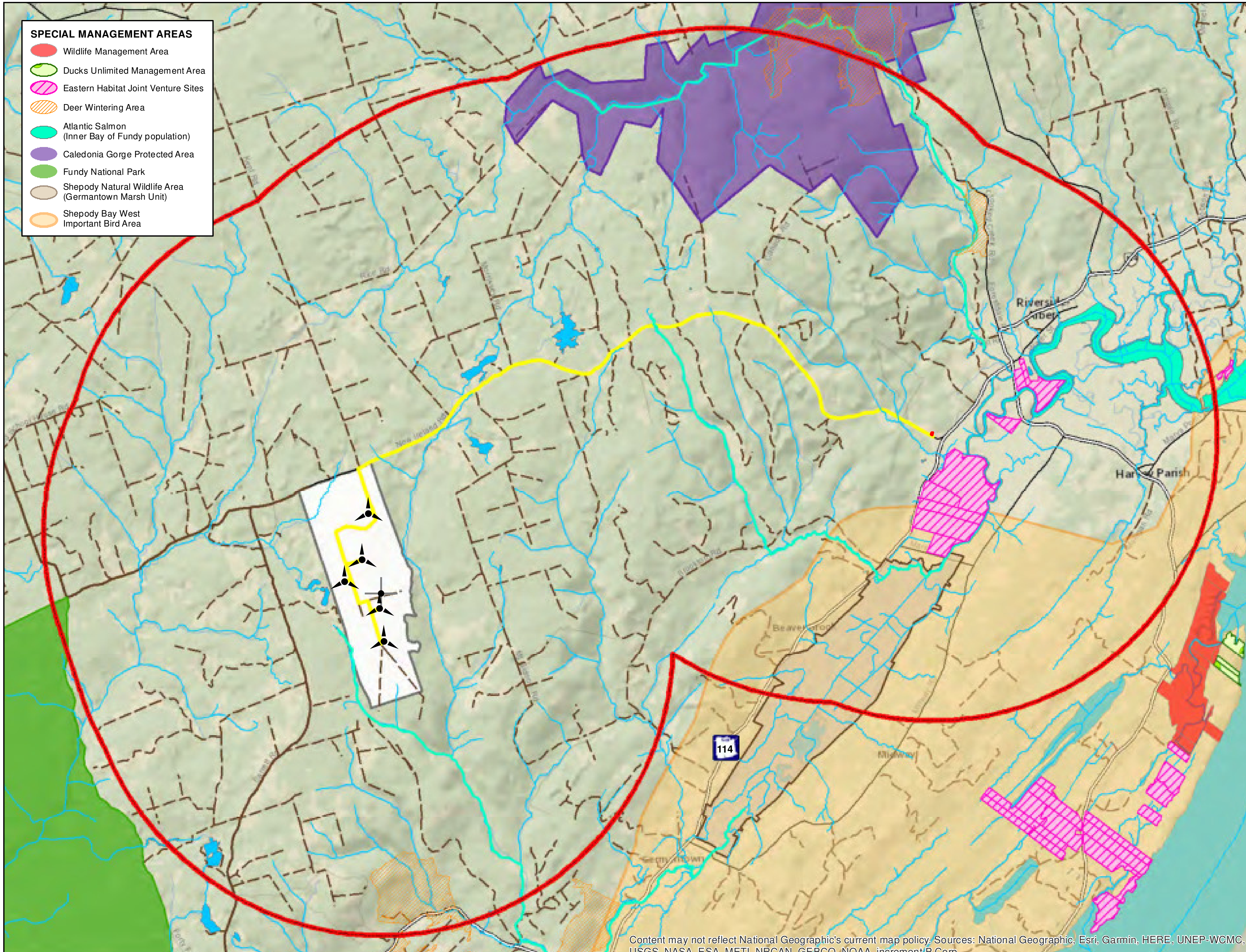
4.9 ENVIRONMENTALLY SENSITIVE AND PROTECTED AREAS

The ACCDC identified three (3) managed areas within 5 km of the Project. These include the Caledonia Gorge Protected Natural Area, Shepody National Wildlife Area, and Fundy National Park. The ACCDC also identified a biologically significant site within 5 km of the Project, Shepody Bay West IBA (Figure 4.9-1). Caledonia Gorge Protected Natural Area is an approximate 2,900 ha Class II Protected Natural Area. Class II areas are permanently set aside for the conservation of biological diversity, where certain recreational activities having minimal impact will be allowed.

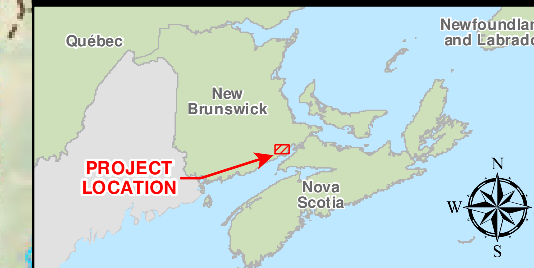
Shepody National Wildlife Area was established in 1980 and is comprised of the Germantown Marsh, Mary's Point and New Horton sections that are situated on and adjacent to Chignecto and Shepody Bays. The Shepody National Wildlife Area is also designated as part of a RAMSAR site (wetland of international importance under the Ramsar Convention) because it supports large numbers of mud shrimp, the principle food source for millions of fall migrating shorebirds.

Shepody Bay West IBA is globally significant for congregatory species and shorebird concentrations (IBA Canada, 2018). The mudflats and tidal marshes at the head of the Bay of Fundy are considered one of the most important stopover sites for shorebirds in eastern North America.

There is a Deer Wintering Area 3.8 km of the southern-most WTG. There are no Provincial Parks, operational quarries and mine sites, economically viable peatlands, Old Forest Communities and Habitats, Eastern Habitat Joint Venture sites, International Shorebird Reserves, or conservation areas managed by Ducks Unlimited within the Project area.



KEY MAP:



LEGEND:

- WTG
- MET TOWER
- SUBSTATION FOOTPRINT
- PROJECT FOOTPRINT
- 5 km BUFFER
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- WATERCOURSE
- WATERBODY
- LAND LEASE AREA (1252 ha)

PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT
ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: 161-08790 PHASE 19

CLIENT: WISOKOLAMSON ENERGY LP

FIGURE:

TITLE: PROVINCIALLY SIGNIFICANT AREAS

FIGURE NO.: 4.9-1	REVISION NO.: 0
SCALE: 1:65,000 (0, 500, 1,000, 2,000, 3,000 Metres)	
DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: J. FERNET
CREATED DATE: (YYYY-MM-DD) 2018-03-22	REVISION DATE: (YYYY-MM-DD) 2018/04/13

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4.10 SOCIAL AND CULTURAL ENVIRONMENT

4.10.1 EXISTING LAND USE

The Project is located on Crown land south of New Ireland Road, entirely within Albert County, NB (Figure 4.10-1). Albert County is divided into six parishes and include Coverdale, Hillsborough, Elgin, Hopewell, Harvey, and Alma. The County has numerous communities. The largest community in the county is Riverview. The closest community to the Project is the village of Riverside-Albert. There are four (4) residences located approximately 2.5 km southwest of Riverside-Albert. A NAVCanada Radar is about 14 km northeast of the Project and the nearest aerodrome is in Moncton International Airport about 45 km northeast of the Project. The primary land use in the area is forestry. The Project is within Wildlife Management Zone 24.

4.10.2 RECREATION AND TOURISM

Recreational activities in-and-around the Project primarily include snow mobile trails, all-terrain vehicle (ATV) trails, and all-season trails for hiking, cross-country skiing and snowshoeing.

The NB Federation of Snow Mobile Clubs is a non-profit, volunteer organization whose goal is to organize snowmobile clubs and create and maintain snowmobile trails (NBFSC, 2017-2018). The Project is in Zone 8 where there are a number of local and provincial trails that traverse the area, including one local trail that uses a portion of the Crown Access Road through the Project area. There is a local/provincial trail that is associated with New Ireland Road. The warming shack located on the corner of New Ireland Road and the Crown Access Road is the Kent Road Shelter associated with this trail network.

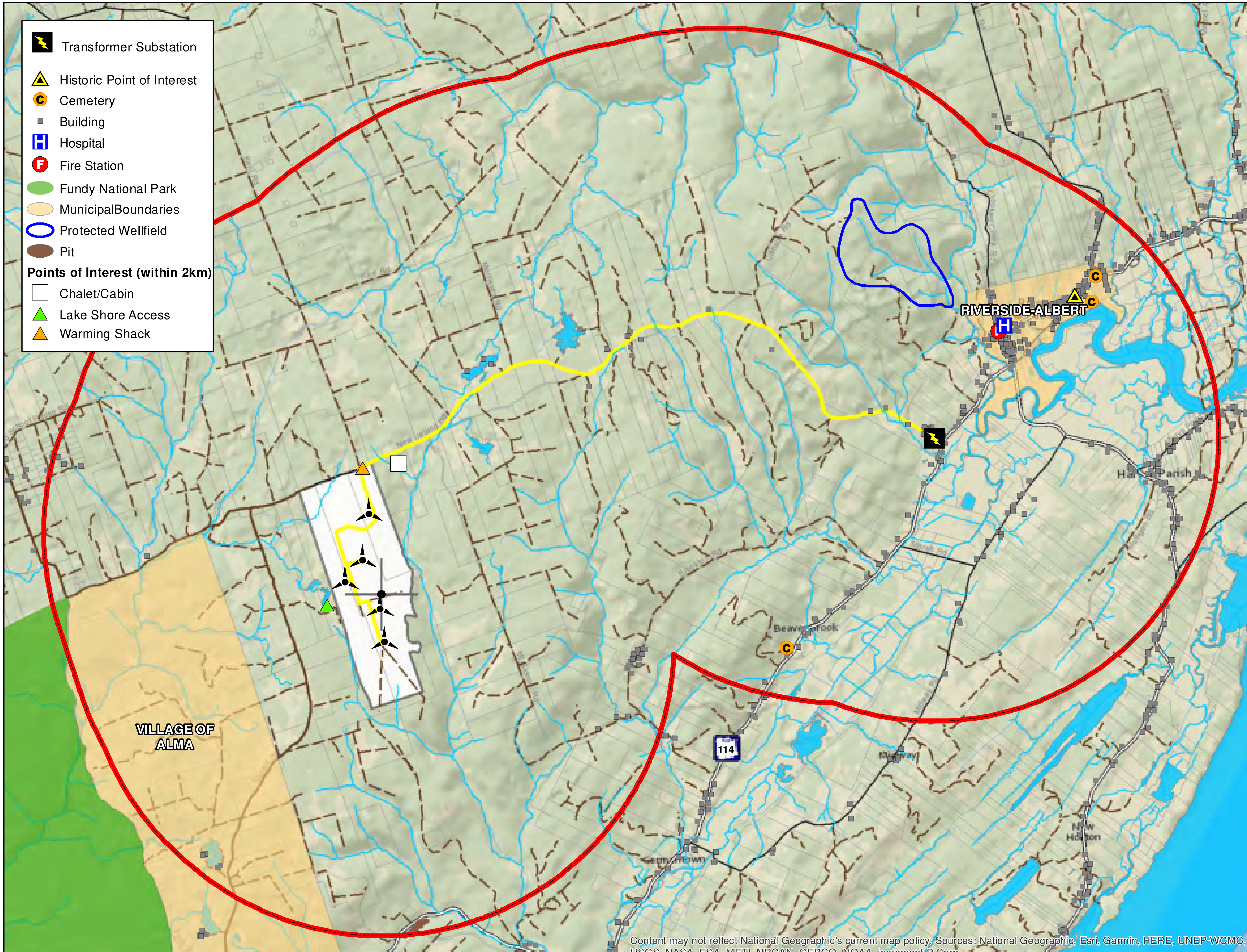
The NB All-Terrain Vehicle Federation runs a province-wide trail network that is linked to local member trails and promotes safe ATV Trails for all (NBATVF, 2018). The Project is within Region 8. A network of non-managed trails traverse the Project area. These are associated with New Ireland and Barrett roads.

There is an all-season trail, the Dobson Trail, which runs from Riverview to Fundy National Park (FHTA, 2018). The Dobson Trail is a 57.75 km hiking trail that traverses a variety of woodland terrain. The closest point of the trail is about 5 km northwest of the Project.

4.10.3 ECONOMY

According to the 2016 census, there were 29,158 people living in Albert County with a population density of 16.1 persons per square kilometre (Statistics Canada, 2016). The majority of the population is within Riverview (19,667 people). The population of Riverside-Albert is 350 people.

In 2016 Statistics Canada reported the median total income for households in Albert County to be approximately $66,500 compared to the provincial average of approximately $59,350. The current unemployment rate is approximately 9.8% compared to that of NB of approximately 10.9% (Statistics Canada, 2017). The main sources of income include sales and service occupations; business, finance and administration occupations; and trades, transport and equipment operators and related occupations. The major industries for Albert County include retail trade, health care and social services, administrative and support, waste management and remediation services, transportation and warehousing, accommodation and food services, and construction (Statistics Canada, 2017).



KEY MAP:

LEGEND:

- WTG
- MET TOWER
- PROJECT FOOTPRINT
- 5 km BUFFER
- PRIMARY HIGHWAY (DTI)
- SECONDARY HIGHWAY (DTI)
- PRIMARY FOREST ROAD (DERD)
- TERTIARY/LIMITED ACCESS FOREST ROAD (DERD)
- WATERCOURSE
- WATERBODY
- SNB PROPERTY BOUNDARY (ALBERT COUNTY)
- LAND LEASE AREA (1252 ha)

PROJECT:

PROJECT: WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: 161-08790 PHASE 19

CLIENT: WISOKOLAMSON ENERGY LP

FIGURE:

TITLE: LAND USE

FIGURE NO.: 4.10-1 | REVISION NO.: 0

SCALE: 1:65,000 — 0 500 1,000 2,000 3,000 Metres

DATUM: NAD 83 CSRS | PROJECTION: NB Stereographic

DRAWN BY: T. MOREHOUSE | CHECKED BY: J. FERNET

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4.10.4 HERITAGE AND ARCHEOLOGICAL RESOURCES

WSP contracted Stratis Consulting Inc. (Stratis) to complete a Heritage Resource Impact Assessment (HRIA) for the Project. The full report is included in Appendix G. The following is a brief summary of the report.

Stratis completed a background research for the Project footprint which includes the WTG locations, Crown Access Roads, and the New Ireland Road ROW. This background research included aerial photographs; research of documents found at Archaeological Services in Fredericton; published materials such as topographic and surficial geology maps and reports; and the NB Register of Historic Places. A field visit and preliminary field examination took place on November 13 and November 17, 2017 under Archaeological Field Research Permit 2017 NB 145, issued to Dr. Grant Aylesworth, RPA No. 15583. The preliminary field examination included a visual survey of the Project footprint, including walking and visually surveying WTG locations and the existing ROW along New Ireland Road where utility poles will be installed. Focus was placed on watercourse crossing locations.

The document review indicated no areas of high archaeological potential near the WTG locations or south of New Ireland Road. There was one known archaeological site, cataloged as BkDf-2 that represents the location of a 19th century Anglican Church and cemetery. Another site, BkDf-1, is located to the west along New Ireland Road.

No new heritage resources were found within the Project area during the preliminary field examination. Some historic period resources, such as BkDf-2, and other features such as rock walls and building foundations, are likely in the area; however the Project is unlikely to encounter these features if construction of the powerlines remains within the existing New Ireland Road ROW and existing Crown Land Access roads.

Based on the results of the assessment, 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, however, crosses a number of high potential archaeological areas, therefore it is recommended that archaeological monitoring of ground disturbing activities within 80 m of a current or former watercourse location and archaeological monitoring for utility pole installation within 200 m of the location of the Anglican Church and cemetery (BkDf-2) should be undertaken. Accidental discovery of heritage resources remains possible whenever any ground disturbing activities take place. If archaeological materials are encountered, Archeological Services New Brunswick (ASNB) must be notified and any ASNB protocols related to accidental discovery of heritage resources must be followed.

If any change to the proposed footprint is anticipated, consultation with a permitted archaeologist should be completed to ensure minimal damage to possible buried heritage resources.

4.10.5 VISUAL LANDSCAPE

WSP completed a Visual Impact Assessment for the Project. The full report is included in Appendix H. The following is a brief summary of the existing conditions in the Project area.

The landscape surrounding the Project is remote and consists of forested areas that are currently used for logging operations. There are no major industrial facilities in the area. The Kent Hills Wind Farm is about 5 km north of the Project. The representative photographs of the current visual landscape can be viewed in Photos 4.10-1 and 4.10-2.

Photo 4.10-1 Pre-Project Landscape View from the Warming Shack (45°43'43.03"N, 64°53'16.22"W), Facing South at the Project Location

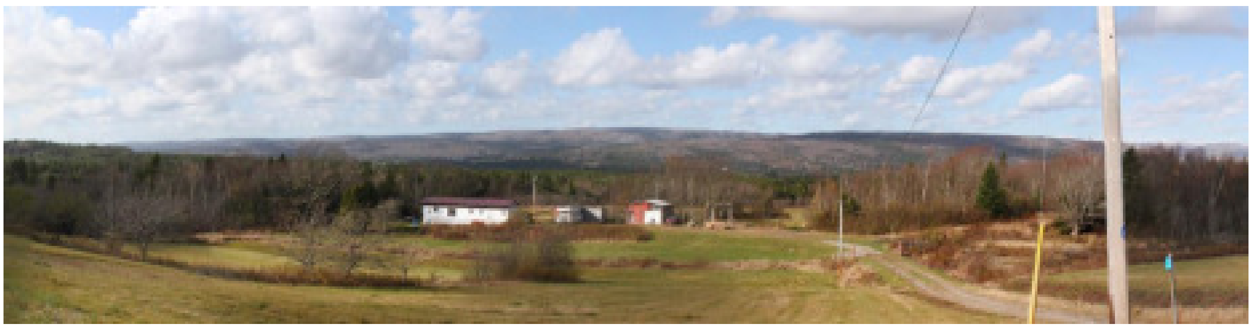

Photo 4.10-2 Pre-Project Landscape View from Midway Road (45°40'24.08"N, 64°46'42.18"W), Facing Northwest at the Project Location

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 or the Project and include construction (2018 to 1019), 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	— 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. — 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
		Changes to soil quality through disturbance to soils (i.e., soil loss, admixing, compaction) from site clearing, excavation, and grading.		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	— 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	— 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

<table>
<tr><th>PROJECT ACTIVITY</th><th>VALUED ENVIRONMENTAL COMPONENT(S)</th><th>POTENTIAL INTERACTION AND ENVIRONMENTAL EFFECT</th><th>PROPOSED MITIGATION</th><th>PREDICTED RESIDUAL EFFECT</th></tr>
<tr><td></td><td>Fish and Fish Habitat</td><td>Alteration to fish habitat from increased sediment loading from increases in erosion</td><td rowspan="2">— 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
— 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.</td><td>No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to the VEC</td></tr>
<tr><td>Construction of the Project (continued)</td><td>Wetlands
Vegetation
Wildlife
Species of Conservation Concern
Land Use</td><td>Alteration to wetlands, vegetation, wildlife habitat, SOCC, and land uses from increased erosion following construction</td><td>No residual effect is anticipated because mitigation will remove the interaction and result in no measureable change to VECs</td></tr>
</table>

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	— 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	— 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	— 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, ASNB will be notified and any ASNB 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	— 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	— 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	— 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	— 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
			  — 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

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 cause birds to alter their migration flyways	— 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	— 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	— 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	— 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	— 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	— 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	— 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.	— 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	— A Fuel and/or Hazardous Materials Spills Contingency Plan will be developed — Dangerous goods will be stored, handled, and transported according to the NB *Clean Environment Act* and the *Transportation of Dangerous Goods Act* — 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 lighting 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.

6 RESIDUAL ENVIRONMENTAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

6.1 APPROACH TO DETERMINATION OF SIGNIFICANCE

The assessment or determination of the significance of potential effects is based on the framework/criteria provided in Canadian Environmental Assessment Agency (Agency) guidance document "Responsible Authorities Guide" (Agency, 1994) which summarizes the requirements that have been applied to similar projects in the past. An updated version is now available for Projects designated under CEAA 2012 (Agency, 2015). These documents are similar in nature and are widely accepted as guidance documents used by government and regulatory agencies in Canada are used as the basis for determining the significance of identified potential effects. This consists of the following steps:

— Determining whether the residual environmental effect is adverse
— Determining whether the adverse environmental effect is significant
— Determining whether a significant environmental effect is likely

For the purposes of the EIA, an effect is defined as the change to VECs as a result of project activities. A project-induced change may affect specific groups, populations, or species, resulting in modification of VECs in terms of an increase or decrease in its nature (characteristics), abundance, or distribution. Effects are categorized as either negative (adverse) or positive. Any adverse effects are then determined to be significant or non-significant in consideration of assessment criteria discussed above. The assessment focuses on those interactions between VECs and Project activities which are likely to cause residual effects.

6.2 SUMMARY OF RESIDUAL EFFECTS AND DETERMINATION OF SIGNIFICANCE

The residual effects classification is based on the magnitude, geographic extent, duration/frequency, reversibility and ecological context and is to describe residual effects predicted for the Project. The criteria are used to describe the nature and type of an effect on VECs. The residual effects classification is then used to determine the environmental significance of Project effects to VECs. The definitions of the criteria are presented below.

Magnitude is a measure of the intensity of a residual effect or the degree of change cause by a Project on a VEC relative to the existing conditions. Geographic extent and duration of an effect is important in classifying magnitude for a VEC. For magnitude, the criteria is defined as follows:

— High: A residual environmental effect affecting a whole stock, population, habitat or ecosystem, outside the range of natural variation that may be near or exceed the resilience limits of a population or community, such that communities do not return to pre-Project levels for multiple generations. For social environment VECs, the residual effect is expected to substantially enhance or interfere with existing conditions in communities in the local area and beyond.
— Moderate: A small, measureable residual environmental effect affecting a portion of a population or habitat, or ecosystem, returns to pre- Project levels in one generation or less, rapid and unpredictable change, temporarily outside range of natural variability. For social environment VECs, the residual effect is noticeable and may be potentially beneficial or detrimental to individuals and communities in the local area but not beyond.
— Low: A negligible residual environmental effect affecting a specific local group, habitat, or ecosystem, returns to pre-Project levels in one generation or less, within natural variation. For social environment VECs, the residual effect is limited to a slight positive effect or nuisance to individuals or communities in the local area.

- Nil: No discernable change to a VEC.
- Unknown: A residual environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.

Geographic extent refers to the spatial extent of the area affected and is related to the spatial distribution and movement of a VEC. When considering geographic extent in the determination of magnitude, it is important to understand that local scale effects are less severe than those that extend to the regional scale or beyond. Geographic extent is broken into local, regional, and beyond regional as defined as follows:

- Local scale effects are those largely associated with direct effects from the Project footprint (i.e., removal of vegetation for construction of project components) and project specific small-scale indirect changes (i.e., within the Local Assessment Area).
- Regional scale effects are those that are associated with incremental and cumulative changes from the Project and other developments but are restricted to within the Regional Assessment Area.
- Beyond regional includes cumulative residual effects from the project and other developments that extend beyond the Regional Assessment Area.

Frequency refers to how often a residual effect will occur but is not to be confused with the frequency of the activity that causes a residual effect. Frequency is explained by identifying when the source of change and residual effect occurs. Frequency is broken into the following categories:

- Infrequent – isolated or confined to a discrete period
- Frequent – occur repeatedly over the assessment period
- Continuous – occurs continuously over the assessment period.

Duration is defined as the amount of time from the beginning of a residual effect to when that effect on a VEC is reversed. Duration is the results of two factors, the amount of time between the start and end of a project activity that causes stress on a VEC and the time required for the effect to be reversible. The duration of individual Project activities and the period in which the residual effect may occur are considered. Some effects are reversible shortly after the stress has been removed (e.g., changes in the distribution of some wildlife species following the removal of noise after decommissioning and abandonment), while others may take longer to be reversed (e.g., the change in abundance of some species until revegetation has occurred). In some cases, a prediction of duration may be well beyond the temporal boundary of the Project, it is not known when those effects may be reversed, and a VEC may never return to a state that was unaffected by the Project. In these cases, the likelihood of reversibility is so low that the effect is classified as irreversible. Therefore, duration is broken into the following categories:

- Short-term – the residual effect is reversible at the end of construction
- Medium-term – the residual effect is reversible at the end of operation of the project
- Long-term – the residual effect is reversible within a defined length of time where prediction certainty can predict the effect is reversible after decommissioning and abandonment.
- Permanent – the residual effect is predicted to influence a VEC indefinitely. This is applied when an effect is determined to be irreversible.

Reversibility is considered is the likelihood that the Project will no longer affect a VEC and as the ability of a VEC to return to an equal or improved condition once the interaction with the Project has ended. Reversibility has two alternatives, reversible or irreversible. Reversible is applied to short- medium- and long-term duration residual effects where the Project no longer cases changes to a VEC. Irreversible is applied when the residual effect is predicted to influence a VEC indefinitely or the duration of an effect is unknown.

For adverse residual effects, the evaluation for the individual criteria was combined into an overall rating of significance as follows:

- Major: Potential impact could jeopardize the long term sustainability of the resource, such that the impact is considered sufficient in magnitude, aerial extent, duration, and frequency, as well as being considered irreversible. Additional research, monitoring, and/or recovery initiatives should be considered.

- Medium: Potential impact could result in a decline of a resource in terms of quality/quantity, such that the impact is considered moderate in its combination of magnitude, aerial extent, duration, and frequency, but does not affect the long term sustainability (that is, it is considered reversible). Additional research, monitoring, and/or recovery initiatives may be considered.
- Minor: Potential impact may result in a localized or short-term decline in a resource during the life of the Project. Typically, no additional research, monitoring, and/or recovery initiatives are considered.
- Minimal: Potential impact may result in a small, localized decline in a resource during the construction phase of the Project, and should be negligible to the overall baseline status of the resource.

An adverse effect is considered "significant" where its residual effects are classified as major; while they are considered "not significant" where residual effects are classified as medium, minor, or minimal. For effects of the Project to have a significant effect on VECs, individuals would have to be affected to the extent that there would be a permanent adverse change to survival and reproduction at the population level.

6.2.1 EFFECTS ON BIRDS

The effects of a wind farm on birds are variable and depend on factors such as the development design, topography of the area, habitats affected, and the bird community in the wind farm area (Drewitt and Langston, 2006). Although some effects are related to construction (e.g., habitat alteration), most potential effects on avifauna are related to mortality resulting from direct collision and sensory disturbance.

The most apparent potential effect of the Project on birds is direct mortality resulting from collision with WTG blades during the operational phase. Most evidence suggests that mortality levels resulting from WTG collisions are low (Environment Canada et al., 2012). A recent review of Canadian wind farms concluded that less than 0.2% of the population of any species is affected by either collisions with, or displacement by, WTGs (Zimmerling et al., 2013).

Collision risk is greater on or near areas used by large numbers of foraging or roosting birds or in important migratory flyways (Drewitt and Langston, 2006). The probability of raptor collision with WTGs depends on the species, WTG height, and local topography (de Lucas et al., 2008). Collision risk can be greatly reduced by incorporating knowledge of the avifauna into the design and placement of wind power infrastructure. Available research suggests that the probability of large-scale fatality events occurring at wind farms is low (Kerlinger et al., 2010). Because no major migratory movements of passerines, shorebirds, waterfowl, or birds of prey were observed at the Project site, it is unlikely that significant mortality events will occur as a result of collisions with WTGs and other Project infrastructure.

Sensory disturbance to birds can occur during the construction, operation, and decommissioning and abandonment phases of the Project, and can be caused by the increased presence of personnel, vehicle movement, operation of heavy equipment, and the operation of the WTGs (Drewitt and Langston, 2006). It is thought that sensory disturbance to birds may have a greater population impact than collisions, although research is lacking in this area (Kingsley and Whittam, 2005). Some studies have shown that birds will exhibit avoidance behaviours, leading to a variable degree of displacement from previously used habitat (Drewitt and Langston, 2006). However, while birds may avoid specific sites, the evidence does not suggest that birds abandon the general area as a whole. Other research indicates that the presence of WTGs has no effect on the distribution of the bird community (Devereux et al., 2008) and birds may habituate to the presence of operating WTGs (Madsen and Boertmann, 2008). The majority of the Project crosses existing roads and forest that is currently disturbed by harvesting activities and has been sited to avoid environmentally sensitive areas thereby minimizing disturbance to new areas which can reduce displacement effects to birds.

No important concentrations of bird was detected during the winter, summer or autumn field surveys (Section 4.8.1). Only few birds of prey were noted. A total of five (5) bird SOCC were observed and included pine siskin, turkey vulture, common nighthawk, eastern wood-pewee, and evening grosbeak. Pine siskin and turkey vulture are ranked by the ACCDC; however, both are not listed under the NB SARA, designated by COSEWIC or listed under SARA. Additional spring bird migrations surveys are being completed in April/May 2018 to supplement the data in this report.

The collision of birds with WTGs and other Project infrastructure and displacement of birds from the Project was determined to be moderate in magnitude because it is unknown what the effects would be at the population level (Table 6.2-1). The Project consists of 5 WTGs in an area that appears to have highly variable distribution of birds based on habitat availability (Section 4.8.1). Similar observations were recorded at the Kent Hills wind farm about 5 km north of the Project. The incremental effects from the Project are predicted to be local in geographic extent and the effects are expected to be reversible following decommissioning and reclamation (long-term). The incremental contribution of the Project to existing conditions is not likely to decrease the resilience and increase the risk to local or sub-regional bird populations in the area. Therefore, the Project was given an overall significance rating of medium and is predicted to not have significant adverse effects on birds. Confidence in this prediction is moderate because of limited knowledge about the resilience of bird populations in the area. To test the prediction of significance presented in this EIA and to reduce uncertainty, a Post-construction Monitoring program will be implemented (Section 8). If the Project is found to be causing significant mortality during post-construction monitoring, additional mitigation will be evaluated.

6.2.2 EFFECTS ON BATS

Wind projects have the potential to affect bats both directly and indirectly (Arnett et al., 2007). Although some effects are related to construction (e.g., habitat alteration), most potential effects on bats are related to mortality resulting from direct collision and sensory disturbance.

Activities that cause noise, vibration, and dust, such as deforestation, earth-moving, excavation, blasting, transportation, and construction activities, could disturb local populations of bats. Because bats use echolocation in their movements and to locate and capture prey, the presence of anthropogenic noise could conflict with these activities. The effects of sensory disturbance varies among species of bats because each uses a specific range of ultrasound frequencies (Bunkley et al., 2015). The noise generated by road traffic have frequencies varying between 0 kHz and 50 kHz; typical ranges are between 1 kHz and 20 kHz (Schaub et al., 2008). These frequencies are likely to cause a greater sensory disturbance in species using low frequencies for echolocation such as hoary bat and big brown bat than in other species. However, traffic noise is unlikely to affect peak activity times of bats in the study area because construction is scheduled to occur during daytime hours. Vibrations generated by the Project near bat maternity colonies can lead to a reduction in reproductive success or cause bats to leave the site to find an alternative location (McCracken, 2011; ECCC, 2015). Among the recorded bat species, *Myotis* species, tri-colored bat, and big brown bat are resident species that over winter in NB in habitats where conditions are suitable for hibernation. Frequent awakenings during the hibernation period can be a cause of mortality (Gauthier et al., 1995; Thomas, 1995). No potential hibernaculum or other critical habitat (maternity sites) for bats was identified during field surveys. The closest known bat hibernaculum is located about 18 km north from the Project area.

Bat activity is mostly nocturnal and bats can be affected by light pollution (Stone et al., 2015). The presence of artificial light appears to disrupt the movements of some species of bats and can cause them to use alternative routes which may require higher energy costs and increased risk of predation (Stone et al., 2009; Stone et al., 2015). Conversely, species such as big brown bat and *Myotis* species may use areas of artificial light for foraging because artificial light can concentrate many flying insects (Rydell, 1992; Stone et al., 2015). Lighting on WTG hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.

Increased vehicles and equipment traffic may result in collisions with bats (Lesiński et al., 2011; Medinas et al., 2013). Mortality rates are highest near roosts and active foraging areas (Medinas et al., 2013) and forest-adapted species, such as northern long-eared bat and tri-colored bat, have the highest risk due to their characteristic low and slow flight (Abbott et al., 2015). However, construction is scheduled during daytime hours and speed limits will be enforced during the Project, thereby reducing the potential for bat-vehicle collisions.

The most apparent potential effect of the Project on bats is direct mortality resulting from collision with WTG blades during the operational phase of a wind project. Mortality can either occur from direct contact with WTG blades or from barotrauma (Grodsky et al., 2011). Barotrauma is caused by rapid air-pressure reduction that causes tissue damage due to expansion of air in the lungs that is not accommodated by exhalation (Baerwald et al., 2008). A drop in atmospheric pressure along the top of a rotating WTG blade causes thoracic, abdominal, and pulmonary injury to bats when passing through the low pressure area (Baerwald et al. 2008). Recent studies indicates that barotrauma is probably the major cause of bat mortality from wind facilities (Rollins et al., 2012).

According to other post-construction monitoring programs of wind facilities, bat fatalities in Canada outnumbers bird fatalities (Environment Canada et al., 2012). Because bats have a long life span and a low reproductive rate, fatalities from wind facilities may be important. Species in the genus *Myotis* are killed by WTGs at lower rates (e.g., 0 to 13% of fatalities) relative to long-distance migratory species such as hoary bat (Arnett et al., 2008). This is likely because *Myotis* are non-migratory species that move shorter distances and generally fly at low altitudes during summer (Reynolds, 2006). Most bat fatalities are reported in the late summer months coinciding with the start of swarming and autumn migration (Johnson, 2005; Arnett et al., 2007; Environment Canada et al., 2012). Periods of high mortality may therefore be linked with the timing of large-scale insect migrations when bats feed at altitudes consistent with WTG heights (Rydell et al., 2010).

The collision of bats with WTGs and other Project infrastructure and displacement of bats was determined to be moderate in magnitude because it is unknown what the effects would be at the population level given the other pressures on bat populations (i.e., white-nose syndrome; Table 6.2-1). The Project consists of 5 WTGs in an area that appears to have relatively low bat activity (i.e., approximately 0.15 calls per night) when compared to other areas with 1.4 calls per night (Section 4.8.2). Similar observations of low bat activity were recorded at the Kent Hills wind farm about 5 km north of the Project. The incremental effects from the Project are predicted to be local in geographic extent and the effects are expected to be reversible following decommissioning and reclamation (long-term). The incremental contribution of the Project to existing conditions is not likely to decrease the resilience and increase the risk to remaining local or sub-regional bat populations in the area. Therefore, the Project was given an overall significance rating of medium and is predicted to not have significant adverse effects on bats. Confidence in this prediction is moderate because of limited knowledge about the resilience of the remaining bat populations in the area. To test the prediction of significance presented in this EIA and to reduce uncertainty, a Post-construction Monitoring program will be implemented (Section 8). If the Project is found to be causing significant mortality during post-construction monitoring, additional mitigation will be evaluated.

6.2.3 EFFECTS TO LOCAL ECONOMY

The Project will have a significant positive residual effect on the social environment in relation to employment and business opportunities (Table 6.2-1). Project construction and operations will create jobs and generate income, although much of the construction workforce may not be hired locally, which will reduce the benefits of job creation and income during Project construction. The Project will result in increased training and experience in the labour force, which will affect future opportunities. Project spending will result in increased gross domestic product and Project operations will generate tax revenue for municipal, provincial, and federal governments. WISK will attempt to source as much of the labour and materials locally when possible.

Table 6.2-1 Summary of Residual Effects Classification and Predicted Significance

Potential Interaction and Environmental Effect	Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Significance
Construction and operation of the Project may result in birds and bats colliding with WTGs and other Project infrastructure	Moderate	Local	Continuous	Long-term	Reversible	Medium, Not Significant
Construction and operation of the Project may cause birds to alter their migration flyways to avoid WTGs	Low to Moderate	Local	Continuous	Long-term	Reversible	Medium, Not Significant
Employment and business opportunities	High	Regional	Continuous	Long-term	Irreversible	Significant positive effect

6.3 CUMULATIVE RESIDUAL EFFECTS

Cumulative residual environmental effects are defined as the sum of residual environmental effects from all past, current, and reasonably foreseeable projects and/or activities on the physical, biological, social and cultural components of the environment. In addition, natural disturbances such as fire, floods, insects, disease, and climate change can contribute to cumulative residual environmental effects.

The Project will implement mitigation practices to limit incremental environmental effects from the Project that will occur. Implementation of the mitigation practices is expected to result in minor changes to the biophysical and socio-economic environments from the Project relative to baseline conditions. The Project is located in an area that contains a large amount of forestry activity that will likely continue for the duration of the Project. Effects on VECs from the Kent Hills wind farm are not expected to overlap with effects on VECs in the local area. As such, no cumulative residual environmental effects are expected. As the Project progresses, SWEB will develop site-specific mitigation to further reduce the potential for cumulative environmental effects as required.

7 SUMMARY OF PROPOSED MITIGATION

GENERAL

- All necessary permits and approvals will be obtained and on-site.
- Pre-project surveys will be completed to identify locations for avoidance.
- 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.

SOILS, UNSTABLE TERRAIN, AND EROSION

- 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.
- 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.
- 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
- 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.

SURFACE DRAINAGE AND WATERCOURSES

- 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.
- To the extent practical, existing surface drainage patterns will be maintained in the Project area.
- 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.
- 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

WETLANDS

- 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.
- 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.
- 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).

VEGETATION AND WILDLIFE HABITAT

- 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.
- 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).
- 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
- Disturbed areas not required for Project operation will be revegetated with an approved, weed free mix, as soon as practical following construction.

WILDLIFE IN GENERAL

- 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 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
- Construction activities will follow activity restriction guidelines and set-back distances for wildlife

SPECIES OF CONSERVATION CONCERN

- 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.

BIRDS AND BATS

- 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.
- 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.
- 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.
- Spring bird migrations surveys are being completed in April/May 2018
- 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.

BLASTING

- 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

NOISE

- 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

WASTE MANAGEMENT

- Recyclable and waste hazardous materials will be stored on-site in appropriate containers to prevent exposure and shipped off-site to an approved facility
- All litter, garbage, and other debris generated by the Project will be collected and transported to approved disposal locations or facilities.

ACCIDENTS AND UNPLANNED EVENTS

- A Fuel and/or Hazardous Materials Spills Contingency Plan will be developed
- Dangerous goods will be stored, handled, and transported according to the NB *Clean Environment Act* and the *Transportation of Dangerous Goods Act*
- 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.

TRAFFIC

- 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.
- 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.

LOCAL ECONOMY

- Local communities will benefit greatly from the development, construction, and operation of the Project as outlined in SWEB’s Social and Economic Benefit Plan.
- Local and regional business communities and labour organizations will be informed of the opportunities arising from the construction, operation and maintenance of the Project.

LAND USE

- Early and meaningful engagement with First Nations communities and all potential stakeholders was completed for the Project and will continue during the Project.

- 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.
- Disturbed areas will be recontoured and reclaimed to a stable profile to permit existing land uses.

HERITAGE RESOURCES

- 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, ASNB will be notified and any ASNB protocols related to accidental discovery will be followed.

8 FOLLOW-UP MONITORING

8.1 POST-CONSTRUCTION SURVEY

Areas disturbed by construction of the Project will be periodically inspected following completion to assess success of any reclamation efforts completed during the Project and to assess effectiveness of applied mitigation measures (e.g., erosion control). This will determine the necessity for any immediate remedial or follow-up work (e.g., additional erosion control in unstable areas). If any additional work is required, additional inspection may be required.

8.2 BIRD AND BAT POST-CONSTRUCTION MONITORING PLAN

A Post-construction Monitoring Plan will be prepared for the Project following the Post-Construction Bat and Bird Mortality Survey Guidelines for Wind Farm Development in New Brunswick (ERD, 2011) and the Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (CWS, 2007). Consultation with NBDERD and Canadian Wildlife Service (CWS) will be completed as part of Plan development. The Post-construction Monitoring Plan will be submitted for review by the Fish and Wildlife Branch at NBDERD prior to implementation of the monitoring program. The Plan will be designed to collect information to reduce uncertainty in effects predictions and inform and direct mitigation for the Project when necessary. Post-construction monitoring will begin with the commencement of operation of the Project and will be completed for a minimum of two years. It is understood that the NBDERD has the option to extend the post-construction monitoring period for operators depending on survey results.

Post-construction monitoring for bats will include, but not limited to, mortality surveys, carcass removal trials, and searcher efficiency trials and will be combined with the required post-construction bird mortality studies. An annual Post-construction Monitoring Report that will include all raw data, results, and analysis of the monitoring program will be submitted to the Fish and Wildlife Branch at NBDERD. If the Project is found to be causing significant bird and bat mortality or causing barrier or exclusion effects during post-construction monitoring, additional mitigation may be required for the Project and the monitoring program may be extended based on requirements determined from consultation with the NBDERD and CWS.

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A CLEARANCES AND APPROVALS

New Brunswick Nouveau-Brunswick
CANADA

June 30, 2016

File No.: 447 02 1206

SWEB Development
6080 Young Street, Suite 106
Halifax, Nova Scotia
B3K 5L2

Attention: Mr. Daniel Roscoe

Dear Mr. Roscoe:

Re: **Licence of Occupation for Wind Exploration with Option Agreement**

This is further to your company's application to obtain a three-year Licence of Occupation together with an Option Agreement authorizing your company to conduct wind exploration activities on approximately **511** hectares of Crown lands located near Germantown, Albert County (outlined in purple on the attached maps).

Licence of Occupation

Under subsection 2(1) of the *Crown Lands and Forests Act*, the Minister of Energy and Resource Development has designated me to administer all matters pertaining to licences of occupation. Pursuant to subsection 26(1) of the *Crown Lands and Forests Act*, I hereby provide you with a licence of occupation (hereinafter called authorization) for the above noted purpose on Crown lands, for a period of three years which shall expire **June 30, 2019**. Throughout the term of this authorization you **must adhere to the terms and conditions outlined in the attached Schedule "C"**. This authorization shall begin upon receipt of your written acceptance of this offer and submission of the following items:

1. Your written acceptance of the terms and conditions associated with this authorization must be received by Jeff Connors, Crown Lands Branch, prior to occupation.

2. The annual consideration for a Licence of Occupation authorizing non-exclusive wind exploration and the installation of test towers is based on a rate of \$1.00 per hectare plus HST (The fiscal year begins on April 1st). The exploration area contains approximately **511** hectares. Therefore, the total annual fee payable for the remainder of the 2016 fiscal year beginning **July 1, 2016**, is **\$440.74** (\$383.25 plus HST) (code 1799).

3. The annual fee for each test tower authorized under a Licence of Occupation is \$640.00 plus HST. The total fee for the remainder of the 2016 fiscal year beginning **July 1, 2016**, for the 1 test tower is **\$552.00** (\$480 plus HST) (code 1799).

.../2

4. To prepare the Licence of Occupation for Wind Exploration is **$230.00** ($200.00 plus HST) (code 1799).

5. A third-party liability insurance policy in the amount of $2,000,000.00, per occurrence, shall be maintained throughout the term of this authorization. Her Majesty the Queen in Right of the Province of New Brunswick will be named as an additional insured to protect against any and all claims by users and the public. **Please note that proof of insurance must be submitted within four weeks from the date of your acceptance of this offer.**

6. The policy of the Department of Energy and Resource Development is to protect and preserve investments made in silviculturally treated areas on Crown lands. **SWEB has indicated that proposed tower Site I is the preferred MET tower location, therefore the LOSA Policy does not apply to that location.** Should SWEB wish to amend the MET tower locations a recovery charge as per the Loss of Silviculture Areas Policy (LOSA) may apply.

7. The proposed MET tower location IV described in the Site Development Plan (SDP) submitted on March 30, 2016 would negatively impact Departmental programs and therefore cannot be considered in its current location.

8. A new SDP must be approved prior to any deviations from the SDP submitted on March 30, 2016.

If your company is in agreement with the above noted terms and conditions, please sign and return one of the copies of this Licence of Occupation along with a cheque payable to the Minister of Finance in the amount of **$1,222.74** to the attention of Jeff Connors, Crown Lands Branch, at the address on the bottom of the first page.

<u>Option Agreement</u>

Two copies of the Option Agreement are attached for your consideration. The annual fee for an Option Agreement granting the exclusive right to apply for a Wind Farm Lease on the same area of Crown land identified above is based on a rate of **$3.00 per hectare plus HST** (The fiscal year begins on April 1st). Based on the area listed above, the total annual payment for the exploration area will be **$1,533** (plus HST). The total fee for the remainder of the 2016 fiscal year beginning **July 1, 2016** for the **511 ha** option area is **$1,322.21** ($1,149.75 plus HST) (code 1799)

If your company wishes to enter into an Option Agreement, sign and return both copies along with a cheque payable to the Minister of Finance in the amount of **$1,322.21** to the attention of Mr. Jeff Connors.

Upon receipt of the signed Option Agreement and cheque, the necessary documents will be prepared and presented for approval by the Lieutenant-Governor in Council. The cheque will be held in a temporary trust account until the Minister has obtained approval to enter into the Option Agreement. Should approval not be given, the cheque will be returned to you.

.../3

If the signed Option Agreements are not received by **July 22, 2016**, it will be assumed that your company does not wish to obtain the exclusive first right to apply for a Wind Farm Lease and the area will be open to applications from other interested parties.

Financial Requirements

The financial requirements reflect annual payments ending March 31st, the end of each fiscal year. Therefore, your company will be invoiced annually. As for reimbursements, the Department's position is that while the company may terminate the Licence of Occupation and the Option Agreement at any time, once paid, all fees are non-refundable. However, should the holder of the disposition apply for a Wind Farm Lease, the outstanding balance of any fees paid may be credited to the annual lease rental.

If you have any questions, please contact Mr. Jeff Connors at (506) 453-6646.

Yours truly,

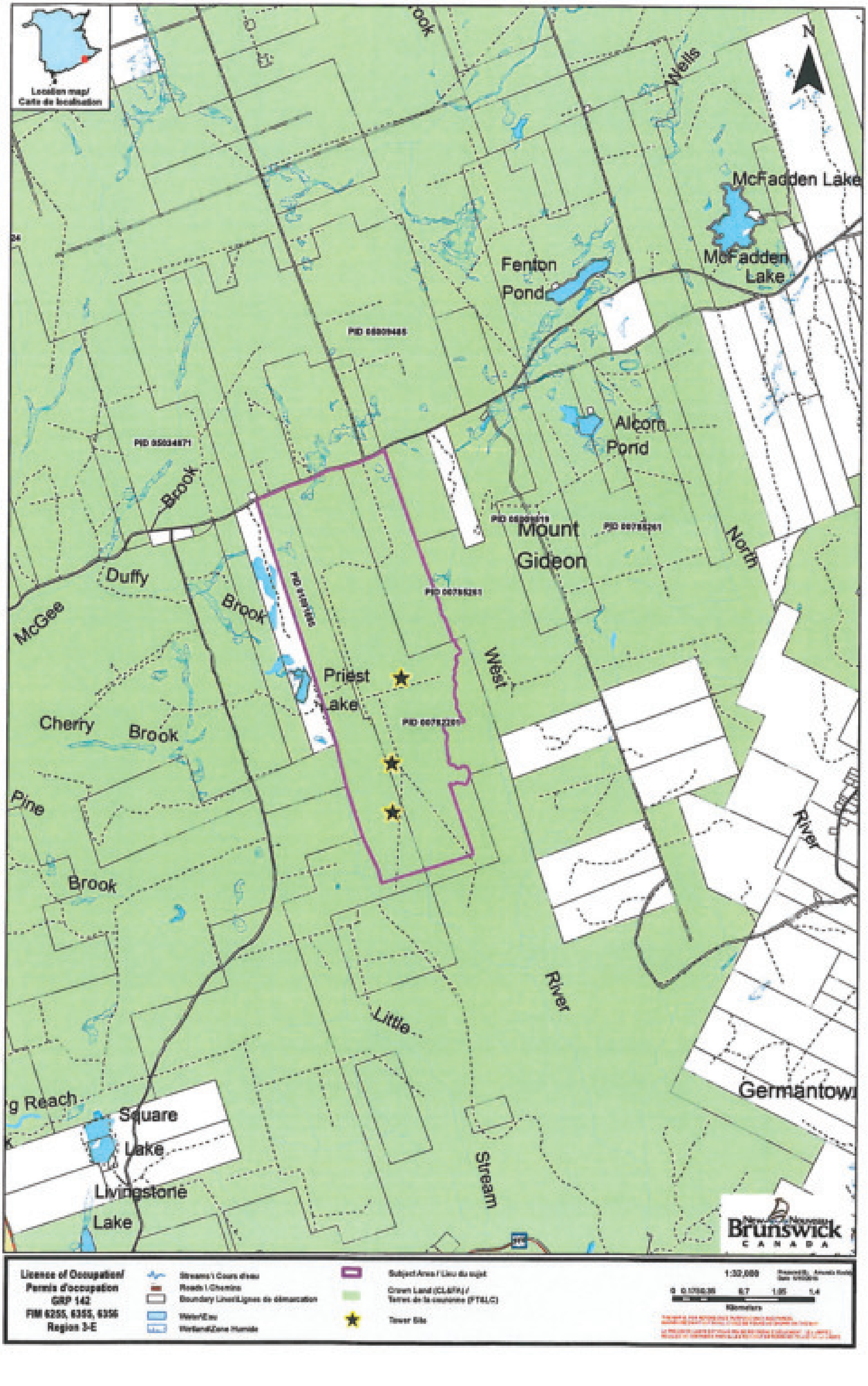
Cade Libby
Director of Crown Lands
Minister's Designate

ACCEPTANCE:
I accept the terms and conditions for the Licence of Occupation set out in this letter.

Daniel Roscoe
(SWEB Development)

July 15/2016
Date

cc: Frederic Paillard, Regional Programs Manager, Region 3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Roads / Chemins
Boundary Lines/Lignes de démarcation
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Terres de la couronne (FT&LC)
Tower Site
1:32,000
Kilometers

June 17, 2016

Your file
Riverside - Albert Met Tower
Our file
16-0838

Mr. Jason Parise
SWEB Development Inc.
6080 Young Street, Suite 106
Halifax, NS
B3K 5L2

RE: Wind Structures: Meteorological Tower - Long Term (2+ years) - Riverside - Albert, NB
(N45° 42’ 32.117” W64° 53’ 03.184” / 196.8504’ AGL / 1361.5486’ AMSL)

Mr. Parise,

We have evaluated the captioned proposal and NAV CANADA has no objection to the project as submitted.

However, due to geographical location, potential wind turbines in this area have an increased probability of being visible by the Moncton Radar. Only with having detailed information on proposed turbine quantity, locations, heights, blade widths, materials used, will we be able to conduct an engineering study and provide a more definitive answer.

While this proposed wind structure is acceptable, it does not constitute NAV CANADA’s approval for any other structure at this location such as a wind turbine. The nature and magnitude of electronic interference to NAV CANADA ground-based navigation aids, including RADAR, due to wind turbines depends on the location, configuration, number, and size of turbines; all turbines must be considered together for analysis. The interference of wind turbines to certain navigation aids is cumulative and while initial turbines may be approved, continued development may not always be possible.

In the interest of aviation safety, it is incumbent on NAV CANADA to maintain up-to-date aeronautical publications. To assist us in that end, we ask that you notify us upon completion of construction and upon removal. These notification requirements can be satisfactorily met by returning completed, signed copies of the attached forms by e-mail at landuse@navcanada.ca or fax at 613-248-4094. In the event that you should decide not to proceed with this project or if the structure is dismantled, please advise us accordingly so that we may formally close the file.

If you have any questions, contact the Land Use Department by telephone at 1-866-577-0247 or e-mail at landuse@navcanada.ca.

NAV CANADA's land use evaluation is valid for a period of 12 months. Our assessment is limited to the impact of the proposed physical structure on the air navigation system and installations; it neither constitutes nor replaces any approvals or permits required by Transport Canada, Industry Canada, other Federal Government departments, Provincial or Municipal land use authorities or any other agency from which approval is required. Industry Canada addresses any spectrum management issues that may arise from your proposal and consults with NAV CANADA engineering as deemed necessary.

Yours truly,

David Legault | NAV CANADA
Manager - AIM Service Delivery Data Management & NOTAM Office

cc ATLR - Atlantic Region, Transport Canada

August 8, 2016

Your file
Albert Wind Energy Project
Our file
16-1783

Mr. Jason Parise
SWEB Development Inc.
6080 Young Street, Suite 106
Halifax, NS
B3K 5L2

RE: Wind Farm: 5 Wind Turbines - Riverside - Albert, NB
(See attached spreadsheet)

Mr. Parise,

We have evaluated the captioned proposal and NAV CANADA has no objection to the project as submitted.

The nature and magnitude of electronic interference to NAV CANADA ground-based navigation aids, including RADAR, due to wind turbines depends on the location, configuration, number, and size of turbines; all turbines must be considered together for analysis. The interference of wind turbines to certain navigation aids is cumulative and while initial turbines may be approved, continued development may not always be possible.

In the interest of aviation safety, it is incumbent on NAV CANADA to maintain up-to-date aeronautical publications and issue NOTAM as required. To assist us in that end, we ask that you notify us at least 10 business days prior to the start of construction. This notification requirement can be satisfactorily met by returning a completed, signed copy of the attached form by e-mail at landuse@navcanada.ca or fax at 613-248-4094. In the event that you should decide not to proceed with this project or if the structure is dismantled, please advise us accordingly so that we may formally close the file.

If you have any questions, contact the Land Use Department by telephone at 1-866-577-0247 or e-mail at landuse@navcanada.ca.

NAV CANADA's land use evaluation is valid for a period of 12 months. Our assessment is limited to the impact of the proposed physical structure on the air navigation system and installations; it neither constitutes nor replaces any approvals or permits required by Transport Canada, Industry Canada, other Federal Government departments, Provincial or Municipal land use authorities or any other agency from which approval is required. Industry Canada addresses any spectrum management issues that may arise from your proposal and consults with NAV CANADA engineering as deemed necessary.

Yours truly,

David Legault | NAV CANADA
Manager - AIM Service Delivery Data Management & NOTAM Office

cc ATLR - Atlantic Region, Transport Canada

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December 2, 2017

Your file
Albert Wind Energy Project
Our file
17-3986

Mr. Jason Parise
SWEB Development Inc.
6080 Young Street, Suite 106
Halifax, NS
B3K 5L2

RE: Wind Farm: 5 Wind Turbines - Riverside - Albert, NB
(Spreadsheet attached)

Mr. Parise,

NAV CANADA has evaluated the captioned proposal and has no objection to the project as submitted however the Wind Turbines will have minor impacts to the 25 Nautical Mile Minimum Sector Altitude (MSA) for multiple procedures at Greater Moncton Romeo Leblanc Airport (CYQM) which we find acceptable.

The nature and magnitude of electronic interference to NAV CANADA ground-based navigation aids, including RADAR, due to wind turbines depends on the location, configuration, number, and size of turbines; all turbines must be considered together for analysis. The interference of wind turbines to certain navigation aids is cumulative and while initial turbines may be approved, continued development may not always be possible.

In the interest of aviation safety, it is incumbent on NAV CANADA to maintain up-to-date aeronautical publications and issue NOTAM as required. To assist us in that end, we ask that you notify us at least 10 business days prior to the start of construction. This notification requirement can be satisfactorily met by returning a completed, signed copy of the attached form and accompanying spreadsheet by e-mail at landuse@navcanada.ca or fax at 613-248-4094. In the event that you should decide not to proceed with this project or if the structure is dismantled, please advise us accordingly so that we may formally close the file.

If you have any questions, contact the Land Use Department by telephone at 1-866-577-0247 or e-mail at landuse@navcanada.ca.

NAV CANADA's land use evaluation is valid for a period of 12 months. Our assessment is limited to the impact of the proposed physical structure on the air navigation system and installations; it neither constitutes nor replaces any approvals or permits required by Transport Canada, Industry Canada, other Federal Government departments, Provincial or Municipal land use authorities or any other agency from which approval is required. Industry Canada addresses any spectrum management issues that may arise from your proposal and consults with NAV CANADA engineering as deemed necessary.

Yours truly,

Gheorghe Adamache | NAV CANADA
Manager - AIM IFP Service Delivery

cc ATLR - Atlantic Region, Transport Canada

From:	Radars Météo / Weather Radars (EC)
To:	Jason Parisé
Cc:	Radars Météo / Weather Radars (EC); Young, Jim (EC)
Subject:	RE: Wind Energy Project Evaluation - Albert Wind Project
Date:	October-18-16 3:55:11 PM
Attachments:	image001.png image002.png image003.png

Dear Mr. Jason Parisé,

Thank you for contacting the Meteorological Service of Canada, a branch of Environment and Climate Change Canada, regarding your wind energy intentions.

Our preliminary assessment of the information provided to us via e-mail on October 6, 2016 indicates that any potential interference that may be created by the Albert wind farm, located west of the town of Riverside-Albert in the County of Albert, New Brunswick will not be severe. Although we would prefer our radar view to be interference free, this is not always reasonable. As a consequence, we do not have strong objections to the current proposal.

If your plans are modified in any manner (e.g. number of turbines, height, placement or materials) this analysis would no longer be valid. An updated analysis must be conducted.

Please contact us at: ec.radarsmeteo-weatherradars.ec@canada.ca

Thank you for your ongoing cooperation and we wish you success.

Best Regards,

Ingrid Wong
Junior Physical Scientist, Meteorological Service of Canada
Environment and Climate Change Canada / Government of Canada
ingrid.wong@canada.ca / Tel: +1 416-739-4508

Scientifique junior, Service météorologique du Canada
Environnement et Changement climatique Canada / Gouvernement du Canada
ingrid.wong@canada.ca / Tél: +1 416-739-4508

From: Jason Parisé [mailto:jason.parise@swebdevelopment.ca]
Sent: October 6, 2016 12:22 PM
To: Radars Météo / Weather Radars (EC)
Subject: Wind Energy Project Evaluation - Albert Wind Project

Good afternoon,

Please find attached a location map illustrating a proposed wind energy facility west of the town of Riverside-Albert in the County of Albert, New Brunswick. Please evaluate this project for potential impacts to Environment Canada Weater Radar operations and advise regarding any concerns you may have.

Kind regards,

Jason Parisé
Development Manager, SWEB Development
t (902) 431-0564 ext 254
c (902) 789-4501
6080 Young Street, Suite 106 | Halifax, NS | B3K 5L2

From:	CCG Wind Farm Coordinator / Coordinateur Parcs Eoliens GCC (DFO/MPO)
To:	Jason Parisé
Subject:	RE: Proposed Wind Farm - Riverside-Albert, New Brunswick
Date:	October-13-16 3:00:46 PM
Attachments:	image001.png image002.png image003.png

Hello,

There is no CCG communication or radar site in the vicinity of the proposed wind farm (Riverside-Albert). Therefore no interference issues are anticipated.

Regards / Salutations,

Martin Grégoire, P. Eng
Canadian Coast Guard

From: Jason Parisé [mailto:jason.parise@swebdevelopment.ca]
Sent: October-06-16 1:43 PM
To: CCG Wind Farm Coordinator / Coordinateur Parcs Eoliens GCC (DFO/MPO)
Subject: Proposed Wind Farm - Riverside-Albert, New Brunswick

Good afternoon,

Please find attached, a 1:50,000 scale map detailing a proposed wind energy project located in the County of Albert, approximately 12km west of the town of Riverside-Albert, New Brunswick. Please advise if the CCG has any objections to this project or if additional information is required.

Kind regards,

Jason Parisé
Development Manager, SWEB Development
t (902) 431-0564 ext 254
c (902) 789-4501
6080 Young Street, Suite 106 | Halifax, NS | B3K 5L2

Protected A

Jason Parisé
Development Manager
SWEB Development

GV 1620-7-3

October 31st 2016

Dear Sir,

SUBJECT: Riverside-Albert Wind Project

Reference is made to your email “Proposed Wind Farm – Riverside-Albert, New Brunswick”, coordination request dated 2016 October 6th, on your plans to install a wind farms in the province of New Brunswick.

The RCMP has no nearby facilities which could be impacted by your proposed plan.

If more information is required, or if you have any questions, please don't hesitate to contact us.

Sincerely,

Jules Lefrançois
Spectrum Unit
Tel: 613-993-1005
Fax: 613-998-7528
Email: jules.lefrancois@rcmp-grc.gc.ca

Jonathan Lafrenière
Wind farm administrative coordinator
Tel : 613-949-3806
Fax: 613-998-7528
Email:windfarm_coordinator@rcmp-grc.gc.ca

National Radio Services
CIO Sector
Royal Canadian Mounted Police

Transport Canada | Transports Canada

Transport Canada number: TC # 2017-265

Applicant number

AERONAUTICAL ASSESSMENT FORM FOR OBSTRUCTION EVALUATION

JP

SECTION 1

Owner's Name	Contact Person	
SWEB Development Inc.	Jason Parisé	
Address		
6080 Young Street, Suite 106		
City	Province	Postal Code
Halifax	Nova Scotia	B3K 5L2
Telephone number (999-999-9999): 902-431-0564	Fax number (999-999-9999): 902-407-2122	Email Address: jason.parise@swebdevelopment.ca

SECTION 2

Applicant's Name	Contact Person	
Address		
City	Province	Postal Code
Telephone number (999-999-9999)	Fax number (999-999-9999)	Email Address

SECTION 3

Description of Proposal (or as attached)

Five (5) industrial wind turbine generators on steel towers. Project is expected to operate for 25 years.

SECTION 4

Geographic Coordinates ☑ NAD83 ☐ NAD27 ☐ WGS84

For multiple structures in a grouping, submit geographical coordinates on a seperate spreadsheet (e.g. windfarms, transmission lines)

N Latitude deg ___ min ___ sec ___

W Latitude deg ___ min ___ sec ___

See Attached Excel Chart.

SECTION 5

Nearest Community	Province
Riverside-Albert	New Brunswick

SECTION 6

Nearest Aerodrome

Moncton Airport

SECTION 7

Have you contacted the aerodrome?

◯ Yes ☑ No

SECTION 8

Notice of

☑ New Construction ◯ Change to existing structure

SECTION 9

Duration

◯ Permanent ☑ Temporary

Canada

Transport Canada number
TC 2017-265

SECTION 10

Proposed Construction Date Beginning (yyyy-mm-dd)
2019-05-01

SECTION 11

Temporary Structure
From date (yyyy-mm-dd) 2019-05-01 To date (yyyy-mm-dd) 2044-05-01

SECTION 12

Marking and Lighting Proposed (refer to Standard 621)

- [x] Red lights and paint
- [ ] Red and M.I. white lights
- [ ] White M.I. lights
- [ ] Red and H.I. white lights
- [ ] White H.I. lights
- [ ] No painting
- [ ] No lighting
- [ ] Paint marking only
- [ ] Other (provide description)

SECTION 13

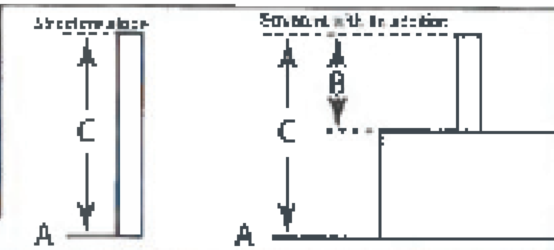
Monitoring to Standard 621, article 4.7 — [ ] Visual inspection [x] Remote indicator

SECTION 14

Catenary/Cable Crossing

- [ ] Paint supporting structures
- [ ] Cable marker spheres
- [ ] Shore markers
- [ ] Support structure lighting
- [ ] Cable marker lights

SECTION 15	Feet	Metres
A Ground Elevation (AMSL)		
B Height of an addition to a structure		
C Total structure height including B (AGL)		
Overall height (A plus C) (AMSL)		



SECTION 16

Does the proposal comply with *Airport Zoning Regulations*?
(✓) Yes ( ) No ( ) N/A
Where the location of the object is on lands affected by *Airport Zoning Regulations*, a legal survey is required with the submittal

I hereby certify that all the above statements made by me are true, complete and correct to the best of my knowledge. Also, I agree to mark and/or light and maintain the structure with established marking and lighting standards as necessary.

Jason Pariso
Name of person filing notice

Jason Pariso
Signature

2017-10-14
Date (yyyy-mm-dd)

TRANSPORT CANADA ASSESSMENT

Marking and Lighting required (as per Standard 621)

- [x] Lighting Required
- [x] Marking Required
- [ ] Temporary Lighting Required
- [ ] No Lighting or marking required

Comments (Transport Canada use Only)
All 5 turbines require lighting & marking.

Completion of this form does not constitute authorization for construction nor replace other approvals or permits. See Instruction D and E

Civil Aviation Inspector	Signature	Date (yyyy-mm-dd)
Denise Murphy	Denise Murphy	2017-10-25

Note 1: This assessment expires 18 months from the date of assessment unless extended, revised, or terminated by the issuing office.
Note 2: If there is a change to the intended installation, a new submittal is required.

Canada

Transport Canada / Transports Canada

AERONAUTICAL ASSESSMENT FORM FOR OBSTRUCTION EVALUATION

Transport Canada number
2016-047
Applicant number

SECTION 1

Owner's Name	Contact Person
SWEB Development Inc.	Jason Parisé

Address
5030 Young Street, Suite 105

City	Province	Postal Code
Halifax	Nova Scotia	B3K 5L2

Telephone number (999-999-9999)	Fax number (999-999-9999)	Email Address
902-431-0564	902-407-2122	jason.parise@swebdevelopment.ca

SECTION 2

Applicant's Name	Contact Person

Address

City	Province	Postal Code

Telephone number (999-999-9999)	Fax number (999-999-9999)	Email Address

SECTION 3

Description of Proposal (or as attached)

Temporary 60 metre tubular steel meteorological test tower. Tower will be approximately 10" in diameter with guy wires.

SECTION 4

Geographic Coordinates ☑ NAD83 ☐ NAD27 ☐ WGS84

For multiple structures in a grouping, submit geographical coordinates on a separate spreadsheet (e.g. windfarms, transmission lines)

N Latitude deg 45 min 42 sec 54.117

W Latitude deg 64 min 53 sec 3.184

SECTION 5

Nearest Community	Province
Riverside-Albert	New Brunswick

SECTION 6

Nearest Aerodrome: Moncton

SECTION 7

Have you contacted the aerodrome?

○ Yes ☑ No

SECTION 8

Notice of

☑ New Construction ○ Change to existing structure

SECTION 9

Duration

○ Permanent ☑ Temporary

Transport Canada number
2016-047

SECTION 10

Proposed Construction Date Beginning (yyyy-mm-dd)
2016-04-29

SECTION 11

Temporary Structure
From date (yyyy-mm-dd) 2016-04-29 To date (yyyy-mm-dd) 2019-04-29.

SECTION 12

Marking and Lighting Proposed (refer to Standard 621)

- [ ] Red lights and paint
- [ ] Red and M.I. white lights
- [ ] White M.I. lights
- [ ] Red and H.I. white lights
- [ ] White H.I. lights
- [ ] No painting
- [ ] No lighting
- [x] Paint marking only
- [ ] Other (provide description)

SECTION 13

Monitoring to Standard 621, article 4.7 — [ ] Visual inspection — [x] Remote indicator

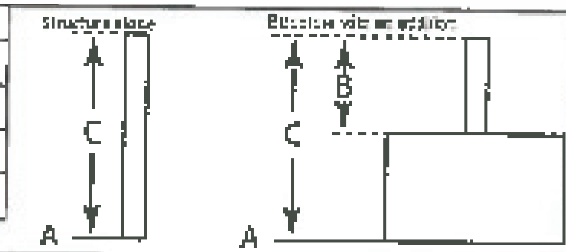
SECTION 14

Catenary/Cable Crossing

- [ ] Paint supporting structures
- [ ] Cable marker spheres
- [ ] Shore markers
- [ ] Support structure lighting
- [ ] Cable marker lights

SECTION 15

		Feet	Metres
A	Ground Elevation (AMSL)	1164	355
B	Height of an addition to a structure		
C	Total structure height including B (AGL)	196	60
	Overall height (A plus C) (AMSL)	1360	415



SECTION 16

Does the proposal comply with *Airport Zoning Regulations*?
(✓) Yes ( ) No ( ) N/A

Where the location of the object is on lands affected by ***Airport Zoning Regulations***, a legal survey is required with the submittal.

I hereby certify that all the above statements made by me are true, complete and correct to the best of my knowledge. Also, I agree to mark and/or light and maintain the structure with established marking and lighting standards as necessary.

Jason Parizé
Name of person filing notice

[signature]
Signature

2016-03-29.
Date (yyyy-mm-dd)

TRANSPORT CANADA ASSESSMENT

Marking and lighting required (as per Standard 621)

- [ ] Lighting Required
- [x] Marking Required
- [ ] Temporary Lighting Required
- [ ] No Lighting or marking required

Comments (Transport Canada use Only)

Completion of this form does not constitute authorization for construction nor replace other approvals or permits. See Instruction D and E.

Civil Aviation Inspector	Signature	Date (yyyy-mm-dd)
André Vautour	[signature]	2016/04/12

Note 1: This assessment expires 18 months from the date of assessment unless extended, revised, or terminated by the issuing office.
Note 2: If there is a change to the intended installation, a new submittal is required.

B PRELIMINARY INDIGENOUS KNOWLEDGE STUDY

December 8th 2017

WSP
90 Woodside Lane, Unit 104
Fredericton, NB E3C 2R9 Canada
(506) 247-4003

Attention: Christina Laflamme

Preliminary IK Study – Albert County Wind Farm

Introduction

On November 17 2017, a preliminary traditional Indigenous Knowledge study was conducted for the proposed Albert County Wind Farm. The proposed site is located off the New Ireland Road, North East of Fundy National Park and adjacent to the Kent Hills Wind Farm. The study was carried out under the direction of Elder Gilbert Sewell of Pabineau First Nation, with assistance of Laura Buck (Fort Folly First Nation), Christina LaFlamme (WSP), and Grant Aylesworth (Stratis Consulting). In addition to this study, other preliminary assessments have been carried out by Ms. LaFlamme and Mr. Aylesworth pertaining to archeological settlements and surrounding flora and fauna. The study focused on 5 proposed wind turbine locations within the Albert County Wind Farm corridor, with an additional 7 sites examined along the New Ireland Road leading up to the proposed turbine locations.

Methods

The crew used a handheld GPS (Global Positioning System) and map provided by Ms. LaFlamme to locate the already marked out proposed locations. Mr. Sewell and Ms. Buck recorded these locations on a personal GPS (Garmin Etrex 10), took photos of site locations and surrounding vegetation, and recorded notes in their field books. The areas were examined visually for evidence of any past Indigenous and/or European settlements, and rare or culturally significant vegetation.

The crew visited each of the 5 proposed turbine sites with trucks, which were accessible via logging roads that branched off the New Ireland Road from NB Route 104. Other sites examined on the New Ireland Road consisted of: a potential substation, tributary of Crank Brook and Crank Brook itself, North River, wetlands, a historic church area no longer discernible, a Catholic church cemetery, and the roadside vegetation where power lines will be installed. In total, 12 sites were visited and examined.

Results and Discussion

Turbines Locations and Additional Examined Sites

The turbine locations and other areas of interest had previously been examined by Mr. Aylesworth for the purpose of archeological inspections, at which time no evidence of previous Indigenous or European settlement was observed. Mr. Sewell and Ms. Buck also found no evidence of any type of settlement relating to either Indigenous or European settlers. Evidence of historic settlements would include culturally significant remnants of structures such as dwellings, sweat lodges, fire pits, grave yards, as well as artifacts such as items made from stones, basketry, spear heads, pottery, etc. The study area of the proposed turbine locations is heavily disturbed, which made it difficult to find remnants of settlements. The proposed turbine sites consisted predominately of a mixture of old and young secondary growth forests, made up of deciduous trees with some conifers, and on-going clear cutting, the product of years of logging and harvesting.

During the survey, Mr. Sewell and Ms. Buck looked for any culturally significant flora which would include vegetation such as black ash, sweet grass, cedar, etc., as well as other significant plants that may be tied to a medicinal or cultural use. While an abundance of flora and fauna were identified at all sites, they are common to the area and Mr. Sewell concluded they were not of threat to the proposed project.

The power lines to be installed will have minimal effect on roadside vegetation, as little disturbance will be required to install poles. However, there will be some impact on roadside vegetation when the roads are widened to transport the turbines. Mr. Sewell did not find any threatened plants or trees that he considered culturally significant that will be affected by the roadside clearing.

Conclusions

The results of the field survey conducted by Mr. Sewell and Ms. Buck, determine that no cultural heritage resources and no concerns regarding plant/vegetation that are culturally significant were identified within the proposed Albert County Wind Farm area or the other examined sites leading up to the proposed turbine locations. Based on previous historical knowledge there is a good likelihood that no settlements would be in the area. However, there is still the possibility of discovery in regards to settlement or land use but during the preliminary assessment nothing was found.

C LETTER OF SUPPORT

Village of Riverside-Albert
5823 King Street, Riverside-Albert
N.B. E4A 4B4

Phone: 882-3022
Fax: 882-3016

January 27, 2017

New Brunswick Power Corporation
515 King Street
P.O. Box 2010
Fredericton, NB E3B 4X1

RE: Letter of Support for Albert Wind Energy Project

This letter is intended to illustrate our support of the Albert Wind Energy Project being co-developed by Woodstock First Nation (WFN) and SWEB Development LP (SWEB). The Village of Riverside-Albert was approached by SWEB early in the project's development, and we are impressed by the effective consultation to date. The ongoing, two-way communication has allowed us to develop a firm understanding of the Project, while ensuring that our interests are being recognized and addressed.

The Village of Riverside-Albert is particularly interested in how the Project will create multifaceted benefits for our community. The Fundy region is always looking for new ways to generate economic activity, and this Project provides an opportunity for our community to receive a sustained monetary benefit from business activities that respect our natural environment. The revenue generated from the Project would substantially impact our community as it creates opportunities to fund new employment, infrastructure upgrades, and other initiatives that are aimed at making our community an attractive area for New Brunswick residents to live and work.

Our community is excited to host a renewable energy project that enhances the Province's energy security through supplying clean electricity to the rural areas from Riverside-Albert to Hillsborough and beyond. The Village of Riverside-Alert is keen to host the Albert Wind Energy Project, and is looking forward to exploring additional renewable energy development in the future to support the Province's renewable energy and emissions reduction targets.

Sincerely,

Jim Campbell
Mayor

JC/dpm-b

Appendix

D NOISE IMPACT ASSESSMENT

WISOKOLAMSON ENERGY LP

WISOKOLAMSON ENERGY PROJECT

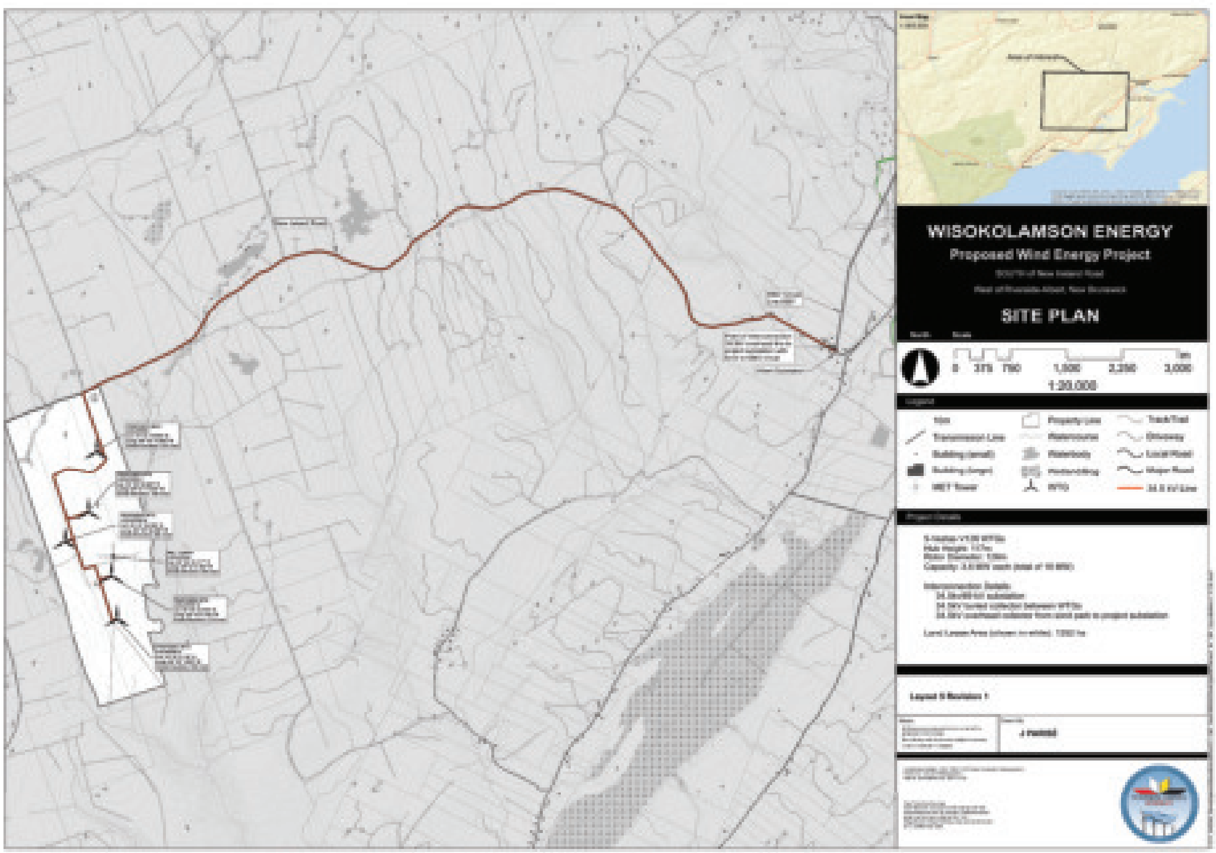
NOISE IMPACT ASSESSMENT

ALBERT COUNTY, NEW BRUNSWICK

WSP REF.: 161-08790-00

DATE : 12 APRIL 2018

CONFIDENTIAL



wsp

WISOKOLAMSON ENERGY LP

WISOKOLAMSON ENERGY PROJECT

NOISE IMPACT ASSESSMENT

ALBERT COUNTY, NEW BRUNSWICK

CONFIDENTIAL

WSP REF.: 161-08790-00
DATE : 12 APRIL 2018

REPORT (FINAL VERSION)

WSP CANADA INC.
FLOOR 16
1600 RENÉ-LÉVESQUE BLVD WEST
MONTRÉAL QC H3H 1P9
CANADA

TEL.: +1-514-340-0046
FAX: +1-514-340-1337

WSP.COM

QUALITY MANAGEMENT

VERSION	DATE	DESCRIPTION
01	2018-03-16	Preliminary version
02	2018-04-12	Final version

SIGNATURES

PREPARED BY

Nicolas Garcia, Eng.
Acoustics and Vibration

REVIEWED BY

12 avril 2018

Marc Deshaies, M. Eng.
Team Leader – Acoustics and Vibration

This report was prepared by WSP for the account of Wisokolamson Energy LP, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

Reference to mention:

WSP. 2018. Wisokolamson Energy Project, *Noise impact assessment, Albert County, New Brunswick*. Report produced for Wisokolamson Energy LP. WSP Ref.: 161-08790-00. 15 pages and appendices.

PRODUCTION TEAM

WISOKOLAMSON ENERGY LP

Development Manager	Jason Parisé

WSP CANADA INC. (WSP)

Team Leader	Marc Deshaies, M. Eng.
Project Manager	Nicolas Garcia, Eng.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 CONTEXT

Wisokolamson Energy LP (WISK) is undertaking the development of a five (5) wind turbine generators (WTGs), 18 MW wind energy project, west of Riverside-Albert in Albert County, New Brunswick.

WSP Canada Inc. (WSP) was retained by WISK to complete a Noise Impact Assessment (NIA) for the wind energy project (the Project).

The purpose of the NIA is to determine the potential noise impact resulting from the Project's operation, and the Project's compliance with the New Brunswick Department of Environment and Local Government's (NBDELG) Environment Impact Assessment (EIA) Sector Guidelines for Wind Turbines [1].

1.2 PROJECT DETAILS

The Project includes the installation of five (5) WTGs (Vestas V126, 3.6 MW each). The five WTG locations are positioned in one cluster, south of New Ireland Road, west of Riverside-Albert. The Project's substation will be located at the base of New Ireland Road, opposite the existing NB Power-operated Albert substation (see Figure 1).

Figure 1 Project Location

2 EXISTING ACOUSTIC ENVIRONMENT

The existing acoustic environment surrounding the Project site, was determined by way of an ambient sound measuring campaign.

2.1 DATA COLLECTION

Ambient sound levels were measured at four (4) receptor locations over a 24-hour period. Sound level data was collected on November 1st, 2017, from midnight to midnight the following day.

The receptor points are located at the following locations:

- Receptor R1: cabin located south of New Ireland Road at 45°43’45’’ N | 64°52’47’’ W;
- Receptor R2: warming shack located next to Kent Road intersection at 45°43’43’’ N | 64°53’16’’ W;
- Receptor R3: located by Priest Lake at 45°42’25’’ N | 64°53’47’’ W, which corresponds to a recreational use;
- Receptor R4: located by New Ireland Road, next to the proposed substation location at 45°43’56’’ N | 64°45’30’’ W.

Receptor R3 doesn’t correspond to an existing residential building but was selected for the sensitive aspect of the area, as per NBDELG guidelines for wind turbines which specify that a noise impact study is required for all noise sensitive locations surrounding the project, including recreational, residential and institutional uses.

Receptor R4 was selected in order to characterize the existing ambient sound in the vicinity of the proposed substation. This receptor is representative of the sound climate of the inhabited areas surrounding the proposed substation.

The microphones were located away from any large reflecting surfaces and approximately 1.5 m above ground. Sound measurements were performed using the following sound level meters and an acoustic calibrator:

- Larson Davis sound level meters, models LXT, SN: 2611, 4823, 4824 and 4826;
- Larson Davis precision acoustic calibrator, model CAL200.

The sound level meters meet the IEC 61672 Class I specifications. All instruments had a valid calibration certificate issued by an independent laboratory.

Site calibration was also performed at the beginning and end of the monitoring period. The differential calibration did not exceed 0.5 dBA.

2.2 ANALYSIS AND RESULTS

Sound measurements were analyzed and extraordinary events (such as people speaking and animal noises close to the microphone or helicopters flying overhead, etc.), were excluded from the analysis.

Table 1 presents a summary of the ambient sound measurement results. Sound evolutions are presented in Appendix A.

Table 1 Summary of Ambient Sound Levels

Receptor	$L_{Aeq, 24h}$ (dBA)[1]	$L_{Aeq, 1h\ min}$ (dBA)[2]	$L_{Aeq, 1h\ max}$ (dBA)[3]
R1	30	25	35
R2	36	23	44
R3	32	23	40
R4	40	34	44

1 $L_{Aeq, 24h}$: equivalent continuous sound level over the 24 hour period, in dBA;
2 $L_{Aeq, 1h\ min}$: minimum 1 hour equivalent continuous sound level, in dBA;
3 $L_{Aeq, 1h\ max}$: maximum 1 hour equivalent continuous sound level, in dBA.

The existing acoustic environment surrounding the Project site is characterized as mainly quiet, with the dominant sound being natural sources (wind, birds, etc.), and an occasional contribution from local road traffic. The sound contribution from road traffic is greater at receptor R4 (proposed substation), as R4 is close to Road NB-104 and New Ireland Road.

3 SOUND LEVEL CRITERIA

3.1 WIND TURBINE NOISE

NBDELG recommends sound criteria for wind turbines in the EIA Sector Guidelines for Wind Turbines [1]. These guidelines suggest that a noise impact assessment should be performed for all sensitive receptors within 1 km of the nearest projected WTG, to show compliance with the criteria presented in Table 2.

Table 2 Recommended Sound Criteria for Wind Turbines

Wind Speed (m/s)	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Wind Turbine Noise Criteria (dBA)	40	40	40	43	45	49	51	53

3.2 SUBSTATION NOISE

The EIA Sector Guidelines for Wind Turbines does not discuss substation noise requirements. In addition, to WSP's knowledge, neither the city, the county, nor the province of New Brunswick regulates outdoor noise. Therefore, the following sections aim to discuss information gathered from various documents to establish a sound level criteria which could be applied to the substation noise.

3.2.1 HEALTH CANADA

Health Canada does not intend to regulate noise by providing threshold limits that should not be exceeded. Rather, the organization aims to provide information on the potential impact of noise on health, providing guidelines which indicate values and criteria to evaluate during the completion of a noise impact study. Thus, in the « Health Canada Noise Impact Assessment Guidance for Environmental Assessment » [2], a method is described for the preparation of impact assessments of noise on health. This method uses the different possible interactions of sound with a human being and provides recommendations on threshold noise levels to mitigate potential concerns or impacts relating to the following: hearing loss caused by exposure to noise, sleep disturbance, interference with speech comprehension, noise complaints, and elevated discomfort.

Health Canada recommends a night-time continuous noise level $L_{n,\ int}$[1,2] (background noise outside of a specific event) below 30 dBA inside the bedroom of a dwelling or receptor. Given that it is common to sleep with windows slightly open (acoustical isolation of approximately 15 dBA), recommendations imply that 45 dBA $L_{n,\ ext}$[3] (continuous) is acceptable for outdoor noise.

This same document defines criteria for « Highly Annoyed Percentage », HA%. This criteria considers a collection of parameters from the noise climate (i.e. type of noise, impulsive or very impulsive noise, tone, low frequency, etc.) and allows for the comparison of two situations to evaluate the variation of the quality of a noise environment. A HA% criterion increase of over 6.5% is considered problematic and requires a solution implementation plan for the reduction of noise.

[1] L_n: night-time continuous noise level, between 10 pm and 7 am.
[2] $_{int}$: prefix signifying interior, to specify that the noise level is evaluated inside the bedroom of a dwelling or receptor.
[3] $_{ext}$: prefix signifying exterior, to specify that the noise level is evaluated outside the dwelling or receptor.

3.2.2 WORLD HEALTH ORGANIZATION

The proposed thresholds proposed by Health Canada are consistent with those provided by the World Health Organization (WHO) in the « Guidelines for Community Noise » [3] document.

The WHO has also more recently published the document « Night Noise Guidelines for Europe » [4] which presents the findings from a large number of studies on the annoyance due to noise in exterior $L_{n,\ ext}$ of 40 dBA and a maximal limit of 55 dBA. This maximum limit is a compromise, taking into consideration the imperatives of urban planning, but implies a possible impact on the quality of sleep of inhabitants, specifically those who are most vulnerable (children, chronic illnesses, senior citizens, etc.).

3.2.3 SELECTED CRITERIA

Following a review of the documents noted in this section, WSP proposes a substation noise limit of 45 dBA at the window panes or facades of nearby dwellings.

4 NOISE IMPACT ASSESSMENT

4.1 METHODOLOGY

The dispersion and attenuation of sound in the atmosphere is modelled using algorithms based on the conversion of energy and the absorption of the expanding sound waves by the atmosphere and barriers in the path. The SoundPLAN® version 7.4 software was used to conduct the Project's sound modelling.

The Project's sound contribution at each sensitive receptor was calculated based on the ISO 9613-2 model. This noise propagation model is widely accepted as an appropriate model for the assessment of wind farms when appropriate inputs are used. The ISO 9613-2 model has the ability to take into account the distance between the source and receptor, topography, hardness of the ground and atmospheric absorption at different frequencies.

The ISO 9613-2 model is based on meteorological conditions favourable to sound propagation. According to the standard these conditions are for downwind propagation, or, equivalently, propagation under a well-developed moderate ground-based temperature inversion.

The assessment has been based on the following inputs.

4.1.1 METEOROLOGICAL FACTORS

The following meteorological conditions were considered for the NIA:

- Ambient air temperature: 10°C;
- Ambient barometric pressure: 101.32 kPa;
- Relative humidity: 70%.

These are the standard values recommended as per ISO 9613-2 as they maximize sound transmission.

4.1.2 TERRAIN AND VEGETATION

The following inputs were considered:

- Local topography;
- Global ground absorption factor: 0.7.

The ground absorption factor is a decimal value varying from 0 (perfect reflection) to 1.0 (perfect absorption).

4.1.3 WIND TURBINE SOUND LEVEL

Vestas V126 – 3.6 MW WTGs with a 117 m hub height will be used for the Project. Blades will not have serrated trailing edges. The WTG's broadband and third-octave band sound power levels were provided by Vestas, the turbine manufacturer. The acoustic emission levels used in this assessment are shown in Table 3.

Table 3 Vestas V126 – 3.6 MW – Sound Power Levels – Mode PO1-0S (Blades without Serrated Trailing Edge)

Wind Speed (m/s)	4	5	6	7	8	9	10	11
Broadband sound power level (dBA)	92.3	94.4	98.0	101.6	105.0	107.6	108.0	108.0

At this stage in the Project's development, the substation design is not yet complete. Nevertheless the transformer specifications are expected to be 12/16/20 MVA based on ONAN/ONAF/OFAF modes. With these preliminary specifications, it is possible to establish the sound emission level of such a transformer, from a known empirical formula[4]. For a 20 MVA transformer, the sound pressure level at 150 m would be 37 dBA (which is also equivalent to 42 dBA at 80 m and 45 dBA at 60 m).

4.1.4 RECEPTORS

The noise sensitive receptors include the locations (including recreational, residential and institutional) that are located within 1 km of the nearest turbine. There are three (3) noise sensitive receptors located within 1 km of the Project, corresponding with the three measuring locations R1, R2 and R3. The receptor locations, with respect to the wind turbines, are presented in Figure 2.

[4] Noise and Vibration Control Engineering, Second edition, I. L. Vér and L. L. Beranek, 2005.

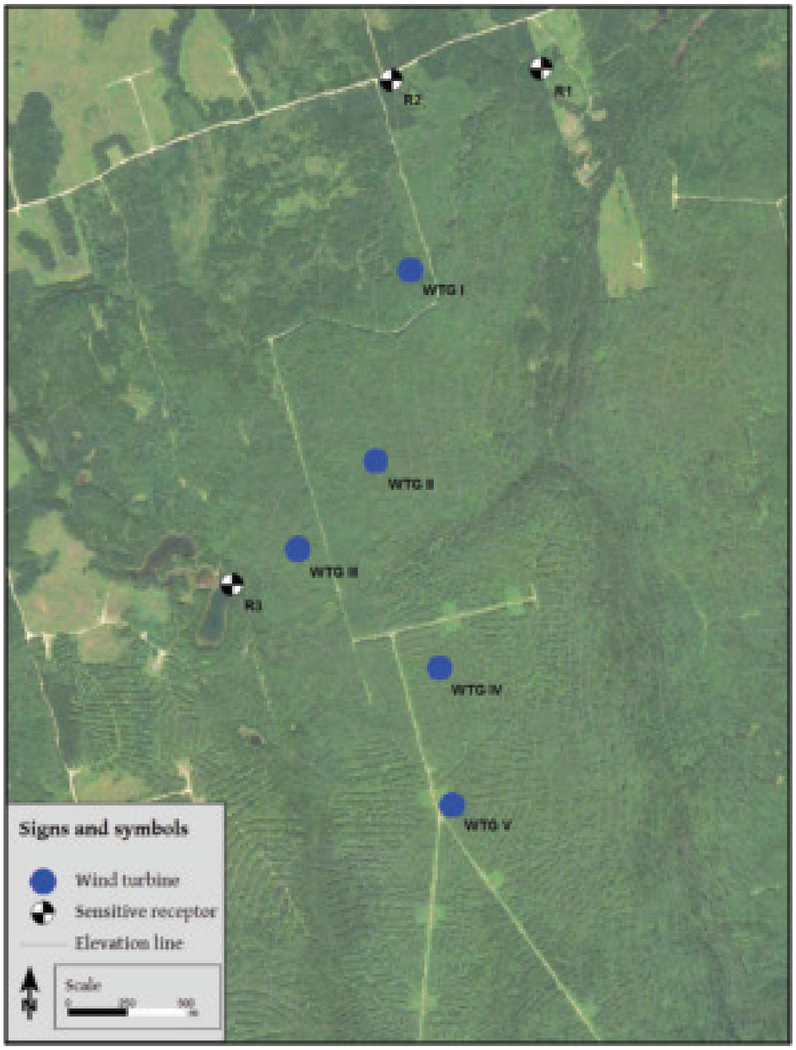


Figure 2 Receptor Locations with Respect to the Wind Turbines

Regarding the substation, its preliminary proposed location is 45°43’55’’ N | 64°45’30’’ W. The closest sensitive receptor to this location, which is the residence located at 46 New Ireland Road, is approximately 80 m away. The residential building location, with respect to the substation, is presented in Figure 3.

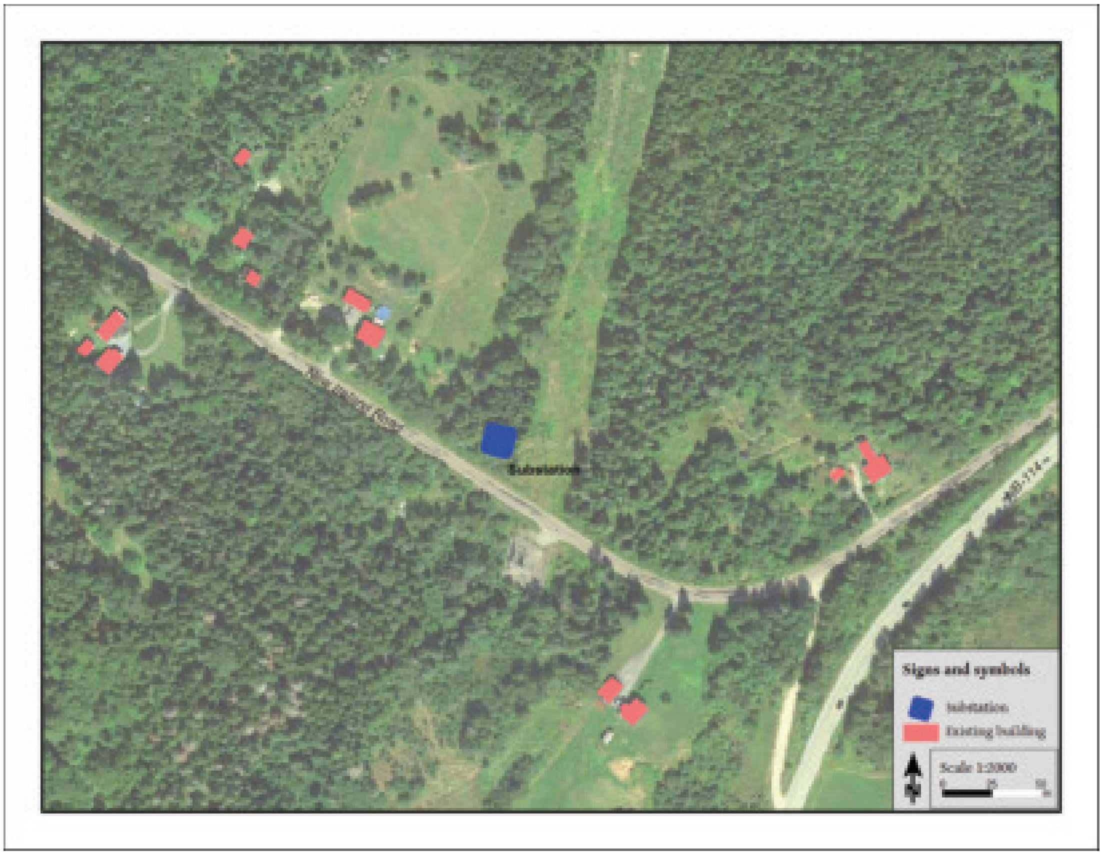


Figure 3 **Receptor Locations with Respect to the Substation**

4.2 RESULTS

4.2.1 TURBINE NOISE IMPACT ASSESSMENT

The predicted sound pressure levels by wind speed, at each sensitive receptor within 1 km to the closest turbine, are presented in Table 4. These predictions assume that the Project is composed of five (5) Vestas V126 – 3.6 MW WTGs.

Table 4 **Predicted Sound Pressure Levels at Sensitive Receptors**

Wind Speed (m/s)	4	5	6	7	8	9	10	11
R1	18	20	24	27	31	33	34	34
R2	20	22	26	30	33	36	36	36
R3	29	31	35	39	42	45	45	45

These predicted sound pressure levels are below the recommended sound criteria for wind turbines presented in Table 2, for all sensitive receptors within 1 km of the Project, and for all wind speeds. A detailed noise map is presented in Appendix B, for a wind speed of 11 m/s.

4.2.2 SUBSTATION PRELIMINARY SOUND ASSESSMENT

Regarding the substation, it has been established (section 4.1.3), as a preliminary assessment, that it would produce a sound pressure level of 45 dBA, which is also the selected criteria (section 3.2.3), at a distance of 60 m from the transformer.

The closest residence to the proposed preliminary location of the substation is at a distance of 80 m. At such a distance, the sound level of the transformer is expected to be 42 dBA, which is below the 45 dBA selected criteria.

5 CONCLUSION

In the assessed scenario, considering five (5) Vestas V126 – 3.6 MW turbines with 117 m hub height, all sensitive receptors are expected to receive sound pressure levels from the Project that are in compliance with the recommended criteria from the NBDELG.

Regarding the substation, which is not covered by any provincial noise requirement, it is expected that its sound contribution is in compliance with the selected criteria from Health Canada.

Given the results of this study, no mitigation measures are required.

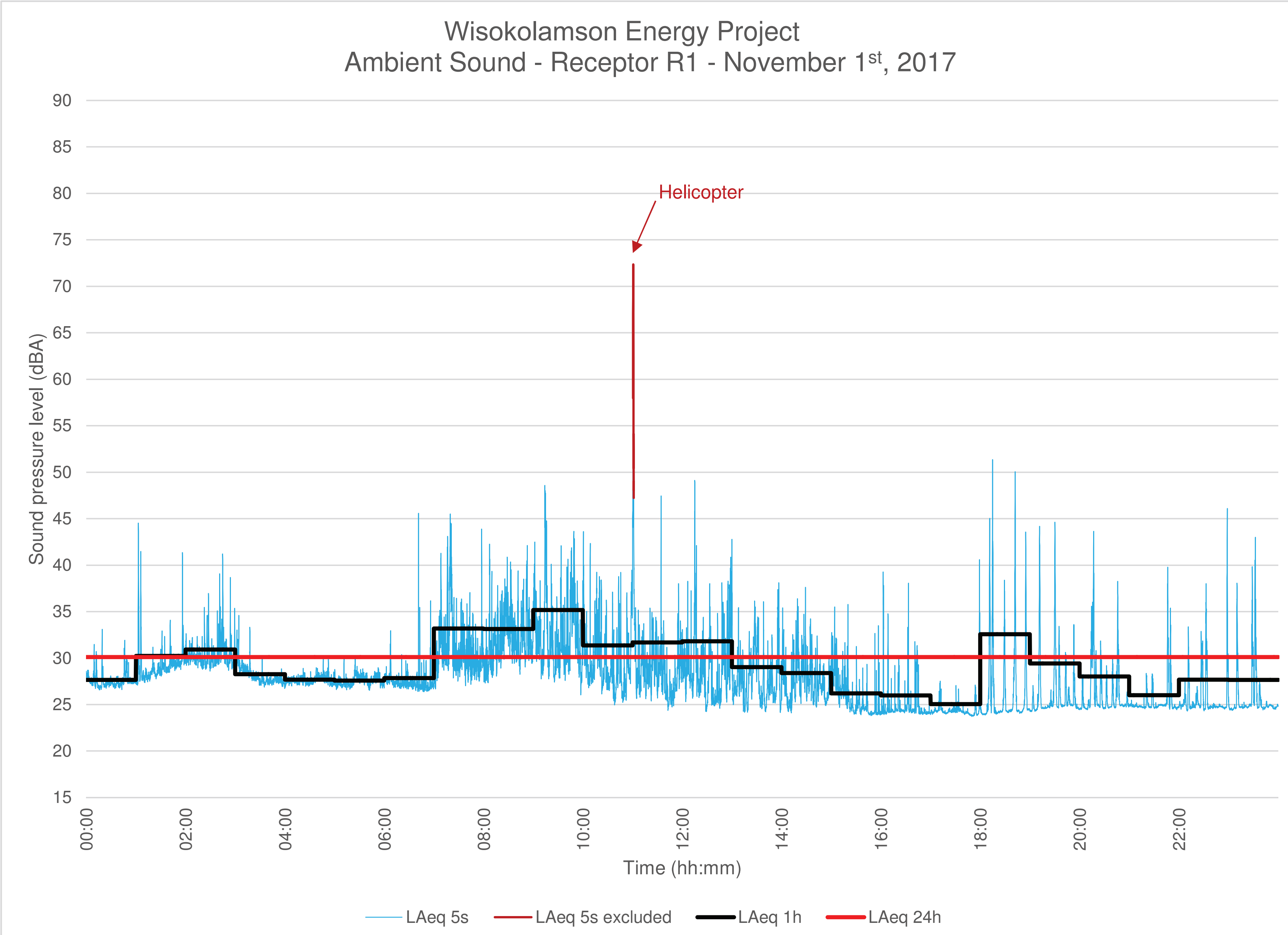
6 BIBLIOGRAPHY

- [1] Government of New Brunswick, Additional Information Requirements for Wind Turbines, undated.
- [2] Health Canada, Noise Impact Assessment Guidance for Environmental Assessment, February 2010.
- [3] World Health Organization, Guidelines for Community Noise, Geneva, March 1999.
- [4] World Health Organization, Night Noise Guidelines for Europe, Geneva, 2009.

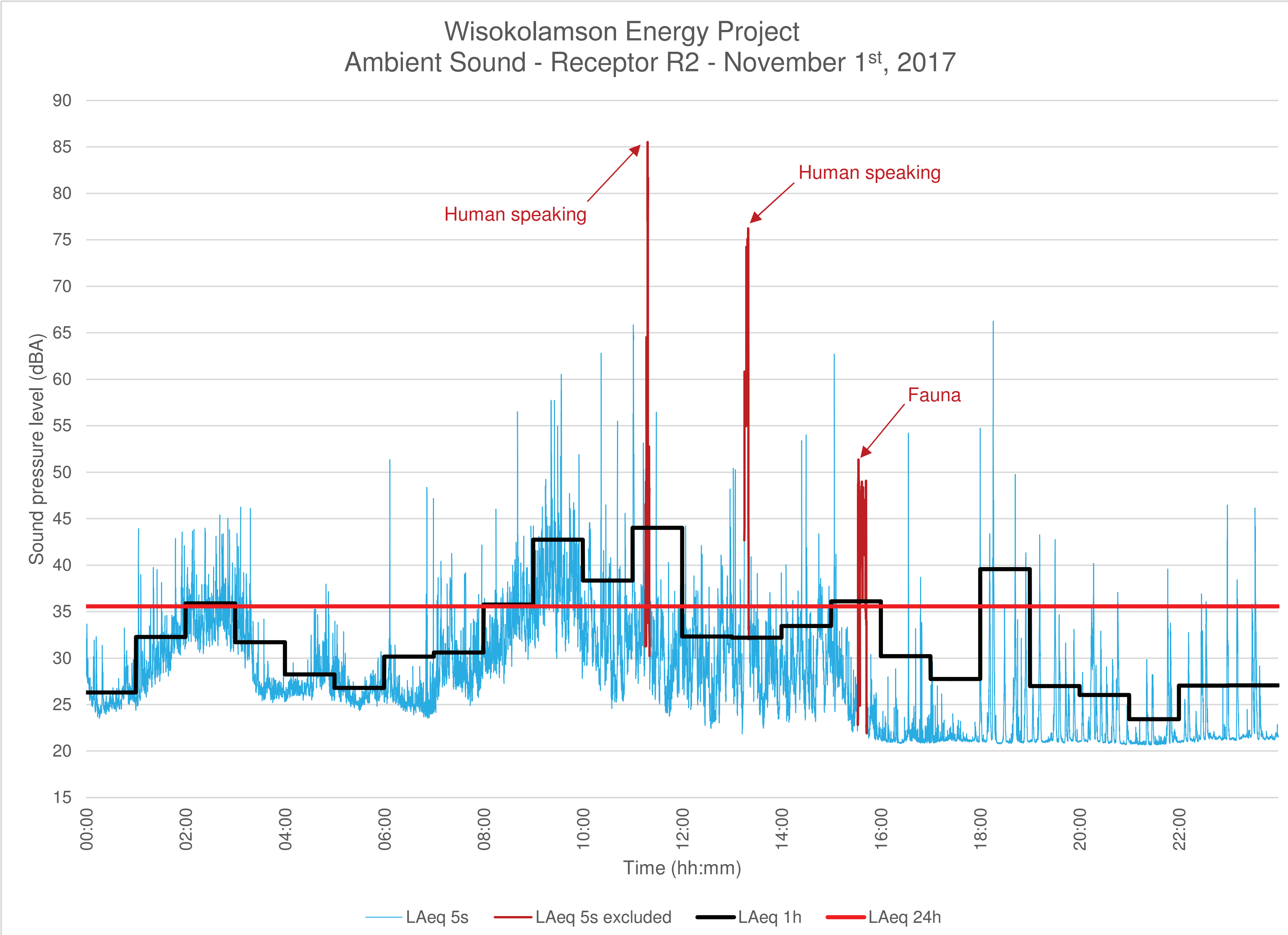
APPENDICES

A

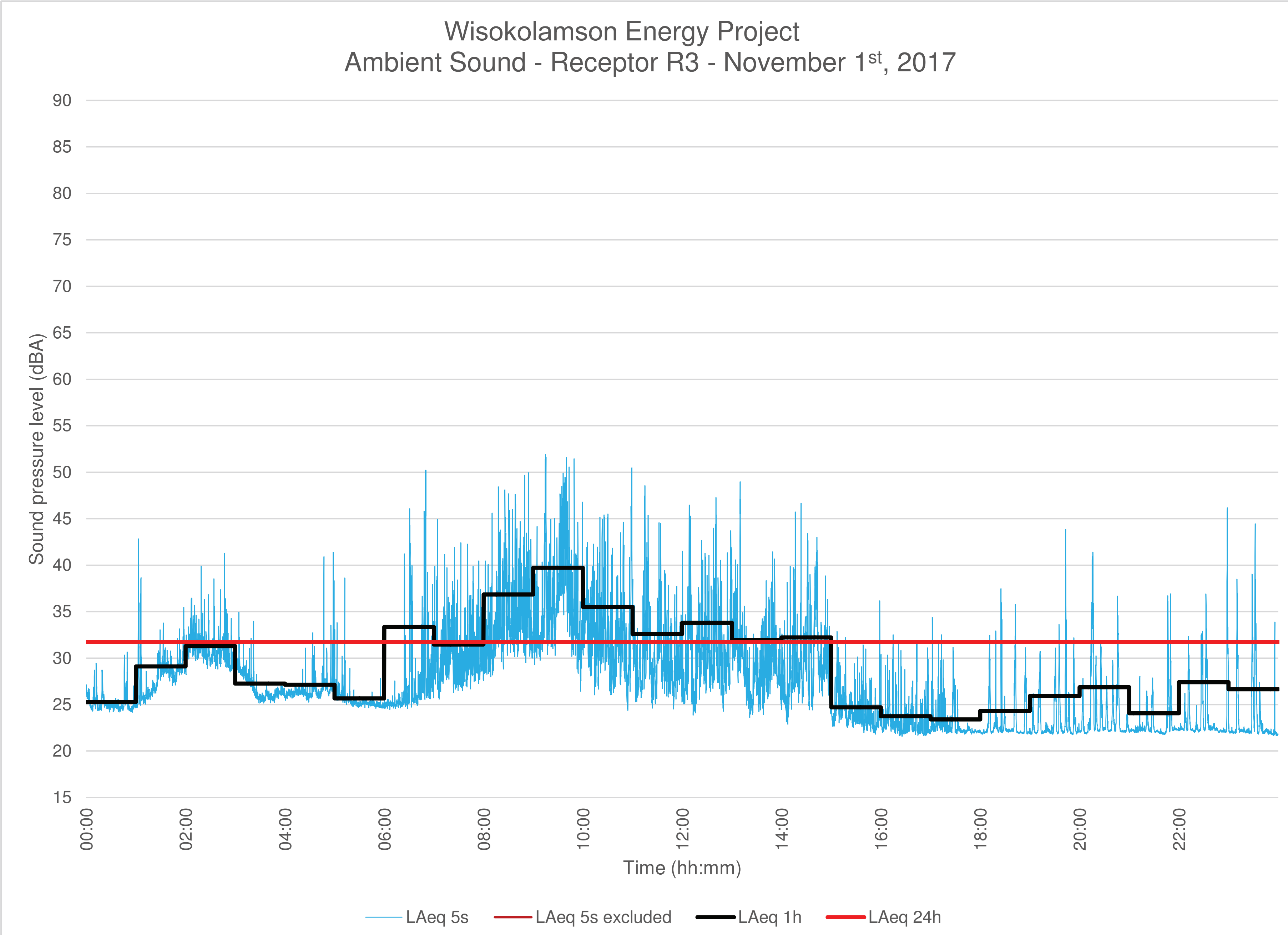
MEASURED AMBIENT SOUND LEVELS



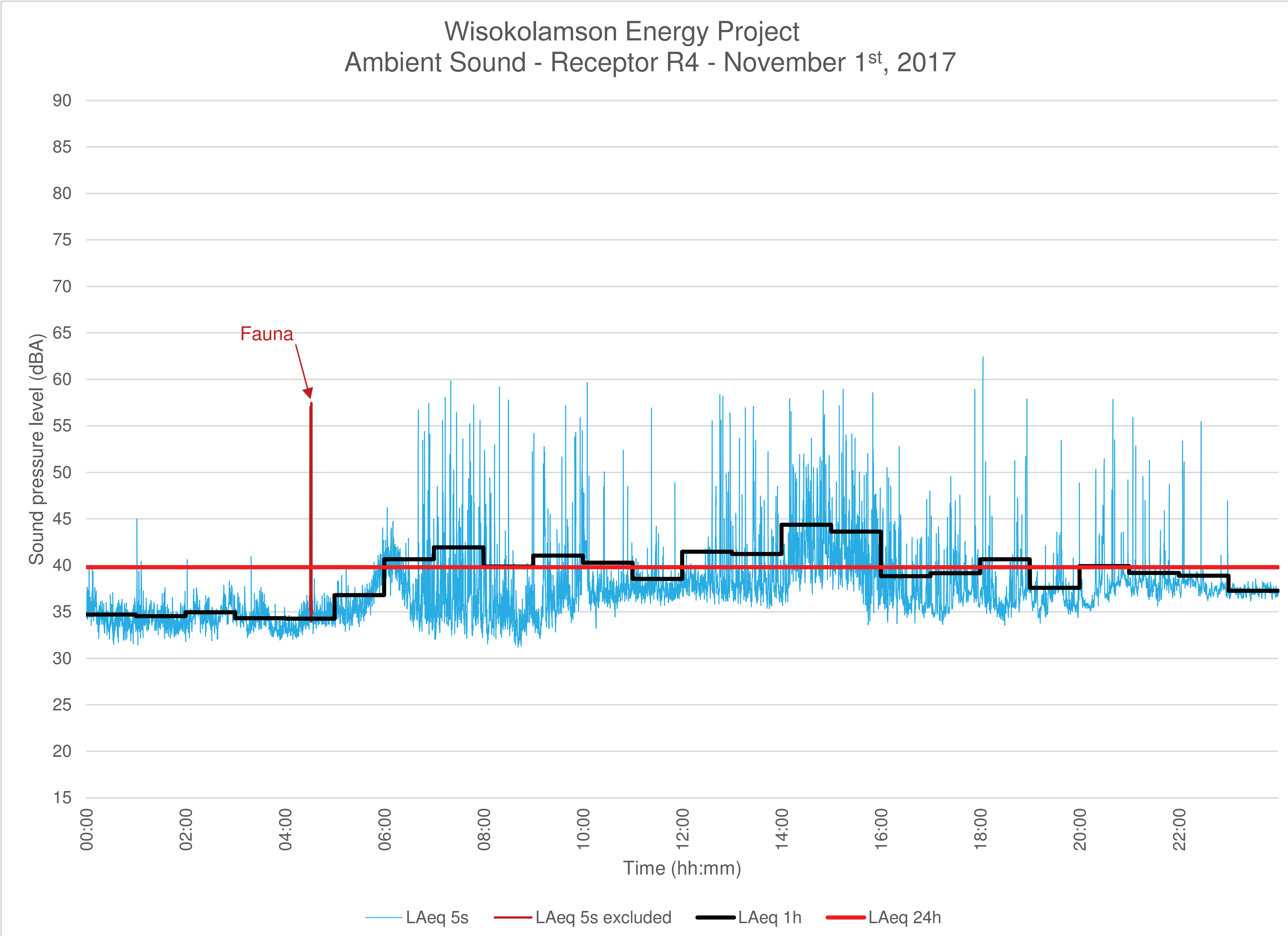
Wisokolamson Energy Project
Ambient Sound - Receptor R1 - November 1st, 2017
Helicopter
Sound pressure level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hh:mm)
LAeq 5s
LAeq 5s excluded
LAeq 1h
LAeq 24h



Wisokolamson Energy Project
Ambient Sound - Receptor R2 - November 1st, 2017
Human speaking
Human speaking
Fauna
Sound pressure level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hh:mm)
LAeq 5s
LAeq 5s excluded
LAeq 1h
LAeq 24h

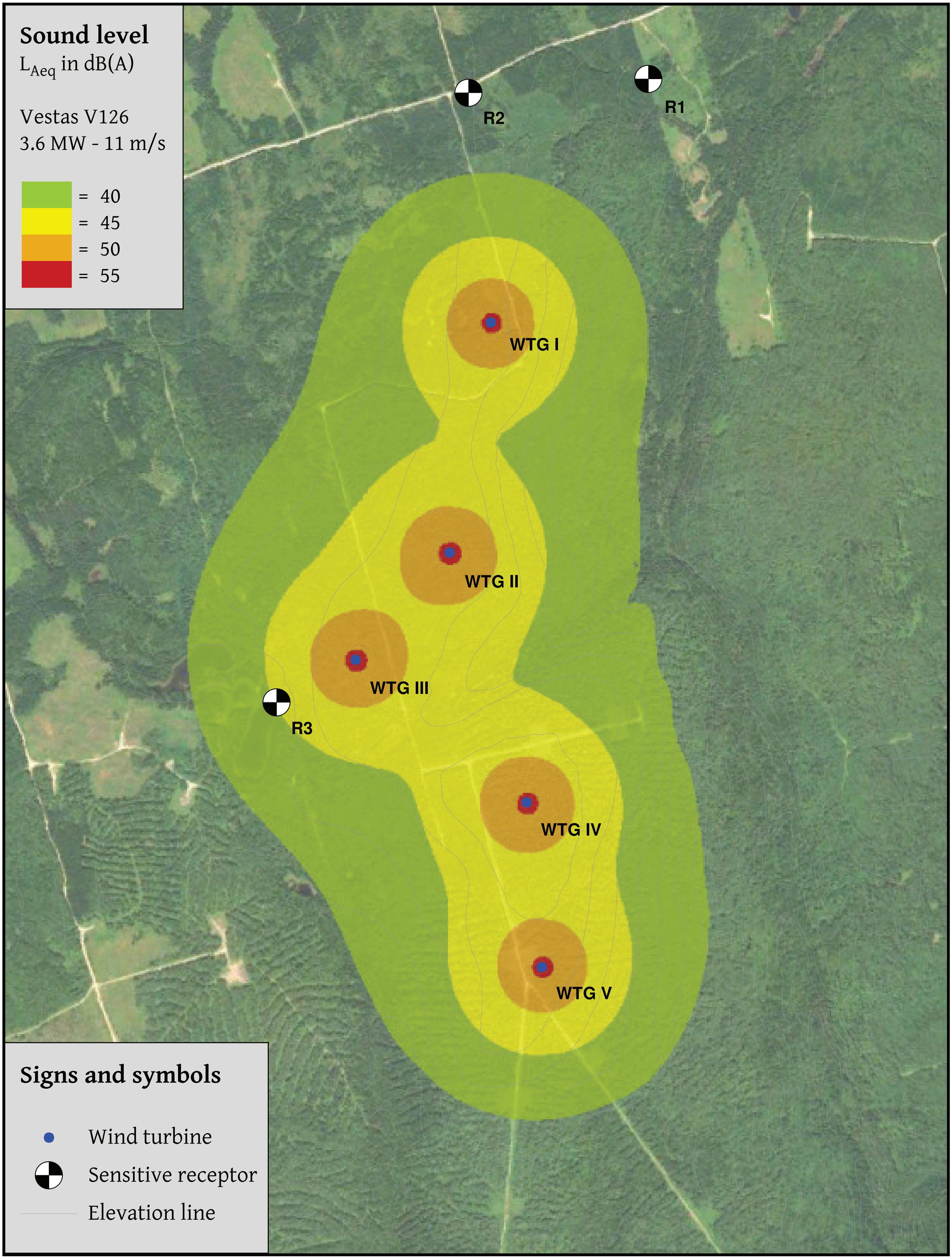


Wisokolamson Energy Project
Ambient Sound - Receptor R3 - November 1st, 2017
Sound pressure level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hh:mm)
LAeq 5s
LAeq 5s excluded
LAeq 1h
LAeq 24h


Wisokolamson Energy Project
Ambient Sound - Receptor R4 - November 1st, 2017
Sound pressure level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
Fauna
00:00
02:00
04:00
06:00
08:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Time (hh:mm)
LAeq 5s
LAeq 5s excluded
LAeq 1h
LAeq 24h

B

NOISE MAP WITH WIND SPEED AT 11 M/S


Sound level
L_{Aeq} in dB(A)
Vestas V126
3.6 MW - 11 m/s
= 40
= 45
= 50
= 55
R1
R2
R3
WTG I
WTG II
WTG III
WTG IV
WTG V
Signs and symbols
Wind turbine
Sensitive receptor
Elevation line

E BIRD INVENTORY REPORT

WISOKOLAMSON ENERGY PROJECT BIRD INVENTORY REPORT

WISOKOLAMSON ENERGY PROJECT

WISOKOLAMSON ENERGY LP

APRIL 2018

BIRD INVENTORY REPORT

WISOKOLAMSON ENERGY PROJECT

WISOKOLAMSON ENERGY LP

WSP PROJECT NO.: 161-08790-00
DATE: APRIL 2018

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TABLES

FIGURES

1 INTRODUCTION

In Canada, wind energy development in a commercial context is one of the fastest growing sectors. New Brunswick alone is striving to meet an aggressive target of 40% of the province's electricity needs to be met by renewable energy by the year 2020 (Government of New Brunswick, 2018). Today, there is 294 MW of wind energy on the grid. New Brunswick currently has three operating wind farms but they represent some of the largest such projects in Atlantic Canada (The Maritimes Energy Association, 2018). Even though electrical generation from wind turbines has many environmental benefits, the rapid growth has raised concerns on impacts of migratory and resident wildlife populations.

The Bay of Fundy region is recognized as an important breeding and migration stop-over area for birds. Since a wind energy facility could potentially put birds at risk through collisions with wind turbines, alteration of breeding and stop-over habitats, this requires detailed and comprehensive studies to determine the risk to birds and what mitigation measures may be necessary. The components of this study include surveys of migrating birds, wintering birds, and breeding birds.

2 METHODS

2.1 EXISTING INFORMATION

A request has been made to the Atlantic Canada Conservation Data Centre (ACCDC) in February 2018, regarding the presence of rare and endangered species or special areas into the Study Area and in a 100 km buffer around it. Christmas Bird Count data, from the Village of Riverside-Albert in Albert County for the 2010 to 2015 period, were also used to complete the list of wintering birds in the Study Area.

2.2 BIRD SURVEYS

A field program was initiated in 2016 to collect data on birds in the study area, with emphasis on migrating, wintering and breeding birds. Migration surveys were conducted within the area in the fall of 2016, breeding bird surveys were performed in 2016 and 2017, and wintering bird surveys were conducted in 2017.

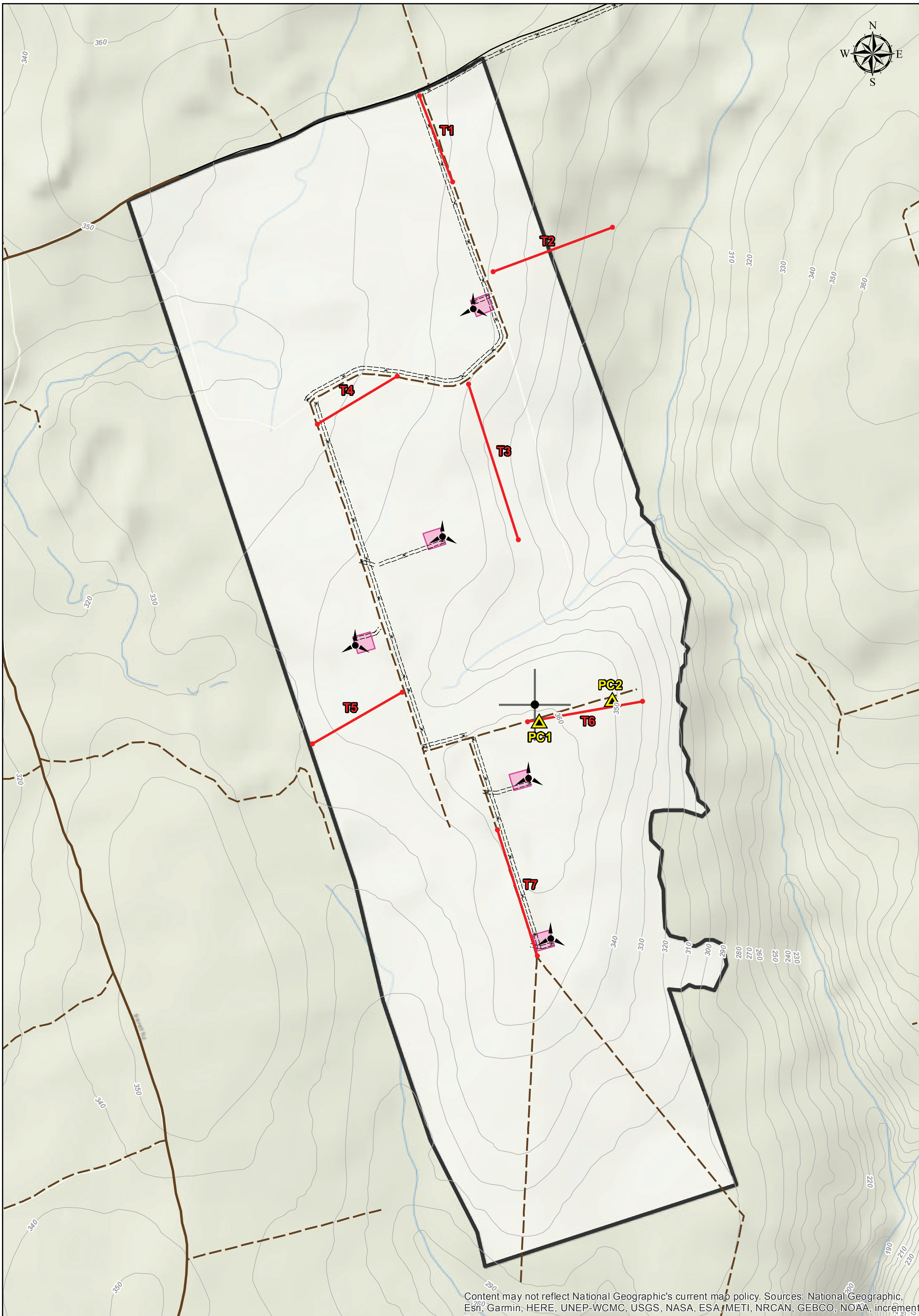
2.2.1 FALL MIGRATION SURVEYS

The fall migration survey has been conducted from mid-September to mid-October 2016. Seven transects (T1 to T7) and two observation stations (PC1 and PC2) were selected to reflect habitat availability in the study area. Transect and observation station locations and habitat descriptions are provided in Table 2.1 and on Figure 2.1.

Each transect was surveyed ten times from September 13 to October 20. Transects were 325 m to 580 m in length, with all birds located (distance and direction from the observer). Bird behaviour and flight height and direction were also recorded. The duration of each transect survey was of 10 minutes on average, and the observation stations surveys were of a duration a 1 hour per visit.

Table 2.1: Transect and Observation Station Locations and Habitat Descriptions for Fall Migration Stations

TRANSECT	COORDINATES	HABITAT DESCRIPTION
T1	45.72827 N - 64.88891 W to 45.72547 N - 64.88744 W	Mixed forest to the west (approx. 30-40 years old); coniferous plantation to the east (approx. 30 years old)
T2	45.72255 N - 64.88568 W to 45.72389 N - 64.88013 W	Mic of clear cut & partical commerical thnning (PCT); what remains is immature hardwood forest; has recently been logged
T3	45.71894 N - 64.88689 W to 45.7139 N - 64.88475 W	Across the top of slope - W is higher and E drops off significantly; PCT for 3/4 and clear cut for 1/4
T4	45.71925 N - 64.89018 W to 45.71776 N - 64.8939 W	North - mature mixed wood; S- PCT and regenerating
T5	45.70906 N - 64.89025 W to 45.70746 N - 64.89442 W	W- top of sope- hardwood regeneration changed to mature mixed woods; E - top of slope- PCT - hardwood forest
T6	45.70802 N - 64.8845 W to 45.7086 N - 64.8792 W	PCT - road curls around ridge
T7	45.70456 N - 64.88599 W to 45.70048 N - 64.88427 W	Majority is PCT - some clear cutting
PC1	45.70806 N - 64.88397 W	Open landscape to allow a free view of the surrounding airspace
PC2	45.70871 N - 64.88057 W	Open landscape to allow a free view of the surrounding airspace



PROJECT:

PROJECT:
WISOKOLAMSON ENERGY PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY LP**

FIGURE:

TITLE:
TRANSECT AND OBSERVATION STATION LOCATIONS FOR FALL MIGRATION SURVEYS

FIGURE NO.: **2.1**

REVISION NO.: **0**

WSP Canada Inc.
1 Spectacle Lake Drive,
Dartmouth, Nova Scotia
www.wsp.com

DATUM: NAD 83 CSRS

PROJECTION: NB STEREOGRAPHIC

DRAWN BY: T. MOREHOUSE

CHECKED BY: J. FERNET

CREATED DATE: (YYYY-MM-DD) 2018-04-05

REVISION DATE: (YYYY-MM-DD) 2018-04-12

LEGEND:

- OBSERVATION STATIONS (FALL MIGRATION SURVEYS)
- SURVEY TRANSECTS (FALL MIGRATION SURVEYS)
- TRANSMISSION LINE
- ELEVATION CONTOUR (10 metre Interval)
- WTG ERECTION FOOTPRINT
- LAND LEASE AREA (1252 ha)
- MET TOWER
- WTG

SCALE: 1:13,000

0 100 200 400 600 Metres

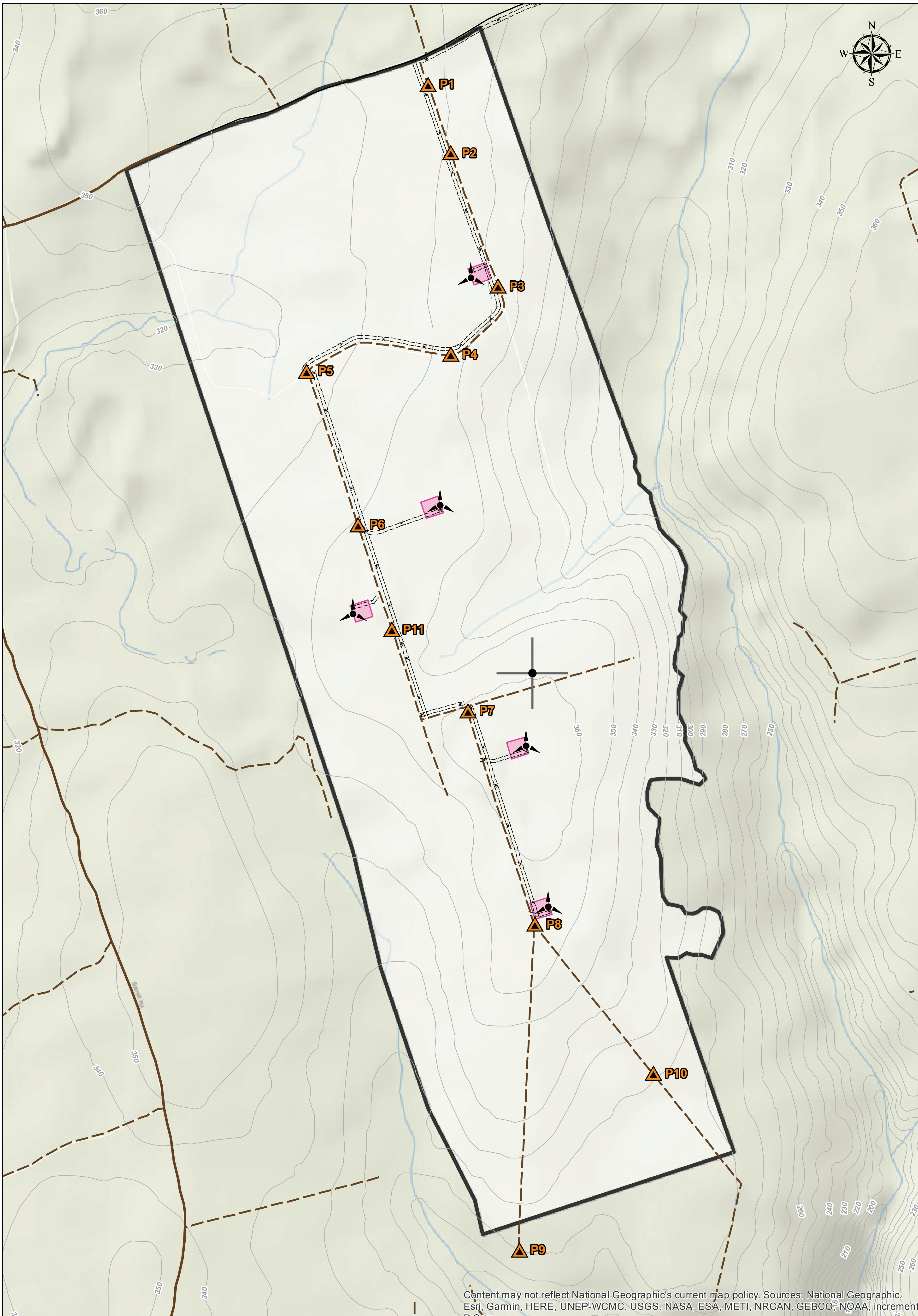
Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180412_161_08790_Phase19_FIG2_1_FallMigratorySurvey.mxd

2.2.2 BREEDING BIRD SURVEY

The breeding bird survey has been conducted June 24 and July 6 2016 and May 5 to July 3 2017. Besides 7 transects selected for the fall migration inventories, 11 point count survey stations (P1 to P1)1were chosen to reflect the turbine locations and habitat availability in the study area. Station locations and habitat descriptions are provided in Table 2.2 and on Figure 2.2. The duration of each point count was ten minutes. A nocturnal nighthawk survey was also performed during the night of July 2/3, 2017.

Table 2.2: Point Count Survey Station Locations and Habitat Descriptions for Breeding Bird Surveys

STATION	COORDINATES	HABITAT DESCCRIPTION
P1	45.72764 N - 64.8884 W	Mature mixed, coniferous dominated, dry understory
P2	45.72542 N - 64.88743 W	Mature, coniferous dominated on west; E, SE + SW is regen. Approx. 10 years old
P3	45.72109 N - 64.88537 W	West- regen (10-15 years old); S+SE mature mixed; E- regen (10-15 years old)
P4	45.71892 N - 64.88761 W	North - immature; South - mature - hard wood dominated
P5	45.71847 N - 64.89427 W	West + north - mature mixed
P6	45.71348 N - 64.89203 W	East- mature hardwood
P7	45.70741 N - 64.88715 W	Former mature hardwood stand
P8	45.70048 N - 64.88427 W	regen surrounding location, more mature farther in woods
P9	45.68998 N - 64.88529 W	Edges are regen; farther in woods is more mature
P10	45.69559 N - 64.87895 W	Patch of mature woods
P11	45.71008 N - 64.89059 W	Mature hardwood, some wood has been cleared



PROJECT:	FIGURE:			LEGEND:
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			PROJECTION: NB STEREOGRAPHIC	
PROJECT NO.: 161-08790 PHASE 19	FIGURE NO.: 2.2	REVISION NO.: 0	DRAWN BY: T. MOREHOUSE	
CLIENT: WISOKOLAMSON ENERGY LP	WSP Canada Inc. 1 Spectacle Lake Drive, Dartmouth, Nova Scotia www.wsp.com		CHECKED BY: J. FERNET	
			CREATED DATE: (YYYY-MM-DD) 2018-04-05	
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2.2.3 WINTERING BIRDS

Wintering birds were surveyed along the same transects (T1 to T7) used for the fall migration and breeding birds surveys. These transects were visited on January 10th, February 21st and March 30th, 2017.

3 RESULTS

3.1 EXISTING INFORMATION

3.1.1 ATLANTIC CANADA CONSERVATION DATA CENTRE DATA

The ACCDC is part of a network of NatureServe data centres and heritage programs serving 50 states in the U.S.A, 10 provinces and 1 territory in Canada, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology.

According to the ACCDC data, the study area contains 28 553 records of 138 vertebrate, including 26 bird species of particular interest which occur within 100 km of the Project study area (Table 3.1). A dozen of them are considered threatened or endangered at the national level, as well as by the New Brunswick authorities.

Table 3.1: Results Obtained from the Atlantic Canada Conservation Data Centre

SPECIES SCIENTIFIC NAME	COMMON NAME	COSEWIC	SARA	PROV LEGAL PROT	# RECS	DIST KM
Calidris canutus rufa	Red Knot rufa ssp	Endangered		Endangered	524	11.2 ± 2.0
Charadrius melodus melodus	Piping Plover melodus ssp	Endangered	Endangered	Endangered	327	10.8 ± 7.0
Sterna dougallii	Roseate Tern	Endangered	Endangered	Endangered	1	54.7 ± 0.0
Buteo lineatus	Red-shouldered Hawk	Not At Risk	Special Concern		27	10.5 ± 0.0
Haliaeetus leucocephalus	Bald Eagle	Not At Risk		Endangered	1286	5.9 ± 0.0
Asio flammeus	Short-eared Owl	Special Concern	Special Concern	Special Concern	37	7.7 ± 7.0
Bucephala islandica (Eastern pop.)	Barrow's Goldeneye - Eastern pop.	Special Concern	Special Concern	Special Concern	104	36.7 ± 83.0
Coccothraustes vespertinus	Evening Grosbeak	Special Concern			358	7.7 ± 7.0
Contopus virens	Eastern Wood-Pewee	Special Concern	Special Concern	Special Concern	723	2.4 ± 7.0
Coturnicops noveboracensis	Yellow Rail	Special Concern	Special Concern	Special Concern	6	22.3 ± 3.0
Euphagus carolinus	Rusty Blackbird	Special Concern	Special Concern	Special Concern	103	2.4 ± 7.0
***Falco peregrinus** pop. 1*	Peregrine Falcon - anatum/tundrius	Special Concern	Special Concern	Endangered	378	0.7 ± 5.0
Histrionicus histrionicus pop. 1	Harlequin Duck - Eastern pop.	Special Concern	Special Concern	Endangered	2	69.2 ± 1.0
Phalaropus lobatus	Red-necked Phalarope	Special Concern			19	11.5 ± 0.0
Caprimulgus vociferus	Whip-Poor-Will	Threatened	Threatened	Threatened	18	12.4 ± 7.0
Catharus bicknelli	Bicknell's Thrush	Threatened	Special Concern	Threatened	9	18.6 ± 11.0
Chaetura pelagica	Chimney Swift	Threatened	Threatened	Threatened	427	5.6 ± 0.0
Chordeiles minor	Common Nighthawk	Threatened	Threatened	Threatened	285	2.4 ± 7.0
Contopus cooperi	Olive-sided Flycatcher	Threatened	Threatened	Threatened	522	2.4 ± 7.0

SPECIES SCIENTIFIC NAME	COMMON NAME	COSEWIC	SARA	PROV LEGAL PROT	# RECS	DIST KM
Dolichonyx oryzivorus	Bobolink	Threatened	Threatened	Threatened	1337	6.2 ± 0.0
Hirundo rustica	Barn Swallow	Threatened	Threatened	Threatened	1266	2.4 ± 7.0
Hylocichla mustelina	Wood Thrush	Threatened	Threatened	Threatened	95	13.0 ± 0.0
Ixobrychus exilis	Least Bittern	Threatened	Threatened	Threatened	16	5.7 ± 0.0
Riparia riparia	Bank Swallow	Threatened	Threatened		656	7.7 ± 7.0
Sturnella magna	Eastern Meadowlark	Threatened	Threatened	Threatened	52	13.5 ± 0.0
Wilsonia canadensis	Canada Warbler	Threatened	Threatened	Threatened	698	1.6 ± 0.0

3.1.2 CHRISTMAS BIRD COUNTS

According to the Christmas Bird Count data, more than 80 species occur in the study area during winter (Table 3.2).

Table 3.2: Results Obtained from Christmas Bird Count Surveys for the Village of Riverside-Albert in Albert County (2010 to 2015)

SPECIES SCIENTIFIC NAME	COMMON NAME
Acanthis flammea	Common Redpoll
Acanthis hornemanni	Hoary Redpoll
Accipiter cooperii	Cooper's Hawk
Accipiter gentilis	Northern Goshawk
Accipiter striatus	Sharp-shinned Hawk
Agelaius phoeniceus	Red-winged Blackbird
Anas acuta	Northern Pintail
Anas platyrhynchos	Mallard
Anas rubripes	American Black Duck
Anatinae sp.	Duck sp.
Ardea Herodias	Great Blue Heron
Bombycilla cedrorum	Cedar Waxwing
Bombycilla garrulus	Bohemian Waxwing
Bombycilla garrulus/cedrorum	Bohemian/Cedar Waxwing
Bonasa umbellus	Ruffed Grouse
Branta canadensis	Canada Goose
Bubo virginianus	Great Horned Owl
Bucephala albeola	Bufflehead
Bucephala clangula	Common Goldeneye
Buteo jamaicensis	Red-tailed Hawk
Buteo lagopus	Rough-legged Hawk
Cardinalis cardinalis	Northern Cardinal
Certhia americana	Brown Creeper
Circus cyaneus	Northern Harrier
Coccothraustes vespertinus	Evening Grosbeak
Colaptes auratus auratus/luteus	Northern Flicker
Columba livia	Rock Pigeon
Corvidae sp.	Jay sp.
Corvus brachyrhynchos	American Crow
Corvus corax	Common Raven
Larus argentatus	Herring Gull
Larus delawarensis	Ring-billed Gull
Larus glaucoides	Iceland Gull
Larus marinus	Great Black-backed Gull
Loxia curvirostra	Red Crossbill
Loxia leucoptera	White-winged Crossbill
Melanerpes carolinus	Red-bellied Woodpecker
Melanerpes erythrocephalus	Red-headed Woodpecker
Melanitta americana	Black Scoter
Melospiza georgiana	Swamp Sparrow
Melospiza melodia	Song Sparrow
Mergellus/Lophodytes/Mergus sp.	Merganser sp.
Mergus merganser	Common Merganser
Molothrus ater	Brown-headed Cowbird
Passer domesticus	House Sparrow
Passerculus sandwichensis	Savannah Sparrow
Passerella iliaca	Fox Sparrow
Perisoreus canadensis	Gray Jay
Phasianus colchicus	Ring-necked Pheasant
Picoides pubescens	Downy Woodpecker
Picoides sp.	Picoides sp.
Picoides villosus	Hairy Woodpecker
Pinicola enucleator	Pine Grosbeak
Pipilo erythrophthalmus	Eastern Towhee
Plectrophenax nivalis	Snow Bunting
Poecile atricapillus	Black-capped Chickadee
Poecile hudsonicus	Boreal Chickadee
Quiscalus quiscula	Common Grackle
Regulus calendula	Ruby-crowned Kinglet
Regulus satrapa	Golden-crowned Kinglet

SPECIES SCIENTIFIC NAME	COMMON NAME
Cyanocitta garrulus	Blue Jay
Dryocopus pileatus	Pileated Woodpecker
Emberizidae sp.	Sparrow sp.
Euphagus carolinus	Rusty Blackbird
Falco columbarius	Merlin
Fringillidae sp.	Finch sp.
Gavia immer	Common Loon
Gavia stellate	Red-throated Loon
Haemorhous purpureus	Purple Finch
Halieetus leucocephalus	Bald Eagle
Icterus galbula	Baltimore Oriole
Junco hyemalis hyemalis/carolinensis	Dark-eyed Junco
Lanius excubitor	Northern Shrike
Larinae sp.	Gull sp.
Sitta canadensis	Red-breasted Nuthatch
Sitta carolinensis	White-breasted Nuthatch
Somateria mollissima	Common Eider
Spinus pinus	Pine Siskin
Spinus tritis	American Goldfinch
Spiza americana	Dickcissel
Spizella passerina	Chipping Sparrow
Spizelloides arborea	American Tree Sparrow
Strix varia	Barred Owl
Sturnus vulgaris	European Starling
Turdus migratorius	American Robin
Zenaida macroura	Mourning Dove
Zonotrichia albicollis	White-throated Sparrow
Zonotrichia leucophrys	White-crowned Sparrow

3.2 FALL MIGRATION SURVEYS

The fall migration survey has been conducted from September 13 to October 20, 2016. 29 species, comprising 214 individual birds at heights generally less than 100 m, were observed at the project site (Table 3.3). Dark-eye Junco (*Junco hyemalis*) and Black-capped chickadee (*Poecile atricapillus*) were the most common species among the surveyed stations. Transects T4, T5 and T6 were the richest, with 14 to 19 species each, while transect T3 shows only 3 bird species.

Table 3.3: Fall migration surveys (13 September to 20 October 2016)

SPECIES		STATION									NUMBER OF STATION WHERE OBSERVED
SCIENTIFIC NAME	COMMON NAME	PC1	PC2	T1	T2	T3	T4	T5	T6	T7	
Bombycilla cedrorum	Cedar Waxwing	•							•		**2**
Cathartes aura	Turkey Vulture					•					**1**
Corvus brachyrhynchos	American Crow	•		•	•	•	•	•		•	**7**
Corvus corax	Common Raven	•									**1**
Cyanocitta cristata	Blue Jay	•					•		•	•	**4**
Dendroica coronata	Yellow-rumped Warbler		•						•		**2**
Dendroica fusca	Blackburnian Warbler							•			**1**
Dendroica magnolia	Magnolia Warbler						•	•	•		**3**
Dendroica virens	Black-throated Green Warbler			•			•	•	•	•	**5**
Falcipennis canadensis	Spruce Grouse	•						•		•	**3**
Geothlypis trichas	Common Yellowthroat							•	•		**2**
Junco hyemalis	Dark-eyed Junco	•	•	•	•	•	•	•	•	•	**9**
Melospiza melodia	Song Sparrow								•		**1**

SPECIES		STATION									NUMBER OF STATION WHERE OBSERVED
SCIENTIFIC NAME	COMMON NAME	PC1	PC2	T1	T2	T3	T4	T5	T6	T7	
Mniotilta varia	Black-and-white Warbler		•		•		•	•	•	•	6
Parula americana	Northern Parula								•		1
Parulidae sp.	Unidentified Warbler								•		1
Perisoreus canadensis	Gray Jay	•				•	•				3
Picoides pubescens	Downy Woodpecker					•		•			2
Poecile atricapillus	Black-capped Chickadee	•		•	•	•	•	•	•	•	8
Regulus calendula	Ruby-crowned Kinglet							•			1
Regulus satrapa	Golden-crowned Kinglet			•	•	•	•	•	•	•	7
Setophaga ruticilla	American Redstart						•	•	•		3
Sitta canadensis	Red-breasted Nuthatch			•			•				2
Spinus tristis	American Goldfinch							•	•		2
Turdus migratorius	American Robin			•	•	•	•	•	•	•	7
Vermivora ruficapilla	Nashville Warbler						•	•			2
Vireo olivaceus	Red-eyed Vireo	•						•	•	•	4
Vireo solitarius	Blue-headed Vireo							•			1
Zonotrichia albicollis	White-throated Sparrow			•			•	•	•	•	5
	Species diversity (n)	**9**	**3**	**8**	**6**	**8**	**14**	**19**	**18**	**11**	

3.3 BREEDING BIRD SURVEY

The breeding bird survey has been conducted June 24 and July 6 (point count stations) in 2016, and May 5 to July x (transects) in 2017. Including the Common Nighthawk*(Chordeiles minor),* the Eastern Wood-Pewee (*Contopus virens*), and Evening Grosbeak (*Coccothraustes vespertinus),* which were observed out of our survey stations, 55 bird species, comprising 227 individual birds, were observed in the study area during the 2016 and 2017 breeding seasons (Table 3.3). American Robin *(Turdus migratorius),* White-throated sparrow *(Zonotrichia albicollis),* and Dark-eye Junco were the most common species among the surveyed stations. Point count stations P2 and P9 were the richest, with 24 and 23 species each, while transect T6 shows only 5 bird species.

Table 3.2: Breeding Bird Surveys (June 24 and July 6 2016 (•), and May 5 to July 3 2017 (•))

SPECIES		STATIONS											TRANSECTS								# STATIONS WHERE OBSERVED
SCIENTIFIC NAME	COMMON NAME	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	T1	T2	T3	T4	T5	T6	T7	W-MET	
Bonasa umbellus	Ruffed Grouse							R					R								2
Buteo jamaicensis	Red-tailed Hawk																			R	1
Carpodacus purpureus	Purple Finch		R				R			R		R									4
Cathartes aura	Turkey Vulture																R				1
Catharus guttatus	Hermit Thrush	G R		G R	G R	G	G R	G	G	G R	G				R	R	R			R	13
Catharus ustulatus	Swainson's Thrush	R	G	G R		G R	G	R				G		R	R	R		R	R		12
Coccothraustes vespertinus	Evening Grosbeak		R																		1
Colaptes auratus	Northern Flicker			G R				R						R					R		4
Contopus virens	Eastern Wood-Pewee										G										1
Corvus corax	Common Raven		R			R								R					R		4
Cyanocitta cristata	Blue Jay	G				G R														R	3
Dendroica caerulescens	Black-throated Blue Warbler				G			G		G	R	G									5
Dendroica castanea	Bay-breasted Warbler							G													1
Dendroica coronata	Yellow-rumped Warbler	G R			R	R	R			R		R		R		R	R		R	R	11
Dendroica fusca	Blackburnian Warbler									R	G								R		3
Dendroica magnolia	Magnolia Warbler	G R	G R	R		R				G R	G R		R	R					R		9
Dendroica palmarum	Palm Warbler	G																			1
Dendroica pensylvanica	Chestnut-sided Warbler		G R	G R				G	G	G											5
Dendroica virens	Black-throated Green Warbler	G R	G R	G	G	G R	R			G R	G R	G R	R		R	R			R		13
Empidonax alnorum	Alder Flycatcher	G	G						R	G											4
Empidonax minimus	Least Flycatcher			R	R							G R				R			R		5

SPECIES		STATIONS											TRANSECTS								# STATIONS WHERE OBSERVED
SCIENTIFIC NAME	COMMON NAME	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	T1	T2	T3	T4	T5	T6	T7	W-MET	
Gavia immer	Common Loon							•													1
Geothlypis trichas	Common Yellowthroat		••	•				•	••	••	••	•								•	8
Junco hyemalis	Dark-eyed Junco	•	•	•	••		•		•	••	••	•		•		•	•		•	•	14
Melospiza melodia	Song Sparrow						•														1
Mniotilta varia	Black-and-white Warbler		•	•	••	•	•		•	•				•	•				•		10
Oporornis philadelphia	Mourning Warbler			•	•	•				••											4
Parula americana	Northern Parula			•	•			•		•									•		5
Perisoreus canadensis	Gray Jay	•																			1
Picidae sp.	Woodpecker sp.			•				•	•												3
Picoides pubescens	Downy Woodpecker				•						•	•									3
Picoides villosus	Harry Woodpecker		•			•			•												3
Poecile atricapillus	Black-capped Chickadee		•			•	••	•			•								•		6
Poecile hudsonicus	Boreal Chickadee	•																			1
Common Grackle	Common Grackle		•																		1
Regulus calendula	Ruby-crownded Kinglet	••	•			•							•								4
Regulus satrapa	Golden-crowned Kinglet	••	•								••		•				•				5
Scolopax minor	American Woodcock																			•	1
Seiurus aurocapilla	Ovenbird		•	•	••	••	••	••	•	••	••	••				•		•	•	•	14
Setophaga ruticilla	American Redstart		•	••	•	••	••	••	•	•		•		•						•	11
Sitta canadensis	Red-breasted Nuthatch	••	•		•				•	•	••					•					7
Sitta carolinensis	White-breasted Nuthatch							•													1

SPECIES		STATIONS											TRANSECTS								# STATIONS WHERE OBSERVED
SCIENTIFIC NAME	COMMON NAME	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	T1	T2	T3	T4	T5	T6	T7	W-MET	
Sphyrapicus varius	Yellow-bellied Sapsucker									●											1
Spinus pinus	Pine Siskin	●																			1
Spinus tristis	American Goldfinch				●			●													2
Troglodytes hiemalis	Winter Wren		●●					●	●	●	●			●				●		●	8
Turdus migratorius	American Robin	●●	●	●●	●●	●●	●●	●●	●●	●●	●	●●	●	●	●	●	●	●	●	●	19
Tyrannidae sp.	Flycatcher sp.								●												1
Vermivora ruficapilla	Nashville Warbler		●											●							2
Vireo olivaceus	Red-eyed Vireo			●	●	●	●●	●●	●●	●	●	●				●	●		●	●	13
Vireo solitarius	Blue-headed Vireo	●●	●		●	●●	●			●	●										7
Zonotrichia albicollis	White-throated Sparrow	●●	●●	●●		●		●●	●●	●●	●●	●	●	●	●			●	●	●	15
	Species diversity (n)	**18**	**24**	**18**	**17**	**18**	**14**	**20**	**16**	**23**	**18**	**14**	**7**	**12**	**6**	**10**	**7**	**5**	**16**	**13**	

3.4 WINTERING BIRDS SURVEY

Wintering birds surveys were performed on January 10th, February 21st and March 30th, 2017. Only 10 bird species were observed in the study area during the 2017 winter surveys (Table 3.4). American Crow *(Corvus brachyrhynchos),* White-throated sparrow *(Zonotrichia albicollis),* Black-capped Chickadee, and Red-breasted Nuthatch *(Sitta canadensis)* were the most common species among the surveyed stations. Transect T1was the richest, with 6 species, while transect T6 shows only one bird species.

Table 3.3: Winter surveys (2017 season)

SPECIES		TRANSECTS						
Scientific Name	Common Name	T1	T2	T3	T4	T5	T6	T7
Accipitridae sp.	Hawk sp.		•					
Aves sp.	Unknown species	•						•
Corvus brachyrhynchos	American Crow	•	•				•	
Larinae sp.	Gull sp.					•		
Larus marinus	Great Black-backed Gull							•
Perisoreus canadensis	Gray Jay	•						•
Picoides pubescens	Downy Woodpecker		•	•				
Poecile atricapillus	Black-capped Chickadee	•		•	•			
Sitta canadensis	Red-breasted Nuthatch	•			•	•		
Sitta sp.	Nuthatch	•			•			
	Species diversity (n)							

4 GENERAL DISCUSSION

Although the fact that the Bay of Fundy region is recognized as an important breeding and migration stop-over area for birds, and that the ACCDC data report the presence of 26 bird species of particular interest within 100 km of the Project study area, no important concentration of bird was detected during the field surveys, whether it is during winter, summer or autumn. Only few birds of prey were noted and, as well as three articular status or special concern bird species, namely the Common Nighthawk, the Eastern Wood-pewee, and the Evening Grosbeak.

Common Nighthawk, which two individuals were observed during the field surveys, prefers open or rocky areas as roosting and nesting locations. It is likely that this species is utilizing exposed forest floors or the logging roads themselves as roost or nest locations. These birds were observed during the breeding season, indicating that they are "probable" breeders in the Study area. Eastern Wood-pewee, which was noted only once during the field inventories, is a known associate of mid-aged to mature hardwood or mixed-wood forests. Given that the species was detected during the breeding season, Eastern Wood-pewee should be considered a "possible" breeder within the Study area.

The Evening Grosbeak is for its part an erratic species, what means that its spatial distribution varies considerably from one year to the next. Given it was noted only once during the field inventories, is a known associate of mid-aged to mature hardwood or mixed-wood forests, but it may take advantage of other habitats. The Evening Grosbeak's spatial distribution varies considerably from one year to the next, therefore may not be a regular breeder within the Project area.

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Appendix

F BAT INVENTORY REPORT

BAT INVENTORY REPORT

WISOKOLAMSON ENERGY PROJECT

WISOKOLAMSON ENERGY LP

APRIL 2018

BAT INVENTORY REPORT

WISOKOLAMSON ENERGY PROJECT

WISOKOLAMSON ENERGY LP

WSP PROJECT NO.: 161-08790-00
DATE: APRIL 2018

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1 INTRODUCTION

In Canada, wind energy development in a commercial context is one of the fastest growing sectors. New Brunswick alone is striving to meet an aggressive target of 40% of the province's electricity needs to be met by renewable energy by the year 2020 (Government of New Brunswick, 2018). Today, there is 294 MW of wind energy on the grid. New Brunswick currently has three operating wind farms but they represent some of the largest such projects in Atlantic Canada (The Maritimes Energy Association, 2018).

Even though electrical generation from wind turbines has many environmental benefits, the rapid growth has raised concerns on impacts of migratory and resident wildlife populations. Wind farm projects are subject to impact studies, the same as other major development projects. Since large numbers of bat fatalities at wind energy facilities is a relatively recent issue (Johnson, 2005), bats have become a primary environmental concern associated with wind energy development. Mortality is known to be caused by either direct strike by the rotating turbine blades, collision with the turbine towers, and/or barotrauma (Burns and Broders, 2013). Barotrauma is caused by a quick loss of air pressure near moving wind turbines and involves tissue damage in the bats lungs, and is still under discussion on its impact on the bat populations (Rollins et al. 2012). Due to these fatalities, provincial governments are now requiring risk avoidance surveys prior to the construction of the wind turbines.

In New Brunswick, seven species of bat occurrences have been documented: the Little Brown Myotis or Little Brown Bat (*Myotis lucifugus*), the Northern Myotis or Northern Long-Eared Bat (*Myotis septentrionalis*), the Big Brown Bat (*Eptesicus fuscus*), the Hoary Bat (*Lasiurus cinereus*), the Red Bat (*Lasiurus borealis*), the Silver-haired Bat (*Lasionycteris noctivagans*), and the Eastern Pipistrelle or Tri-colored Bat (*Pipistrellus subflavus*) (Government of New Brunswick, n.d.). Four species overwinter locally (Little Brown Bat, Northern Long-Eared Bat, Tri-colored Bat, and Big Brown Bat) and three (Hoary Bat, Silver-haired Bat, and Red Bat) are considered to be migratory species because they spend the winter in the south. It should be noted that at fall, even resident bat species migrate, although the distances are much smaller, and less important than in the case of migratory species. Each of these species has been documented to have experienced fatalities at wind turbine sites (Broders, 2011). In North America, large bat fatalities mainly occur in late summer and early fall and the most affected species are long distant migrant species. Nevertheless, bat mortalities have also been documented, in smaller numbers for short-distant migrant (or "resident") bat species (Broders, 2011). Even though some fatalities have been reported during spring migrations, it is thought that spring migration behavior is less structured and occurs by different routes compared to fall migration (Broders, 2011).

Of these seven species found in New Brunswick, three (Little Brown bat, Northern Long-eared Bat, and Tri-colored bat) were emergency listed as Endangered on Schedule 1 of the federal *Species at Risk Act* (SARA) in 2014 because of sudden and dramatic declines across the eastern portions of the ranges of Little Brown Bat and Northern Long-Eared Bat, and throughout the entire Canadian range of Tri-colored Bat. These declines are the direct result of White-Nose Syndrome (WNS), which is responsible for large numbers of mortality in hibernating bats through much of eastern North America (Blehert et al., 2009; CBC News, 2014; Burns and Broders, 2013, Environment Canada, 2015). In Canada, the total number of *Myotis* sp. bats recorded in New Brunswick, Nova Scotia, Ontario, and Quebec hibernacula declined by approximately 94% between 2010 and 2012 (Environment Canada, 2015). In Quebec, New Brunswick, and Nova Scotia, some hibernacula no longer have any individuals of these bat species present (Environment Canada, 2015). In March of 2011 White-nose-syndrome was first detected in a cave in Albert County, the province's most important bat hibernaculum (overwintering site) (Government of New Brunswick, n.d.).

All of the seven bat species found in New Brunswick could be potentially present within the study area. According to the Atlantic Canada Conservation Data Centre (ACCDC) ranking, based on occurrence records from New Brunswick and Nova Scotia, three of the seven bat species present in New Brunswick, namely the Little Brown Bat, the Northern Long-Eared Bat, and the Tri-colored Bat are listed as S1 (Critically Imperiled—Critically imperiled in the province because of extreme rarity [often 5 or fewer occurrences] or because of some factor[s] such as very steep declines making it especially vulnerable to extirpation from the state/province).

This report presents acoustical inventory data collected during the reproduction and the fall bat migration periods in 2016, and during the reproduction period in 2017.

2 METHODS

2.1 EXISTING INFORMATION

A request has been made to the Atlantic Canada Conservation Data Centre (ACCDC) in February 2018, regarding the presence of rare and endangered species or special areas into the Study Area and in a 100 km buffer around it. Additional bat survey data from other studies in New Brunswick were also considered to evaluate the potential of presence of the different bat species in the vicinity.

2.2 ACOUSTIC SURVEY

The bat inventory has been conducted using the stationary acoustic inventory technique. In this method, automated stations, each composed of a waterproof box containing an *AnaBat® II* ultrasound detector, *AnaBat® CF Storage ZCAIM*) and a set of long-lasting batteries, were installed at various points in the Study Area.

The system's operating principle is relatively simple. During the after-dark hours, the *AnaBat® II Bat Detector* is active, waiting to receive ultrasound. When a signal is received, sounds are transmitted to an interface (*AnaBat® CF Storage ZCAIM*) which process and stores the information on a *Compact Flash* format memory card. At the time of analysis, the recordings on the memory cards are transferred to a computer. Sound analysis software (*AnaBat®6, version 6.3 and Batview*) is used to produce sonograms which can be used to view and analyze the recorded calls. The bats are then identified by comparing the sonograms with the known characteristics of particular species echolocation calls (sound signatures). Bat call sonograms which could not be attributed to species (or genus) are labelled "Undetermined". This technique has certain limitations. Due to the similarity of their sound signatures, it is difficult to discriminate the two most common species in the genus *Myotis* (Little Brown Bat and Northern Long-Eared Bat). In most cases, the identification is limited to the genus level.

Detectors were installed, taking into account the topography of the Study Area, habitat, presence of potential travel and/or migration corridors, and site availability for the installation of the *AnaBat® II Bat Detector*.

In 2016, two detectors were deployed July 6th and deactivated July 18th (stations AB1 and AB2-3). Three detectors were deployed August 8th and deactivated August 18th (stations AB1, AB2-3 and AB4). Finally, two detectors were deployed in two locations on September 15th and the cards and batteries were swapped on October 8th (stations AB5 and AB6). These last detectors were officially taken down on October 20th.

In 2017, two additional detectors were deployed on June 8th (AB7 and AB8). One of these detectors (AB8) had a technical problem and was replaced with a new detector on June 14th. Those detectors were deactivated on June 29th.

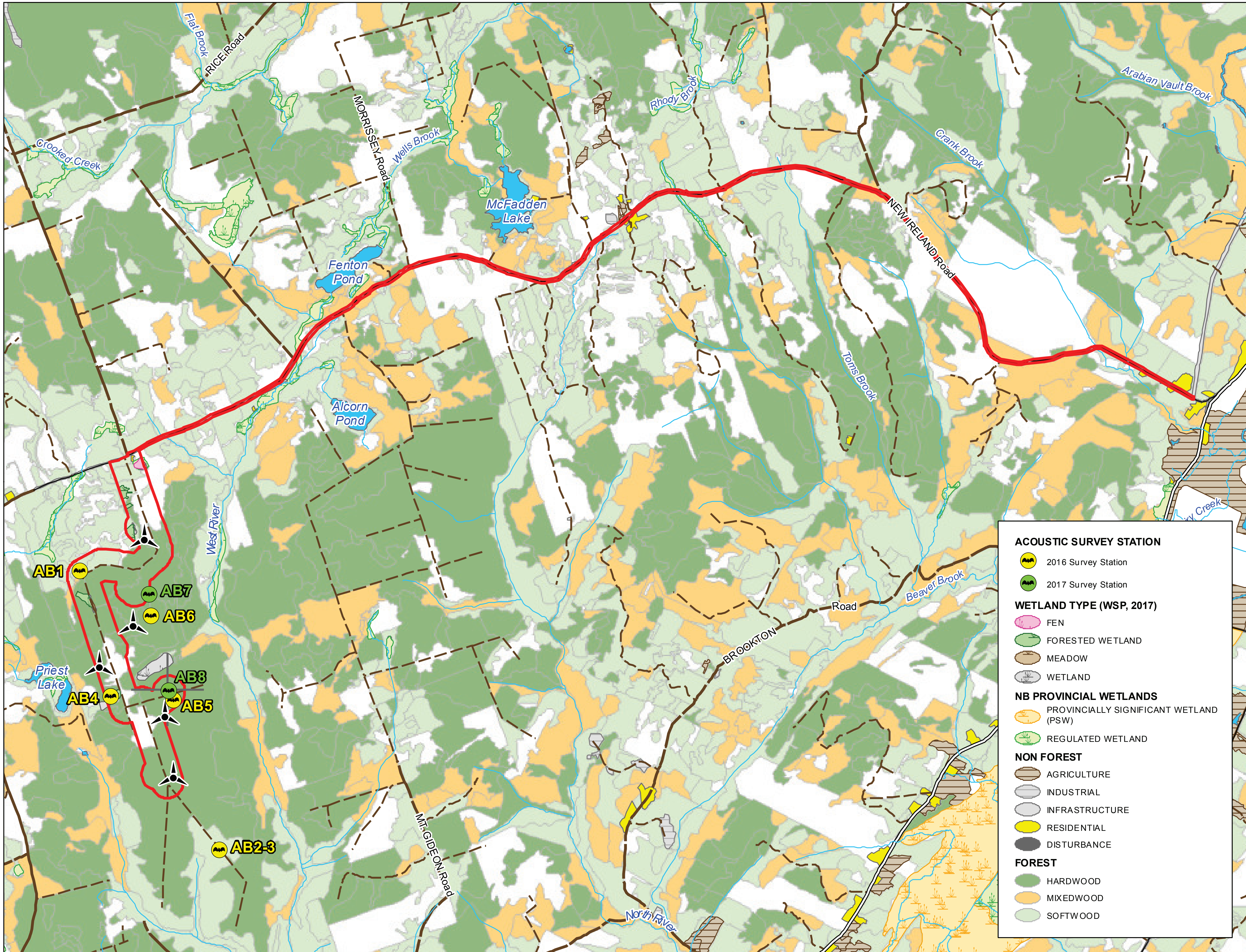
Sound signatures were collected from a total of six stations. Stations were equipped with an automated system and were set to record between 8:00 pm and 6:00 am. All the stations were placed in trees approximately 4 to 6 meters above ground, except for station AB8 which was placed on a meteorological tower, approximately 30 meters high.

The location of the acoustic inventory stations is illustrated on Figure 2.1. Table 2.1 presents a general habitat description for each station location. Photographs of the habitat adjacent to each station are included in Appendix A.

Table 2.1: Survey Stations Locations and Habitats

STATION	COORDINATES	DEPLOYED	RETRIEVED	RECORDING PERIOD	HABITAT DESCRIPTION
AB1	E 352558 N 5064557	7/6/2016 8/8/2016	7/18/2016 8/18/2016	7/6/2016 to 7/15/2016 (10 nights) 8/9/2016 to 8/18/2016 (10 nights)	Placed in a mature conifer tree on the edge of a clearing. The clearing is surrounded by mature conifer trees and 10–15 years old hardwood.
AB2-3	E 353764 N 5061860	7/6/2016 8/8/2016	7/18/2016 8/18/2016	N/A*	On the edge of the clearing next to the road. The clearing is surrounded by mature mixed forest.
AB4	E 352799 N 5063357	8/8/2016	8/18/2016	8/9/2016 to 8/17/2016 (9 nights)	Placed in a mature conifer tree on the edge of a mixed-tree swamp pointing in the north/northeast direction.
AB5	E 353389 N 5063294	9/15/2016	10/20/2016	9/15/2016 to 10/19/2016 (35 nights)	On the edge of a southern edge of a cleared opposite the lot of the met tower. Partially commercially thinned (PCT) and some clear cutting.
AB6	E 353218 N 5064100	9/15/2016	10/20/2016	9/15/2016 to 10/19/2016 (35 nights)	Along the road of T6. PCT area/clearcutting.
AB7	E 353205 N 5064307	6/14/2017	6/29/2017	6/14/2017 to 6/28/2017 (15 nights)	On the edge of a clearing surrounded by sparse forest, on a slope.
AB8 (Met Tower)	E 353349 N 5063389	6/8/2017	6/29/2017	6/8/2017 to 6/28/2017 (21 nights)	Placed on a Met Tower, about 30 m high. Clear cutting surrounded by mixed forest with some very mature trees.

* Technical failure prevents the recording of bat calls



KEY MAP:

LEGEND:

WTG

MET TOWER

WATERCOURSE

WATERBODY

STUDY AREA BOUNDARY

TRANSPORTATION

Dept. of Transportation & Infrastructure (DTI)

PRIMARY HIGHWAY

SECONDARY HIGHWAY

Dept. of Energy & Resouce Development (DERD)

PRIMARY FOREST ROAD

TERTIARY/LIMITED ACCESS FOREST ROAD

LOGGING ROAD (Within Harvest Block)

PROJECT:

PROJECT:
ENVIRONMENTAL IMPACT ASSESSMENT RIVERSIDE-ALBERT, NEW BRUNSWICK

PROJECT NO.: **161-08790 PHASE 19**

CLIENT: **WISOKOLAMSON ENERGY**

FIGURE:

TITLE:
LOCATION OF ACOUSTIC SURVEY STATIONS

FIGURE NO.: 1	REVISION NO.: 0
SCALE: 1:35,000 (0, 500, 1,000, 2,000 Metres)	
DATUM: NAD 83 CSRS	PROJECTION: NB Stereographic
DRAWN BY: T. MOREHOUSE	CHECKED BY: R. DUHAMEL
CREATED DATE: (YYYY-MM-DD) 2018-03-28	REVISION DATE: (YYYY-MM-DD) 2018/03/28

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1 Spectacle Lake Drive,
Dartmouth, Nova Scotia
www.wsp.com

Document Path: S:\GIS\2_PROJECTS\2016\161_08790_SWEB_LP_BioSurvey_RiversideAlbert_NB\8_MXD\20180322_161_08790_Phase19_FIG1_AnabatSurveyLocations.mxd

3 RESULTS

3.1 EXISTING INFORMATION

According to the ACCDC report, no known bat hibernaculum is present within 5 km of the Project study area. To our knowledge, the closest known bat hibernaculum is located about 18 km north from the Study Area (Vanderwolf et al., 2012). ACCDC reports the presence of the Little Brown Bat, the Northern Long-Eared Bat, and the Tri-colored Bat about 15.5 km from the Study Area. The Big Brown Bat is also reported about 18 km from the Study Area.

Furthermore, a bat survey conducted in 2017 for the Richibucto Wind Power Project (Natural Forces, 2017), located about 100 km north of the Study Area, confirm the presence of all the 7 species reported in New Brunswick, namely the Little Brown Bat, the Northern Long-Eared Bat, the Big Brown Bat, the Hoary Bat, the Red Bat, the Silver-haired Bat, and the Tri-colored Bat.

3.2 ACOUSTIC SURVEY—SUMMER AND FALL 2016

Echolocation surveys were conducted south off of New Ireland Road within the study area from July 6th to October 20th, 2016. In total, there were 973 separate sound files recorded and of these only 19 files were determined to be ultrasound generated by bats. All the remaining files were extraneous noise. Weather conditions (raindrops and wind), some insects like the cicada, and vehicle traffic on the dirt road are among the potential sources of extraneous noise recordings.

Three bat species and a genus were identified during this survey among the 19 bat sonograms recorded, including:

- Hoary Bat;
- Species in the genus *Myotis*;
- Big Brown Bat; and
- Tri-colored Bat.

Table 3.1 shows the results obtained at the different survey stations. The species encountered, the number of identified recordings for each species, as well as the total number of recordings per station are included. For each station, the relative percentage of each bat species is calculated (% per Station), and for each species the percentage sonograms collected at each station is also given (% per Species). Information concerning endangered species in New Brunswick is highlighted in red.

Table 3.1: Results Obtained at the Different Survey Stations – 2016 season

STATION	SPECIES	COMMON NAME	# OF BAT SONOGRAMS	% PER STATION	% PER SPECIES
AB1	None		0		
	Total		**0**		
AB2-3	None		N/A*		
	Total		**N/A**		
AB4	*Lasiurus cinereus*	Hoary Bat	8	72.7	100
	Myotis sp.	Species in the genus Myotis	1	9.1	25.0
	No ID	No ID	2	18.2	100
	Total		**11**	**100**	**N/A**
AB5	None		0		
	Total		**0**		
AB6	*Eptesicus fuscus*	Big Brown Bat	1	0.1	100
	Myotis sp.	Species in the genus Myotis	3	0.4	75.0
	Perimyotis subflavus	Tri-colored Bat	4	0.5	100
	Total		**8**	**100**	**N/A**
	Grand Total		**19 bat sonograms**		

* Technical failure prevents the recording of bat calls

3.3 ACOUSTIC SURVEY—SPRING 2017

Additional echolocation surveys were conducted south of New Ireland Road within the study area from June 8th to 28th, 2017. In total, there were 799 separate sound files recorded and of these only one file was determined to be ultrasound generated by bat. All the remaining files were extraneous noise. Weather conditions (raindrops and wind), some insects like the cicada, and vehicle traffic on the dirt road are among the potential sources of extraneous noise recordings.

The only bat sonogram collected in spring 2017 was from Hoary Bat. The call was recorded at the AB7 station, on June 27th at 00:45 am. No bat activity was recorded at the 30 m high station.

3.4 GENERAL DISCUSSION

The Hoary Bat represented approximately 45% of the sonograms, and had the highest percent of sonograms out of all the species identified. The Tri-colored Bat represents approximately 20% of the sonograms. Species in the genus Myotis represent approximately 20% of the sonograms but, due to limitations of methodology, the relative proportion of the sonograms belonging to each species of Myotis cannot be determined. However, the presence of the species in the genus Myotis was assessed during sonogram identification.

Only one sonogram of the Big Brown Bat has been collected, representing approximately 5% of the recordings.

Furthermore, 10% of the recordings couldn't be identified to any species (no ID). Those calls are mostly recordings that are too short to recognize key characteristics. This may happen when bats fly near the limits of the detection zone. Considering this type of event is independent of the species, the distribution of the ''unidentified", between bat species would, in principle, follow the same pattern as the recordings specific to the species.

According to their seasonal movements, bat species are divided into two categories, residents or migratory. In fall, even resident species can travel hundreds of kilometers to reach their winter habitat, usually a cave or a mine opening. These hibernacula can be found at the latitude of the study area. Concerning migratory species, they migrate south, wintering in the southern part of the United States to the Gulf of Mexico.

Both resident and migratory species were encountered during this survey, but most of the sonograms were collected during early migration (August 9th to 14th 2016) and migration (September 17th to 21st 2016), with 11 and 8 sonograms respectively. Early migration peak time bat activity is mostly due to Hoary Bat, which represents 8 out of 11 sonograms collected in August (all the recordings for this species). September peak time bat activity is mostly due to species of the Myotis genus (3 out of 8 sonograms) and Tri-colored Bat (4 out of 8 sonograms, all the recordings for this species). The only sonogram of Big Brown Bat was also collected in September. Only one sonogram, from Hoary Bat, was collected during 2017 summer survey (reproduction period) while no bat where recorded in the reproduction period in 2016. Indeed, bats exhibit nightly and seasonal activity patterns that vary among species and individuals (Johnson et al., 2011).

During this survey, all the recordings for Hoary Bat were collected between 11:30 pm and 02:40 am, those from species of the genus Myotis between 08:00 pm and 00:30 am, and those for Tri-colored Bat between 09:30 pm and 05:30 am. The sonogram from Big Brown Bat was collected around 01 00 pm. Bats typically forage in several different locations each night and display dynamic movements across the landscape (Kunz et al. 2007). However, the methodology does not control the action of whether several calls of a given species recorded during a single night or even different nights came from one or several individuals. Therefore, some of the recorded calls could originate from a single bat repeatedly calling near the same station during the night, or even for several nights. Indeed, 5 out of the 8 sonograms from Hoary Bat were recorded on August 9th between 11:44 pm and 11:52 pm

Bat activity was recorded at 3 of the 6 stations that were functional at a given period during 2016 and 2017 surveys, namely AB4, AB6, and AB7 stations. All Hoary Bat calls but one were recorded at the AB4 stations, along with 1 call from a species of the genus Myotis and 2 undetermined sonograms (total of 11 recordings). The other recordings from species of the genus Myotis, as well as all the recordings from Tri-colored Bat and Big Brown Bat, were collected at the AB6 station (total of 8 recordings). Finally, a single Hoary Bat call was collected during the 2017 summer survey (AB7). All the habitats selected for survey stations were suitable for bats: forest patches with some mature trees alternate with clearings, and sometimes wetlands, as for AB4 station, providing both resting and foraging sites for bats.

Indeed, most of inventoried bat species are arboreal. Hoary Bat prefers arboreal roosting habitats, while species of the genus Myotis and Tri-colored Bat use both buildings and trees (Tremblay and Jutras, 2010; Environment Canada, 2015). The Big Brown Bat, for its part, usually prefers buildings or rock structures (McAlpine et al., 2002; Tremblay and Jutras, 2010), but it also uses mature trees with cavities (peak holes, cracks, etc.) (Willis et al., 2006). Many bat species (including species of the genus Myotis) preferentially roost in older forest stands, compared to young forests (Barclay and Brigham, 1996). Furthermore, swamps, peat bogs, beaver ponds, lakes and streams are known to be drinking and foraging habitats used by bats (Taylor, 2006).

Although most of the survey stations are near forest patches, AB4 station is the only one located near a wetland, in the valley between Priest Lake and West River, which could be used by bats as a moving/migrating corridor. Indeed, when moving from one site to another, bats generally use linear forest structures to guide themselves (Grindal and Brigham 1998, Henderson and Broders 2008). Stream valleys, with their riparian strips of vegetation, as well as road and power lines, are therefore potential corridors for their movements. Bat activity at AB6 station, which is located along an access road, could also be explained by its use as a moving corridor by bats. East of the project footprint, the valley of the East River is probably the most suitable moving/migrating corridor for bats near the Study Area, since it is globally north—south oriented.

The Hoary Bat is a long distance migratory bat that is a solitary tree roosting species. It had the largest number of calls in this study. Scientific knowledge on the status of these bats is that they are common but occur in low population frequencies in Nova Scotia (van Zyll de Jong, 1985).

Myotis species in New Brunswick are the most widely distributed and abundant species (Vanderwolf et al., 2012). Both the Little Brown Bat and the Northern Long-Eared Bat were likely active in the site area, but generally their calls are not distinguishable from each other. The Little Brown Bat is mainly found foraging in open areas and over water, while the Northern Long-Eared Bat is known as an interior forest species (Henderson and Broders, 2008).

The Big Brown Bat is a resident species, and for long, was considered to have reached the northern limit of its eastern North American range in southern New Brunswick (van Zyll de Jong, 1985, McAlpine et al., 2002). However, recurrent annual surveys performed in Quebec since 2000 show that Big Brown Bat distribution is far more Nordic than it was previously thought (Jutras et al., 2012). Due to its rarity, Big Brown Bat does not seem to be a significant component of forested ecosystems in New Brunswick (McAlpine et al., 2002) nor in Nova Scotia (Broders et al., 2003). But considering the preference of this species for using buildings as roosting sites as well as hibernacula, it is possible that Big Brown Bat is more common in the province—and in Atlantic Canada—than it is usually thought (McAlpine et al., 2002; Broders et al., 2003).

Overall, with 20 bat calls recorded with an effort of 135 detector-nights from June to October, the average bat passes recorded is approximately 0.15 call per night. When comparing this result to bat acoustic survey of Richibucto Wind Project (Natural Forces, 2017), with an average bat passes of 1.4 calls per night, the bat activity within the Study Area appears to be low.

4 CONCLUSION

The acoustic inventory results confirm the use of the Study Area by bats, although the rate of bat activity seems to be low. Five species of bats were identified including; 9 recordings of Hoary bat, 4 recordings of species of the genus Myotis (Little Brown Bat, and the Northern Long-Eared Bat), 4 recordings of Tri-colored Bat, and 1 recording of Big Brown Bat. One of the species was identified as long distance migratory species (Hoary Bat), and the others as resident species (species of the genus Myotis, Tri-colored Bat, and Big Brown Bat). Recorded bat activity is relatively low in the Study Area.

The bat surveys were carried out between Jul 6th, and October 19th, 2016, and from June 8th to 28th, 2017. Consequently, data analysis gives information about bat use of the Study Area during the reproduction and migration periods. No evidence of the presence of a “maternity” or potential hibernaculum was collected during this study. The nearest known hibernacula and/or maternity is located about 18 km north from the Study Area. Before the white-nose syndrome, this hibernaculum was considered as a major site for bats (> 1000 bats) (Vanderwolf et al., 2012).

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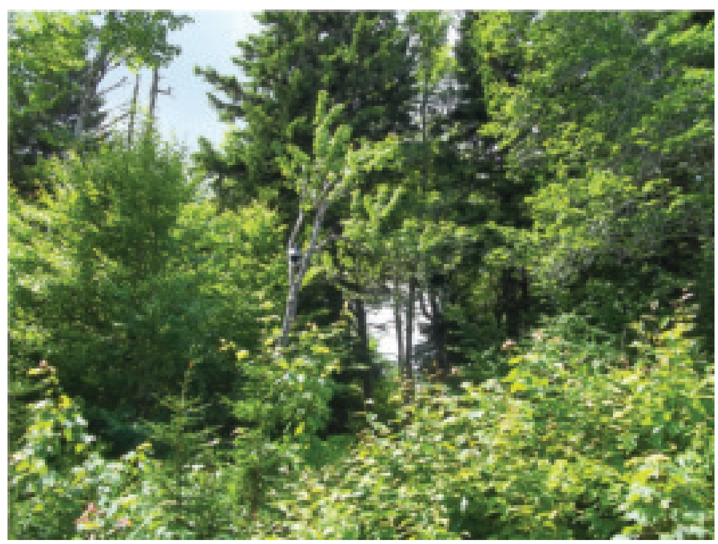
APPENDIX

A PHOTOGRAPHS

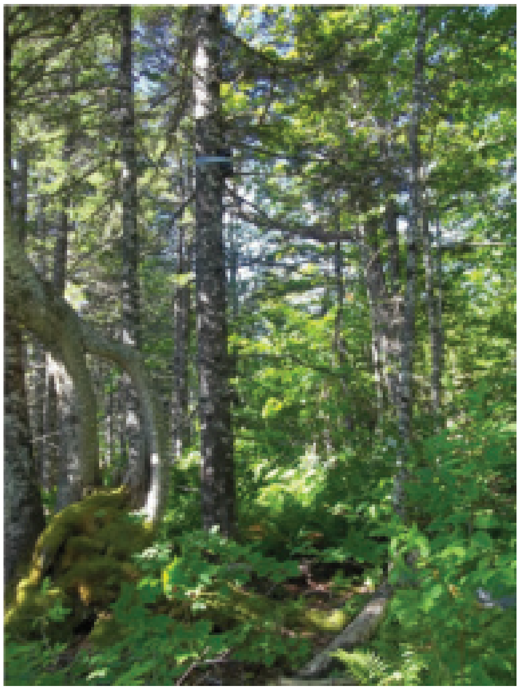
Picture 1 – AB1 Survey Station

Picture 2 – AB1 Survey Station



Picture 3 – AB2-3 Survey Station

Picture 4 – AB2-3 Survey Station



Picture 5 – AB4 Survey Station

Picture 6 – AB4 Survey Station

Picture 7 – AB5 Survey Station

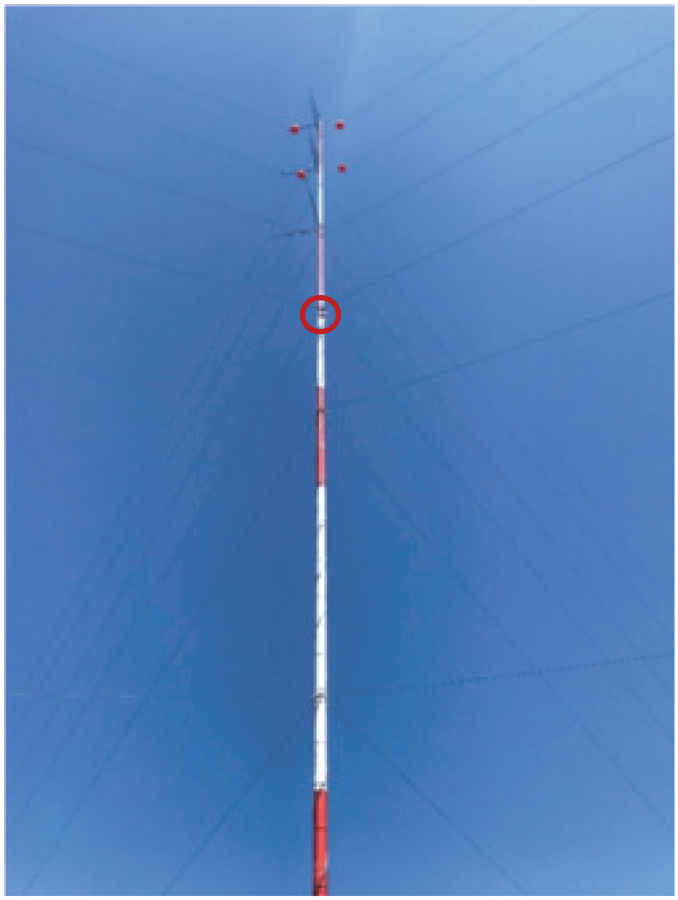
Picture 8 – AB5 Survey Station

Picture 5 – AB6 Survey Station

Picture 6 – AB6 Survey Station

Picture 7 – AB7 Survey Station

Picture 8 – AB8 Survey Station (installation)



Picture 9 – AB8 Survey Station (red circle: 30m high)

Appendix

G ARCHAEOLOGY REPORT

Archaeological Field Research Permit
Final Report

Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County

AFRP No. 2017 NB 145

Prepared by
Stratis Consulting Inc.

Stratis

Archaeological Field Research Permit Final Report
Wisokolamson Energy LP 18 MW Wind Farm,
New Ireland Road Area (west of Riverside-Albert),
Albert County

AFRP No. 2017 NB 145

Report to:

Archaeological Services
Heritage Branch
Department of Tourism, Heritage and Culture
Province of New Brunswick
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Proponent:

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On behalf of:
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c/o SWEB Development
6080 Young Street, Suite 106
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31 March 2018

Grant Aylesworth, PhD, RPA (Reg. No. 15583)
Principal Investigator and Author

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Appendix D	Archaeological Field Research Permit
Appendix E	Field Notes
Appendix F	NAPL Metadata
Appendix G	Project-Related Infrastructure Locations

List of Generally Used Abbreviations

AFRP	Archaeological Field Research Permit
ASNB	Archaeological Services New Brunswick, GNB
GNB	Government of New Brunswick
GPS	Global Positioning System
HRIA	Heritage Resource Impact Assessment
MARI	Maritime Archaeological Resource Inventory
MW	Megawatt (one million watts)
NAPL	National Air Photo Library
NB	New Brunswick
NBDNRE	New Brunswick Department of Natural Resources and Environment (now NB ERD)
NB ERD	New Brunswick Department of Energy and Resource Development
NTS	National Topographic Service
PANB	Provincial Archives of New Brunswick
RoW	Right of Way
RPA	Registered Professional Archaeologist
Stratis	Stratis Consulting Inc.
WISK	Wisokolamson Energy LP
WSP	WSP Canada
WTG	Wind turbine generator

Introduction

WSP Canada (WSP) retained Stratis Consulting Inc. (Stratis) to complete a Heritage Resource Impact Assessment (HRIA) of Wisokolamson Energy LP's (WISK) planned 18 MW Wisokolamson Energy Project, a wind farm located south of New Ireland Road and west of Riverside-Albert in Harvey parish, Albert County. WISK is a limited partnership between SWEB Development LP and Woodstock First Nation.

Stratis completed field visits to the project area on 13 November 2017 and 17 November 2017, under Archaeological Field Research Permit (AFRP) 2017 NB 145, issued to Dr. Grant Aylesworth, RPA No. 15583.

This report has information in several appendices, including:

- Appendix A Archival Photographs, Documents, and Drawings
- Appendix B Field Photographs
- Appendix C Predictive Model, purchased from Archaeological Services New Brunswick
- Appendix D AFRP
- Appendix E Field Notes
- Appendix F NAPL (National Air Photo Library) Metadata
- Appendix G Project-Related Infrastructure Locations, courtesy WSP and WISK

Stratis will deposit a hard copy of this Final Report with ASNB along with a CD containing GPS track logs for the visual survey, a PDF of this report, copies of historic aerial photographs, and field notes. ASNB does not provide written acceptance of archaeological permit reports or recommendations.

Proponent

At the request of WSP, Stratis completed this HRIA on behalf of WISK. Contact information for WSP and WISK is as follows:

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Project

The Project will consist of 5 Wind Turbine Generators (WTG), access roads, collector system, substation, and associated temporary laydown areas needed for construction. Construction of the Project is scheduled to begin in 2018, with WTG delivery and commissioning commencing in June 2019. The total project capacity will amount to 18 MW of electricity.

The Project is expected to use Vestas V126 wind turbines with a nominal power of 3.6 MW. Each assembly will consist of the tower, hub, nacelle, rotor blades, controller and transformer, with a total height of 180 m. The total rotor diameter will be 126 m. It is anticipated that each turbine 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. The substation area will be 40 m x 40 m and utility poles will be installed adjacent to existing roads leading from the WTGs to the substation.

The collection line leading to the substation may cross several named watercourses and some unnamed watercourses. The named watercourses are Tributary to West River, West River, North River, Beaver Brook, Toms Brook, Crank Brook, and Tributary to Crank Brook. In some cases, the watercourse may not be crossed during construction, but construction may take place within the 80 m archaeological potential zone. New Ireland Road contains a public RoW and the overhead line is a distribution voltage line, not a transmission line.

Project Area

The Assessment Area is defined as the area in which project-related infrastructure will be constructed, as shown in Appendix G. It includes the WTG pad placement locations and access roads to those locations, the substation location, and watercourse crossings for the installation of utility poles along New Ireland Road or other existing logging roads in the turbine installation area. Some laydown areas will be in existing RoW, along New Ireland Road and existing logging roads. Other laydown areas, for WTG foundations and installation, will be adjacent to WTG foundation locations.

The Project is located on Crown land along and south of New Ireland Road, between Riverside-Albert and Fundy National Park.

Methodology

The method for this HRIA followed ASNB Guidelines and generally accepted principles as well as professional standards and ethics dictated by the Register of Professional Archaeologists. The methods included searching for and reviewing existing HRIA-related documents (e.g., Provincial Archives of New Brunswick (PANB), NAPL), reviewing the Archaeological Predictive Model from ASNB, direct consultation with ASNB and local history experts in Albert County, and a preliminary field examination.

The preliminary field examination included a visual survey of the entire project area, including walking and visually surveying WTG locations and the existing RoW where utility poles will be installed with attention to watercourse crossing locations. Date and location stamped Photographs (Appendix B) were taken, field notes were written (Appendix E), and a GPS track log was recorded. Some aspects of the survey route are shown in Items A7-A16 (Appendix A) and digital track log files will be given to ASNB with a hard copy of this Final Report. No shovel tests were undertaken, and none are recommended.

Documentary Research, Direct Consultation, and Preliminary Field Examination

The output of the ASNB Predictive Model (Appendix C) was obtained and reviewed. The model shows that the high archaeological potential areas near watercourses will be crossed during the construction of utility poles in the existing RoW along New Ireland Road. The Predictive Model shows no areas of high archaeological potential near the WTG locations or any of the area south of New Ireland Road. The Predictive Model shows one known archaeological site, cataloged as BkDf-2 and shown on the Predictive Model in Appendix C. This site represents the location of a 19th century Anglican church and cemetery. Another site, BkDf-1, is located outside the project area to the west along New Ireland Road. The locations of both these known sites proved problematic in that the locations provide by the Predictive model and the relevant Maritime Archaeological Resource Inventory (MARI) records indicate locations that proved inaccurate during the Preliminary Field Examination.

Surface and bedrock geology maps were reviewed, and the earliest available archival aerial photographs from the National Air Photo Library were obtained and reviewed (Appendix A). The records of the Provincial Archives of New Brunswick (PANB) were consulted and materials relevant to the project area were found (Appendix A).

Consultation with First Nations is being undertaken by WSP and WISK. Consultation with ASNB took place regarding the installation of utility poles and archaeological shovel testing and it was decided that archaeological monitoring done under an Archaeological Field Research Permit during the installation of the poles will be sufficient in areas within 80 m of watercourses. Archaeological shovel testing of these areas will not be required. Consultation with a local history expert was undertaken by telephone.

Research at PANB included a review of numerous finding aids that may have provided information about the project area, including:

- The photograph collections card catalogue was consulted under “Bridges”, “Place Names” and “Waterways/Rivers & Streams” and no photos relating to the project were found. Bridges were consulted because the watercourse crossing at Crank Brook, now a culvert, was formerly a bridge.
- Albert County Bridge Records (PANB Finding Aid RS290) were consulted and one file relating to the former bridge at Crank Brook was reviewed.
- Provincial Secretary: Bridges administration Records 1785-1890 (PANB Finding Aid No. RS562) was consulted and nothing related to the project area was found. This included a search for Great Road Bridges and other records.
- Bridge Inspection 1976-1991 Records (PANB Finding Aid No. RS544) was consulted and no material relating to the project was found.
- Fire Insurance Map Records (MC1238) do not cover rural areas and therefore do not cover the project area.

- MC1236, item 529 was consulted as this is the 19th century Walling (1862) map of Albert County, including the locations of churches in Harvey parish.

- MC223, relating to church records was consulted and the deeds of consecration for the Anglican church and cemetery (BkDf-2) were found along with material documenting the location of the church and cemetery land parcel and including an alleged photo of the interior of the former church. The most relevant material is included in Appendix A.

- Rayburn (1975) and Fellows (1998) were consulted and no information about the project area was found.

- Other publications at PANB were found through various finding aids and consulted. These included Christopher (1996), Long (1995), Steeves (1980).

The archives of ASNB were consulted and HRIA reports relating to nearby areas were reviewed. These included Jacques Whitford (2008a; 2008b; 2009). These reports cover the Kent Hills area to the north of the project area and as such were not particularly relevant.

The National Air Photo Library (NAPL) was searched for the earliest aerial photograph of the project area. This resulted in one photo, No. A7805/82, dating to 5 May 1945, being located and included Appendices A and B with metadata in Appendix F.

Registered historic places were also searched at the provincial and federal level. The New Brunswick Register of Historic Places was searched and nothing within the project area was found. A search of Parks Canada's National Historic Places was done and nothing in the project area was found. A Search of The Register of Canada's Historic places was done and nothing in the project area was found.

A review of surficial geology (Rampton 1984) and bedrock geology (NBDNRE 2000) showed no issues of concern with respect to heritage resources.

A visual survey of the project area was undertaken on 13 November 2017 and 17 November 2017.

Findings

This section outlines the findings of the Documentary Research and Preliminary Field Examination.

General

There are no known pre-historic sites in the project area, as indicated on the ASNB Predictive Model. In terms of historic period sites, it is known that a variety of stone features such as fences, building foundations, and wells are present in the New Ireland area. Morrissey, Smith, and Teahan (n.d.) provide the basis for this general discussion. Early land grant and census records indicate the first European settlers arrived in the area by 1818. These settlers constructed dwellings, agricultural features such as stone walls, wells, churches, cemeteries, and post offices. Economic activities included gold, silver, and copper mining, maple syrup production, logging, ship building near the water, and farming. The Morrissey et al. publication includes a recent photo of the stone fireplace, likely at BkDf-1, a stone fence, and a historical photo of the Catholic Rectory, which was located across the road from the Catholic cemetery (outside the project area, see Item A15, Appendix A).

PANB

At PANB, documents were found relating to a previous bridge structure at Crank Brook and relating to the location of the Anglican church and cemetery.

Crank Brook

The Albert County Bridge Records (RS290) at PANB contained a variety of documents relating to the repair and replacement of a bridge structure that used to cross this watercourse (RS290 C33). This included correspondence to and from the Chief Bridge Engineer and a field sketch dating to the late 1930s. At that time, the bridge was modified, though this would not have been the first structure to cross the watercourse at this location. The documents relate to the condition of the bridge and document repairs. During the Preliminary Field Examination, it was noted that Crank Brook is currently crossed by a culvert and fill, although the area immediately adjacent to the north side of New Ireland Road and east of the brook contains the prior RoW and approach with stone fill.

BkDf-2

Locating BkDf-2, the Anglican church and cemetery was problematic because the location given on the MARI form proved to be incorrect. Following the unsuccessful attempt to locate the site during the Preliminary Field Examination, further research was undertaken at PANB to pinpoint the location.

Materials related to this site were found in MC233, church records and several other sources. In MC 233, the deed of consecration (MC233 C8-2b), dating to 1851 and signed by the Archbishop of Fredericton was located. This did not provide an exact location, but other documents did. Various documents in MC233 C8-2A-2a indicate the location on a cadastral map and on the Walling (1862) map. This file documents the donation of the land by the Cairnes family to the Anglican church. Long (1995:92) indicates that the Anglican church was likely called St. Stephen's and various attempts to find its location were unsuccessful. Christopher (1996:23) indicates that the church and cemetery were located "7.0 km from Route 114 at the north west corner just past the gravel pit". Christopher documented that in 1985, an elderly resident of the area stated that the headstones from the cemetery were removed prior to 1948 by the custodian of a nearby sporting lodge who used them to make a walkway. The MARI form, dating to 31 July 1974, indicates that the cemetery stones were "removed by someone who was making a walk…after the church was destroyed". The description from 1974 indicated that there were no features visible on the surface at that time. Given that the location given on the MARI form was incorrect, the location could not be found during the Preliminary Field examination.

Following the additional research at PANB, the location of the parcel containing the church and cemetery was identified, as shown in Item A17, Appendix A. A photo, which is possibly the interior of the church, then in ruins, is given in Item A20, Appendix A. The location is immediately south east of McFadden Lake and north of New Ireland Road (see Item A17, Appendix A).

The Walling (1862) Map

This map of Albert County was reviewed on micro fiche (MC1236, 529) following consultation with the Cartographic Section, PANB. The map shows the location of the Anglican church as well as other structures that were once present in the New Ireland area (excerpt given in Item A17, Appendix A). Since the location of BkDf-2 was of interest, this map was cross referenced with cadastral maps as given in MC233, c8-2A-2a to establish a reliable location for BkDf-2. The structures shown on the Walling map are outside the assessment area.

ASNB Predictive Model

The incorrect location of BkDf-2, discussed above, is shown in the Predictive Model (Item A17, Appendix A and Appendix C). The location in the model would have been based on the MARI form, which has been shown to be incorrect.

With respect to the other known archaeological site, BkDf-1, the accuracy of the given location is also questionable. The site could not be located during the Preliminary Field Investigation (see Item A15, Appendix A). Although some linear stone arrangements were found in the field, the fireplace, oven, and well could not be found. According to the MARI from, this site, known as the O'Donnel Farm site, consisted of a standing fireplace, oven, rocked in spring, basement, and stone wall. The interview with Ms. Morrissey (see Direct Consultation) indicated that the oven is in fact located east of BkDf-2 and the well described in the MARI form was known locally as "Pioneer Well". The location of BkDf-1, given in the ASNB Predictive Model and the MARI form appears to coincide well with the known and obvious location of the Roman Catholic cemetery, which is well maintained and contains many stone grave markers (see Item A15, Appendix A).

National Air Photo Library

Six aerial photographs of the project area were obtained from the National Air Photo Library (NAPL). These dated to 1939 and 1945. The photos are given as Items A1-A6, Appendix A, with their meta data included in Appendix F. These photos were obtained as a high-resolution TIFF image scans of the original negative. The high-resolution digital files for each photo will be given to ASNB with the Final Report. These are the earliest known aerial photographs of the project area.

A review and comparison of the 1939 and 1945 images with contemporary aerial and satellite images shows that the alignment of New Ireland Road has not changed significantly since the first half of the 20th century. The currently existing road that leads to WTG I-V locations did not exist when the historical aerial photographs were taken. Given current activities in the area, it is assumed that this road was constructed for logging. The historical aerial photographs do not appear to show any evident historic period structures immediately adjacent to the road, where the utility poles will be installed.

Surficial and Bedrock Geology

With respect to surficial geology, the project area is underlain by Wisconsinan or pre-Wisconsinan morainal and colluvial stony sediments that are found throughout New Brunswick (Rampton 1984, see Item A19, Appendix A). This material would have been associated with the Laurentide Ice Sheet, which covered most of Canada.

In terms of bedrock geology, Middle Neoproterozoic mafic and felsic volcanic rocks, dating from 570-723 million years ago underlie the project area (NBDNRE 2000, Item A18, Appendix A). The area near the substation is underlain by Late Carboniferous sandstone, dating from 300-311 million years ago. This material was evident during the Preliminary Field Investigation in and around the Substation location.

Direct Consultation

Telephone interviews were conducted with three people: the Jim Campbell, the Mayor of Riverside-Albert, Stuart Liptay, President of the Albert County Historical Society, and Beulah Morrissey, an expert in local history. Mr. Liptay referred the interviewer to Ms. Morrissey's expertise about the area, as did Mr. Campbell (who recommended interviewing Ms. Morrissey on behalf of four people the Mayor spoke to about the consultation). Ms. Morrissey is an expert on the local history, having written about it and given presentations.

Mr. Campbell indicated that, although there was a settlement in the project area historically, it would be unlikely that the project would encounter archaeological resources during construction, particularly the installation of utility poles for the distribution voltage line along New Ireland Road.

The interview with Ms. Morrissey indicated that the location of the "oven" and a location called the "Pioneer Well" are in fact east of the Anglican cemetery. The Anglican cemetery and the oven are both catalogued by Archaeological Services Branch and were visited by Government of New Brunswick archaeologists in the 1970s. During the initial field assessment, neither the oven nor the Anglican cemetery locations could be located based in the information on the MARI forms, which appear to give incorrect locations for both sites. Ms. Morrissey indicated that the Anglican cemetery was located. Ms. Morrissey confirmed that the Anglican cemetery does not have any visible grave markers or stones and that she had visited the area within the last several years and it had been logged recently.

Lastly, Ms. Morrissey indicated that there used to be stone building foundations in the New Ireland area from school houses, mining-related structures, logging related structures, dwellings, and religious structures. In particular, she noted that the foundation of the church associated with the Roman Catholic cemetery (which is well outside the project area) used to be accessible across the road (south) of the cemetery. The Roman Catholic cemetery still has stone grave markers and is well maintained.

Preliminary Field Investigation

The project area was visited on 13 November 2017 and 17 November 2017. A GPS track log, photographs, and field notes were taken. A digital version of the GPS track log will be submitted to Archaeological Services with the Final Report. Some of the "breadcrumbs" from the GPS track log are shown in various figures in Appendix A (figures do not show complete survey that will be submitted digitally to ASNB). Photographs from the visual survey are in Appendix B.

Substation Area

The substation area is on the north side of New Ireland Road across from an existing NB Power substation and along an existing transmission line (Item A7, Appendix A, Photo B1, Appendix B). The area is low-lying, grassy, and very wet, with a few areas exhibiting exposed sandstone bedrock. The area does not have high archaeological potential.

Tributary to Crank Brook

The tributary to Crank Brook is an area of road fill and a culvert (Item A7, Appendix A, Photos B2, B3, B4, B5, Appendix B). Below the road fill the banks have archaeological potential and the area should be monitored if utility poles will be installed outside of the existing road fill.

Crank Brook

Crank Brook is in a steep ravine near the crest of a hill (Item A7, Appendix A, Photos B6, B7, B8, B9, B10, Appendix B). Immediately adjacent the existing road fill and east of the brook, an area of previous road fill for a prior RoW approach to the watercourse crossing is evident (Photo B6). This is likely the crossing evident in the historic aerial photos. The RoW near the brook consists of about 8 m of fill above a culvert. This fill does not have archaeological potential. If utility poles are installed outside of this fill, archaeological monitoring should be undertaken. North of New Ireland Road and west of the brook, some metal debris from a likely 1950s era truck are present in badly damaged and fragmentary condition (Photo B9). West of the brook and south of New Ireland Road, a former staging area is evident, an area that has been previously bulldozed with an abandoned road leading to the south (Photo B10).

Toms Brook

The Toms Brook location is shown in Item A8, Appendix A. There is no watercourse or obvious channel at New Ireland Road, as predicted by the Archaeological Potential Model. This area is outside the predicted high archaeological potential area and with no watercourse or signs of a past watercourse, this area would not require archaeological monitoring.

Beaver Brook

Beaver Brook (Item A9, Appendix A, Photos B11, B12, B13, B14) is a low lying and wet area with plastic culvert running under New Ireland Road. The area of the RoW consists of fill above the wet area with alders and other wet area plants growing immediately adjacent to the watercourse. Installation of utility poles around Beaver Brook, if they are installed outside of existing road fill, should be monitored by an archaeologist.

North River

North River (Item A9, Appendix A) is located south of New Ireland Road and does not cross New Ireland Road. Parts of the existing RoW fall within the 80 m high potential zone and archaeological monitoring should be undertaken during installation of utility poles in this area.

West River

Generally, the West River area and the tributaries to West River are low lying wet areas that run parallel to the New Ireland Road along the road's south side (Item A10, Appendix A, Photos B15, Photo B16, Appendix B). This area was visited on 13 November 2017 and 17 November 2017 and the watercourse channel is dry though appeared to have been previously active with numerous cobbles in the watercourse channel. Areas within 80 m of this watercourse should be monitored during utility pole installation.

Tributary to West River

This area is low-lying and wet with a culvert running under New Ireland Road (Item A11, Appendix A, Photo B17, Appendix B). The road consists of fill above the wet area and areas within 80 m of the watercourse should be monitored if utility pole installation takes place outside of existing fill.

WTG I

The area for WTG I (Item A12, Appendix A, Photo B22, Appendix B) is a slightly elevated area with low archaeological potential. The area has been lumbered in the past but is currently forested. Archaeological monitoring is not recommended for this location.

WTG II

The area for WTG II (Item A12, Appendix A, Photo B21, Appendix B) is elevated and undulating with a slight rise from the existing logging road to the WTG location. The area has been recently logged and is mostly devoid of trees. The area has low archaeological potential and archaeological monitoring is not recommended here.

WTG III

WTG III (Item A13, Appendix A, Photo B20, Appendix B) is very close to the existing logging road and most of the area has been recently cleared. This area has low archaeological potential and monitoring is not recommended.

WTG IV

The location for WTG IV (Item A14, Appendix A, Photo B19, Appendix B) is also very close to the existing logging road and parts of this area have been recently cleared. The area has low archaeological potential and monitoring is not recommended.

WTG V

WTG IV (Item A14, Appendix A, Photo B18, Appendix B) will be located in a flat area that has been recently logged and has few trees surrounding it. The area has low archaeological potential and monitoring is not recommended.

Resource Inventory

No new heritage resources were found within the project area. Some historic period resources, such as BkDf-2, and other features such as rock walls and building foundations, are likely in the area although the project is unlikely to encounter these if working in the existing RoW clearing for New Ireland Road and existing logging roads.

Conclusions and Recommendations

Any area within 80 m of a watercourse is considered to have medium to high potential to contain archaeological sites unless there is reason to believe otherwise. Since the installation of utility poles in the existing logging road and New Ireland Road RoW is fairly small in its footprint, archaeological testing in high potential areas near watercourse crossings was not undertaken. As such, archaeological monitoring of ground disturbing activities within 80 m of a current or former watercourse location is recommended. Further, archaeological monitoring near the location of the Anglican church and cemetery (BkDf-2) should be undertaken. It is possible that pre-contact heritage resources may be encountered during ground disturbing activities within high potential archaeological areas (i.e., within 80 m of a current for former watercourse).

Archaeological Monitoring

None of the areas near WTGs I-V are of high archaeological potential and archaeological monitoring during construction for these areas is not recommended. Similarly, the substation location is not a high potential archaeological area and monitoring during construction is not recommended. The installation of utility poles along the existing RoW for New Ireland Road, however, crosses a number of high potential archaeological areas. Specifically, any area within 80 m of a watercourse is considered to have high archaeological potential. Project-related activities near these locations, however, is relatively limited in terms of ground disturbance since activities are currently understood to be limited to installation of utility poles in the existing RoW. As such, archaeological testing of these areas is not recommended but archaeological monitoring of the installation of any utility poles within 80 m of a watercourse crossing should be monitored by a permitted archaeologist. This plan was discussed and agreed to by ASNB in the fall of 2017. Some of the areas near watercourses will be fill that will not contain archaeological materials, so monitoring of any given location would be undertaken at the discretion of the permitted archaeological monitor at the time of construction. Areas further than 80 m from a present or previous watercourse location do not need archaeological monitoring.

Ground disturbing activities including utility pole installation within 200 m of BkDf-2 (Item A17, Appendix A), should be monitored.

Areas to Avoid

It is not anticipated that the WTG construction locations will contain heritage resources, and none were observed during the visual survey of the WTG areas. Similarly, no heritage resources were noted immediately adjacent to New Ireland Road, where utility poles will be installed, and none were found within the footprint for the Substation. During construction, if any stone features such as stone walls are found, these should be avoided. The areas where known historic period archaeological sites (BkDf-2), such as building foundations and cemeteries, are located are expected to be outside of the area of project-related construction. Nevertheless, installing utility poles along the north side of New Ireland Road near the likely location of the Anglican church and cemetery, should be avoided with poles installed along the south side of the road.

Accidental Discovery

Accidental discovery of heritage resources remains possible whenever any ground disturbing activities take place. If archaeological materials are encountered, ASNB must be notified and any ASNB protocols related to accidental discovery of heritage resources must be followed.

Closing

This report is subject to review and acceptance by ASNB. Written notification about the acceptability of this report is issued at the discretion of ASNB. Other agencies and stakeholders may review this report before it is deemed acceptable.

This report has been prepared as a requirement of AFRP No. 2017 NB 145 for the sole benefit of WSP and WISK and is not intended to be used by any other person or entity, other than for its intended purposes, without the written consent of Stratis, WSP, and WISK. Use of this report by third parties is the responsibility of such third party. This report is copyrighted by Stratis with all rights reserved.

The information and recommendations in this report are based upon work undertaken in accordance with ASNB Guidelines and generally accepted practices at the time the work was undertaken. The information and recommendations in this report are in accordance with the author's understanding of the project as it was presented at the time the work was undertaken.

This report was reviewed and approved by WSP and WISK before submission to ASNB. This report was authored by the undersigned.

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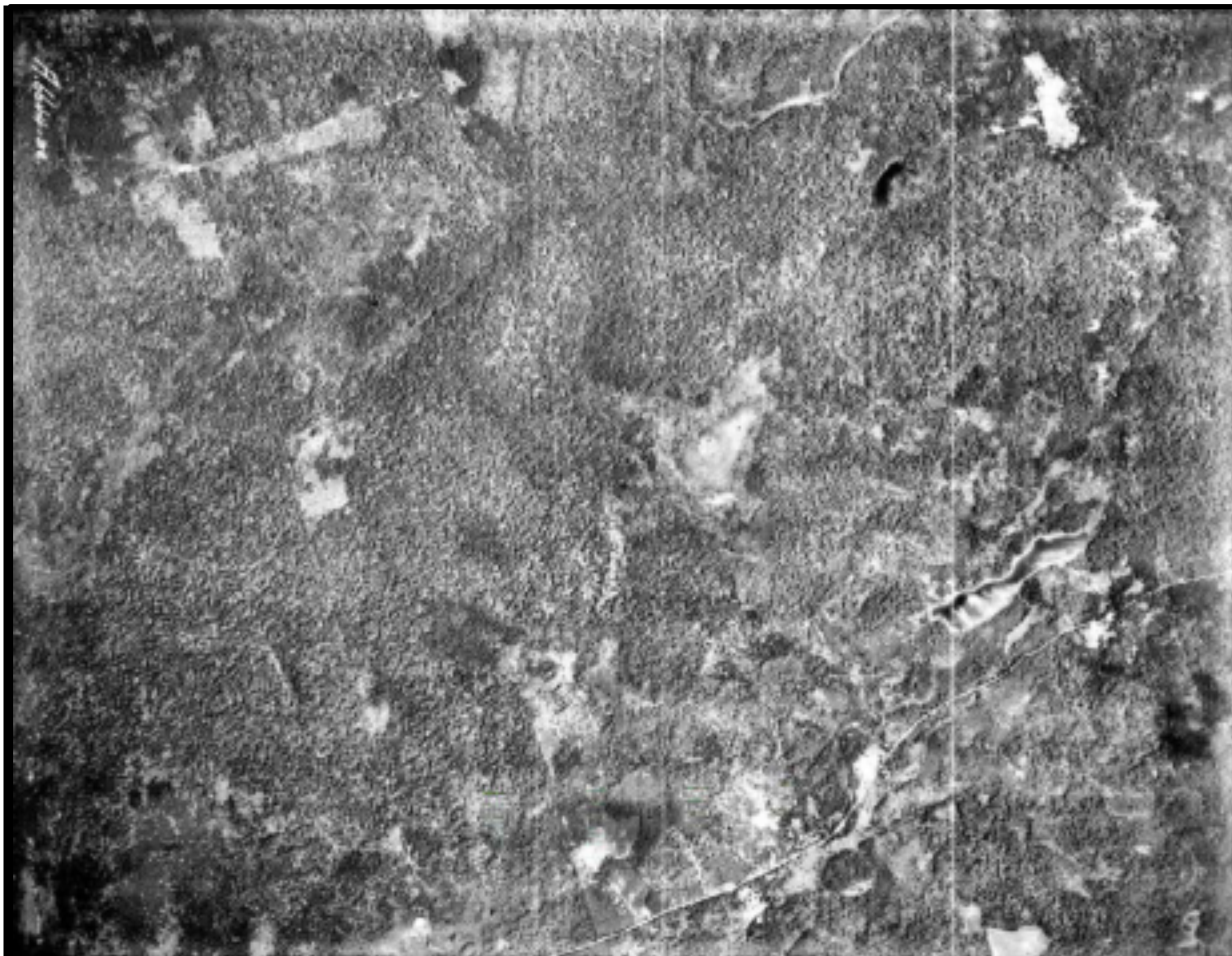
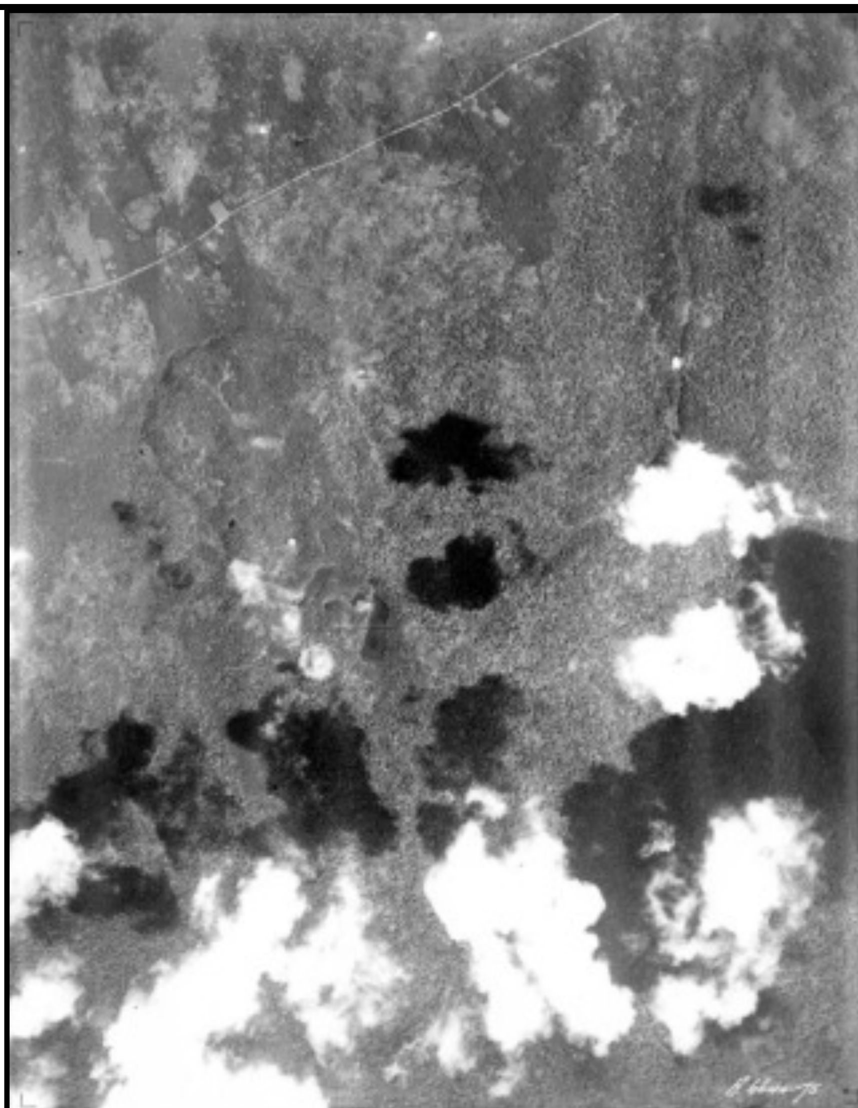
Appendix A

Archival Photographs, Documents, and Drawings



Historical Aerial Photograph (A6644/38), dating to 27 June 1939.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A1 Refer to meta data in Appendix F for photo location and other details.
Client: WSP on behalf of WISK	Source: NAPL



Historical Aerial Photograph (A6644/75), dating to 27 June 1939.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A2 Refer to meta data in Appendix F for photo location and other details.
Client: WSP on behalf of WISK	Source: NAPL

Historical Aerial Photograph (A6643/94), dating to 29 June 1939.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A3 Refer to meta data in Appendix F for photo location and other details.
Client: WSP on behalf of WISK	Source: NAPL

Historical Aerial Photograph (A8262/106), dating to 4 July 1945.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A4 Refer to meta data in Appendix F for photo location and other details.
Client: WSP on behalf of WISK	Source: NAPL

Historical Aerial Photograph (A8242/23), dating to 4 July 1945.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A5
	Refer to meta data in Appendix F for photo location and other details.
Client: WSP on behalf of WISK	Source: NAPL

Historical Aerial Photograph (A8242/20), dating to 4 July 1945.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A6 Refer to meta data in Appendix F for photo location and other details.
Client: WSP on behalf of WISK	Source: NAPL

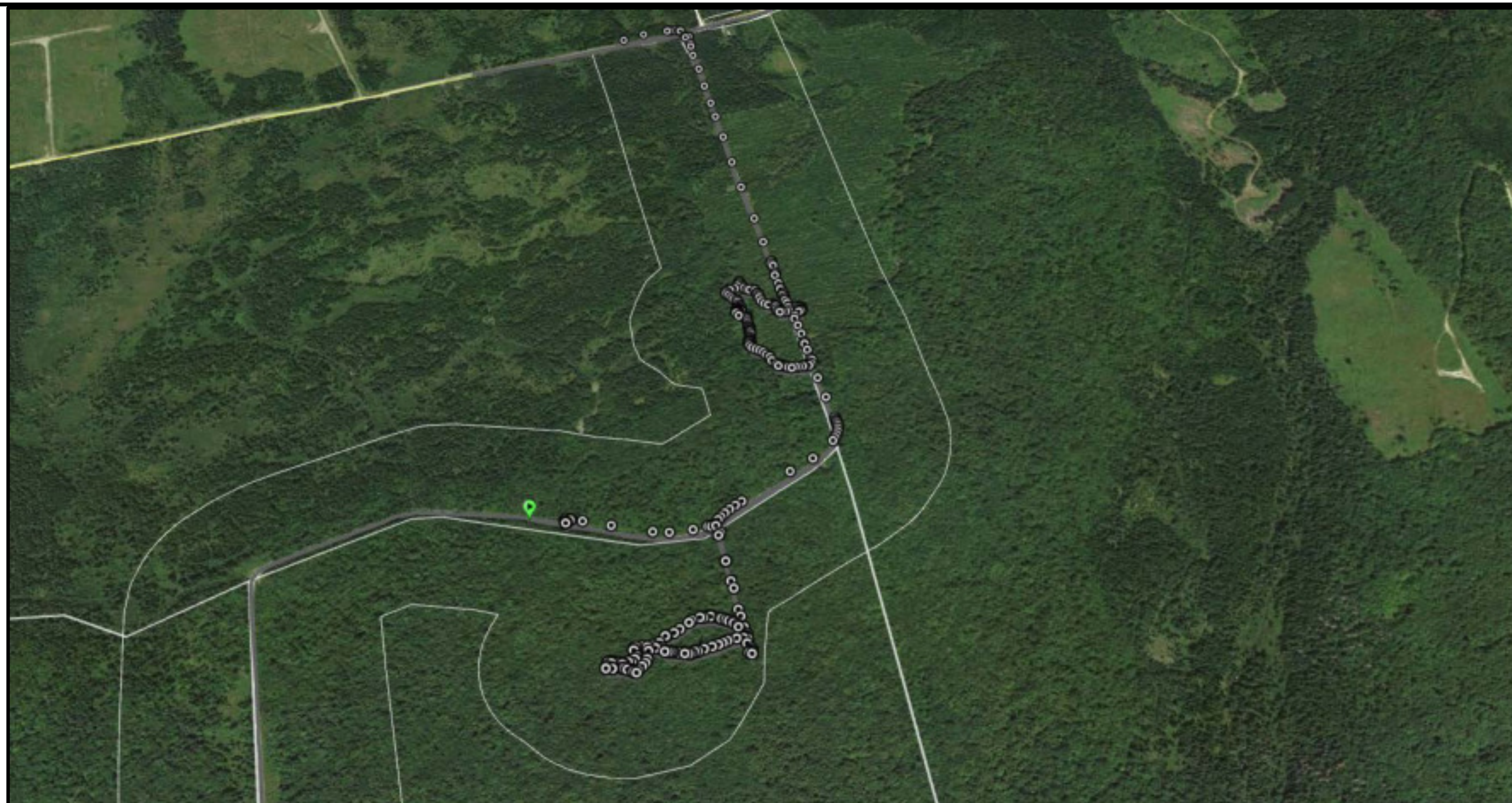
Visual survey locations/route, substation to Crank Brook area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A7 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis

Visual survey locations/route, Crank Brook to Toms Brook area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A8 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis

Visual survey locations/route, Toms Brook to North River area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A9 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis

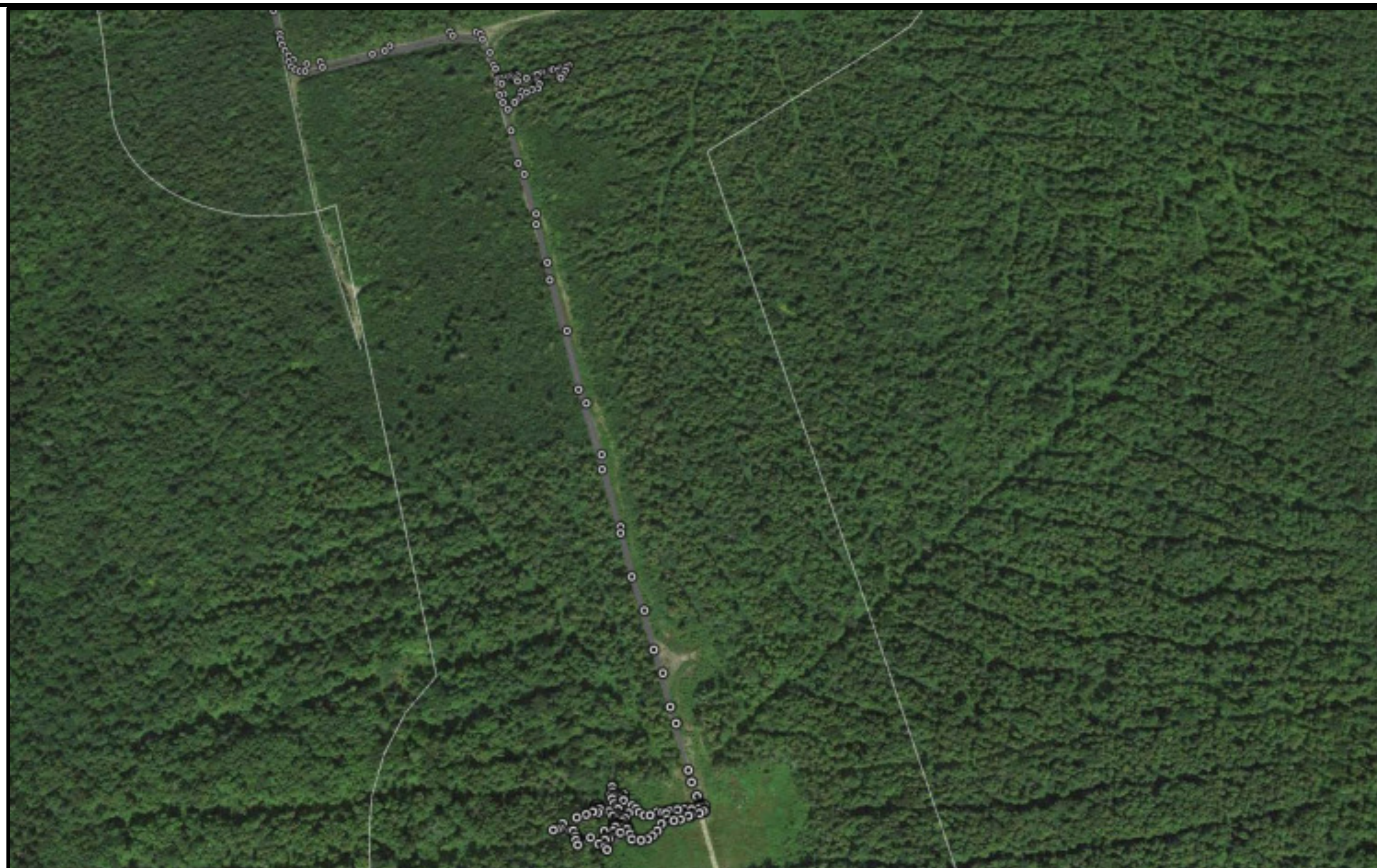
Visual survey locations/route, North River to West River area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A10
	Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis

Visual survey locations/route, West River to tributary to West River area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A11
	Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis



Visual survey locations/route, WTG I (top) and WTG II (bottom) area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A12 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis

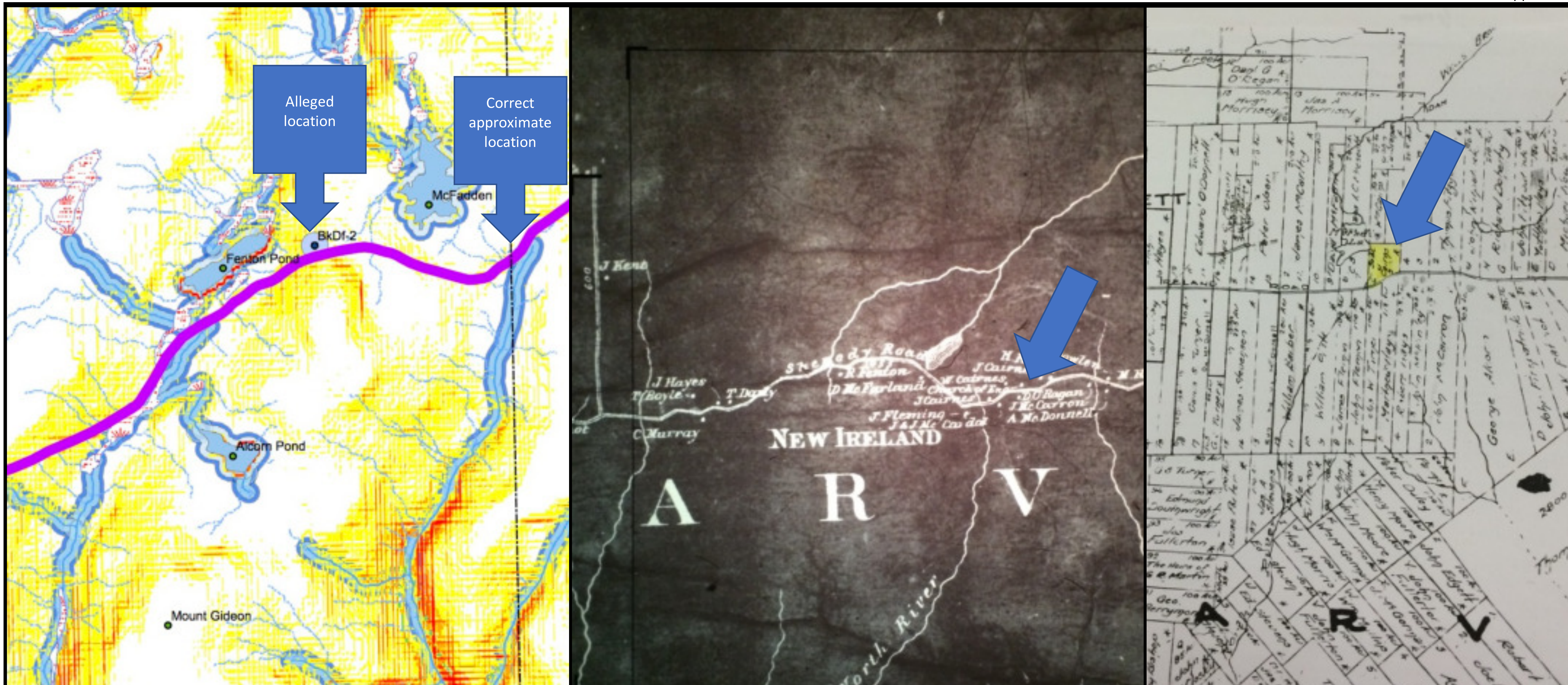
Visual survey locations/route, WTG III area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A13 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis



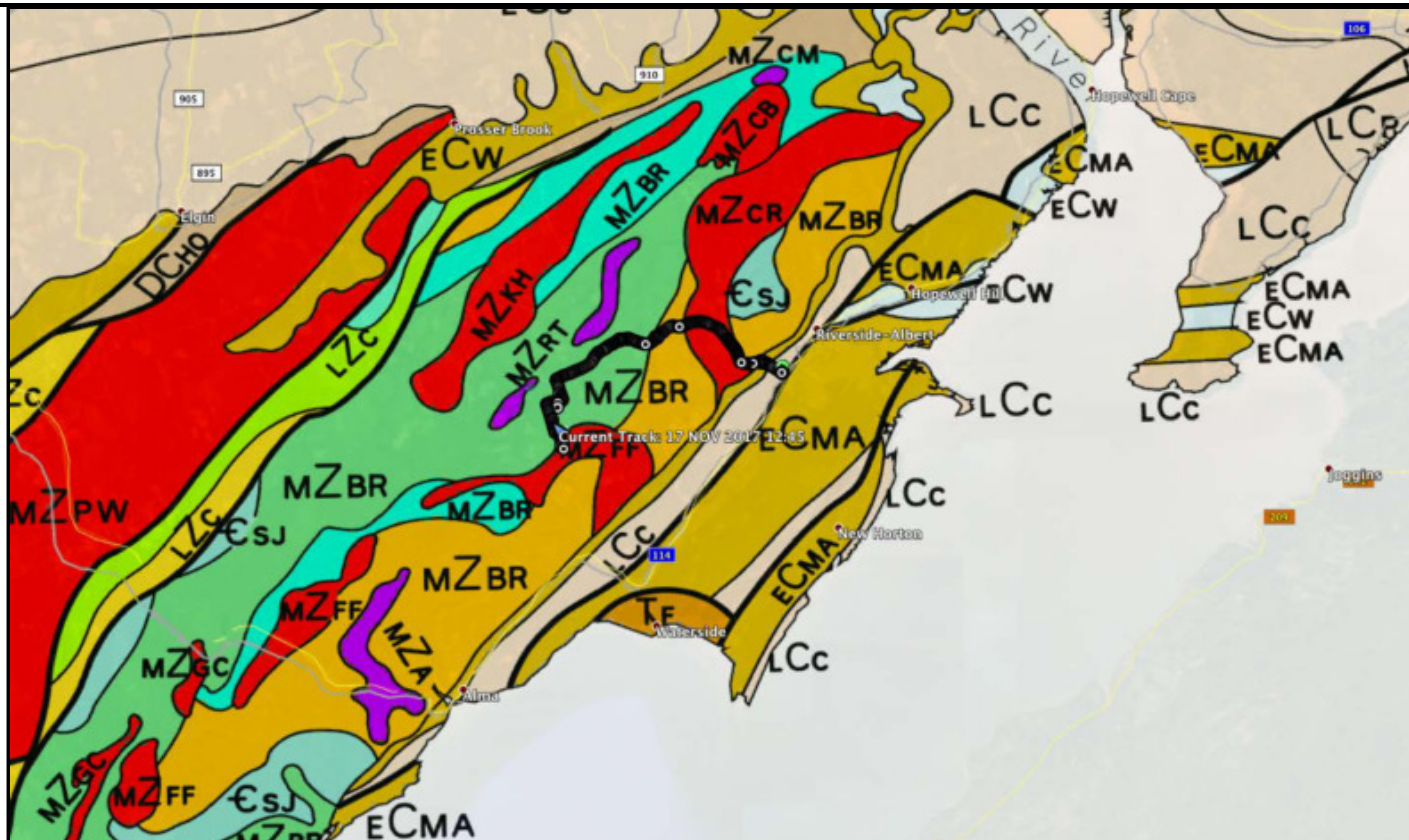
Visual survey locations/route, WTG IV (top) and WTG V (bottom) area.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A14 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis

Visual survey locations/route, alleged BkDf-1 (left) and delineation of Roman Catholic cemetery (right).	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A15 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis

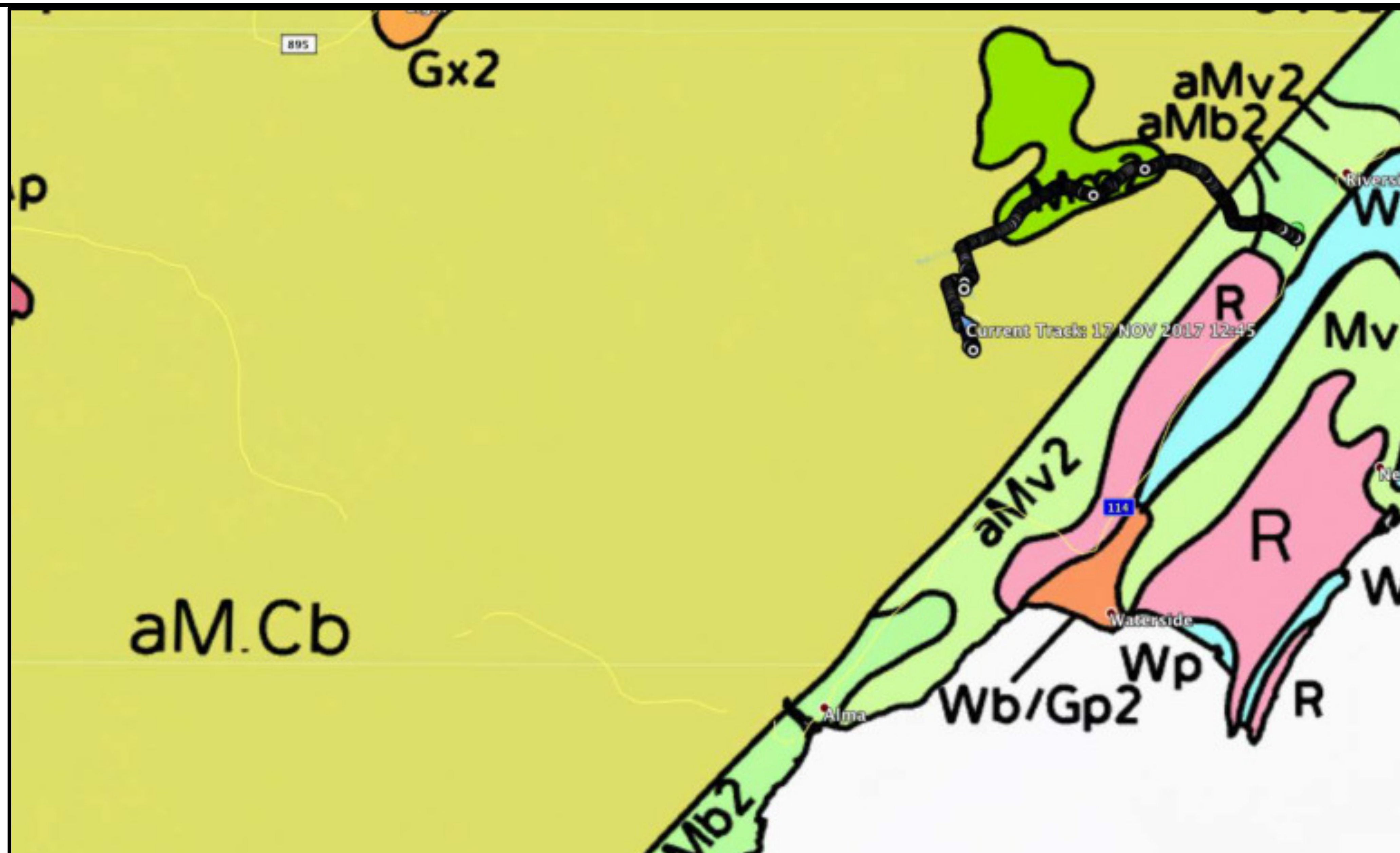
Visual survey locations/route, alleged BkDf-2 location.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A16 Dots represent partial GPS track log (complete digital track logs submitted to ASNB).
Client: WSP on behalf of WISK	Source: Stratis



Anglican cemetery (BkDf-2) location. Alleged location from Archaeological Services and MARI form (left), location based on Walling (1862) given as "Church of Eng" (centre), location based on PANB land transfer from James and Maria Cairnes to the Bishop of Fredericton (MC223, c8-2A-2a) (right). The correct location is southeast of McFadden Lake, not west of McFadden Lake.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A17 Not to scale.
Client: WSP on behalf of WISK	Sources: Archaeological Services NB, PANB, Stratis



Bedrock geology.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A18
	Heavy black line represents GPS breadcrumbs in assessment area.
Client: WSP on behalf of WISK	Source: NBDNRE (2000), Google Earth Pro, Stratis



Surficial geology.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A19
	Heavy black line represents GPS breadcrumbs in assessment area.
Client: WSP on behalf of WISK	Source: Rampton (1984), Google Earth Pro, Stratis

Believed to be interior of St. Stephens Church (BkDf-2). PANB MC223 C8-17A, undated.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A20 PANB, MC223 C8-17A
Client: WSP on behalf of WISK	Source: PANB

October 19th,1937.

Mr. F.J. O'Connor,
Bridge Superintendent,
Harvey, Albert Co., N.B.

Dear Sir:--

Concerning

CRANK BROOK BRIDGE,
Old Shepody Road- Albert to Elgin,
Parish of Harvey,
Albert Co., N.B.

which we visited together on the 13th instant, I would instruct that you arrange to build two cedar cribwork abutments stone filled along the lines pointed out to you when we were at the site of the work together. These abutments to be stepped up into the bank at level plane foundation and to be stepped back towards the bank about 16 feet. Stone embankment with hand laid side stone riprap slopes to extend back from the back of the abutments a further distance of 10 feet. The balance of the embankment approaches to be made up of earth and stone. The space between the abutments to be 45 feet centre to centre of top face logs at bridge seat elevation. This will allow for three framed trestle bents and stringer spans. Mr. Boone, who is now assisting Mr. Russell on some work on the Red House Bridge and a cribwork protection wall on the Red House Road, will give you any assistance concerning the building of this work. Two trestle bents to be Spruce 15 ft. on centres and 15 ft. from the centre of top face log of the abutments. These trestle bents will be framed and creosoted and shipped to the site of the work by truck or by rail freight to Albert. When erecting the bents after framing, they will rest on stone masonry bases prepared to receive them.

I am also shipping the necessary stringers.

Yours very truly,

G.A.MacVey,
Chief Bridge Engineer.

Letter regarding Crank Brook Bridge from Harvey Parish Bridge Superintendent to Chief Bridge Engineer, dating to 19 October 1937.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Item No: A21 PANB, RS 290 C33
Client: WSP on behalf of WISK	Source: PANB

Appendix B

Field Photographs

Substation location.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B1 Date: 13 Nov 2017 JPG Frame No.: 5499
Client: WSP on behalf of WISK	Source: Stratis

Tributary to Crank Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B2 Date: 13 Nov 2017 JPG Frame No.: 5500
Client: WSP on behalf of WISK	Source: Stratis

Tributary to Crank Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B3 Date: 13 Nov 2017 JPG Frame No.: 5501
Client: WSP on behalf of WISK	Source: Stratis

Tributary to Crank Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B4 Date: 15 Nov 2017 JPG Frame No.: 5501
Client: WSP on behalf of WISK	Source: Stratis

Tributary to Crank Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B5 Date: 13 Nov 2017 JPG Frame No.: 5503
Client: WSP on behalf of WISK	Source: Stratis

Crank Brook, fill from old bridge, north side of road, east of brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B6 Date: 13 Nov 2017 JPG Frame No.: 5510
Client: WSP on behalf of WISK	Source: Stratis

Crank Brook, fill approaching east side of culvert.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B7 Date: 13 Nov 2017 JPG Frame No.: 5513
Client: WSP on behalf of WISK	Source: Stratis

Crank Brook, from fill above culvert looking down to water course.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B8 Date: 13 Nov 2017 JPG Frame No.: 5515
Client: WSP on behalf of WISK	Source: Stratis

Crank Brook, truck wreckage west of brook and north of road.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B9 Date: 13 Nov 2017 JPG Frame No.: 5516
Client: WSP on behalf of WISK	Source: Stratis

Crank Brook, old logging road, west of brook and south of New Ireland Road.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B10 Date: 17 Nov 2017 JPG Frame No.: 5589
Client: WSP on behalf of WISK	Source: Stratis

Beaver Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B11 Date: 13 Nov 2017 JPG Frame No.: 5539
Client: WSP on behalf of WISK	Source: Stratis

Beaver Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B12 Date: 13 Nov 2017 JPG Frame No.: 5540
Client: WSP on behalf of WISK	Source: Stratis

Beaver Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B13 Date: 13 Nov 2017 JPG Frame No.: 5541
Client: WSP on behalf of WISK	Source: Stratis

Beaver Brook.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B14 Date: 13 Nov 2017 JPG Frame No.: 5542
Client: WSP on behalf of WISK	Source: Stratis

Likely tributary to West River, south of Fenton Pond.	
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B15 Date: 13 Nov 2017 JPG Frame No.: 5550
Client: WSP on behalf of WISK	Source: Stratis

Plastic culvert in wet area around West River.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B16 Date: 13 Nov 2017 JPG Frame No.: 5554
Client: WSP on behalf of WISK	Source: Stratis

Corrugated steel pipe in tributary to West River.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B17 Date: 13 Nov 2017 JPG Frame No.: 5557
Client: WSP on behalf of WISK	Source: Stratis

WTG V location (tower number in photo is incorrect).	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B18 Date: 13 Nov 2017 JPG Frame No.: 5563
Client: WSP on behalf of WISK	Source: Stratis

WTG IV location (tower number in photo is incorrect).	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B19 Date: 13 Nov 2017 JPG Frame No.: 5565
Client: WSP on behalf of WISK	Source: Stratis

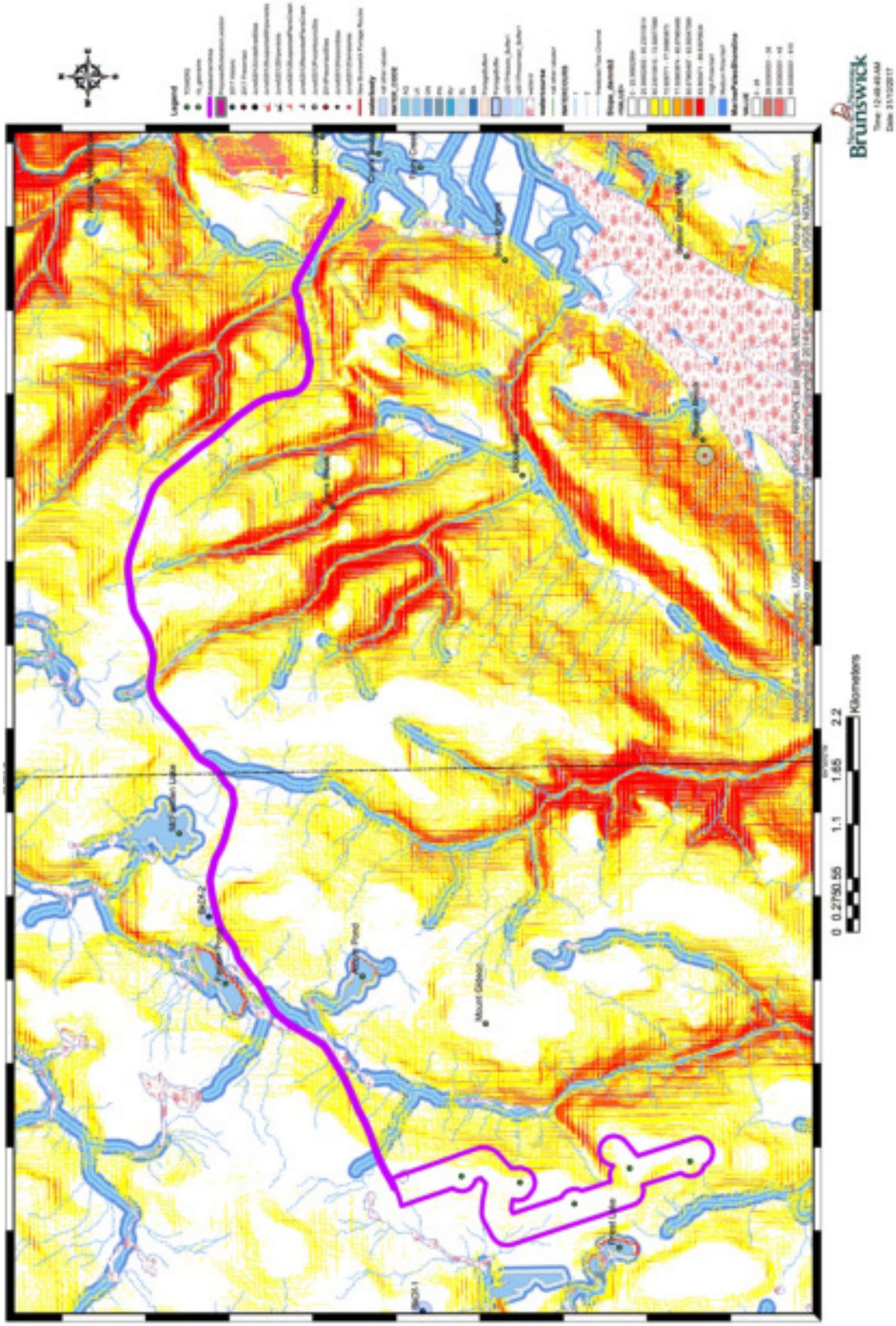
WTG III location.	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B20 Date: 13 Nov 2017 JPG Frame No.: 5566
Client: WSP on behalf of WISK	Source: Stratis

WTG II location (tower number in photo is incorrect).	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B21 Date: 13 Nov 2017 JPG Frame No.: 5569
Client: WSP on behalf of WISK	Source: Stratis

WTG I location (tower number in photo is incorrect).	Stratis
Wisokolamson Energy LP 18 MW Wind Farm, New Ireland Road Area (west of Riverside-Albert), Albert County	Photo No.: B22 Date: 13 Nov 2017 JPG Frame No.: 5572
Client: WSP on behalf of WISK	Source: Stratis

Appendix C

Predictive Model, Courtesy of ASNB



Appendix D

Archaeological Field Research Permit

New Nouveau Brunswick

The Province of New Brunswick
Archaeological Field Research Permit

Province du Nouveau-Brunswick
Permis de travaux archéologiques sur le terrain

Under the provisions of Sections 13 and 14 of the *Heritage Conservation Act*, a permit is hereby granted to:

En vertu des l'articles 13 et 14 de la *Loi sur la conservation du patrimoine*, un permis est octroyé à:

Grant Aylesworth

to undertake the following archaeological field research project entitled:

pour entreprendre le projet de recherches archéologiques mentionné ci-après et intitulé :

New Ireland Road Area 18 MW Wind Farm

in the county(ies) of:

dans le (s) comté (s) de :

Albert

under the following conditions:

1. The Permit shall be issued on the understanding the investigations are to be conducted for the sole purpose of recovering information and materials for scientific and historical study, and for the preservation of New Brunswick's historic resources; and that the research shall conform to the best scientific standards available.
2. The archaeological field research being carried out under this Permit may be inspected at any reasonable times; and this Permit may be revoked at any time by the Minister.
3. The holder of this Permit will report to Archaeological Services Section, Heritage Branch, any archaeological site found during the archaeological field research being carried out under this Permit within two (2) working days of the find.
4. This Permit shall be valid until December 31, 2017
5. A final technical report will be due March 31, 2018
6. The holder of this Permit must provide copies to Archaeological Services Section, Heritage Branch, of all field records, notes, maps, drawings, catalogues, and photographs pertaining to the description and context of all objects recovered under this Permit.
7. All cultural material recovered under this Permit must be deposited with Archaeological Services Section, Heritage Branch, upon termination of the Permit.

aux conditions suivantes :

1. Le permis est émis à condition que les recherches soient effectuées dans le seul but d'obtenir des renseignements et du matériel pour des études scientifiques et historiques et de préserver les ressources historiques du Nouveau-Brunswick; la recherche se conformera aux normes scientifiques les plus rigoureuses parmi celles disponibles.
2. Les recherches archéologiques menées dans le cadre de ce permis peuvent faire l'objet d'une inspection à n'importe quelle heure raisonnable, et le ministre peut révoquer le permis en tout temps.
3. Le détenteur du permis signalera à la Section des services d'archéologie de la Direction du patrimoine tout site archéologique trouvé au cours des recherches archéologiques réalisées dans le cadre du permis et ce, dans un délai de deux jours de travail après la découverte.
4. Le permis sera valide jusqu'au 31 décembre 2017
5. Un rapport technique final sera rédigé pour le 31 mars 2018
6. Le détenteur du permis fournira à la Section des services d'archéologie, Direction du patrimoine, une copie de tous les documents, dessins et catalogues ainsi que de toutes les notes, cartes et photographies servant à la description et à l'établissement du contexte pour les objets trouvés dans le cadre du permis.
7. Tout article culturel découvert dans le cadre du permis doit être confié à la Section des services d'archéologie de la Direction du patrimoine à l'expiration du permis.

APPROVED: / APPROUVÉ :

Brent Suttie

Brent Suttie,
Director / Directeur
Archaeological Services Branch /Lieux Service d'archéologie
Department of Tourism, Heritage and Culture/ Ministère du Tourisme, du Patrimoine et de la Culture
(A person duly designated by the Minister of Tourism, Heritage and Culture pursuant to Sec. 100 of the Heritage Conservation Act to sign this permit on his behalf)
(Une personne dûment désignée par le Ministre du Tourisme, du Patrimoine et de la Culture en vertu de l'article 100 de la Loi sur la conservation du patrimoine pour signer ce permit à sa place)

NOV 06 2017
Date granted / Date d'octroi

PERMIT NO: / N° DU PERMIS : **2017 NB 145** (Impact Study / Étude d'impact)

Appendix E

Field Notes

Field notes are on file in the Archaeological Project Manuscripts of

Archaeological Services Branch, Government of New Brunswick

Appendix F

NAPL Metadata

Government of Canada Gouvernement du Canada

Canada

National Earth Observation Data Framework Catalogue

Metadata summary and geographic extent

Photo Metadata

Dataset Attribute	Attribute Value
Photo Number	38
Acquisition (UTC)	1939-06-27
Scale	20000
Altitude	15000 (ft)
Original Negative Available (photo)	Yes
Negative size (WxH)	7 x 9
Overlap	60
NTS Map	021H10
Season	Summer

Flight Line Metadata

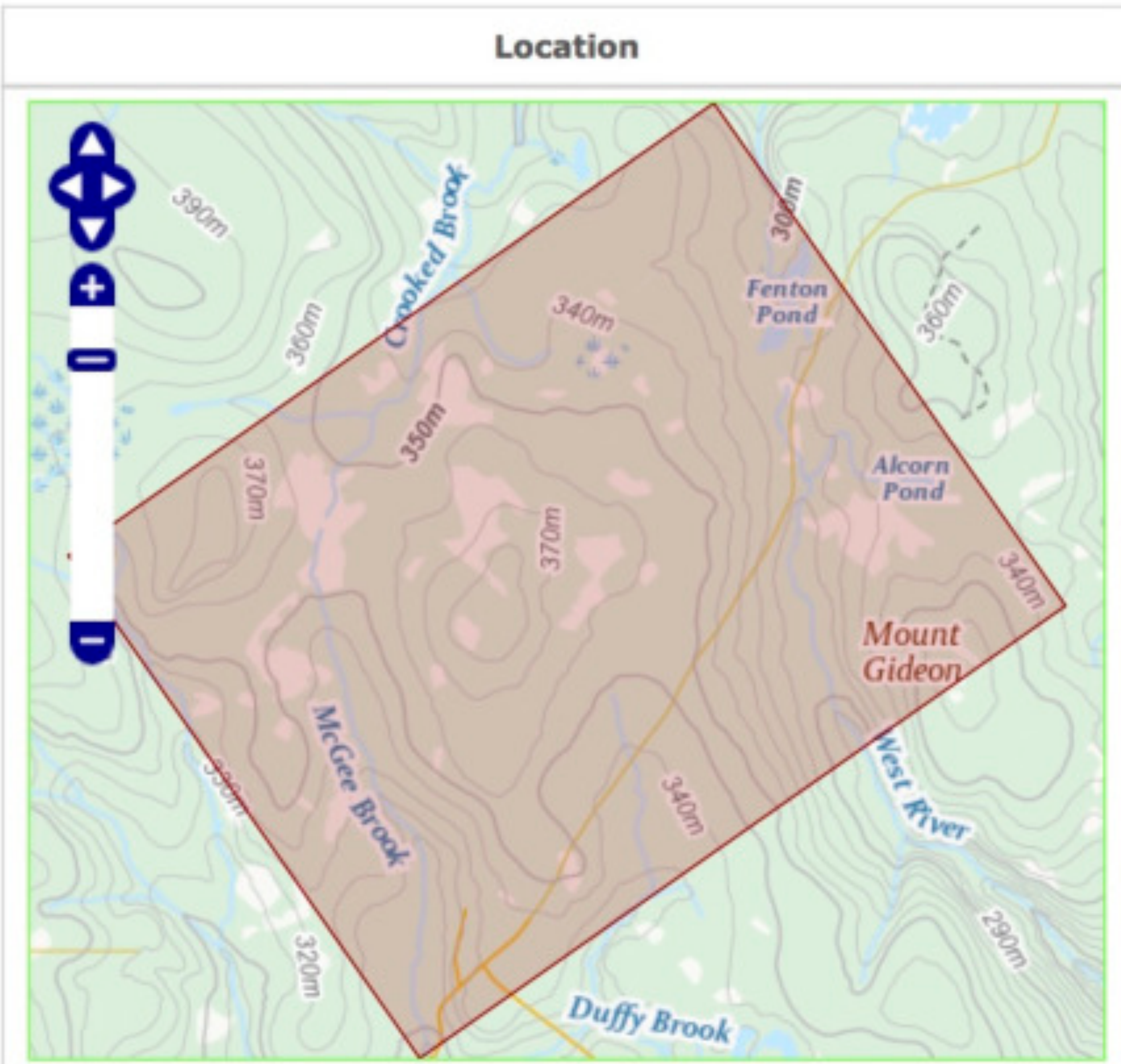
Dataset Attribute	Attribute Value
Line Number	95
Frame Start	19
Frame End	48

Roll Metadata

Dataset Attribute	Attribute Value
Roll Number	A6644
Viewing Angle	Vertical
Spectral Range	Black&White
Area	SHEDIAC
Roll Date	1939-06-27
Camera Name/Number	F3-10
Lens Name/Number	
Focal length (mm)	203.2
Camera Filter	
Film Type	DUP NEGS
ASL	Yes
Total Frames	92

Geographic extent	Value
North	45.76
South	45.72
East	-64.86
West	-64.92

Location


Location
390m
360m
Crooked Brook
340m
350m
370m
370m
Fenton Pond
360m
Alcorn Pond
340m
Mount Gideon
McGee Brook
340m
West River
290m
320m
Duffy Brook

Government of Canada Gouvernement du Canada

Canada

National Earth Observation Data Framework Catalogue

Metadata summary and geographic extent

Photo Metadata

Dataset Attribute	Attribute Value
Photo Number	75
Acquisition (UTC)	1939-06-27
Scale	20000
Altitude	15000 (ft)
Original Negative Available (photo)	Yes
Negative size (WxH)	7 x 9
Overlap	60
NTS Map	021H10
Season	Summer

Flight Line Metadata

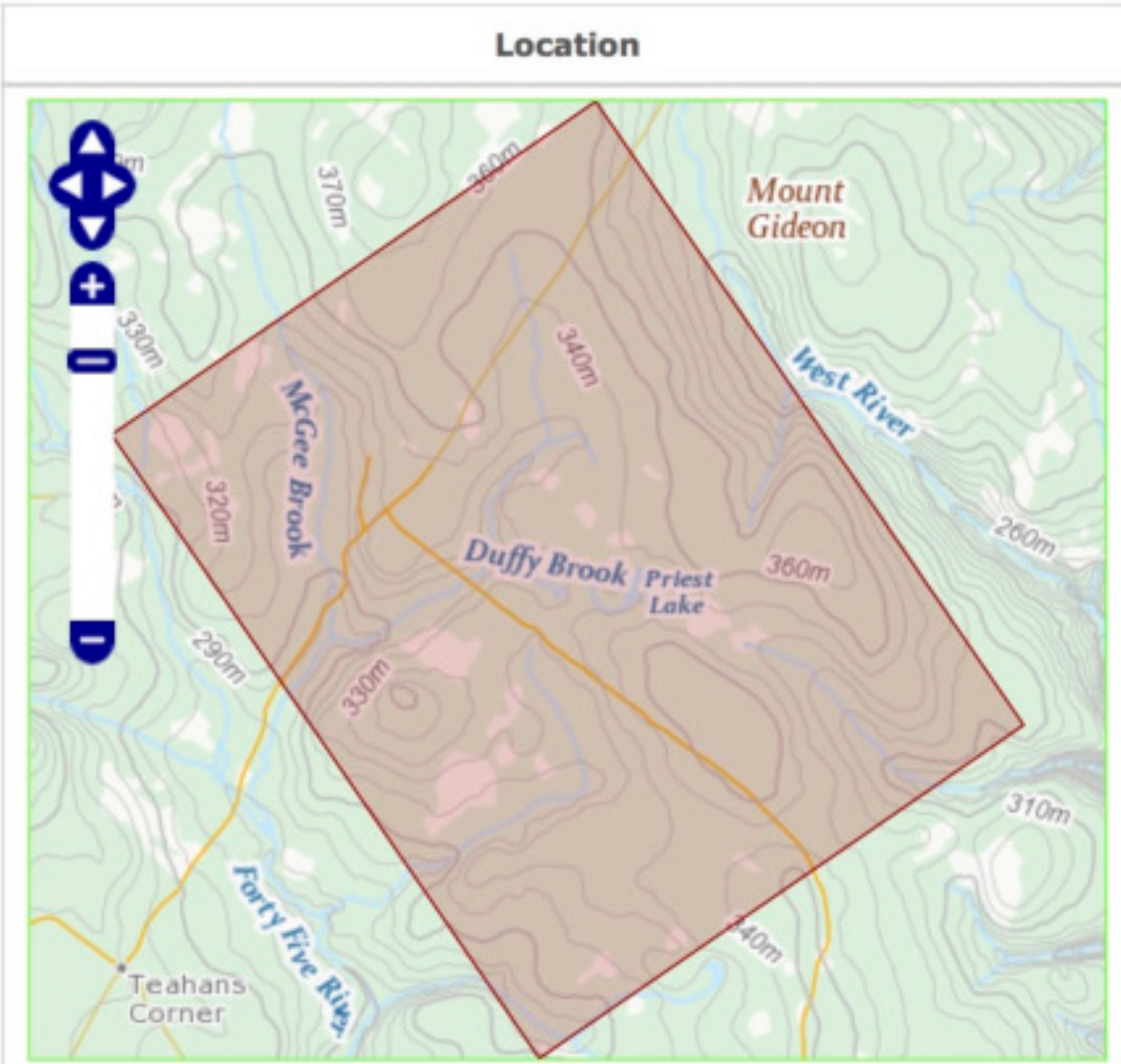
Dataset Attribute	Attribute Value
Line Number	20E
Frame Start	70
Frame End	92

Roll Metadata

Dataset Attribute	Attribute Value
Roll Number	A6644
Viewing Angle	Vertical
Spectral Range	Black&White
Area	SHEDIAC
Roll Date	1939-06-27
Camera Name/Number	F3-10
Lens Name/Number	
Focal length (mm)	203.2
Camera Filter	
Film Type	DUP NEGS
ASL	Yes
Total Frames	92

Geographic extent	Value
North	45.74
South	45.69
East	-64.88
West	-64.93

Location


Location
370m
360m
Mount
Gideon
330m
340m
West River
McGee Brook
320m
260m
Duffy Brook
Priest
Lake
360m
290m
330m
310m
Forty Five River
340m
Teahans
Corner

Government of Canada / Gouvernement du Canada — Canada

National Earth Observation Data Framework Catalogue

Metadata summary and geographic extent

Photo Metadata

Dataset Attribute	Attribute Value
Photo Number	94
Acquisition (UTC)	1939-06-29
Scale	20000
Altitude	15000 (ft)
Original Negative Available (photo)	Yes
Negative size (WxH)	7 x 9
Overlap	60
NTS Map	021H10
Season	Summer

Flight Line Metadata

Dataset Attribute	Attribute Value
Line Number	8N
Frame Start	66
Frame End	97

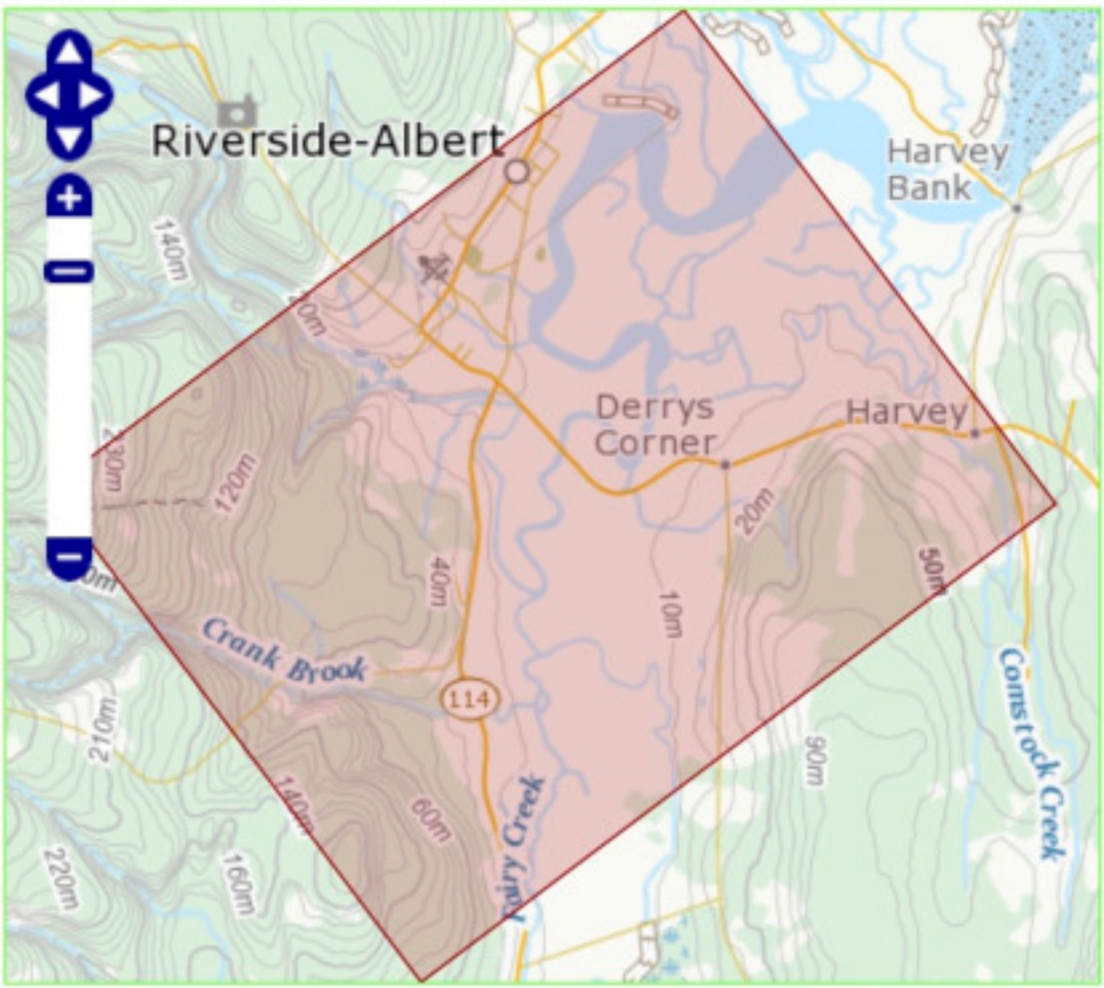
Roll Metadata

Dataset Attribute	Attribute Value
Roll Number	A6643
Viewing Angle	Vertical
Spectral Range	Black&White
Area	SHEDIAC
Roll Date	1939-06-29
Camera Name/Number	F3-10
Lens Name/Number	
Focal length (mm)	203.2
Camera Filter	
Film Type	DUP NEGS
ASL	Yes
Total Frames	97

Geographic extent	Value
North	45.75
South	45.72
East	-64.71
West	-64.78

Location

Location


Riverside-Albert
Harvey Bank
Derrys Corner
Harvey
Crank Brook
114
Fairy Creek
Comstock Creek
140m
20m
120m
40m
10m
50m
210m
140m
60m
90m
220m
160m

Government of Canada Gouvernement du Canada

Canada

National Earth Observation Data Framework Catalogue

Metadata summary and geographic extent

Photo Metadata

Dataset Attribute	Attribute Value
Photo Number	106
Acquisition (UTC)	1945-07-04
Scale	20000
Altitude	12000 (ft)
Original Negative Available (photo)	No
Negative size (WxH)	9 x 9
Overlap	60
NTS Map	021H10
Season	Summer

Flight Line Metadata

Dataset Attribute	Attribute Value
Line Number	108E
Frame Start	73
Frame End	109

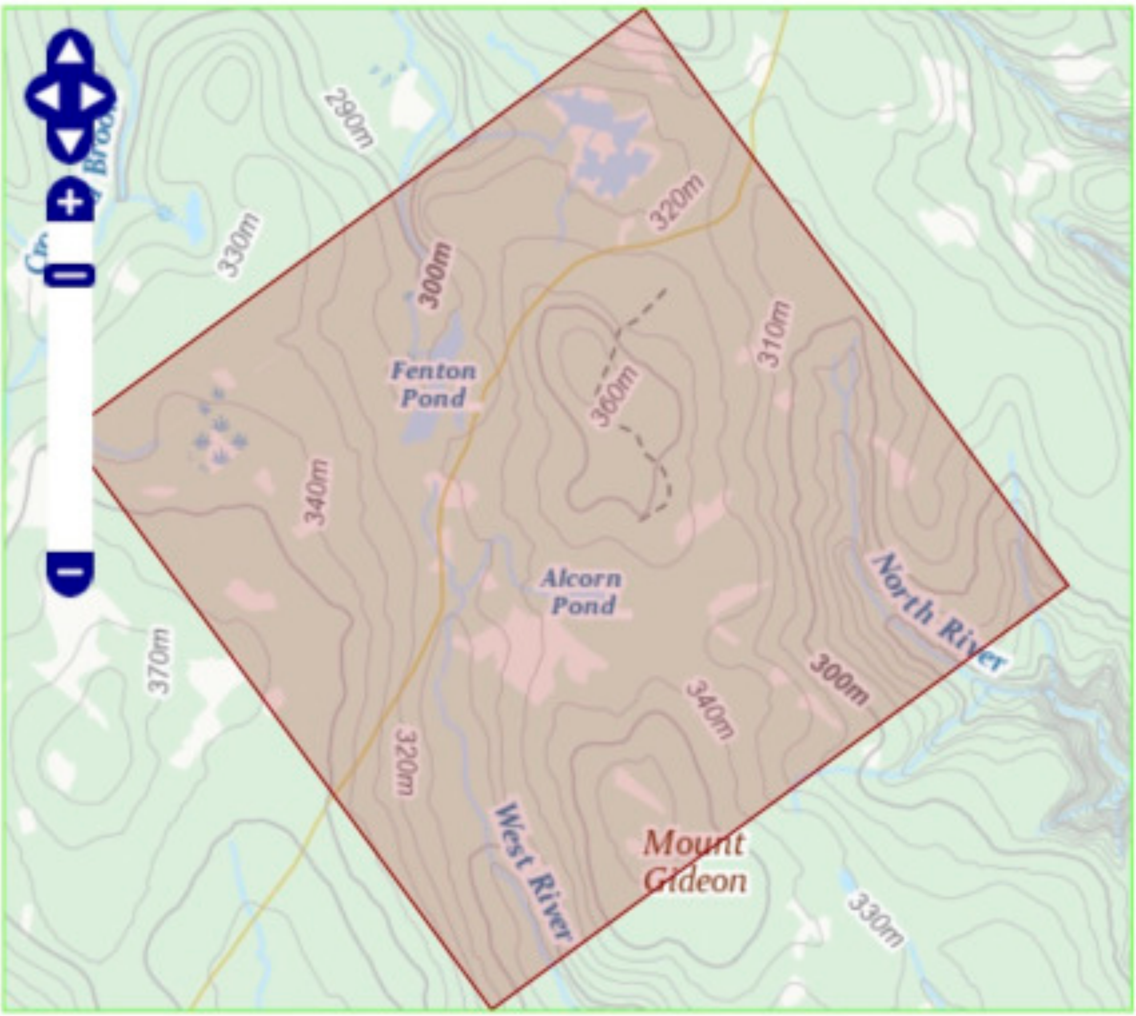
Roll Metadata

Dataset Attribute	Attribute Value
Roll Number	A8262
Viewing Angle	Vertical
Spectral Range	Black&White
Area	
Roll Date	1945-07-04
Camera Name/Number	F-3-10
Lens Name/Number	NOT SPECIFIED
Focal length (mm)	209.55
Camera Filter	
Film Type	SUPER XX
ASL	Yes
Total Frames	109

Geographic extent	Value
North	45.75
South	45.72
East	-64.83
West	-64.88

Location

Location


290m
330m
300m
320m
310m
Fenton Pond
360m
340m
Alcorn Pond
North River
370m
300m
340m
320m
West River
Mount Gideon
330m

Government of Canada Gouvernement du Canada

Canada

National Earth Observation Data Framework Catalogue

Metadata summary and geographic extent

Photo Metadata

Dataset Attribute	Attribute Value
Photo Number	23
Acquisition (UTC)	1945-07-04
Scale	20000
Altitude	12000 (ft)
Original Negative Available (photo)	No
Negative size (WxH)	9 x 9
Overlap	60
NTS Map	021H10
Season	Summer

Flight Line Metadata

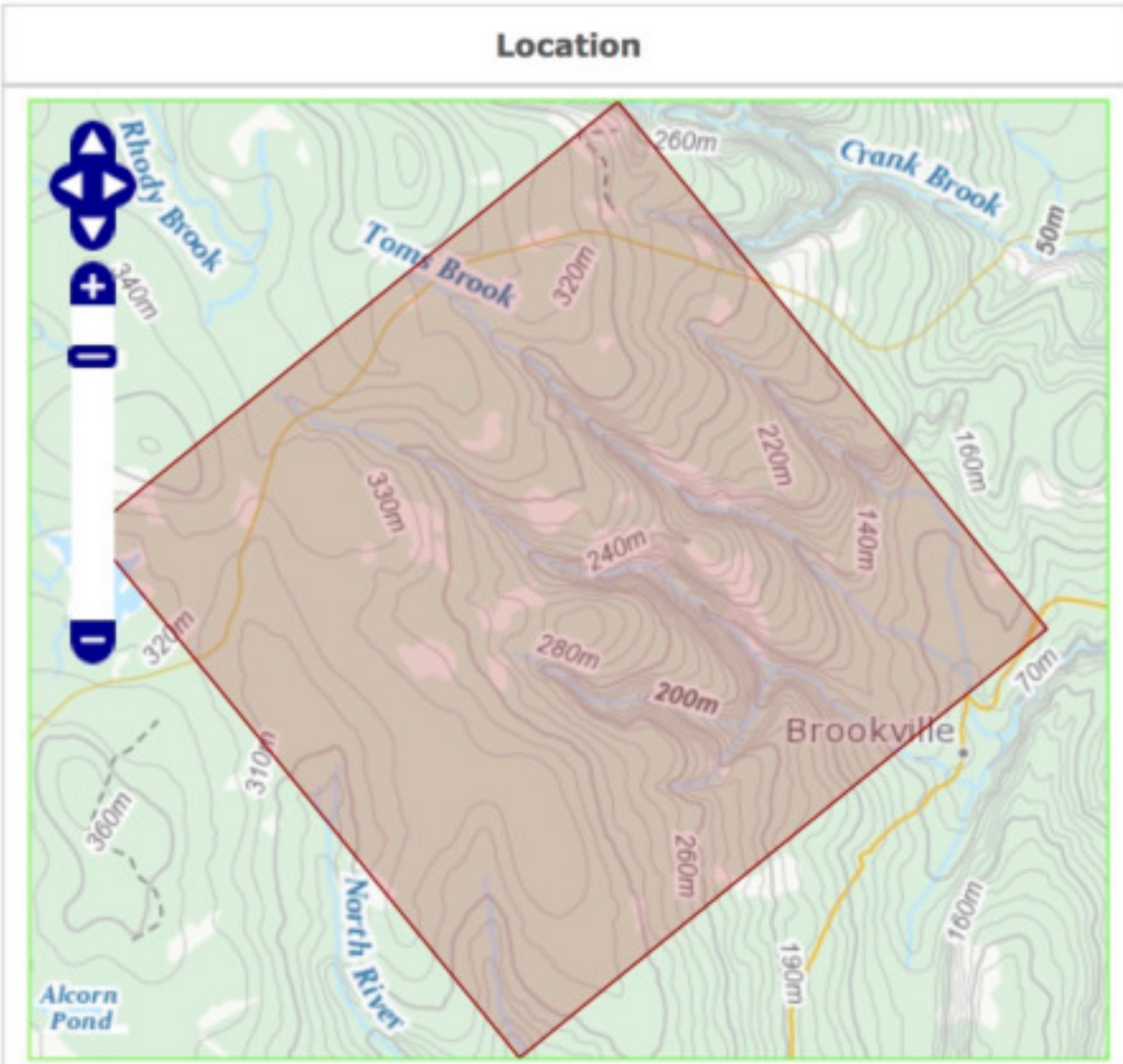
Dataset Attribute	Attribute Value
Line Number	108W
Frame Start	1
Frame End	98

Roll Metadata

Dataset Attribute	Attribute Value
Roll Number	A8242
Viewing Angle	Vertical
Spectral Range	Black&White
Area	
Roll Date	1945-07-04
Camera Name/Number	F-3-13
Lens Name/Number	NOT SPECIFIED
Focal length (mm)	209.55
Camera Filter	
Film Type	SUPER XX PAN
ASL	Yes
Total Frames	98

Geographic extent	Value
North	45.75
South	45.72
East	-64.78
West	-64.84

Location


Location
Rhody Brook
Toms Brook
Crank Brook
260m
320m
50m
340m
330m
220m
160m
140m
240m
280m
200m
320m
70m
Brookville
310m
360m
260m
North River
160m
190m
Alcorn Pond

Government of Canada Gouvernement du Canada Canada

National Earth Observation Data Framework Catalogue

Metadata summary and geographic extent

Photo Metadata

Dataset Attribute	Attribute Value
Photo Number	20
Acquisition (UTC)	1945-07-04
Scale	20000
Altitude	12000 (ft)
Original Negative Available (photo)	No
Negative size (WxH)	9 x 9
Overlap	60
NTS Map	021H10
Season	Summer

Flight Line Metadata

Dataset Attribute	Attribute Value
Line Number	108W
Frame Start	1
Frame End	98

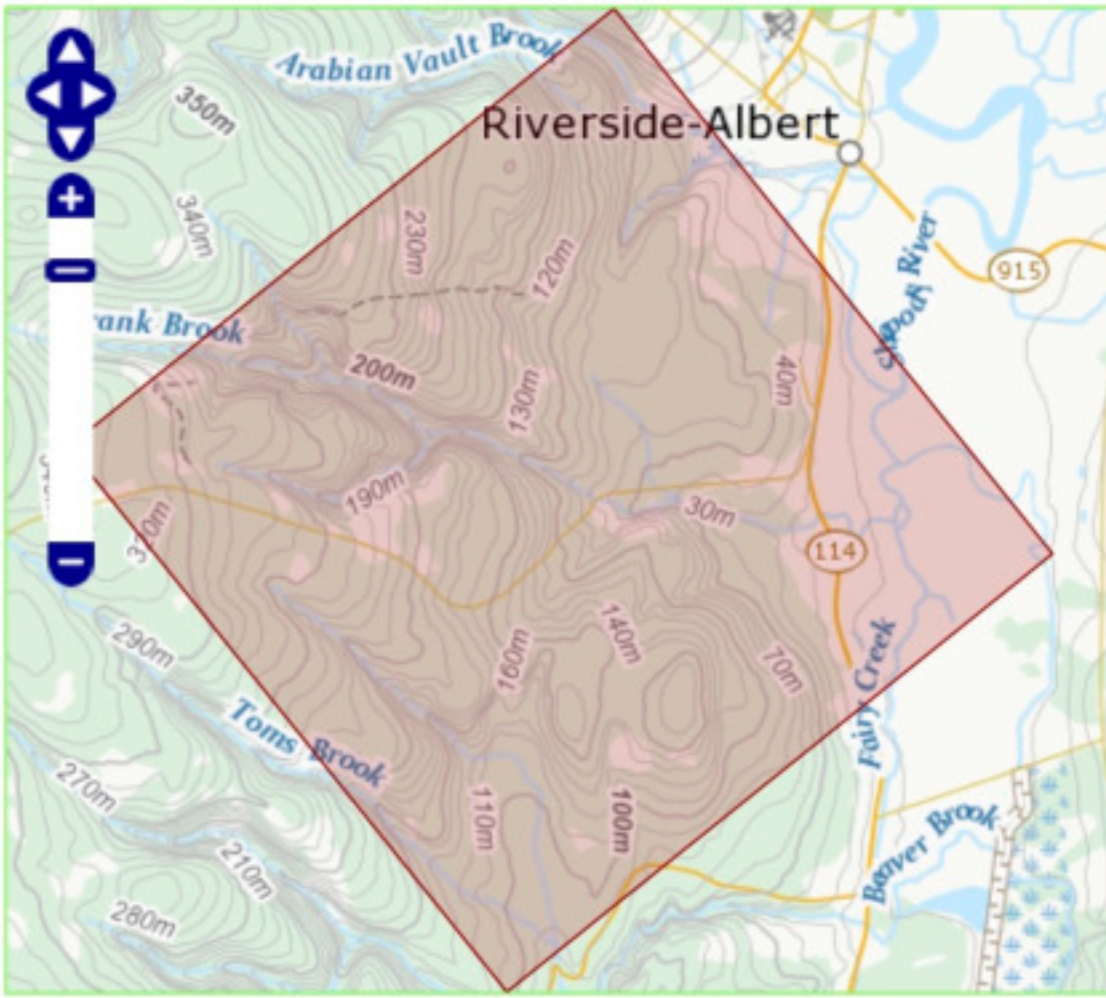
Roll Metadata

Dataset Attribute	Attribute Value
Roll Number	A8242
Viewing Angle	Vertical
Spectral Range	Black&White
Area	
Roll Date	1945-07-04
Camera Name/Number	F-3-13
Lens Name/Number	NOT SPECIFIED
Focal length (mm)	209.55
Camera Filter	
Film Type	SUPER XX PAN
ASL	Yes
Total Frames	98

Geographic extent	Value
North	45.76
South	45.72
East	-64.75
West	-64.80

Location

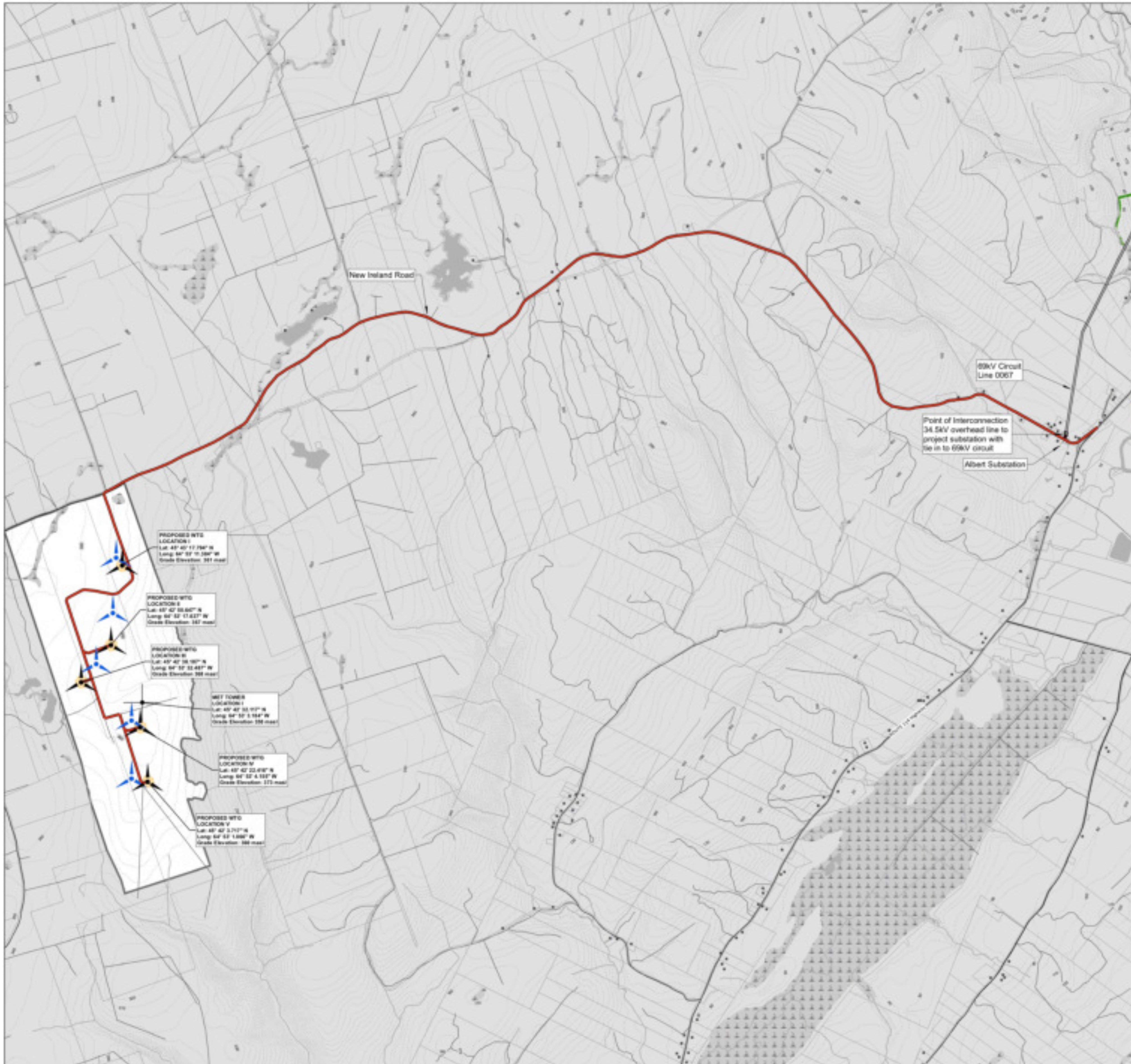
Location


Arabian Vault Brook
Riverside-Albert
350m
340m
230m
120m
915
Shepody River
200m
130m
40m
190m
30m
114
290m
140m
160m
70m
Fairy Creek
Toms Brook
270m
110m
100m
Beaver Brook
210m
280m

Appendix G

Project-Related Infrastructure Locations

Courtesy of WSP and WISK



WISOKOLAMSON ENERGY

Proposed Wind Energy Project

SOUTH of New Ireland Road

West of Riverside-Albert, New Brunswick

SITE PLAN

North Scale

0 375 750 1,500 2,250 3,000 m

1:20,000

Legend

10m	Property Line	Track/Trail
Transmission Line	Watercourse	Driveway
Building (small)	Waterbody	Local Road
Building (large)	Wetland/Bog	Major Road
MET Tower	Rotor Diameter (63m)	34.5 kV Line

Project Details

5-Vestas V126 WTGs
Hub Height: 117m
Rotor Diameter: 126m
Capacity: 3.6 MW each (total of 18 MW)

Alternative Layout
Original Layout

Interconnection Details:
- 34.5kv/69 kV substation
- 34.5kV buried collector between WTGs
- 34.5kV overhead collector from wind park to project substation

Land Lease Area (shown in white): 1252 ha
- Leased area will be adjusted post-EIA and will be restricted to the footprint of the wind farm (15-20 ha)

Layout 4 Revision 1

Notes:
All distances measured to the centre of the proposed turbine base.
Boundaries and dimensions subject to survey.
Contour interval: 10 metres

Drawn By:
J PARISÉ

Coordinate System: NAD 1983 CSRS New Brunswick Stereographic
Projection: Double Stereographic
Datum: North American 1983 CSRS

Site Plan Data Sources:
Base features produced under license with the Government of New Brunswick. Additional crown land road features obtained from the Department of Natural Resources and redistributed on a confidential basis.

SWEB Development | a W.E.B company

Stratis tackles the most complex challenges by delivering evidence-based solutions to real world problems. The foundation of our consulting engagements is research and stakeholder engagement led by an experienced team with advanced degrees and credentials.

We customize advisory and research teams to meet the needs of each engagement by drawing upon our network of senior consultants. Our experts have relevant academic and applied experience in many specialties and disciplines.

Stratis Consulting Inc.
527 Dundonald Street, Suite 115
Fredericton, NB E3B 1X5
Web: stratis.consulting

Stratis

Appendix

H VISUAL IMPACT ASSESSMENT

MEMO

TO: Jason Parisé, Development Manager, SWEB Development

FROM: Les Ryan, P.Eng.

SUBJECT: Wisokolamson Energy Project Photomontages

DATE: April 13, 2018

WSP has completed the following tasks for the Wisokolamson Energy Project photomontages:

— Site visit to capture images at five locations
— Post-processing of photos
— Stitching of the photos together to create panoramas
— Generation of photo montages for Vestas V126 3.6 MW turbine with a hub height of 117 metres

The photographs were taken using a Canon EOS REBEL T1i DSLR camera (4752 x 3168 resolution) with Canon EFS 18-55 mm lens. The camera was mounted on a tripod at approximately 1.5 m above ground. The skies were cloudy to partly-cloudy on the days the photos were taken.

The photomontages where generated using WindPRO version 3.1.617. Control points were used to orient the photos (pan, tilt, and rotation angles) and to confirm the focal length and field of view. The control points used were collected during the field work and from georeferenced aerial photographs (Google maps and Bing maps). The turbines were rendered taking into account the effects of cloud cover and the time of day on the light. A combination of automated and manual masking was performed as needed to create accurate depictions of the turbines.

Hugin (version 2017.0.0.eac5e8cc546e) was used to stitch the photomontage photos into panoramas. Photoshop was used to correct minor stitching flaws, remove spots resulting from dust on the camera sensor, and for resizing and cropping of the photomontage images. The resulting panoramas have a field of view of approximately 120 degrees.

Two locations where selected: “Cabin”, and “Midway Road”. For these locations, maps were produced that show the before and after panorama, the location of that the photos were taken, and the panorama pan arcs. An analysis of the other three locations showed that no turbines would not be visible and no further action was taken.

Please let me know if you have any questions or need any further information.

Sincerely,

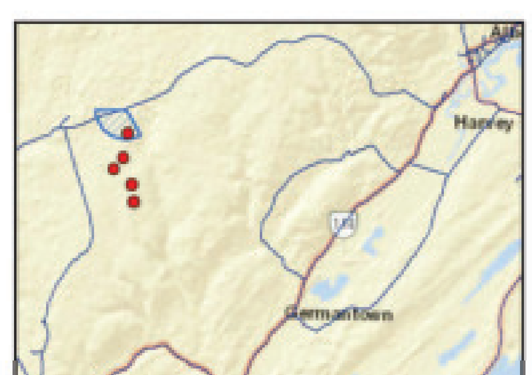
Les Ryan, P.Eng.
Attachments.

Title: Photomontage: Location 2 (Cabin)	
Project: Wisokolamson Energy LP Wisokolamson Energy Project	
wsp	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2018-04-02
	Version: 2

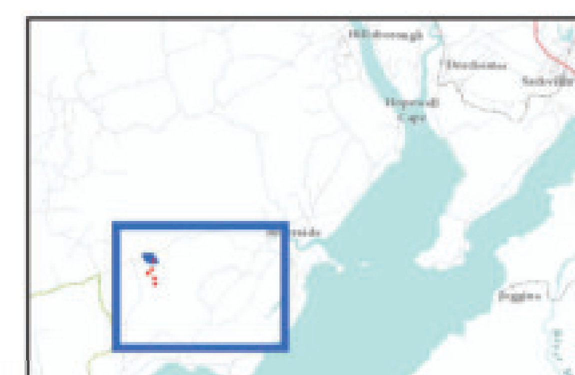
Notes:
Photographs taken with Canon EOS REBEL T1i DSLR camera and EFS 18-55 mm lens. Panoramic view compiled from multiple individual photographs. Photomontage simulated using Vestas V126- 3.6 MW turbine with rotor diameter of 126 m and hub height of 117 m using 5 turbine locations (Layout Rev 5 - 2018-03-21).

Data Sources:
GeoNB.

Prepared By: WSP Canada Inc.
Author: L. Ryan
Reviewed: A. Louro
Approved: R. Istchenko



Legend:
- Turbines
- Photo Location and Field of View
- Road



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Title: Photomontage: Location 5 (Midway Road)	
Project: Wisokolamson Energy LP Wisokolamson Energy Project	
wsp	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: N.T.S.
	Date: 2018-04-02
	Version: 2

Notes:
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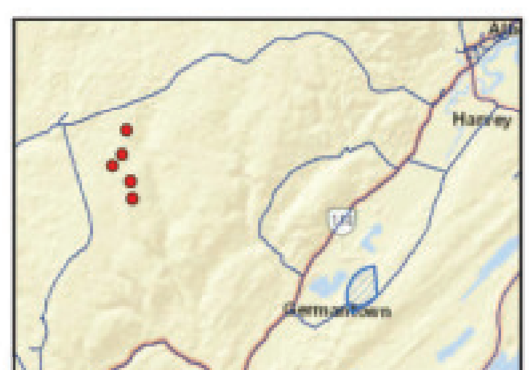
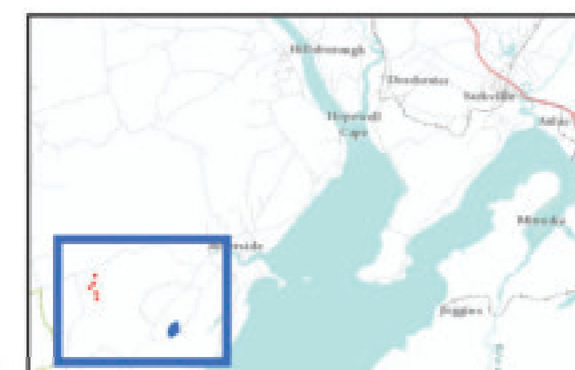


Legend:
Turbines
Photo Location and Field of View
Road



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MEMO

TO: Jason Parisé, Development Manager, SWEB Development

FROM: Les Ryan, P.Eng.

SUBJECT: Wisokolamson Energy Project Photomontages

DATE: April 13, 2018

INTRODUCTION

WSP has completed a high-level turbine visibility analysis for the Wisokolamson Energy Project. The objective of this analysis was to determine the extent of the visual influence of the wind turbines.

The results of the analysis are presented as two maps:

— A map that shows the extent of the visibility of the wind turbine blades that reach heights of 180 m above ground.
— A map that shows the extent of the visibility of the wind turbine tower and nacelle that is at 117 m above grade.

METHODOLOGY

A visibility analysis was conducted using the Visibility Tool in ArcMap (GIS software). The visibility tool identifies which observable points are visible from each raster surface location. Inputs to the model include a grid of ground elevations of the area around the turbines, the height of the object being observed, and the height of the observer.

For the elevation grid, digital elevation model (DEM) data was obtained from Natural Resources Canada. The base resolution for DEM is 0.75 arc seconds along a profile in the south-north direction and varies from 0.75 to 3 arc seconds in the west-east direction, depending upon the geographic location.

An observer height of 1.5 m was used.

For the height of the objects being observed (i.e., the wind turbine) two scenarios were used: 180 m, which is the maximum height that the blade tip reaches; and 117 m, which is the hub height or average height of the nacelle.

In the first scenario, an object height of 180 m, the maximum distance was limited to 15 km. Beyond that it was assumed that the turbine blades would not be visible to the unaided eye. For the second scenario, an object height of 117 m, the maximum distance was limited to 25 km. The increase in maximum distance used for the second scenario is because the nacelle is larger than the blades and can be seen from a greater distance.

The analysis does not take into consideration objects that may obstruct the view such as trees or buildings.

RESULTS

The results of the visibility analysis are shown on the two attached maps. The first map shows the areas from which it would be possible to see at least some portion of the turbine blades (maximum height above ground of 180 m). The second map shows the areas from which it would be possible to see the turbine nacelle (height above ground of 117 m) and possibly some of the tower.

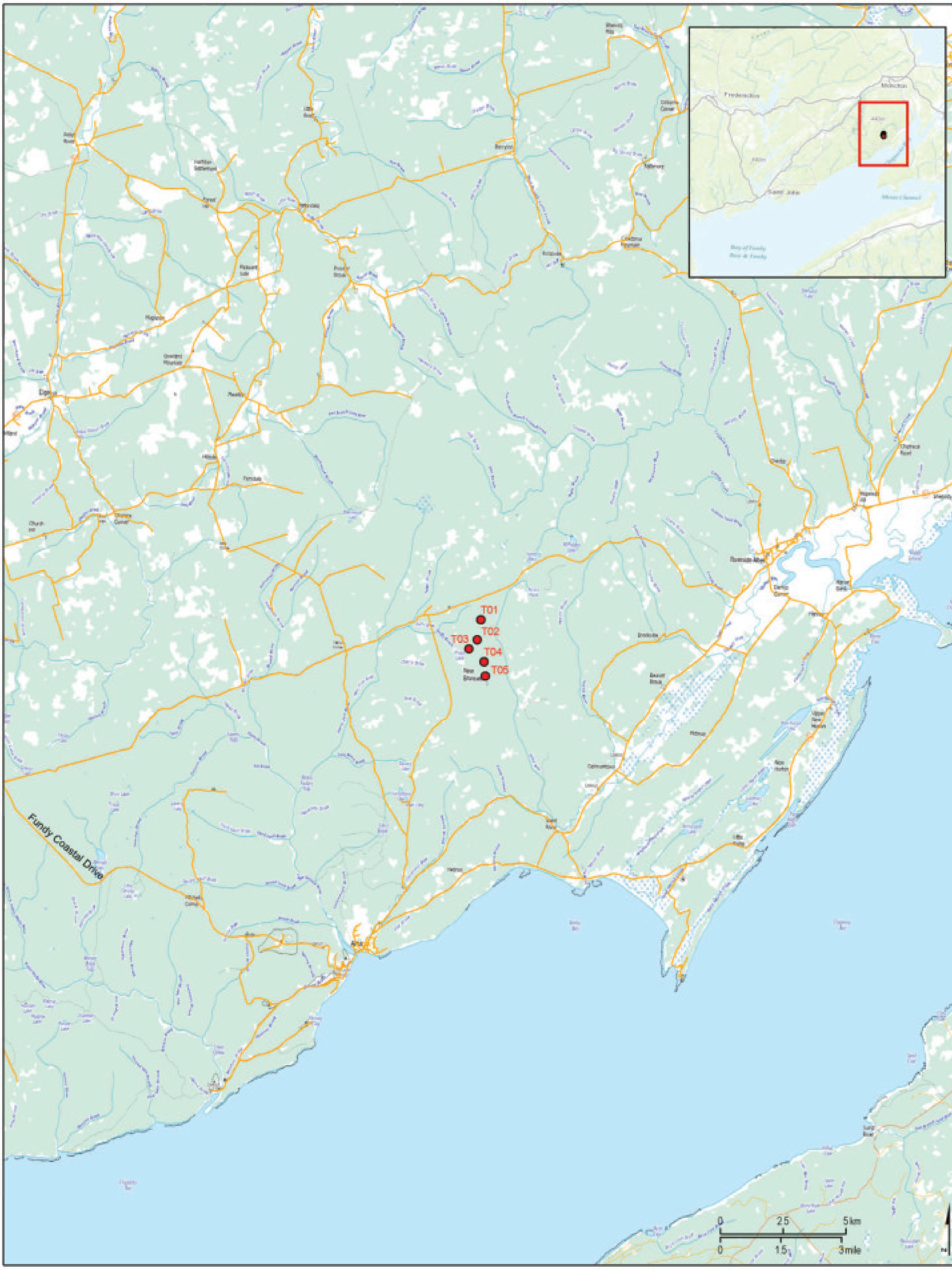
The visibility analysis results in what can be considered a "worst case" viewshed area. Practically speaking, there are several factors that were not accounted for that would limit the visibility of turbines, such as:

— Obstructions (e.g., trees, buildings),
— Atmospheric, weather and lighting conditions (e.g., clouds, low contrast lighting, haze, etc.),
— The amount of the turbine that is visible (e.g., only a portion of the blade tip might be visible),
— Relative size of the turbine at the viewing distance (e.g., turbines farther away are smaller and harder to see or recognize).

Please let me know if you have any questions or need any further information.

Sincerely,

Les Ryan, P.Eng.
Attachments.



● Turbines

Road

Zone of Visual Influence

WSP

Wisokolamson Wind Project

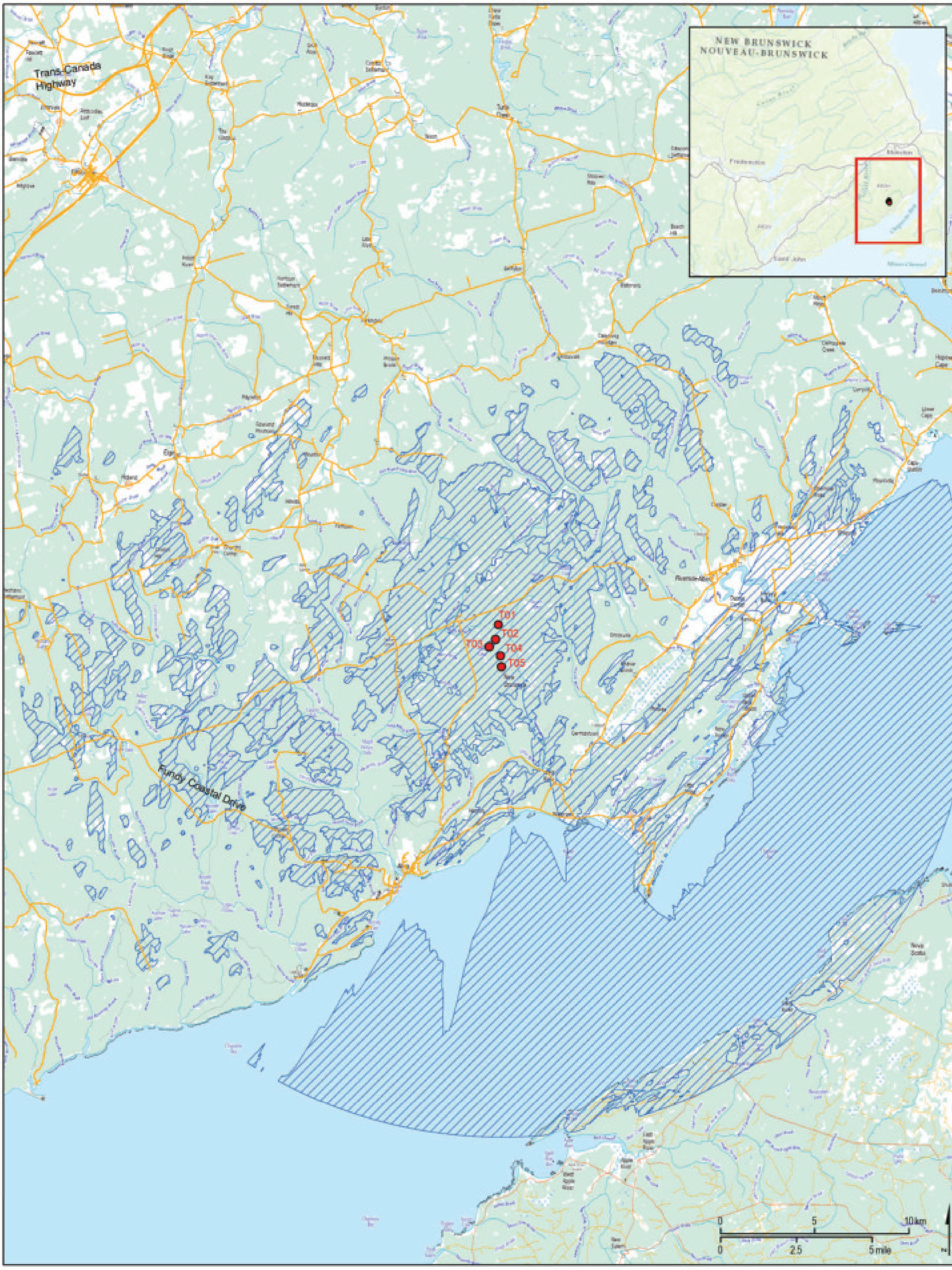
Zone of Visual Influence Map
Turbine Tip (180 m above grade)
15 km Limit

In the preparation of this map, WSP has relied upon certain information provided by the Client. While WSP has taken reasonable measures to present accurate information in the map, WSP does not warrant the reliability, accuracy, quality, currency, validity, or completeness of information found in the map.

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, [illegible]

Date: 2019 04 1[illegible]
[illegible]
Scale 1: [illegible]

Prepared by WSP
[illegible]



Turbines

Road

Zone of Visual Influence

Wisokolamson Wind Project

Zone of Visual Influence Map
Turbine Nacelle (117 m above grade)
25 km Limit

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Appendix

I

SHADOW FLICKER ASSESSMENT

WISOKOLAMSON ENERGY LP

SHADOW FLICKER ASSESSMENT

WISOKOLAMSON ENERGY PROJECT

APRIL 5, 2018

SHADOW FLICKER ASSESSMENT

WISOKOLAMSON ENERGY PROJECT

WISOKOLAMSON ENERGY LP

VERSION 3

PROJECT NO.: 161-08790-00
DATE: APRIL 2018

WSP
405 18 STREET SE
CALGARY, AB, CANADA T2E 6J5

TEL.: +1 403 248-9463
WSP.COM

REVISION HISTORY

Version	Issue Date	Description
1	March 20, 2018	Overview of shadow flicker assumptions, procedure, and calculations. Presentation of shadow flicker results using provided shadow receptors and turbine layout.
2	April 2, 2018	Updated with new turbine layout.
3	April 5, 2018	Fixed inconsistent naming of SR01.

SIGNATURES

PREPARED BY

Les Ryan, P.Eng.
Analyst, Energy

REVIEWED BY

Errol Halberg, P.Eng.
Manager Resource Assessment, Energy

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Permit Number P7641
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1 EXECUTIVE SUMMARY

The Wisokolamson Energy Project is being developed by Wisokolamson Energy LP and is located approximately 12 kilometres southwest the town of Riverside-Albert, New Brunswick. The purpose of this analysis is to quantify the impact of shadow flicker at each identified receptor.

Impact of shadow flicker was quantified as total hours per year and maximum minutes per day. The SHADOW module of the WindPRO software package was used to model “worst-case” and “corrected-case” scenarios for the shadow flicker at 3 receptor locations within or near project boundaries.

The analysis assumes that the receptors are sensitive to shadow flicker from any direction (this is referred to as “greenhouse mode”). Inputs to the model include terrain data, turbine specifications, geographic location of the project (to determine the daily sun path), and on-site meteorological data. The shadow flicker modelled for the worst-case assumes that the sky is clear during all daylight hours, the turbine rotor is always perpendicular to the sun, and that the turbine blades are always rotating. In contrast, the shadow flicker modelled for the corrected-case reduces the hours of shadow flicker to account for the times when the sun is not shining, the turbine is not operating, or the orientation of the turbine (due to the direction of the wind) is not perpendicular to the sun. Public weather station data is used to determine the probability of bright sunshine and meteorological data is used to estimate the periods of turbine operation and turbine orientation.

This analysis considers one layout with 5 Vestas V126-3.6 MW on 117 m towers. The receptors with shadow flicker impact from the project are listed in Table 1, below.

Table 1: Impacted Shadow Flicker Receptors

Receptor		Location NAD83, UTM Zone 20			Worst Case [HH:MM]		Real Case [HH:MM]	Largest Contribution	
ID	Type	X	Y	Elevation	Annual	Max Daily	Annual	Turbine	Month
Lake Shore Access (SR01)	Public Place	352379	5063236	336	30:34	00:31	7:08	T04	September

It is important to consider that the modelling assumptions used in the shadow calculation are conservative and may result in an overestimation of the shadow flicker amounts. The model assumes receptors are susceptible to shadow flicker from all directions but this may not be the case. The actual size, location and orientation of the receptor's windows relative to turbine locations may reduce the degree of flicker inside the dwellings. As well, the presence of buildings, trees, and other obstacles are not considered by the model and may also reduce the effects of shadow flicker on these receptors.

2 INTRODUCTION

2.1 OBJECTIVE

This report presents the algorithm, assumptions and results of the shadow flicker assessment. The impact of shadow flicker on receptors was assessed for both the "corrected-case" and "worst-case" modelling scenarios.

2.2 OVERVIEW OF SHADOW FLICKER

Shadow flicker occurs when the rotating blades of a turbine pass through the path between the sun and a receptor window when the sun is not obstructed by clouds. This phenomenon is dependent on weather conditions, site topography, and wind direction. The severity of shadow flicker will change both seasonally and hourly as a result of the daily and seasonal movements of the sun.

Shadow flicker can be calculated using the worst-case scenario or the corrected-case scenario. The worst-case, or "astronomical maximum" shadow flicker analysis, considers only the relative geographical location between turbines and receptors and assumes the sun is shining and the turbine rotor is spinning perpendicular to the path of the sunlight at all times. The corrected-case, or "meteorologically probable", shadow flicker analysis utilizes on-site wind data and expected sunshine probability statistics to account for periods when: the turbine is not operational; the orientation of the turbine is not perpendicular to the path of the sunlight; and the sunlight is not strong enough to cast a shadow.

The occurrence of shadow flicker within a residence occurs when the rotating blades of a turbine momentarily interrupt the sunlight shining into the window of a receptor. The occurrence of shadow flicker may be reduced by the following:

— Obstructions that block the sunlight from reaching the window during some or all of the time that shadow flicker is occurring;
— The orientation of the turbine due to changing wind direction.

In the event that the amount of shadow flicker is a concern, introduction of obstacles and turbine operation adjustment for specific wind directions or times of day may be effective mitigation techniques. New Brunswick has regulations stipulating that shadow flicker at a receptor must be limited to 30 hours per year and a maximum of 30 minutes per day for the worst case.

2.3 SITE DESCRIPTION

The Wisokolamson Energy Project is located approximately 12 km southwest of the town of Riverside-Alberta, New Brunswick. The project location is rural, consisting mainly of forested areas, scrub brush, and some cultivated fields.

For this analysis, 3 receptors were identified. Receptor locations have been listed in *Appendix B: Shadow Flicker Results* and are shown in *Appendix E: Maps*.

The shadow flicker assessment was completed for a 5 turbine layout (Rev 5, 2018-03-21) using the Vestas V126-3.6MW on 117 m towers.

Locations of wind turbines are listed in *Appendix D: Turbine Locations* and are shown in *Appendix E: Maps*.

3 METHOD

3.1 SHADOW FLICKER ALGORITHM & ASSUMPTIONS

The WindPRO SHADOW module was used to model the shadow flicker at the Wisokolamson Energy Project. WindPRO calculates the cumulative effect of shadowing from all turbines with a line of sight to each receptor. The worst-case results are evaluated on yearly and daily averaging periods; the corrected-case on a yearly averaging period.

The blade shadow gets gradually fainter as the distance from the turbine and at some distance from the turbine; the edge of the turbine shadow will be hard to distinguish by the human eye. Within WindPRO, the maximum distance of shadow propagation may be calculated using the turbine blade width or may be set to a constant – usually ten times the turbine's rotor diameter[1]. A conservative constant distance of 2,000 m was selected for the analysis. Due to atmospheric diffusion and lower light levels, shadow flicker is ignored when the sun is lower than 3° above the horizon. The presented shadow flicker amounts are based only on total frequency of shadow flicker and do not distinguish the character of the shadow flicker.

WindPRO executes a site-specific simulation of the solar trajectory relative to the wind project for an entire year. The complete description and shadow flicker calculation algorithm of WindPRO is provided in *Appendix A: WindPRO Model.*

Both the worst-case and corrected-case shadow flicker modelling scenarios assume that receptors have windows oriented in every direction and are, as a result, susceptible to flicker from all directions. This is known as the "greenhouse mode" and represents a conservative estimate of the impact of shadow flicker. Obstacles such as trees or large structures, which could block some or all of the shadow flicker effect at a receptor, are not considered in the analysis thus making the shadow flicker additionally more conservative. Topography was included in the modelling; however, elevation changes smaller than the resolution of the sourced data may not have been captured[2] .

The calculations of modelled worst-case results assume the following:

— The sun is unobstructed by cloud cover for all daylight hours for the entire year.

— The turbine blades are always rotating.

---

[1] Parsons Brinckerhoff, Update of UK Shadow Flicker Evidence Base, Department of Energy and Climate Change.
[2] Lidar15 (Elevation data) has a grid spacing of 15 m with a horizontal accuracy of 50 cm. The vertical accuracy is 30 cm. ---OR--- CDED (Elevation data) has a grid spacing of 8-23 m with a horizontal accuracy of 10 m. The vertical accuracy is 6 m.

— The turbine rotor is always perpendicular to the path between the sun and the receptor.

The calculation of modelled “corrected-case” shadow flicker incorporated the probability of sunshine (hours of bright sunshine per month). The sunshine hours for the Wisokolamson site were derived from the measurements from the “Moncton A” (New Brunswick) Environment Canada Monitoring station located approximately 47 km from the project site. Environment Canada uses the Campbell-Stokes sunshine recorder. This recorder consists of a 10-cm glass sphere which focuses sunlight on a card calibrated in hours. Sunlight burns a trace on the card, allowing the observer to determine to the nearest tenth of an hour the amount of sunshine that occurs on a given day. It should be noted that the recorder measures only “bright” sunshine, which is less than “visible” sunshine. For example, sunshine immediately after sunrise and just before sunset would not be bright enough to register. The monthly probabilities of sunshine used in the modelling are presented in Table 2[3].

[3] Environment Canada, October, 2017:
http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnName&txtStationName=Moncton+A&searchMethod=contains&txtCentralLatMin=0&txtCentralLatSec=0&txtCentralLongMin=0&txtCentralLongSec=0&stnID=6207&dispBack=1

Table 2: Average Daily Hours of Bright Sunshine for the "Moncton A" Environment Canada Station

Month	Bright Sunshine [hours/day]
January	3.8
February	4.4
March	4.5
April	5.5
May	6.7
June	7.8
July	8.3
August	7.8
September	5.8
October	4.8
November	3.2
December	3.3

Twenty-one (21) years (1988 to 2018 inclusive) of MERRA-2 reanalysis data was used as an input into the shadow flicker calculations. The MERRA-2 grid point is located at 45.5° N and 65.0° W, approximately 25 kilometres away from the site centre. The estimated annual number of hours of operation at the Wisokolamson project is 8,518 hours. For the periods when the wind speed at the project is outside the operational range of the turbines, WindPRO assumes that the blades do not turn and consequently that there will be no shadow flicker. The real case shadow flicker hours include a reduction of 2.8% from worst case shadow flicker hours to account for the frequency the wind turbine blades are not rotating due to low winds.

The yaw system of the wind turbine changes the orientation of the rotor according to the wind direction, thus the shadow cast by the rotating blades changes according to the wind direction. The wind rose representing the wind direction distribution at the Wisokolamson Energy Project is presented in Figure 1, below. Shadow flicker will have a maximum impact when the rotor is perpendicular to the path of the sun and a minimum impact when the rotor is parallel to a line between the sun and the receptor. Based on the wind rose and orientation of each turbine to each receptor, a yaw correction factor was estimated for each pair and this correction factor is presented in *Appendix C: Direction Reduction Factor for the Corrected Case*. The yaw correction factor has only been estimated for turbine-receptor pairs with at least 1 minute of shadow flicker in a year.

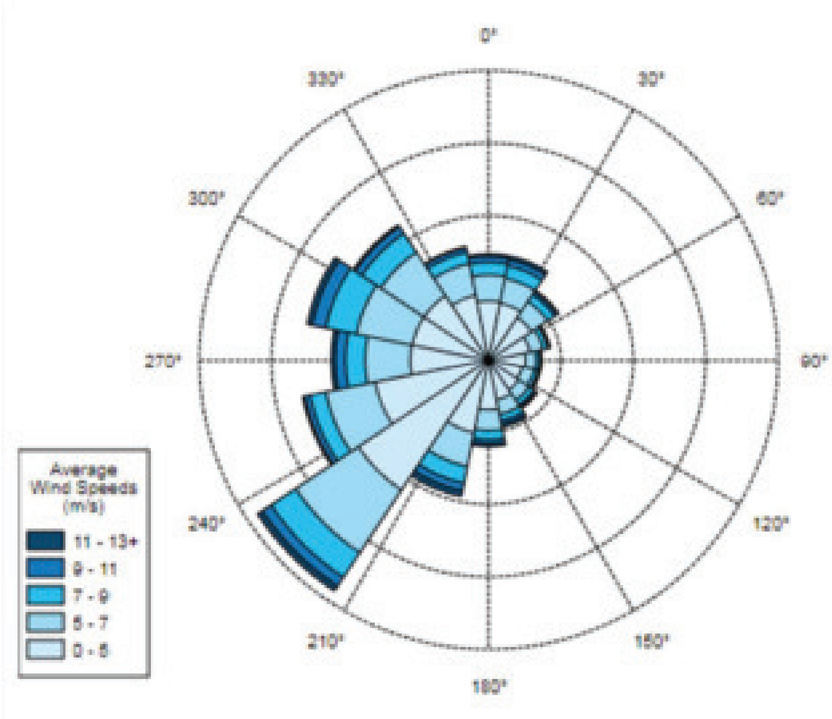


Figure 1: Wind Direction Distribution (Frequency %) at Wisokolamson (MERRA-2 Grid 45.5° N and 65.0° W, 1988 through 2018)

4 SHADOW FLICKER RESULTS

4.1 GREENHOUSE MODE SHADOW FLICKER RESULTS

The detailed results of the WindPRO shadow flicker model are presented in tabular form in *Appendix B: Shadow Flicker Results* which includes the "corrected-case" annual hours, the “worst-case” annual hours, and the maximum daily minutes of shadow flicker for the “worst-case” scenario. Maps showing the iso-contour of the shadow flicker results have been included in *Appendix E: Maps*:

— For the “corrected-case” annual hours,

— For the “worst case” annual hours and daily maximum minutes.

The results shown in *Appendix B: Shadow Flicker Results*, and tabulated in Table 3, below, represent the predicted cumulative shadow flicker results from the Wisokolamson Energy Project. The results are sorted from most to least time per year for the corrected case. Only receptors experiencing more than 1 minute of shadow flicker originating from a Wisokolamson wind turbine are presented in the tables. The table also includes the largest contributing wind turbine and month.

Table 3: Estimated Shadow Flicker on Impacted Shadow Receptors

Receptor		Location NAD83, UTM Zone 20			Worst Case HH:MM		Real Case HH:MM	Largest Contribution	
ID	**Type**	**X**	**Y**	**Elevation**	**Annual**	**Max Daily**	**Annual**	**Turbine**	**Month**
Lake Shore Access (SR01)	Public Place	352379	5063236	336	30:34	00:31	7:08	T04	September

5 CONCLUSIONS

The present study estimates the cumulative shadow flicker caused by the Wisokolamson Energy Project surrounding 3 receptors. The only receptor with subject to shadow flicker from the project are listed in Table 4, below.

Table 4: The Five Most Impacted Shadow Flicker Receptors

Receptor		Location NAD83, UTM Zone 20			Worst Case [HH:MM]		Real Case [HH:MM]	Largest Contribution	
ID	**Type**	**X**	**Y**	**Elevation**	**Annual**	**Max Daily**	**Annual**	**Turbine**	**Month**
Lake Shore Access (SR01)	Public Place	352379	5063236	336	30:34	0:31	7:08	T04	September

In cases where mitigation is necessary, Wisokolamson Energy LP has various mitigation measures at their disposal that can be investigated. For example, shutters could be installed on windows or trees planted between the proposed wind turbine and the houses in order to block the shadow.

APPENDIX

A

WINDPRO MODEL

The following information has been modified from section 4.2 of the WindPRO help files.

A.1 INTRODUCTON TO SHADOW

SHADOW is the WindPRO calculation module that calculates how often and in which intervals a specific area will be affected by shadows generated by one or more wind turbines. These calculations are expected case scenarios (i.e. calculations which are solely based on the probability of sunshine as calculated from the monthly maximum total duration of bright sunshine and the position of the turbine relative to the sun or the astronomical maximum shadow). Shadow flicker impact may occur when the blades of a wind turbine pass through the sun's rays seen from a specific spot (e.g. a window in an adjacent settlement). If the weather is overcast or calm, or if the wind direction forces the rotor plane of the wind turbine to stand parallel with the line between the sun and the neighbour, the wind turbine will not produce shadow flicker impacts.

Apart from calculating the potential shadow flicker impact at a given neighbour, a map rendering the iso-lines of the shadow flicker impact can be printed. This printout will render the amount of shadow flicker impact for any spot within the project area.

The time of the day for which shadow flicker impact is critical and the definition of a receptor for which shadow flicker impact is calculated are less rigidly defined by best practices and is often something which should be evaluated in each individual case.

As an example, a factory or office building would not be affected if all the shadow flicker impact occurred after business hours, whereas it would be more acceptable for private homes to experience shadow flicker impact during working hours, when the family members are at work/school.

Finally, the actual amount of shadow flicker impact as a fraction of the calculated potential risk will depend heavily on the geographic location in question. In areas with high rates of overcast weather the problem would obviously decrease, and during potential hours of shadow flicker impact in the summer the wind turbine may often be stationary due to lack of wind.

Statistics regarding the wind conditions and number of hours with clear sky can also be taken into account.

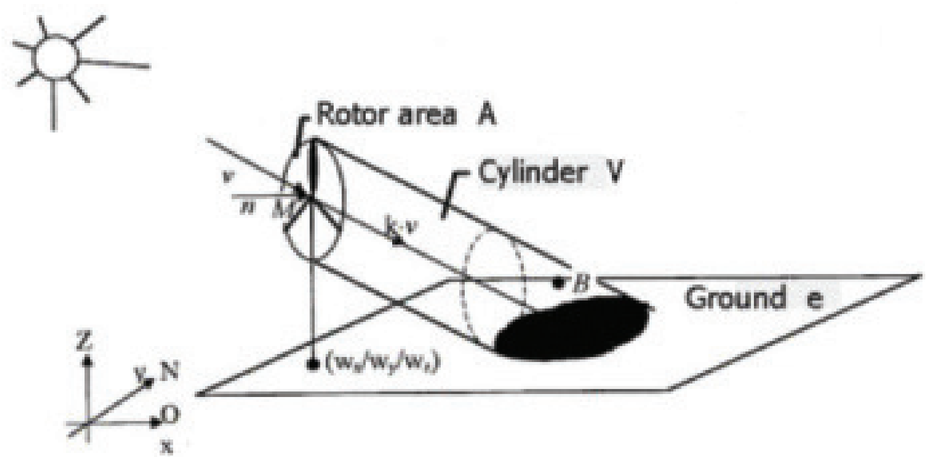
As in the other WindPRO modules, input of data can be based solely on entering coordinates and characteristics for the individual wind turbine and shadow flicker receptors manually.

A significant strength in the WindPRO system is the option of direct graphic on-screen input of wind turbines and receptors on a map.

A.2 THE SHADOW CALCULATION METHOD

The calculation of the potential shadow flicker impact at a given receptor is carried out simulating the situation. The position of the sun relative to the wind turbine rotor disk and the resulting shadow flicker is calculated in steps of 1 minute throughout a complete year. If the shadow flicker of the rotor disk (which in the calculation is assumed solid) at any time casts a shadow flicker reflection on the window, which has been defined as a receptor object, then this step will be registered as 1 minute of potential shadow flicker impact. The following information is required:

- The position of the wind turbines (x, y, z coordinates)
- The hub height and rotor diameter of the wind turbines
- The position of the receptor object (x, y, z coordinates)
- The size of the window and its orientation, both directional (relative to south) and tilt (angle of window plane to the horizontal).
- The geographic position (latitude and longitude) together with time zone and daylight-saving time information.
- A simulation model, which holds information about the earth's orbit and rotation relative to the sun.



A.3 THE SHADOW CALCULATION MODULE

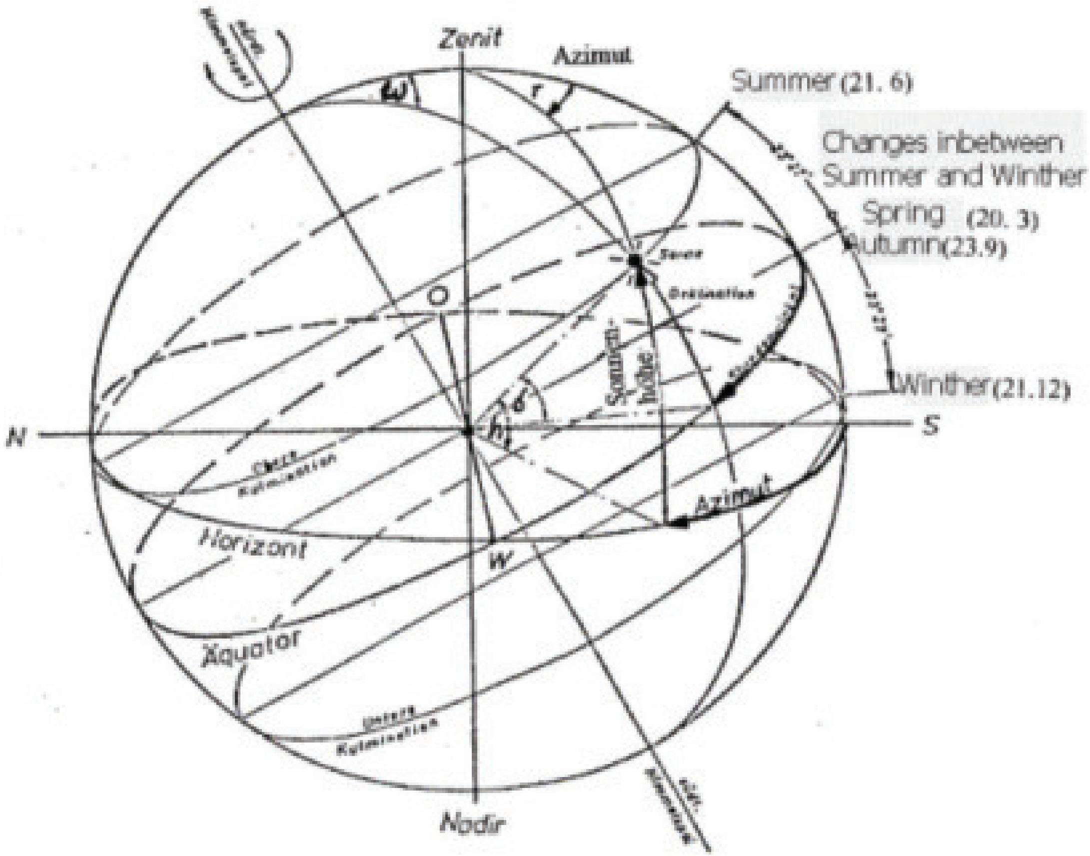
In the shadow flicker calculation model used by WindPRO the following parameters defines the shadow flicker propagation angle behind the rotor disk:

- The diameter of the sun, D: 1,390,000 km
- The distance to the sun, d: 150,000,000 km
- Angle of attack: 0.531 degrees

Theoretically, this would lead to shadow flicker impacts in up to 4.8 km behind a 45 m diameter rotor disk. In reality, however, the shadows never reach the theoretical maximum due to the optic conditions of the atmosphere. When the sun gets too low on the horizon and the distance becomes too long the shadow dissipates before it reaches the ground (or the receptor). How far away from the wind turbine the shadow will be visible is not well documented and so far only the German guidelines set up limits for this. The default distance of WindPRO is calculated based on blade width or maximum distance and the default minimum angle is 3° above the horizon. If the German guidelines are used, the maximum distance from each wind turbine can be calculated using the formula.

— Max. distance = (5*w*d) / 1,097,780

Where w is the average width of the blade. The value of 1,097,780 is derived from the diameter of the sun, reduced by a compensation factor for the fact that the sun disk is a circle and not a square.



The wind direction reduction factor is calculated by WindPRO based on the geographic location of each receptor, turbine and the site specific wind rose. The following tables are based on detailed WindPRO output for the shadow flicker simulation. Receptor ID is across the left and turbine number on the top. Reduction values have only been calculated for turbine-receptor pairs with at least one minute of recorded shadow flicker. Empty rows and columns have been removed.

APPENDIX

B

SHADOW FLICKER RESULTS

SHADOW FLICKER RESULTS

Receptor		Location NAD83, UTM Zone 20			Worst Case [HH:MM]		Real Case [HH:MM]	Largest Contribution	
ID	Type	X	Y	Elevation	Annual	Max Daily	Annual	Turbine	Month
Lake Shore Access (SR01)	Public Place	352379	5063236	336	30:34	0:31	7:08	T04	September
Warming Shack (SR03)	House	353106	5065628	351	0:00	0:00	0:00	-	-
Chalet/Cabin (SR02)	House	353738	5065677	329	0:00	0:00	0:00	-	-

APPENDIX

C DIRECTION REDUCTION FACTORS FOR THE CORRECTED CASE

DIRECTION REDUCTION FACTORS

<<DIRECTION_REDUCTION_FACTORS>>

UD	T04	T05
Lake Shore Access (SR01)	0.63	0.57

APPENDIX

D

TURBINE LOCATIONS

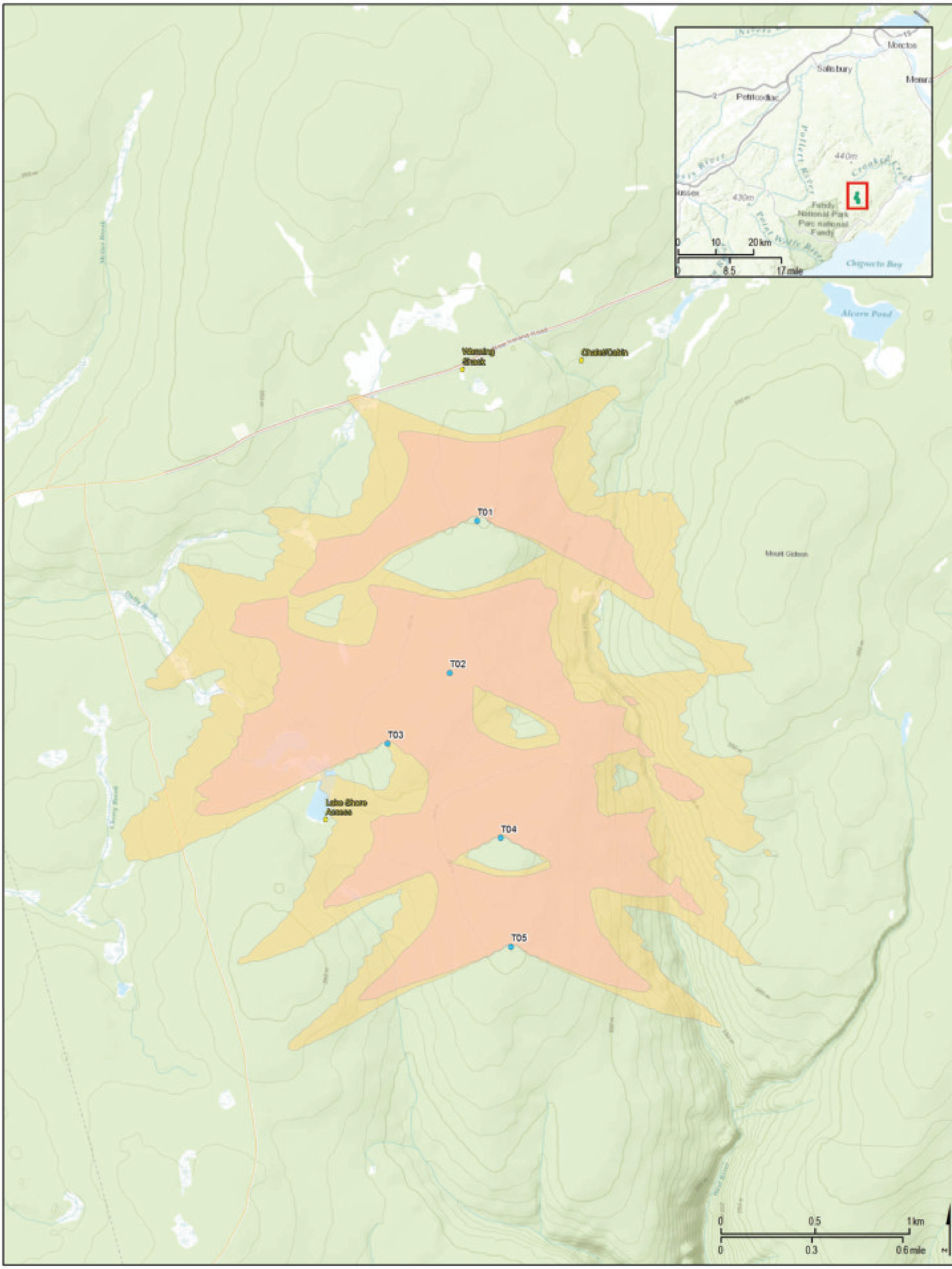
TURBINE LOCATIONS

Turbine ID	NAD 83 CSRS		Elevation [m]
	Latitude	Longitude	
T01	45° 43' 16.956" N	64° 53' 11.805" W	352
T02	45° 42' 50.646" N	64° 53' 17.636" W	358
T03	45° 42' 38.186" N	64° 53' 32.486" W	360
T04	45° 42' 22.416" N	64° 53' 4.155" W	368
T05	45° 42' 3.716" N	64° 53' 1.065" W	358

APPENDIX

E

MAPS



wsp

Wisokolamson Energy Project

Shadow Flicker Map

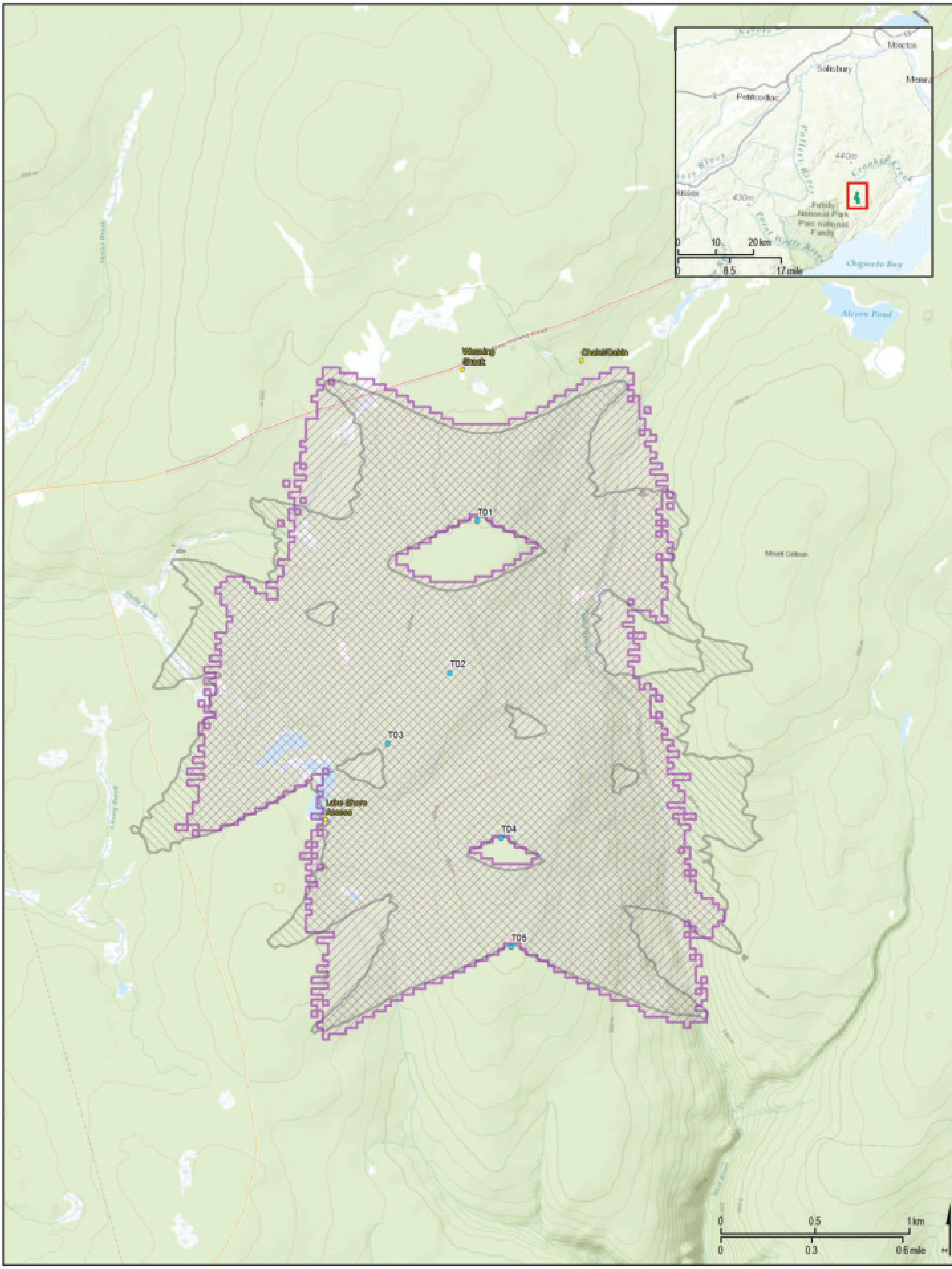
- V126-3.6 Wind Turbine
- Receptors
- Corrected Case: Exceeds 15 horus per year
- Corrected Case: Exceeds 8 hours per year

In the preparation of this map, WSP has relied upon certain information provided by the Respondent. While WSP has taken reasonable measures to present accurate information in the map, WSP does not warrant the reliability, accuracy, quality, currency, validity, or completeness of information found in the map.

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, [illegible]

Datum: NAD 83
Layout: Rev 5 2010 [illegible]
Scale: [illegible]

Produced by: WSP
Reviewed: [illegible], P. Eng
Approved: [illegible], P. Eng



- V126-3.6 Wind Turbine
- Receptors
- Worst Case: Exceeds Maximum 30 Minutes In A Day
- Worst Case: Exceeds 30 hours per year

wsp

Wisokolamson Energy Project

Shadow Flicker Map

In the preparation of this map, WSP has relied upon certain information provided by the Respondent. While WSP has taken reasonable measures to present accurate information in the map, WSP does not warrant the reliability, accuracy, quality, currency, validity, or completeness of information found in the map.

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, Increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,

Appendix

J ELECTROMAGNETIC INTERFERENCE STUDY

WISOKOLAMSON ENERGY LP

ELECTROMAGNETIC INTERFERENCE STUDY

WISOKOLAMSON ENERGY PROJECT

ELECTROMAGNETIC INTERFERENCE STUDY

WISOKOLAMSON ENERGY PROJECT

WISOKOLAMSON ENERGY LP

PROJECT NO.: 161-08790-00
DATE: APRIL 2018

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REVISION HISTORY

Version	Issue Date	Description
1	March, 2018	Analysis of the potential EMI interference at the Wisokolamson Energy Project.
2	April 3, 2018	Updated turbine locations. Edits as per client comments.

SIGNATURES

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Association of Professional Engineers and Geoscientists of Alberta

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1 EXECUTIVE SUMMARY

The Wisokolamson Energy Project is located approximately 12 kilometres southwest of the town of Riverside-Albert, New Brunswick. The goal of this EMI study is to provide information on possible electromagnetic frequency interference that may be caused by the installation of wind turbines at the wind farm. The scope of the EMI analysis was to investigate radio frequencies registered within a study area extending 120 kilometres (km) from the project's center and identify consultation zones in accordance with the Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA) guidelines[1]. Location information and frequency details were obtained from the Spectrum Management System Data[2] (SMS Data) that is administered by Industry Canada.

A total of 3,307 licenses were found in the SMS data with stations located inside a search area extending 120 km outwards from the center of the project lands[3]. Of these licenses, 1 licenses at 1 distinct location[4], was found to have consultation zones that intersect with a turbine location lands. These are the stations that this report focuses on and are summarized in Table 1, below.

The licensees of all possibly conflicting communication systems and broadcasters should be notified to assess interferences and mitigate concerns if required. As the coordinates for the stations in the SMS Data may be inaccurate by several hundred meters all relevant tower locations should be verified by high resolution air photos where possible or a site visit.

Television reception from local broadcasters may be affected by the wind farm. The RABC/CanWEA guidelines recommend that all residences within a TV service area and within 15 km of a wind turbine (for an analog service area) or 10 km (for a digital TV service area) be notified of this potential interference. All residents within the broadcasting consultation zone should be considered stakeholders and included in a public consultation. A method to record complaints from broadcasting receptors and a plan for mitigating problems should be established. Depending on the concerns of stakeholders, an impact study might include a field validation of reception before and after turbine installation. In the case of diminished reception due to turbine installation, the most cost-effective mitigation techniques for broadcasting reception include relocation of reception towers, purchase of a taller reception tower/antenna structures for TV/radio, or the purchase of cable/satellite TV/radio for affected receptors. Finally, mitigation methods can be applied in both

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[1] Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA). Technical Information and Coordination Process Between Wind Turbines and Radio communication and Radar Systems. March 4, 2010.
[2] Industry Canada Spectrum Management System, https://sms-sgs.ic.gc.ca/eic/site/sms-sgs-prod.nsf/eng/home
[3] A 8 km square area was assumed for the project lands as the exact project lands were not provided.
[4] End-points for microwave links that cross project lands have been included in this count.

the planning stages of the wind power facility and after the installation of the wind turbines.

The Industry Canada SMS Data does not list non-disclosed (protected) frequency assignments for public safety systems. These include the Federal DND, RCMP, Environment Canada, NAV CANADA, Canadian Coast Guard, provincial and municipal police services, fire departments, and ambulance services. These entities, and Industry Canada, should be notified to address any potential radiocommunication interference issues.

Table 1: Summary of Priority EMI Consultation Zones

System	Comments
Microwave Links	No line-of-sight microwave links pass through the project lands. One non-line-of-sight microwave link (frequency below 890 MHz) passes through the project lands[5].
Base Stations and Land Mobile Systems	There are no licensees operating fixed or base stations that have consultation zones that intersect project lands or have end points for point-to-point links that pass through the project lands. None of the proposed turbine locations[6] are within the consultation zones of the base station and land mobile systems.
Satellite System	The project lands do not intersect with the consultation zone of any meteorological satellite earth station. Licensees should be notified and interference concerns mitigated.
Broadcasting Stations	No TV, FM, or AM broadcasting stations were found near the project lands.
Broadcast TV Reception	The project lands are within a broadcasting reception zones. Receptors (home owners) in an around the project lands should be notified of potential interference.
RCMP	The RCMP has been contacted by Wisokolamson Energy LP to determine if there are any interference concerns.
Environment Canada Radar	The project lands do not intersect with the consultation zone of any Environment Canada weather radar station.
Civilian Radar and Navigation (NAV CANADA)	The project lands intersect with the consultation zones of one radar system and one radionav station of NAV CANADA. Wisokolamson Energy LP has contacted NAV CANADA and no interference concerns have been identified.
Civilian Aerodromes	The project lands do not intersect with the consultation zones of any aerodromes.
Military (DND) Radar, Radiocommunications and Aerodromes	DND has been consulted (as part of NAV CANADA's review of the project) and have no interference concerns.

[5] The RABC/CanWEA guidelines do not include a recommendation to consult with the licensees of low frequency links (<890 MHz) radiocommunications as wind turbines generally do not cause interference with these links. They are; however, included in the report to document their existence.
[6] WSP, Wartenbe_TurbinePositions_Opt1_20171213_V4.shp

System	Comments
Canadian Coast Guard	The Canadian Coast Guard should be contacted directly to address any interference concerns.

WSP does not anticipate significant interference with any communication systems.

2 INTRODUCTION

Wind turbines are large enough to potentially interfere with radio waves emitted from telecommunication, navigation, and radar systems. In response to the potential for interference, the Radio Advisory Board of Canada (RABC) and the Canadian Wind Energy Association (CanWEA) has issued a set of guidelines which describe the methodology for assessing electromagnetic interference caused by wind turbines[7]. This guideline specifies areas, or consultation zones, surrounding communication transmission systems based on system type and function. If a potential turbine location is within a consultation zone, the owner of the radio communication system should be contacted to assess how the potential interference will impact both parties.

The location of radiocommunication stations was determined from a search of the data from the *Spectrum Management System*[8] (SMS Data) which is administered by Industry Canada. Appropriate consultation zones were assigned to the stations, as per the RABC/CanWEA guidelines, and an analysis was performed to identify the potentially impacted stations. Licensee information for stations of interest was retrieved from the SMS Data.

The procedure to complete an Electromagnetic Interference Study can be found in the *Recommended Process* section of the RABC/CanWEA guideline and is listed below.

1. The wind project proponent develops a map showing the location of the proposed wind farm. The proponent obtains and provides preliminary information for the proposed project, including project area, representative turbine characteristics and proposed number of wind turbines.
2. The proponent sends notices of consultation with the proposed wind farm location and preliminary project information to all mandatory contacts operating non-disclosed systems.
3. The proponent determines whether any of the consultation zones for disclosed systems overlaps/intersects the proposed project area as described by these Guidelines (the RABC/CanWEA guidelines).
4. In the event that the guidelines or mandatory consultation contacts indicate that a given installation is located within a consultation zone, the proponent contacts the applicable authority/owner of the disclosed or non-disclosed systems to determine if, in fact, further investigation is warranted.
5. The proponent and applicable authority/owner of the disclosed or non-disclosed systems undertake the necessary studies and identify mitigation measures to resolve the issue to the satisfaction of both parties. The wind

[7] Radio Advisory Board of Canada (RABC) and Canadian Wind Energy Association (CanWEA). Technical Information and Coordination Process Between Wind Turbines and Radio communication and Radar Systems. March 4, 2010.
[8] Industry Canada Spectrum Management System, https://sms-sgs.ic.gc.ca/eic/site/sms-sgs-prod.nsf/eng/home

project proponent develops a map showing the location of the proposed wind farm and all the wind turbines within.

This report provides general information regarding the different types of radio communications, possible mechanisms of interference and identifies sources of potential radio communication conflict. Maps have been created which show all disclosed radiocommunication station locations and areas of potential interference between the proposed wind facility and radio signals. This includes microwave communication links that may be impacted by the potential wind facility. The radiocommunication licensees must be contacted to determine whether further interference investigation is required, particularly in cases where proposed turbine locations fall within a consultation zone. Communication tower locations, specifications, and consultation zones have been presented in this report, as well as licensee contact information for each required consultation zone based on registered frequencies.

This analysis identifies consultation zones which should be incorporated into layout design. The reader is cautioned that the coordinates listed in the SMS Data can be inaccurate by up to 200m; therefore, the locations of all on-site communication towers should be verified with a GPS and adjusted for each registered frequency. The SMS Data may also contain obsolete and prospective registered communication frequencies, so all potential conflicts should be verified.

3 BACKGROUND

The electromagnetic interference created by a wind turbine can be classified in two broad categories. The first type of interference, known as obstruction, occurs when a wind turbine is placed between a receiver and a transmitter, creating a shadowed area where the signal is weakened or blocked. The second type of interference, known as reflection, is caused by the distortion between the raw signal and a reflection of the signal from an object. Interaction between the de-synchronised counterparts can degrade the signal. Scatter is a sub-category of reflection caused by the rotor blade movement. An example of scatter occurs when a wind turbine is identified as a moving object by radar systems due to the Doppler shift from the reflection of the moving rotor blades. Additionally, the orientation of the turbine nacelle changes with wind direction and the blades pitch according to wind speed, which may cause complex interference patterns.

The specific characteristics of a wind turbine will influence the type and magnitude of the interference. Other factors that influence interference include blade dimension and design, tower height, diameter of the supporting tower, as well as the material used for blade and tower construction. Furthermore, wind turbines affect different types of signals in various ways as some telecommunication signals are more susceptible to interference than others. AM radio, for example, is affected more by the presence of wind turbines than is FM radio[9]. The guideline establishes a list of systems that should be investigated early in the wind farm development process including, but not limited to, the following:

- Point-to-Point Systems (Microwave Hops, STLs, TTLs)
- Point-to-Multipoint Systems
- Over-the-Air Reception (Master Antenna TV (MATV), Cable TV (CATV) Head Ends, MMDS Systems, VHF TV, UHF TV, DTV)
- Cellular Type Networks
- Satellite Systems (DTH, Satellite Ground Stations)
- Land Mobile Networks
- Air Defence Radars, Vessel Traffic Radars and Air Traffic Control Radars
- Weather Radars

[9] Guidelines for a Technical Engineering Report on the Environmental Impacts of Wind Turbines on Radiocommunication Services, CBC, 1400 Rene-Levesque Blvd. East, Montreal, Quebec H2L 2M2.

4 SUMMARY OF REGISTERED FREQUENCIES

The SMS data contained 3,307 license records at 3,866 distinct station-locations[10] for radiocommunication stations contained in the study area (an area extending out 120 kilometres from the project's center). Table 2 summarizes the number of station locations with consultation zones that intersect the project lands. Broadcast receptor conflicts is addressed in Section 6.4.

WSP has provided an interpretation of the Potential for Interference for the purpose of ranking the severity of the potential impact of turbine placement within any required consultation zone of each ITU class. According to the RABC/CanWEA guidelines, all communications with potential for interference should be consulted by contacting the licensee of the communication source.

[10] Unique call-sign and location combinations.

Table 2: Summary of Licensees near Project Lands

ITU Class[11]	No. of Licensee Stations in Search Area	No. of Licensee Stations Requiring Consultations	Station Type	Frequency Category	Potential for Interference [12]	Consultation Zone
AL	20	1	Aeronautical radio navigation land station		Low	1000m; up to 15 km (VOR)
AX	0	0	Aeronautical fixed station		N/A	
BC	4	0	Broadcasting station, sound	AM - TX < 3 MHz	N/A	5 km; up to 15 km
BC	56	0	Broadcasting station, sound	FM - TX > 80 MHz	N/A	2000 m
BT	8	0	Broadcasting station, television	Television	N/A	
EX	0	0	Experimental		N/A	
FA	33	0	Aeronautical station		N/A	1000 m
FB	201	0	Base station	Other - TX < 890 MHz	N/A	1000 m
FB	44	0	Base station	Cellular/Paging - TX > 890 MHz	N/A	1000 m
FC	27	0	Coast station		N/A	
FL	0	0	Land station		N/A	
FX	1,239	0	Fixed station	Land mobile network or low capacity station < 890 MHz	N/A[13]	1000 m
FX	583	0	Fixed station	Microwave TX > 890 MHz	N/A	1000 m + link
LR	13	0	Radiolocation land station		N/A	
ML	1,616	0	Land mobile station		N/A	
MO	0	0	Mobile station		N/A	
MS	5	0	Ship station		N/A	
NL	1	0	Maritime radio navigation land station		N/A	
RC	0	0	Non-directional radio beacon		N/A	
SM	0	0	Meteorological aids station	Radar	N/A	
TC	11	0	Earth station in the fixed satellite service	Satellite	N/A	
TE	0	0	Earth station in the satellite service– search and rescue	Satellite	N/A	
TM	3	0	Earth station in the meteorological-satellite service	Satellite	N/A	500 m + link

[11] Industry Canada. ITU Class of Station Decoded Fields, Spectrum Direct. https://spectrumdirect.ic.gc.ca/engdoc/decode/itu_cls.txt
[12] WSP has provided an interpretation of the Potential for Interference for the purpose of ranking the severity of the potential impact of turbine placement within any required consultation zone of each ITU class. According to the RABC/CanWEA guidelines, all communications with potential for interference should be consulted by contacting the licensee of the communication source.
[13] The RABC/CanWEA guidelines do not include a recommendation to consult with the licensees of low frequency links (<890 MHz) radiocommunications as wind turbines generally do not cause interference with these links.

5 NETWORKS

5.1 FIXED LINK SYSTEMS

Fixed link systems can be classified as either point-to-point or point-to-multipoint. Point-to-point telecommunication systems are used to transfer data from one location to another. High capacity microwave systems use radio signals in the range of 890 MHz to 40 GHz to transmit data between two specific nodes in the communication network. These systems are line-of-sight and objects within the 3 times the maximum first Fresnel zone clearance may result in interference. Low capacity links use frequencies below 890 MHz and do not depend on a clear line-of-sight for signal propagation. Point-to-point systems may function to transport a television or radio signal prior to broadcast, telephone, or other high-volume data transfer. Television and radio networks use point-to-point systems (Studio-to-Transmitter link (STL) or Transmitter-to-Transmitter link (TTL)) to send their signals over long distances prior to broadcast. Telephone and cellular phone networks also use point-to-point systems as the signal can be delivered over large distances with minimal reception loss.

Point-to-multipoint telecommunications refer to systems that provide multiple paths from a single location to multiple locations. Point-to-multipoint systems are typically used to offer cable TV (MMDS) and internet access to multiple users in sparsely populated areas, as well as data transfer from multiple sites such as oilfield or irrigation SCADA systems. This system can be treated as multiple point-to-point systems.

The rotating blades of wind turbines near point-to-point beam paths can either obstruct or cause a pulsed scatter of the signal. The result of either type of interference is signal degradation or signal interruption.

A wind power developer can avoid interference with microwave point-to-point systems by placing turbines outside of corridors linking the transmitter and receiver. The RABC/CanWEA guideline recommendations for point-to-point systems distinguish between two types of consultation zones:

1. To avoid problems due to close proximity of the tower, a 1 km consultation zone should be applied around all towers (microwave and low capacity links) and stations (receiver or transmitter).
2. In order to avoid obstructing or scattering microwave links, line of sight consultation zones are calculated between the transmitter and the receiver for all systems above 890 MHz. This is represented by a cylinder with a width based upon three times the first Fresnel zone. The width of the Fresnel zone is proportional to the signal frequency and total link length as described in the RABC/CanWEA guidelines and is designed to avoid interference with the radio reception. A turbine blade diameter of 126 m was used to calculate the link path consultation zone.

The RABC/CanWEA guidelines do not include a recommendation to consult with the licensees of low frequency links (<890 MHz) radiocommunications as wind turbines generally do not cause interference with these links. They are; however, included in the report to document their existence.

A map of the microwave links passing through the project lands and their associated consultation zones is shown in *Appendix B: Wisokolamson Energy Project Site Maps*

5.2 BASE STATIONS: LAND MOBILE NETWORKS AND CELLULAR TYPE NETWORKS

Land Mobile Networks and other Base Stations are used by police services, fire departments, farmers, emergency services, military and other private companies to communicate with moving units or mobile users located in an area. Cellular type networks refer to mobile telephone systems that use frequency or phase modulation similar to FM radio between 800 and 1900 MHz.

The RABC/CanWEA guidelines recommend a 1 km consultation zone around such transmission sources. This is a conservative guideline for consultation and turbines will often be able to operate much closer to these stations.

Land mobile networks operated by police services and military are not listed in the spectrum data. The RCMP and DND should be contacted directly to determine if any radiocommunication interference concerns exist.

5.3 SATELLITE SYSTEMS

Satellite systems can be found in three basic forms: large commercial satellite systems used for data transfer between ground stations and orbiting repeater stations; satellite systems used for space exploration; and ground receptor satellite dishes used for private television reception or Internet. The RABC/CanWEA guidelines describe the method for calculating a satellite system consultation zone using the transmitting frequency, antenna height, and the satellite's orientation. One satellite base station was found with a consultation zone that intersects project lands.

Direct-to-Home (DTH) satellite broadcasting uses geostationary satellites to provide radio and television service. Users of such services are not listed in the spectrum data. However, existing regulations for setbacks from homes (for issues such as sound levels) should ensure adequate distances between DTH users and wind turbine locations.

6 BROADCASTING

Broadcasting signals are used to deliver television and radio service to the general population. These signals are typically transmitted over a general area reaching up to 80 km. This category of radio transmission can be split into three basic groups: AM (Amplitude Modulation) radio, FM (Frequency Modulation) radio, and television (analog and digital).

Multichannel Multipoint Distribution Services (MMDS), operating at microwave frequencies, are also used for radio and television broadcasting, internet, and IP telephone service. Any stations of this type will be assigned a consultation zone similar to a television broadcasting station

6.1 AM SIGNALS

The mechanism behind AM data transfer is modulation of the amplitude of a set frequency. This type of broadcasting system has relatively low capacity for data content. AM signals used for radio broadcasting typically operate in the frequency range of 0.525 MHz to 1.705 MHz[14]. Tall structures made of electrically conductive materials, such as wind turbines, can modify the radiation patterns of AM stations and may cause reception problems and interference with other stations.

6.2 FM SIGNALS

FM signals are typically used for audio broadcasting and operate in the frequency range of 87.5 to 108 MHz[15]. This technology incorporates frequency modulation of a signal to broad areas of reception. FM radio is less susceptible to interference than AM radio.

6.3 TELEVISION

Analogue and digital television signals are located in several bands of frequencies including the range of 54-72 MHz for channels 2-4, 76-88 MHz for channels 5-6, 174-216 MHz for channels 7-13, 470-608 MHz for channels 14-36 and 614-698 MHz for channels 38 51[16]. Examples of interference in television reception could include picture shadow caused by reflection from an obstacle, or picture flicker caused by the rotating blades of a turbine.

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[14] < https://en.wikipedia.org/wiki/Broadcast_band >, Wikipedia, The Free Encyclopedia, Accessed December 2017.
[15] < https://en.wikipedia.org/wiki/Broadcast_band >, Wikipedia, The Free Encyclopedia, Accessed December 2017.
[16] <http://en.wikipedia.org/wiki/North_American_broadcast_television_frequencies>, Wikipedia, The Free Encyclopedia, Accessed December 2017.

6.4 MITIGATION FOR BROADCASTING STATIONS

According to the Canadian Broadcasting Corporation guidelines[17], a 2 km buffer is recommended around all television stations, a 2 km buffer for FM radio broadcasting transmitters, a 5 km buffer for omnidirectional AM radio broadcasting transmitters, and 15 km around directional AM radio broadcasting transmitters.

Based on the RABC/CanWEA guidelines, a public consultation should be organised for all broadcasting receptors in the vicinity of the wind power project. The consultation zone for broadcasting receptors is based upon a 10 km buffer around each turbine for digital TV and 15 km for analog TV.

The service areas[18] of TV broadcasters are retrieved as part of this analysis. The TV broadcast service areas and consultation zones are shown in *Appendix B: Wisokolamson Energy Project Site Maps*. Broadcaster information is provided in *Appendix A: Industry Canada Spectrum Management System Data*. A 10 km consultation buffer was applied to the proposed location of each turbine since all stations are broadcasting a digital signal.

Residents with a potential for interference should be notified about the potential reception interference risk in a public stakeholder meeting. This notification should provide details for a process of recording complaints of reception interference. In the case of a complaint, a third party communications engineer can be contracted to determine the protected service contour for each station, and measure the broadcasting signal to confirm affected dwellings. Mitigation methods might include the purchase of a taller reception tower for the affected residents, or providing a subscription for cable or satellite TV.

[17] Guidelines for a Technical Engineering Report on the Environmental Impacts of Wind Turbines on Radiocommunication Services, CBC, 1400 Rene-Levesque Blvd. East, Montreal, Quebec H2L 2M2.
[18] Industry Canada. Broadcast Contours. https://sms-sgs.ic.gc.ca/eic/site/sms-sgs-prod.nsf/eng/h_00015.html

7 RADAR

The potential impacts of wind turbines on radar (radio detection and ranging) systems are difficult to assess and usually require a case-by-case analysis. Interference is heavily dependent on topography, land cover, existing obstacles and other terrain features. The RABC/CanWEA guidelines[1] have established large consultation areas around radar facilities. Improper placement of turbines may render a radar station inoperable or severely compromised. In order to avoid such situations, a proper investigation must be performed in the planning process of a wind energy project. Under certain circumstances, even if a project is within the consultation zone of a radar station, it is possible for the interference effects to be mitigated.

Most radar systems operate within the 1 GHz to 10 GHz frequency band[19]. These systems are used mainly for aeronautical and maritime navigation, as well as for meteorological forecasting. Radar systems involve the transmission of radio waves in a sweeping or burst pattern and an antenna that collects waves reflected (scattered) by objects in the vicinity. By filtering the scattered electromagnetic waves, the radar operator is capable of identifying the range and size of fixed objects and the direction, altitude, size, range, and speed of moving objects. Conductive objects are more likely to reflect the electromagnetic waves.

Although most radar systems are capable of filtering unwanted echoes (clutter) from fixed obstacles, the rotating blades of wind turbines can generate dynamic interference which is difficult to filter. The problem is amplified because the turbine nacelle may rotate 360° based upon wind direction at hard to predict intervals.

The following section discusses three types of radar systems identified by the RABC/CanWEA guidelines which may have potential conflict with wind turbines.

7.1 WEATHER RADARS

Environment Canada (EC) operates the Canadian Weather Radar Network, which consists of 31 Doppler radar stations installed throughout the country. These radars are used for the purpose of meteorological forecasting, and also serve as a public safety tool by detecting severe weather events in advance. Environment Canada uses weather radar stations in order to locate and identify types of precipitation and forecast changes in position and intensity of meteorological activity. In addition, weather radar services such as hail monitoring programs are provided by private companies throughout Canada.

[19] Canadian Table of Frequency Allocations 9 kHz to 275 GHz (2005 Edition), Spectrum Management and Telecommunications, Industry Canada. Last amended February 2007

Turbines may cause interference by either obstruction or by creating Doppler shift of the signal via reflection from their rotating blades. In addition, wake induced turbulence may be detected by these radar systems.

Weather radars use various techniques that differ from aeronautical radar systems. They typically are located in regions with a clear line-of-sight far into the horizon. Weather radar systems are often located on high topographical features, allowing far-reaching radar detection at low altitudes (negative depression angle). In contrast, aeronautical radar stations are typically focused towards flying objects above the horizon. The target detection zone of weather radar systems results in a particular sensitivity to wind power projects, especially if there is clear line of sight between the radar and the turbines.

The RABC/CanWEA guidelines have recommended that a 50 kilometre radius consultation zone be applied around weather radar systems. Environment Canada has provided positions of their weather radars. Table 3 shows the location and the name of the closest weather radar to the wind power project, as well as the approximate distance that separates it from the study area.

Table 3: Environment Canada Radar Stations near the Project

Radar ID	Latitude	Longitude	Distance to Project (km)
Chipman, NB (XNC)	46.2221	-65.6994	84

7.2 AIR TRAFFIC CONTROL RADARS AND CIVILIAN AIRFIELDS

Most air traffic control radars are located in the vicinity of major airports. In addition, they can be located along major aerial traffic routes distant from populated regions. Air traffic control radars can be affected by the presence of wind turbines obstructing their line of sight. Although they typically sweep high altitude areas, large obstacles such as wind turbines may be difficult to differentiate from a flying object, especially if they are placed on ridges or in clusters. In addition, the signal from a plane may be lost when passing behind a cluster of wind turbines. A commercial wind turbine is equipped with blades that are comparable in length with a medium range airliner (a Boeing 737-400 is 36.4 m long).

NAV CANADA, a private company that provides civil air navigation services for Canada, operates all of the civilian air traffic control radars. The RABC/CanWEA guidelines have recommended that an 80 km radius consultation zone be applied around NAV CANADA Primary Surveillance Radars (PSR) and a 10 km consultation zone around Secondary Surveillance Radars (SSR). The RABC/CanWEA guidelines have also recommended that a minimal 10 km radius consultation zone be applied around any major civilian airfield to avoid the possibility of a collision between planes and wind turbines. A consultation zone of 15 km should be applied to all VOR beacons. There are no major civilian airfields within 10 km of the Wisokolamson Energy Project.

NAV CANADA has supplied WSP with the location of all of their radar stations in Canada. The project lands are within the consultation zone of the Caledonia Mountain NAV CANADA radar station. Wisokolamson Energy LP has contacted NAV CANADA and no interference concerns have been identified.

NAV CANADA also maintains a database of all Canadian Aerodromes and Water Aerodromes. This database can be accessed using the Canadian Flight Supplement or Canadian Water Aerodrome Supplement. Based on the information contained in these documents, there are no Aerodromes with a consultation zone that intersects project lands.

7.3 MILITARY RADARS AND AIRPORTS

The Department of National Defence operates Air Defence Radars which provide the capability for the detection of foreign aircraft. This network is comprised of radars located throughout the country. This radar network represents a portion of Canada's contribution to NORAD and is considered more sensitive than civilian airfield infrastructure. The RABC/CanWEA guidelines have recommended that a 100 km radius consultation zone be applied around DND Air Defence Radars, 80 km around Primary Surveillance Radars (PSR) and 40 km for DND Precision Approach Radars (PAR). The RABC/CanWEA guidelines have also recommended that a minimal 10 km radius consultation zone be applied around any major military airfield.

DND has been notified of the Wisokolamson Energy Project as part of the NAV CANADA consultation conducted by Wisokolamson Energy LP and no interference concerns have been identified.

8 CONCLUSION

The results of the investigation into potential electromagnetic interferences at the Wisokolamson Energy Project have been compiled and presented in Table 2. There are no high capacity microwave links passing through the project areas studied in this report. The project lands are within the consultation zone of the Caledonia Mountain NAV CANADA radar station.

The consultation zones indicated on the maps found in *Appendix B: Wisokolamson Energy Project Site Maps* should be investigated during the turbine layout design. Licensee contact information can be cross referenced between the maps in *Appendix B: Wisokolamson Energy Project Site Maps* and tables in *Appendix A: Industry Canada Spectrum Management System Data*.

Wisokolamson Energy LP has been in contact with NAV CANADA, DND, Environment Canada, the RCMP, and the Canadian Coast Guard regarding the Wisokolamson Energy Project. No interference concerns have been raised.

Television reception from local broadcasters may be affected by the wind farm. The RABC/CanWEA guidelines recommend that all residents within the broadcasting consultation zone should be considered stakeholders and included in a public consultation. A method to record complaints from broadcasting receptors and a plan for mitigating problems should be established. Depending on the concerns of stakeholders, an impact study might include a field validation of reception before and after turbine installation. In the case of diminished reception due to turbine installation, the most cost-effective mitigation techniques for broadcasting reception include relocation of reception towers, purchase of a taller reception tower/antenna structures for TV/radio, or the purchase of cable/satellite TV/radio for affected receptors. Finally, mitigation methods can be applied in both the planning stages of wind power facility and after the installation of the wind turbines.

APPENDIX

A

INDUSTRY CANADA SPECTRUM MANAGEMENT SYSTEM DATA

Table 4: Low Capacity Microwave Fixed Links with Consultation Zones Passing Through Project Lands

Origin Station Call Sign	Origin Station Location NAD 83 Zone 10N		Frequency (GHz)	Licensee	Address	License #	Link Station Call Sign	Link Station Location NAD 83 Zone 10N	
	Easting	Northing						Easting	Northing
VEF607	344501	5050675	0.466	VILLAGE OF ALMA	8 SCHOOL STREET,ALMA,NB,E4H 1L2	010412119-001	VEF605	364115	5074301
VEF605	364115	5074301	0.461	VILLAGE OF ALMA	8 SCHOOL STREET,ALMA,NB,E4H 1L2	010412119-001	VEF607	344501	5050675

Table 5: Licensees of Fixed and Base Stations with Consultation Zones Intersecting Project Lands[20]

Licensee	Address	NAD 83 Zone 10N		Licensee	Call Sign	TX (MHz)	RX (MHz)
		Easting	Northing				
NAV CANADA CNS ENGINEERING	1601 TOM ROBERTS, PO BOX 9824 STN T, OTTAWA, ON, K1G 6R2	360884	5079499	010651893-001	XLI738	1336 1335 132.5 1311 1310	1336 1335 132.5 1311 1310

[20] May also include the end-points of high capacity (greater than 890 MHz) point-to-point links that intersect with the project lands.

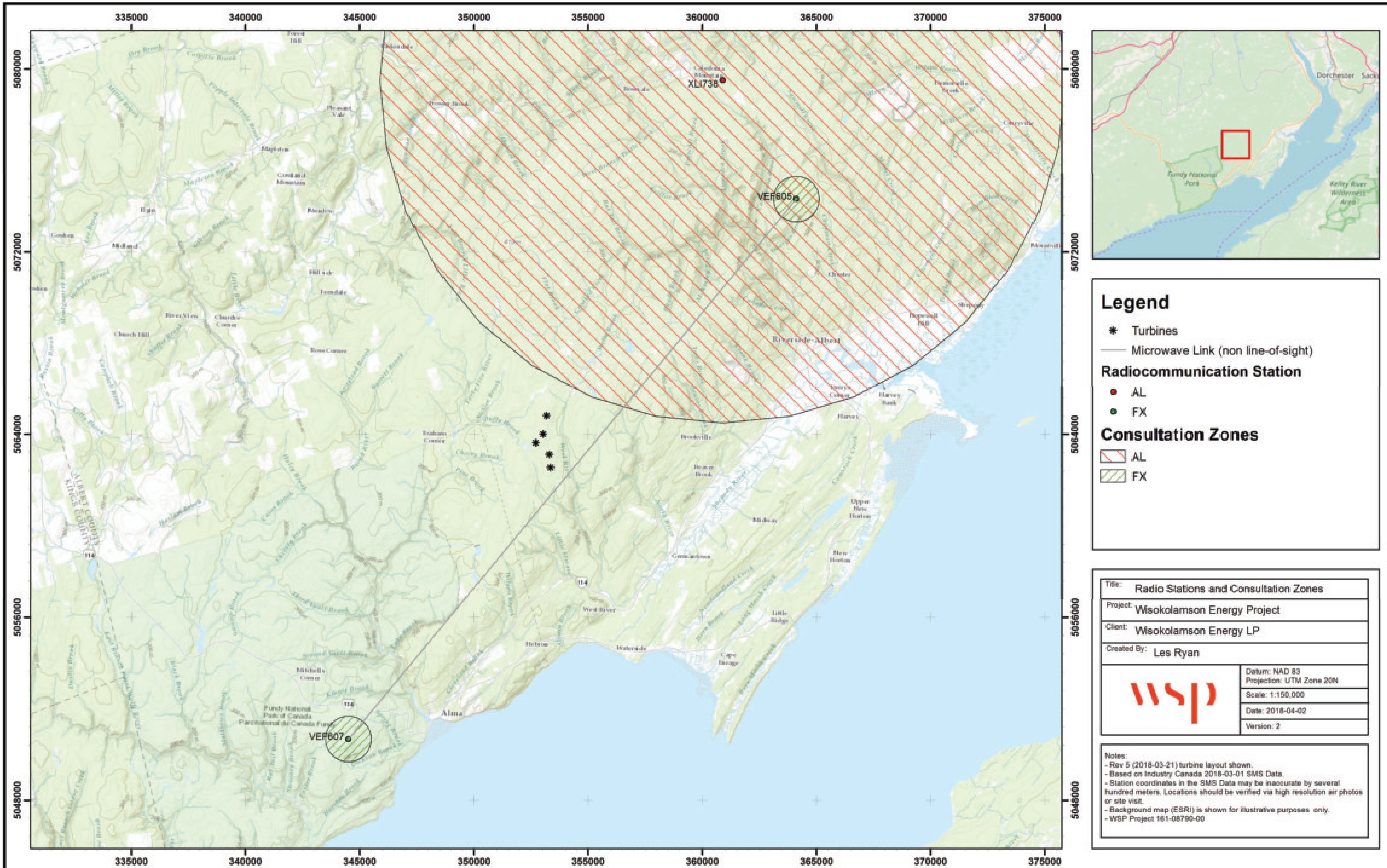
Table 6: TV Broadcasters with Reception Areas in the Vicinity of Project Lands

Call Sign	NAD 83 Zone 10N		Type	Station Location	Licensee	Address
	Easting	Northing				
CKCW-DT	359281	5079195	Digital	Moncton	Bell Media Inc.	299 Queen Street West,Toronto,ON,M5V2Z5
CIHF-DT-3	364115	5074332	Digital	Moncton	Corus Television Limited Partnership	25 Dockside Drive,Toronto,ON,M5A 0B5
CIHF-DT-5	393265	4988750	Digital	Wolfville	Corus Television Limited Partnership	25 Dockside Drive,Toronto,ON,M5A 0B5
CBAFT-DT	353090	5111794	Digital	Moncton	CBC/ Radio-Canada	1400, boul René-Lévesque E,Montréal,QC,H2L 2M2

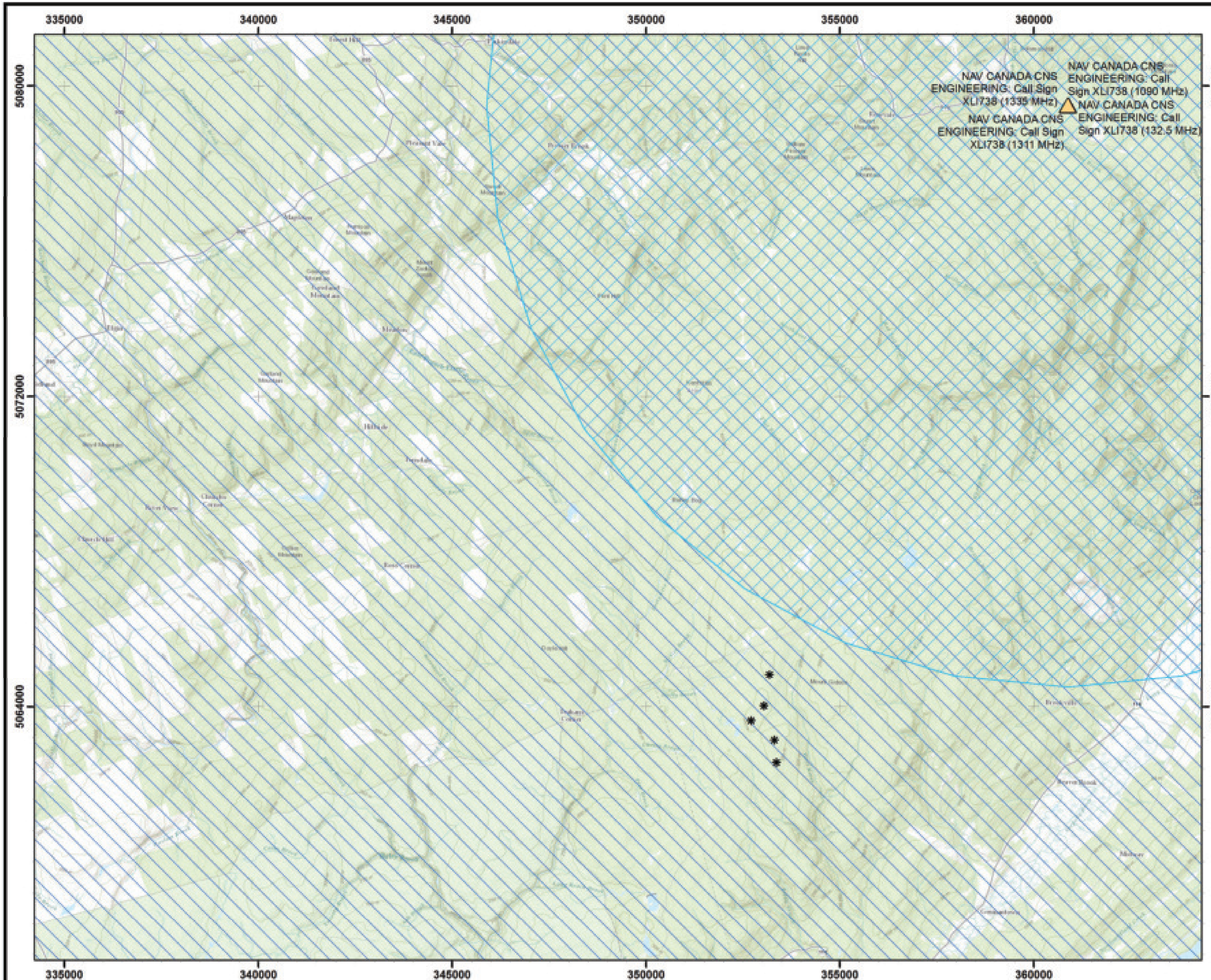
APPENDIX

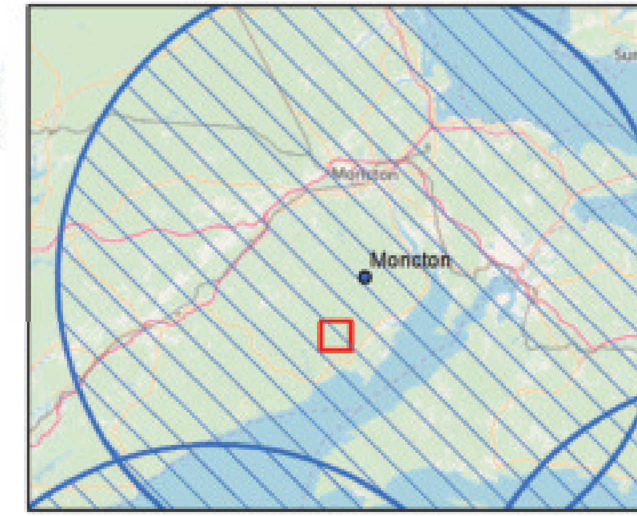
B

WISOKOLAMSON ENERGY PROJECT SITE MAPS



Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community



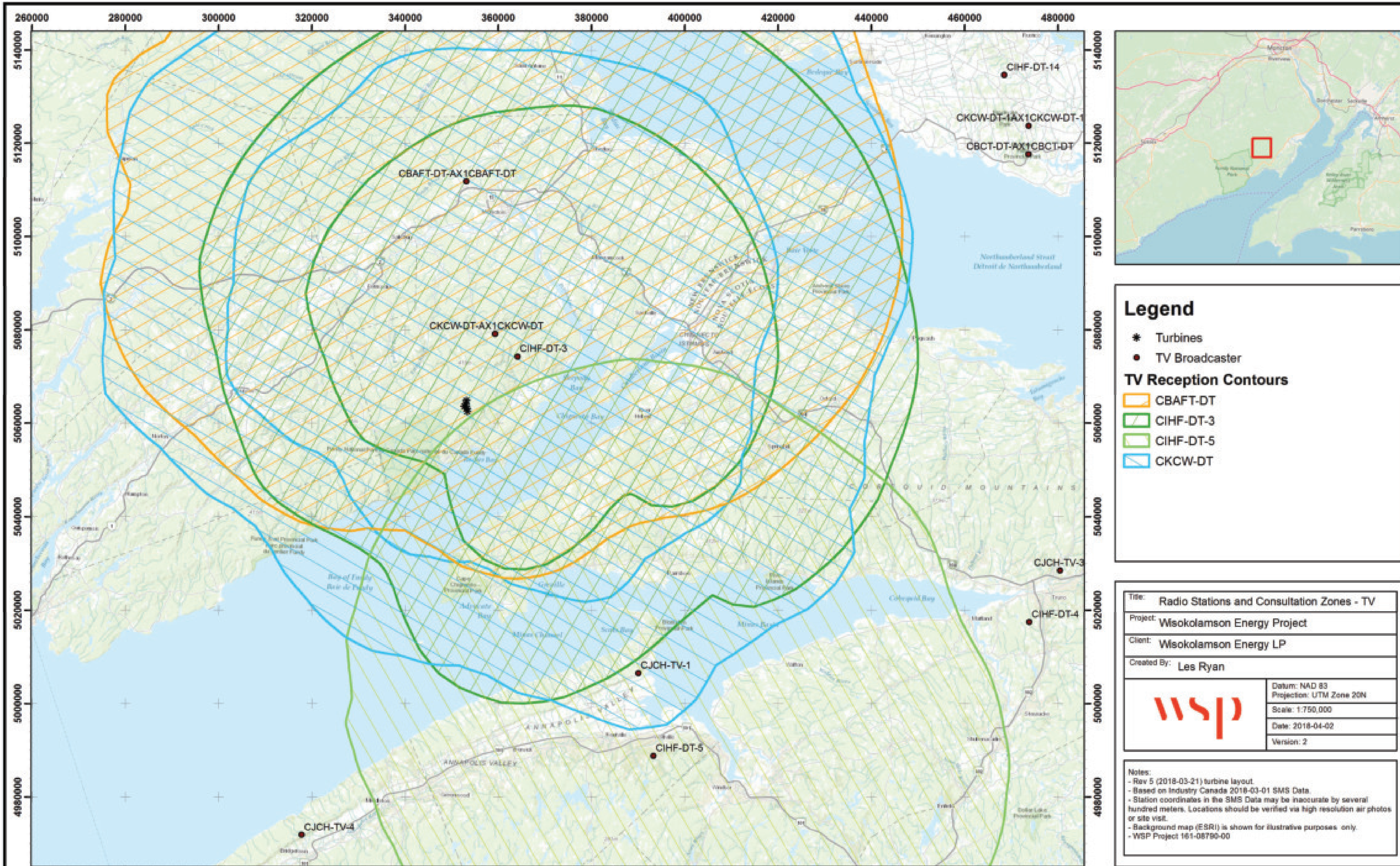


Legend

- ✱ Turbines
- Aeronautical Radionav Land Station
- NAV CANADA Radar Buffer
- Aeronautical Radionav Consultation Zone

Title: Radio Stations and Consultation Zones - Nav	
Project: Wisokolamson Energy Project	
Client: Wisokolamson Energy LP	
Created By: Les Ryan	
wsp	Datum: NAD 83 Projection: UTM Zone 20N
	Scale: 1:100,000
	Date: 2018-04-02
	Version: 2

Notes:
- Rev 5 (2018-03-21) turbine layout.
- Based on Industry Canada 2018-03-01 SMS Data.
- Station coordinates in the SMS Data may be inaccurate by several hundred meters. Locations should be verified via high resolution air photos or site visit.
- Background map (ESRI) is shown for illustrative purposes only.
- WSP Project 161-08790-00



Legend

- ✱ Turbines
- ● TV Broadcaster

TV Reception Contours

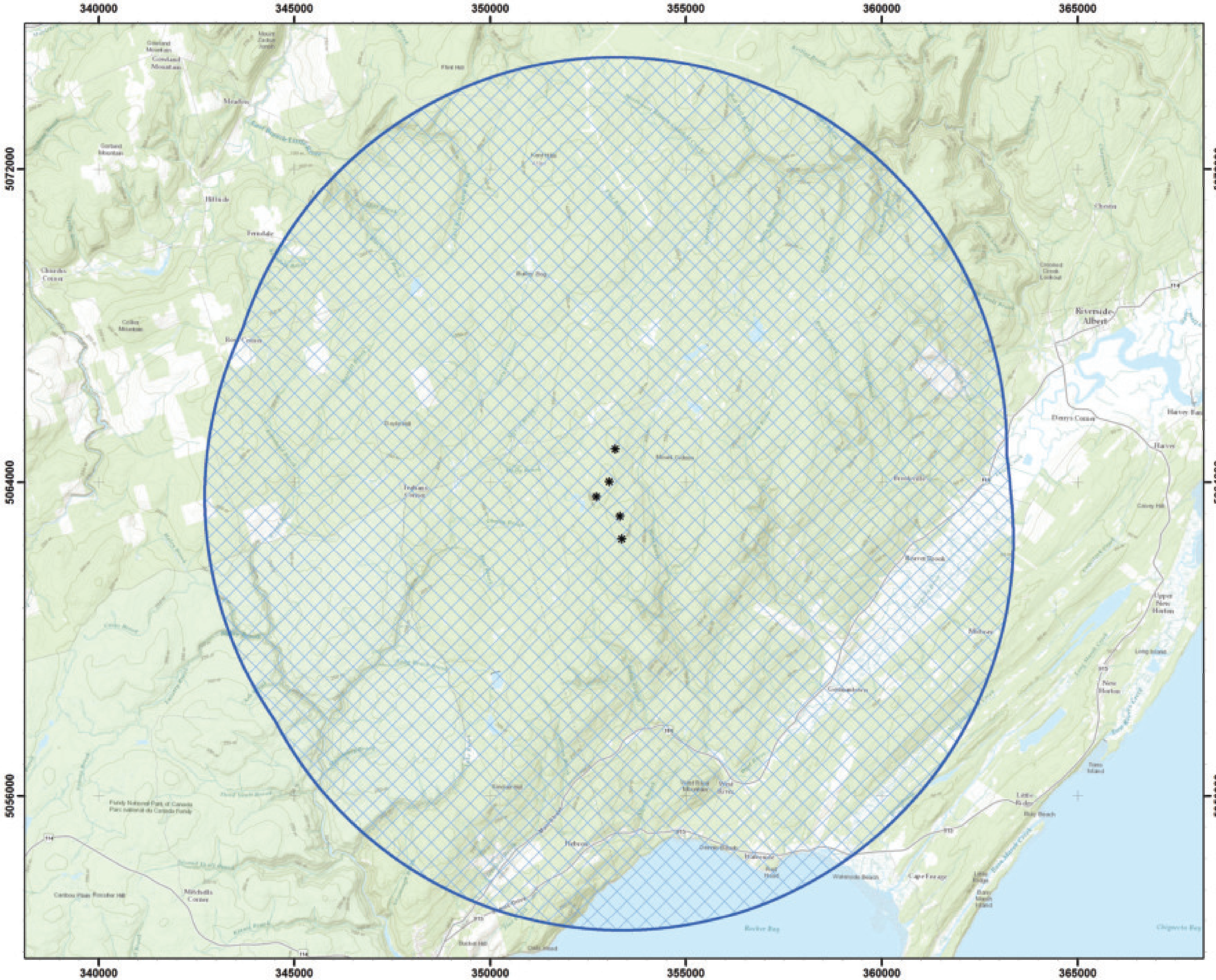
- CBAFT-DT
- CIHF-DT-3
- CIHF-DT-5
- CKCW-DT

Title:	Radio Stations and Consultation Zones - TV
Project:	Wisokolamson Energy Project
Client:	Wisokolamson Energy LP
Created By:	Les Ryan

wsp

Datum: NAD 83
Projection: UTM Zone 20N
Scale: 1:750,000
Date: 2018-04-02
Version: 2

Notes:
- Rev 5 (2018-03-21) turbine layout.
- Based on Industry Canada 2018-03-01 SMS Data.
- Station coordinates in the SMS Data may be inaccurate by several hundred meters. Locations should be verified via high resolution air photos or site visit.
- Background map (ESRI) is shown for illustrative purposes only.
- WSP Project 161-08790-00



Legend

- ✱ Turbines
- Digital TV Reception Consultation Zone

Title:	TV Reception Consultation Zones
Project:	Wisokolamson Energy Project
Client:	Wisokolamson Energy LP
Created By:	Les Ryan
Datum: NAD 83 Projection: UTM Zone 20N	
Scale: 1:100,000	
Date: 2018-04-02	
Version: 2	

Notes:
- Rev 5 (2018-03-21) turbine layout.
- Based on Industry Canada 2018-03-01 SMS Data.
- Station coordinates in the SMS Data may be inaccurate by several hundred meters. Locations should be verified via high resolution air photos or site visit.
- Background map (ESRI) is shown for illustrative purposes only.
- WSP Project 161-08790-00