MELVIN LAKE WIND PROJECT

Environmental Assessment Registration Document

Prepared for: Melvin Lake Wind Inc.

strum CONSULTING

November 21, 2024

November 21, 2024

Ms. Meghan Rafferty
Nova Scotia Department of Environment & Climate Change
Environmental Assessment Branch
#2085 - 1903 Barrington Street
PO Box 442
Halifax, NS B3J 2P8

Dear Ms. Rafferty,

Re: Environmental Assessment Registration Document
Melvin Lake Wind Project

Please find enclosed the Environmental Assessment Registration Document for the Melvin Lake Wind Project.

The undersigned approves and accepts the contents, as submitted to Nova Scotia Environment & Climate Change, Environmental Assessment Branch.

Sincerely,

Robin Reese
Director
Melvin Lake Wind Inc.

EXECUTIVE SUMMARY

Melvin Lake Wind Inc. acknowledges that the Melvin Lake Wind Project is in Mi'kma'ki, the traditional and unceded territory of the Mi'kmaq people.

Melvin Lake Wind Inc. proposes to construct and operate the Melvin Lake Wind Project, an up to 161 megawatt (MW) wind development located near the community of Pockwock, in Halifax Regional Municipality and East Hants, Nova Scotia. The Project will consist of up to 23 wind turbines along with associated infrastructure, including access roads, substation, and interconnection lines. The development of this Project will support Nova Scotia in their target of producing 80% renewable energy by 2030, reducing the provinces dependency on coal generated electricity.

The Project is considered a Class I Undertaking under Schedule A of the Nova Scotia Environmental Assessment Regulations, NS Reg 26/95, and therefore, requires the registration of an Environmental Assessment Registration document. The Environmental Assessment Registration document has been completed according to methodologies and requirements outlined in A Proponent's Guide to Environmental Assessment, and has incorporated guidance from the Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia.

Several Valued Components were identified and evaluated as part of this assessment. Based on provincial guidance, desktop analysis, and subsequent field studies. Valued Components determined for assessment were as follows:

- Atmospheric Environment
- Geophysical Environment
- Aquatic Environment
- Terrestrial Environment
- Socioeconomic Environment
- Archaeological and Cultural Resources
- Human Health
- Electromagnetic Interference
- Shadow Flicker
- Visual Aesthetics
- Sound

The results of the assessment indicated that the Project, with the implementation of mitigation and monitoring measures, will not result in significant adverse residual effects. The Project will also have a positive residual effect associated with the reduction of greenhouse gas emissions (i.e., production of renewable energy) and economic prosperity within Nova Scotia. The Project was also determined to not act cumulatively with nearby developments.

Melvin Lake Wind Inc. has, and will continue, to engage and collaborate with local communities, the Mi'kmaq of Nova Scotia, and government representatives to ensure that any potential concerns identified in association with the Project are addressed and mitigated.

TABLE OF CONTENTS

page

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AAQS	Ambient Air Quality Standards
ACCDC	Atlantic Canada Conservation Data Centre
AFNWA	Atlantic First Nations Water Authority
APCFNS	Atlantic Policy Congress of First Nations Chiefs Secretariat
AQHI	Air Quality Health Index
ARD	Acid rock drainage
ARIA	Archaeological Resource Impact Assessment
ARS	Avian radar system
ATV	All-terrain vehicle
ATVANS	All-Terrain Vehicle Association of Nova Scotia
AVDI	Average total diametre
BMP	Best Management Practices
BS	Black spruce
BT	Biological targets
°C	Degrees celsius
CAAQS	Canadian Ambient Air Quality Standards
CanREA	Canadian Renewable Energy Association
CCG	Canadian Coast Guard
CCME	Canadian Council of Ministers of the Environment
CCOHS	Canadian Centre for Occupational Health and Safety
CEPA	Canadian Environmental Protection Act
CH_4	Methane
CIB	Canada Infrastructure Bank
CLC	Community Liaison Committee
cm	Centimetres
CMM	Confederation of Mainland Mi’kmaq
CNWI	Canadian Wetland Inventory
CO	Carbon monoxide
CO_2e	Carbon dioxide equivalent
CONI	Common Nightjar
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPWS	Canadian Parks and Wilderness Society
CSD	Census subdivision
CWS	Canadian Wildlife Service
dB	Decibels
dBA	Decibels A (sound level)
DBH	Diameter at breast height
DEM	Digital elevation model
DFO	Fisheries and Oceans Canada
DNA	Deoxyribonucleic acid
DND	Department of National Defense
DO	Dissolved oxygen

EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EMF	Electromagnetic field
EMI	Electromagnetic interference
EMO	Emergency Management Office
EPFU	Big brown bat
ERP	Emergency Response Plan
ESA	*Endangered Species Act*
ESRI	Environmental Systems Research Institute
FAC	Facultative
FACU	Facultative upland
FACW	Facultative wetland
FEC	Forest Ecosystem Classification
FORNON	Forest/non-forest
FWI	Fire Weather Index
GCP	Green Choice Program
GHG	Greenhouse gas
GIS	Geographic Information System
GPS	Global Positioning System
ha	Hectares
HRM	Halifax Regional Municipality
HSI	Habitat suitability index
HV	High voltage
IBA	Important Bird Areas
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IPCC	Intergovernmental Panel on Climate Change
ISED	Innovation, Science and Economic Development Canada
kg	Kilogram
kg/MW	Kilogram per megawatt
km	Kilometre
Km^2	Square kilometre
km/h	Kilometre per hour
KMKNO	Kwilmu'kw Maw-klusuaqn Negotiation Office
kPa	Kilopascal
kV	Kilovolt
kW	Kilowatt
kWh/year	Kilowatt hour per year
LAA	Local Assessment Area
LABO	Eastern red bat
LACI	Hoary bat
LANO	Silver-haired bat
Lpm	Liters per minute
m	Metre
m/s	Metres per second

m^2	Metres squared
m^2/day	Square metres per day
m^3	Cubic metre
masl	Metres above sea level
MBBA	Maritime Bird Breeding Atlas
MBCA	Migratory Bird Conservation Act
MBII	Migratory bird interaction index
MD	municipal district
MEKS	Mi'kmaq Ecological Knowledge Study
MHz	Megahertz
MLA	Member of the Legislative Assembly
mm	Millimetre
MOU	Memorandum of Understanding
MP	Member of Parliament
mS/cm	Milisiemens per centimetre
MW	Megawatts
MYOT	Myotis species
N_2O	Nitrous oxide
NFC	Night flight call
NI	No indicator
NL	Not listed
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrous oxide
NREL	National Renewable Energy Laboratory
NS	Nova Scotia
NS AAQS	NS Ambient air quality standards
NSAQR	Nova Scotian Air Quality Regulation
NSCCTH	NS Communities, Culture, Tourism and Heritage
NSECC	Nova Scotia Environment and Climate Change
NSDPW	Nova Scotia Department of Public Works
NSNRR	Nova Scotia Natural Resources and Renewables
NSPW	Nova Scotia Public Works
O_3	Ozone
OBL	Obligate
OLA	Office of L'nu Affairs
PC	Point count
PESU	Tri-coloured bat
PGI	Pellet group inventory
PID	Premises identification
PM	Particulate matter
ppb	Parts per billion
PPE	Personal protective equipment
RAA	Regional assessment area

RABC	Radio Advisory Board of Canada
RCMP	Royal Canadian Mounted Police
RFP	Request for Proposals
RM	Red maple
RS	Red spruce
ROW	Right of way
RU	Rural Zone
SANS	Snowmobilers Association of Nova Scotia
SAR	Species at Risk
SARA	*Species at Risk Act*
SCADA	Supervisory Control and Data Acquisition
SD	Secure digital
SGEM	Nova Scotia Silvicultural Guide for the Ecological Matrix
SM4	Song Meter 4
SMATVA	Safety Minded All-Terrain Vehicle Association
SMBSA	St. Margaret's Bay Stewardship Association
SMPZ	Special Management Practice Zones
SO_2	Sulphur dioxide
SOCI	Species of Conservation Interest
SO_x	Sulfur oxides
SP1	Leading Species
SREP	Smart Renewables and Electrification Pathways
S-Rank	Subnational rank
tCO_2e	Tonnes of carbon dioxide equivalent
tCO_2e/kg	Tonnes of carbon dioxide equivalent per kilogram
tCO_2e/tonne·km	Tonnes of carbon dioxide equivalent per Tonnes by kilometer
tCO_2e/year	Tonnes of carbon dioxide equivalent per year
TRS	Total reduced sulphur
TSP	Total Suspended Particulate
µm	Micrometres
$µm/m^3$	Micrograms per cubic metre
UNKWN	Unknown bat
UNLO	Unknown low frequency bat
UNHI	Unknown high frequency bat
UPL	Upland
UTM	Universal Transverse Mercator
VC	Valued Component
WAM	Wet Area Mapping
WESP-AC	Wetland Ecosystem Services Protocol – Atlantic Canada
WMA	Wskijnu'k Mtmo'taqnuow Agency
WP	White pine
WSS	Wetlands of Special Significance
WT	Wind turbine
YB	Yellow birch

LIST OF DRAWINGS

LIST OF APPENDICES

1.0 PROPONENT DESCRIPTION

Melvin Lake Wind Inc. (the Proponent), a majority equity owned Mi'kmaq company, in partnership with ABO Energy Canada Ltd., is proposing to plan, develop, finance, construct, own, and operate the Melvin Lake Wind Project (the Project). ABO Energy Canada Ltd. is a Canadian renewable energy developer based in Halifax, Nova Scotia (NS).

The Proponent retained Strum Consulting to support the development and submission of the Environmental Assessment (EA) Registration Document. Strum Consulting is an independent multi-disciplinary team of consultants with extensive experience in undertaking EAs throughout Atlantic Canada. Contact information for the Proponent and their consultant is included in Table 1.1.

Table 1.1: Proponent and Consultant Contact Information

Proponent Information	
Project Name	Melvin Lake Wind Project
Proponent Name	Melvin Lake Wind Inc.
Chief Executive Officer(s) / Principal(s)	Robin Reese, Managing Director, ABO Energy Canada Ltd.
Mailing and Street Address	ABO Energy Canada Ltd. 200 - 2111 Maitland Street Halifax, NS B3K 2Z8
Website	www.melvinlakewind.ca
Proponent Contact Information for the EA Registration	Jesse Cameron, Project Manager Phone: +1 (902) 439-8111 Email: jesse.cameron@aboenergy.com
Consultant Information	
Name of Consultant	Strum Consulting
Mailing and Street Address	Strum Consulting #210 – 211 Horseshoe Lake Drive Halifax, NS B3S 0B9
EA Contact	Heather Mosher, Senior Environmental Scientist Phone: 902-835-5560 Email: hmosher@strum.com

2.0 PROJECT INFORMATION

2.1 Project Introduction

The Proponent proposes to develop, construct, and operate the up to 161 megawatt (MW) Project located on crown and private lands in the Municipality of East Hants and Halifax Regional Municipality, near the communities of Upper Hammonds Plains and Pockwock, NS (Drawing 2.1). The approximate center of the Project is located at 44.803222° N, 63.901563° W. The Project will consist of up to 23 turbines rated up to 7.0 MW (Drawing 2.2), access roads, above-ground collector lines, interconnecting transmission system, substation, and the associated infrastructure for the aforementioned facilities.

The Project location was selected based on a number of factors, including proximity to existing electrical and civil infrastructure, wind speed, previous disturbance from forestry activity, network of existing access roads, and distances from nearest residences. The Project will interconnect to NS Power's transmission system through a direct line tap to the 138 kilovolt (kV) L-6011 transmission line, located approximately 660 metres (m) from the proposed substation.

The Study Area including the land parcels on which the Project was proposed (Drawing 2.2) and further defined in Section 3.0 consists of private and Crown lands, which are currently utilized for forestry and silviculture. All Project turbines, substation, and transmission lines are located on private lands, and associated infrastructure (access roads and collector lines) are located on a mix of Crown and private lands. The Proponent has secured the land required through lease agreements on private properties and is currently working with the Nova Scotia Natural Resources and Renewables (NSNRR) to obtain an easement for ancillary infrastructure planned on Crown lands.

Upon approval of the EA Registration Document, construction activities are proposed to begin in 2026 and, once constructed, the Project is expected to be operational in 2028 for a minimum of 25 to 30 years.

2.2 Purpose and Need for the Undertaking

As part of the Clean Power Plan released in fall 2023, the Government of Nova Scotia set targets of producing 80% renewable energy by 2030 and cutting greenhouse gas emissions produced from electricity by 90%. The development of wind energy is expected to be a significant part of achieving these goals. The Project has been proposed in support of this renewable energy target. Dependence on fossil fuels increases the vulnerability of Nova Scotians to rising international energy prices, weakens energy security, and takes valuable revenue out of the province, further leading Nova Scotia towards a preference for renewable energy (Province of NS, 2015). Negative impacts to human health (particularly in developing countries) and the environment, mainly in the form of climate change, are among the widely cited challenges associated with fossil fuel consumption around the world.

In its assessment report, "Climate Change 2022 - Impacts, Adaptation and Vulnerability", the United Nations Intergovernmental Panel on Climate Change (IPCC) provides a detailed synopsis of the impacts associated with climate change on both global and regional scales. Evidence from all continents indicates that many biological systems and habitats are currently being affected by regional climate change. Ecological changes include changes to the thermal dynamics and quality of aquatic habitats, shifts in migratory timing and ranges of fauna and flora, changes in fish abundance, and increased risk of extinction and loss of forest habitat (IPCC, 2022). In North America specifically, the increase in ground, water, and atmospheric temperatures has resulted in direct mortality and redistribution of flora and fauna species. In addition, coastal flooding along with an increase in the frequency and intensity of extreme weather events will continue to impact the socioeconomic environment through displacement and / or damage to communities and economies (IPCC, 2022). Impacts of climate change are, and will increasingly be felt, across environmental, social, human health, and economic sectors (IPCC, 2022).

Canadian climate experts acknowledge that the debate has largely evolved from questions about the reality and causes of climate change, to what actions can be taken to adapt to the realities of a changing climate. As the second most important and fastest growing (along with solar) renewable energy source in Canada (NRCan, 2017), wind energy is a critical component of Canada's renewable energy strategy. Wind energy is emission-free; with every megawatt of wind energy generated, greenhouse gas emissions are reduced in comparison to previous levels associated with coal-related production (NSNRR, n.d). Numerous benefits can be expected from the transition to renewable energy, including:

- Long term stability in energy prices.
- Long term security in locally-sourced energy supply and decreased dependence on international markets.
- Creation of jobs and economic opportunities throughout the province.
- Community investment and economic return.
- Protection of human health and the environment.
- Educational opportunities for youth and the broader community about renewable energy technology, its benefits, and the role it will play in Nova Scotia's energy future.

As part of this overall strategy, the Project will contribute to meeting Nova Scotia's renewable energy target of 80% renewable by 2030 as outlined in the *Environmental Goals and Climate Change Reduction Act* (Government of NS, 2021; Government of NS, 2023) by producing enough energy to power approximately 28,000 Nova Scotian homes.

The Proponent is committed to sharing economic opportunities with the local community throughout the development and lifespan of the Project via the use of local skills and labour, and where possible, municipal tax revenue, and ongoing energy literacy/education. Consultation with local groups has been ongoing to support both community and Project development.

2.3 Regulatory Framework

2.3.1 Federal

Potentially applicable federal regulatory requirements including approvals, permits, notification, and compliance for the Project along with the current status are provided in Table 2.1.

Table 2.1: Federal Regulatory Requirements

Requirement/Permit	Regulatory Body	Application/Permit Status and Comments
Notification of Project	Royal Canadian Mounted Police (RCMP)	Notification was completed as part of the electromagnetic interference (EMI) consultation process. A letter of non-objection has been received. The EMI consultation process is described further in Section 10.2.
Aeronautical obstruction clearance Lighting design for navigational purposes	Transport Canada	Transport Canada aeronautical assessment, including lighting plan submitted to Transport Canada November 2024.
Operations Interference Clearance	Department of National Defence (DND)	Notification was completed as part of the EMI consultation process. A letter of non-objection has not yet been received. The EMI consultation process is described further in Section 10.2.
Weather Radar Interference Approval	Environment and Climate Change Canada (ECCC), Meteorological Service of Canada	Notification was completed as part of the EMI consultation process. A letter of non-objection has not yet been received. The EMI consultation process is described further in Section 10.2.
Land Use Approval	NAV CANADA	A land use submission was completed during the EMI consultation process. A letter of non-objection has been received. The EMI consultation process is described further in Section 10.2.
Fisheries Act Authorization	Fisheries and Oceans Canada (DFO)	Compliance legislation - there is currently no expectation that an authorization under the *Fisheries Act* will be required. If, during the detail design phase, the Project is determined to have potential to cause a harmful alteration, disruption or destruction of fish habitat or accidental death of fish, the Proponent will submit a Request for Project Review to DFO.
Species at Risk Act (*SARA*) Permit	ECCC, DFO	No *SARA* permits were acquired for studies on site and none are expected based on Project design.
Migratory Birds Convention Act (*MBCA*)	ECCC	Compliance legislation – there is no expectation that a *MBCA* permit will be required.

A federal impact assessment is not required for the Project as it is not located on federal lands or listed as a physical activity that constitutes a designated project as listed in the Physical

Activities Regulations, SOR/2019-285 under the *Impact Assessment Act*. No navigable waters were found within the Study Area to warrant any compliance under the *Canadian Navigable Waters Act*.

2.3.2 Provincial

The Project is subject to a Class I EA as defined by the Environmental Assessment Regulations, NS Reg. 221/2018 under the *Environment Act,* SNS 1994-95, c. 1. As such, this submission has been prepared in accordance with:

- A Proponent's Guide to Environmental Assessment (NSECC, 2017).
- The Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009).
- Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia (NSECC, 2021).

Other potentially applicable regulatory requirements including provincial approvals, permits, notification, and compliance for the Project along with their current status are provided in Table 2.2.

Table 2.2: Provincial Regulatory Requirements

Requirement/ Permit	Regulatory Body	Application/ Permit Status and Comments
Watercourse Alteration Permit Wetland Alteration Permit	Nova Scotia Environment and Climate Change (NSECC)	Alteration applications will be submitted to NSECC in accordance with the Activities Designation Regulations, N.S. Reg. 47/95 following EA approval. Locations requiring alteration are described in Section 7.3.
Endangered Species Act, S.N.S. 1998, c. 11 (ESA),	NSNRR	Compliance legislation – there is no expectation that an ESA permit will be required.
Overweight/Special move permit Access permit Work within highway right-of-way Use of right-of-way for pole lines	Nova Scotia Public Works (NSPW)	Permits to be applied for before mobilizing oversize vehicles on public roads or commencing within a highway right-of-way
Crown Land Easement	NSNRR	Application to be filed for Project components occurring on Crown lands.
Elevator Lift License	NS Labour Skills and Immigration	Application to be filed prior to erection of the wind turbines
Archaeology Field Research Permit	NS Communities, Culture, Tourism and Heritage (NSCCTH)	Permit obtained to complete the archeology assessment. Discussed in further detail in Section 9.0.
Nova Scotia Temporary Workplace Traffic Control Manual	NSPW	Compliance for the use of provincial roads during the construction, operation, and decommissioning phases of the Project.

2.3.3 Municipal

Municipal Planning Strategies and Land use By-laws exist in the Municipality of East Hants and in Halifax Regional Municipality, where both require approval for wind power projects. The Project is in an East Hants Rural Zone (RU) and is permitted subject to site plan approval. The Project is located within Halifax's "Rural Wind Zone (RW-2)", though development permitting must still occur.

Table 2.3: Municipal Regulatory Requirements

Requirement/Application	Regulatory Body	Application Permit Status and Comments
Development Permit	Municipality of the District of East Hants	Application will proceed following receipt of EA Approval and in advance of construction.
Development Permit	Halifax Regional Municipality	

2.4 Funding

Equity funding for the Project has been secured. The Proponent is arranging debt financing. Commercial banks, along with additional funding sources, have been approached to participate in the Project as a lender. One of the leading Canadian banks and a well rated financial institution based in Germany with proven expertise in arranging and structuring debt financings in Canada, are engaged to lead the financing of the Project, and have provided their support letters.

2.5 Structure of the EA Registration Document

An outline of the content of each section of the EA Registration Document is provided in Table 2.4.

Table 2.4: EA Registration Document Structure

Section	Content
Section 1	Proponent Description
Section 2	Project Information
Section 3	Description of the Undertaking
Section 4	Project Scope and Assessment Methodology
Section 5	Mi'kmaq of Nova Scotia
Section 6	Government and Public Engagement
Section 7	Biophysical Environment
Section 8	Socioeconomic Environment
Section 9	Archaeological Resources
Section 10	Other Considerations
Section 11	Effects of the Undertaking on the Environment – Summary
Section 12	Effects of the Environment on the Undertaking
Section 13	Accidents and Malfunctions
Section 14	Cumulative Effects Assessment
Section 15	Closure
Section 16	Limitation of Liability
Section 17	References

3.0 DESCRIPTION OF THE UNDERTAKING

3.1 Geographical Location

The Project is located within the Indian River and Northeast River watersheds, near the community of Pockwock, in Halifax and Hants Counties, NS (Drawing 2.1).

A Study Area used for the desktop assessment to inform field surveys and enable preliminary Project design included the boundaries of the land parcels [i.e., PIDs (parcel identifications)] on which the Project was proposed (Table 3.1, Drawing 2.2). An Assessment Area was subsequently established for detailed field investigations, which included the physical footprint of the Project where the direct physical disturbance is expected to occur (i.e., the Project Area), plus a buffer to allow design flexibility and assess for indirect effects beyond the direct effects within the Project Area. For this Project, the buffer included a 200 m radius from each turbine and a 25 m buffer on either side of the centreline for the road layout.

Table 3.1: Land Parcels within the Study Area

PID	Landowner	Land Use
00423483	NS Crown	N/A
00425181	NS Crown	Provincial Forest
00425207	NS Crown	N/A
00425231	NS Crown	Provincial Forest
00427138	NS Crown	N/A
00516773	NS Crown	Provincial Forest
00516799	NS Crown	Provincial Forest
00550897	NS Crown	N/A
00554022	NS Crown	Provincial Forest
00574202	NS Crown	Provincial Forest
00575258	NS Crown	Provincial Forest
00595785	NS Crown	Provincial Forest
00595934	NS Crown	Provincial Forest
00595983	NS Crown	Provincial Forest
00595991	NS Crown	Provincial Forest
00607408	NS Crown	Provincial Forest
00619197	NS Crown	Provincial Forest
00630046	NS Crown	Provincial Forest
00630160	NS Crown	Provincial Forest
45140936	NS Crown	Provincial Forest
45141066	Private	Resource Forest
45142015	Private	Resource Forest
45156775	Private	Resource Forest
45157096	Private	Resource Forest
45157104	Private	Resource Forest
45157112	Private	N/A

PID	Landowner	Land Use
45172087	Private	Resource Forest
45172178	Private	Resource Forest
45172186	Private	Resource Forest
45186863	Private	Resource Forest
45186889	Private	Resource Forest
45186897	Private	Resource Forest
45186905	Private	Resource Forest
45186913	Private	N/A
45186921	Private	Resource Forest

The measured areas of the Study Area, Assessment Area, and Project Area are provided in hectares (ha) in Table 3.2.

Table 3.2: Areas of Study

Area of Study	Area (ha)
Study Area	5,504
Assessment Area	392
Project Area*	128

*Area is a conservative estimate of the permanent footprint of the Project Area and is subject to change upon final design. It was calculated by a conservative estimate of 120 m x 120 for turbine pads, 25 m road corridors and 30 collector and transmission line.

3.1.1 Siting Considerations

The Project is mostly sited on private lands that were previously partially disturbed by commercial forestry activity. Project siting was completed using a multi-phased approach:

- Original siting was based upon a detailed constraints analysis, primarily consisting of a GIS exercise after considering land ownership, grid capacity and proximity, setbacks, and wind speed to develop a preliminary layout. Siting considerations included:
    - Siting turbines at locations for efficient capture of wind energy and proximity to the Nova Scotia power grid.
    - Utilizing existing disturbed areas to the greatest extent practical.
    - Complying with regulated setbacks and separation distances (Table 3.3).
    - Avoiding interference with telecommunication and radar systems.
    - Avoiding known protected areas; field identified archaeological, cultural, and heritage resources, significant habitats; and wildlife sites, provincial parks, or reserves.

- The original layout included turbine placement on a combination of both private and Crown land. However, due to changes to the Green Choice Program (GCP), a provincial renewable energy power purchasing program, the turbine placement was restricted to only private land to support NSNRR in achieving their 20% Crown land conservation targets. As a result, the Project was significantly downsized to accommodate a smaller buildable area.

- Further refinement to the proposed layout was completed based on the results of desktop studies, field assessments, and engagement with the Mi'kmaq of Nova Scotia, government agencies, stakeholders, local communicates and special interest organizations.

As a result, many layout iterations were created and considered to reflect a growing knowledge of the Study Area, the constraints from the GCP, and surrounding community and environmental considerations before developing the current layout for the purposes of this EA.

The minimum setbacks and separation distances applied during the development, design, and siting of the Project are summarized in Table 3.3.

Table 3.3: Summary of Minimum Setbacks and Separation Distances

Setback Category	Distance	Relevant Regulators / Stakeholders
Watercourses	30 m from turbines where possible or otherwise authorized by NSECC (from tip of blade)	NSECC
Wetlands	30 m from turbines where possible or otherwise authorized by NSECC (from tip of blade)	NSECC, NSNRR
Wetlands of Special Significance	At least 30 m, to be determined in consultation with NSECC	NSECC, NSNRR
Important Habitat Features - Old Growth Forests + Talus Slopes	100 m limited development buffer where possible on Crown land	NSNRR
Protected Areas and Public Resources	To be determined in consultation with NSECC and NSNRR, as appropriate.	NSECC / NSNRR
Rare Plants and Lichens	Species-specific (Section 7.4.2)	NSNRR
Adjacent Property Line	206.5 m (*Hub Height + Blade Length*)	Halifax Regional Municipality
Residences on Adjacent Property	1000 m from turbine base	Halifax Regional Municipality
Adjacent Property Line	826 m (*4 x Turbine Height)* (variance available)	Municipality of the District of East Hants
Public Roads	309.8 m *(1.5 x Turbine Height)*	Health Canada
Powerlines	309.8 m from non-project-related powerlines, except designated crossing locations *(1.5 x Turbine Height)*	NS Power
Shadow Flicker	As necessary to meet shadow flicker constraints based off shadow flicker modelling	NSECC

Setback Category	Distance	Relevant Regulators / Stakeholders
Sound / Noise	As necessary to meet sound / noise constraints based off sound modelling	NSECC

The Project Area also offers considerable development opportunities that were incorporated into the Project design to minimize potential effects to surrounding land uses, local residents, and environmental features. Project development opportunities include the following:

- Accommodation of a large permanent residential setback of over 1,000 m.
- The use of a site that has been previously disturbed by forestry activities (i.e., tree clearing and logging trails/roads are present throughout the Study Area).
- Working with community groups familiar with EA and conservation, including the Saint Margarets Bay Stewardship Association (SMBSA).
- Working with academia within the local area to understand impacts and mitigation measures to species at risk.
- Involvement of Mi'kmaq Earth Keepers in terrestrial wildlife surveys.
- Involvement of local ATV and recreation users of the area.
- Engaging with Mi'kmaq communities and conducting a Mi'kmaq Ecological Knowledge Study (MEKS) to understand potential conflicts with traditional land use.
- Working with first responders when planning access road routes to facilitate easier access to the Project in the event of an emergency, in addition to implementing suggested fire mitigation plans into draft Emergency Response Plan (ERP).
- Working with local recreational organizations to continue to allow local access after the Project is constructed.

3.2 Physical Components

3.2.1 Turbines

The Project will be powered by up to 23 wind turbines (Drawing 2.3), each rated at up to 7.0 MW. Each turbine is comprised of the foundation, tower, rotor and blades, nacelle (including the rotor shaft and brake and gearbox system), and a cleared pad surrounding the turbine for construction purposes. Turbine specifications are provided in Table 3.4.

Table 3.4: Turbine Technical Specifications

Turbine Component	Specifications		
	Primary Selection	Alternate Selection	Market Availability
	Nordex N163/6.X	Nordex N163/5.X	Alternative Turbine Range
Rated Capacity	Up to 7 MW	Up to 5.9 MW	4.5 – 7.0 MW
Rotor Diameter	163 m	163 m	150 – 180 m
Hub Height	118 m	125 m	110 – 140 m

Turbine Component	Specifications		
	Primary Selection	Alternate Selection	Market Availability
	Nordex N163/6.X	Nordex N163/5.X	Alternative Turbine Range
Cut-in Wind Speed	3 m/s	3 m/s	3 m/s
Cut-out Wind Speed	up to 26 m/s	up to 26 m/s	up to 26 m/s
Swept Area	20,867 m^2	20,867 m^2	17,671 – 25,447 m^2
Rotor Speed	Variable	Variable	Variable
Generator	6-pole doubly-fed induction	6-pole doubly-fed induction	6-pole doubly-fed induction*
Brake System	Aerodynamic brake plus disc brake	Aerodynamic brake plus disc brake	Aerodynamic brake plus disc brake
Remote Monitoring	Supervisory Control and Data Acquisition (SCADA)	SCADA	SCADA
Lighting Requirements	Per Transport Canada Requirements	Per Transport Canada Requirements	Per Transport Canada Requirements
Materials	Tubular steel tower with glass/carbon fibre reinforced plastic rotors	Tubular steel, concrete, or hybrid steel / concrete tower with glass/carbon fibre reinforced plastic rotors	Tubular steel, concrete, or hybrid steel / concrete tower with glass/carbon fibre reinforced plastic rotors
Colour	Based on manufacturer specifications and regulatory requirements	Based on manufacturer specifications and regulatory requirements	Based on manufacturer specifications and regulatory requirements

* Subject to change pending turbine model selected in final design.

3.2.2 Roads

The proposed access roads consist of both new and existing roads (Drawing 2.3). A comprehensive road network currently exists in the Study Area and is associated with ongoing forestry activities. All roads will be constructed or upgraded, as required to safely transport the turbines, provide appropriate turning radii, and support construction activities in compliance with local and provincial guidelines/requirements. During the civil design process, consideration will be made to minimize adverse impacts to sensitive habitats, such as wetlands and watercourses, as well as rare species. In some cases, the construction of new roads will be required to access proposed turbine locations; however, the Proponent is planning to leverage the network of existing roads to the greatest extent feasible.

Transport to the site is currently proposed via access from Highway 101 or Bowater Mersey Road. A transportation plan will be completed in consultation with the turbine manufacturers and NSPW.

3.2.3 Substation and Power Collection Systems

The Project requires a substation that will be installed within a fenced yard and will include a step-up transformer, circuit breakers, relays, SCADA system, revenue meter, telecommunication equipment, control building, and support structures. The system connection at the substation will consist of a single span line tap to NS Power 138 kV transmission line L-6011, anticipated to be approximately 0.66 kilometres (km) from the substation's 138 kV dead-end structure. The new three breaker ring bus substation will be installed approximately 16.5 km from 17V-St Croix substation and 13.5 km from the 120H-Brushy Hill substation.

The Project's electrical collection system will bring power from the wind turbines to the substation (Drawing 2.3). The collection system will be comprised of a series of 34.5 kV aboveground collector lines. Aboveground components will include a standard pole structure with the associated guy wire, foundation, and groundings. Underground collector lines will be installed in trenches that will generally be co-located with the access roads.

3.3 Project Phases

The Project will include three phases:

- Site preparation and construction.
- Operations and maintenance.
- Decommissioning.

Activities and requirements associated with each phase are discussed in the following sections. Transportation of turbine components is addressed in Section 8.3.

3.3.1 Site Preparation and Construction

Site preparation activities include:

- Land surveys for placement of roads, turbines, potential quarries, and associated works.
- Geotechnical investigations.
- Demarcating boundaries of environmentally sensitive features and applying appropriate buffers.
- Placement of erosion and sedimentation control measures.
- Clearing of trees, grubbing, excavating, grading, and compacting local and potentially imported materials for construction.

General construction activities include:

- Installation of access road infrastructure (upgrading existing and new construction). Laydown area and turbine pad construction.
- Transportation of turbine components, equipment, and materials.
- Site traffic control measures
- Foundation excavation and construction, including blasting, if required.
- Materials preparation and storage (e.g., aggregate crusher and storage areas).
- Turbine and infrastructure assembly.
- Site waste and dust management.
- Construction of collection system and substation.

- Grid connection.
- Removal of temporary works and site restoration.
- Commissioning.

Access Road Construction

A total of 23.8 km of the existing road network will be used as part of the Project, with approximately 11.1 km of new road construction required. Roads are expected to be constructed to a standard carriageway width of 7 m plus ditches sloped at a ratio of 2:1 to accommodate proper drainage and culverts where required. In areas where the existing road network does not meet these standards, these roads will require upgrading which may include road widening. There will be areas where the roadway width could increase to 11 m plus the width for ditches to accommodate cut and fill areas, wide turning radiuses, or areas where the assembly crane will transit between turbines during construction.

During the construction phase, Project roads will be maintained with additional gravel or periodic grading. Aggregate material for road construction will be transported from the site or off-site quarries and stored temporarily until used. Any material removed for road construction will be stored or disposed of in accordance with regulations for road construction. Any material stored on the site will be managed with appropriate erosion and sedimentation control measures or re-used.

The following equipment is typically used during road upgrading and construction:

- Excavators
- Feller buncher
- Dump trucks
- Bull dozers
- Rollers
- Graders
- Aggregate crushers
- Light trucks

Laydown Area, Turbine Pad, and Foundation Construction

General activities during the creation of the laydown areas (areas at the base of the turbines for the storage of equipment, as well as one general construction laydown area), turbine pad, and turbine foundation construction areas may include:

- Delineation of work areas and installation of erosion and sedimentation control measures.
- Removal of vegetation and site grading.
- Removal of overburden and soils.
- Blasting/breaking of bedrock (to be determined, based on geotechnical conditions and foundation design).
- Pouring and curing of concrete foundations (complete with reinforcing steel).

- Placement of competent soils to bring area to grade.
- Compaction of fill or soils.
- Trenching and installation of above ground electrical collector systems and fibre optic communication systems.

Depending on the turbine foundation requirements, foundations could be approximately 18 m in diameter and extend to a depth of 3 to 5 m below grade. Each turbine pad and laydown area is expected to be approximately 120 m by 120 m. Each turbine foundation, turbine pad, and crane pad will be designed to suit the specific requirements of the turbine and the geology and surrounding topography during the detailed design process.

The construction of a typical turbine pad (from clearing to final preparation for erecting of the turbine) can take between one to four months, depending on weather, soil, and construction vehicle access. The following equipment may be used for the laydown area and turbine pad construction:

- Excavators
- Dump trucks
- Bulldozers
- Rollers
- Graders
- Crusher (not required if a local quarry can supply gravel sizes)
- Concrete trucks
- Light cranes
- Light trucks

Turbine Assembly

The wind turbine assembly includes tower sections, the nacelle, the hub, and three-blade rotors. All sections will be delivered by specialized transportation equipment and the pieces will require a crane for removal from the vehicle at each of the prepared turbine pads or staging areas as required.

The tower sections will be erected in sequence on the turbine foundation, followed by the nacelle, hub, and rotor blades. Turbine assembly will require the use of cranes and tag lines. Erection will depend on weather, specifically wind and daylight conditions. Typical assembly duration per turbine is expected to be between two to five days. The following equipment is expected to be used for turbine assembly:

- Main crane unit
- Assembly cranes
- Tag line support vehicles
- Manufacturer’s support vehicles

Collection System and Substation Construction

The Project will connect to a substation constructed strategically to be near the closest available grid connection. The construction of a substation can take between eight to ten months, depending on weather, soil, and construction vehicle access. The electrical collector system will be constructed during 2027 and can take between two and four months to complete.

The following equipment is expected to be used during the collector system and substation construction process:

- Excavator
- Backhoe
- Bucket trucks
- Light cranes
- Light trucks
- Hydrovac
- Directional Driller
- Telehandler
- Rollers

Removal of Temporary Works and Site Restoration

Once construction has been completed at each of the components listed in Section 3.2, temporary works will be removed, and the site will be appropriately graded. The following equipment is expected to be used in this process:

- Excavator and/or backhoe
- Grader
- Dump trucks
- Hydroseeder truck
- Light trucks

Commissioning

The turbines will undergo a series of tests for mechanical, electrical, and control functions prior to initializing the unit start-up sequence. Once the start-up sequence has been initiated, another series of performance checks for safety systems will be completed. When the turbines have cleared all tests, turbine commissioning can begin.

Commissioning includes performance testing which will be conducted in coordination with NS Power (as the electrical grid operator), to ensure that the generated electricity meets NS Power quality criteria. These performance tests will be completed by qualified wind power technicians and electrical utility (i.e., NS Power) employees. Additional testing may also be required for transformers, power lines, and substation components; all of which will be performed by qualified engineers and technical personnel.

3.3.2 Operations and Maintenance

The lifespan of the Project is estimated to be a minimum of 25 to 30 years. During this time, roads will be used to access the turbines by staff and maintenance personnel. The roads will be maintained with additional gravel and grading, as required. During the winter months, all roads will be plowed, sanded, and/or salted, as required for driving safety and to ensure access to all site locations in the event of an emergency.

A vegetation management plan will be developed to ensure that access roads and turbine locations will remain clear of vegetation during operations. Vegetation management will include removal and pruning. Timing of vegetation management will depend on site-specific conditions.

Due to the potential for public access to the wind farm, signage will be affixed and maintained on access roads to provide essential safety information such as emergency contacts and telephone numbers, speed limits, and the hazards associated with being in proximity to the turbines. These signs will be maintained during the life of the Project.

All turbines will be affixed with adequate lighting in compliance with NAV CANADA and Transport Canada requirements for aviation during their operational life.

Maintenance activities will conform to manufacturer's equipment specifications, industry best management practices (BMPs), and standard operating procedures. Maintenance work will be carried out on a proactive, periodic, and as needed basis. Maintenance activities may require the use of a variety of cranes for brief periods of time for the replacement of blades and/or other turbine components. The most common vehicle used during maintenance work will be light/medium pickup trucks.

3.3.3 Decommissioning

As noted above, the operational life of the Project is estimated to be a minimum of 25 to 30 years with the possibility of extension. NSECC will be provided with decommissioning plans for review prior to Project decommissioning. If operation of a specific turbine also ceases for two years during the operations and maintenance phase, the Proponent will notify NSECC of its plans to either remove the turbine, recommission, or repower it.

Generally, the decommissioning phase will follow the same steps as the construction phase (in the reverse order) but will also include:

- Dismantling and removal of the turbines.
- Decommissioning the turbine foundations as per the conditions of the land lease agreement.
- Removal, recycling (where possible), and disposal of collection system, conductor, and poles.
- Removal of other equipment, as required, and reinstatement and stabilization of land, where necessary.

- Access roads will either be removed or remain in place as per lease agreements with the landowner.

According to the Canadian Renewable Energy Association (CanREA, n.d.), up to 90% of wind turbine blades can be recycled. Additional components, such as the steel from the towers, copper cables, and electrical equipment, can also be recycled or reused. Materials that cannot be recycled can sometimes be reused in other applications, such as filler in construction materials. Recent innovations in fibreglass recycling have used various chemical and mechanical means to prepare the material for reuse in other applications (Power Technology, 2024). At the time of decommissioning, it is anticipated that newer technologies will allow for a greater amount of recycling or reuse of the end-of-life turbine materials. Any material that cannot be recycled or reused, will be sent for final disposal at an approval disposal facility.

3.4 Project Schedule

Table 3.5 presents the Project schedule from EA registration to Project decommissioning.

Table 3.5: Project Schedule

Project Activity	Timeline[1]
EA Registration	Q4 2024
Additional Project Permitting	Q1 2025 to Q1 2027
Post-EA Environmental Monitoring Programs	Q1 2025 onward (as required)
Geotechnical Assessment	Q2 2025 to Q3 2025
Detailed Engineering Design	Q2 2025 to Q1 2026
Municipal Decision on Development Permits	Q1 2025
Construction (including clearing, site preparation, and road work, component installations)	Q1 2026 to Q1 2028
Commissioning	Q1 2028
Operation	Q1 2028 to Q4 2058 (based on lifespan of 30 years)
Decommissioning	2059

[1] The Project schedule is based on professional estimates current at the time of the EA and may be subject to change as each activity progresses. The Proponent will keep NSECC informed on any revisions to the schedule in advance.

4.0 PROJECT SCOPE AND ASSESSMENT METHODOLOGY

As a Class 1 EA, this Registration Document and supporting studies have been developed to meet all requirements under Section 9(1A) of the Nova Scotia *Environment Act*. As such, this submission has been prepared in accordance with:

- A Proponent's Guide to Environmental Assessment (NSECC, 2017)
- The Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009)
- Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia (NSECC, 2021)

The Project team contacted the following regulatory bodies to provide input and advice on the EA scope and planning:

- ECCC-Canadian Wildlife Service (CWS)
- NSCCTH
- NSECC
- NSNRR
- Nova Scotia Office of L'nu Affairs (OLA)

4.1 Site Sensitivity

Potential wind farms are assigned a project risk category level, according to a matrix provided in the "Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia". This matrix considers the overall project size and the sensitivity of the project site. The category level then outlines guidance for the collection of baseline data and post-construction monitoring requirements.

As the total turbine height being considered for the proposed Project is greater than 150 m, the Project is automatically considered to have a category 4 risk rating.

4.2 Assessment Scope and Approach

EA is a planning tool used to predict the environmental effects of a proposed project, identify measures to mitigate adverse environmental effects, and predict the significance of any residual effects after the application of mitigation measures.

The EA focuses on Valued Components (VCs). VCs are specific components of the physical, biophysical and human/social environments that, if altered by the Project, may be of concern to regulators, the Mi'kmaq of Nova Scotia, stakeholders, and/or the general public. The scope of the EA for this Project includes:

- Identify VCs that the Project may interact with (by activity and phase) within established spatial and temporal boundaries.
- Establish the existing conditions for VCs.
- Identify potential interactions between the Project and the VCs.
- Assess the potential effects that could occur from the interaction.
- Identify mitigation measures to reduce or eliminate those effects.
- Evaluate the significance of the residual environmental effects using VC-specific criteria.
- Identify monitoring of follow-up programs to verify predictions and/or evaluate the need to implement adaptive management.

4.3 Identification of Valued Components

The following VCs were identified based on the experience of the Project team and through engagement with regulators, the Mi'kmaq of Nova Scotia, and the public.

- Biophysical environment
    - weather, climate, air quality
    - geology, hydrogeology/groundwater
    - watercourses, fish and fish habitat
    - wetlands
    - flora, fauna (including Mainland moose), habitat
    - bats
    - avifauna
    - species at risk (considered in the appropriate VC chapter, as necessary)
- Socioeconomic environment
    - economy, land use, transportation, recreation and tourism
    - archaeological and cultural resources
    - human health
    - electromagnetic interference
    - shadow flicker
    - visual impacts
    - sound

4.4 Spatial and Temporal Boundaries

4.4.1 Spatial Boundaries

Spatial boundaries are considered separately for each VC and are typically based on natural system boundaries or administrative/political boundaries, as appropriate. The following spatial boundaries have been established for the effects assessment:

- Project Area - the physical footprint of the Project, where the direct physical disturbance is expected to occur.
- Local Assessment Area (LAA) – the area where Project-related effects can be predicted or measured for assessment. The LAA is VC-specific and defined in each VC chapter.
- Regional Assessment Area (RAA) – includes the area established, if relevant for each VC, for evaluation of Project-specific effects. It is also the area in which accidents and malfunctions and cumulative effects are assessed. The RAA is VC-specific and is defined in each VC chapter where applicable.

As detailed in Section 3.1, a Study Area was established as a large assessment area based on land parcels (i.e., PIDs) that are included in the development area (Table 3.1, Drawing 2.2). The intent of the Study Area was to first survey a broad area at a high-level to allow flexibility in the design to move infrastructure and minimize effects to VCs. An Assessment Area was subsequently established for detailed field investigations, which includes the physical footprint of the Project where the direct physical disturbance is expected to occur (i.e., the Project Area), plus a buffer to allow design flexibility and assess for indirect effects beyond the direct effects within the Project Area. For this Project, the buffer included a 200 m radius from each turbine, and a 25 m buffer on either side of the centreline for the road layout, to include road expansions as well as the collector and transmission lines required. Other laydown areas and proposed substation locations were also included in the Assessment Area.

Where appropriate, the Study Area and Assessment Area are identified as the LAA and RAA for specific VCs in the individual VC chapters.

4.4.2 Temporal Boundaries

The temporal boundaries in Table 4.1 apply to all VCs unless otherwise stated.

Table 4.1: Temporal Boundaries

Project Phase	Temporal Boundary
Site Preparation and Construction	18-24 months
Operation and Maintenance	25 years or more
Decommissioning	Commence after the operations cease (25-30+ years)

4.5 Potential Project-Valued Component Interactions

The potential interactions between the Project and the VCs, by phase, are presented in the individual VC chapters (Sections 7 to 10), following a description of existing conditions. Where an adverse effect on a VC is identified, strategies for mitigation, avoidance, or compensation are proposed. Where possible, mitigation measures are incorporated into the Project design to eliminate or reduce potential adverse effects.

4.6 Residual Effects Assessment Criteria

The significance of the effects after mitigation is determined using defined criteria. Most criteria will be the same for all VCs (Table 4.2); however, the magnitude criteria are VC-specific and are provided in the individual chapters.

Table 4.2: Effects Assessment Criteria

Rating Criteria	Rating
Magnitude The amount of change in measurable parameters or the VC relative to existing conditions	**VC-specific as outlined in individual chapters.**
Geographic Extent The geographic area in which a residual effect occurs	**Project Area –** residual effects are restricted to the Project footprint **Local Assessment Area –** residual effects extend into the local assessment area **Regional Assessment Area –** residual effects extend into the regional assessment area
Timing and Seasonality Considers when the residual effect is expected to occur	**Not applicable –** seasonal aspects are unlikely to affect the VC **Applicable –** seasonal aspects may affect the VC
Duration The time required until the measurable parameter or VC returns to its existing condition, or the	**Short term –** residual effect restricted to no more than the duration of the construction phase

Rating Criteria	Rating
residual effect can no longer be measured or otherwise perceived	**Medium term –** residual effect extends through the operation and maintenance phase **Long term –** residual effect extends beyond the decommissioning phase
Frequency Identifies how often the residual effect occurs and how often in a specific phase	**Single event –** occurs once **Intermittent –** occurs occasionally or intermittently during one or more phases of the Project **Continuous –** occurs continuously
Reversibility Describes whether a measurable parameter or the VC can return to its existing condition after the activity ceases	**Reversible –** the residual effect is likely to be reversed after the activity is completed **Irreversible –** the residual effect is unlikely to be reversed

If, based on the criteria in Table 4.2, a residual effect is identified, its significance is then evaluated based on the criteria in Table 4.3.

Table 4.3: Definition of Significant Residual Environmental Effect

Significance Level	Definition
Significant	The potential effect could threaten sustainability of a resource or result in a moderate to high change in baseline levels within the RAA. The effect is anticipated to last for a medium to long-term duration and will occur on a continuous basis. Research, monitoring, and/or recovery initiatives should be considered and may be required.
Not Significant	The potential effect may result in a negligible to low change in a resource or condition in the RAA but should return to baseline levels within the short-term and occur only once or on an intermittent basis. Research, monitoring, and/or recovery initiatives are not recommended.

4.7 Monitoring and Follow-up

Follow-up programs and monitoring, in some cases developed in conjunction with regulators, may be recommended to verify predictions and/or assess effectiveness of mitigation measures and the need to implement adaptive management. Follow-up programs and monitoring are presented, as necessary, in individual VC chapters.

4.8 Assessment for Wild Species

The assessment for wild species (e.g. birds, mammals, fish, plants, etc.) was conducted in accordance with the Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2005). Special consideration of species at risk (SAR), listed under the *SARA* and the *Endangered Species Act*, S.N.S. 1998, c. 11 (*ESA*), along with species of conservation interest (SOCI), which, for the EA Registration Document, includes species that are:

- Assessed as 'Endangered', 'Threatened', or 'Special Concern' by the Committee on the Status of Endangered Wildlife in Canda (COSEWIC) that are not already listed under *SARA*.
- Have a subnational rank (S-Rank) or 'S3', 'S2', or 'S1' from the Atlantic Canada Conservation Data Centre (ACCDC).

For SAR, said species and their dwellings are provided protection under *SARA*, *ESA*, and the *Biodiversity Act.*

Priority species were developed based on the SAR and SOCI identified through desktop review or field assessments that have the potential to interact with the Project through their presence, or the potential for presence, in the Study Area.

5.0 MI'KMAQ OF NOVA SCOTIA

The Project is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq people who are the founding people of Nova Scotia and currently live throughout the province, including in 13 Mi'kmaq communities (OLA, 2015).
The Project is located within the Mi'kmaq territory of Sipekne'katik, which means 'area of wild potato/turnip' (Parks Canada, 2023a).

The Mi'kmaq in the provinces of Nova Scotia, New Brunswick, and Prince Edward Island, and the Gaspé Peninsula in Quebec, are founded on land historically occupied by the ancestors of the Mi'kmaq. The earliest evidence of the Mi'kmaq of Nova Scotia in the Maritimes Region indicates that the ancestors of the Mi'kmaq have existed on the land for more than 11,000 years (Mi'kmawey Debert Cultural Centre, 2024).

The Mi'kmaq of Nova Scotia have established Aboriginal and Treaty rights, including the right to fish for a "moderate livelihood" which flows from the Peace and Friendship Treaties (DFO, 2022a), and Aboriginal rights to hunt, fish, and gather for food, social, and ceremonial purposes, more broadly referred to as "traditional" purposes. Mi'kmaq rights are communal rights and therefore shared amongst all members of the Mi'kmaq Nation in Nova Scotia.

The Crown has a duty to consult with the Mi'kmaq of Nova Scotia, which is achieved in accordance with the Mi'kmaq-Canada-Nova Scotia Consultation Terms of Reference. As per Supreme Court of Canada instruction and subsequent guidance from governments, such as the Updated Guidelines for Federal Officials to Fulfill the Duty to Consult (Government of Canada, 2011) and the Proponents' Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia (OLA, 2012), the Crown may delegate procedural aspects of consultation to Proponents. However, the duty to consult, and ultimate decision-making authority, remains with the Crown. The results of the Proponent's Mi'kmaq of Nova Scotia engagement program and EA development are expected to be considered by the provincial government in the EA decision-making process.

For the purposes of consultation, 10 of the 13 Mi'kmaq communities are represented in consultation by Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO), which reports to the Assembly of Nova Scotia Mi'kmaq Chiefs. At this time, Membertou First Nation, Millbrook First Nation, and Sipekne'katik First Nation represent their own communities in consultation through their elected Chiefs and Councils. The Proponent engaged with the Native Council of Nova Scotia to ensure engagement with Mi'kmaw people living off-reserve.

The most populous nearby Mi'kmaq community to the Project is the Sipekne'katik community on the Indian Brook Reserve (No. 14) with a population of 2,739 (Statistics Canada, 2023). Sipekne'katik is located approximately 37 km northeast of the Project. Other nearby Mi'kmaq communities include Glooscap First Nation on the Glooscap (No. 35) Reserve (population 111; approximately 31 km northwest), and Millbrook First Nation on the Millbrook (No. 27) Reserve (population 921, approximately 66 km northeast).

Nearby known Mi'kmaq placenames to the Project Area include (Mi'kmawey Debert Cultural Centre, 2024):

- Pakwek ("shallow") corresponding with Pockwock Lake
- Paqasimkwajk ("at the boggy place stretching out"), corresponding with Five Mile Lake
- Wisik ("beaver house"), corresponding with Little Indian Lake
- L'nskuma'tijik ("where conversation can be carried over a long distance"), corresponding with the community of Mount Uniacke

5.1 Overview

To share information and identify, assess, and avoid potential impacts to the Mi'kmaq of Nova Scotia, a Mi'kmaq Ecological Knowledge Study was completed, and community engagement was undertaken for the Project, which are discussed in the following sections.

5.2 Engagement

As an integral component of any project development activity in Nova Scotia, the Proponent prioritized early engagement with Nova Scotia Mi'kmaq communities.

The Proponent notified the Mi'kmaq early in the development process, provided as much information as possible, met with Mi'kmaq communities, completed a MEKS with Membertou Geomatics, met with and provided regular updates to KMKNO and the office of L'Nu Affairs, and documented the engagement process per steps one through six of the Proponents' Guide: The Role of Proponents in Crown Consultation with the Mi'kmaq of Nova Scotia (OLA, 2012). Furthermore, the Proponent participated in four KMKNO-hosted events for First Nations participants to provide information on the Project and discuss job and procurement opportunities. The Proponent also presented the Project to Wskijnu'k Mtmo'taqnuow Agency Ltd. (WMA) in February 2024, the economic development organization that represents all 13 Mi'kmaw communities in the province.

Table 5.1 summarizes engagement efforts with the Mi'kmaq of Nova Scotia, of which there were over 300 individual touchpoints.

Table 5.1: Engagement with the Mi'kmaq of Nova Scotia

First Nation / Organization	Representatives/Role(s)	Contact Details
First Nations		
Acadia First Nation	Chief Deborah Robinson Bruce Clarke Glenda Macdonald Julian O'Connell Lloyd MacDougall Rachel Stevenson	The Proponent has engaged with Acadia First Nation since April 2020 with an interest in working together. Communication began by sharing information via meetings, PowerPoints, and information sessions. A Memorandum of Understanding (MOU) was drafted, reviewed, and approved and an Exclusive Agreement for Equity Partnership was discussed and signed between September 2021 and February 2022. A response to the Smart Renewables and Electrification Pathways application was discussed in March 2022. Additional introductions and Project information were shared in late 2022 and early 2023. The Proponent provided a Project update in July 2023 in person and also provided an invitation to upcoming open houses, encouraging feedback. Acadia First Nation opted not to continue as a partner in November 2023 due to uncertainty about the viability of wind projects in general and a desire to focus on other ventures. The Proponent reached out again in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement.
Annapolis Valley First Nation	Chief Gerald Toney Julie Crossman	The Proponent has engaged with Annapolis Valley First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent reached out again in July 2023 and April 2024 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. Further requests were made by the Proponent in early 2024 to meet and gather feedback concerning the Project.
Eskasoni First Nation	Chief Leroy Denny Michael Denney Steve Parsons	The Proponent has engaged with Eskasoni First Nation since March 2022, first providing a Project description and Project update pamphlet and in May 2022 requesting to meet.

First Nation / Organization	Representatives/Role(s)	Contact Details
		The Proponent reached out again in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent and a representative of Eskasoni First Nation met in December 2023 to discuss the Project and possible partnership. The Proponent and a representative of Eskasoni First Nation met in March 2024 to discuss the Project. The Proponent reached out in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement and has had numerous virtual and in-person meetings since that time.
Glooscap First Nation	Chief Sidney Peters Michael Peters	The Proponent has engaged with Glooscap First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent sent an additional invitation to meet in May 2022, followed-up by discussions by phone and an agreement to include Glooscap First Nation in Project engagements. The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent presented a Project overview and opportunities for partnership and capacity building to representatives from Glooscap First Nation in April 2024, inviting feedback. The Proponent reached out again in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement.
L’sitkuk (Bear River) First Nation	Chief Carol Dee Potter	The Proponent has engaged with L’sitkuk First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent sent a Project update in May 2022, along with an invitation to discuss the Project, and an additional invitation to meet.

First Nation / Organization	Representatives/Role(s)	Contact Details
		The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent reached out again in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement.
Membertou First Nation	Chief Terrance Paul	The Proponent has engaged with Membertou First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent sent a Project update in May 2022, along with an invitation to discuss the Project, and an additional invitation to meet. The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent reached out in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement.
Millbrook First Nation	Chief Robert Gloade	The Proponent has engaged with Millbrook First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent reached out again in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement.
Paq'tnek First Nation	Chief TMA Francis Acting Chief Corey Julian	The Proponent has engaged with Paq'tnek First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent reached out again in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement.
Pictou Landing First Nation	Chief Andrea Paul	The Proponent has engaged with Pictou Landing First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet.

First Nation / Organization	Representatives/Role(s)	Contact Details
		The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent reached out again in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement.
Potlotek First Nation	Chief Wilbert Marshall	The Proponent has engaged with Potlotek First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent reached out again in April 2024 to provide a Project update and invite further feedback, collaboration, and engagement, followed by correspondence discussing partnership details. The Proponent presented to Potlotek First Nation in-person in June 2024 about the Project, and provided MOU documents to Potlotek Chief and Council. Engagement has been ongoing since, through e-mail and virtual meetings.
Sipekne'katik First Nation	Former Chief Michael P Sack Chief Michelle Glasgow Brian Dorey Brooke Willis Cheryl Maloney Lena Knockwood Marine Courtois Ron Knockwood Rufus Copage Samantha Watts	The Proponent has engaged with Sipekne'katik First Nation since March 2022, first sharing information via presentations/pamphlets, requesting input, and discussing a community solar opportunity. The Proponent and a representative of Sipekne'katik First Nation met virtually to discuss the Project further, including the engagement process. The Proponent requested information from Sipekne'katik on consultation and engagement protocol. The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback, followed by an in-person meeting of both parties in community. The Proponent submitted the initial SGI Phase 1 Application Form to Sipekne'katik First Nation on July 27, 2023. The Proponent followed up with representatives from Sipekne'katik First Nation in April 2024 to share updates and gather feedback on Project, followed by correspondence inviting representatives to attend public information sessions and sharing maps of the Project as requested. Another in-person meeting in the community occurred on April 3, 2024, to discuss updates on the Melvin Lake Project and further opportunities for input

First Nation / Organization	Representatives/Role(s)	Contact Details
		and engagement. The proponent followed up again in November 2024 to request an in-person update meeting.
Wagmatcook First Nation	Chief Norman Bernard Donald Hanson	The Proponent has engaged with Wagmatcook First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent reached out in July 2023 and April 2024 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent met with Wagmatcook First Nation Chief and Council in May 2024 to present a partnership opportunity. The Proponent sent MOU documents to Wagmatcook First Nation in June 2024. Meetings have been ongoing to discuss the Project updates on a regular basis.
We'koqma'q First Nation	Chief Annie Bernard Daisley	The Proponent has engaged with We'koqma'q First Nation since March 2022, first providing a Project description and Project update pamphlet and requesting to meet. The Proponent reached out in July 2023 and April 2024 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. In May 2024, the Proponent met with Chief and Council in person to discuss the Project, including opportunities for partnership and future benefits (including capacity building etc.). The Proponent provided a slide deck to We'ko'kma'q First Nation with information on the Project and opportunities for First Nations involvement, following in-person presentation. Meetings have been ongoing to discuss the Project updates on a regular basis.
Organizations		
Atlantic Policy Congress of First Nations Chiefs Secretariat (APCFNS)	John Paul	The Proponent has engaged with APCFNS since March 2022, first providing a Project description and offering to meet. The Proponent then provided a Project update pamphlet later in the month, again extending an offer to meet.
Assembly of First Nations Nova Scotia	N/A [General e-mail]	The Proponent has engaged with Assembly of First Nations Nova Scotia since February 2022, first offering an introduction and providing project information.

First Nation / Organization	Representatives/Role(s)	Contact Details
		The Proponent reached out again in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback.
Atlantic First Nations Water Authority (AFNWA)	AFNWA	The Proponent reached out on May 16, 2023, requesting to set up an introductory meeting to provide information on the potential project.
Canada Infrastructure Bank (CIB)	Lyndsay Brisard	The Proponent held a virtual meeting on January 17, 2024, to discuss avenues/programs to support Indigenous partners in accessing equity/project costs before the initial round of procurement.
Confederacy of Mainland Mi'kmaq (CMM)	Winter Sack	The Proponent engaged with Mi'kmaq Conservation Group (part of CMM) in 2022 through the distribution of a series of Project update pamphlets. An offer to meet with the Mi'kmaq Conservation Group was also extended to discuss the Project and any potential concerns.
Kwilm'kw Maw-Klusuaqn Negotiation Office (KMKNO)	Patrick Butler Tracy Menge Twila Gaudet	The Proponent has engaged with KMKNO since 2021, requesting to meet to discuss the Project in October 2021. The Proponent and KMKNO met virtually in February 2022 to discuss the Project and status of environmental studies. General concerns raised include Section 35 rights (hunting moose and salmon fishing), local and traditional plants and medicines, and the need for a MEKS. This meeting was followed up by the Proponent providing further Project details in the form of pamphlets and other summary information. The Proponent provided an update on engagements with communities and organizations in May 2022, and extended an offer to meet to discuss the Project further and understand any early concerns. The Proponent requested contact information from KMKNO in July 2022 for any Indigenous companies or individuals with the capacity to do tree clearing work. The Proponent reached out in July 2023 to provide a Project update and send an invitation to upcoming open houses, encouraging feedback. The Proponent requested contact information from KMKNO in December 2023 for any Indigenous snow clearing contractors who may be able to work at the Project site.

First Nation / Organization	Representatives/Role(s)	Contact Details
		The Proponent provided project updates to KMKNO in April 2024, inviting engagement for feedback and collaboration. The Proponent participated in four events hosted by KMKNO for First Nations procurement and employment information in during 2023 and 2024, providing informational materials on the Project.
Membertou Geomatics (Membertou GIS)	Jason Googoo	The Proponent engaged with Membertou Geomatics throughout 2023 and 2024 regarding fieldwork and MEKS.
Native Council of Nova Scotia	Chief Lorraine Augustine	The Proponent engaged with the Native Council of Nova Scotia in 2022 through the distribution of Project mailouts/pamphlets outlining project information and website information; also included was any recent updates on the Project (e.g., status, layout changes, etc.). Invitations for further engagement, collaboration, and feedback were also provided.
Nova Scotia Native Women's Association	Karen Pictou	The Proponent engaged with the Nova Scotia Native Women's Association in 2022 through the distribution of Project mailouts/pamphlets outlining Project information and website information; any recent updates on the Project were also included (e.g., status, layout changes, etc.). Invitations for further engagement, collaboration, and feedback were also provided.
Unama'ki Institute of Natural Resources	Lisa Young	The Proponent has had ongoing engagement with the Unama'ki Institute of Natural Resources since 2022 through the distribution of a series of Project mailouts/pamphlets outlining Project information and website information; any recent updates on the Project were also included (e.g., status, layout changes, etc.). Invitations for open houses, further engagement, collaboration, and feedback were also provided. A virtual presentation was held in June 2022 to provide an introduction and to present the Project and its submission to the provincial rate base program Request for Proposals (RFP). The Proponent also provided an overview on size and location of the Project, the public and Indigenous engagement, as well as local and community benefits. The Proponent met with UINR in 2023 to provide a Project update and opportunity for feedback.
Union of Nova Scotia Mi'kmaq	Douglas Brown	The Proponent has engaged with the Union of Nova Scotia Mi'kmaq since March 2022, sending a project update pamphlet.

First Nation / Organization	Representatives/Role(s)	Contact Details
Wskijinu'k Mtmo'taqnuow Agency Ltd. (WMA)	WMA	The Proponent has engaged with WMA in 2024 through a virtual meeting that was held to provide a project and company overview, as well as seek additional partnerships for the Project.

5.2.1 Review of Concerns

Feedback on the Project from the Mi'kmaq Nova Scotia has been overall positive to-date. Key areas of interest identified through engagement are described below.

Lifestyle Impacts

No specific impacts were brought forward; however, the Proponent has shared that Project planning will be prioritized to minimize restrictions on land use. Typically, most activities carried out before the construction of a windfarm can continue afterwards.

Participation in MEKS

The MEKS provides the opportunity for First Nations participation and review.

Section 35 Rights (hunting moose and salmon fishing)

It has been communicated that Project planning will be prioritized to minimize restrictions on land use. Typically, most activities carried out before construction of a windfarm can continue afterwards.

Local and Traditional Plants and Medicines

MEKS and environmental studies completed on-site to identify presence of species.

Assurance to Receive Social and Economic Benefits

Benefits Agreement and a Capacity Building and Business Procurement Plan developed to provide equity dollars, jobs, and capacity building opportunities for the members of involved and adjacent First Nations.

Several of the topics of interest listed above were considered and assessed as part of the MEKS report completed by Membertou Geomatics Solutions.

5.2.2 Ongoing Engagement

The Proponent is committed to on-going, meaningful engagement with the Mi'kmaq of Nova Scotia and will continue to provide regular updates and seek feedback throughout all phases of the Project. Tours of the Project site have been offered to the Mi'kmaq of Nova Scotia and will continue to be offered during construction and operation. The Proponent is also committed to minimizing footprint disturbance and impacts to the Mi'kmaq of Nova Scotia while generating positive economic and environmental benefits through capacity building and business procurement planning. The Proponent will develop a Mi'kmaq Communication Plan that outlines an ongoing two-way communication process throughout the life of the Project.

5.3 MEKS

A MEKS presents a thorough and accurate understanding of the Mi'kmaq's use of the land and resources within an area. It is a report of gathered, identified, and documented ecological knowledge which is held by individual Mi'kmaq people. In addition, the MEKS report provides information on proposed Project activities that may impact the traditional land and resources of the Mi'kmaq. The MEKS for this Project was developed by Membertou Geomatics Solutions and was geographically scoped to include an evaluation of the Project Area along with a 5 km buffer surrounding the Project Area (referred to as the "Study Area" in the MEKS report). The MEKS for this Project is currently underway with site visits having been completed in July 2023, and again in June 2024 to accommodate Project layout changes. Once available, a copy of the MEKS will be provided directly to the required reviewers under separate cover.

MEKS considers the land and water areas in which the proposed Project is located to identify what Mi'kmaq traditional use activities have occurred or are currently occurring within the "Study Area"; and what Mi'kmaq ecological knowledge presently exists with respect to the area. This process is done in accordance with the Mi'kmaq Ecological Knowledge Protocol, 2nd Edition, which was established by the Assembly of Nova Scotia Mi'kmaq Chiefs and speaks to the process, procedures, and results that are expected of a MEKS.

The MEKS consists of two major components:

- Mi'kmaq Traditional Land and Resource Use Activities
    - Considers both past and present uses of the area.
    - Uses interviews as the key source of information regarding Mi'kmaq use.

- A Mi'kmaq Significance Species Analysis
    - Identifies species in the area and considers resources that are important to Mi'kmaq use (food/sustenance resources, medicinal/ceremonial plant resources, and art/tools resources).
    - Considers resource availability/abundance in the area (along with adjacent areas or in other areas outside), their use, and their importance, with regards to the Mi'kmaq.

Interviews undertaken by the MEKS Team with Mi'kmaq knowledge holders are ongoing. Interviewees were shown topographical maps of the Project Area and its 5 km buffer and asked to identify where they undertake their activities as well as to identify where and what activities were undertaken by other Mi'kmaq, if known. These interviews allowed the MEKS Team to develop a collection of data that reflected the most recent Mi'kmaq traditional use in this area, as well as historic accounts. The data gathered was also considered regarding its significance to the Mi'kmaq people. Once the analysis is complete, the MEKS report and any recommendations will be reviewed by the Project Team to determine if any mitigation measures are required to support the continued traditional use of the Study Area by the Mi'kmaq of Nova Scotia.

6.0 ENGAGEMENT

The Proponent is committed to transparent, meaningful, and ongoing engagement with government, the public, stakeholders, and the Mi'kmaq of Nova Scotia. The Proponent has directly engaged with members of the public, municipal leadership and staff, as well as relevant provincial and federal departments through in-person meetings, letters, e-mails, telephone conversations, open houses, and the formation of a Community Liaison Committee (CLC). This section provides a summary of the activities that have been conducted by the Proponent and outlines how the Proponent will continue to engage throughout the remainder of the Project's permitting, construction, and operational life.

Associated presentations, posters, and meeting agendas/minutes are provided in Appendix A.

6.1 Engagement with Government Departments, Agencies, & Regulators

The Proponent has been in contact with government entities and officials representing federal, provincial, and municipal jurisdictions (Table 6.1) to open lines of communication about the Project and ensure all regulatory requirements are met.

Table 6.1: Government Meetings and Events

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
Federal Government		
Canadian Coast Guard (CCG)	Wind Farm Coordinator	September 24, 2024 EMI notification letter sent via email. October 3, 2024 Email received confirming no interference expected.
DND	Military Air Defence and Air Traffic Control; Military Radio communication users	September 24, 2024 EMI notification letter sent via email. November 4, 2024 Strum provided the Natural Resources Canada (NRCan) project number to DND, as requested.
ECCC	Weather Radar Coordinator	April 12, 2022 A virtual meeting was held regarding submission of the Project into the Province of Nova Scotia's Rate Based Procurement RFP. September 24, 2024 EMI notification letter sent via email. October 30, 2024 Email received outlining internal consultation ongoing to determine potential impacts.
Innovation, Science, and Economic Development (ISED) Canada	Nova Scotia District Office	September 24, 2024 EMI notification letter sent via email. September 24, 2024 Acknowledgement email received.

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
Government of Canada	Member of Parliament (MP) for Kings Kody Blois	July 6, 2023 The proponent provided Project information and an invitation to MP Kody Blois via email. April 8, 2024 Proponent provided Project information and an invitation to MP Kody Blois via email. June 26, 2024 Virtual meeting with the Proponent and MP Kody Blois to provide a Project update.
	MP for South Shore – St. Margarets Rick Perkins	July 6, 2023 The Proponent reached out via email to provide an open house invitation and Project update to MP Rick Perkins. June 27, 2024 The Proponent reached via email to provide a Project update.
Health Canada	Unknown	April 12, 2022 A virtual meeting was held regarding submission of the Project into the Province of Nova Scotia's Rate Based Procurement RFP.
NAV CANADA	Land Use Specialist	September 24, 2024 EMI notification letter sent via email. November 4, 2024 Land Use Submission Form submitted.

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
RCMP	Wind Farm Coordinator	September 24, 2024 EMI notification letter sent via email. September 25, 2024 Letter of non-objection received via email.
Transport Canada	Unknown	April 12, 2022 A virtual meeting was held regarding submission of the Project into the Province of Nova Scotia's Rate Based Procurement RFP.
Provincial Government		
Member of the Legislative Assembly (MLA) for Sackville-Uniacke MLA for Chester – St. Margarets	MLA Brad Johns MLA Danielle Barkhouse	July 6, 2023 The Proponent reached out via email to provincial MLAs near the Project inviting them to Open houses and provided an update on the Project (Danielle Barkhouse, Brad Johns). August 31, 2023 The Proponent was contacted by MLA Barkhouse wondering how the open house went in July. The Proponent responded with updated information along with feedback from the Open House (Danielle Barkhouse). April 9, 2024 The Proponent sent an invitation via email to drop-in information sessions for the proposed Melvin Lake Wind Project, featuring updates and local feedback opportunities (Danielle Barkhouse, Brad Johns).

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		June 21, 2024 MLA Danielle Barkhouse reached out to ask questions about a lichen on the site. The Proponent replied with detailed information about environmental studies to-date and upcoming mitigations that would be determined through the EA process (Danielle Barkhouse).
Nova Scotia Department of Agriculture	Unknown	April 12, 2022 A virtual meeting was held regarding submission of the Project into the Province of Nova Scotia's Rate Based Procurement RFP.
NSECC	Oliver Maass Kermit deGooyer Neil Morehouse Bridget Tutty Candace Quinn Paula Francis Lynda Weatherby Helen MacPhail	January 7, 2022 Email confirmation of meeting and agenda (Oliver Maass). January 11, 2022 Email received from EA Branch requesting presentation for Project being proposed and to postpone meeting until Proponent can provide more details (Oliver Maass). January 13, 2022 Email received recommending a meeting with Protected Areas and Ecosystems Branch (Oliver Maass). January 18, 2022 Virtual meeting with Protected Areas and Ecosystems Branch focused on overview of Project and to review known areas in proximity to the Project (Oliver Maass, Kermit deGooyer, Neil Morehouse). January 20, 2022

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		Email received asking about overwintering deer areas and protected areas (Oliver Maass, Kermit deGooyer, Neil Morehouse). January 20, 2022 Email to wildlife sector for deer areas and inform no legal setbacks from protected areas (Oliver Maass, Kermit deGooyer, Neil Morehouse). February and March 2022 Proponent worked with EA Branch to produce a Project Description, schedule a virtual meeting, and coordinate geographic information system (GIS) resources. April 12, 2022 Virtual meeting presenting Project and proposing to submit to Nova Scotia's Rate Based Procurement RFP [Candace Quinn]. April 27, 2022 Virtual meeting with OLA and NSECC to obtain further clarification on Mi'kmaq and Public Engagement requirements [Candace Quinn, Janel Hayward (OLA)]. May 2022 A virtual meeting was held to discuss ecological connectivity within the Project boundary. A follow-up email from NSECC provided a link to a connectivity study and a contact for the connectivity

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		layers [David MacKinnon (NSECC), Kermit DeGooyer (NSECC), Keith Towse (Community Wind Farms)]. April 2023 The Proponent emailed meeting minutes and meeting follow ups from discussion with NSECC on EA requirements. February 14, 2024 The Proponent met with NSNRR and NSECC to discuss changes to the Project layout and additional filed work necessary to meet EA Registration Document requirements. A slide deck and information package was sent following the presentation, following their request [Bridget Tutty, Paula Francis, Lynda Weatherby]. June 13, 2024 Virtual meeting with NSNRR and the NSECC EA Branch to discuss Project updates, changes to the submission schedule and field program progress [Lynda Weatherby, Helen MacPhail].
NS Department of Municipal Affairs and Housing	Head Office	April 12, 2022 A virtual meeting was held regarding submission of the Project into the Province of Nova Scotia's Rate Based Procurement RFP.

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
NS Department of Public Works (NSDPW)	Head Office Area Manager Director, Operations Services	April 12, 2022 A virtual meeting was held regarding submission of the Project into the Province of Nova Scotia's Rate Based Procurement RFP. December 14, 2023 The Proponent reached out via email to discuss turbine transport/routing. July 18, 2024 The Proponent met with NSDPW in-person to discuss the Project and turbine transport/routing options.
NSCCTH	General Inquiries Email	April 12, 2022 A virtual meeting was held regarding submission of the Project into the Province of Nova Scotia's Rate Based Procurement RFP.
NSNRR	Louise Boudreau Mark McGarrigle Lisa Doucette Bob Petrie Shavonne Meyer Maureen Cameron-MacMillan Leslie Hickman Peter Geddes Bradley Middlemiss Joan MacLean Tara Crewe	May 5, 2022 Held a virtual meeting to share and review proposed surveys with EA reviewers for VC Flora and Fauna and obtained recommendations that should be considered or addressed in the Project's EA Registration Document (Louise Boudreau, Mark McGarrigle; Lisa Doucette, Bob Petrie, Shavonne Meyer, Maureen Cameron-MacMillan). May 26, 2022 In-person meeting to introduce Proponent and Project Team (Leslie Hickman, Peter Geddes, Bradley Middlemiss).

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		May 27, 2022 Email response received from NSNRR including map from May 26 meeting and highlighting the importance of community consultation (Leslie Hickman, Peter Geddes, Bradley Middlemiss). May 30, 2022 Email sent by Proponent thanking NSNRR for planning tool and informing them the Proponent would reach out the next time they were in Halifax (Leslie Hickman, Peter Geddes, Bradley Middlemiss). May 4, 2023 Email follow-up with meeting times for an in-person meeting. The Proponent set up a meeting with the NS Government regarding Crown Land leases (Joan MacLean). December 7, 2023 In-person meeting with NSNRR and the EA Branch to discuss the current status of the Project and gain input from the NSECC team about the EA process and expectations (Bridgett Tutty, Lynda Weatherbee). February 14, 2024 The Proponent met with NSNRR and NSECC to discuss changes to the Project layout and additional filed work necessary to meet EA Registration Document requirements. A slide deck and information package

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		was sent following the presentation, following their request. (Mark McGarrigle, Tara Crewe) May 30, 2024 Email outreach to the Department of Natural Resources – Emergency Management Office (EMO)/Fire Prevention - to request a meeting with Scott Tingley to discuss Emergency Response Plan and fire mitigation at the site. This contact was suggested by Halifax Regional Municipality (HRM) Councilor Lovelace (Scott Tingley). Email outreach to request a follow-up meeting with NSNRR and the NSECC EA Branch to discuss updates to EA submission timelines (Mark McGarrigle). June 13, 2023 Meeting with NSNRR and NSECC EA Branch to discuss updates to the submission timelines and component study progress (Mark McGarrigle).
OLA	General Contact Janel Hayward Salima Medouar	February 15, 2022 Introductory email from Janel Hayward stating she would be the contact for the Project under the Rate Base Program. The Proponent responded on February 17, 2022, with potential meeting times. On February 22, 2022, a meeting request was sent for March 1, 2022 (Janel Hayward, Salima Medouar). March 1, 2022 Virtual meeting with Janel Hayward to introduce the Project and describe the communication to date with

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		Mi'kmaq Communities. Janel provided information regarding expectations, the consultation process, and MEKS. Janel stated it would be good practice to reach out to all the Mi'kmaq Communities regarding the Project as traditional territories could be impacted (Janel Hayward). March 14, 2022 Email outreach to confirm if OLA would like copies of all the correspondence with the Mi'kmaq communities as is outlined in the 'Proponent's Guide for Consultation with Mi'kmaq. March 24, 2022 The March 2022 Project Update Pamphlet was sent for the Project as well as directions to additional information on each website. The offer to meet was extended. April 27, 2022 A virtual meeting was requested and held following the EA Scoping Meeting to obtain further clarification on the Mi’kmaq & Public Engagement requirements [Janel Hayward, Candace Quinn (NSECC)]. May 4, 2022 The May 2022 Project Update Pamphlet was sent via email as well as directions to additional information on each website. An offer to meet was extended to further discuss the project and understand any early concerns. OLA requested updated contacts, which the Proponent provided.

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		July 12, 2023 The Proponent provided information and Project updates via email for the Project to OLA. The Proponent previously met with OLA to introduce the Project and seek guidance regarding consultation and engagement. April 8, 2024 Email outreach to provide a Project update, including information sessions and community engagement, with attachment of project brochures and maps.
Municipal Government		
HRM	Pam Lovelace – District 13 Councilor Erin MacIntyre – Director – Current Planning, HRM Planning & Development	January 20, 2021 In-person meeting to discuss municipality regulations, by-laws, and permitting [Pam Lovelace (HRM), Bill McLean (Community Wind Farms)]. November 1, 2021 In-person meeting to discuss the Project [Pam Lovelace (HRM), Bill McLean (Community Wind Farms)]. December 21, 2021 In-person meeting to discuss the Municipal Regulations [Pam Lovelace (HRM), Bill McLean (Community Wind Farms)]. February 28, 2022

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		The Proponent requested a letter of support via email. HRM stated they are unable to provide a letter of support until the permitting process is complete [Pam Lovelace, Erin MacIntyre (HRM), Keith Towes (Community Wind Farms)]. May 5, 2022 The Proponent provided an email update on the Project [Pam Lovelace (HRM), Bill McLean (Community Wind Farms)]. June 28, 2023 The Proponent provided a Project update and open house information via email to Deputy Mayor Lovelace who is also Councilor for the Melvin Lake region. She agreed to share information on the upcoming Melvin Lake open house in an upcoming e-newsletter (Pam Lovelace). July 2023 The Proponent followed up with Fire Station 65 in proximity of the Project site after in-person meeting and provided invitations to open houses [Amos Robia (Halifax Regional Fire and Emergency)]. The Proponent reached out to the HRM Councilor responsible for the Project region via email and sent a map, information, and a request to meet or provide suggestions. The outreach resulted in ongoing correspondence and an in-person meeting with the Councilor (Pam Lovelace).

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		December 19, 2023 Email outreach to the HRM Councilor to provide an update on the Project and a timeline (Pam Lovelace). March 18, 2024 The Proponent sent a social media promo for the upcoming Project information sessions to Councilor Lovelace, mentioning an attached graphic and plans for distributing a flyer closer to the session date (Pam Lovelace). May 2024 The Proponent reached out to Councilor Lovelace via email to request a meeting on May 24 regarding follow up from the open house she attended and to discuss access opportunities for the Project site. Councilor Lovelace agreed to the meeting and the Proponent and Councilor met in-person to discuss updates to the Project and provided suggestions around access points. The Proponent followed up with Provincial Government contacts as suggested by the Councilor, including EMO and NSNRR. The councilor indicated she is in support of the Project (Pam Lovelace). May 30, 2024 The Proponent reached out to HRM to connect with EMO - Erica Fleck to discuss the Project and

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		Emergency Response Plan for input. This was a suggestion of Councilor Pam Lovelace.
Halifax Regional Water Commission	Barry Geddes	April 12, 2021 In-person meeting with the Proponent, Halifax Water and Community Wind Farms to discuss site access [Barry Geddes (Halifax Water), Bill McLean (Community Wind Farms)]. May 2023 The Proponent reached out to Halifax Water via email to inform them of the Project and for any suggestions or concerns regarding the Project. A meeting was then set up regarding road access for the Project (Barry Geddes). June 14, 2023 The Proponent sent a meeting request via email to meet with Halifax Water to discuss the watershed areas and lands in the vicinity of the Project (Barry Geddes). July 6, 2023 Email outreach regarding the site and setbacks with Halifax Water (Barry Geddes). November 11, 2023 Email outreach to Halifax Water regarding possible land access request (Barry Geddes, Braden Rooke). January 22, 2024 Email outreach regarding the watershed areas. The Proponent responded to Barry's inquiries regarding

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		turbine operations and potential hazards, offering detailed explanations and assurances, expressing willingness to discuss further (Barry Geddes). February 13, 2024 Correspondence from Barry Geddes expressing optimism regarding ongoing dialogue for the safety of the Pockwock primary water supply.
Municipality of East Hants	Kelly Ash – Manager of Development Services John Woodford – Director of Planning and Development	June 12, 2021 In-person meeting to discuss Municipal Regulations [Kelly Ash (Municipality of East Hants), Bill McLean (Community Wind Farms)]. December 22, 2021 In-person meeting to discuss Municipal Regulations [Kelly Ash (Municipality of East Hants), Bill McLean (Community Wind Farms)]. January 7, 2022 In-person meeting to discuss Municipal Regulations [Kelly Ash (Municipality of East Hants), Bill McLean (Community Wind Farms)]. May 5, 2022 The Proponent provided an update via email on the Project. Bill McLean requested and received a letter of support from the Planning Director [John Woodford (Municipality of East Hants), Bill McLean (Community Wind Farms)]. May 6, 2023

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		The Proponent reached out via email to the municipal Council of East Hants to request an in-person meeting, which occurred in June 2023. The meeting was to discuss a Project update, seek feedback, and plan for development permits required after the Project is approved [John Woodford (Municipality of East Hants), Bill McLean (Community Wind Farms)]. July 5, 2023 The Proponent in-person met with East Hants Municipality Planning and Development staff on July 5, discussed upcoming presentation to Council and requirements for site specific development permits after the Project is approved. The Proponent sent an email to East Hants Municipal Staff and Councilors for Open House invitations for the Project and provided a Project update (Kelly Ash). September 5, 2023 The Proponent rescheduled a meeting to present to East Hants Planning & Advisory Committee due to recent updates in GCP and updated layout changes since the last meeting and presentation to this municipality (John Woodford). December 20, 2023 The Proponent followed up with East Hants Council with a summary of feedback and Project update following in-person presentation to Planning and Advisory Committee (E. Roulston, S. Garden-Cole, N. Mitchell, E. Hebb, C. MacPhee, krhyno@easthants.ca,

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		W. Greene, W. Tingley, M. Perry, E. Moussa, T. Isenor, Kelly Ash (Municipality of East Hants), John Woodford (Municipality of East Hants). January 22, 2024 The Proponent confirms location suggestions via email with Councilor Moussa for an upcoming community engagement session regarding the Project (E. Moussa). March 25, 2024 The Proponent informs Councilor Moussa via email about scheduled open houses for the Project, provides a social media post, and outlines further outreach efforts (E. Moussa). April 5, 2024 Email outreach to invite Councilors and East Hants Staff to upcoming drop-in information sessions for the Project, highlighting the transition from Crown lands to private lands and providing details on dates, times, and locations (E. Roulston, S. Garden-Cole, N. Mitchell, E. Hebb, C. MacPhee, krhyno@easthants.ca, W. Greene, W. Tingley, M. Perry, E. Moussa, T. Isenor, Kelly Ash (Municipality of East Hants), John Woodford (Municipality of East Hants), info@easthants.ca, J. Cashen). May 2024 The Proponent reached out to Planning & Development staff via email to request to present a Project update to East Hants Council. Following this request, the

Government Departments, Agencies, & Regulators	Representative	Dates, Activities, & Comments
		Proponent provided a presentation to East Hants Council (John Woodford, Kelly Ash, Amanda Coldham, Rachel Gilbert, East Hants Council). The Proponent replied to East Hants Council / Planning and Advisory staff via email to thank them for their recent Letter of Support for the Project. They voted unanimously to provide support for the Project, provided the Proponent follows the required Development Permit process following the GCP and EA (John Woodford).
Emergency Management Office (EMO) – Halifax Regional Municipality	Erica Fleck	May 30, 2024 The Proponent reached out to HRM to connect with EMO to discuss the Project and the ERP for input.

6.1.1 Review of Government Concerns

Discussions with federal and provincial regulators primarily focused on:

- Project scope
- Turbine layout
- Project and EA timeline
- Scope and design of environmental surveys
- Habitat, ecological connectivity, and protected areas in proximity to the Project
- Setback requirements
- Public engagement
- Mi'kmaq engagement
- Emergency response planning
- Crown land easement applications
- Rate Based Procurement RFP

Questions from municipal government, planners, and the Halifax Regional Water Commission mainly pertained to:

- Municipal regulations and permitting
- Watershed interactions
- Site access
- Emergency response planning
- Community benefits
- Project layout
- Community and stakeholder consultation

Engagement with government officials will continue through development, construction, and operational phases of the Project.

6.2 Public & Stakeholder Engagement

The Proponent has been involved in extensive formal engagement activities with the public and stakeholders to ensure the community was made aware of the Project and given ample opportunity to receive information, ask questions, provide feedback, and share local knowledge.

Acknowledging the importance of giving back to communities where it works, the Proponent has contributed funding toward local causes including the local Safety Minded ATV Association (SMATVA), St. Margaret's Bay Stewardship Association and a nearby Mi'kmaq community.

The Proponent is committed to continuing sponsorships and donations through a community giving strategy to ensure communities in proximity of the Project avail of funding during each year of the Project's planning and operation. A significant Community Benefit Fund and a Capacity Building and Business Procurement Plan has also been created by the Proponent for this Project to implement in East Hants and Halifax Regional Municipality.

With a Local Economic Development policy in place, the Proponent is focused on assuring that residents and businesses in the local region receive preferential attention and access to business and employment opportunities. It is the Proponent's intent to maximize economic benefits for communities and First Nations in the local region through promoting long-term commercial growth through access to goods and service contracts, capacity training, and employment.

Engagement with the public and stakeholders will continue through development, construction, and operational phases of the Project. Table 6.2 summarizes engagement with stakeholders.

Table 6.2: Stakeholder Meetings and Events

Community/Stakeholder Organization	Engagement
ATV Association of Nova Scotia (ATVANS)	December 2023 Email outreach to request shapefiles for ATV trails in NS following a meeting with ATV association.
CIB	January 17, 2024 The Proponent emailed avenues/programs to support our Indigenous partners in accessing equity/project costs before the initial round of the procurement.
Coho (independent procurement administrator for the Green Choice Program)	November 8, 2023 The Proponent submitted communications logs (June 2023-November 2023) and documentation of Notice of Proposals to M5 for the Green Choice Program requirements. November 9, 2023 M5 Public Affairs confirmed receipt of attachments and content for November 8 deadline of Notice of Proposal postings and communications logs dating back to June 2023. November 27, 2023 The Proponent emailed records of previous engagement going back to 2021 for the Project. December 1, 2023 The Proponent shared a communication log engagement update and Community Liaison outreach information with M5. M5 confirmed receipt. January 3, 2024 The Proponent emailed the Monthly Communication Log Submissions. February 13, 2024 The Proponent provides comprehensive updates on the Project, including community engagement plans and upcoming information session details. March 16, 2024 The Proponent provides a monthly GCP comms/consultation update for M5 on the Project, providing details on recent developments, including website updates, community engagement efforts, and upcoming information sessions.

Community/Stakeholder Organization	Engagement
	March 20, 2024 The Proponent shares the finalized ads and invitations for the Project Information Sessions, detailing plans for extensive distribution to stakeholders and local media, with a commitment to include the information in the next monthly report. April 22, 2024 As requested by M5 for the GCP, the Proponent submitted all relevant community engagement documentation to summarize efforts and submission into the 2021 Rate Base Procurement bid.
Canadian Parks and Wilderness Society (CPWS)	January 10, 2022 CPWS expressed concerns via email with the Project location and protected areas. January 11, 2022 Email outreach from the Proponent addressing the concerns raised by CPWS and requested a meeting to discuss. CPWS responds with a suggestion for a meeting time.
Dalhousie University	May 23, 2023 The Proponent met with Karen Beazley (School of Resource and Environmental Science) to discuss potential impacts to Mainland Moose and mitigation measures to be included in Project design.
Ecology Action Centre	July 2023 The Proponent followed up with Ecology Action Centre via email regarding Mainland moose and sent along invitations to the Open Houses. July 6, 2023 The Proponent met with Karen McKendry of the Ecology Action Centre who provided valuable suggestions and feedback regarding wind development approaches.
Elmsdale Lumber Company	June 26, 2023 The Proponent reached out via email to provide an update on the Project along with an invitation to the open house. The Proponent received an email confirming they would share the open house invitation with their contacts. July 26, 2023 The Proponent had a discussion through email with the landowner; the landowner sent a shapefile of properties to discuss regarding wind Project opportunities in the area.

Community/Stakeholder Organization	Engagement
	December 13, 2023 The Proponent emailed the proposed road layout and turbine locations as requested.
Halifax Regional Fire and Emergency	May 25, 2023 The Proponent reached out via email to Station 65 for a meeting request. June 14, 2023 The Proponent reached out to Station 65 for introductions and review of the Project and input on emergency response planning. June 20, 2023 The Proponent met in-person with Chief Robia & Captain Young of Halifax Regional Fire Station 65, Upper Tantallon. They provided suggestions around Emergency Response Planning and notifications and suggested incorporating dry hydrants into the Project site. June 23, 2023 The Proponent reached out to the District 3 Fire Chief via phone to see if he was available to meet in the upcoming weeks to discuss emergency response planning at the site. He said that the EMO's Erica Fleck is the person to talk to. The Proponent called Bernard Morrissey to see if he was available in the upcoming weeks to discuss emergency response planning and sent a follow up email to confirm dates (Halifax Regional Fire and Emergency). May 16, 2024 The Proponent followed up via email with Station 65 in Upper Tantallon to provide a draft ERP for local emergency responder review and input. Both parties had met previously and agreed to collaborate on the ERP with local emergency response and access considerations. May 30, 2024 The Proponent reached out via email to Chief and Captain of Station 65 in the Tantallon area to ask if they had reviewed the ERP draft, and whether they had any feedback or would like to meet in-person again to discuss.

Community/Stakeholder Organization	Engagement
Ingramport River Association	January 21, 2022 Had an in-person meeting and discussed possible environmental impacts relating to the proposed Project.
Invest Nova Scotia	July 17, 2023 The Proponent followed up via email with Invest Nova Scotia following the open house. The Proponent also requested contact information for local community members and groups.
Masthead News	December 1, 2023 The Proponent sent an email with a Community Liaison Council (CLC) ad submission for Masthead news – December and January. March 18, 2024 The Proponent requested an ad placement in the April edition of the Masthead, inquired about the possibility of online/web placement as well.
Mount Uniacke Volunteer Fire Department	May 16, 2024 Email outreach to indicate they have drafted an ERP and invited them to meet to review the ERP and provide feedback with local emergency response considerations. May 17, 2024 Emailed to request an in-person meeting with Uniacke Fire to discuss the Project and particularly the ERP. Both parties agreed to set up a meeting, which occurred in-person. May 24, 2024 In-person meeting with the Fire Chief and members of the Uniacke Fire Department to discuss the Project and to seek feedback on fire prevention and emergency response.
Melvin Lake Wind Community Liaison Committee	November-December 2023 The Proponent advertised for Community Liaison Committee membership in local areas, including a poster at several local venues, advertisement in local media and an email to known stakeholders. May 6, 2024 The Proponent followed up via email with an individual who attended the Melvin Lake Wind information session to see if he may be able to join the Melvin Lake CLC. May 7, 2024

Community/Stakeholder Organization	Engagement
	The Proponent followed up with an individual about the CLC after he attended the open house. He said he was very interested and has now joined the Melvin Lake CLC. May 14, 2024 The Proponent spoke with a resident by phone and confirmed his interest in joining the Melvin Lake CLC. He has familiarity with the Mount Uniacke side of Project and is in support of it going ahead, offered to take the team out to site on an ATV if needed. June 6, 2023 The Proponent met with CLC members at the Bay Community Centre to provide a detailed update on the Project and listened to feedback from members for consideration. The group agreed to meet following an update on the Green Choice Program submission or once there were other relevant updates to share.
Pockwock Community	May 9, 2022 The Pockwock Community emailed expressing concerns about not receiving mailouts, visualizations (and concerns relating), asking about turbines versus solar, and the location choice for Melvin Lake. September 23, 2022 The Proponent emailed a community member who had reached with concerns and questions, and provided a project status update. The Proponent provided an update to the environmental study schedule as well as the intention to update photo visualizations with the updated layout. In addition, the Proponent stated they were still evaluating turbine light and mitigation measures. The Proponent also asked the community member to send the list of wildlife in the area that he said he provided at the open house. June 26, 2023 The Proponent reached out via email to community residents with Project information & open house invitations. June 28, 2023 The Proponent followed up via email regarding the Project. The Proponent offered to do visualizations using our consultant to help the community member understand any potential visual impacts from his property.

Community/Stakeholder Organization	Engagement
	July 14, 2024 The community member reached out to the Proponent with a wildlife list for the Project. The Proponent reviewed this and also sent a copy to the consultant. May 10, 2024 The Proponent and community member had additional email correspondence to provide information on setback distances and discuss visual impacts. June 11, 2024 The Proponent met in-person with the community member and some neighbours to discuss feedback, concerns and potential mitigations. June 25, 2024 The Proponent replied to the community member by email to summarize the meeting, indicating ongoing environmental studies will provide additional data. Mitigation options were also discussed. October 9, 2024 The Proponent reached out to the community member to discuss alternate turbine positions based on feedback.
SMATVA	November 2023 The proponent reached out to SMATVA via email to meet in December to provide a Project update and gather community-based feedback. An on-site meeting time has been confirmed. December 2023 In-person introduction meeting with the Proponent and SMATVA (shared users/trail maintainers in the Melvin Lake area). Next steps include obtaining shapefiles for trails and considering their venue as an open house area and keeping in touch with Project updates. The meeting was very positive. April 2024 The Proponent followed up via email with the SMATVA President to thank them for hosting the recent open house. The President replied to say feedback he has had from members and public is positive.

Community/Stakeholder Organization	Engagement
Snowmobilers Association of Nova Scotia (SANS)	July 20,2023 Email outreach to organize an introductory meeting with SANS regarding the Project, Proponent information, and work done to date. A meeting was held and information about the Project was provided. The Proponent agreed to collaborate and coordinate with SANS to mitigate any effects the Project may have on their trail network. SANS did not identify any local snowmobiler clubs within proximity of the Project.
SMBSA	March 6, 2023 In-person meeting with SMBSA to go over the Project and to listen to their feedback relating to the local environment and community engagement. Both parties began to foster an open and communicative relationship from this point forward and have continued to engage. March 14, 2023 Follow-up virtual meeting with the SMBSA to continue discussing options for information-sharing so the Proponent is aware of any concerns particularly relating to the Mainland moose migratory corridors. April 12, 2023 The Proponent sent a summary of the meeting via email along with action items to SMBSA following an in-person meeting. June 9, 2023 The Proponent followed up with SMBSA via email after a recent in-person meeting to discuss pellet group studies that the Proponent participated in. June 26, 2023 The Proponent provided a project update via email along with open house invitations. July 4, 2023 The Proponent reached out to SMBSA to send information regarding GIS Environment Layers. July 17, 2023

Community/Stakeholder Organization	Engagement
	The Proponent was invited by SMBSA to join Recreational site inventory at the site. The Proponent joined multiple rounds. November 3, 2023 The Proponent provided public notice and general project update by email to SMBSA. Executive Director, John Roff noted he was available to meet in late November. November 14, 2023 Email outreach requesting to meet with SMBSA to discuss project updates and hear feedback for upcoming engagement. November 24, 2023 The Proponent distributed minutes via email including next steps/action items. This also included an attachment of a possible CLC advertisement to distribute in the community. December 18, 2023 The Proponent sent a map showing recreational sites and Crown vs. private land as requested. December 19, 2023 Email outreach to schedule time for SMBSA to conduct Mainland moose transect studies. February 2024 The Proponent shares SMBSA methodology for reviewing Strum's wintering studies and additional locations were requested via email. SMBSA is preparing routes for the study and seeking feedback through the Proponent April 5, 2024 Email outreach inviting SMBSA leadership and staff to an upcoming drop-in information session for the Project, highlighting the transition from Crown lands to private lands and providing details on dates, times, and locations. April 8, 2024

Community/Stakeholder Organization	Engagement
	John responds via email expressing regret for his inability to attend due to a scheduling conflict and offering continued liaison support for SMBSA. April 24, 2024 The Proponent thanked SMBSA for coming to the open house on April 15 and indicated they should meet in the coming month or two. May 7, 2024 Email outreach to SMBSA to set up a meeting following the open house. Both parties agreed to meet in-person on May 24. May 24, 2024 In-person meeting. Discussed recreational site survey updates, Project-related impacts, and other concerns. May 30, 2024 The Proponent followed up with SMBSA after the recent in-person meeting. The Proponent invited SMBSA to a CLC meeting, and noted that based on their feedback, they are also reaching out to the ATV association to offer them a rotating seat as part of the CLC as a regular user of the Project area. The Proponent also provided an ERP draft and requested any input that the SMBSA would like to add. May 31, 2024 Email confirmation that the SMBSA President will be attending the upcoming CLC meeting. June 4, 2024 The SMBSA Executive Director reached out to the Proponent to provide a Recreational Impacts Assessment study that he completed at the site. He noted it is great to see the Proponent seeking to attain a better understanding of how infrastructure and energy projects may impact recreational and community values.
St. Margarets Centre	December 6, 2023 Agreement reached over email to promote the CLC opportunity including Project website and lead contact noted at St. Margarets Centre arena.

Community/Stakeholder Organization	Engagement
Upper Hammonds Plains Development Association	November 7, 2023 Email outreach to request that they share/post a Notice of Proposal regarding the Project. They agreed to share the Notice of Proposal on their website and social media.
Westwood Hills Residents Association	July 26, 2023 Email outreach to the Westwood Hills Residents Association regarding the Project, providing a Project update and a request to meet. September 8, 2023 Virtual meeting with Westwood Hills Residents Association. Representatives did not express major concerns but emphasized the importance of community engagement with groups like off-road (ATV) enthusiasts. Feedback from the community has generally been positive regarding wind turbines. September 15, 2023 Email follow-up after the meeting asking for the contacts of anyone that should be consulted for feedback regarding the Project.

6.2.1 Digital Communications

The Proponent has maintained a Project website since September 8, 2021. (www.melvinlakewind.ca). This publicly accessible website continues to be updated regularly. It includes information about the Project and Proponent including:

- About the Project (i.e., ownership, developers, location, sizing, job creation)
- Project contact information
- Project timeline/schedule
- News updates
- Community benefits
- Project engagement documents (open house materials, newsletters, brochures)
- Frequently asked questions (environment, wind turbines, permitting, public engagement, construction, land development, property, and Project benefits)
- Vendor/supplier registration form

6.2.2 Newsletters

The Proponent provided five separate mass mailouts to many thousands of recipients across the region. Consistent information with the mailouts was concurrently shared electronically with a list of all relevant elected officials, key stakeholders, community groups along with residents whom we have contact information for, and permission to contact through previous open houses and local engagement.

Newsletters were posted on the Project website and also distributed via Canada Post Neighbourhood Mail to residents in proximity to the Project in September 2021, March 2022, May 2022, June 2023, and February 2024.

These newsletters were distributed to 1400, 2400, 8049 and 6444 residences, respectively, on each occasion and included the following information:

- Overview of the Project
- Project Timeline
- Introduction to the Proponent
- Information on upcoming open houses
- Map of the Project layout
- Community/local benefits and economic opportunities
- Overview of engagement efforts
- Frequently asked questions
- Information about the Community Liaison Council (CLC)
- Contact information
- Information about upcoming open houses (September 2021, June 2023, April 2024)

6.2.3 Public Update Advertisements

Project update advertisements ran in the Chronicle Herald on September 8 and October 6, 2021, March 16 and May 4, 2022, in the Valley Journal Advertiser in June and October 2023 and April 2024, in the Laker during June 2024, in the Masthead News in June, July and November 2023 and April 2024, and in Uniacke News and the St. Margarets Bay Centre in April 2024.

The 2021 advertisements provided information on the Project and upcoming open house. The 2022 public advertisements introduced the Project, invited consultation and directed the public to review the Project website.

The spring 2023 public advertisements invited individuals to attend the open house and provided contact information and the Project website. The fall 2023 advertising provided information on the Proponent’s intent to submit the Project into the Green choice Program and included contact and website information. The spring 2024 advertising provided contact information, website detail and an invitation to the upcoming open houses.

6.2.4 Public Open House Events

Four public open house events took place in 2021, 2023, and 2024 prior to EA registration. Details are provided below.

Open House #1

The first Open House was held on Wednesday September 15, 2021 from 7:00 pm to 9:00 pm at the Upper Hammonds Plains Community Centre (711 Pockwock Road, Upper Hammonds Plains). This event was advertised on the Project website, in the September 2021 mailout, and in the Chronicle Herald (September 8, 2021 edition). The objective of this open house was to introduce the Project to the community, show a preliminary Project layout, early visual similations, and sound modelling, and to gather community feedback to inform the Project design.

The Proponent presented 16 posters, answered questions, and took feedback about concerns and interest from the local community and various stakeholders. Sign-in sheets were available for participants to provide their contact information and enable follow up. A total of 21 attendees were recorded on the sign-in sheets. All materials presented at the session were also made available on the Project website. A follow up advertisement ran in the Chronicle Herald (October 6, 2021 edition) thanking the community for their participation and providing contact information.

Feedback received from Open House #1 was incorporated into the planning and development of Open House #2 and to inform the Project design process.

Open House #2

The second Open House was held on Thursday July 13, 2023 from 6:00 pm to 8:30 pm at the Estabrooks Community Hall (4408 St. Margarets Bay Road, Lewis Lake). This event was advertised on the Project website, in the June 2023 Newletter mailout, and via a reminder postcard sent late June 2023. The objective of this open house was to provide updated information on the Project to the community, show an updated Project layout, provide consultation and CLC information, display visual similations and sound modelling, and to gather community feedback to inform the Project design.

The Proponent presented 16 posters, answered questions, and took feedback about concerns and interest from the local community and various stakeholders. Sign-in sheets were available for participants to provide their contact information and enable follow up. Comment forms were also available for participants to provide written feedback. A total of 14 individuals opted to sign in at this event. All materials presented at the session were also made available on the Project website.

Open House #3 & #4

Two open houses were held in April 2024. The first was held at the Safety Minded ATV Association Clubhouse (15 Station Road, St. Margarets Bay) on Monday April 15, 2024 from 6:00 pm – 8:30 pm. The second was held at the Uniacke and District Fire Hall (654 Highway 1, Mount Uniacke) on Tuesday April 16, 2024 from 6:00 pm – 8:30 pm. These events were advertised on the Project website, in the April 2024 Masthead News, the Valley Journal (April 9, 2024), and the April 2024 newletter mailout. The objective of these open houses was to provide updated information on the Project to the community, show an updated Project layout, provide consultation and CLC information, display visual similations and sound modelling, and to gather community feedback to inform the Project design.

The Proponent presented 19 posters, answered questions, and took feedback about concerns and interest from the local community and various stakeholders. Sign-in sheets were available for participants to provide their contact information and enable follow up. Comment forms were also available for participants to provide written feedback. A total of 11 individuals opted to sign in at the April 15, 2024, event, although attendance was higher, and five individuals opted to sign in at the April 16, 2024 event. All materials presented at the session were also made available on the Project website.

Feedback received from Open House #3 and #4 was used to inform the Project design process.

6.2.5 Review of Concerns

Issues and concerns raised by the public have been grouped into broader categories and reference to the relevant section of the EA in which the concern is addressed have been noted (Table 6.3).

Table 6.3: Comments Received from the Public

Key Issues	Proponent Response	Section of EA
Human Health		
Have studies been done on sound impacts to nearby residences?	Sound modelling was completed for the Project incorporating the nearby Chebucto Pockwock Community Wind Project turbines. Sound levels were in compliance at all receptors. Further information is provided in Section 10.5	Section 10.4
Concern with anticipated noise from turbines in Pockwock neighbourhood	The proponent provided information that it had completed a noise modeling study previously through its environmental consultant. The Proponent met in-person with some residents of the neighbourhood to discuss the study results that indicate the sound meets all required thresholds, but we will continue dialogue to explore any other possible mitigation measures moving forward.	Section 10.4
Has the effect for shadow flicker been studied?	A shadow flicker assessment was completed and shadow flicker levels were in compliance for all receptors. Further information is provided in Section 10.3.	Section 10.2
Socio-Economic		
How will the Project benefit the community.	This project will help Nova Scotia achieve its goal of 80% renewable energy by 2030. Additionally, tax revenue would provide substantial financial benefit for municipal services. The Project will require services and materials that will be sourced locally. A Community Benefit Fund will be established to support community-level initiatives.	Section 8.1
How will the Project impact current land use?	Project planning will be done to minimize restrictions to land use. Most activities underway before construction can continue afterwards. Discussions are ongoing with recreational users, including the ATV club and St. Margarets Bay Stewardship Association to mitigate impacts and incorporate suggestions. A Recreational Impact Assessment was also completed for the Proponent to understand current and historical land use.	Section 8.2
How will the Project impact electromagnetic interference?	An electromagnetic interference assessment was completed with providers within the appropriate consultation zones. Further information is provided in Section 10.2.	Section 10.1
Environmental Impacts		
How will you protect wildlife?	Wildlife surveys were completed through the Study Area to assess the existing environmental condition and potential Project impacts on wildlife. Project design included mitigations to minimize habitat fragmentation and habitat loss.	Section 7.4.4

Key Issues	Proponent Response	Section of EA
General		
What type of access is needed for the turbines?	The Project will utilize existing roads, upgrading to adequate width for turbine transport. New roads will also be developed in select areas. Roads will be maintained at a narrower width for the Project lifespan. Based on CLC feedback, the Proponent is actively seeking alternate strategies regarding access to the Project site during construction.	Section 3.2.2
What is the life expectancy of the Project?	The lifecycle of a turbine is typically 20 to 30 years. The life expectancy of this Project will be subject to the requirements set out by the Province of Nova Scotia within the Power Purchase Agreement, but it is expected to be 25 – 30 years.	Section 3.4
Who maintains the turbines, access road, equipment?	During the life of the Project, there will be a local site manager who will ensure the turbines, roads and equipment are well maintained and operating safely.	Section 3.3

6.2.6 Ongoing Engagement

The Project has evolved to address feedback received from the public. Some examples include:

- Changes to the Project layout to address concerns regarding wildlife and habitat fragmentation.
- Additional visual simulation and sound modelling for individual residences.
- Inclusion of additional turbine pads into the EA to provide flexibility for turbine locations.
- Reviewing alternative transportation/routing options for turbines.

The Proponent will continue to document questions and concerns raised by the public through telephone and e-mail correspondence, and any additional in-person contact. When possible, the Proponent will directly engage with members of the public, landowners, stakeholders, and government entities who have expressed concerns relating to the Project.

7.0 BIOPHYSICAL ENVIRONMENT

7.1 Atmospheric Environment

7.1.1 Atmosphere and Air Quality

7.1.1.1 Overview

The assessment of the atmospheric environment included a review of weather, climate, and air quality data.

7.1.1.2 Regulatory Context

Relevant legislation includes:

- *Environment Act*, S.N.S. 1994-95, c.1
- Air Quality Regulations, N.S. Reg. 8/2020

7.1.1.3 Assessment Methodology

The assessment was completed through a review of the following resources:

- Ecological Land Classification for Nova Scotia (Neily et al., 2017)
- ECCC Weather and Climate (ECCC, 2024a; ECCC, 2024b)
- NSECC Ambient Air Quality Data (NSECC, 2024a)

7.1.1.4 Assessment Results

Weather and Climate

Nova Scotia's climate is quite varied and is largely governed by coastal influences and elevation (Davis & Browne, 1996). The Project is located within the St. Margarets Bay Ecodistrict (780) of the Nova Scotia Western Ecoregion (Drawing 7.1). This ecodistrict's climate is relatively moist, influenced by its proximity to cooler coastal waters, increasing local rain and fog (Neily et al., 2017).

The local temperature and precipitation data were obtained from the Pockwock Lake meteorological station (Climate ID 8204453) located approximately 2 km southeast of the Study Area at 44.76667 N, 63.83333 W (Table 7.1).

Table 7.1: Climate Data from the Pockwock Lake Meteorological Station (2014-2023)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature													
Daily Avg. (°C)	-4.6	-4.7	-1.2	4.3	9.5	14.8	19.1	19.2	15.9	10.2	4.0	-1.4	7.1
Daily Max (°C)	0.2	3.2	3.2	9.3	15.0	20.1	23.9	23.9	20.6	14.6	8.2	2.9	12.1
Daily Min (°C)	-9.3	-5.5	-5.5	-0.8	3.9	9.4	14.2	14.4	11.1	5.8	-0.3	-5.8	2.6
Extreme Max (°C)	13.5	18.5	18.5	24.0	30.5	32.0	32.5	31.0	38.0	25.0	20.5	15.0	24.9
Extreme Min (°C)	-25.5	-26	-19.5	-12.5	-5.0	-2.0	4.0	1.5	0.5	-7.5	-14.0	-19.5	-10.5
Precipitation													
Rain (mm)	70.4	46.0	48.2	95.5	66.1	103.6	92.3	76.2	82.1	93.9	102.4	109.3	985.9
Snow (cm)	24.3 2	30.4	37.7	8.2	0.2	0.0	0.0	0.0	0.0	0.0	3.0	15.9	119.6

Source: ECCC 2024a

From 2014 to 2023, the mean annual temperature was 7.1 degrees Celsius (°C), with a mean daily maximum of 12.1°C and a mean minimum of 2.6°C. January and February were the coldest months (mean daily average of -4.6°C and -4.7°C, respectively), while the warmest months were July and August (mean daily average of 19.1°C and 19.2°C, respectively). From 2014 to 2023, the meteorological station recorded mean annual snowfall and mean annual rainfall. The rain and snow data were recorded in terms of monthly averages, with the most rain occurring in November and December (102.4 mm and 109.3 mm, respectively) and snow occurring in February and March (30.4 cm and 37.7 cm, respectively (ECCC, 2024a).

Wind speed and direction data were not recorded at the Pockwock Lake meteorological station; therefore, wind characteristics were obtained from the Halifax International Airport meteorological station (Climate ID 8202251) located approximately 27 km northeast of the Study Area at 44.88111 N, 63.508611 W (Table 7.2).

Table 7.2: Wind Data from the Halifax International Airport Meteorological Station (2014-2023)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maximum Hourly Speed (km/h)	122	109	113	102	87	76	95	73	125	100	102	116
Most Frequent Direction	NW	NW	NW	N	N	S	SW	N	N	N	NW	NW

Source: ECCC 2024b

The maximum hourly wind speeds recorded at the Halifax International Airport meteorological station between 2014 and 2023 ranged from 73 km per hour (km/h) in August to 125 km/h in September. The wind direction most observed at the meteorological station is from the north or northwest; however, between June and July, wind occurred primarily from the south and southwest. Within the Assessment Area, wind measurement data indicate that the predominant wind direction is north to northwest. Note that wind directions may occur in all directions; however, during calm wind flows, the direction is not recorded at the meteorological station (ECCC, 2024b). A windrose plot provided for the Halifax International Airport meteorological station (CYHZ), located approximately 32 km northeast of the Project at 44.88083 N, 63.50861 W, demonstrates the wind directions from 2014 to 2023 (Figure 7.1).

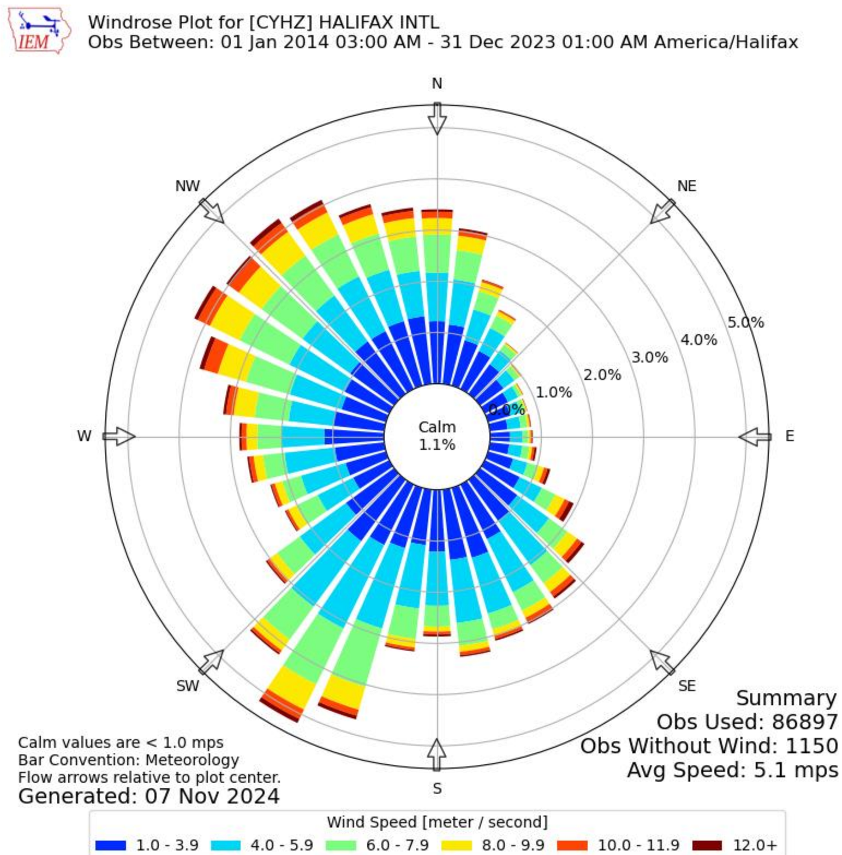


Figure 7.1: Windrose Plot for the Halifax International Airport Meteorological Station (CYHZ) – January 1, 2014, through December 31, 2023 (Iowa State University, 2024)

Figure 7.1 demonstrates that between January 1, 2014, and December 31, 2023, wind speeds above 6 m/s (21.6 km/h) occurred the most frequently from the southwest and northwest. However, based on wind measurement data collected within the Assessment Area, the predominant wind direction is north to northwest.

Air Quality

The Canadian Council of Ministers of the Environment (CCME) has established Canadian Ambient Air Quality Standards (CAAQS) for fine particulate matter [≤2.5 micrometres (µm) ($PM_{2.5}$) or ≤10 µm (PM_{10}) in size], ozone (O_3), sulphur dioxide (SO_2), and nitrogen dioxide (NO_2) over select averaging time periods (CCME, n.d.); while the Government of Nova Scotia has legislated Air Quality Regulations (NSAQR), NS Reg. 8/2020 under the *Environment Act,* S.N.S. 1994-95, c.1 (Table 7.3).

The ambient air quality standards published in the NSAQR set the maximum permissible ground-level concentration limits (Table 7.3).

Table 7.3: Summary of Regulations Pertaining to Ambient Air Quality in Nova Scotia

Contaminant	Averaging Period	Regulatory Threshold (µg/m^3)
		Provincial[1]
Carbon Monoxide (CO)	1-hour	34,600
	8-hour	12,700
Nitrogen Dioxide (NO_2)	1-hour	400
	24-hour	-
	Annual	100
Ozone (O_3)	1-hour	160
$PM_{2.5}$	24-hour	-
	Annual	-
PM_{10}	24-hour	-
	Annual	-
Sulphur Dioxide (SO_2)	1-hour	900
	24-hour	300
	Annual	60
Total Suspended Particulate (TSP)	24-hour	120
	Annual	70[2]

[1] Current Ambient Air Quality Standards (NS AAQS) [Air Quality Regulations, NS Reg. 8/2020].
[2] Geometric mean.

Nova Scotia monitors air quality at eight ambient air quality monitoring stations located throughout the province (NSECC, 2024a). Measured parameters at these locations may include the following:

- Carbon monoxide (CO)
- Ground-level ozone (O_3)
- Nitrogen oxides (NO_x)
- Nitric oxide (NO)
- Nitrogen dioxide (NO_2)
- Particulate matter ($PM_{2.5}$)
- Sulphur dioxide (SO_2)
- Total reduced sulphur (TRS)

The NO_2, O_3, and $PM_{2.5}$ values from seven of the eight air quality monitoring stations are used to calculate a score on the Air Quality Health Index (AQHI) (ECCC, 2024c; NSECC, 2024a). The AQHI is a scale from 1-10+, in which scores represent the following health risk categories: Low (1-3), Moderate (4-6), High (7-10), and Very High (10+) (ECCC, 2024c).

The air quality monitoring station closest to the Project is in Halifax, NS, approximately 26 km southeast of the Study Area at 44.647175 N, 63.573689 W.

Table 7.4 summarizes the current (baseline) maximum ambient air quality conditions observed at the Halifax air quality monitoring station from 2019 to 2023. The monitored parameters are compared to the current NSAQR.

Table 7.4: Current (Baseline) Maximum Ambient Air Quality Conditions in Proximity to the Project

Parameter	Averaging Period	O_3 (ppb)	SO_2 (ppb)	NO_X (ppb)	NO (ppb)	NO_2 (ppb)	$PM_{2.5}$ µg/m³)	TSP (µg/m³)	CO (ppb)	H_2S (ppb)
Halifax Ambient Monitoring 2019-2023	1 hour	66.4	24.1	258.7	219.6	44.1	71.2	-	11,010	-
	24 hours	49.9	9.7	55.8	42.0	18.9	21.0	-	2,300	-
	Annual	29.1	0.3	7.9	2.7	5.1	5.4	-	100	-
NS AAQS Schedule A	1 hour	82	340	-	-	210	-	-	30,000	30
	24 hours	-	110	-	-	-	-	120	-	6
	Annual	-	20	-	-	50	-	70*	-	-
Fraction of NS AAQS Schedule A	1 hour	81%	7%	-	-	21%	-	-	37%	-
	24 hours	-	9%	-	-	-	-	-	-	-
	Annual	-	2%	-	-	10%	-	-	-	-

Source: NSECC 2024a
*geometric mean

As seen in Table 7.4, existing air quality conditions (i.e., baseline data) indicate that most of the measured contaminants are well below their respective NS Ambient Air Quality Standards (AAQS) Schedule A limits. In reviewing the available data for the Halifax air quality monitoring station, the reported AQHI is typically scored 'low' at all times of the year (ECCC, 2024c).

7.1.1.5 Effects Assessment

Project-Atmospheric Interactions

Project activities will primarily interact with the atmospheric environment through fugitive dust and exhaust emissions from construction equipment (Table 7.5). While this may occur during all phases of the Project, fugitive dust and exhaust emissions would be highest during the construction phase. No air emissions are associated with the operation of the wind turbines as the generation of wind power will offset power production that would have otherwise been generated from fossil fuels (Section 7.1.2).

Table 7.5: Potential Project-Atmospheric Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Atmospheric Environment		X	X	X	X	X	X	X		X		X	X	X	X

Assessment Boundaries

The LAA for the atmospheric environment is the Study Area (Drawing 2.2). The RAA for atmospheric is not applicable.

Assessment Criteria

The assessment criteria provided in Section 4.6 apply to the atmospheric environment. The VC-specific definition for magnitude is as follows:

- Negligible – no changes are expected to ambient air quality.
- Low – minimal changes are expected to ambient air quality.
- Medium – some changes are expected to ambient air quality.
- High – widespread changes are expected to ambient air quality.

Effects

Fugitive dust emissions consist of particulate matter and may be generated from open-air activities (e.g., moving earth/disturbing soil, wind erosion, increase in traffic). Fugitive dust emissions are composed mainly of soil minerals, but can also contain salt, pollen, spores, and tire particles. There are two forms of PM which pose the greatest concern for human health: PM with a diameter of 10 microns (µm) or less (PM_{10}) and PM with a diameter of 2.5 µm or less ($PM_{2.5}$). PM is measured by TSP and is defined as the mass of airborne particles having a diameter of less than 44 µm.

When fugitive dust enters the atmosphere, it may potentially affect lung and heart functions. Particulate matter has been linked to premature death (people with lung and heart disease), non-fatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms such as irritation of the airways, coughing, or difficulty breathing. People with underlying lung and heart disease, children, and the elderly are the most susceptible to particulate pollution exposure (US EPA, 2024).

Fugitive dust may also affect the environment through visibility impairment and environmental damage. Fine particles are the leading cause of reduced visibility in many cities, national parks, and wilderness areas. In addition, fugitive dust particles can be carried over long distances (via wind), deposited in other locations, and within surface water features. Some of the effects of particulate deposition may include the following (US EPA, 2024):

- Increasing lake and stream acidity.
- Altering the nutrient balance in coastal waters and large river basins.
- Depleting the nutrients in the soil.
- Damaging sensitive forests and farm crops.
- Affecting the diversity of ecosystems.
- Contributing to acid rain effects.

Anticipated sources of fugitive dust emissions from the Project will be primarily associated with the construction of the Project and may include the following activities:

- Soil disturbance during site preparation (i.e., clearing/grubbing, grading, blasting).
- Wind erosion from soil or rock stockpiles during grading.
- Increase in traffic on roadways from travel by Project personnel (to/from the site).
- Management of on-site materials transfers (i.e., loading/unloading).

The source of fugitive dust will be in the Project Area. Therefore, the distance from the Project Area to local receptors was assessed to determine environmental impacts on ambient air quality from fugitive dust emissions. The closest receptors are located 1.5 km from the Assessment Area (Drawing 7.2). Fugitive dust travel distance is based on several factors, including particle height, wind conditions, and particle size. Under most standard conditions, fugitive dust above 30 micrometres settles out within 100 m of the emission source. Other finer particles have a slower settling velocity and may travel further (US EPA, 1995). Although particles under 30 micrometres may travel further before they settle, it is anticipated that these particles will disperse with respect to distance. Furthermore, the LAA is well vegetated, which will likely help to reduce the travel distance of fugitive dust emissions from the Project Area (US EPA, 2014). Therefore, the nearest receptors are located beyond the extent to which fugitive dust emissions of all sizes are expected to travel or pose an impact. As a result, no impacts are anticipated as fugitive dust emissions are considered short-term (construction), intermittent, and within the LAA.

Construction of the Project may result in an increase of combustion residuals and/or exhaust tailpipe emissions, primarily PM, NO_x, SO_2, and CO from vehicles (i.e., travel by Project personnel, transport/delivery activities) and heavy equipment. The closest receptors are located 1.5 km from the nearest turbines (Drawing 7.2). Exhaust emissions are primarily anticipated to be associated with local roadways and roads developed for the Project within the Project Area. The US EPA (2014) determined that most roadway emissions are contained within the first 200 m from the emission source. Therefore, exhaust emissions are not anticipated to travel beyond the extent of the LAA, and as such, impacts to local residential receptors are not anticipated. Overall, exhaust emissions are considered short-term, intermittent, and within the LAA.

Mitigation

An Air Quality and Dust Management Plan will be developed to define measures to minimize and mitigate the creation and emission of pollutants, including fugitive dust and exhaust emissions, particularly for the Project's construction phase.
In addition, general mitigation measures for fugitive (dust) emissions include:

- Conduct grading and site preparation in phases to minimize disturbed soil areas until just prior to construction activities.
- Stabilize exposed soil surfaces by sloping or using vegetation, stone, soil, or geotextiles to prevent dust and airborne particles.
- Compact and/or ridge disturbed soil to prevent dust formation.
- Consider ceasing dust generating construction activities during dry periods (i.e. summer) when winds are high (>30 km sustained winds).
- Enclose or cover soil storage and/or stockpile areas where feasible.
- Wet (with water) aggregate and soil stockpiles to control dust.
- Design storage areas and material stockpiles with prevailing wind directions in mind.
- Wet roadways and heavy traffic areas with water or dust suppressant technologies to minimize airborne emissions.
- Tie down, cover, and/or store loose site materials and/or products prior to inclement weather and wind events to prevent materials from becoming airborne.
- Wash down vehicles and equipment using hoses and water to remove accumulated mud/dirt on undercarriages, tracks, or wheel wells.
- Ensure Project personnel adhere to all safety protocols and wear appropriate personal protective equipment (PPE) during significant fugitive emissions events (i.e., windstorms, dust storms).

General mitigation measures for exhaust emissions include:

- Ensure equipment meets all applicable provincial and air quality regulations and emissions standards.
- Ensure equipment is fueled using low-sulphur diesel (to reduce SO_x air emissions).
- Maintain engines and exhaust systems according to the manufacturer's specifications and the recommended maintenance schedule.
- Remove from service malfunctioning equipment and/or equipment generating excess amounts of smoke, odour, or noise until an assessment and necessary repairs can be completed.
- Remove from service construction equipment with improperly functioning emissions control systems.
- Restrict the idling of equipment where feasible.

Monitoring

Given the low to negligible impacts, no monitoring is required.

Conclusion

After mitigations, residual effects on atmosphere and ambient air quality are characterized as follows:

- Low to negligible magnitude, as predicted project emissions will not greatly impact ambient air quality.
- Within the LAA, as predicted project emissions are not anticipated to extend beyond the project LAA.
- Short duration, as predicted project emissions are not expected to extend beyond the construction period.
- Intermittent frequency, as predicted project emissions are likely to occur intermittently throughout the construction period.
- Reversible, as predicted project emissions are not anticipated to have sustained impacts.

Therefore, the residual effects are considered to have an insignificant impact on ambient air quality.

7.1.2 Climate Change

The Project is being developed to support various end-use electrical requirements. Climate change for this Project is addressed in terms of greenhouse gas (GHG) emissions and per NSECC's "Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia" (2021). For the purposes of this EA, the GHG emissions only consider the emissions from wind energy.

7.1.2.1 Overview

Climate change is a long-term alteration of weather patterns and conditions strongly impacted by changes in temperature and precipitation. Climate change typically involves changes in average conditions, as well as changes in variability. The main contributor to climate change is GHGs from anthropogenic sources. Since GHGs disrupt the natural heat transfer processes within the Earth's atmosphere, a build-up of these gases has enhanced the natural greenhouse effect. These human-induced enhancements are especially of concern since ongoing GHG emissions have the potential to warm the planet to levels that have yet to be experienced (Government of Canada, 2019a).

The impacts of climate change on the Project are assessed separately under Section 12.1.

7.1.2.2 Regulatory Context

The climate change assessment considered the following *Acts* and Regulations:

- *Canadian Environmental Protection Act*, *1999* (*CEPA*)
  - Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations, S.O.R./2010-201
  - Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations, S.O.R./2013-24
  - Ozone-depleting Substances and Halocarbon Alternatives Regulations, S.O.R./2016-137
- *Environment Act*, S.N.S. 1994-95, c. 1
  - Regulations Respecting Greenhouse Gas Emissions, N.S. Reg. 305/2013
- *Environmental Goals and Sustainable Prosperity Act,* S.N.S. 2007, c. 7

Regulatory guidance was used to determine the appropriate assessment methodologies, mitigation controls, best management practices, and emissions targets.

7.1.2.3 Assessment Methodology

The objectives of this assessment include the following:

- Establish the sources of GHG contributions from the Project.
- Quantify baseline and Project-generated GHG emissions.
- Mitigate and minimize GHG generation from Project-related activities.

Sources of GHG emissions were identified through a review of Project phases, components, and equipment.

Baseline GHGs were quantified using emission factors published in the NSECC Standards for Quantification, Reporting, and Verification of Greenhouse Gas Emissions (NSECC, 2020a) and current electricity generating practices from NS Power.

Project-generated GHGs were quantified in accordance with the specifications described in the International Standard ISO 14064 (ISO, 2019) and using published values found in the literature (sources provided in applicable sections that follow). GHG emissions and removal enhancements are stated in tonnes of carbon dioxide equivalent (tCO_2e).

7.1.2.4 Sources of Greenhouse Gas Emissions

The main GHGs of concern include:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Halocarbons
- Water vapour

GHGs may be natural or anthropogenic in origin, except halocarbons, which are human-made (Government of Canada, 2019b). The following subsections describe the GHGs and their contributors (sources) as anticipated during each phase of the Project.

Carbon Dioxide

The primary source of atmospheric CO_2 is burning carbon-containing fossil fuels (i.e., coal, oil, and natural gas) and deforestation/land clearing activities.

Site preparation and construction will include several activities that are likely to produce CO_2. These include, but are not limited to, the following:

- Use of heavy equipment (excavators, dozers, cranes, etc.).
- Use of light-duty vehicles and equipment (pick-up trucks, light plants, generators, etc.).
- Land clearing, including the decay of cut foliage (which releases CO_2 slowly).
- Cement production results in the heating of limestone, which releases CO_2 (Government of Canada, 2019b).

During the operations phase, CO_2 emissions will be limited to maintenance activities (i.e., transportation and materials). Where these activities are intermittent and short-term, the GHG contributions from operations are negligible and are not considered further.

Methane

Methane is produced when fossil fuels are burned with insufficient oxygen to complete combustion (Government of Canada, 2019b). The Project's construction phase requires different heavy- and light-duty equipment, contributing to methane emissions.

During the operations phase, methane emissions will be limited to maintenance activities (i.e., transportation and materials). Where these activities are intermittent and short-term, the GHG contributions from operations are negligible and are not considered further.

Nitrous Oxide

The primary sources of N_2O are related to the use of nitrogen-based synthetic fertilizers and manure. These sources have added significant amounts of reactive nitrogen to Earth's ecosystems. Other contributors include the release of N_2O into the atmosphere during the combustion of fossil fuels and biomass (e.g., trees or wood-based fuels) and from some industrial sources (Government of Canada, 2019b).

The Project's construction phase requires heavy- and light-duty equipment, which can contribute to nitrous oxide emissions. Land restoration activities (i.e., soil amendments and reclamation) following construction will also contribute nitrous oxide emissions. Overall, the production of N_2O in association with this Project is anticipated to be minimal.

During the operations phase, N_2O emissions will be limited to maintenance activities (i.e., transportation and materials). Where these activities are intermittent and short-term, the GHG contributions from operations are negligible and are not considered further.

Halocarbons

Halocarbons are a group of synthetic chemicals containing a halogen group (e.g., fluorine, chlorine, and bromine) and carbon (Government of Canada, 2019b). They are typically used in refrigerants, fire-extinguishing agents, solvents, foam-blowing agents, and fumigants (Government of Canada, 2013). There are various industrial sources, but the main contributor is aluminum production (US EPA, 2021).

The primary source of halocarbon emissions from the Project will be associated with coolants in air conditioning units found in vehicles, portable construction buildings (i.e., trailers), and equipment. Air conditioning units will be used during the Project's construction phase. Fire-extinguishing agents (containing halocarbons) may also be used at the Project in the event of an emergency which requires a fire-fighting response.

During the operations phase, halocarbon emissions will be limited to maintenance activities (i.e., transportation and materials). Where these activities are intermittent and short-term, the GHG contributions from operations are negligible and are not considered further.

Water Vapour

Water vapour is the most important naturally occurring GHG. Human activities do not directly influence the amount of water vapour in the atmosphere as it is a function of the atmosphere's temperature. The atmosphere can hold about 7% more water vapour for every additional degree Celsius in air temperature. When the air becomes saturated with water vapour, the water vapour condenses and falls as rain or snow, leading to climate change effects (i.e., variances in weather patterns).

As climate warming gases (i.e., CO_2, CH_4, N_2O) increase in the atmosphere, the temperature rise increases water evaporation from the Earth's surface and increases the atmospheric water vapour concentrations. This increased water vapour, in turn, amplifies the warming from the initial GHGs, causing the cycle to repeat and temperatures to keep rising (Government of Canada, 2019b).

Project activities contributing to GHG emissions are not anticipated to impact water vapour concentrations in the atmosphere.

7.1.2.5 Quantification of the GHG Baseline Conditions

The GHG baseline is a reference of sources, sinks (removing), and reservoirs (storing) occurring in the absence of the Project and is used to compare pre- and post-Project conditions. That said, the baseline determines the quantity of carbon dioxide equivalent (CO_2e) emitted from current electricity production methods for the same electrical capacity of the Project.

The baseline sources are related to emissions generated from electricity currently produced in Nova Scotia from coal, oil, natural gas, and wind. There are no sinks and reservoirs attributed to the baseline scenario.

The Project consists of 23 turbines capable of generating 161 MW of renewable energy. Based on the wind turbine design capacity and a capacity rating of 33.35% (Hatch, 2008), the Project will be capable of producing approximately **470,355,060**[1] kilowatt hours per year (kWh/year). The lifespan of the Project is estimated at a minimum of 25 to 30 years.

Quantifying GHGs in terms of tCO_2e requires using emission factors published in the NSECC Standards for Quantification, Reporting, and Verification of Greenhouse Gas Emissions (NSECC, 2020a) and current electricity generating practices. For the year 2023 (latest available data), electricity generated in Nova Scotia by NS Power (the leading producer) was produced from the following fuel sources (NS Power, 2024):

- Coal (31%)
- Natural Gas (17%)
- Wind (14%)
- Renewable Imports (17%)
- Hydro (9%)
- Non-Renewable Imports (8%)
- Biomass (3%)
- Oil (1%)

For this assessment, the 8% non-renewable energy imports are distributed amongst coal (+3%), natural gas (+3%), and oil (+2%) as a conservative assumption to quantify the emission factors for non-renewable energy imports. Therefore, the fractions used for this assessment were coal at 34%, natural gas at 20%, and oil at 3%. Renewable energy (locally sourced and imported) was lumped together, and for this assessment, all renewables were considered as wind energy, totalling 43%.

Table 7.6 summarizes the GHG emission factors for the different types of electricity generated in Nova Scotia.

Table 7.6: Electricity Fuel Source Emission Factors

Electricity Fuel Source	Emission Factor (tCO_2e/year)
Coal	0.001251
Natural Gas	0.00044
Oil	0.0011068
Wind	0

Source: US EIA 2022

[1] $7.0\ \frac{MW}{Turbine} \times 23\ Turbines \times 0.3335 \times 365\frac{days}{year} \times 24\frac{hours}{day} \times 1000\frac{kW}{MW} = 470{,}355{,}060\frac{kWh}{year}$

Given the current electricity generation methods and the fuel source emission factors (Table 7.6), Table 7.7 summarizes the baseline GHG emissions.

Table 7.7: Baseline Quantification Summary

Electricity Fuel Source	Electricity Generation (kWh/yr)	Emissions (tCO_2e)
Coal	159,920,720	166,938.28
Natural Gas	94,071,01279,288,424	41,429.75
Oil	14,110,652	15,383.82
Wind	202,252,676	0
Total	**470,355,060**	**223,751.85**

The total annual GHG emissions generated in Nova Scotia for the same electrical capacity of the Project is **223,751.85 tCO_2e.**

Detailed CO_2e calculations are provided in Table 1 (Appendix B).

7.1.2.6 Quantification GHG Emissions – Construction Phase

Access Roads

Primary site access roads exist, however new access roads to turbines will be required. The construction of new roads and upgrading of existing roads will require the removal of vegetation and overburden, which will create fugitive dust and GHG emissions. Where fugitive dust and GHG contributions for these activities are temporary, short-term, and represent a small incremental addition compared to the overall Project emissions, they were not quantified.

Fugitive dust and air emissions as they relate to the Project, are discussed in Section 7.1.1 (Atmosphere and Air Quality).

Laydown Areas

A laydown area (estimated area 120 m x 120 m = 14,400 m^2 each) is intended to store equipment temporarily, the turbine pad foundation, and the crane pad. These areas will be prepped by removing the vegetation and overburden and placing competent soils. Construction activities and equipment associated with the laydown areas are anticipated to create fugitive dust and GHG emissions. However, where fugitive dust and GHG contributions for these activities are temporary, short-term, and represent a small incremental addition compared to the overall Project emissions, they were not quantified. Additionally, a vegetation management plan will be initiated to recover the lost flora and reduce dust resuspension while maintaining access and clearances to the turbine.

Concrete Foundation

A concrete tower foundation and pedestal will be required for each wind turbine. As such, the Project will require a significant quantity of concrete to be produced and delivered to each wind turbine location.

In 2017, Casey Concrete Ltd. poured approximately 1,000 cubic metres (m^3) to build the base of a 3 MW wind turbine in Amherst, NS. Transportation of the concrete consisted of 140 truckloads (Kenter, 2017). Note that a concrete supplier has not been procured at this stage of the Project; as such, for the purpose of this assessment, the Casey Concrete Ltd. quantities will be assumed for GHG quantification. The quantification of the GHG emissions requires the following inputs:

- The vehicle size and fuel type used to transport the concrete.
- The distance travelled to and from the concrete manufacturer to the wind turbine sites.
- The freight and weight associated with each trip (to and from each turbine location).
- The quantity of concrete produced for the wind turbine bases.

Heavy duty diesel concrete trucks will be required to transport concrete to the Project Area. For the purposes of this assessment, transportation distances are based on the nearest known concrete supplier, which is located approximately 36 km from the Project Area. Given the turbine locations are scattered across the Project Area, transportation distances range from 35 km to 52 km (Table 7.8).

Table 7.8: Distance from the Nearest Known Concrete Supplier to Individual Wind Turbine Locations

Wind Turbine	Approximate Distance (km)
1	49.02
2	51.51
3	51.95
4	49.71
5	51.22
6	51.26
7	46.13
8	46.66
9	47.41
10	48.28
11	48.32
12	39.69
13	39.84
14	39.51
15	38.90
16	37.88
17	36.70
18	37.54
19	35.34
20	39.21
21	36.51
22	50.17
23	37.24
Total	**1,010.00**

Based on Table 7.8, the total distance between the wind turbines and the nearest concrete supplier is **1,010.00 km**. Assuming 140 truckloads per wind turbine, the total one-way distance travelled is **141,400.00 km**. GHG quantification considered travel to and from the nearest concrete supplier to the wind turbine locations.

It is assumed that each concrete truck will carry approximately 17.86 tonnes[2] of concrete per delivery for a total of 2,500 tonnes of concrete per wind turbine.
Table 7.9 summarizes the GHG emission factors for the different components used for concrete-related activities.

Table 7.9: Concrete Manufacturing and Transportation Emission Factors

Component	Emission Factor
Concrete Production	$3x10^{-4}$ tCO_2e/kg
Concrete Truck (Diesel) with Freight	$1.35x10^{-4}$ $tCO_2e/tonne \cdot km$
Concrete Truck (Diesel) without Freight	$1.106x10^{-3}$ tCO_2e/km

Source: GHGenius v5.0d (Squared Consultants Inc., 2022)

Given the travelling distances, the quantity of concrete required for the Project, and the emission factors (Table 7.9), the CO_2e emissions are expected to be approximately **17,747.26 tCO_2e** for constructing all the tower foundations and pedestals.

Detailed CO_2e calculations are provided in Table 2 (Appendix B).

Turbine

The Project will require wind turbines to be manufactured and delivered to the Project Area. As mentioned, various wind turbines are under consideration, but for this assessment, the Nordex N163/7.X will be used to quantify GHG contributions. This turbine has a rotor diameter of 163 m and can generate up to 7.0 MW of power.

To quantify GHG contributions from the turbines during the construction phase, the following items were assessed:

- The turbine materials and quantity.
- The turbine transportation distances from the manufacturer to the intended wind turbine laydown.
- The vehicle size and fuel type used to transport the wind turbines.

For quantification purposes, the assessment assumed the following:

- Manufacturing Material: Steel
- Manufacturing Location: Chennai, India
- Nearest Shipping Port: Chennai, India
- Nearest NS Shipping Port: Halifax, NS, Canada

[2] $2{,}500\,\frac{Tonnes\ of\ Concrete}{Turbine} \div 140\,\frac{Trucks}{Turbine} = 17.86\,\frac{Tonnes\ of\ Concrete}{Truck}$

Wind turbines are typically made up of 12 principal components (Electrical Academia, n.d.):

- Blades (three)
- Drive Train
- Gearbox
- Generator
- Hub
- Nacelle
- Rotor
- Speed Shafts (low and high)
- Tower

According to the National Renewable Energy Laboratory (NREL, 2017), the total weight of manufacturing material is equivalent to approximately 120,000 kilograms per MW (kg/MW). Given the Project's wind turbine model capacity of up to 7.0 MW, the total weight of a wind turbine is assumed to be approximately 840,000 kg.

GHG emission factor for wind turbine manufacturing is provided in Table 7.10.

Table 7.10: Wind Turbine Manufacturing Emission Factor

Component	Emission Factor (tCO_2e/kg)
Wind Turbine Material (Steel)*	$1.5x10^{-3}$

*Estimated from the UK's mixture of steel types, excluding stainless steel (University of Bath, 2011).

Given the steel required to produce the wind turbines for the Project and the emission factor (Table 7.10), the CO_2e emissions from the manufacturing of all the wind turbines are expected to be approximately **28,980.00 tCO_2e**.

Nordex SE occupies an onshore turbine manufacturing plant in Chennai, India (Nordex SE, 2024). For the purposes of this assessment, Project turbines are assumed to be manufactured at this location, then will travel to the Port within Chennai by heavy diesel hauler (transport), where they will be shipped via diesel cargo vessel to Halifax, NS. Table 7.11 summarizes the transportation distances from the manufacturer to the Project.

Table 7.11: Wind Turbine Transportation Distances

Originating Destination	Final Destination	Distance* (km)
Chennai, India	Port of Chennai, India	49 (Land)
Port of Chennai, India	Port of Halifax	16,300 (Marine)
Halifax, NS	Melvin Lake (Project)	42 (Land)

*These measurements were based on a desktop geospatial analysis; the exact routes and distances may vary.

To determine the travel distance for a wind turbine, the following assumptions were made:

- Each component will be individually transported via a single diesel heavy hauler.
  - 12 components per turbine to travel from the manufacturing facility in Chennai to the Port of Chennai (total of 588 km per turbine).
  - 12 components per turbine to travel from Halifax, NS, to the turbine location (distance will vary from one turbine location to another).
- Each wind turbine (in its entirety) will be transported via a single diesel cargo vessel.

Land transportation distances were calculated according to the assumptions in Table 7.12.

Table 7.12: Land Distance from the Manufacturer to Individual Wind Turbine Locations

Wind Turbine	Approximate Distance* (km)
1	1,248.24
2	1,278.12
3	1,283.40
4	1,256.52
5	1,274.64
6	1,275.12
7	1,213.56
8	1,219.92
9	1,228.92
10	1,239.36
11	1,239.84
12	1,148.28
13	1,150.08
14	1,146.12
15	1,138.80
16	1,126.56
17	1,112.40
18	1,122.48
19	1,096.08
20	1,142.52
21	1,110.12
22	1,262.04
23	1,118.88
Total	**27,432.00**

* Estimated distances from the Strait of Canso Superport to the individual turbines one way. The number of trips and the number of transport vehicles should be considered for a cumulative travel distance.

Based on Table 7.12, the total land transportation distance between the wind turbine manufacturer and the wind turbine laydowns (not including marine transportation) is **27,432.00 km**. The total marine transportation distance associated with getting the wind turbines from Chennai, India, to Halifax, NS, is **374,900 km**. The distances travelled consider travel from the manufacturer to the Project Area only; an equivalent return distance is not considered as the hauling companies would have commitments with other clients, and those GHG emissions would not be attributable to the Project.

GHG emission factors for the different components of wind turbine transportation are provided in Table 7.13.

Table 7.13: Wind Turbine Transportation Emission Factors

Component	Emission Factor (tCO_2e/tonne·km)
Heavy Duty Truck (Diesel) with freight	$1.35x10^{-4}$
Marine Cargo and Container Vessel (Diesel) with Freight	$1.51x10^{-5}$

Source: GHGenius v5.0d (Squared Consultants Inc., 2022)

Given the land transportation distances required to deliver the wind turbines to the Project and the emission factors (Table 7.13), the CO_2e emissions from land transportation of the wind turbines are expected to be approximately **259.23 tCO_2e**. In addition, the marine transportation distances required to deliver the wind turbines from India to Canada will contribute **4,755.23 tCO_2e**.

Detailed CO_2e calculations are provided in Table 2 (Appendix B).

7.1.2.7 Quantification of GHG Emissions – Operations Phase

Following the construction phase, the turbine will be operational, and the reduction (or sinking) of GHG emissions will begin. Based on the wind turbine design capacity and a capacity rating 33.35% (Hatch, 2008), the Project will be capable of producing approximately 470,355,060 kWh/year. Therefore, the renewable energy produced will replace power production from fossil fuels and more intense generation methods described under baseline conditions (Section 7.1.2.5).

According to Padey et al. (2012), maintenance activities are the only contributor of GHGs during the operations phase. The maintenance typically includes replacing approximately 15% of the nacelle components and one blade during the wind turbine's lifetime. According to a submission by Number Three Wind LLC (2018) to the New York State Department of Public Services, a wind turbine blade weighs 18,688 kg, while the nacelle weighs 76,204 kg. This replacement rate is equivalent to approximately 18,688 kg of blade material and 11,431 kg of nacelle material. The total emission from the replacement material for all the Project's wind turbines is **1039.11 $tCO2_e$** (Table 3, Appendix B).

7.1.2.8 Effects Assessment

Project-GHG Interactions

Project activities will emit GHGs during all phases of the Project (Table 7.14).

Table 7.14: Potential Project-GHG Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
GHG		X	X	X	X	X	X	X		X		X	X	X	X

Assessment Boundaries

The LAA for GHGs is the Study Area. The RAA for GHGs is not applicable.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for Project-related GHG contributions. The VC-specific definition for magnitude is as follows:

- Positive – Project is expected to have a positive effect on GHG emissions.
- Negative – Project is expected to have a negative effect on GHG emissions.

Effects

The Project is intended to have a net positive effect on the GHG environment (Table 7.15).

Table 7.15: Project GHG Emission Summary

Component	Emissions (tCO_2e)
Baseline	
Electricity Generated from Coal	166,938.28
Electricity Generated from Natural Gas	41,429.75
Electricity Generated from Oil	15,383.82
Electricity Generated from Wind	0
Total	**223,751.85**
Construction Phase	
Concrete Production and Transportation	17,747.26
Wind Turbine Manufacturing	28,980.00
Wind Turbine Transportation	4,755.23
Total	**51,741.73**
Operations Phase	
Electricity Generated from Wind	0
Wind Turbine Maintenance	1039.11*
Total	**1039.11**

Rounding errors may cause the values in this table to differ from those in Appendix B; however, the rounding errors are negligible and do not change their representation.
*Project lifespan emissions (single event)

As mentioned, the current GHG emissions for the quantity of electricity required by the Project using Nova Scotia Power's conventional generation methods contribute to **223,751.85 tCO_2e**.

The Project's construction phase will generate the most GHGs from the manufacturing and transportation of the wind turbine, as well as the production and transport of the concrete for the tower foundation and pedestal. The total GHG emission contributions from the construction phase are **51,741.73 tCO_2e**.

The operations phase will generate GHGs from the wind turbines' maintenance (i.e., part replacements) as a one-time (Project lifespan) occurrence of **1039.11 tCO_2e**.

Following the commissioning of the Project, the annual Project GHG emission reduction is expected to be **223,751.85 tCO_2e**. A one-time **1039.11 tCO_2e** may be subtracted from any annual reduction; however, the annual reduction rate will be applied for the lifespan of the Project (25 to 30 years). The Project is anticipating a 0.23-year[3] payback period to offset the construction-related GHG emissions. Following this period, the Project will positively offset GHG emissions that would typically be emitted from conventional production methods employed by NS Power.

The assumptions considered in this assessment propose a conservative estimate of GHG emissions, which may be lower if turbine and concrete manufacturer locations are closer to the Project and manufacturing materials are less than assumed. Where assumptions may change the values provided in this assessment, the results remain constant; the Project will offset GHG emissions.

Mitigation

Mitigation measures to reduce the Project's contributions to GHG emissions, thus reducing the overall impact of climate change, include:

- Use locally sourced materials, where possible, to reduce CO_2, CH_4, and NO_x emissions associated with transport.
- Incorporate the shortest construction/transport routes where possible to minimize the use of fossil fuels during construction.
- Recover and recycle construction and demolition/decommissioning waste, where possible.
- Recycle and compost workforce waste (i.e., food waste). Diverting this waste will reduce methane generated in landfills as it decomposes.
- Minimize deforestation during land clearing by only clearing the area that will be needed. This will reduce CH_4 and NO_x emissions associated with soil disturbance and limit the use of equipment (lowering emissions produced during equipment operations).
- Plan construction activities to reduce the double handling of materials, reducing GHG emissions associated with heavy equipment operations.

[3] $\frac{Construction\ Emissions}{Offset\ Emissions} = \frac{\mathbf{51{,}741.73}\ \ tCO2e}{223{,}751.85\ tCO2e/year} = 0.23\ years$

- Use recycled or repurposed materials, where possible, to reduce GHG emissions associated with embodied energy (i.e., the energy associated with manufacturing a product or service).
- Ensure Project equipment meets all applicable provincial and air quality regulations and emissions standards.
- Maintain engine and exhaust systems according to the manufacturer's specifications and applicable maintenance schedule.
- Remove from service malfunctioning equipment or equipment generating excess amounts of smoke, odour, or noise until an assessment and necessary repairs can be completed.
- Ensure construction equipment with an improperly functioning emission control system is not operated.
- Ensure regular equipment maintenance is undertaken to maintain good operations and fuel efficiency.
- Ensure equipment containing coolant (i.e., air conditioning units) undergoes preventative maintenance and inspections (i.e., leak testing).
- Train Project personnel (as appropriate) in the proper disposal of halocarbon-containing substances.
- Hire from a local labour force to reduce emissions associated with workforce transportation.
- Dispose of halocarbon-containing substances at an approved hazardous waste facility per applicable regulations and in compliance with local requirements.
- Ensure trucks removing waste from or bringing materials to the Project are filled to the maximum allowable capacity where practical (dependent on the truck size and load weight) to reduce transportation requirements and limit the number of trips.
- Implement an anti-idling policy to limit GHG emissions from vehicles and equipment and limit the use of fossil fuels.
- Incorporate energy-efficient infrastructure (i.e., solar panels) where feasible to limit GHG emissions and the use of fossil fuels resulting from standard equipment (e.g., diesel-powered generators or light stands).

Monitoring

No monitoring programs are recommended.

Conclusion

After mitigations, residual effects on Climate Change are characterized as follows:

- Low magnitude, as predicted, project GHG emissions will not contribute greatly to climate change.
- Within the RAA, as effects from Project GHG emissions will extend beyond the Project LAA or footprint.
- Medium duration, as the residual effects will extend through the operational and maintenance phase.
- Continuous frequency, as GHG emissions will be continuously offset.
- Irreversible, as the effect will continue beyond the life of the project.

Therefore, the residual effects are considered to have a significant positive impact on climate change.

7.2 Geophysical Environment

7.2.1 Overview

The assessment of the geophysical environment included a review of topography, surficial geology, bedrock geology, and hydrogeology/groundwater.

7.2.2 Regulatory Context

Relevant legislation includes:

- *Environment Act*, S.N.S. 1994-95, c. 1
- Sulphide Bearing Material Disposal Regulations, N.S. Reg. 57/95

In addition to the legislation, if blasting is required for the construction of the Project, groundwater wells within 800 m must undergo assessment according to NSECC's Procedure for Conducting a Pre-Blast Survey (1993) which will involve individual consultation with well owners, a description of the condition of the structure and a thorough description of the water supply.

7.2.3 Assessment Methodology

The assessment was completed through a review of the following resources:

- Aerial imagery and topography
- Ecological Land Classification for Nova Scotia (Neily et al., 2017)
- Nova Scotia Geoscience Atlas (NSNRR, 2024a)
- Mineral Resource Land-Use Atlas (NSNRR, 2002)
- Nova Scotia Groundwater Atlas (NSNRR, 2024b)
- Karst Risk Map (NSNRR, 2019b)
- Well Logs Database (NSECC, 2020b)
- Nova Scotia Pumping Test Database (NSNRR, 2022a)
- Nova Scotia Groundwater Observation Well Network (NSECC, 2015a)
- Potential for Radon in Indoor Air (NSNRR, 2009)

7.2.4 Assessment Results

Topography

The Study Area lies within the St. Margarets Bay ecodistrict (780) of the Western Ecoregion (Drawing 7.1) (Neily et al., 2017). The St. Margarets Bay ecodistrict extends from Halifax Regional Municipality to Lunenburg County and encompasses the eastern portion of the South Mountain granitic batholith, a large and irregularly shaped granite slab. Topography ranges from flat to rolling, with sporadic hummocks, rounded hills, pronounced ridges, and areas of exposed bedrock. Elevations within the ecodistrict rise from sea level to 175 metres above sea level (masl) near Five Mile Lake, with a mean elevation of 100 masl (Drawing 7.3) (Neily et al., 2017).

Within the Study Area specifically, elevations range between approximately 71 masl to 229 masl (Drawing 7.3).

Surficial Geology

Surficial geology within the northern extent of the Study Area consists primarily of exposed bedrock overlain by a thin discontinuous veneer of till (NSNRR, 2024a) (Drawing 7.4). In the southern half of the Study Area, the surficial layer consists primarily of ground moraines and streamlined drifts composed predominantly of stony till plains (stony-sandy material) between 2 m and 20 m in thickness. This stony/sandy material is sourced from local bedrock and was deposited at the base of receding ice sheets (NSNRR, 2024a). Other surficial units found within the Study Area include:

- Silty drumlins
- Silty till plain
- Organic deposits

Silty drumlins comprise of silty till with a thickness of 4 m to 30 m that is derived from distance sources (including red clay). These features formed as a result of material deposition at the base of melting ice sheets and provide moderate drainage due to stoniness. In addition, silty drumlins have calcareous bedrock components, which provide good acid rain buffering capacity (NSNRR, 2024a).

Silty till plains are also a result of glacial deposition and are composed of compact silty material from distant and local sources that ranges in thickness between 3 m and 30 m. This till plain is usually deep enough to cover bedrock undulations and contains few surface boulders (NSNRR, 2024a).

Organic deposits (i.e., wetlands/peatlands) develop because of topographic depressions collecting and/or storing surface water along with the infilling of ponds/watercourses with vegetation. Within the Study Area, the organic deposits range in depth from 1 m to 5 m (NSNRR, 2024a).

Bedrock Geology

The Study Area is underlain by the South Mountain Batholith (a massive granitoid formation) that extends between Yarmouth and Halifax Counties. More specifically, bedrock units present within the Study Area include (NSNRR, 2024a) (Drawing 7.5):

- Middle to late Devonian granodiorite.
- Middle to late Devonian muscovite biotite monzogranite.
- Goldenville formation (sandstone turbidites and slate).

According to the Mineral Resource Land-Use Atlas, there are no occurrences of sulphide-bearing slates within the Study Area (NSNRR, 2002). In addition, a review of the NS Karst Risk Map (based on provincial geology maps, sinkhole occurrence data, lidar data and hydrogeological databases) indicated that the Study Area is within a "Low Risk" area for karst topography (Drawing 7.6) (NSNRR, 2019). Lastly, radon potential mapping (Drawing 7.7) shows the Study Area is primarily located in “Medium Risk” area for radon in indoor air, with pockets of "Low Risk" and "High Risk" throughout (NSNRR, 2009).

Groundwater Quality and Quantity

The Study Area is underlain by plutonic rocks (mainly granite) which carry groundwater through fractures and cracks within the bedrock. Groundwater sourced from plutonic rock is generally classified as plutonic water and is typically associated with lower quantities of groundwater and consequently lower well yields compared to other regions. Wells located in plutonic rock typically have lower dissolved solids, hardness, and well water yields as a result of groundwater only flowing through cracks and fractures in the rock (NSECC & NSNRR, 2009).

A review of the groundwater risk mapping indicated that the Study Area is located in a “High Risk” zone for arsenic (Drawing 7.8) and primarily a "High Risk" zone for uranium in the groundwater wells (with the exception of several small pockets of "Low Risk") (Drawing 7.9) (NSNRR, 2024b).

Groundwater Wells

An assessment of nearby groundwater wells was conducted using the NSECC Well Logs Database (2020b). This database contains records of well locations and characteristics within the province, dating back until approximately 1920. The database was reviewed to identify groundwater wells that may exist within proximity of the Study Area; however, there are limitations associated with the spatial accuracy of this database. For the purposes of this assessment, any groundwater wells that had a spatial uncertainty of greater than 1,000 m were not considered/assessed.

A total of 242 individually drilled wells are located within 2 km of the Study Area (Drawing 7.10) (NSECC, 2020b). Water well use for these wells is classified as domestic (236), heat transfer (three), or unspecified (three). A summary of well properties within 2 km of the Study Area is presented in Table 7.16, and a complete characterization log of wells within 2 km is provided in Appendix C.

Table 7.16: Summary of Well Records within 2 km of the Study Area

	Drilled Date (year)	Well Depth (m)	Casing Depth (m)	Depth to Bedrock (m)	Static (m)	Estimated Yield (Lpm)
Minimum	1969	7.92	3.04	0.30	-0.03	0.00
Maximum	2020	165.95	42.63	39.58	30.45	544.80
Average	n/a	89.42	11.18	4.85	6.07	21.87

Source: NSECC Well Logs Database (2020b).
*Negative values represent overflowing wells or static water level at ground level.

Based on short term driller's estimates for the wells located within 2 km of the Study Area, the average yield is approximately 21.87 Lpm (litres per minute) with an average well depth of approximately 89.42 m. These measurements represent very short-term yields estimated by the driller at the completion of well construction (NSECC, 2020b).

None of the water wells identified are located within 800 m of the Assessment Area.

The NSNNR Pumping Test Database (2022a) provides longer term yields for select wells within the province. The nearest test well (with a complete dataset) is located approximately 2.5 km north of the Study Area in the community of Mount Uniacke (Well #891831) which indicates a long-term safe yield (Q_{20}) of 39.27 Lpm and an apparent transmissivity of 1.18 square metres per day (m^2/day). This well is located in metamorphic bedrock of the Goldenville Formation (NSNRR, 2022a).

NSECC maintains the Nova Scotia Groundwater Observation Well Network (2015a). The nearest observation well to the Study Area is the Lewis Lake Well (ID 079) located approximately 6.5 km south near the community of Stillwater Lake. This well was drilled to a depth of 77.00 m through granitic bedrock. This well has been monitored since 2008, where water levels have ranged between approximately 68.56 to 69.81 masl. Water quality in this observation well was tested in 2008 and again in 2018. Both 2008 and 2018 water samples had elevated fluoride levels above Health Canada drinking water guidelines. In addition, the 2008 sampling event recorded arsenic levels above Health Canada drinking water guidelines, however, arsenic guidelines were not exceeded in the 2018 sampling event (NSECC, 2015a).

7.2.5 Effects Assessment

Project-Geophysical Interactions

Project activities will primarily interact with the geophysical environment during earth moving activities (Table 7.17).

Table 7.17: Potential Project-Geophysical Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Geophysical Environment		X		X	X	X				X				X	X

Assessment Boundaries
The LAA for the geophysical environment is the Assessment Area. The RAA is the Study Area (Drawing 2.2).

Assessment Criteria
Assessment criteria provided in Section 4.6 apply for the geophysical environment. The VC-specific definition for magnitude is as follows:

- Negligible – no expected changes to local topography or geology; no anticipated impacts to the quality/quantity of groundwater wells.
- Low – changes to local topography/geology are possible but not anticipated as no geologic hazards are presence within the Study Area; impacts to the quality/quantity of groundwater wells are possible but not anticipated.
- Moderate – changes to local topography/geology are possible as geologic hazards exist within proximity to the Study Area; impacts to the quality/quantity of groundwater wells are possible.
- High – changes to local topography or geology are anticipated due to the presence of geologic hazards within the Study Area; impacts to the quality/quantity of groundwater wells or public water supply are anticipated.

Effects
The geophysical environment will be disturbed within the Assessment Area during the site preparation and construction phase, and again during decommissioning. During these phases, potential impacts related to the geologic environment are primarily due to the presence and subsequent disturbance of geologic hazards including:

- Sulphide-bearing slates (i.e., acid generating rock)
- Karst topography
- Colluvial deposits
- Radon
- Arsenic and/or uranium containing bedrock

In Nova Scotia, several bedrock formations are known to contain acid generating rock (sulphide minerals such as pyrite, pyrrhotite) that, when disturbed, can result in the production of acid rock drainage (ARD). ARD occurs when sulphide-bearing rocks are disrupted and exposed to air or water, producing sulphuric acid and metal oxides that are subsequently mobilized/leached through freshwater systems (NSNRR, 2021a). Based on provincial risk mapping, there are no sulfide-bearing slates or formations recorded within the Study Area (NSNRR, 2002). The presence/absence of sulfide bearing minerals and further likelihood of ARD will be confirmed following the results of the geotechnical evaluation.

Karst topography is characterized by naturally occurring sinkholes, underground drainage systems, and caves which are formed by the dissolution of soluble bedrock (e.g., limestone). The presence of karst terrain has the potential to cause extensive damage to infrastructure and the local landscape due to the risk of sudden collapse/subsidence. A review of the Karst Risk Map identified that the Study Area is located in a “Low Risk” area (NSNRR, 2019). As part of geotechnical investigations completed for the Project, turbine pads (and other permanent infrastructure) will be assessed for constructability limitations.

Colluvial deposits (also known as talus slopes) are loose deposits of surficial material at the base of steep slopes. These geologic features can pose significant hazards as they are subject to sudden and rapid slides/failures. No records of colluvial deposits were identified within the Study Area (NSNRR, 2024a).

Radon potential mapping shows the Study Area is primarily located in “Medium Risk” area for radon in indoor air (NSNRR, 2009). There is no indoor air pathway for radon gas associated with the Project; radon gas is not considered a risk for outdoor inhalation.

Construction activities, primarily blasting (if required), have the potential to impact the quality and quantity of surrounding groundwater supply depending on the proximity to drinking water wells and extent of disturbance caused by construction activities. Disturbance of arsenic and/or uranium containing bedrock can mobilize arsenic/uranium within groundwater, and subsequently degrade nearby groundwater well quality. Risk mapping shows the Study Area is situated in a “High Risk” area for arsenic containing bedrock and primarily within a "High Risk" area for uranium containing bedrock (with the exception of several "Low Risk" pockets) (NSNRR, 2020d & NSNRR, 2017a).

In addition to water quality, groundwater quantity can also potentially be impacted if blasting activities (as required) alter local hydrogeological flow regimes, resulting in groundwater draining from or flowing towards existing wells. As a result of potential impacts to groundwater quality and quantity, wells located within 800 m of blasting activities require monitoring per NSECC’s Procedure for Conducting a Pre-Blast Survey (1993). Based on results of the desktop review, no wells are located within 800 m of the Assessment Area. The requirement for blasting and pre-blast surveys will be confirmed and assessed further during geotechnical investigations.

Mitigation

The use of existing road networks, siting in previously disturbed areas, and use of existing ROWs all contributed to minimizing the Project’s impact to the geologic environment.

The following mitigation measures are also recommended to minimize impacts to the geologic environment:

- Conduct blasting, if required, in accordance with provincial legislation and subject to terms and conditions of applicable permits.
    - Conduct pre-blast surveys for wells within 800 m of blasting activities.
    - Ensure all blasts are conducted and monitored by certified professionals.
    - Notify landowners in advance of any blasting activities.

  - Recover and revegetate exposed soils or bedrock as required to minimize any exposure following blasting.
- Develop site-specific mitigation for sulphide bearing materials if they are identified through pre-construction geotechnical surveys.
- Ensure rock removal in known areas of elevated sulphide potential will conform to the Sulphide Bearing Material Disposal Regulations, N.S. Reg. 57/95 and in consultation with relevant regulatory departments.
- Store any soil needed for backfilling, after foundations have been poured, temporarily adjacent to the excavations until needed. Any remaining excavated material will be used on-site or removed and sent to an approved facility.
- Install erosion and sedimentation control measures prior to excavation activities and inspect controls on a regular basis.
- Remove temporary erosion and sedimentation controls once backfilled material has stabilized. Attention will be paid during site reinstatement to ensure areas will promote wildlife return to the area, to the extent possible.

Monitoring

No monitoring programs are recommended at this time in relation to the geophysical environment.

If geologic hazards (ARD, etc.) are identified within the Assessment Area during geotechnical investigations, a site-specific monitoring plan may be developed.

If blasting activities are required to construct the Project (to be confirmed during geotechnical investigations), activities will adhere to the Procedure for Conducting a Pre-Blast Survey (NSECC, 1993).

Conclusion

After mitigations, residual effects on the geophysical environment are characterized as follows:

- Low magnitude as there are no water wells within 800 m of the Assessment Area (and therefore, potential impacts to well water quality associated with the disturbance of potentially arsenic and uranium containing bedrock is not anticipated).
- Within the LAA.
- Short-term duration as the residual effects will not extend beyond the duration of the construction phase.
- Of intermittent frequency, as disturbance of the geophysical environment will only occur during the construction phase.
- Reversible, as the effect will terminate at the end of the Project lifespan following decommissioning/reclamation.

As a result, the residual effects are considered not significant.

7.3 Aquatic Environment

7.3.1 Waterbodies and Watercourses

7.3.1.1 Overview

The objective of the waterbody and watercourse assessment was to inform the Project's design and collect the information necessary to assess potential impacts to waterbodies, watercourses, and fish habitat (assessed separately in Section 7.3.2) resulting from the Project. This was accomplished using the following approach:

- Identify watercourses and waterbodies within the Study Area using desktop resources.
- Use the information collected to inform Project design (e.g., avoid/minimize impacts to waterbodies and watercourses) and develop an Assessment Area.
- Traverse the entirety of the Assessment Area to ground truth waterbodies and watercourses and provide characterization of any identified features.
- Use the information collected to inform mitigation and management practices and further refine the Project Area.

7.3.1.2 Regulatory Context

Under the *Environment Act,* SNS 1994-95, c. 1, NSECC has the authority to promote the sustainable management of water resources in Nova Scotia. More specifically, as per section 5A of the Activities Designation Regulations, NS Reg 47/95, the alteration of a watercourse or the flow of water within a watercourse is an activity that requires an approval from NSECC, or a notification to NSECC if the work will be completed in accordance with the Nova Scotia Watercourse Alterations Standards (NSECC, 2015b).

There are also federal regulations that impact the management of watercourses. DFO has a responsibility to oversee the protection of fish and fish habitat in accordance with the *Fisheries Act* and *SARA*. Furthermore, the *Canadian Navigable Waters Act* gives Transport Canada the authority to regulate interferences with the public right to navigable waters, including approving and setting the terms and conditions for works within navigable waterways.

7.3.1.3 Desktop Review

Waterbodies

A desktop review was conducted to identify mapped and potential waterbodies within the Study Area, along with any associated aquatic species-at-risk (SAR), using the following sources:

- CanVec Database – Hydrographic Features (NRCan, 2022a)
- Significant Species and Habitats Database (NSNRR, 2023a)

A review of the federal CanVec Database – Hydrographic Features (2022a) identified one unnamed waterbody feature within the Study Area, along with 159 named and unnamed features within 5 km. A complete list of named waterbodies located within 5 km of the Study Area is provided in Table 7.18.

Table 7.18: Named Waterbodies Within 5 km of Study Area

Name of Waterbody	Distance (km)
Waterbodies Within 5 km of Study Area*	
Anderson Lake	1.65
Back Lake	1.64
Baker Lake	4.83
Bates Lake	4.56
Beaver Lake	3.94
Beaver Pond	0
Beaverdam Lake	5.08
Beeswanger Lake	1.44
Bennett Lake	4.60
Bezanson Ponds	0
Bezanson Ponds	0
Big Indian Lake	0
Big Walsh Lake	1.97
Black Brook	0.70
Blind Lake	2.27
Bottle Lake	3.55
Bowsprit Lake	0.51
Brunswick Lake	2.28
Bull Pond	3.69
Carney Lake	5.46
Cellarhole Lake	1.97
Christie Lake	2.52
Clarke Lake	0
Clay Lake	0
Clements Lake	0
Cochran Lake	4.36
Cockscomb Lake	1.67
Coon Pond	1.96
Cooper Lake	2.98
Daley Lake	4.57
Dauphinees Pond	1.59
Deep Lake	2.64
Dore Mud Pond	4.34
Dorey Pond	4.44
Duck Pond	2.88
Duck Ponds	1.11

Name of Waterbody	Distance (km)
Fales Lake	1.51
Fifteen Minute Lake	0.19
Five Island Lake	3.61
Five Mile Lake	0
Fultz Lake	0
Granite Lake	0
Green Lake	0.35
Hamilton Pond	0.90
Harry Hole	0
Hoop Pole Pond	4.31
Isaacs Lake	2.47
Island Lake	1.02
Kehoe Lake	3.26
Lacey Lake	2.07
Lily Lake	2.78
Little Beeswanger Lake	3.30
Little Indian Lake	0
Little Lake	0
Little Pockwock Lake	0.22
Little Walsh Lake	2.26
Lizard Lake	1.86
Long Hill Pond	4.64
Long Ponds	0.58
Marshy Lake	0
McNab Pond	1.52
Melvin Lake	0
Mill Lake	3.51
Mud Pond	1.57
Murphy Lake	2.24
Muskrat Lakes	1.84
Norman Lake	3.01
North River	0.01
Northwest Brook	0.85
Patient Ross Lake	3.17
Peggys Pond	0
Pentz Lake	3.10
Pigott Lake	3.33
Pockwock Lake	2.54
Proctor Pond	1.76
Rafter Lake	0.23
Rees Lake	2.11

Name of Waterbody	Distance (km)
Sackville River	4.66
Sandford Lake	0.36
Sandy Lake	0.33
Snowshoe Pond	0
Soldier Lake	1.05
Stillwater Lake	3.46
Taylor Lake	3.80
Thompson Lake	0
Thompson Pond	0
Tomahawk Lake	4.33
Two Mile Lake	3.60
Uniacke Lake	1.96
Wall Lake	4.86
West Lake	1.67
Wrights Lake	0

*Measurement from the nearest point of the Study Area.

According to the Significant Species and Habitats Database (2023a), Big Indian Lake and Pockwock Lake were identified as significant habitat based on the confirmed presence of Common Loon (*Gavia immer*). As this record is related to an avifauna species, refer to Section 7.4.5 for further details.

The Pockwock Designated Water Supply Area is located to the east of the Study Area. It overlaps the Study Area in the northeast and overlaps the Assessment Area on a portion of Pipeline Road.

The results of the desktop review indicated that Project infrastructure has three turbine pads within proximity of Fultz Lake and Granite Lake. A 30 m setback will be established around all lakes and the Project will not interact waterbodies, thus waterbodies were not included within the Assessment Area.

Watercourses

A desktop review was conducted to identify mapped and potential watercourses within the Study Area, along with any associated aquatic SAR, using the following sources:

- NS Topographic Database – Water Features (GeoNOVA, 2022)
- CanVec Database – Hydrographic Features (NRCan, 2022a)
- Significant Species and Habitats Database (NSNRR, 2023a)
- Wet Areas Mapping (WAM) (NSNRR, 2021b)
- NS 1:10,000 Primary Watersheds (NSECC, 2011)

A review of the NS Topographic Database – Water Features (GeoNOVA, 2022) identified 283 watercourse feature segments within the Study Area and 1,958 feature segments within 5 km of the Study Area (Drawing 7.11). Five named watercourses were identified within the Study Area including:

- Marr Brook
- Melvin Brook
- North River
- Sandy Brook
- Uniacke River

The Study Area is located within the East/Indian River primary watershed (1EH), and the Northeast River (1EH-2) and Indian River (1EH-3) secondary watersheds (Drawing 7.11). The largest watercourse flowing through the Study Area is North River, located within the northern portion of the Study Area. This watercourse and its associated tributaries direct flow into the Study Area from the north, eventually discharging into Big Indian Lake. Big Indian Lake ultimately discharges into the Atlantic Ocean near the Head of St. Margarets Bay via Indian River.

Sandy Brook and Melvin Brook along with their associated tributaries direct flow through the center of the Study Area, eventually discharging into Big Indian Lake. Uniacke River and its associated tributaries direct flow southeast, through the north of the Study Area, eventually discharging into Granite Lake, which ultimately discharges into the Atlantic Ocean near the Head of St. Margarets Bay. Finally, Marr Brook and its associated tributaries direct flow through the south of the Study Area, eventually discharging into Wrights Lake. Wrights Lake ultimately discharges into the Atlantic Ocean near the Head of St. Margarets Bay via Northeast River.

According to the Significant Species and Habitats Database (2023a), there are no watercourses within the Study Area recorded as containing significant species and/or their habitat (Drawing 7.12).
Within the Study Area, WAM data indicates that groundwater ranges from 0 m to >10 m of the surface, with the majority being within >10 m of the surface on account of the area being rapidly to well drained (Drawing 7.12). WAM results generally aligned with the locations of watercourses identified using topographic mapping and highlighted the potential for additional watercourses throughout the Study Area (NSNRR, 2021b).

7.3.1.4 Field Assessment Methodology

The results of the desktop review were used to inform Project design (e.g., avoid/minimize impacts to waterbodies and watercourses) and determine the Assessment Area. Given that the Project will avoid all waterbodies, field assessment efforts were focused on potential Project-watercourse interactions.

Watercourse assessments were completed between July and October 2024. Desktop-identified watercourses, along with WAM and predicted flow data, were provided to field staff to guide the identification and assessment of watercourses within the Assessment Area. Field crews assessed the entire footprint of the Assessment Area, including a 25 m area on either side of both proposed and existing access roads, a 10 m area on either side of the proposed transmission line routes, and a 200 m radius around the center of the proposed turbine locations. Every watercourse identified was delineated (until the watercourse's extent reached the edge of the Assessment Area boundary or the watercourse terminated) and assessed for general watercourse characteristics. Supplementary information on fish and fish habitat was also recorded during the surveys (Section 7.3.2). Information collected included:

- Date and time
- Flow type
- Flow characteristics (direction, velocity)
- Channel characteristics (width, length, depth, degree of entrenchment)
- Substrate composition
- Habitat characteristics
- Bank stability
- Photographs

This information was collected and georeferenced using Survey123, an Environmental Systems Research Institute (ESRI) application for creating, sharing, and analyzing data. As a result of field-verified environmental constraints, including watercourses, the Project's turbine layout underwent several iterations to minimize potential interactions and limit the number of required watercourse crossings. Information collected on watercourses was also used to guide further freshwater species assessments (i.e., fish and herpetofauna).

7.3.1.5 Field Assessment Results

A total of 32 watercourses were identified within the Assessment Area (Appendix D and Drawing 7.13A-F), including perennial (18), intermittent (11), and ephemeral (three) features ranging in bankfull width from 0.24 m to 13.5 m. There were no incidental observations of aquatic SAR identified during the watercourse assessment. However, several areas of potential turtle habitat were noted and are described further in Section 7.4.3.

Perennial, or permanent, features see flow for the vast majority, if not the entirety, of the year. Their continuous flow is often attributed to their direct connection to stable sources of water, including lakes and groundwater springs (US EPA, 2013). Small permanent features include streams, brooks, and creeks. These features are often first- and second-order streams fed by springs, groundwater, and run-off, and often act as tributaries to larger features, creating larger permanent features at their confluence. Large permanent features often exhibit lower flow path gradients, larger channel dimensions, and an increased flow (US EPA, 2013).

Intermittent watercourses exhibit overland flow in intervals throughout the duration of the year. They typically have well-defined stream morphology, and often have subterranean flow when overland flow is absent (US EPA, 2013). These features are heavily influenced by seasonality, often displaying characteristics similar to permanent features during periods of heavy rain, or after significant snowmelt. During drier times of the year, flow velocity within these features may reduce to pools of standing water, or eventually dry stream beds (US EPA, 2013).

Ephemeral watercourses do not have stable courses of water, and exhibit flow only after heavy precipitation or significant snowmelt events. Runoff is the primary source of water for these features, and they serve an important role of redirecting overland flow towards more established riverine environments (US EPA, 2013). As such, these features also play an important part in the flood prevention and nutrient cycling regimes of their respective environment.

A total of 12 of the 31 watercourses identified within the Assessment Area showed evidence of alteration resulting from anthropogenic development activities during the last century. For example, many watercourses have been disrupted by the installation of culverts or bridges to facilitate forestry activities and/or recreational use of the area.

7.3.1.6 Effects Assessment

A GIS suitability analysis was conducted to design a Project Area that would optimize the placement of Project infrastructure to avoid waterbodies and watercourses, to the greatest extent possible. The Assessment Area has considered multiple options/configurations of infrastructure components such as roads, transmission lines, a substation, and a laydown area. Further, the Project design utilizes as many pre-existing roads as possible. The Project's detailed design phase may see additional refinements to the Project Area and placement of infrastructure which could further reduce interactions with field-identified watercourses within the Assessment Area. As previously mentioned, there are no identified Project-waterbody interactions.

Project-Watercourse Interactions

Project activities, primarily those that involve earth moving, vegetation removal, and road construction have the potential to impact watercourses (Table 7.19). These potential impacts could include habitat loss, changes to hydrology, and/or displacement of sediment,

Table 7.19: Potential Project-Watercourse Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Watercourses			X	X	X	X			X				X		X

Assessment Boundaries

The LAA for watercourses includes the Assessment Area. The RAA for watercourses includes the Study Area (Drawing 2.2).

Assessment Criteria

Assessment criteria provided in Section 4.6 also apply to watercourses. The VC-specific definition for magnitude is as follows:

- Negligible – no loss of aquatic habitat. No expectation for altered hydrology.
- Low – no loss of aquatic habitat, with minimal potential for altered hydrology.
- Moderate – small loss of aquatic habitat. Altered hydrology expected but can be managed with routine measures.
- High – loss of aquatic habitat. Altered hydrology expected that would be challenging to manage with routine measures.

Direct Effects

Direct effects to watercourses such as habitat loss and altered hydrology are likely to be most prominent during the construction phase. Effect-specific active management, mitigation, and monitoring are required to eliminate, mitigate, or otherwise manage the magnitude of these direct effects.

Watercourse alterations required for the Project have the potential to impact aquatic habitat. The removal of overhanging vegetation from stream banks decreases shade or cover for fish resulting in increased vulnerability to predators. Likewise, the removal of instream cover, such as coarse woody debris or edge habitat (e.g., undercut banks) can have a negative effect on both fish and aquatic invertebrate habitat (MTO, 2009). Furthermore, alterations to channel morphology including altered substrate composition and interference with sediment transport can also result in aquatic habitat degradation.

An assessment of potential Project-watercourse interactions was completed for all watercourses identified in the Study Area (Table 7.20). The Project may interact with up to 18 watercourses through either an upgrade to an existing watercourse crossing or construction of a new crossing. None of the interactions are expected to result in the diversion, redistribution, or realignment of the respective watercourse. That is, each alteration will be executed as a means of retrofitting the current or natural conditions to facilitate Project developments.

Table 7.20: Watercourse Alteration Summary

Watercourse	Existing Alteration Present?	Forecasted Alteration
WC1	Yes, metal culvert installation for road crossing	Culvert to be assessed and potentially replaced during road upgrades.
WC2	None observed	None – watercourse expected to be spanned by collector line.
WC3	None observed	None – watercourse expected to be spanned by collector line.

Watercourse	Existing Alteration Present?	Forecasted Alteration
WC4	None observed	None – watercourse expected to be avoided.
WC5	None observed	None – watercourse expected to be spanned by collector line.
WC6	None observed	None – watercourse expected to be avoided.
WC7	Yes, road crossing with no culvert	Crossing to be assessed and a culvert may be installed with road upgrade.
WC8	None observed	None – watercourse expected to be spanned by collector line.
WC9	None observed	None – watercourse expected to be avoided.
WC10	None observed	None – watercourse expected to be avoided.
WC11	None observed	None – watercourse expected to be avoided.
WC12	Yes, road crossing with no culvert	Crossing to be assessed and a culvert may be installed with road upgrade.
WC13	Yes, road crossing with no known culvert	Crossing to be assessed and a culvert may be installed with road upgrade.
WC14	Yes, open-bottom bridge for road crossings	Bridge to be assessed and potentially replaced during road upgrades.
WC15	No	Crossing to be installed with road construction.
WC16	No	Crossing to be installed with road construction.
WC17	Yes, plastic culvert installation for road crossing	Culvert to be assessed and potentially replaced during road upgrades
WC18	None observed	Crossing to be installed with road construction
WC19	None observed	None – watercourse expected to be avoided
WC20	Yes, plastic culvert installation for road crossing	Culvert to be assessed and potentially replaced during road upgrades
WC21	Yes, plastic culvert installation for road crossing	Culvert to be assessed and potentially replaced during road upgrades
WC22	Yes, plastic culvert installation for road crossing	Culvert to be assessed and potentially replaced during road upgrades
WC23	Yes, metal culvert installation for road crossing	Culvert to be assessed and potentially replaced during road upgrades
WC24	Yes, open-bottom bridge for road crossings	Bridge to be assessed and potentially replaced during road upgrades

Watercourse	Existing Alteration Present?	Forecasted Alteration
WC25	None observed	None – watercourse expected to be spanned by collector line
WC26	None observed	None – watercourse expected to be spanned by collector line
WC27	None observed	None – watercourse expected to be avoided
WC28	None observed	Crossing to be installed with road construction
WC29	None observed	None – watercourse expected to be avoided
WC30	Yes, open-bottom bridge for road crossings	Bridge to be assessed and potentially replaced during road upgrades
WC31	Yes, open-bottom bridge for road crossings	Bridge to be assessed and potentially replaced during road upgrades
WC32	Yes, open-bottom bridge for road crossings	Bridge to be assessed and potentially replaced during road upgrades

Road and Turbine Pad Construction

If determined to be required, 14 of the potential alterations will be upgrades to existing watercourse crossings during road construction. Of these, 11 would stem from upgrading existing infrastructure (six culverts and five bridges) to accommodate road widening or to meet current engineering standards and NSECC flow/sizing requirements. The remaining three alterations are at existing road crossings that presently do not have culverts, or it is unknown whether a culvert is present. Project engineers will make final culvert upgrade/installation determinations during the detailed design phase.

The construction of new roads and turbine pad access roads will require the installation of four new watercourse crossings. Each of these crossings will be designed to avoid any permanent diversion, restriction, or blockage of natural flow, such that the hydrologic function of the watercourse is maintained. Specific details of each crossing will be finalized during the detailed design phase and will be included in any necessary applications for alteration or notifications to NSECC.

Collector Line and Transmission Line

Of the identified watercourses within the Assessment Area, six are either partially or fully within the proposed collector line or transmission line route. None of these crossings are anticipated to impact the respective watercourses, as the lines will span the watercourse. Further, any activity related to the installation of poles or structures to string or pull the collector or transmission lines will be confined to the area above the ordinary high-water mark and will ensure a sufficient vegetative buffer is preserved along the riparian zone.

Indirect Effects

Indirect effects such as erosion and sedimentation or changes in water quantity and quality can be farther reaching, extending outside of the LAA and into the greater RAA. These effects are often foreseeable, and research based, standardized best management practices (BMPs) can be implemented to mitigate the resulting outcomes, and the magnitude at which they are felt.

Erosion and Sedimentation

The mobilization of sediment within aquatic environments can cause shifts in ecological integrity, including changes to the plant species composition, the distribution of primary and secondary producers, and the habitat suitability for vulnerable species (Tilman et al., 1997). Erosion and sedimentation can occur throughout the lifecycle of the Project, including during construction efforts, routine road maintenance, and daily traffic. However, the highest potential for these effects is related to the construction and upgrading of access roads, and the installation or upgrading of crossing structures. The alteration or removal of riparian vegetation can also result in bank instability and erosion.

Changes in Surface Water Quantity

Changes to the amount of flow can alter channel morphology, increase flood potential, and disrupt habitat characteristics that support vulnerable species (MTO, 2009). These impacts could result from the alteration of bank or channel grades for road development, the compaction of soil from the heavy machinery required for turbine assembly, or the alteration of channel beds to facilitate the removal and replacement of preexisting infrastructure (e.g., rusted culverts).

Changes in Surface Water Quality

Changes in the quality of surface water can arise from alterations to the surrounding environment and can include an increase in water temperature from decreased shade, an increase in pollutants from machinery and infrastructure, and the mobilization of sediments (MTO, 2009). Given the dynamic nature of channeling water, effects upon water quality can quickly spread throughout different reaches of the respective watershed.

Mitigations

As required, all work completed under the provincial watercourse alteration notification process will be done in accordance with the Nova Scotia Watercourse Alterations Standards and will be executed by a certified Watercourse Alteration Installer/Sizer. For work requiring an approval, specific and detailed mitigation will be developed and submitted to NSECC as part of the application process.

The following specific mitigative measures will be implemented to avoid and mitigate potential effects on watercourses:

Habitat Loss

- Educate Project personnel on the sensitivity of aquatic habitat.
- Ensure watercourses are clearly marked and avoid impacts to the watercourse and adjacent riparian habitat to the extent possible.

- Revegetate along the watercourse edge and above the ordinary high-water mark to stabilize the area.
- Redesign existing watercourse crossings to facilitate habitat upgrades, including unblocking culverts and making waterways more conducive to fish passage.
- Conduct in-water work between June 1 and September 30 to avoid sensitive periods in the life cycles of fish, to better control water flow, and to allow for a faster revegetation period (NSECC, 2015c).

Altered Hydrology

- Plan any construction activities that may impact stream banks and substrate to align with low-flow periods.
- Design necessary alterations in a way that maintains the natural grade of the watercourse, to ensure the hydroperiod remains as it was pre-alteration.

Erosion and Sedimentation

- Develop a site-specific erosion and sedimentation plan during the detailed design phase.
  - The plan will target the disturbance to banks (as required) and adjacent land, and will address the type of control structures, proper installation techniques, grading, maintenance and inspection, timing of installation, and revegetation.
- Limit the area of exposed soil and the length of time soil is exposed without mitigation (e.g., mulching, seeding, rock cover).
- Limit the slope and gradient of disturbed areas to minimize the velocity of surface water runoff.

Changes in Surface Water Quantity

- Integrate water management systems including diversion and collection ditches, roadside drainage channels, vegetated swales, and stormwater retention ponds.
- Fit any watercourse crossings with appropriately sized infrastructure, as prescribed by a certified Watercourse Alteration Installer/Sizer.

Changes in Surface Water Quality

- Leave riparian vegetation as intact as Project developments will allow.
- Integrate outlet protection features to dissipate flow velocities and decrease erosion at the outflow.
- Ensure that if concrete is to be used, it is pre-cast and cured for at least one week prior to use at a crossing site (NSECC, 2015c).
- Utilize untreated, rot-resistant timber (e.g., hemlock, tamarack, juniper, or cedar) below the ordinary highwater mark to avoid the leaching of toxic preservatives into waterways (NSECC, 2015c).
- Utilize rock material that is clean, coarse granular, non-ore-bearing, non-watercourse-derived, and non-toxic to aquatic life (NSECC, 2015c).
- Engage Halifax Water for road upgrades that overlap with the Pockwock Water Supply Area within the Assessment Area, as required.

Monitoring

For crossings subject to provincial notification requirements, visual monitoring will be completed during the installation process to ensure the work is conducted in accordance with the Nova Scotia Watercourse Alteration Activity Standards (2015b). Monitoring requirements for crossings requiring an approval will be determined on a crossing-specific basis during the detail design phase.

A watercourse monitoring plan, if required as part of the permitting phase, may include hydrological, sediment, and stability assessments upstream, downstream, and at the crossing of the watercourse. An example is included in Table 7.21.

Table 7.21: General Watercourse Monitoring Parameters and Methods of Assessment

Monitoring Parameter	Tasks	Method of Assessment	
		General Monitoring	Detailed Monitoring
Erosion and Sedimentation	Examine stability of watercourse banks both upstream and downstream of the crossing. Examine grade of slope at the crossing, taking note of any erosive channeling in substrate that would indicate the slope may be too steep.	Yes	Yes
	Inspect sediment control measures for effectiveness and look for evidence of sedimentation within the watercourse.	Yes	No
Water Quantity	Examine flow velocity, taking note of any undercutting or abrasive channeling, leftover construction debris, or obstruction to flow resulting from alteration activities.	No	Yes
	Preserve ability for fish passage by maintaining flow and adequate water levels.	No	Yes
	Examine water management systems (e.g., drainage channels) for effectiveness, taking note of any blockages, washouts, or unfavorable conditions.	Yes	No
Water Quality	Record basic water quality parameters and infer whether alteration activities have drastically disrupted natural conditions.	Yes	Yes
	Note the physical characteristics of watercourse, including colour, odour, cloudiness, or presence of algae.	Yes	Yes
Habitat Loss	Conduct stream assessments equivalent to those completed prior to alteration. Examine substrate, taking note of any obvious sediment mobilization, residual slash, or a build-up of fines/muck.	Yes	Yes
	Examine crossing for visual observance of fish, and/or any obvious signs of deteriorated fish habitat (e.g., desiccation of riparian vegetation, channel infill, etc.) or diversified fish habitat (e.g., pools, woody debris, etc.).	Yes	No

Conclusion

After mitigations, residual effects on waterbodies and watercourses are characterized as follows:

- Moderate magnitude such that a small loss of aquatic habitat will occur and altered hydrology is expected but can be managed with routine measures.
- Within the LAA, as direct impacts will occur only within the LAA and indirect impacts are expected to be minimized through the implementation of effect-specific management and mitigation measures.
- Timing and seasonality are not applicable as mitigation measures will minimize the potential for indirect effects to be exacerbated during high precipitation events in the spring and fall.
- Short duration as the residual effects will be restricted to the construction phase.
- A single event, as the residual effects will be restricted to the construction phase.
- Reversible, as the effect will terminate at the end of the Project lifespan.

As a result, the residual effects are considered not significant.

7.3.2 Fish and Fish Habitat

7.3.2.1 Overview

The objective of the fish and fish habitat assessment was to inform the Project's design and collect the information necessary for the assessment of fish species and associated habitat within the Study Area. This was accomplished using the following approach:

- Identify potential fish habitat (waterbodies, watercourses, and wetlands) within the Study Area using desktop resources.
- Use the information collected to inform the Project design (e.g., avoid/minimize impacts to watercourses and water bodies) and determine an Assessment Area.
- Assess the quality of fish habitat within the Assessment Area via field surveys.
- Inventory and assess abundance and diversity of fish within the Assessment Area.
- Use the information collected to inform mitigation and management practices and further refine the Project Area.

7.3.2.2 Regulatory Context

Federally, DFO is responsible for the protection of fish and fish habitat in accordance with the *Fisheries Act.* The *Fisheries Act* defines fish as "(a) parts of fish, (b) shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans, or marine animals, and (c) the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans, and marine animals;", and fish habitat as "waters frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas".

Section 34.4(1) of the *Fisheries Act* states that no person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish, and Section 35(1) of the *Fisheries*

Act restricts any work, undertaking or activity that results in the harmful alteration, disruption, or destruction of fish or fish habitat. Under Section 35(2) of the *Act,* authorization may be granted for a proposed work, undertaking or activity that may, respectively, result in the death of fish or the harmful alteration, disruption, or destruction of fish habitat. The *Fisheries Act* provides additional protection to fish and fish habitat through means such as permitting, licensing, regulations, habitat restoration, marine refuge, and fish stocks.

Provincially, the potential for alterations/activities to impact fish and fish habitat is considered through the watercourse and/or wetland alteration application process, as appropriate.

7.3.2.3 Desktop Review

The desktop component included a review of the following resources and databases:

- Completed watercourse assessments (Section 7.3.1)
- Completed wetland assessments (Section 7.3.3)
- NS 10K Topographic Database – Hydrographic Network (Open Data NS, 2022)
- WAM (NSNRR, 2021b)
- Aquatic Species at Risk Map (DFO, 2022b)
- NS Significant Species and Habitats Database (NSNRR, 2023a)
- ACCDC Data Report (ACCDC, 2024)

Surface water mapping and associated information conducted for waterbodies, watercourses, and wetlands is found in Sections 7.3.1 and 7.3.3, respectively.

The Aquatic Species at Risk Map (DFO, 2022b) is a federal database showing the distribution of SAR and their associated critical habitat within Canadian waters. A review of this database determined that there are no water features within the Study Area that contain SAR.

The Nova Scotia Significant Species and Habitat Database (NSNRR, 2023a) contains 25 unique species and/or habitat records pertaining to fish and fish habitat within a 100 km radius of the Study Area. These records include:

- 9 “Species of Concern” records relating to the Triangle floater (*Alasmidonta undulata*) (5), Brook floater (*Alasmidonta varicosa)* (1), Creeper (*Strophitus undulatus*) (2); and Molluscs (1)
- 15 “Species at Risk” records relating to Triangle floater (10), Brook floater (2), and Delicate lamp mussel (*Lampsilis cariosa*) (3)
- 1 “Other Habitat” record relating to Ribbed mussel (*Geukensia demissa*)

None of these records are within the Study Area, and the closest records relate to Triangle floater and are located approximately 15 km southeast from the Study Area.

The Atlantic Canada Conservation Data Centre (ACCDC) database identified 17 fish and aquatic invertebrate SAR or SOCI within 100 km of the Study Area (Table 7.22).

Table 7.22: Fish and Aquatic Invertebrate SOCI within a 100 km Radius of the Study Area

Common Name	Scientific Name	COSEWIC Status[1]	*SARA* Status[1]	*ESA* Status[2]	NS S-Rank[3]
Fish					
Alewife / Gaspereau	*Alosa pseudoharengus*	---	---	---	S3B
American eel	*Anguilla rostrata*	Threatened	---	---	S3N
Atlantic salmon - Gaspe-Southern Gulf of St Lawrence pop.	*Salmo salar pop. 12*	Special Concern	---	---	S1
Atlantic salmon - Inner Bay of Fundy pop.	*Salmo salar pop. 1*	Endangered	Endangered	---	S1
Atlantic salmon- NS Southern Upland pop.	*Salmo salar pop. 6*	Endangered	---	---	S1
Atlantic sturgeon	*Acipenser oxyrinchus*	Threatened	---	---	S2S3N
Atlantic whitefish	*Coregonus huntsmani*	Endangered	Endangered	Endangered	S1
Brook trout	*Salvelinus fontinalis*	---	---	---	S3
Lake trout	*Salvelinus namaycush*	---	---	---	S3
Striped bass	*Morone saxatilis*	Endangered / Special Concern	---	---	S2S3B,S2S3N
Striped bass - Bay of Fundy pop	*Morone saxatilis pop. 2*	Endangered	---	---	S2S3B,S2S3N
Aquatic Invertebrates					
Atlantic mud-piddock	*Barnea truncata*	Threatened	Threatened	---	S1
Brook floater	*Alasmidonta varicosa*	Special Concern	Special Concern	Threatened	S3
Creeper	*Strophitus undulatus*	---	---	---	S3
Eastern pearlshell	*Margaritifera margaritifera*	---	---	---	S2
Tidewater mucket	*Atlanticoncha ochraea*	---	---	---	S1
Triangle floater	*Alasmidonta undulata*	---	---	---	S2S3

Source: (ACCDC, 2024) [1](Government of Canada, 2022); [2](Government of NS, 2022); [3](ACCDC, 2024)

The ACCDC Data Report (2024) also identified five observations of marine fish and four observations of marine mammals within 100 km of the Study Area which can be found in Appendix E. These species are not discussed further as the Study Area is contained inland and will not impact the marine environment.

No fish or aquatic invertebrate SAR/SOCI have ACCDC-documented observations within 5 km of the Study Area (ACCDC, 2024).

7.3.2.4 Field Assessment Methodology

Fish presence and existing habitat were documented as part of the watercourse surveys for all watercourses that may require an alteration (e.g. located along access roads). For each watercourse, notes on the visual observance of fish were recorded along with any habitat characteristics that may influence fish presence such as pool/riffle sequences, barriers to fish passage, and substrate composition. Watercourses were assessed according to their ability to support fish habitat relating to spawning, rearing, and overwintering. More detailed fish habitat assessments and qualitative electrofishing were completed in four watercourses identified during desktop review (Drawing 7.13A-F):

- Sandy Brook (EF001)
- Melvin Brook (EF002)
- Unnamed Watercourse (EF003)
- Marr Brook (EF004)

Locations selected considered the likelihood of each watercourse to support a variety of fish species, and the position of the watercourse within the watershed with the goal of assessing all secondary watersheds within the Study Area. Furthermore, the selected watercourses were all notable, permanent features that offered a representation of the surficial hydrology across the entire Study Area.

Fish Habitat Assessment

Fish habitat assessments were completed during summer 2022 at the same time as electrofishing surveys. Assessments included: a physical analysis of the watercourse including bank characteristics and substrate composition, an analysis of in-situ water chemistry, and an assessment of fish habitat potential across various life stages (i.e., spawning, rearing, and overwintering). Assessments were completed at three positions along the watercourse, including the proposed crossing location, and 100 m upstream and downstream of the crossing. A description of assessment components is provided below:

Physical Makeup

- Substrate Percent
  Substrate composition was evaluated based on percent cover of bedrock, boulders, rubble, cobble, gravel, sand, and fines/muck. Habitat potential was assessed based on the presence/absence of suitable areas for various fish life stages, including spawning, rearing, and overwintering.

- In-stream Habitat Types
  In-stream habitat diversity was assessed by presence of pools, riffles, runs, flat sections, rapids, or cascades. A diverse selection of in-stream habitat can cater to a diverse assemblage of species.

- In-stream Cover
  Watercourse was assessed for physical characteristics that provide fish refuge, including boulders, overhanging and instream vegetation, woody debris, deep pools, and undercut banks. These parameters were ranked as being present in either trace, moderate, or abundant amounts.

- Bank Characteristics
  Bank conditions were evaluated for evidence of siltation, erosion, stability, and undercutting. Conditions were ranked as being present in either trace, moderate, or abundant amounts.

- Barriers to Fish Passage
  Watercourse was assessed for any potential barriers to fish passage. Barriers may include any physical structure or feature that hinders the ability of fish to navigate throughout the watercourse.

Water Chemistry

- Temperature
  As most fish are considered ectotherms, water temperature is a crucial factor in habitat suitability. While the ideal temperature range is mostly species-specific, extreme temperature changes can have adverse effects on critical processes including metabolism, energy levels, behaviour, and nutrient uptake (Volkoff & Rønnestad, 2020).

- Dissolved Oxygen
  Dissolved oxygen (DO) fluctuates in response factors such as plant biomass, substrate, velocity, and temperature. Optimal DO concentrations should be >6.5-8 mg/L, with a subsequent saturation of around 80-120% (DataStream Initiative, 2021).

- Conductivity
  Conductivity is a measure of how easily water can conduct electricity, providing an indirect estimate of salinity. Conductivity is often categorized by the following hierarchy:
  - Low conductivity [0-0.2 milliSiemens per centimetre (mS/cm)] is used as an indicator of pristine conditions.
  - Medium conductivity (0.2-1 mS/cm) is the typical range of most major rivers.
  - High conductivity (1-10 mS/cm) indicates saline conditions (Government of Northwest Territories, 2013).

- pH
  pH is a measure of acidity based on a 0-14 scale. Waterbodies of low pH (high acidity) typically register below 6 or 6.5. Waterbodies of high pH (low acidity), typically register above 9. Aquatic species typically have an optimum pH range, and fluctuation from this range can result in reduced hatching rates, poor health, or mortality (US EPA, 2022a).

Electrofishing Surveys

Electrofishing is a standard fish capture measure used to collect juvenile and adult fish in streams, rivers, and standing bodies of water (e.g., lakes). The process involves submerging an anode and cathode in the water and passing an electrical current through the water to attract and immobilize fish for capture. Qualitative electrofishing surveys were conducted in summer 2022 and performed in aquatic features with the goal of evaluating fish species presence and relative abundance under DFO Scientific License #360444.

DFO's Interim Policy for the Use of Backpack Electrofishing Units (DFO, 2003) was reviewed and followed by all members of the electrofishing crew. This document provides a detailed list of standard equipment, safety, training, and emergency response procedure requirements for electrofishing. Each electrofishing crew consisted of two individuals, one of which (the crew lead) was a qualified person as defined under the DFO Interim Electrofishing Policy. The crew lead is responsible for operating the backpack electrofisher according to their training and the Policy, and for communicating safety policies and electrofishing procedures to the second crew member.

Fish were sampled using a Halltech Battery Backpack Electrofisher (HT-2000) with un-pulsed direct current. A crew member walked alongside the electrofisher operator to net any stunned fish using a D-frame landing net (1/8" mesh). All captured fish were held in a live well containing ambient stream water, kept out of the sun, checked regularly for any signs of stress. At the conclusion of each pass, fish in the live well were identified (species confirmation), photographed, and measured for length. After recuperating, all fish were released back into the watercourse. As part of the assessment, field staff made note of any fish observed but not caught, along with any points of concern such as obstructions to fish passage (e.g., elevated culverts, waterfalls, etc.).

Qualitative electrofishing surveys were performed using an "open" site methodology with no barrier nets. One pass with a backpack electrofisher was performed over a 200 m stretch. In the Salmonid Field Protocols Handbook: Techniques for Assessing Status and Trends in Salmon and Trout Populations, Johnson et al. describe the use of single-pass electrofishing without barrier nets and provide a summary of academic reports supporting this method (2007). Though the technique does not support estimates of absolute abundance or population estimates, research has found that single-pass electrofishing works well to determine species richness (Simonson and Lyons, 1995).

7.3.2.5 Field Assessment Results

Fish Habitat Assessment

Fish presence and existing habitat were documented as part of the watercourse surveys during the 2024 field season. Notes on the visual observance of fish were recorded along with fish habitat characteristics such as pool/riffle sequences, substrate composition, and barriers to fish passage (e.g., elevated culverts). Detailed descriptions and characterization parameters for each watercourse are found in Appendix D. A summary of the high-level fish habitat assessment for each watercourse that may require an alteration is found in Appendix F.

Habitat assessments were also conducted in surveyed watercourses during electrofishing surveys in 2022. Detailed results are also in Appendix F.

Electrofishing Surveys

Electrofishing was conducted during summer 2022. Qualitative electrofishing was conducted along Sandy Brook, Melvin Brook, an unnamed watercourse flowing into North River, and Marr Brook (Drawing 7.14). Across all watercourses assessed, a total of 84 fish were caught, comprising five different species (Table 7.23).

Table 7.23: Electrofishing Survey Results

Watercourse	Count	Common Name	Scientific Name	COSEWIC[1]	*SARA*[1]	*ESA*[2]	S-Rank[3]
EF001 / Sandy Brook	41	Brook trout	*Salvelinus fontinalis*	---	---	---	S3
	1	White sucker	*Catostomus commersonii*	---	---	---	S5
EF002 / Melvin Brook	1	Brook trout	*Salvelinus fontinalis*	---	---	---	S3
	8	White sucker	*Catostomus commersonii*	---	---	---	S5
EF003 / Unnamed watercourse	9	Brook trout	*Salvelinus fontinalis*	---	---	---	S3
	14	Ninespine stickleback	*Pungitius pungitius*	---	---	---	S5
EF004 / Marr Brook	5	Lake chub	*Couesius plumbeus*	---	---	---	S5
	1	White sucker	*Catostomus commersonii*	---	---	---	S5
	4	Yellow perch	*Perca flavescens*	---	---	---	S5

Source: [1] (Government of Canada 2022); [2] (Government of NS, 2022); [3] ACCDC 2024

7.3.2.6 Effects Assessment

Project-Fish and Fish Habitat Interactions

Project activities, primarily those that involve watercourse crossing, earth moving, or vegetation removal, have the potential to impact fish and fish habitat (Table 7.24). These potential impacts could include habitat removal, disruptions to hydrology, and/or displacement of sediment.

Table 7.24: Potential Project-Fish and Fish Habitat Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Fish and Fish Habitat			X	X	X	X				X			X		X

Assessment Boundaries

The LAA for fish and fish habitat includes the Assessment Area. The RAA for fish and fish habitat includes the Study Area (Drawing 2.2).

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for fish and fish habitat. The VC-specific definition for magnitude is as follows:

- Negligible – no loss of fish habitat or impact to fish behaviour expected.
- Low – small loss of fish habitat or impact to fish behaviour.
- Moderate – moderate loss of fish habitat or impacts to fish behaviour, but these impacts will only be experienced by individuals rather than entire populations and can be managed with routine measures.
- High – high loss of fish habitat and impacts to fish behaviour that will be experienced by entire populations and cannot be managed with routine measures; the population's life history is permanently altered.

Priority Species

The Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009) was utilized to identify any priority species and habitat associated with this Project. All fish SAR/SOCI and their respective habitat associations identified within the RAA through desktop review and field inventory were considered. Only those fish SAR/SOCI, and their respective habitats, with potential to interact with the Project have been designated as Project-specific priority species. Interactions may include removal or disturbance of a SAR/SOCI and/or their associated habitat. The priority species for fish habitat include:

- American Eel (*Anguilla rostrata*)
- Atlantic Salmon – Southern Upland population (*Salmo salar pop. 6*)
- Brook Trout (*Salvelinus fontinalis*)

American Eel

Suitable habitat for eel is varied. As a catadromous species, eel spend the majority of their lives in freshwater, moving to the Sargasso Sea to spawn. Once hatched, American eel larvae drift back to the coast, undergoing several phases of metamorphosis. By the time they reach freshwater, young glass eel have developed pigment and are now referred to as elvers (Scott and Crossman, 1973). In freshwater, elvers develop into yellow eels – immature adults and at which point sexual differentiation occurs. As growth proceeds, the yellow eel metamorphoses into silver eel, or mature adults that are now physiologically prepared to return to the sea to spawn (COSEWIC, 2012).

American eel are frequently found in watercourses that offer structural complexity and shade in the form of coarse woody debris, rocks, in-stream vegetation for daytime cover, and an available food source of forage fish, invertebrates, molluscs and vegetation. Migrating elvers are bottom dwellers and spend most of their time burrowed or hidden, including directly into soft bottom sediments (Tomie, 2011). In freshwater, yellow eel continue their migration upstream into rivers, streams, and muddy or silt bottomed lakes (Scott and Scott, 1998). Like elvers, yellow eel are primarily nocturnal, spending most of the day under cover or buried in soft substrates. These soft substrates are particularly important for overwintering, where the eel hibernate by burying themselves into the bottoms of lakes and rivers (Smith and Saunders, 1955; Scott and Scott, 1998). Trautman (1981) also reported that eel partially or completely bury themselves in mud, sand and gravel during the day, emerging at dusk to begin feeding.

American eel have been assessed as threatened by COSEWIC (2012) and are considered provincially vulnerable by ACCDC (S3N). Although no American eel were observed during electrofishing surveys, it is expected that there would be suitable habitat within the Study Area for them.

Atlantic Salmon – Southern Upland population

Within the freshwater environment, Atlantic salmon of the Nova Scotia Southern Upland population are found in cool, clear, well-oxygenated waters that support a reliable food source of aquatic invertebrates. Gravel and cobble are the preferred substrates for spawning (Bowlby et al., 2013), with redd sites (depressions dug in the substrate by female salmon to deposit eggs) typically located in well aerated areas – a riffle above a pool, or at the tail of pools on the upstream edge of riffles with depths of 10-70 cm (Grant and Lee, 2004). Juveniles can be found occupying a variety of habitats. In summer and fall, they are typically found in moderate velocity runs with clean, rocky substrate free of sand, silt, and detritus (Rimmer et al., 1983). Older parr are usually found in riffles, whereas deeper pools are the preferred habitat during low water levels, high temperatures, and winter freeze (Grant and Lee, 2004).

The Southern Upland population of Atlantic salmon has been assessed as endangered by COSEWIC (2010) and is considered provincially critically imperiled by ACCDC (S1). This population is not currently protected under *SARA* or *ESA*.

Water flows from the Study Area and its environs through Indian River, draining Big Indian and Sandy Lakes, and Northeast River, draining Clay and Wrights Lakes. According to a recovery potential assessment by DFO, Indian River is 50.1% - 94.2% upstream of a physical barrier without fish passage, the highest category of stream network dysconnectivity (Bowlby et al., 2013). The same document does not have data on the Northeast River. No Atlantic salmon were observed or caught in any stream during field assessments, nor were any sightings of the Southern Upland population of Atlantic salmon to the Study Area is 10.8 ± 0.5 km away.

Brook Trout

Brook trout are not listed under federal (*SARA*) or provincial (*ESA*) legislation as a SAR; however, they are listed as 'S3' by ACCDC (2024). This species of trout is typically found in cold, clear, and well oxygenated rivers and lakes with plenty of shade and gravel substrate (US FWS, 2021). They prefer water temperatures that do not exceed 20° C, though adult fish can tolerate temperatures of up to 25° C for short periods of time. Furthermore, despite being able to reproduce in waters with a pH as low as 4.5, they do best in a pH range of 5.0 to 7.5 (Maryland Department of Natural Resources, 2012).

Brook trout are a migratory species that migrate further inland to rivers and lakes during the fall months to spawn. Sea-run Brook trout may spend April to June in marine environments, but migration to marine habitat does not always occur year to year, with some Brook trout never entering marine environments (DFO, 1996). In Nova Scotia, Brook trout are considered the number one sportfish, with approximately 2 million trout stocked within the province on an annual basis (NS Department of Agriculture and Fisheries, 2005).

Brook trout were caught during electrofishing surveys in three of the four watercourses assessed. A total of 51 adult Brook trout were caught, all of which were released alive. The three watercourses where Brook trout were caught were all within the Indian River Secondary Watershed (1EH-3), while the fourth watercourse (EF004/Marr Brook) is located within the Northeast River Secondary Watershed (1EH-2).

Direct Effects

Direct effects to fish and fish habitat, such as habitat loss, are likely to be most prominent during the construction phase. Effect-specific active management, mitigation, and monitoring are required to eliminate, mitigate, or otherwise manage the magnitude of these direct effects.

Habitat Loss

The Project design has been optimized to minimize interactions between the Project and watercourses and wetlands that may support fish and fish habitat. However, in areas where watercourse/wetland interactions are unavoidable, there is a potential for habitat loss.

Watercourse alterations required for the Project have the potential to impact fish and fish habitat. The removal of overhanging vegetation from stream banks decreases shade/cover for fish resulting in increased vulnerability to predators. Likewise, the removal of instream cover, such as coarse woody debris or edge habitat (e.g., undercut banks) can have a negative effect on both fish and aquatic invertebrate habitat (MTO, 2009). Alterations to channel morphology and interference with sediment transport can also result in aquatic habitat degradation.

As detailed in Section 7.3.1, there is a potential for 18 watercourse alterations for the Project. These alterations are associated with upgrades to existing roads and associated crossings, as well as new road construction. For the structures that require upgrading and where a new structure must be installed, each watercourse will be fitted with an adequately sized culvert or open bottomed structure and designed to meet the Nova Scotia Watercourse Alterations Standard and the Guidelines for Fish Passage in Nova Scotia.

Wetland alterations required to facilitate Project developments also have the potential to impact fish and fish habitat. Wetlands that are contiguous with a watercourse or offer areas of open water may provide areas of fish feeding, spawning, and/or rearing. The dense macrophytic vegetation that often comes with these wetland environments can offer refuge to fish including shelter from predators, a substrate to which eggs can be adhered, and a source of food.

A review of wetlands was completed and identified 14 wetlands that have an associated watercourse (see Section 7.3.3.5 for a description of wetland characteristics). Based on the watercourse characteristics, it is possible that the following seven wetlands within the Assessment Area may offer some form of fish habitat:

- WL10
- WL13
- WL12
- WL34
- WL51
- WL62
- WL78

In these situations, habitat loss may be attributed to either partial or total infill, thus altering wetland functionality such as water cooling, sediment stabilization, or stream flow support. However, given the position of these wetlands it is anticipated that alterations can be avoided or limited to road crossing. Any potential effects to fish and fish habitat stemming from Project-wetland interactions are addressed below and will be further addressed through the watercourse notification or alteration permitting process.

Indirect Effects

The temporal and spatial extent of indirect effects such as erosion and sedimentation and changes in water quantity and quality can be wide-reaching, but are often predictable, and research based, standardized BMPs can be implemented to mitigate the resulting outcomes.

Erosion and Sedimentation

The mobilization of sediment within aquatic environments can cause shifts in ecological integrity, including changes to the plant species composition, the distribution of primary and secondary producers, and the habitat suitability for vulnerable species (Tilman et al., 1997). Erosion and sedimentation can occur throughout the lifecycle of the Project, including during construction efforts, routine road maintenance, and daily traffic. However, the highest potential for these effects is related to the construction and upgrading of access roads and crossing structures. The alteration or removal of riparian vegetation can also result in bank instability and erosion, further exasperating these effects (MTO, 2009).

Blasting

Blasting may result in sensory disturbance to fish, impacting fish behaviour, spawning grounds, and migration patterns. The detonation of explosives near watercourses can produce post-detonation shock waves which involves a rise to a high peak pressure and then a subsequent fall to below ambient hydrostatic pressure. This pressure deficit can cause impacts in fish (Wright & Hopky, 1998). An overpressure in excess of 100 kilopascals (kPa) can result in adverse effects to fish including damage to the swim bladder in finfish, and potential rupture and hemorrhage to the kidney, liver, spleen, and sinus venous. It is also possible that fish eggs and larvae can be damaged (Wright & Hopky, 1998). The degree of damage is related to the type of explosive, the size and pattern of the charges, and the distance to the watercourse; depth of water within the watercourse; and species, size, and life stage of the fish. Sublethal effects have also been observed, including changes in fish behaviour as a result of noise produced during blasting (Wright & Hopky, 1998). It is not yet known whether blasting will be required during construction. If blasting for turbine foundations is required, explosive charge weights will be restricted based on setbacks to fish habitat to achieve the 100 kPa guideline criteria outlined in Wright and Hopky (1998).

Changes in Surface Water Quantity

Changes to the amount of flow can alter channel morphology, increase flood potential, and disrupt habitat characteristics that support vulnerable species (MTO, 2009). These impacts could result from the alteration of catchment area grades for road development, the compaction of soil from the heavy machinery required for turbine assembly, or the redirection of overland flow via roadway construction.

Changes in Surface Water Quality

Changes in the quality of surface water can arise from alterations to the surrounding environment and can include an increase in water temperature due to decreased shade, an increase in pollutants from machinery and infrastructure, and the mobilization of sediments (MTO, 2009). Given the dynamic nature of channeling water, effects upon water quality can quickly spread throughout different reaches of the respective watershed.

Mitigation

As required, all work completed under the provincial watercourse alteration notification process will be done in accordance with the Nova Scotia Watercourse Alterations Standards (2015c) and executed by a certified Watercourse Alteration Installer/Sizer. For work requiring an approval, specific and detailed mitigation will be developed and submitted to NSECC as part of the application process.

In addition, the following mitigative measures will be implemented:

Habitat Loss

- Educate Project personnel on the sensitivity of aquatic habitat.
- Flag watercourses and avoid impacts to the watercourse and adjacent riparian habitat to the extent possible.
- Revegetate along the watercourse edge and above the ordinary high-water mark to stabilize the area.
- Conduct any work within the bed of a watercourse or along the banks of a watercourse between June 1 and September 30, where possible, to avoid sensitive periods in the life cycles of fish, to better control water flow, and to allow for a faster revegetation period (NSECC, 2015c).
- Complete a fish rescue, as required, during crossing construction.

Altered Hydrology

- Plan any activities within the bed of a watercourse or along the banks of a watercourse to align with low-flow periods, where possible.
- Design any necessary alterations in a way that maintains the natural grade of the watercourse, to ensure the hydroperiod remains as it was pre-alteration.

Erosion and Sedimentation

- Develop a site-specific erosion and sedimentation plan during the detailed design phase.
  - The plan will target the disturbance to banks and adjacent land, and will address the type of control structures, proper installation techniques, grading, maintenance and inspection, timing of installation, and revegetation.
- Limit the area of exposed soil and the length of time soil is exposed without mitigation (e.g., mulching, seeding, rock cover).
- Limit the slope and gradient of disturbed areas to minimize the velocity of surface water runoff.
- Require that surface run-off containing suspended materials or other harmful substances is minimized.

Blasting

- Blasting, if required, will follow the guidelines presented by Wright and Hopky (1998).

Changes in Surface Water Quantity

- Integrate water management systems into the design, where appropriate, including diversion and collection ditches, roadside drainage channels, and vegetated swales.
- Design any necessary alterations in a way that maintains the natural grade of the watercourse, to ensure the hydroperiod remains as it was pre-alteration.
- Fit any watercourse crossings with appropriately sized infrastructure, as prescribed by a certified Watercourse Alteration Installer/Sizer or Engineer.

Changes in Surface Water Quality

- Leave riparian vegetation as intact as Project developments will allow.
- Integrate outlet protection features to dissipate flow velocities and decrease erosion at the outflow.
- If concrete is to be utilized, ensure it is pre-cast and cured for at least one week prior to use at a crossing site (NSECC, 2015c)
- Utilize untreated, rot-resistant timber (e.g., hemlock, tamarack, juniper, or cedar) below the ordinary highwater mark to avoid the leaching of toxic preservatives into waterways (NSECC, 2015c)
- Utilize rock material that is clean, coarse granular, non-ore-bearing, non-watercourse-derived, and non-toxic to aquatic life (NSECC, 2015c)
- Store on-site machinery and potential pollutants in areas sited above the flood water limits.
- Locate designated areas for fuel storage, refueling, or lubrication of equipment at least 30 m from any water body, watercourse or wetland.
- Complete washing and servicing of machinery and equipment at least 30 m from a waterbody or watercourse or in an area where wash water will not run into a water body, watercourse or wetland.
- Contain construction debris in areas where flood water will not come in contact with debris.

Monitoring

If bridge and/or culvert replacement/installation is required and the new structure is subject to provincial notification requirements, visual monitoring will be completed during the installation process to ensure the work is conducted in accordance with the Nova Scotia Watercourse Alteration Activity Standards (2015c). Monitoring requirements for crossings requiring approval will be determined on a crossing-specific basis during the detail design phase.

A watercourse monitoring plan, if required as part of the permitting phase, will consist of detailed monitoring and general spot checks. Detailed monitoring will include hydrological, sediment, and stability assessments upstream, downstream, and at the crossing of the watercourse. Spot checks will involve a general overview of vegetative, hydrological, and substrate conditions, focusing on evidence of significant hydrologic alterations, sedimentation, and degradation of fish habitat. An example is included in Table 7.25.

Table 7.25: General Watercourse Monitoring Parameters and Methods of Assessment

Monitoring Parameter	Tasks	Method of Assessment	
		General Monitoring	Detailed Monitoring
Erosion and Sedimentation	Examine stability of watercourse banks both upstream and downstream of the crossing. Examine grade of slope at the crossing, taking note of any erosive channeling in substrate that would indicate the slope may be too steep.	Yes	Yes

Monitoring Parameter	Tasks	Method of Assessment	
		General Monitoring	Detailed Monitoring
	Inspect sediment control measures for effectiveness and look for evidence of sedimentation within the watercourse.	Yes	No
Water Quantity	Examine flow velocity, taking note of any undercutting or abrasive channeling, leftover construction debris, or obstruction to flow resulting from alteration activities.	No	Yes
	Preserve ability for fish passage by maintaining flow and adequate water levels.	No	Yes
	Examine water management systems (e.g., drainage channels) for effectiveness, taking note of any blockages, washouts, or unfavorable conditions.	Yes	No
Water Quality	Record basic water quality parameters and infer whether alteration activities have drastically disrupted natural conditions.	Yes	Yes
	Note the physical characteristics of watercourse, including colour, odour, cloudiness, or presence of algae.	Yes	Yes
Habitat Loss	Conduct stream assessments equivalent to those completed prior to alteration. Examine substrate, taking note of any obvious sediment mobilization, residual slash, or a build-up of fines/muck.	Yes	Yes
	Examine crossing for visual observance of fish, and/or any obvious signs of deteriorated fish habitat (e.g., desiccation of riparian vegetation, channel infill, etc.) or diversified fish habitat (e.g., pools, woody debris, etc.).	Yes	No

Conclusion

After mitigations, residual effects on fish and fish habitat are characterized as follows:

- Low magnitude as a small loss of fish habitat or impacts to fish behaviour may occur as a result of alterations to potential or confirmed fish-bearing watercourses and wetlands.
- Within the LAA, as direct impacts will occur only within the LAA and indirect impacts are expected to be minimized through the implementation of effect-specific active management and mitigation measures.
- Timing and seasonality are not applicable as mitigation measures will minimize the potential for indirect effects to be exacerbated during high precipitation events in the spring and fall.
- Short duration as the residual effects will be restricted to the construction phase.
- A single event, as the residual effects will be restricted to the construction phase.
- Reversible, as the effect will terminate at the end of the Project lifespan.

As a result, the residual effects are considered not significant.

7.3.3 Wetlands

7.3.3.1 Overview

Wetland assessments were conducted to identify and delineate wetland habitat so that impacts to wetland area and function could be avoided and minimized, to the extent feasible. This was achieved by using the following approach:

- Identify wetland habitat in the Study Area using desktop resources.
- Use the findings of the desktop study to design the Project (e.g., avoid/minimize impacts to wetlands), and establish an Assessment Area, thus informing planning and logistics for field studies.
- Ground-truth and delineate wetland habitat within the Assessment Area.
- Complete functional assessments for delineated wetlands identified within the Assessment Area.
- Identify the potential for, and confirm the presence of, Wetlands of Special Significance (WSS) within the Assessment Area.

7.3.3.2 Regulatory Context

The Nova Scotia Wetland Conservation Policy outlines a policy goal of no loss of WSS and no net loss in area and function for other wetlands (NSECC, 2019). Wetlands are considered WSS if the wetland has significant species or species assemblages, high levels of biodiversity, significant hydrological value, or high social or cultural importance. Under this policy, the following are considered WSS:

- All salt marshes.
- Wetlands that are within or partially within a designated Ramsar site, Provincial Wildlife Management Area (Crown and Provincial lands only), Provincial Park, Nature Reserve, Wilderness Area, or lands owned or legally protected by non-government charitable conservation land trusts.
- Intact or restored wetlands that are project sites under the North American Waterfowl Management Plan and secured for conservation through the Nova Scotia Eastern Habitat Joint Venture program.
- Wetlands known to support at-risk species as designated under *SARA* or the *ESA*.
- Wetlands in designated protected water areas as described within Section 106 of the Nova Scotia *Environment Act,* SNS 1994-95, c. 1.
- A wetland that scores as a WSS based on functional characteristics using the Wetland Ecosystem Services Protocol for Atlantic Canada (WESP-AC).

As per Section 5 of the Nova Scotia *Environment Act*, SNS 1994-95, c. 1 approval from NSECC is required to alter a wetland. Nova Scotia considers a wetland alteration to be any activity that may affect wetland function and habitat. Such activities include, but are not limited to, excavating, flooding, infilling, or draining (NSECC, 2019).

7.3.3.3 Desktop Review

A desktop review for the location and extent of potential wetlands across the Study Area was completed using the following information sources:

- Wetlands Inventory (NSNRR, 2021c)
- WSS Database (NSNRR, 2020a)
- NS Topographic Database – Water Features (GeoNOVA, 2022)
- Nova Scotia Wet Areas Mapping Database (NSNRR, 2021b)
- Nova Scotia Digital Elevation Model (DEM) (2018)
- Provincial Landscape Viewer (NSNRR, 2017b)
- Satellite and aerial imagery

The NSNRR Wetland Inventory (2021c) identified 110 wetlands within the Study Area, which are classified as either swamp (91), bog or fen (10), marsh (5), fen (3), or water (1). The wetlands range in size from 0.12 to 13.2 ha (Drawing 7.15).

According to the WSS database (2020a), there are eight WSS located within the Study Area. Each of these wetlands were designated as WSS based on the presence of SAR. These WSS are located along the eastern extent of the Study Area. The Project has been designed in a way that will see no Project interactions with any of these features.

The NS Topographic Database – Water Features (GeoNOVA, 2022) was used in conjunction with the Nova Scotia WAM database and Nova Scotia DEM layer to further assess the distribution of confirmed and potential wetland habitat within the Study Area. These sources identified potential wet areas and predicted flow based on the assumed depth-to-water generated from digital elevation data (Drawing 7.12) (NSNRR, 2021b). The depth-to-water ranged from 0 m to >10 m from the surface across the Study Area, with the majority of the Study Area being rapidly to well drained.

The Provincial Landscape Viewer (NSNRR, 2017b) was reviewed to confirm the presence of wetlands and WSS, as well as to identify areas of interest including significant habitat, special management practice zones, and protected areas that may be associated with wetlands. The results show that the Study Area contains lands classified as Mainland moose (*Alces alces americana*) core habitat (discussed in Section 7.4.3). Furthermore, the Study Area is located between Big Indian Lake (west) and Pockwock Lake (east), both of which have been identified as significant habitat "of concern" (discussed in Section 7.4.1).

Satellite and aerial imagery were used as a quality assurance/quality control tool when reviewing desktop resources.

The results of the desktop review assisted in scoping field studies and were ultimately used to conduct a constraints analysis, thus refining turbine and road siting locations to avoid known wetlands and significant areas.

7.3.3.4 Field Assessment Methodology

General

Wetland field assessments were completed within the Assessment Area in 2022, 2023, and 2024 due to various changes to the Project layout. This included high-level assessments for hydrology, complimented by in-depth wetland delineations and functional assessments. Wetland surveys were done in conjunction with watercourse assessment surveys. Field assessments aimed to minimize wetland alteration by establishing areas to be avoided during Project scoping for turbine siting and road placement. This approach resulted in several layout modifications as the Project Area was optimized to minimize interactions with wetlands. Although extensive wetland field assessments were completed throughout the entire Study Area, only wetlands within the current Assessment Area are discussed in the EA.

Prior to wetland field surveys, a list of SAR and SOCI known to occur within the general area of the Project was compiled to support with incidental identification in the field. During the wetland surveys all incidental observations of SAR and SOCI were noted; details of these observations are captured within the EA under their respective reporting sections, as applicable to the species observed.

Field Delineations

Field crews surveyed the Assessment Area, delineating and characterizing each wetland identified. Wetland boundaries were determined by confirming the following:

- Presence of hydrophytic vegetation.
- Presence of hydrologic conditions which result in periods of flooding, ponding, or saturation during the growing season.
- Presence of hydric soils.

A positive indicator must typically be present for all three parameters to definitively identify any given site as a wetland (Environmental Laboratory, 1987). If the identified wetland extended outside of the Assessment Area, the extent of its boundary was estimated using aerial imagery and other desktop resources.

Identification of Hydrophytic Vegetation

Hydrophytic vegetation is defined as the sum of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produces permanent or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present (Environmental Laboratory, 1987). Hydrophytic vegetation should be the dominant plant type observed in wetland habitat (Environmental Laboratory, 1987).

Dominant plant species observed in each wetland were classified according to indicator status (probability of occurrence in wetlands), in accordance with the US Fish and Wildlife Service National List of Vascular Plant Species that Occur in Wetlands: NE Region (Region 1) (Reed, 1988) (Table 7.26). These indicators are used as this region most closely resembles the flora and climate regime of Nova Scotia. Further relevant information was reviewed in Flora of Nova Scotia (Zinck, 1998).

Table 7.26: Classification of Wetland-Associated Plant Species1

Plant Species Classification	Abbreviation[2]	Probability of Occurring in Wetland
Obligate	OBL	>99%
Facultative Wetland	FACW	66-99%
Facultative	FAC	33-66%
Facultative Upland	FACU	1-33%
Upland	UPL	<1%
No indicator status	NI	Insufficient information to determine status
Not listed (assumed upland species)	NL	Does not occur in wetlands in any region.

[1] Source: (Reed, 1988)
[2] A '+' or '-' symbol can be added to the classification to indicate greater or lesser probability, respectively, of occurrence in a wetland.

If the majority (greater than 50%) of the dominant vegetation at a data point is classified as obligate (OBL), facultative wetland (FACW), or facultative (FAC), then the location of the data point is considered to be dominated by hydrophytic vegetation.

Identification of Hydric Soils

A hydric soil is formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper layer (USDA-NRCS, 2010). Indicators of the presence of hydric soils include soil colour (gleyed soils and soils with bright mottles and/or low matrix chroma), aquic or preaquic moisture regimes, reducing soil conditions, sulfidic material (odour), soils listed on the hydric soils list, iron and manganese concretions, organic soils (histosols), histic epipedons, high organic content in the surface layer of sandy soils, and organic streaking in sandy soils.

During field surveys, soil pits were excavated to a maximum depth of 40 cm or until (auger) refusal. The soil in each pit was then examined for hydric soil indicators. The matrix colour and mottle colour (if present) of the soil were determined using Munsell Soil Colour Charts.

Identification of Wetland Hydrology

Wetland habitat, by definition, either periodically or permanently has a water table at, near, or above the land surface. To be classified as a wetland, a site should have at least one primary indicator or two secondary indicators of wetland hydrology (Table 7.27). Wetland habitat is assessed for signs of hydrology via visual observations across the area and through the assessment of soil pits.

Table 7.27: Indicators of Wetland Hydrology

Examples of Primary Indicators	Examples of Secondary Indicators
Surface Water	Oxidized Root Channels in the Upper 30 cm
Saturation	Local Soil Survey Data
Sediment Deposition	Dry Season Water Table
Drainage Patterns	Stunted or Stressed Plants
Water-stained Leaves	Drainage Patterns
Sparsely Vegetated Concave Surfaces	Surface Soil Cracks
Hydrogen Sulfide Odor	Moss Trim Lines

Source: (Environmental Laboratory, 1987)

Functional Assessments

Wetland functional assessments were completed for all wetlands identified within the Assessment Area. Functional assessments were completed using the WESP-AC evaluation technique. The WESP-AC process involves the completion of three forms; a desktop review portion (Office Form) that examines the landscape level aerial conditions to which the wetland is situated, and two field forms identifying biophysical characteristics of the wetland (Field Form) and stressors to the wetland (Stressors Form), if any. The process serves as a rapid method for assessing individual wetland functions and values. WESP-AC addresses 17 specific functions that wetlands may provide (Table 7.28).

The specific wetland functions are individually allocated into grouped wetland functions and measured for “functional” and “benefit” scores. Wetland function relates the wetland’s natural ability (i.e., water storage), whereas wetland benefits are benefits of these functions, whether it is ecological, social, or economic. The highest functioning wetlands are those that have both high ‘function’ and ‘benefit’ scores for a given function. WESP-AC enables a comparison to be made between individual wetlands within a province to gain a sense of the importance each has in providing ecosystem services.

Table 7.28: WESP-AC Function Parameters

Grouped Wetland Function	Specific Wetland Functions
Hydrologic Function	Surface Water Storage
Aquatic Support	Aquatic Invertebrate Habitat
	Stream Flow Support
	Organic Nutrient Export
	Water Cooling
Water Quality	Sediment Retention & Stabilization
	Phosphorus Retention
	Nitrate Removal & Retention
	Carbon Sequestration
Aquatic Habitat	Anadromous Fish Habitat
	Resident Fish Habitat
	Waterbird Feeding Habitat

Grouped Wetland Function	Specific Wetland Functions
	Waterbird Nesting Habitat
	Amphibian and Turtle Habitat
Terrestrial Habitat	Songbird, Raptor, & Mammal Habitat
	Pollinator Habitat
	Native Plant Habitat

In addition to the grouped wetland functions above, WESP-AC also measures the following specific wetland functions, however, these are only evaluated by their benefit scores:

- Wetland Condition; and
- Wetland Risk (i.e., sensitivity to potential impacts).

The following individual functions are assessed to determine the benefit scores associated with each wetland:

- Public Use & Recognition
- Wetland Sensitivity
- Wetland Ecological Condition
- Wetland Stressors

For each wetland evaluated, the WESP-AC process calculates the overall score for the seven grouped wetland functions and the 17 specific wetland functions listed in Table 7.31. One score each is provided for function and benefit. Scores are ranked as ‘Lower’, ‘Moderate’, or ‘Higher’, allowing for analysis of the wetland as compared to calibrated baseline wetland scores in Nova Scotia to date. A ‘Higher’ WESP-AC score means that wetland has a greater capacity to support those processes as compared to other wetlands in the province. A ‘Higher’ WESP-AC score in both the function and benefits category means the wetland supports the natural ecosystem functions and provides services with potentially societal importance.

Additionally, the WESP-AC process assesses the wetland for a determination of WSS based on the functional results. The grouped functions outlined in Table 7.28 are further combined into “supergroups” for habitat (Aquatic Habitat and Transition Habitat) and support (Hydrologic Support, Water Quality Support and Aquatic Support) functions. WSS designation is dependant on a certain combination of ‘moderate’ and ‘high’ scores within these groups.

The WESP-AC functional evaluation technique recognizes that, in many cases, delineation of entire wetlands where they extend beyond a Assessment Area is not always feasible (e.g., property ownership) or required to complete an appropriate assessment using this tool (NBDELG, 2018). Instead, WESP-AC permits the delimitation of an assessed area, defined as the wetland or portion of wetland physically assessed in the field, while the Office Form considers the broader landscape characteristics and functions that extend beyond the assessed area and/or Study Area.

7.3.3.5 Field Assessment Results

General

Field surveys completed during between June and September in 2022, 2023 and 2024 identified 80 wetlands either partially or fully within the Assessment Area (Drawings 7.13A-F). Detailed results are found in Appendix G.

The most prominent wetland type identified was swamps, with 69 identified. The Canadian Wetland Classification System (1997) defines a swamp as a wetland characterized by the dominance of woody vegetation in which the water table is typically at or near the surface or inundates the soil for a significant portion of the growing season. Swamps are often associated with poorly drained or saturated soils, and they provide important habitat for various plant and animal species adapted to wet conditions. Swamps can be further sub-divided into treed swamps or shrub swamps, depending on their physiological makeup.

Of the identified swamps, 38 were classified as treed swamps. Treed swamps are characterized by an environment that is not as waterlogged as other wetland types, such as shrub swamps or marshes, and typically experience their highest hydroperiod during spring and fall precipitation events (Province of NS, 2018). As a result, treed swamps provide deciduous trees (e.g., red maple and yellow birch) and coniferous trees (e.g., black spruce and balsam fir) the opportunity to establish themselves and adapt to the inconsistent inundation periods (Province of NS, 2018). Typical species composition of treed swamps within the Assessment Area include cinnamon fern (*Osmundastrum cinnamomeum*), three-seeded sedge (*Carex trisperma*)*,* creeping snowberry (*Gaultheria hispidula*), mountain holly (*Ilex mucronata*) black spruce (*Picea mariana*), red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and red maple (*Acer rubrum*). Surface water was observed more frequently in treed swamps than in shrub swamps. Hydrological indicators such as saturation and a high table were often present during soil pit assessments.

A total of 31 wetlands identified within the Assessment Area were shrub swamps. Shrub swamps tend to form in permanently or seasonally flooded areas where the surface is moist from ground saturation. In many cases, shrub swamps eventually transition into treed swamps via succession (Province of NS, 2018). The typical species composition of shrub swamps identified within the Assessment Area included cinnamon fern, tawny cotttongrass (*Eriophorum virginicum),* swamp dewberry (*Rubus hispidus*), mountain holly, black spruce, red spruce (*Picea rubens*), balsam fir, and red maple.

Four bogs were observed within the Assessment Area. These wetlands are characterized by their poor drainage, accumulation of peat, and dense coverage of either sphagnum moss or grass-like sedges (Province of NS, 2018). Typical species composition observed included cinnamon fern, black spruce, red maple, and tamarack (*Larix laricina*).

Three fens were observed within the Assessment Area. Fens are characterized by an accumulation of peat and are ground or surface water-fed. Typically, where the water table is at the surface, sedges and moses are the dominant vegetation, whereas shrubby trees such as tamarack and willow are dominant in drier areas (Province of NS, 2018). Typical species composition observed included Northwest Territory sedge (*Carex utriculate*), American mannagrass (*Glyceria grandis*), sweetgale (*Myrica gale*), speckled alder (*Alnus incana*), and red maple.

A total of 10 wetland complexes were observed within the Assessment Area, including two bog/shrub swamps, six shrub/treed swamps, and two marsh complexes composing of shrub and treed swamp components.

Marshes are characterized by fluctuating water levels and high nutrient levels, which result in high vascular plant productivity and high decomposition rates. Emergent aquatic plants are the dominant vegetation type (Province of NS, 2018). Typical species composition observed included soft rush (*Juncus effusus*), northern long sedge (*Carex folliculate*), woolgrass (*Scirpus cyperinus*), speckled alder, and yellow birch (*Betula alleghaniensis*).

Functional Assessments

Functional assessments were completed in 2024 by Strum wetland specialists for all 80 wetlands within the Assessment Area. Results for each wetland are further detailed in Appendix G. The raw WESP-AC files can be provided to NSECC upon request. None of the field-delineated wetlands met the criteria for WSS, as dictated by the Functional WSS Interpretation Results within the WESP-AC spreadsheet calculator.

None of the field-delineated wetlands met the criteria for WSS, as dictated by the Functional WSS Interpretation Results within the WESP-AC spreadsheet calculator. The results of the wetland field assessments were also cross-referenced with breeding bird, vegetation, and lichen survey results.

Table 7.29: Summary of WESP-AC Assessments Using Version 2.0 for Wetlands within the Assessment Area

Wetland ID	Wetland Type (s)	WSS[1] (Yes /No)	Benefit Ratings for Grouped Functions				
			Hydrologic	Water Quality Support	Aquatic Support	Aquatic Habitat	Transition Habitat
WL1	Shrub Swamp; Treed Swamp	No	Higher	Higher	Moderate	Lower	Moderate
WL2	Treed Swamp	No	Moderate	Higher	Higher	Moderate	Higher
WL3	Treed Swamp	No	Higher	Lower	Lower	Lower	Moderate
WL4	Treed Swamp	No	Higher	Higher	Higher	Lower	Higher
WL5	Shrub Swamp; Bog	No	Lower	Lower	Higher	Higher	Higher

Wetland ID	Wetland Type (s)	WSS[1] (Yes /No)	Benefit Ratings for Grouped Functions				
			Hydrologic	Water Quality Support	Aquatic Support	Aquatic Habitat	Transition Habitat
WL6	Shrub Swamp	No	Moderate	Higher	Moderate	Moderate	Higher
WL7	Shrub Swamp; Treed Swamp	No	Higher	Higher	Higher	Lower	Moderate
WL8	Shrub Swamp; Treed Swamp	No	Moderate	Lower	Lower	Lower	Lower
WL9	Treed Swamp	No	Moderate	Lower	Lower	Lower	Lower
WL10	Treed Swamp; Marsh	No	Lower	Higher	Lower	Moderate	Moderate
WL11	Treed Swamp	No	Moderate	Lower	Lower	Moderate	Moderate
WL12	Treed Swamp	No	Moderate	Moderate	Moderate	Moderate	Lower
WL13	Treed Swamp	No	Higher	Lower	Lower	Moderate	Moderate
WL14	Shrub Swamp	No	Moderate	Lower	Lower	Lower	Lower
WL15	Shrub Swamp; Bog	No	Lower	Lower	Lower	Lower	Moderate
WL16	Shrub Swamp	No	Moderate	Lower	Lower	Lower	Lower
WL17	Treed Swamp	No	Moderate	Moderate	Moderate	Moderate	Lower
WL18	Shrub Swamp	No	Moderate	Lower	Lower	Lower	Lower
WL19	Shrub swamp; Treed swamp	No	Moderate	Higher	Moderate	Higher	Moderate
WL20	Shrub Swamp	No	Moderate	Moderate	Lower	Lower	Lower
WL21	Shrub swamp; Marsh	No	Moderate	Lower	Lower	Lower	Lower
WL22	Shrub swamp	No	Moderate	Lower	Lower	Lower	Moderate
WL23	Treed swamp	No	Moderate	Lower	Lower	Lower	Lower
WL24	Shrub swamp	No	Moderate	Lower	Moderate	Moderate	Lower
WL25	Treed swamp	No	Moderate	Lower	Moderate	Lower	Lower

Wetland ID	Wetland Type (s)	WSS[1] (Yes /No)	Benefit Ratings for Grouped Functions				
			Hydrologic	Water Quality Support	Aquatic Support	Aquatic Habitat	Transition Habitat
WL26	Shrub swamp	No	Moderate	Moderate	Moderate	Moderate	Lower
WL27	Shrub swamp	No	Moderate	Lower	Moderate	Moderate	Moderate
WL28	Treed swamp	No	Moderate	Lower	Moderate	Moderate	Moderate
WL29	Shrub swamp	No	Moderate	Moderate	Lower	Moderate	Moderate
WL30	Shrub swamp	No	Moderate	Lower	Lower	Moderate	Moderate
WL31	Shrub swamp	No	Moderate	Moderate	Lower	Moderate	Moderate
WL32	Shrub swamp	No	Moderate	Lower	Lower	Lower	Lower
WL33	Shrub swamp	No	Moderate	Lower	Lower	Moderate	Moderate
WL34	Fen	No	Moderate	Moderate	Moderate	Higher	Moderate
WL35	Shrub swamp	No	Lower	Moderate	Lower	Lower	Moderate
WL36	Shrub swamp	No	Lower	Moderate	Lower	Higher	Moderate
WL37	Shrub swamp	No	Moderate	Moderate	Lower	Higher	Moderate
WL38	Shrub swamp	No	Moderate	Moderate	Lower	Moderate	Moderate
WL39	Shrub swamp	No	Lower	Moderate	Lower	Higher	Moderate
WL40	Bog	No	Higher	Moderate	Lower	Higher	Higher
WL41	Shrub swamp	No	Higher	Moderate	Moderate	Moderate	Lower
WL42	Shrub swamp	No	Higher	Moderate	Lower	Moderate	Lower
WL43	Shrub swamp	No	Moderate	Lower	Lower	Lower	Lower
WL44	Shrub swamp	No	Moderate	Lower	Lower	Lower	Lower
WL45	Shrub swamp	No	Moderate	Lower	Lower	Lower	Lower
WL46	Treed swamp	No	Moderate	Lower	Moderate	Moderate	Lower
WL47	Treed swamp	No	Moderate	Lower	Lower	Lower	Lower

Wetland ID	Wetland Type (s)	WSS[1] (Yes /No)	Benefit Ratings for Grouped Functions				
			Hydrologic	Water Quality Support	Aquatic Support	Aquatic Habitat	Transition Habitat
WL48	Treed swamp	No	Moderate	Lower	Moderate	Moderate	Lower
WL49	Shrub swamp	No	Moderate	Moderate	Moderate	Moderate	Lower
WL50	Fen	No	Moderate	Higher	Moderate	Moderate	Lower
WL51	Fen	No	Lower	Higher	Moderate	Higher	Higher
WL52	Treed swamp	No	Lower	Lower	Lower	Higher	Moderate
WL53	Treed swamp	No	Lower	Lower	Lower	Higher	Higher
WL54	Treed swamp	No	Lower	Moderate	Lower	Moderate	Higher
WL55	Shrub swamp	No	Moderate	Higher	Moderate	Moderate	Higher
WL56	Shrub swamp	No	Lower	Lower	Lower	Moderate	Higher
WL57	Treed swamp	No	Moderate	Lower	Lower	Higher	Higher
WL58	Treed swamp	No	Moderate	Lower	Lower	Moderate	Higher
WL59	Treed swamp	No	Lower	Moderate	Lower	Moderate	Higher
WL60	Bog	No	Lower	Higher	Moderate	Higher	Higher
WL61	Treed swamp	No	Lower	Lower	Lower	Moderate	Higher
WL62	Treed swamp	No	Lower	Lower	Lower	Moderate	Higher
WL63	Bog	No	Lower	Moderate	Lower	Moderate	Higher
WL64	Treed swamp	No	Moderate	Lower	Lower	Moderate	Higher
WL65	Bog	No	Lower	Lower	Lower	Moderate	Higher
WL66	Treed swamp	No	Lower	Higher	Moderate	Higher	Higher
WL67	Treed swamp	No	Moderate	Lower	Lower	Moderate	Higher
WL68	Treed swamp	No	Moderate	Lower	Lower	Moderate	Higher
WL69	Treed swamp	No	Lower	Lower	Lower	Moderate	Higher

Wetland ID	Wetland Type (s)	WSS[1] (Yes /No)	Benefit Ratings for Grouped Functions				
			Hydrologic	Water Quality Support	Aquatic Support	Aquatic Habitat	Transition Habitat
WL70	Treed swamp	No	Lower	Lower	Lower	Moderate	Higher
WL71	Treed swamp	No	Lower	Lower	Lower	Moderate	Higher
WL72	Treed swamp	No	Moderate	Lower	Lower	Moderate	Higher
WL73	Shrub swamp	No	Lower	Higher	Lower	Moderate	Higher
WL74	Treed swamp	No	Lower	Lower	Lower	Higher	Higher
WL75	Treed swamp	No	Lower	Moderate	Lower	Higher	Higher
WL76	Shrub swamp	No	Lower	Moderate	Lower	Higher	Higher
WL77	Treed swamp; Shrub swamp	No	Lower	Moderate	Lower	Moderate	Higher
WL78	Treed swamp	No	Lower	Higher	Moderate	Higher	Higher
WL79	Treed swamp; Shrub swamp	No	Lower	Lower	Lower	Moderate	Higher
WL80	Treed swamp	No	Lower	Higher	Moderate	Higher	Higher

[1]Wetlands of Special Significance determination as dictated by the Functional WSS Interpretation Results within the WESP-AC spreadsheet calculator

Hydrological Group

The hydrologic group evaluates the effectiveness of a wetland to store or delay the downslope movement of surface water. However, the model does not account for wetland size, and in turn, the ability of larger wetlands to store more water than smaller wetlands. Wetlands that have the highest benefit scores within this group tend to be located within developed areas, where water storage is more valuable to reduce flood risks. The majority of the wetlands (53%) had a moderate benefit score.

Water Quality Group

The water quality group is compiled from four different functions: sediment retention and stabilization; phosphorus retention; nitrate removal; carbon sequestration. The main function of this group is to evaluate the wetland's potential to intercept, retain, and filter sediments, particulates, and organic matter. Similar to the hydrologic group, the wetlands that have the higher benefit score in this regard include those that do not have a surface water outlet, and instead are isolated from flowing surface water. This model also does not account for wetland size and as such, larger wetlands do not necessarily score higher than small wetlands, although size may factor into this function.

More than half (53%) of the wetlands have a lower benefit score. This is likely due to the isolation from surrounding developed areas, and the small size of the wetlands compared to their catchment sizes, which limits the potential benefits of the water purification function within this group.

Aquatic Support Group

The aquatic support group comprises four individual functions: stream flow support; aquatic invertebrate habitat; organic nutrient export; and water cooling. The main function of this group is to determine the wetland's ability to support ecological stream functions that promote habitat health. Wetlands lying adjacent to or containing flowing water score higher than those that do not (e.g., isolated wetlands). Additionally, headwater wetlands are crucial for supporting stream flow during the dry season by contributing to water flow via groundwater input and storage capacity. Headwater wetlands provide stream flow and cooling functions due to their typically limited exposed surface water, insulating properties and groundwater water storage and retention time. Treed swamps can also provide aquatic support through groundwater discharge (e.g., seeps) and vegetation shading. Majority of wetlands within the Assessment Area are hydrologically isolated, resulting a in lower benefit score (68%).

Aquatic Habitat Group

The aquatic habitat group is compiled from five different functions: anadromous fish habitat, resident fish habitat, amphibian and turtle habitat, waterbird feeding habitat, and waterbird nesting habitat. Wetlands that have the higher functions within this group include those that are adjacent to or contain water features with potential habitat characteristics (e.g., in-stream cover, aquatic vegetation, etc.). The majority of wetlands (74%) received moderate or higher benefit scores.

Transition Habitat Group

The transition habitat group comprises three different functions: songbird, raptor, and mammal habitat, native plant habitat and pollinator habitat. The main function of the collective group is to evaluate the wetland's ability to support healthy habitat for birds, mammals, and native plants.

Due to the relatively remote Study Area location, most of the wetlands provide relatively remote, undisturbed and unfragmented habitat, resulting in a higher to moderate average benefit score (70%) for the transitional habitat group.

Wetland Condition

Wetland condition refers to the integrity or health of a wetland as defined by its vegetative composition and richness of native species. Scores are derived from the similarity between the wetland being evaluated and reference wetlands of the same type and landscape setting (Adamus, 2021). Refer to Table 7.30 for a summary of wetland condition benefit scores.

Table 7.30: Summary of Wetland Condition Benefit Scores

Benefit		
Lower	**Moderate**	**Higher**
n =29 (36%)	n = 24 (30%)	n = 27 (34%)

Note: The numbers presented in this table indicate the total number of wetlands, not the wetland IDs
Only wetland benefits, not functions are scored in this group.

On average, wetlands within the Assessment Area had a moderate to higher in wetland condition rank. Wetlands scoring moderate to higher carry a relatively good range of vegetative community health and natural functions. Higher scoring wetlands may have greater ecological integrity, microhabitats, species diversity, etc., while lower scoring wetlands may have lost their function and integrity due to historical natural or anthropogenic impacts.

Wetland Risk

Wetland risk takes sensitivity and stressors into account by averaging the two. Sensitivity is the lack of intrinsic resistance and resilience of the wetland to human or naturally caused stress (Niemi et al., 1990). Stress relates to the degree to which the wetland is or has recently been anthropogenically altered in a way that degrades natural condition and/or function. The functional assessment tool uses five metrics to measure sensitivity: abiotic resistance, biotic resistance, site fertility, availability of colonizers, and growth rate. The model applies four stress groups: hydrologic stress, water quality stress, fragmentation stress, and general disturbance stress. Wetlands that are highly resilient may have lower risk scores despite their exposure to multiple stressors. Additionally, wetlands exposed to fewer threats, but with low resilience may have higher risk scores. Wetland resilience is tied to multiple factors, such as size, proximity to natural land cover, and presence of invasive species.

Most of the wetlands in the Assessment Area scored moderate (35% of wetlands) or higher (63% of wetlands) for wetland risk (Table 7.31), meaning they have a reasonable resilience and are not highly susceptible to change. Only two wetlands scored lower, indicating a greater risk and susceptibility to anthropological impacts.

Table 7.31: Summary of Wetland Risk Benefit Scores

Benefit		
Lower	**Moderate**	**Higher**
n =2 (3%)	n = 28 (35%)	n = 50 (63%)

Note: The numbers presented in this table indicate the total number of wetlands, not the wetland IDs
Only wetland benefits, not functions are scored in this group.

Wetlands of Special Significance (WSS)

A review of SAR identified through plant, lichen and avifauna surveys was completed and compared to field delineated wetlands to identified potential Wetlands of Special Significance based on the presence of SAR species. Four wetlands were identified as potential WSS based on avian SAR observation within the wetland boundaries. Species observed were Common

Nighthawk (*Chordeiles minor*), Olive-sided Flycatcher (*Contopus cooperi*), Eastern Wood Pewee (*Contopus virens*) and Rusty Blackbird (*Euphagus carolinus*), however due to the sensitive nature of SAR species, locations are not included in this document but provided to NSECC separately. Avifauna SAR are further discussed in Section 7.4.5.

No wetlands were flagged as WSS based on the WESP-AC Functional WSS Interpretation Results (Table 7.29).

7.3.3.6 Effects Assessment

Project-Wetland Interactions

Project activities, primarily those that involve earth moving or vegetation removal, have the potential to impact wetlands through habitat removal, disruptions to hydrology, and/or displacement of sediment (Table 7.32).

Table 7.32: Potential Project-Wetland Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Wetlands				X	X	X			X	X			X		X

Assessment Boundaries

The LAA for wetlands is the Assessment Area. The RAA for wetlands is the Study Area (Drawing 2.2).

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for wetlands. The VC-specific definition for magnitude is as follows:

- Negligible – no direct loss of wetland habitat or alteration to wetland functions expected.
- Low – direct loss of wetland habitat, but overall wetland functions remain intact.
- Moderate – direct loss of wetland habitat and impact to wetland functions, but wetland area loss will not impact the hydrology of the watershed and/or the impacted wetland areas are not part of a WSS.
- High – direct loss of wetland habitat and impact to wetland functions; and wetland area loss will affect the hydrology of the watershed and/or the impacted wetland areas are part of a WSS.

Direct Effects

Direct effects on wetland habitat and functionality such as habitat loss and changes to hydrology can occur throughout the life of the Project but are likely to be most prominent during construction. Effect-specific active management, mitigation, and monitoring are required to eliminate, mitigate, or otherwise manage the magnitude of these direct effects.

Habitat Loss

Habitat loss can occur both directly (i.e., excavation or infilling) and indirectly (i.e., altered hydrology or canopy cover) as a result of the Project (Trombulak & Frissell, 2000). Loss of habitat can fragment wildlife corridors, potentially isolating species and lowering species richness. Habitat loss can also disrupt vital habitat characteristics that support vulnerable species. Further, the removal or infilling of wetland habitat can impact the hydroperiod of neighbouring wet areas, resulting in farther reaching impacts on habitat quality (Mitsch & Gosselink, 2001).

Hydrological Effects

The hydrology of a wetland is one of the most important aspects of its overall structure and function. Project infrastructure within or near a wetland can result in changes in the timing and quantity of flow, potentially impacting species composition, water treatment capabilities, and nutrient export (Mitsch & Gosselink, 2001). Further, disruption to the hydrology of one area may hinder the hydrological connectivity to other areas, thus resulting in impacts being felt in neighbouring wet areas.

A GIS suitability analysis was conducted to design a Project Area that would optimize the placement of Project infrastructure to avoid and minimize loss of wetland area and function, to the greatest extent possible. A summary of the wetlands identified within the Assessment Area (Drawing 7.13A – F) and how they may be affected by the Project is provided in Table 7.33.

Table 7.33: Habitat Alteration for Wetlands within the Assessment Area

ID	Wetland Type	Delineated Area (m^2)	Estimated Area Of Potential Alteration (m^2)[1]	Activity
WL1	Shrub swamp	476.89	110	Road construction
WL2	Treed swamp	2801.07	1519	Road and substation construction
WL3	Treed swamp	751.1	100	Road construction
WL4	Treed swamp	805.17	230	Road construction
WL5	Shrub swamp, Bog	880.82	90	Road upgrade
WL6	Shrub swamp	619.56	210	Road upgrade
WL7	Treed swamp	2715.04	0	Transmission line – wetland can be avoided
WL8	Treed swamp	396.81	0	Transmission line – wetland can be avoided
WL9	Treed swamp	401.68	0	Transmission line – wetland can be avoided

ID	Wetland Type	Delineated Area (m^2)	Estimated Area Of Potential Alteration (m^2)[1]	Activity
WL10	Treed swamp, Marsh	1170.51	0	Collector Line – wetland can be avoided
WL11	Treed swamp	148.59	0	Collector line – wetland can be avoided
WL12	Treed swamp	1433.22	0	Turbine pad – wetland can be avoided
WL13	Treed swamp	2364.41	0	Road construction – wetland can be avoided
WL14	Shrub swamp	224.64	0	Turbine pad – wetland can be avoided
WL15	Shrub swamp, Bog	205.16	0	Collector line – wetland can be avoided
WL16	Shrub swamp, Bog	231.92	0	Road construction – wetland can be avoided
WL17	Treed swamp	373.56	0	Turbine pad – wetland can be avoided
WL18	Shrub swamp	340.54	0	Road construction – wetland can be avoided
WL19	Shrub swamp, Treed swamp	7190.39	0	Turbine pad – Wetland can be avoided
WL20	Shrub swamp	980.09	0	Turbine pad – wetland can be avoided
WL21	Shrub swamp, Marsh	508.39	0	Turbine pad – wetland can be avoided
WL22	Shrub swamp	785.82	0	Turbine pad – wetland can be avoided
WL23	Treed swamp	3680.14	0	Turbine pad – wetland can be avoided
WL24	Shrub swamp	7782.28	0	Turbine pad – wetland can be avoided
WL25	Treed swamp	1987.86	0	Turbine pad – wetland can be avoided
WL26	Shrub swamp	4650.7	0	Road construction – wetland can be avoided
WL27	Shrub swamp	2431.62	820	Turbine construction and road upgrade
WL28	Treed swamp	5770.44	0	Turbine pad – wetland can be avoided
WL29	Shrub swamp	384.46	0	Turbine pad – wetland can be avoided
WL30	Shrub swamp	1215.9	496	Road upgrade
WL31	Shrub swamp	1248.02	630	Road upgrade
WL32	Shrub swamp	7744.27	350	Turbine pad

ID	Wetland Type	Delineated Area (m^2)	Estimated Area Of Potential Alteration (m^2)[1]	Activity
WL33	Shrub swamp	1242.26	0	Turbine pad – wetland can be avoided
WL34	Fen	5319.5	0	Turbine pad – wetland can be avoided
WL35	Shrub swamp	1254.5	360	Road upgrade
WL36	Shrub swamp	375.77	140	Road upgrade
WL37	Shrub swamp	1473.87	410	Road upgrade
WL38	Shrub swamp	255.57	0	Road upgrade
WL39	Shrub swamp	178.29	0	Road upgrade
WL40	Bog	652.86	0	Road upgrade
WL41	Shrub swamp	1899.4	0	Road upgrade and turbine pad – wetland can be avoided
WL42	Shrub swamp	823.86	0	Road upgrade – wetland can be avoided
WL43	Shrub swamp	1388.81	0	Turbine pad – wetland can be avoided
WL44	Shrub swamp	379.87	0	Turbine pad – wetland can be avoided
WL45	Shrub swamp	2434.91	200	Road construction
WL46	Treed swamp	2495.95	0	Turbine pad – wetland can be avoided
WL47	Treed swamp	7156.09	330	Road construction
WL48	Treed swamp	2846.69	515	Road upgrade
WL49	Shrub swamp	686.25	220	Road upgrade
WL50	Fen	832.69	220	Road upgrade
WL51	Fen	9155.37	0	Collector line – wetland can be avoided
WL52	Treed swamp	990.6	0	Turbine pad – wetland can be avoided
WL53	Treed swamp	6276.99	950	Turbine pad
WL54	Treed swamp	3067.1	0	Turbine pad – wetland can be avoided
WL55	rub swamp	2856.64	340	Road construction
WL56	Shrub swamp	11219.49	0	Turbine pad – wetland can be avoided
WL57	Treed swamp	1184.66	0	Turbine pad – wetland can be avoided
WL58	Treed swamp	569.88	0	Turbine pad – wetland can be avoided
WL59	Treed swamp	628.9	45	Road construction
WL60	Bog	1500.04	510	Road construction
WL61	Treed swamp	2088.1	110	Turbine pad

ID	Wetland Type	Delineated Area (m^2)	Estimated Area Of Potential Alteration (m^2)[1]	Activity
WL62	Treed swamp	1239.2	0	Turbine pad – wetland can be avoided
WL63	Bog	4881.17	0	Turbine pad – wetland can be avoided
WL64	Treed swamp	247.05	0	Road construction- wetland can be avoided
WL65	Bog	219.88	0	Road construction – wetland can be avoided
WL66	Treed swamp	3411.12	425	Turbine pad
WL67	Treed swamp	632.74	0	Turbine pad – wetland can be avoided
WL68	Treed swamp	483.3	0	Turbine pad – wetland can be avoided
WL69	Treed swamp	313.71	0	Turbine pad – wetland can be avoided
WL70	Treed swamp	1139.2	0	Turbine pad – wetland can be avoided
WL71	Treed swamp	2252.46	1000	Road construction
WL72	Treed swamp	395.44	0	Road construction – wetland can be avoided
WL73	Shrub swamp	313.04	0	Turbine pad – wetland can be avoided
WL74	Treed swamp	2401.42	0	Turbine pad – wetland can be avoided
WL75	Treed swamp	1614.88	0	Turbine pad – wetland can be avoided
WL76	Shrub swamp	2131.68	700	Road upgrade
WL77	Treed swamp, Shrub swamp	3503.58	0	Turbine pad – wetland can be avoided
WL78	Treed swamp	3389.05	750	Road upgrade
WL79	Shrub swamp	15098.98	880	Turbine pad and road upgrade – wetland cannot be avoided
WL80	Treed swamp	4241.79	0	Turbine pad – wetland can be avoided

[1] The area of potential alteration was calculated via GIS by assuming a conservative road disturbance width of 25 m and turbine pad area of 120 m x 120 m. As the detailed design is completed, the actual area of alteration required to upgrade or construct a new road will be used to determine the precise area of alteration, which will be smaller than the estimates presented here.

The results of the field assessments indicate that there is a potential for 29 project-wetland interactions comprising of partial infills to facilitate Project developments for a total impact area of approximately 1.27 ha. The Proponent prioritized the use of existing disturbed areas, with only approximately 11.2 km of new road being constructed, and approximately 24.3 km of previously existing road being utilized. As such, 12 of the potential alterations would be associated with upgrades to existing roads (if determined to be required during the detailed design phase) and 10 of the potential alterations are associated with the construction of new roads. Layout changes have been made to avoid impacts to large wetlands, including moving turbines WT05 and WT12. The remaining seven potential alterations stem from the turbine pad construction.

During the detailed design phase, efforts will be made to microsite turbines further away from wetlands to avoid impacts. In areas where wetland alteration is unavoidable, the detailed design phase will refine the layout so that wetland crossings will occur along wetland edges or narrow portions of the wetland and will configure infrastructure in a way to impact as little of the wetland as possible. Furthermore, any necessary wetland crossings will be designed to avoid any permanent diversion, restriction or blockage of natural flow, such that the hydrologic function of the wetland is maintained. Specific details of the crossings will be finalized during the detailed design phase and will be included in the application for wetland alteration.

Provincial wetland data supplied by NSNRR was used to estimate the total amount of wetland habitat within the 5,504.54 ha RAA. An estimated 238.75 ha of wetland habitat was identified, which equates to approximately 4.34% of the RAA. As such, field delineated wetland habitat that may be directly impacted by the Project comprises approximately 0.021% of the total area within the RAA, approximately 0.5% of the potential wetland habitat within the RAA.

Indirect Effects

The temporal and spatial extent of indirect effects such as erosion and sedimentation, dust, invasive species, and compaction can be far reaching, but are often foreseeable, and research based, standardized BMPs can be implemented to mitigate the resulting outcomes.

Erosion and Sedimentation

Erosion and sedimentation can occur throughout the lifecycle of the Project, including during construction, routine road maintenance, and daily traffic. The accumulation of sediment within wetland environments can cause shifts in ecological integrity, including the plant species composition and subsequent nutrient retention potential, hydrological storage capabilities, and habitat suitability for vulnerable species (Tilman et al., 1997).

Dust

The potential for dust deposition will likely be highest during the construction phase, though the risk will be present across the Project's lifecycle to lesser extents. Dust primarily impacts vegetative health, with particle size influencing the scale of the impact (Farmer, 2003). Smaller particulate can result in clogged pores, hindering vital biochemical processes including photosynthesis, respiration, and transpiration; and larger particulate can result in lacerations in plant tissues, thus jeopardizing the health of the plant (Farmer, 2003).

Invasive Species

The colonization of invasive species can result in detrimental impacts on wetland environments, including alterations to evapotranspiration rates, infilling from reduced decomposition rates, and ultimately a reduction in the complexity of the wetland and its subsequent species richness (Zedler & Kercher, 2004). The creation of access roads can act as a vector for invasive species, with the potential for seed dispersal increasing with both vehicular traffic and animal mediated dispersal. Further, with many invasive species being partial to disturbed soils, routine maintenance of access roads can provide ideal conditions for their establishment (Trombulak & Frissell, 2000).

Compaction

Compaction can hinder both the vegetative and hydrological structure of a wetland, with a loss of pore space restricting root growth and groundwater infiltration (Duiker, 2005). This impacts the absorption of moisture and nutrients, thus impacting the ecological integrity of the wetland and the ecosystem services it provides. Further, compaction can decrease percolation rates, resulting in prolonged periods of saturation, and increasing the potential for flooding (Duiker, 2005).

Mitigation Measures

The following mitigative measures will be implemented to avoid and mitigate potential adverse effects to wetlands. In addition, a site-specific Erosion and Sediment Control Plan will be developed to provide further mitigation measures and BMP.

Habitat Loss

- Flag wetlands to avoid interference with wetland habitat to the extent possible.
- Complete in-season wetland field assessments for areas subject to minor layout modifications (refer to Section 7.3.3.5).
- Avoid impacts to wetlands to the extent feasible.
    - Where unavoidable, complete wetland alterations in accordance with the NS Wetland Conservation Policy and the wetland alteration process during the permitting stage, which includes a requirement to compensate for lost wetland habitat and functions.
    - Design wetland crossings to occur at the narrow portion of the wetland or the wetland's edges, to the extent possible.

Hydrology

- Design wetland crossings to avoid permanent diversion, restriction or blockage of natural flow, such that hydrologic function of wetlands will be maintained.

Erosion and Sedimentation

- Develop a site-specific erosion and sedimentation plan during the detail design phase.
    - The plan will address the type of control structures, proper installation techniques, grading, maintenance and inspection, timing of installation, and revegetation.

- Limit the area of exposed soil and the length of time soil is exposed without mitigation (e.g., mulching, seeding, rock cover).
- Use the existing roads and access routes to the extent feasible.
- Avoid travel through wetlands. If travel through wetlands is required:
    - Use anti-rutting mitigation (e.g., mud mats), as appropriate.
    - Cross the wetland at the narrowest portion, where possible.
    - Time work to occur during frozen ground conditions, where possible.
- Avoid surface run-off containing suspended materials or other harmful substances.
- Direct run-off from construction activities away from wetlands.
- Maintain existing vegetation cover, where possible.

Dust Deposition

- Use water or an approved dust suppressant to control dust on roads, as required.
- Enforce site speed limits to minimize dust generation.

Invasive Species

- Use quarried, crushed materials for road construction to reduce the introduction of invasive vascular plant species, where possible.
- Prior to arrival on site equipment will be cleaned and inspected to prevent the introduction of invasive/non-native species.

Compaction

- Delineate and flag wetlands to avoid unnecessary compaction within wetlands.
- Train staff on the requirements for work in and around wetlands.
- Avoid travel through wetlands. If travel through wetlands is required:
    - Use anti-rutting mitigation (e.g., mud mats), as appropriate.
    - Cross the wetland at the narrowest portion, where possible.
    - Time work to occur during frozen ground conditions, where possible.

Monitoring

A site-specific post-construction wetland monitoring plan will be developed to facilitate adaptive management and contribute to the safeguarding of ecological integrity and environmental stability. The plan will be provided to NSECC as part of the permitting process and will consist of detailed monitoring and general spot checks. Detailed monitoring will include vegetative, hydrological, and soil assessments within the wetland habitat adjacent to the infill site. Spot checks will involve a general overview of vegetative, hydrological, and soil conditions, focusing on evidence of significant hydrologic alterations and sedimentation (Table 7.34).

Table 7.34: General Wetland Monitoring Parameters and Methods of Assessment

Monitoring Parameter	Tasks	Method of Assessment	
		General Monitoring	Detailed Monitoring
Hydrology	A shallow monitoring well will be installed within the remaining wetland habitat of the partially infilled wetland.	No	Yes
	Standing water depth measurements will be noted within the existing wetland (if applicable).	No	Yes
	Evidence of positive indicators of hydrology (e.g., drainage patterns, water-stained leaves, saturated surfaces, raised tree roots, development of a hydrogen sulphide odour in soils, water marks etc.) will be noted.	Yes	Yes
	An assessment of the general hydrologic condition and hydrologic connectivity will be made, including evidence of drier/wetter conditions, impeded water drainage, and upland flooding.	Yes	Yes
Vegetation	Vegetation assessments will be completed within plots along a vegetative transect throughout the remaining wetland habitat of the partially infilled wetlands. An assessment of the potential changes in composition, species, health, and presence/absence of invasive plants will be evaluated. Photographs will be taken of individual vegetation plots for comparison with future monitoring events.	No	Yes
	General assessment of the above variables throughout existing wetland habitat will be completed.	Yes	Yes
	Photographs will be taken of the existing wetland habitat from a fixed location for comparison with future monitoring events.	Yes	Yes
Soils	Assessment of surface soils within the remaining wetland habitat will be completed via hand digging of test pits. An assessment of potential shifts in soil characteristics will be evaluated.	Yes	Yes
	Assessment of potential changes in soil conditions throughout the remaining wetland habitat will be evaluated, including evidence of sedimentation and siltation.	Yes	Yes

Conclusion

Following mitigation, residual effects to wetland habitat and functionality are characterized as follows:

- Low magnitude as there will be a direct loss of wetland habitat, but will exist entirely of partial infills and wetland functions are expected to remain intact.
- Within the LAA.

- Short-term as impacts will be restricted to the construction phase.
- Occur as a single event during construction.
- Irreversible as alterations to wetland function will remain in place.

Therefore, residual effects to wetlands are considered not significant.

7.4 Terrestrial Environment

7.4.1 Terrestrial Habitat

7.4.1.1 Overview

The terrestrial habitat assessment focused on the identification of sensitive and important habitats through a combination of desktop review and field surveys. Wetland habitats are addressed in Section 7.3.3, and habitat assessments related to fish, fauna, bats, and birds are addressed in Sections 7.3.2, and 7.4.3 to 7.4.5.

Historic and existing land use within the Study Area includes forestry operations, hydropower production, and year-round recreation. The Project is east of Big Indian Lake, a component of the St. Margarets Bay Hydro System (Nova Scotia Power, 2018). A dam spillway is present at the southern point of this lake, and multiple transmission corridors and a pipeline run in and around the Study Area. Additionally, forests throughout the Study Area are actively managed through forestry operations. These activities combined have established an expansive and maintained road and trail network that allows for vehicular access to much of the Assessment Area.

To assess the terrestrial habitat within the Study Area, a desktop review was conducted prior to field surveys to identify different habitats and key areas of interest. These findings informed the design of field surveys with the goal of assessing the full range of habitat types within the Study Area. Results of the desktop and field studies informed the siting of wind turbines, laydown areas, spur roads, and other infrastructure. This was an iterative process, with the layout being refined through ground truthing of Project component footprint impacts against sensitive and important habitats confirmed through field studies. The results were also used to develop targeted mitigation and monitoring plans.

7.4.1.2 Regulatory Context

Relevant laws and regulations include:

- *Environment Act*, SNS 1994-95, c 1
- The Old-Growth Forest Policy for Nova Scotia (NSNRR, 2022b) and
- The Nova Scotia Silvicultural Guide for the Ecological Matrix (SGEM) (McGrath et al., 2021).

The *Environment Act*, SNS 1994-95, c 1 supports and promotes the protection, enhancement, and use of Nova Scotia's natural environment while maintaining ecosystem integrity and sustainable development. The Old-Growth Forest Policy and SGEM regulate forest management practices on Crown land in Nova Scotia and inform best practices for management of forested areas on private lands. Both individually and in combination, these policies provide requirements and guidance on how best to maintain forest ecological integrity and provide a framework for the definition, assessment, and protection of old-growth forests. The Old-Growth Forest Policy requires no net loss of old-growth forests on Crown land and provides guidance for avoiding development within 100 m of a confirmed old-growth stand.

7.4.1.3 Desktop Review

To assess terrestrial habitat, a desktop review was undertaken prior to any field activities using the following resources:

- Ecological Land Classification for Nova Scotia (Neily et al., 2017)
- Provincial Landscape Viewer (NSNRR, 2017b)
- Nova Scotia Forest Inventory (NSNRR, 2021d)
- Significant Species and Habitat Database (NSNRR, 2023a)
- Old-Growth Policy Layer (Province of NS, 2024a)
- Nova Scotia Parks and Protected Areas Map (NSECC, 2024b)

The Study Area is at the eastern edge of, but entirely within, the western ecoregion which covers 30.5% of Nova Scotia (Drawing 7.1). This Ecoregion is characterized by slate ridges, granite uplands, till plains, drumlin fields, and extensive wetlands and barrens (Neily et al., 2017). The Assessment Area lies within the St. Margarets Bay ecodistrict (780), which extends from western Halifax County to eastern Lunenburg County. This ecodistrict is characterized by a moist climate due to its proximity to cool coastal waters, with increased levels of precipitation and fog.

The St. Margarets Bay ecodistrict ranges in elevation between sea level and 175 masl, with a mean elevation of approximately 100 masl. Most of the ecodistrict has shallow, coarse, and stony soils derived from granitic till, with an abundance of surface stones and intermittent granite erratics deposited by retreating glaciers throughout the landscape. These characteristics have been a limiting factor for forestry development in the area, as the abundance of surface stones impedes machine operability and tree stocking levels. The Study Area's topography is an irregular arrangement of hummocks and low rounded hills, with a number of rivers, lakes, and wetlands throughout.

The dominant vegetation in this ecodistrict is red spruce (*Picea rubens*) forests, with pockets of eastern hemlock (*Tsuga canadensis*) stands in lower elevations and along watercourses. Poorly drained areas with low relief and that occupy lower slope positions are dominated by black spruce (*Picea mariana*). Similarly nutrient-poor sites with drier, shallow, and coarse soils are dominated by dense ericaceous shrub layers and eastern white pine (*Pinus strobus*) and black spruce in the overstory. Tolerant hardwood stands are only occasionally found, where topography contributes to deeper and well-drained soils (Neily et al., 2017).

The Provincial Landscape Viewer was reviewed to identify the land cover within the Study Area and Assessment Area (Table 7.35; Drawing 7.16). Most of the land cover within the Study Area was found to be softwood forest (82.5%), with lesser amounts of mixedwood (10.9%) and rare hardwood (0.6%) stands. The majority of the Study Area is comprised of untreated (i.e., not treated silviculturally) natural forest stands according to the Nova Scotia Forest Inventory Forest Groupings (75.1% cover) (NSNRR, 2021d). The Nova Scotia Forest Inventory is based on aerial imagery from 2013 and 2017, and more recent imagery from 2020 and 2022 shows that many of these previously natural forest stands have since been harvested. Therefore, the percentage of land cover made up of natural, untreated forest stands is likely lower. Additionally, historical use of this area for forestry and dependence on its resources for early western settlement and resource production (Hammonds Plains Historical Society, n.d.) means that there is likely no forest in the area that is truly unaffected by anthropogenic influences.

Table 7.35: Land Cover Types within the Study Area and their Respected Percent Cover as Determined by the Provincial Landscape Viewer and NSNRR Forest Inventory

Land Cover Type	Percent Cover (%)	
	Study Area	Assessment Area
Softwood	82.5%	78.4%
Mixedwood	10.9%	16.3%
Bogs or Wetlands	3.6%	1.3%
Harvests	1.5%	3.5%
Hardwood	0.6%	0.0%
Utility Corridor	0.6%	0.1%
Urban, Landfill, Quarry, Transport Corridor	0.1%	0.2%
Water	0.1%	0.0%

The Old-Growth Policy layer and an Old-Growth Potential Index layer provided by NSNRR through a data sharing agreement were also reviewed (Province of NS, 2022). There are two confirmed old-growth stands located within 100 m of the Assessment Area, both of which are within 100 m of pre-existing roads (Drawing 7.17). The Old-Growth Potential Index identified several additional stands ranking nine or higher within 100 m from the Assessment Area. A total of 11 stands that are overlapping the Assessment Area were identified for further field surveys including old-growth scoring (Section 7.4.1.5).

A review of the NSNRR Significant Species and Habitat Database (2023a) identified 30 features related to terrestrial habitat within 100 km of the Study Area (Drawing 7.18):

- 26 records classified as ‘Other Habitat’ referring to habitat types that relate to a bay (1), brook (1), cave (1), cliffs (4), estuaries (8), island (1), karst (4), lakes (4), and talus slopes (2).
- 2 records classified as ‘Species at Risk’ relating to caves.
- 2 records classified as ‘Species of Concern’ relating to karst (1) and a valley (1).

None of these features are located within the Study Area, and the closest feature is a karst observation 11 km northwest of the Study Area.

The Nova Scotia Protected Areas database (NSECC, 2024b) was screened to identify any protected areas in, overlapping with, or near the Study Area (Drawing 7.18). Records include:

- Island Lake Wilderness Area
- Old Annapolis Road Nature Reserve
- Pockwock Wilderness area

Pockwock Wilderness Area overlaps with a small portion of the northeastern end of the Study Area and along the southern portion of the Study Area but is further than 400 m from the Assessment Area. The Old Annapolis Road Nature Reserve and Island Lake Wilderness Area are to the southwest of the Study Area, and the Island Lake Wilderness Areas overlaps with the Study Area but is greater than 1 km from the Assessment Area. The Pockwock Protected Watershed, which extends beyond the boundaries of the Pockwock Wilderness Area, interacts with the Assessment Area along a portion of Pipeline Road. The locations of protected areas were considered during the Project planning constraints analysis and the layout was developed to provide as much buffer as possible.

7.4.1.4 Field Assessment Methodology

Terrestrial habitat was assessed through field investigations that targeted watercourses, wetlands, and other conditions suitable for rare plants, lichens, moose, birds, and bats. This includes potential mature/old-growth forest, caves/mines, and concentrations of species (e.g., maternity colonies or other nesting sites). Targeted old-growth surveys were conducted at forest stands with a potential old-growth rank of ≥9 that overlapped or was within close proximity of the Assessment Area. Field biologists trained in the provincial Forest Ecosystem Classification (FEC) process with demonstrated experience in conducting old-growth forest assessments conducted a rapid assessment for old-growth conditions at each pre-determined stand. Where the rapid assessment was inconclusive or indicated potential for old-growth, Part 1 of the old-growth scoring procedure was employed (NSNRR, 2022c). At each plot, a tree core was collected and analyzed under microscope to determine the average stand age.

Sensitive or important terrestrial habitat features identified through field investigations were used to further refine siting proposed Project infrastructure components (e.g. wind turbines and roads) with the objective of avoiding or minimizing interactions with these habitat features.

7.4.1.5 Field Assessment Results

Historic and ongoing forestry operations in the Study Area have resulted in extensive modifications to natural habitat conditions. Current forest habitat conditions include stands that have been subject to various timber harvesting treatments and other silvicultural interventions for over two centuries in this area (Hammonds Plains Historical Society, n.d.). Due to the wide extent of forestry activities in the Assessment Area, there are very few areas that have remained untouched by these types of interventions. The most natural and minimally-disturbed stands are found adjacent to watercourses, wetlands and lakes in the Study Area.

The native vegetation within and surrounding the Assessment Area is primarily comprised of softwood-dominated forest stands. Native tree species, in order of most abundant to least abundant include red spruce, balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), black spruce *(Picea mariana*), eastern white pine, and eastern hemlock. The Study Area's forests are predominantly red spruce dominated, though yellow birch-dominated stands are present in lesser quantities, few of which are mature. Most hardwood stands appear to have historically been subject to stand-replacing disturbance, likely clearcutting, presenting an immature, even-aged hardwood forest during assessment. Red spruce, balsam fir, and black spruce dominate poorly-drained slopes, while black spruce, yellow birch, and red maple are prevalent throughout riparian zones, within many wetlands, and scattered in softwood-dominated stands. White ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), and sugar maple (*Acer saccharum*) are present in only trace amounts within the Study Area. Rare occurrences of sloped, mixedwood stands contain trace amounts of sugar maple and American beech. White ash was only observed in the northern reaches of the Study Area along the Uniacke River.

Forests within the Study Area include even-aged softwood stands with dense canopy cover, mature, uneven-aged softwood stands, and lesser amounts of mixedwood and hardwood stands. Gap disturbances within stands are dominated by regenerating red spruce and balsam fir. Herbaceous species such as wild sarsaparilla (*Aralia nudicaulis*) and bunchberry (*Cornus canadensis*) are the most common species under softwood canopy. Evidence of pre-commercial thinning is frequently found in stands that are regenerating after clearcutting. This is evident from both the uniformity of regrowth and the presence of small, non-merchantable-sized stumps and associated stems on the forest floor. These stands tend to be red spruce dominated, uniformly spaced, have dense canopy cover, present low tree age and species diversity, and low herb layer cover, but have an abundant bryophyte layer. Speckled alder (*Alnus incana*) is present along through-flow wetlands, and in many areas near the headwaters of the brooks and streams that flow in all directions from ridges and high points throughout the Assessment Area.

The province defines old-growth forest as "an area where 20% or more of the basal area is in trees greater than or equal to the reference age for that forest (ecosystem classification vegetation) type" (NSNRR, 2022b). Most of the new and existing road and transmission corridors are on Crown Land, while the turbines and substation infrastructure are situated on private land (Drawing 2.2). Therefore, the Old-Growth Forest Policy (NSNRR, 2022b) is enforceable within much of the Assessment Area where old-growth stands are identified on Crown Land. Several late-successional forest stands were found to overlap with the Assessment Area and Crown Lands, mostly along existing roads and additional overlap of turbine buffers. No forest stands that overlap with the Assessment Area were identified as old growth through field surveys (Table 7.36, Drawing 7.19).

Table 7.36: Old-Growth Scoring Results

Stand ID	Stand Size (ha)	Potential Old Growth Rank	Plot #	Species Cored[1]	DBH[2] (cm)	Height (m)	Age (years)	Old Growth Reference Age (years)	Avg. Stand Age	Old Growth Status
F093-09255	2.5	10	1	RS	43.2	18	78	125	103.3	Not Old Growth
			2	RS	45.2	19	114			
			3	RS	45.2	19.5	118			
F093-02888	12.3	9	1	RM	33.6	25	135	125	116.3	Not Old Growth
			2	RM	58.9	23	134			
			3	RS	36.4	24.5	77			
			4	RM	37.5	24.5	124			
			5	RM	28	23	138			
			6	RS	31.6	25	90			
F093-02423	2.5	9	1	RS	39.3	17	102	125	97	Not Old Growth
			2	RS	48.4	19	96			
			3	RS	44.7	18	93			
F093-02892	7.2	11	1	BS	22.4	16.5	120	125	106.6	Not Old Growth
			2	RS	15.6	14	66			
			3	RS	48	21	126			
			4	BS	15.9	13	82			
			5	WP	68.4	25	139			
F093-05299	**5.7**	9	1	RS	50.6	19.5	97	125	100.4	Not Old Growth
			2	RS	48.1	20	97			
			3	YB	53.8	20	155			
			4	RS	30.2	18	58			
			5	RS	31.8	18.5	95			
F093-04329	5.9	11	1	RS	49.8	21.5	116	125	109.4	Not Old Growth
			2	RS	57.8	23	152			
			3	RS	36.7	20	104			
			4	RS	42.6	21	78			
			5	RS	32.4	18	97			
F093-02880	4.7	10	1	RS	43.4	21	115	125	102.7	Not Old Growth
			2	RS	21.9	16.5	91			
			3	RS	45.1	17	102			
F093-04799	3.3	**9**	1	RS	36.7	20	82	125	91	Not Old Growth
			2	RS	50.7	21	115			
			3	RS	38.3	21.5	76			
	12.2	10	1	RS	38.8	19	78	125	83	

Stand ID	Stand Size (ha)	Potential Old Growth Rank	Plot #	Species Cored[1]	DBH[2] (cm)	Heigh t (m)	Age (years)	Old Growth Reference Age (years)	Avg. Stand Age	Old Growth Status
F093-02864			2	RS	23.7	19	72			Not Old Growth
			3	RS	34.4	19	76			
			4	RS	62.2	19.5	121			
			5	BS	19.2	17.5	67			
			6	BS	16.2	17	84			
F093-04802	5.2	9	1	RS	40.8	18	97	125	121.6	Not Old Growth
			2	RS	45.4	19	130			
			3	RS	42.4	20.5	136			
			4	RS	48.8	18.5	125			
			5	RS	44.5	18	120			
H097-09258	3.2	10	1	RS	43.2	18	78	125	113.33 3333	Not Old Growth
			2	RS	45.2	19	144			
			3	RS	45.2	19.5	118			

[1]BS = Black spruce; RM = Red maple; RS = Red spruce; WP = White pine; YB = Yellow birch
[2]DBH = Diameter at Breast Height.

In addition to mature forests, areas supporting SAR/SOCI flora and fauna, wetlands, watercourses, and talus slopes were surveyed to determine the capacity for these areas to support SAR/SOCI and whether any such species were present. No talus slopes were identified through field investigations within the Assessment Area (wetlands and watercourses are addressed separately in Section 7.3.3). Since the Assessment Area makes substantial use of pre-existing roads and vegetation areas that have been subject to historic and ongoing forestry activities, the interaction between Project infrastructure components and undisturbed/mature stands of naturally occurring vegetation is minimal.

7.4.1.6 Effects Assessment

Project-Terrestrial Habitat Interactions

Project activities, primarily those that involve earth moving or vegetation removal, have the potential to impact terrestrial habitat (Table 7.37). These activities could result in habitat removal or alteration.

Table 7.37: Potential Project-Terrestrial Habitat Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Terrestrial Habitat			X	X	X	X				X			X		X

Assessment Boundaries

The LAA for terrestrial habitat includes the Assessment Area, while the RAA includes the Study Area and all connected neighbouring habitat (Drawing 2.2).

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for terrestrial habitat. The VC-specific definition for magnitude is as follows:

- Low – small loss of terrestrial habitat, but overall habitat functions remain intact.
- Moderate – small to moderate loss of sensitive terrestrial habitat or loss of key habitat functions.
- High – high loss of sensitive terrestrial habitat or key habitat functions.

Effects

Habitat Loss and Fragmentation

The loss or conversion of undisturbed habitat to construct roads, transmission line corridors, and turbine pads can impact the terrestrial habitat. Habitat included for consideration includes habitat for flora and fauna SOCI, old-growth forest, priority habitat features, areas of special concern for conservation or protection, and unfragmented, undisturbed areas.

No pending or designated conservation areas or wilderness areas are found within the Assessment Area. The Pockwock protected watershed overlaps with the Assessment Area along the pre-existing Pipeline Road where upgrades are expected to be minimal and will not change access to the watershed. All other pending or designated conservation areas are found within the Assessment Area. No terrestrial habitat for flora SOCI was identified within the Assessment Area according to the NSNRR Significant Species and Habitat Database (2023a) and the results of the field surveys. High ranking potential old-growth stands were found in the Study Area, however, no old-growth stands were identified within the Assessment Area during the field surveys and, therefore no adjustments to the Project layout were required. Two old-growth forest stands, identified under the Old Growth Policy, are located within 100 m of the Assessment Area; however, both stands occur along pre-existing roads and will not be impacted by the Project.

Habitat loss and fragmentation will occur within previously unfragmented or undisturbed terrestrial habitat within the Study Area. Fragmentation will be caused by vegetation clearing for roads and turbine pads. None of the Project Area will be fenced apart from the substation, required for safety. Due to the widespread extent of forestry activities in the Study Area, the amount of entirely undisturbed habitat that will be affected is limited. Most of the land cover within the Assessment Area, where impacts will occur, is softwood dominated, including natural and treated stands, as determined by desktop review and confirmed through the field surveys. The extent of treated and cleared areas was found to be greater than Forest Inventory database designations suggested. In addition, a large amount of forested habitat exists within 25 m of a pre-existing road or otherwise cleared areas. The Project will consist of 11.2 km of new access roads and utilize 24.3 km of pre-existing roads. Most the new access roads are associated with short spurs that connect individual or small groups of turbines back to existing roads. Some sections of the proposed new roads follow existing tracks, so some level of disturbance is already present. Placing the turbines in three separate clusters, each accessed by a single main road, further minimizes fragmentation. Therefore, impacts to undisturbed and unfragmented habitat will be low and although there will be small losses to terrestrial habitat associated with the Project, habitat functionality will remain intact relative to pre-construction conditions.

Habitat Creation

Although there will be marginal terrestrial habitat modification and loss, there is also an opportunity for new habitat to be created within the Assessment Area. Although the Project Area makes use of an expansive network of existing roads, 11.2 km of new roads will need to be constructed, and existing roads may require widening and additional infrastructure added in the rights-of-way (ditches, transmission line). New gravel roads may become preferred nesting habitat for herpetofauna, and the new and widened roads may become basking habitat for snakes and wildlife corridors for terrestrial mammals. The introduction of road salt may attract ungulates. New and widened roads may provide added habitat for nesting birds who prefer rocky or grassy surfaces to nest in. Roadside ditches and cleared rights-of-way will be revegetated through mitigation measures and naturally over time. This process may lead to the creation of different habitat types than were previously present, including wetlands and early successional forests. Although succession will be induced by anthropogenic factors, the natural process will, in time, persist, and this new habitat may be used by a variety of species. Mitigation measures will be designed to ensure the process can proceed as naturally as possible, and that any new habitat created has a low magnitude of adverse effects on the terrestrial environment.

Mitigation Measures

To address effects on terrestrial habitat, the following mitigation measures will be implemented:

Habitat Loss

- Minimize overall area to be cleared, fragmentation of habitats, and isolation of existing habitats by utilizing pre-existing roads and previously altered areas (e.g., clearcuts) during detailed design.
- Minimize the Project footprint, especially within old-growth and other late-successional stands, by clearing only the area necessary for turbine erection and operation.
- Restore cleared areas where it is possible to reduce permanent habitat loss, primarily through revegetation of road rights of way (ROWs) and other areas cleared temporarily for construction.

Habitat Creation

- Revegetate disturbed areas, exposed soils, and cleared areas using native seed mixes.
- Minimize use of road salt to minimize attraction of ungulates to roadsides during the winter.

Monitoring

No monitoring programs specific to terrestrial habitat are recommended.

Conclusion

Following mitigation, the residual effects to terrestrial habitat are characterized as follows:

- Habitat loss and creation are expected to be of low magnitude as overall habitat functions will remain intact relative to pre-construction functionality.
- Within the LAA.
- Of medium duration and continuous frequency as effects may occur as a single event and persist until natural successional process can occur.
- Reversible upon decommissioning of the Project.

Therefore, the residual effects are considered not significant.

7.4.2 Terrestrial Flora

7.4.2.1 Overview

The terrestrial flora assessment included both desktop and field studies components. The objectives of the terrestrial flora assessment included the following:

- Classify habitat that supports terrestrial flora SAR/SOCI in the Study Area using available desktop resources (see Section 7.3.2.2 for definition of SAR/SOCI species).
- Identify important and sensitive habitat features that support terrestrial flora SAR/SOCI on/near the Project.
- Design field program efforts to document the diversity of terrestrial flora within the Assessment Area, and to identify locations of terrestrial flora SAR/SOCI within the Assessment Area.

- Ground truth and collect information on terrestrial flora SAR/SOCI identified during desktop studies.
- Use the information collected through field studies to update the Project design to avoid or minimize interactions between Project infrastructure components and confirmed locations of terrestrial flora SAR/SOCI or the habitats that are known to support terrestrial flora SAR/SOCI.
- Apply mitigation, construction, and operational management practices to minimize effects to terrestrial flora (i.e., apply setbacks to lichen SAR/SOCI).

7.4.2.2 Regulatory Context

The following section describes terrestrial flora resources with the potential to occur in the Study Area, with a focus on vascular plant and lichen SAR/SOCI, that may be potentially impacted by Project activities. Plant and lichen SAR are listed under *SARA* and/or *ESA* and species listed as 'Endangered' or 'Threatened' receive protection which prohibits their disturbance and destruction. On Crown land, special management practices are required around occurrences of certain rare lichen, as prescribed in the At-Risk Lichens–Special Management Practices (NSNRR, 2018). Additional regulations discussed in Section 7.4.1 aim to protect important habitat features, such as old-growth forests or wetlands, that support many plant and lichen SAR/SOCI in Nova Scotia.

7.4.2.3 Desktop Review

The desktop review included a review of the following databases for terrestrial flora:

- ACCDC Data Report (ACCDC, 2024)
- Boreal Felt Lichen Habitat Layer (NSNRR, 2012a)

ACCDC records (2024) identified 503 flora species within 100 km of the Study Area (Appendix E). Of the 503 species, 293 are vascular plants and 210 are non-vascular plants. ACCDC records also indicate one vascular and one non-vascular (lichen) SAR/SOCI have been found within 5 km of the Study Area (Table 7.45; Drawing 7.20). No plant SAR/SOCI and only one lichen SAR/SOCI were identified by the ACCDC records as being known to occur within the Study Area (Table 7.38, Drawings 7.13A-F). The lichen SOCI identified is found outside of the Assessment Area.

Table 7.38: ACCDC Plant and Lichen SAR/SOCI Identified within 5 km of the Study Area

Common Name	Scientific Name	COSEWIC	*SARA*	*ESA*	NS S-Rank
Plants (Vascular)					
Black ash	*Fraxinus nigra*	Threatened	---	Threatened	S1S2
Lichens (Non-vascular)					
Blistered jellyskin lichen	*Leptogium corticola*	---	---	---	S3S4

Source: (ACCDC 2024)

The Boreal Felt Lichen Layer (provided to Strum by NSNRR) was reviewed to identify potential habitat for boreal felt lichen within the Assessment Area. The habitat model is based on the known distribution of boreal felt lichen, which is known to grow on the trunks of balsam fir trees in peatland and in close proximity (<30 km) to the Atlantic Ocean (NSNRR, 2012a). Boreal felt lichen – Atlantic population (*Erioderma pedicellatum*) is a species listed as “Endangered” under Schedule 1 of *SARA* and *ESA* and is also listed as “S1” by ACCDC. The Boreal Felt Lichen Layer identified 87.82 ha of suitable boreal felt lichen habitat across the Study Area, and 4.58 ha of suitable habitat overlapping with the Assessment Area (Drawing 7.20).

7.4.2.4 Field Assessment Methodology

Preliminary plant and lichen surveys were completed across the Study Area in July 2022 to accommodate a previous Project layout. Additional plant and lichen surveys specific to the Assessment Area were completed in 2024, with plant surveys conducted on June 18, 20, and 21, 2024, and lichen surveys completed on April 9, 10, and 15; June 17, 24, 25, and 26; and July 9, 2024.

In 2022, surveys were completed through targeted transects (Drawing 7.21). Targeted plant and lichen transects were conducted with the goal of understanding the flora communities present in the Study Area. The transects were spaced out through different habitats within the Study Area to ensure survey coverage of all representative habitats was obtained. Habitat types surveyed included vernal pools, clear-cuts, river valleys, mature hardwood stands, regenerating softwood stands, and treed swamps. If important habitat types such as wetlands or fringe habitat were identified adjacent to transects, these areas were investigated. All species observed were recorded in a list, and any SAR/SOCI observed were georeferenced using a handheld global positioning system (GPS) device.

In 2024, a review of site habitat cover, aerial imagery, and the results of the 2022 surveys were used to design a field assessment strategy that targeted habitats with a greater likelihood of supporting SAR and SOCI flora and provide greater coverage within the Assessment Area. Meandering transects were completed on foot within all major habitat types, including wetlands, upland forests, open areas, and forestry trails, to create a list of the vascular plant species and vegetation communities present within the Assessment Area (Drawing 7.21). More time was spent surveying within habitat types more likely to support SAR/SOCI, including mature forests, wetlands, and flooded areas. In addition to these habitat types, all potential boreal felt lichen habitat within a 100 m buffer surrounding the Assessment Area was surveyed for lichens. All vascular and non-vascular plant species were identified as they were encountered. Any vascular or non-vascular SAR/SOCI observed were georeferenced, counted (when possible), photographed, and a description of their habitat was recorded. When unknown species were encountered, surveyors took photos and samples (when appropriate) to verify identification with guidebooks and/or experts as required.

Incidental observations of flora SAR/SOCI were also recorded during other biophysical surveys within the Study Area, including wetland and watercourse surveys.

7.4.2.5 Field Assessment Results

During the plant and lichen surveys conducted in 2022 and 2024, 188 vascular plant and 13 lichen species were identified within the Study Area, which included two vascular plant and 14 lichen SAR/SOCI (Drawings 7.13A-F). A complete list of plant species identified during targeted surveys, along with observations during separate field surveys is provided in Appendix H. All SOCI plants and lichens identified during field assessments are summarized in Table 7.39.

Table 7.39: Flora SOCI Encountered during Flora Surveys

Common Name	Scientific Name	COSEWIC[1]	*SARA*[1]	*ESA*[2]	NS S-Rank[3]	Habitat
Plants (Vascular)						
American beech	*Fagus grandifolia*	---	---	---	S3S4	Understory of hardwood and mixed-wood stands scattered throughout the Assessment Area
Southern twayblade[*+]	*Neottia bifolia*	---	---	---	S3	Shrub swamp, wetland dominated by graminoids in the herbaceous layer, open wetland.
Lichens (Non-Vascular)						
A stubble lichen[*]	*Chaenotheca brachypoda*	---	---	---	S3S4	On Red maple heartwood in mixedwood upland
Blistered jellyskin lichen[*]	*Leptogium corticola*	---	---	---	S3S4	Open mixedwood forest dominated by balsam fir and red maple.
Blue felt lichen[*]	*Pectenia plumbea*	Special Concern	Special Concern	Vulnerable	S3	Treed wetland and riparian areas, mixedwood, wet mixedwood, wet coniferous forest.
Eastern candlewax lichen[+]	*Ahtiana aurescens*	---	---	---	S2S3	Edge of open peat bog on Tamarack
Finger ring lichen	*Arctoparmelia incurva*	---	---	---	S3S4	On boulders with mature red

Common Name	Scientific Name	COSEWIC[1]	*SARA*[1]	*ESA*[2]	NS S-Rank[3]	Habitat
						spruce adjacent to lake
Fragile coral lichen	*Sphaerophorus fragilis*	---	---	---	S3S4	Mature softwood forest dominated by red spruce or balsam fir
Fringe lichen*	*Heterodermia neglecta*	---	---	---	S3S4	Riparian forest, floodplain forest, mixedwood forest near wetland
Frosted glass-whiskers (Atlantic population)*	*Sclerophora peronella (Atlantic pop.)*	Special Concern	Special Concern	---	S3S4	Heartwood of red maples within treed wetlands, along with hardwood dominated riparian and floodplain habitat
Powdered fringe lichen	*Heterodermia speciosa*	---	---	---	S3S4	Adjacent to watercourse and immature, mixed-wood uplands
Powder-tipped antler lichen	*Hypotrachyna catawbiensis*	---	---	---	S2	Edge of fen dominated by ericaceous species
Rockgossamer lichen	*Cystocoleus ebeneus*	---	---	---	S2	On well-shaded and damp rock wall of a boulder overhang
Roughened shingle lichen*	*Fuscopannaria ahlneri*	---	---	---	S3	Mixedwood riparian area of a slow moving stream
Salted shell lichen	*Coccocarpia palmicola*	---	---	---	S3S4	Wetland dominated by balsam fir, red maple, and yellow birch
Shaggy fringed lichen*+	*Anaptychia palmulata*	---	---	---	S3S4	Mature Red spruce and mixed-wood forests

Source: [1] (Government of Canada, 2022); [2] (Government of NS, 2023); [3] (ACCDC 2024)
* Denotes that specimens were found within the Assessment Area
\+ Denotes that specimens were found on Crown Land within the Assessment Area

During lichen surveys, 30 Boreal felt lichen polygons were visited, including seven of which are within or intersect with the Assessment Area. No evidence of Boreal felt lichen was observed during these assessments.

Three non-native plants were also encountered during field surveys (Table 7.40). Two, black knapweed (*Centaurea* nigra) and coltsfoot (*Tussilago* farfara), are considered widespread with a low to moderate risk of invasiveness. A third species of some invasive concern, Multiflora rose (*Rosa multiflora)* was identified within the assessed area and poses a moderate threat of invasiveness (NSECC, 2012).

Table 7.40: Non-Native Flora Encountered during Flora Surveys

Common Name	Scientific Name	Exotic Status	S-Rank
Black knapweed	*Centaurea nigra*	Uncommon	SNA
Coltsfoot	*Tussilago farfara*	Widespread	SNA
Multiflora rose	*Rosa multiflora*	Uncommon	SNA

Source: NSECC 2012

The results of flora studies have been incorporated into the design phase of the Project. Protection of flora SOCI will continue to be employed throughout operation and decommissioning phases through the use of targeted mitigation and BMPs.

7.4.2.6 Effects Assessment

Project-Terrestrial Flora Interactions

Project activities, primarily those that involve earth moving or vegetation removal, have the potential to impact terrestrial flora (Table 7.41). These activities could result in changes to or loss of habitat used by SOCI, loss of plant or lichen SOCI, or introduction of non-native species that may become invasive in the environment.

Table 7.41: Potential Project-Flora Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Terrestrial Flora				X	X	X				X			X		X

Assessment Boundaries

The LAA for terrestrial flora includes the Assessment Area, while the RAA includes the Study Area and all connected neighbouring habitat (Drawing 2.2).

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for terrestrial habitat. The VC-specific definition for magnitude is as follows:

- Negligible – no loss of terrestrial flora SOCI individuals or alteration to habitat supporting terrestrial flora SOCI expected.
- Low – small loss of habitat supporting terrestrial flora SOCI, but no terrestrial flora SOCI individuals lost.
- Moderate – small loss of terrestrial flora SOCI individuals (and associated habitat), but their populations remain largely intact.
- High – high loss of the habitat that supports terrestrial flora SOCI and/or loss of an entire population of terrestrial flora SOCI.

Priority Species

The Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009) was utilized to identify any priority species and habitat associated with this Project. All terrestrial flora SOCI and their respective habitat associations identified within the RAA through desktop review and field inventory were considered. Only those terrestrial flora SOCI, and their respective habitats, with potential to interact with the Project have been designated as Project-specific priority species. Interactions may include removal or disturbance of a SOCI and/or their associated habitat. These priority species include the following SAR as outlined in Table 7.38:

- Blue felt lichen (*Pectenia plumbea)*
- Frosted-glass whiskers (*Sclerophora peronella*)

As well as the following SOCI as outlined in Table 7.38:

- American beech (*Fagus grandifolia*)
- Southern twayblade (Neottia bifolia)
- Necklace spike sedge (*Carex ormostachya*)
- Blistered jellyskin lichen (*Leptogium coricola*)
- Eastern candlewax lichen (*Ahtiana aurescens*)
- Finger ring lichen (*Arctoparmelia incurva*)
- Fragile coral lichen (*Sphaerophorus fragilis*)
- Fringe lichen (*Heterodermia neglecta*)
- Powdered fringe lichen (*Heterodermia speciosa*)
- Power-tipped antler lichen (*Hypotrachyna catawbiensis*)
- Rockgossamer lichen (*Cystocoleus ebeneus*)
- Roughened shingle lichen (*Fuscopannaria ahineri*)

- Salted shell lichen (*Coccocarpia palmicola*)
- Shaggy fringed lichen (*Anaptychia palmulata*)
- A stubble lichen (*Chaenotheca brachypoda*)

American Beech

One of the plant SOCI observed during field surveys (Table 7.38, Drawings 7.13A-F), American beech, was assigned an S-Rank of 'S3S4' in March 2022. This indicates that it is uncommon in the province and/or widespread, common, and apparently secure in the province (ACCDC, 2024). Although historically a common tree species in Nova Scotia, the quality and mast production of American beech trees have been devastated by beech bark disease. While still present across the province, the ecological role that this tree has played in tolerant hardwood forest has changed in recent years, shifting from an overstory tree to an intermediate or understory species (NSNRR, 2021e). Because of the commonality of this species, locations of observations were not recorded.

Southern Twayblade

Southern twayblade was observed in shrub swamps and open wetlands throughout the Study Area (Drawing 7.13A-F), including specimens within the Assessment Area both on and off of Crown Land. This species is found throughout Eastern Canada (national rank of N3) and the Eastern United States (N5), ranging from eastern Texas to Florida in the south, and Ontario to Nova Scotia in the north (NatureServe, 2024a). The most secure populations of the species are found in the eastern to south-eastern United States, though Nova Scotia has the most apparently secure population in Canada, with a conservation status of vulnerable (S3). Southern twayblade is most likely to be found in undisturbed swamps, and may serve as an indicator species for ecosystem integrity (Hill et al., 2018). The proximity of observations to recent and historical human disturbances within the Study Area may indicate that the specimens found are more resilient to such disturbances in this area than the specimens studied by Hill et al. (2018). Their findings at the Halifax Stanfield International Airport suggest that clearcutting and other sediment-generating activities should be more impactful to the species than the observations in the Study Area would suggest.

Blue Felt Lichen

Blue felt lichen was one of two SAR lichen ('Special Concern' under *SARA*, 'Vulnerable' under *ESA*) observed during field surveys with observations in both the Assessment Area and the greater Study Area. Blue felt lichen was designated as Nova Scotia's provincial lichen in 2022 (CBC News, 2022). The species is limited to Atlantic Canada and north-eastern Maine (NatureServe, 2024b), and just under half of the North American population of the lichen occurs in Nova Scotia. Blue felt lichen require mature hardwood or mixed wood forests with high humidity, where several successional stages are present. Air pollution and acid rain are major threats to the survival of this species, and many areas of Nova Scotia currently receive acid deposition greater than the critical load for blue felt lichen. The construction of roads and logging associated with wind farm construction are also considered threats to this species, for the potential to remove the lichen itself, to remove the availability of host trees, and to alter hydrology and therefore impose edge effects such as drying and blow down (ECCC, 2022a).

Multiple specimens of blue felt lichen were found throughout the Study Area in a variety of landscapes including wetland and riparian areas, mixedwood, wet mixedwood, and wet coniferous forests. Some of these instances were found within the Assessment Area, and measures to mitigate effects on these specimens are discussed below (Section 7.4.1.6).

Frosted Glass-Whiskers

The second SAR-listed lichen, frosted glass-whiskers (‘Special Concern’ under *SARA*), was observed in both the Study Area’s north and southern portions, including two instances within the Assessment Area. These specimens were found growing on the heartwood of red maples in both wetlands and riparian habitats, and were verified under microscope. The Atlantic population of frosted glass-whiskers is a Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and *SARA* listed species of “Special Concern”, and Nova Scotia has the most substantial population of this subset of the species (COSEWIC, 2013a). The At-Risk Lichens – Special Management Practices for frosted glass-whiskers lichen (NSNRR, 2018) outlines a 200 m buffer for the species on Crown land. Only one specimen was found on Crown land and is more than 200 m from the nearest portion of the Assessment Area, existing roads used for forestry (Drawing 7.13A-F). Mitigating effects on the two observations on private land (one within the Assessment Area and one outside) are discussed below (Section 7.4.1.6), however the 200 m buffer does not apply to these instances. The project has been designed to avoid these observations and provide as large of a buffer as possible during detailed design.

Other Lichen Species

In addition to the above SAR-listed lichens, twelve other lichen SOCI were observed within the Study Area. Of the observed specimens, only shaggy fringed lichen can be found both on Crown land and within the Assessment Area, where the protection of SOCI is regulated. Two specimens of shaggy fringed lichen were observed along an existing, well-trafficked road. Other lichen SOCI found on private land are found within the Assessment Area’s buffers for both existing and new roads as well as turbines. Mitigation of impacts to SOCI found on Crown Land and others found on private land are discussed below (Section 7.4.1.6).

Effects

Loss of SAR/SOCI

Targeted plant surveys were conducted to identify locations of plant and lichen SOCI across the Study Area. The Project was designed to avoid areas where plant and lichen SOCI were found to the greatest extent possible, while also respecting other conservation values of the landscape.

Seven species of lichen SAR/SOCI were identified within the Assessment Area. The Project has undergone various layout changes, including several changes to the access roads, to avoid lichen SAR/SOCI identified to the extent feasible.

Two occurrences of Blue felt lichen were observed adjacent to existing roadway on Crown land in the northern part of the Study area. Any upgrades required to this road will avoid impacting these specimens by focusing work to the north side of the road. Four additional Blue felt lichen observations occurred on private land within the Assessment Area. One is associated with a WSS along an existing road and is located on the very edge of the Assessment Area. Due to the restrictions with road upgrades in the WSS, impacts to the road in this area are expected to be minimal. An additional specimen is located along another proposed road upgrade. Road upgrades to this existing road will be focused on the northern side of the road to maintain any current buffer existing. One specimen is within a turbine pad and will be avoided during detailed design and provided an adequate buffer. The final specimen is located along a new proposed access road. Detailed design will incorporate the location of the lichen in this area and provide as much of a buffer as feasible.

Four occurrences of Frosted-glass whiskers were observed within the Study Area. Only one was identified within the Assessment Area on perimeter of a turbine pad buffer. Avoidance of this specimen with substantial buffer will be developed into detailed design. Three other occurrences occur outside of the Assessment Area. One is on Crown land and no impacts are expected on this species as it has a buffer of over 250 m from the Assessment Area. Two other occurrences are outside of the Assessment Area, but within a WSS identified due to avifauna SAR presence (Section 7.3.3). Located on private land, these specimens will be avoided with a buffer incorporated during the detailed design.

Additional lichen SOCI observed within the Assessment Area, including Blistered jellyskin, Fringe, Roughened shingle, Shaggy, and a Stubble lichen, will all be avoided in detailed Project design. Only one of these species, two adjacent specimens of Shaggy fringed lichen, was observed both within the Assessment area and on Crown land, where they were found growing to the east of an existing road. No impacts are expected on these specimens as road upgrades, if necessary, will focus on the west side of the road. No direct impacts to the above specimens, nor additional sightings of SAR/SOCI lichen within the Study Area are expected.

One species of vascular plant SOCI, Southern twayblade, was observed within the Assessment Area and on Crown land. Three specimens were found adjacent to a stream near a planned water crossing that will connect turbine 10 to existing roads. This water crossing will be sited appropriately during detailed Project design to avoid direct impacts to these specimens. An additional observation of Southern twayblade within the Assessment Area on private land near turbine two will similarly be avoided during detailed design. Several other sitings of Southern twayblade in the Study Area will not be impacted directly by the Project. Small amounts of American beech were found growing throughout the Assessment Area in low abundances. According to NS forestry records, only three stands in the Study Area are known to contain at least 10% American beech within the canopy, none of which are within the Assessment Area. Due to the relatively low population of American beech within the Assessment Area and the low proportion of stand loss due to the Project, the loss of SOCI will be low.

Habitat Loss

Rare plants often become rare because they require specialized habitats (BCECC, 2018; CPC, 2020). The Project will require 11.2 km new roads. In addition to new road construction, road widening will be required along 24.3 km of pre-existing roads. A targeted approach was used when conducting field assessments for terrestrial flora to survey habitat that may host rare flora. For example, blue felt lichen requires moist wooded areas with mature hardwood trees. The Project design has avoided habitat that is known to support plant and lichen SOCI within the Assessment Area to the extent possible. Detailed Project design will incorporate relevant buffers for known locations of SAR/SOCI flora. Based on these findings, effects to terrestrial flora from habitat loss are therefore expected to be negligible to low.

Invasive Species

Terrestrial flora, particularly rare flora, may be at risk due to threats from invasive species (BCECC, 2018). Non-native species, often introduced into a landscape accidentally by humans, can become invasive when they cause harm to the environment, economy, or human health through rapid reproduction and out-competing native species (National Geographic, 2022). Industrial projects can lead to the introduction of invasive species in two main ways:

- Revegetation of cleared land with non-native seed mixes.
- Increased access to remote areas with equipment carrying seeds, spores, or other reproductive materials from non-native species.

Five non-native plants have been found across the Study Area, and most areas would not be considered remote as access within the Study Area is already widespread. Although the magnitude of effects is expected to be negligible to low, mitigation strategies to minimize the risk of introducing and/or spreading invasive species across the Study Area are provided.

Mitigation Measures

To address effects to terrestrial flora, the following mitigation measures will be implemented:

Loss of SOCI

- Minimize overall area to be cleared by utilizing pre-existing roads and previously disturbed or otherwise low canopy stands (i.e. naturally low canopy cover) to the greatest extent possible.
- Avoid areas with known flora SOCI occurrences during the design phase.
  - Desktop and field assessments identified locations with important habitat features potentially supporting terrestrial flora SOCI which are to be avoided during the design phase.
- Educate Project personnel about the potential for plant or lichen SOCI during construction.
  - Guidance will be provided to Project personnel to raise awareness of terrestrial flora SOCI that are known to exist within the Study Area to increase the number of trained eyes looking for these species.
- Consult with NSNRR if an unexpected flora SOCI is encountered during construction

activities. Potential mitigation measures based upon recognized practices to transplant or collect seeds can be used as a contingency if flora SOCI are unexpectedly encountered during construction activities. A transplantation plan will be developed along with a monitoring protocol through consultation with NSNRR should this be required during construction.

Habitat Loss

- Minimize overall area to be cleared by utilizing pre-existing roads and previously disturbed or otherwise low canopy stands (i.e. naturally low canopy cover).
- Minimize (through avoidance) the loss of important habitat that supports terrestrial flora SOCI during the detailed design phase.
- Restore as much habitat as possible through revegetation (with native seed mix) to promote continued growth of terrestrial flora across the Study Area.

Invasive Species

- Use native seed mixes when revegetating cleared areas.
- Ensure equipment is as clean as possible to prevent the introduction of non-native species into previously untouched areas.
    - Because non-native species are already present within the Study Area, care will be taken when travelling from developed areas to intact areas so that plant material is not transferred between locations.

Monitoring

Recommended construction monitoring for select lichen specimens located near proposed access roads will be outlined in a Project specific Wildlife Management Plan.

Conclusion

After mitigations, residual effects to terrestrial flora associated with the Project have been assessed, including loss of SAR/SOCI, habitat loss, and introduction of invasive species. Based on this assessment and through the implementation of proposed mitigation and monitoring strategies, residual effects on terrestrial flora are characterized as follows:

- Low loss of SAR/SOCI as the Project has been designed to avoid known occurrences of SAR/SOCI flora, low magnitude for habitat loss, and negligible to low for invasive species through use of mitigation techniques plus the existing presence of invasive species.
- Within the LAA.
- Long-term as residual effects will extend through the operational and maintenance phase until after decommissioning.
- Continuous.
- And reversible as the effects will terminate at the end of the Project lifespan, except for introduction of invasive species, which is non-reversible.

As a result, the residual effects are considered not significant.

7.4.3 Terrestrial Fauna

7.4.3.1 Overview

The terrestrial fauna assessment was completed using a combination of desktop and field assessments to achieve the following objectives:

- Identify significant species and habitat supporting SAR/SOCI within/near the Study Area using desktop resources.
- Determine the likelihood of SAR/SOCI species occurring in the Study Area.
- Undertake targeted surveys for different groups of terrestrial fauna to document the presence of species within the Study Area, particularly SAR/SOCI.
- Use the information collected through field studies to update the Project design to avoid or minimize interactions between Project infrastructure components and confirmed locations of terrestrial fauna SAR/SOCI or the habitats that are known to support terrestrial fauna SAR/SOCI.
- Apply mitigation, construction, and operational management practices to minimize effects to terrestrial fauna.

7.4.3.2 Regulatory Context

Applicable laws and regulations relating to the protection of fauna (i.e., mammals, herpetofauna, lepidopterans (butterflies and moths), and odonates (dragonflies and damselflies)) including the following:

- *SARA*
- *ESA*
- *Canada Wildlife Act*
- *Wildlife Act,* R.S.N.S. 1989, c. 504
- *Biodiversity Act*
- *CEPA*
- *Environment Act,* S.N.S. 1994-95, c. 1

The *ESA* and *SARA* prohibit harm to listed SAR along with legally designated core/critical habitat (respectively). The *Canada Wildlife Act* provides a framework for the creation of protected wildlife areas, and the Nova Scotia *Wildlife Act,* R.S.N.S. 1989, c. 504 provides policies and programs for wildlife to maintain diversity of species at levels of abundance to meet specific management objectives. The *Wildlife Act* includes a clause for the protection of den/habitation of a furbearer [48(3)]. The Nova Scotia *Biodiversity Act* provides a framework for the creation of Biodiversity Management Zones used for conservation and sustainable biodiversity values. Lastly, *CEPA* and the *Environment Act,* S.N.S. 1994-95, c. 1 both provide measures for the protection of the environment and pollution prevention.

7.4.3.3 Desktop Review

The desktop component included a review of the NSNRR Significant Species and Habitat Database (2023a), ACCDC data (2024), and the NS Special Management Practice Zones (SMPZ). Additionally, habitat suitability modelling for Mainland moose (*Alces alces americanus*) was conducted to identify important moose habitat within the Study Area.

Mammals

The NSNRR Significant Species and Habitat Database (2023a) contains 44 unique species and/or habitat records pertaining to terrestrial mammals within a 100 km radius of the Study Area. These records include:

- 5 records of “Species at Risk” relating to:
    - American marten (*Martes americana*) – 2
    - Fisher (*Martes pennanti*) – 2
    - Southern flying squirrel (*Glaucomys volans*) – 1
- 11 records of “Species of Concern” relating to:
    - Fisher - 9
    - Long-tailed shrew (*Sorex dispar*) – 1
    - Southern flying squirrel – 1
- 26 records of “Deer Wintering” related to White-tailed deer (*Odocoileus virginianus*).
- 2 records of “Other Habitat” relating to
    - American black bear (*Ursus americanus*) – 1
    - American Beaver (*Castor canadensis*). – 1

The ACCDC Data Report (2024) indicates that eight terrestrial mammal SAR/SOCI (excluding birds and bats, see Sections 7.4.4 and 7.4.5) have been recorded within a 100 km radius of the center of the Study Area (Table 7.42). None of the identified SOCI have records within the Study Area.

Table 7.42: Mammal Species Recorded within a 100 km Radius of the Centre of the Study Area

Common Name	Scientific Name	COSEWIC Status	*SARA* Status	*ESA* Status	NS S-Rank
American Marten	*Martes americana*	---	---	Endangered	S2S3
Canada Lynx	*Lynx canadensis*	Not At Risk	---	Endangered	S2S3
Fisher	*Pekania pennanti*	---	---	---	S3
Maritime Shrew	*Sorex maritimensis*	---	---	---	S3
Mainland moose	*Alces alces americana*	---	---	Endangered	S1
Moose	*Alces alces*	---	---	---	S1

Source: (ACCDC, 2024)

The ACCDC also records marine mammals within 100 km radius of the center of the Study Area, but there are no foreseeable impacts from the Project.

A review of Mainland moose core habitat records indicates that much of the Study Area is within lands indicated in the Mainland moose recovery plan (NSNRR, 2021f) as Mainland moose core habitat (Drawing 7.). These lands are not legally designated as core habitat under the *ESA*.

Mainland Moose Habitat Suitability Modelling

Mainland moose habitat suitability modelling was conducted by Strum based on the Mainland moose recovery plan methodology (NSNRR, 2021f) and using ArcGIS Pro software and the following data sources:

- Provincial Forest Inventory database (NSNRR, 2021d)
- Provincial Roads and Railroads database (Province of NS, 2024b)
- Provincial WAM database (NSNRR, 2021b)

The data contained within the forest inventory database were reclassified for the purposes of this analysis based on land cover types (e.g., forest types, management history, and wet areas) to determine suitability for the different habitat needs of Mainland moose. Wetland environments were a required component in the creation of this model as Mainland moose use wetlands for thermal refuge in summer, and aquatic plants such as pondweed (*Potamogeton spp*.) and yellow pond lily (*Nuphar lutea*) provide important nutritional foraging options. Wetlands, particularly isolated areas surrounded by water, are also important calving areas as they provide protection and nutrients for calves and cows. For the purposes of the model, wetlands were determined from the wet areas database which was used to find areas where the depth to water of 50 cm or less, indicating a high probability of wet conditions favourable to Mainland moose.

Land was classified based on its suitability for the various requirements of Mainland moose to establish favourable attributes for habitat suitability. Habitat types assessed through land cover and landscape features which are counted in a positive criteria layer include:

- Summer forage
- Summer cover
- Winter forage
- Winter cover
- Calving areas

For more information on the criteria and characteristics of the above habitat types, refer to the Recovery Plan for the Moose in Mainland Nova Scotia (NSNRR, 2021f), Section 8.2 Attributes of Core Habitat. From the above datasets, features that detract from suitability of Mainland moose habitat are incorporated into a negative criteria layer to include:

- Urban areas
- Landfill
- Quarry

- Road Density
- Harvested areas

Using Raster Calculator in ArcGIS Pro, the negative criteria raster's values are subtracted from positive criteria raster values to determine the overall suitability of habitat for Mainland moose. To allow for some generalization of the habitat, zonal statistics were calculated based on 5 ha hexagons. A grid of hexagons was generated over the RAA and the mean value in the 5 ha hexagon was assigned. Hexagons help reduce sampling bias and better illustrate habitat connectivity. The final value per 5 ha hexagon is expressed as a habitat suitability index (HSI) which ranges from -3 to 5 (the lowest and highest possible scores), in which a -3 is highly unsuitable, and 5 is ideal Mainland moose habitat. For descriptive purposes, this range is divided into discrete bins that describe habitat suitability on a scale from poor to best (Table 7.43). In this index, any area classified as at least "fair" provides at least one habitat type requirement for the Mainland moose. Habitat designated as "best" is providing multiple habitat types for the species while being minimally impacted by negative factors such as roads or conflicting land-uses. Note that scores greater than 4.01, while mathematically possible, are ecologically infeasible due to the unique characteristics of different Mainland moose habitat types.

Table 7.43: Moose Habitat Suitability Model Weighting Scheme

Score Range	Label	RAA (ha)	RAA (%)	Assessment Area (ha)	Assessment Area (%)
<0	Poor	990.9	8.1%	17.1	3.7%
0	Neutral	2399.6	19.6%	77.5	16.9%
0 to 1.35	Fair	6188.9	50.6%	236.6	51.6%
1.36 to 2.68	Better	2050.8	16.8%	112.8	24.6%
2.69 to 4.01	Best	601.3	4.9%	14.9	3.3%

This model identified that the habitat suitability of the Assessment Area is not highly dissimilar to the RAA in terms of proportional distribution of habitat suitability. Within the RAA, 72.3% of the habitat is classified as 'fair', 'better' or 'best'. Within the Assessment Area, 79.5% of the habitat is classified as 'fair', 'better' or 'best. Potential impacts to this habitat and connectivity are discussed in Section 7.4.3.6.

Herpetofauna

The Nova Scotia Significant Species and Habitat Database (NSNRR, 2023a) contains 803 unique species and/or habitat records pertaining to reptiles and amphibians within a 100 km radius of the Study Area. These records include:

- 793 records of "Species at Risk" related to
  - Blandings turtle (*Emydoidea blandingii*) – 6
  - Ribbon snake (*Thamnophis sauritus*) – 10
  - Snapping turtle (*Chelydra serpentina*) – 10
  - Wood turtle (*Glyptemys insculpta*) – 767

- 3 records of "Species of Concern" related to
  - Painted turtle (*Chrysemys picta*) – 2
  - Wood turtle (*Glyptemys insculpta*) – 1

The database contains no records of reptiles or amphibians within the Study Area. The closest relevant records in this dataset are pertaining to Wood turtle approximately 11 km east in the Hammonds Plains area.

Data from the ACCDC (2024) report indicates that six herpetofauna SOCI have been recorded within a 100 km radius of the Study Area (Table 7.44). Marine herpetofauna were also recorded, but there are no foreseeable impacts to marine species from the Project. The ACCDC report indicates that there are no records of herpetofauna SAR/SOCI within 5 km of or within the Study Area.

Table 7.44: Herpetofauna Species Recorded by ACCDC within a 100 km Radius of the centre of the Study Area

Common Name	Scientific Name	COSEWIC Status	*SARA* Status	*ESA* Status	NS S-Rank
Blanding's Turtle - Nova Scotia population	*Emydoidea blandingii* pop. 1	Endangered	---	---	S1
Eastern Painted Turtle	*Chrysemys picta picta*	Special Concern	Special Concern	---	S4
Eastern Ribbonsnake - Atlantic population	*Thamnophis saurita* pop. 3	Threatened	Threatened	Threatened	S2S3
Four-toed Salamander	*Hemidactylium scutatum*	Not At Risk	---	---	S3
Snapping Turtle	*Chelydra serpentina*	Special Concern	Special Concern	Vulnerable	S3
Wood Turtle	*Glyptemys insculpta*	Threatened	Threatened	Threatened	S2

Source: (ACCDC, 2024)

Lepidopterans and Odonates

The NSNRR Significant Species and Habitats (2023a) database identifies five significant habitat features relating to lepidopterans and odonates within a 100 km radius of the Study Area. These records include:

- 1 record of "Species at Risk" related to Ebony boghaunter (*Williamsonia fletcheri*)
- 7 records of "Species of Concern" related to
  - Elfin skimmer (*Nannothemis bella*) – 1
  - Jutta arctic (*Oeneis jutta*) – 2
  - Kennedy's emerald (*Somatochlora kennedyi*) – 1
  - Northern bluet (*Enallagma cyathigerum*) – 2
  - Sphagnum sprite (*Nehalennia gracilis*) – 1
- 1 record of "Other habitat" related to Hoary elfin (*Callophrys polios*)

None of the habitat records for lepidopterans and odonates are located within the Study Area. The closest relevant records in this dataset are pertaining to four species found in Petite Bog, just over 27 km north of the Study Area. Here, there are observations of Jutta arctic, Elfin skimmer, Northern bluet, and Sphagnum sprite.

The ACCDC report (2024) contains records of 48 unique lepidopterans and odonate SAR/SOCI within a 100 km radius of the Study Area (Table 7.45). None of the identified SOCI have records inside or within 5 km of the Study Area.

Table 7.45: Unique Lepidopteran and Odonate Species Recorded within a 100 km Radius of the Study Area

Common Name	Scientific Name	COSEWIC	*SARA*	*ESA*	NS S-Rank
Acadian Hairstreak	*Satyrium acadica*	---	---	---	S2
Aphrodite Fritillary	*Argynnis aphrodite winni*	---	---	---	S3S4
Blue Dasher	*Pachydiplax longipennis*	---	---	---	S1
Bog Elfin	*Callophrys lanoraieensis*	---	---	---	S3
Brook Snaketail	*Ophiogomphus aspersus*	---	---	---	S3
Compton Tortoiseshell	*Nymphalis l-album j-album*	---	---	---	S2S3
Delicate Emerald	*Somatochlora franklini*	---	---	---	S3S4
Early Hairstreak	*Erora laeta*	---	---	---	S1
Eastern Comma	*Polygonia comma*	---	---	---	S1?
Eastern Red Damsel	*Amphiagrion saucium*	---	---	---	S3S4
Eastern Tailed Blue	*Cupido comyntas*	---	---	---	S3S4
Ebony Boghaunter	*Williamsonia fletcheri*	---	---	---	S2S3
Elfin Skimmer	*Nannothemis bella*	---	---	---	S3S4
Extra-Striped Snaketail	*Ophiogomphus anomalus*	---	---	---	S1
Falacer Hairstreak	*Satyrium calanus falacer*	---	---	---	S3
Forcipate Emerald	*Somatochlora forcipata*	---	---	---	S3
Gray Hairstreak	*Strymon melinus*	---	---	---	S3
Green Comma	*Polygonia faunus*	---	---	---	S3S4
Greenish Blue	*Icaricia saepiolus amica*	---	---	---	SH
Harlequin Darner	*Gomphaeschna furcillata*	---	---	---	S3S4
Harpoon Clubtail	*Phanogomphus descriptus*	---	---	---	S3
Hoary Comma	*Polygonia gracilis*	---	---	---	SH
Jutta Arctic	*Oeneis jutta ascerta*	---	---	---	S3S4
Kennedy's Emerald	*Somatochlora kennedyi*	---	---	---	S2S3
Lance-Tipped Darner	*Aeshna constricta*	---	---	---	S3S4
Maine Snaketail	*Ophiogomphus mainensis*	---	---	---	S3
Milbert's Tortoiseshell	*Aglais milberti*	---	---	---	S2S3

Common Name	Scientific Name	COSEWIC	*SARA*	*ESA*	NS S-Rank
Monarch	*Danaus plexippus*	Endangered	Special Concern	Endangered	S2?B, S3M
Mottled Darner	*Aeshna clepsydra*	---	---	---	S3S4
Northern Cloudywing	*Cecropterus pylades*	---	---	---	S3S4
Ocellated Darner	*Boyeria grafiana*	---	---	---	S3S4
Pepper and Salt Skipper	*Amblyscirtes hegon*	---	---	---	S3S4
Prince Baskettail	*Epitheca princeps*	---	---	---	S3
Purple Lesser Fritillary	*Boloria chariclea grandis*	---	---	---	S1S2
Quebec Emerald	*Somatochlora brevicincta*	---	---	---	S1S2
Question Mark	*Polygonia interrogationis*	---	---	---	S3B
Rusty Snaketail	*Ophiogomphus rupinsulensis*	---	---	---	S3
Satyr Comma	*Polygonia satyrus*	---	---	---	S1?
Seaside Dragonlet	*Erythrodiplax berenice*	---	---	---	S3S4
Skillet Clubtail	*Gomphurus ventricosus*	Special Concern	Endangered		SH
Skimming Bluet	*Enallagma geminatum*	---	---	---	S2S3
Spot-Winged Glider	*Pantala hymenaea*	---	---	---	S2?B
Taiga Bluet	*Coenagrion resolutum*	---	---	---	S2
Vernal Bluet	*Enallagma vernale*	---	---	---	S3
Vesper Bluet	*Enallagma vesperum*	---	---	---	S3S4
Williamson's Emerald	*Somatochlora williamsoni*	---	---	---	S2S3
Zebra Clubtail	*Stylurus scudderi*	---	---	---	S2S3

Source: (ACCDC, 2024)

7.4.3.4 Field Assessment Methodology

Data collection on signs and observations of terrestrial fauna including mammals, herpetofauna, lepidopterans, and odonates was conducted through both incidental observations and targeted surveys. The objective of this assessment was to understand which species are present within the Study Area and how they could potentially interact with the Project. Particular attention was paid to SAR and SOCI.

Direct observations of terrestrial fauna or signs thereof within the Study Area were recorded and photographed, when feasible, during all biophysical field surveys. Incidental observations were chosen in addition to dedicated wildlife surveys as they provide the broadest coverage of the Study Area, both spatially and temporally. Signs included features such as dens, nests, scat, tracks, and evidence of foraging. Specific field methods are provided in the following sections.

Mammals

Targeted Mainland moose winter tracking and pellet surveys were conducted to assess the presence and distribution of mammals across the Study Area, and trail cameras were also placed across the Study Area to capture the presence of wildlife without any interference from human disturbance (Drawing 7.23; Table 7.46). The goal of the surveys was to cover all relevant habitat types present across the Study Area, including roadways, wetlands, various forested habitats, riparian areas along watercourses and waterbodies, and previously disturbed areas (e.g., clearcuts). These surveys provided a broader perspective of terrestrial mammal activity within and around the Study Area, with the objective of informing a discussion of the potential impacts to terrestrial mammals in the RAA. Strum biologists completed all surveys, with the support of the SMBSA during the 2023/2024 pellet group inventory (PGI) surveys and the 2024 winter tracking surveys. Additionally, Acadia First Nation Earth Keepers supported with the 2023 PGI surveys.

Table 7.46: Mammal Assessment Survey Information

Survey Type	Transect/Trail Camera ID	Completed By	Dates Completed/Deployed	Transect Length (km)
Winter Tracking	T1 2022/2023	Strum	2022-03-05, 2023-02-03, 2023-02-16, 2023-03-06	2.1
	T2 2022/2023		2022-03-05, 2023-02-16, 2023-03-06	3.0
	T3 2022/2023		2022-03-04, 2023-02-03, 2023-03-06	2.6
	T4 2022/2023		2022-03-04, 2023-02-03, 2023-03-06	2.1
	T1 2024	Strum/SMBSA	2024-02-16	1.6
	T2 2024		2024-02-16	1.5
	T3 2024		2024-02-21	1.5
	T4 2024		2024-02-21	1.9
PGI	T1 2022	Strum	2022-03-23	3.9
	T2 2022		2022-03-23	6.2
	T3 2022		2022-03-23	4.3
	T1 2023	Strum/SMBSA/ Acadia First Nation Earth Keepers	2023-05-02	3.2
	T2 2023		2023-05-02	5.2
	T3 2023		2023-05-03	4.1
	T4 2023		2023-05-03	3.0
	T1 2024	Strum/SMBSA	2024-04-15	1.4
	T2 2024		2024-04-15	1.7
	T3 2024		2024-04-09	1.6
	T4 2024		2024-04-09	1.5
Trail Cameras	TC-5/81	Strum	2022-03-23 to 2022-10-31	N/A
	TC-17/86		2022-03-31 to 2023-05-17	N/A
	TC-18/87		2022-03-23 to 2023-03-06	N/A
	TC-55		2024-06-17 to 2024-10-31	N/A
	TC-73		2024-06-17 to 2024-10-31	N/A
	TC-77		2024-06-17 to 2024-10-31	N/A
	TC-82		2024-06-17 to 2024-10-31	N/A

Survey methods complied with the requirements of the Nova Scotia Environment's Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009) and were developed in consultation with NSNRR (see Section 6.1).

Methods were adapted from those recommended by the NSNRR Wildlife Division (NSNRR, 2012b & 2022). Winter wildlife tracking surveys were completed over several rounds from 2022 to 2024 to accommodate changes in the Project layout and provide as much coverage of the Study Area as possible. Surveys were completed in March 2022, February and March 2023, and February 2024. Surveys are completed within seven days of the most recent snowfall of 10 cm or more, and when possible, within two to three days of the most recent snowfall. This timeline allowed sufficient time for animals to leave their tracks, and limited opportunities for tracks to deteriorate or disappear as a result of excessive snowfall, melting, or rain. Care was also taken to ensure surveys were not completed during rain or snow events. Recent, intact tracks in fresh snow allow for the most accurate track identification. Pellet surveys were completed in March 2022, May 2023, and April 2024, after snow had melted completely, revealing animal droppings that had been preserved in the snow over the winter.

Surveys were conducted along pre-determined transects covering a range of representative habitats within the Study Area, with priority given to habitat where Mainland moose were expected to be active during the winter, if present. Transect lengths and locations were altered between winter tracking and pellet surveys to account for information gained during winter tracking, to ensure as many habitat types as possible could be covered across surveys, and to maximize coverage across the Study Area. Sections of trails and roads were also surveyed opportunistically, and any observations of interest were recorded. All survey tracks were recorded using ArcGIS Field Maps, and any changes to transects were made such that the new course was similar in length to the planned transect and covered similar or improved habitat types.

Transects were travelled by foot. While slowly travelling along a transect, a 4 m area centred on the transect line was scanned for any sign of animal activity, including tracks, pellets/scat, browse, dens, or animal sightings. When suspected activity from white-tailed deer and any terrestrial mammal SAR/SOCI, including Mainland moose, was observed, detailed notes and photos relating to habitat and animal sign were recorded. Additional observations of interest, such as evidence of predator and prey interactions, were also recorded. Any other activity from non-SAR/SOCI mammals was recorded only if the observation was found to be particularly unusual. All observations were recorded and georeferenced in the field using an ArcGIS Survey123 form. Upon completion of each transect, a general description of the transect including overall tracking conditions, different habitats encountered, and abundance of each species was recorded. Abundance of each species includes all SAR/SOCI and non-SAR/SOCI mammals. If observations of terrestrial mammal SAR/SOCI activity were made during other survey types (i.e., wetland assessments), these observations were also recorded.

Concurrently, trail cameras were deployed at various locations for various periods across the Study Area from March 2022 to October 2024 (Table 7.46). Locations were selected to include various habitat types, and to capture more information from locations previously found to have signs of wildlife (Drawing 7.23). Many large mammals commonly use old roads, trails, or natural corridors such as riparian zones to travel throughout a landscape, and thus cameras were placed in these areas to capture their movements. Riparian areas are often preferred by these mammals as this habitat represents some of the only remaining intact forest within the Assessment Area. Trail cameras were visited regularly to replace storage cards and batteries, and occasionally the trail camera itself was removed from one location and relocated to increase site coverage. All photos/videos were then assessed for signs of wildlife.

Herpetofauna

Targeted Wood turtle surveys were completed at select reaches of watercourses with the SMP buffer within the Study Area and at watercourses with potential habitat intersecting the Assessment Area. According to their Recovery Strategy, Wood turtles require water with sufficient flow and sufficient depth to provide them with ice-free, well-oxygenated water throughout the winter (ECCC, 2020c). In Ontario, Wood turtles hibernate in water with an average depth of 91 ± 34.8 cm, approximately 123.3 cm from the shore (ECCC, 2020c). Wood turtles tend to hibernate wherever instream structures such as boulders or root-wads provide some cover, and rarely hibernate outside of the main channel of a watercourse, as they require well oxygenated water throughout the winter (pers. comm., M. Pulsifer, January 2021).

Wood turtles nest in well-drained gravelly soil on the banks of inhabited watercourses. While some may be attracted to gravelly roadsides for nesting, this habitat is considered unsuitable due to the danger presented to emerging hatchlings. To support egg incubation, soils need to be well-drained, with a southern aspect, and free of vegetation. This habitat is typically present as sand or gravel bars in depositional areas of dynamic, natural watercourses (ECCC, 2020c).

Transect lines were walked approximately 10 m from the water's bank along both sides of each watercourse, surveyed simultaneously by two field biologists (Drawing 7.24). The transect line served as a center point, and surveyors scanned the ground, the banks, and the water up to 10 m on either side for a total search area of 20 m on both sides of the watercourse. Search efforts focused on bank areas with high sun exposure or other adequate basking areas such as instream rocks or logs. Turtles may also be found under or near deadfall, grasses, leaf litter, or woody shrubs, particularly alder trees, and so these areas were searched with greater intensity as they may be more inconspicuous. All survey tracks were recorded using ArcGIS Field Maps, and any changes to transects were made such that the new course was similar in length to the planned transect and covered similar or improved habitat types.

Any observations of turtles, snakes, or salamanders were recorded and georeferenced in the field using an ArcGIS Survey123 form. Upon completion of each transect, a general description of the transect, including the presence of any notable habitat features, was recorded. Any additional observations of herpetofauna made during other survey types such as wetland or watercourse surveys, as well as observations of suitable turtle habitat, were also recorded.

Lepidopterans and Odonates

Targeted surveys for lepidopteran and odonate species were not conducted; however, any incidental observations of lepidopteran and odonate SAR/SOCI during other field surveys were documented.

7.4.3.5 Field Assessment Results

Mammals

A total of 11 species were identified during field assessments either by sighting individuals or signs thereof, including both targeted surveys and incidental observations conducted within the Study Area (Table 7.47). One potential observation of Fisher (*Pekania pennanti*) was recorded during winter track assessments. Impressions were observed in deep snow demonstrating a galloping pattern consistent with Fisher movement in deep snow. There was one observation of browsing on a small tree branch 2.0 to 2.5 m off the ground during winter tracking surveys. Although this could be attributed to Mainland moose, the size of the bite marks and the depth of the snowpack at the time (1.0 to 1.5 m) suggests that it was likely a White-tailed deer that was able to browse that high in the tree.

Table 7.47: Summary Results of the Mammal Field Assessments

Common Name	Scientific Name	COSEWIC Status	*SARA* Status	*ESA* Status	NS S-Rank
American black bear	*Ursus americanus*	---	---	---	S5
North American beaver	*Castor canadensis*	---	---	---	S5
American porcupine	*Erethizon dorsatum*	---	---	---	S5
Bobcat	*Lynx rufus*	---	---	---	S5
Eastern coyote	*Canis latrans*	---	---	---	S5
Raccoon	*Procyon lotor*	---	---	---	S5
Red squirrel	*Tamiasciurus hudsonicus*	---	---	---	S5
Eastern chipmunk	*Tamias striatus*	---	---	---	S5
Snowshoe hare	*Lepus americanus*	---	---	---	S5
American mink	*Neovison vison*	---	---	---	S5
Unknown rodent	N/A	N/A	N/A	N/A	N/A
White-tailed deer	*Odocoileus virginianus*	---	---	---	S5
Red fox	*Vulpes vulpes*	---	---	---	S5
Short-tailed weasel	*Mustela erminea*	---	---	---	S5
Fisher	*Pekania pennanti*	---	---	---	S3

Source: Species Ranks (ACCDC, 2024)

A total of 20 unique mammal sightings of three species were recorded by trail cameras (Table 7.48, Photo log provided in Appendix I).

Table 7.48: Summary of Trail Camera Results

Trail Camera Location	Animals Observed	Number of Observations*
TC-5/81	Black bear	8
	Coyote	2
	White-tailed deer	1
TC-17/86	White-tailed deer	4
TC-18/87	White-tailed deer	1
TC-55	White-tailed deer	1
TC-73	White-tailed deer	3
TC-77	*N/A*	--
TC-82	White-tailed deer	1

*Number of observations adjusted based on likelihood of photos belonging to the same animal; a general rule of one hour between photos was applied to consider photos of the same species to be separate observations.

Herpetofauna

One herpetofauna SOCI species, Snapping turtle (*Chelydra serpentina*), was identified at two locations within and the Study Area, and one location within 500 m of the Study area during 2022-2024 field studies. Additional non-SAR/SOCI species such as frogs and snakes were observed across the Study Area in various habitats. Turtle habitat was noted along various watercourses through the Study Area, characterized by sandy/gravelly shores, clear, flowing water, and adequate sun exposure. Several of these areas overlap with the Assessment Area. Although habitat for Wood turtles was noted during the desktop review, this habitat was searched during ideal conditions and no Wood turtles were observed during targeted surveys. Additionally, all ACCDC records for Wood turtles occurred outside the Study Area and the Study Area is not within Wood turtle special management practice secondary watersheds. Therefore, the species is not carried forward to the Effects Assessment (7.4.3.5), though Snapping turtle, which was observed, is discussed further.

Table 7.49: Summary of the Herpetofauna Field Assessments

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NS S-Rank[4]
Green frog	*Lithobates clamitans*	---	---	---	S5
Maritime garter snake	*Thamnophis sirtalis*	---	---	---	S5
Smooth greensnake	*Opheodrys vernalis*	---	---	---	S4
Snapping turtle	*Chelydra serpentina*	Special Concern	Vulnerable	Special Concern	S3
Wood frog	*Lithobates sylvaticus*	---	---	---	S5

[1]Government of Canada 2022; [2]NS *ESA* 2022; [3]Government of Canada, 2022; [4]ACCDC 2024

Lepidopterans and Odonates

There were no observations of lepidopteran or odonate SAR/SOCI during the field assessments within the Study Area. No priority species were identified based on the results of the field and desktop assessments.

7.4.3.6 Effects Assessment

Project-Terrestrial Fauna Interactions

Project activities, primarily those that involve earth moving or vegetation removal, have the potential to impact terrestrial fauna (Table 7.50). These activities could result in habitat removal, alterations to wildlife corridors, and reductions in food availability. Other Project-related activities, including during construction and operation, may impact terrestrial fauna behaviours, such as increased traffic and noise.

Table 7.50: Potential Project-Terrestrial Fauna Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Terrestrial Fauna	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Assessment Boundaries

For the purposes of this assessment, the LAA for terrestrial fauna includes the Assessment Area. The RAA for terrestrial fauna is the Study Area (Drawing 2.2).

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for terrestrial fauna. The VC-specific definition for magnitude is as follows:

- Negligible – no loss of fauna habitat or impact to fauna behaviours expected.
- Low – small loss of habitat supporting fauna, but no impacts to fauna behaviours expected.
- Moderate – moderate loss of fauna habitat or moderate impacts to fauna behaviours, but these impacts will only be experienced by individuals rather than entire populations.
- High – high loss of fauna habitat or high impact to fauna behaviours on a population scale.

Priority Species

Mammals

Based on the desktop review and field survey results, terrestrial mammals that have been recorded or are likely to occur within the Study Area were screened against the criteria outlined in the Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009) to develop the following list of priority species:

- Mainland moose – Endangered (*ESA*), "S1" (S-Rank)
- Fisher – "S3" (S-Rank)

Mainland moose are a SOCI listed as "Endangered" under the *ESA* with a subnational ranking of S1 (highest priority) (ACCDC, 2024). In 2021, NSNRR published a recovery plan for Moose in mainland Nova Scotia, thereby assigning the common name 'Mainland moose'. Threats to Mainland moose include habitat loss and fragmentation, particularly resulting from industrial activities; and loss of habitat connectivity due to the increased placement and density of roads (NSNRR, 2021f). The Study Area has previously been and continues to be subject to the abovementioned threats as a result of historical and current land-uses, including forestry activities and recreation. Renewable energy projects were described as a medium level threat, as the nature of wind projects usually requires the construction or expansion of road networks and loss of forested habitat.

No evidence of Mainland moose was observed during winter tracking surveys, pellet surveys, wetland surveys, or herpetofauna surveys throughout 2022 to 2024. This includes evidence in the form of tracks, pellets, or photographs taken by trail camera.

Fishers prefer dense, mature to old-growth forests with continuous overhead cover (Allen, 1983). Generally considered forest-interior species (OMNR, 2000), Fishers require large tracts of well-connected habitat (Meyer, 2007). Fishers are distributed throughout mainland Nova Scotia, and trapping data suggests the population is concentrated in Cumberland, Colchester, and Pictou counties. A concentration of Fishers is not known to reside within or near the Study Area.

Herpetofauna

Based on the desktop review and field survey results, herpetofauna that have been recorded or are likely to occur within the Study Area were screened against the criteria outlined in the Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009) to develop the following list of priority species:

- Snapping turtle – 'Special Concern' (*SARA*), 'Vulnerable' (*ESA*), 'Special Concern' (COSEWIC), 'S3' (S-Rank)

Preferred habitat for Snapping turtles includes ponds, lakes, slow-moving streams with soft mud bottoms and abundant aquatic vegetation (ECCC, 2020b). Hibernation occurs in freshwater systems deep enough to prevent freezing during the winter, with a mucky or muddy substrate. Snapping turtles travel through upland habitat and use gravelly areas to nest but they require wetland habitat as part of their life cycle activities (ECCC, 2020b; COSEWIC, 2009). These turtles nest in areas of soft sand, soil, or gravel where there is high sun exposure. This may include meadows, shorelines, rocky outcrops and roadsides (ECCC, 2020b). Preferred habitat exists within the Assessment Area, though it is not widespread.

Effects

Mammals

- Mainland Moose Habitat Loss and Fragmentation
  The Mainland Moose Recovery Plan identifies three localized groups of Mainland moose within the province (within concentration areas) and scattered pockets along the Atlantic coast, one of which overlaps the Study Area (NSNRR, 2021f). This pocket, which both serves as Mainland moose Core Habitat and is important for connectivity between concentration areas, is part of ~8,900 square kilometres (km^2) of similarly defined territory across the Nova Scotia mainland. The Core Habitat (Drawing 7.22) overlapping the Study Area is primarily characterized with a low HSI of 4-6, while a smaller portion of the Core Habitat has a high HSI of 7-9. Mainland moose Core Habitat is dependent on several biophysical parameters to satisfy different habitat requirements, including but not limited to:
  - Summer foraging area composed of either regenerating forest that is within close proximity of winter or summer cover, or mature mixed or hardwood stands.
  - Winter foraging area composed of either regenerating forest; mixed or hardwood forest within close proximity of winter cover; or mixed wood forest dominated by softwood trees.
  - Winter cover area composed of mature softwood stands or mature mixed wood stands dominated by softwood trees.
  - Summer cover area composed of mature hardwood, mixed wood, or softwood stands.
  - Calving area with open water or wetlands in close proximity to both foraging and cover areas.

  The Recovery Plan identifies habitat fragmentation as another key threat to Mainland moose (NSNRR, 2021f). Habitat fragmentation is directly related to habitat connectivity which is a major concern for the longevity of Mainland moose in Nova Scotia, where communities are already highly localized to three areas of the province. Road placement and road density are the main drivers of reduced habitat connectivity and road construction is defined as one of the main activities likely to result in destruction of important moose habitat (NSNRR, 2021f). Wildlife corridors are often cited as a mitigation strategy for improving habitat connectivity; however, effective maintenance of these corridors requires an understanding of natural wildlife corridors and Mainland moose movement patterns on the landscape.

Renewable energy is included as a potential threat to Mainland moose in the Recovery Plan due to potential habitat loss, conversion, and degradation caused by vegetation clearing for infrastructure associated with wind farms. Current and historical land-use in the Study Area (i.e., forestry activities and recreational off-road vehicle use) has altered the landscape within the Study Area to its current state, where road networks are abundant and forested habitat has been altered and degraded. The Project Area will utilize these pre-existing disturbed areas to the greatest extent possible to reduce habitat loss.

Habitat loss and reduced habitat quality may result in behavioural changes, including from reduced opportunities for thermoregulation, loss of overwintering areas, loss of adequate sources of food, reduced space for mating, and reduced protection for calves.

A Mainland moose habitat analysis was developed to assess the quality of Mainland moose habitat within the RAA, and the specific results of this analysis will be provided directly to NSNRR for review. Of the 8841.0 ha of habitat determined to be suitable for Mainland moose within the RAA (receiving a “fair” or higher), 364.4 ha lie within the Assessment Area (4.1%). Qualitatively, while potential habitat with the highest HSI scores (classified as “best”) are found within the Assessment Area, the largest clumps of this habitat are outside of the Assessment Area and therefore should not be impacted directly by Project activities. This not only protects potential habitat, but reduces habitat dysconnectivity, which is furthered by the extensive use of existing roadways within the Study Area.

Approximately 24.3 km of existing roads have been incorporated into the Project design, while 11.2 km of new road construction will be required. Because the length of roads will increase in the Project Area the Project may cause some additional habitat fragmentation in the RAA. Additionally, the size of habitat gaps may increase for roads requiring widening. Areas requiring upgrading to facilitate Project activities (e.g., the widening of a turn to accommodate a radius sufficient for turbine blade transport) are likely to see more impact, whereas areas with roadways large enough to accommodate forestry equipment will generally remain as true to their current state as Project developments will allow. The creation of wider road ROWs will increase the space for early successional vegetation, creating new foraging opportunities for moose adjacent to this built infrastructure that may eventually become suitable habitat.

Although some area considered to be “high” quality Mainland moose habitat will require alteration or removal to construct the Project, the design has maximized the use of existing infrastructure and disturbed areas such that the overall area of habitat loss is small and the direct impacts to moose habitat are expected to be low.

- Disruption of Mainland Moose Life History
  Direct effects to Mainland moose from wind farms may include sensory disturbance and stress from anthropogenic light sources or human presence resulting in behavioural changes. Mitigation strategies to avoid direct impacts resulting in behavioural changes during sensitive windows and in important habitat are described below. Indirect effects may include removal of adequate calving habitat through conversion of the landscape to support new project-related infrastructure and reducing areas with enough seclusion or cover to protect calves from predators. Mainland moose breeding season takes place between September and October, with calving generally occurring in late May to early June, where one to two calves are born. Cows may require specific habitat types for calving, such as secluded islands, peninsulas, and shorelines. Seclusion is an important factor for protecting calves from predators. The cow and calf/calves remain together for one year until the calf/calves become mature enough for independence (NSNRR, 2021f).

  With no desktop or field data supporting Mainland moose activity within the Study Area (Table 7.47, Appendix I), neither age nor sex diversity can be confirmed within the Study Area. An analysis of Mainland moose habitat quality within the RAA has shown that large areas of suitable habitat exist around the Assessment Area that will not be directly impacted by the Project. Mitigation measures will be implemented to minimize impacts; however, the amount of high-quality habitat remaining within the RAA and the extent of pre-existing linear features across the landscape indicate that the magnitude of Project-related impacts to Mainland moose life history will be low.

- Mainland Moose Disease
  Problematic native species have been identified as a pervasive threat to Mainland moose due to their potential to spread debilitating disease. Specifically, White-tailed deer are hosts for Brainworm (*Parelaphostrongylus tenuis*) and Winter tick (*Dermacentor albipictus*), both of which cause mortality in moose and are thought to be regulators of population abundance and distribution (NSNRR, 2021f). A possible concern associated with developments is their potential to cause indirect effects on Mainland moose by increasing access to the site by white-tailed deer and therefore, increasing the chances of disease spreading to Mainland moose.

  There are no records of deer over-wintering within the immediate vicinity of the Study Area in Significant Species and Habitat Database (NSNRR, 2023a); however, signs of White-tailed deer were observed throughout the Study Area during field assessments. Despite this, it is unlikely that the new and upgraded roads will increase access for White-tailed deer as they already have existing access to the Study Area. As such, effects to Mainland moose from disease due to the Project are expected to be negligible.

- Mainland Moose Poaching
  Poaching has been identified as a potential threat facing Mainland moose in the Recovery Plan (NSNRR, 2021f). Increased human access may increase the risk of poaching for rare, sought-after animals. The Project Area is already highly accessible to the public, including local hunters and recreational users. Due to the pre-existing access to the Study Area, effects to Mainland moose from poaching due to the Project are expected to be negligible. Furthermore, the increased presence of staff within the Project may act as a deterrent to moose poaching.

- Mainland Moose and Climate Change
  Climate change has been identified as a potential threat facing Mainland moose in the Recovery Plan; however, the details of how moose will be impacted by climate change are not yet well understood (NSNRR, 2021f). The development of windfarms is one of the province's strategies to transition to renewable energy to reduce provincial emissions. It is expected that this Project will have a net positive impact on climate change (for further details see Section 7.1.2), thus this potential threat is not expected to negatively affect Mainland moose within the LAA or RAA.

- Fisher Habitat Loss
  Fishers show preference for a variety of habitat types depending on location; however, they are most associated with dense, mature forests with continuous canopy cover. Generally considered to be forest interior species, Fishers prefer large tracts of intact forest including hardwood, mixedwood, and softwood stands depending on location. Fishers are also associated with landscape features such as the presence of slopes, lower elevations, nearby water or riparian areas, and shallow snow cover. Denning habitat is often restricted to downed woody debris, tree snags, or standing living trees (Meyer, 2007). In Nova Scotia, the Fisher has a low but relatively stable population with concentrations in Cumberland, Colchester, and Pictou counties, plus interior western Nova Scotia (Sabean, 1989)

  Within the LAA, past forest management has limited the extent and continuity of mature forest canopy that Fisher tend to favour. However, likely evidence of Fisher was observed during winter tracking surveys, indicating that there is a probable population of Fisher who have found a niche despite ongoing forest management, recreation, and other activities in the area. No other desktop or field data indicates the presence of Fisher habitat within the Study Area.

- Fisher Habitat Fragmentation
  Fishers have large home ranges, and can move long distances; however, they may exhibit sensitivity to habitat fragmentation. When suitable habitat is bisected by a large tract (10 to 20 km) of unsuitable habitat, Fishers may be unable to cross this distance and therefore be excluded from this neighbouring habitat. Unsuitable habitat generally refers to open or clear-cut forests which are avoided by Fishers. The degree of habitat connectivity may also influence genetic dispersal, as large distances between

populations may reduce chances of dispersal (Meyer, 2007). Tracks observed during winter tracking surveys indicate that Fishers in this area are willing to cross roads to travel between habitat types. Because the Project Area will maximize the use of pre-existing roads, and no intact areas will be bisected by large tracts of unsuitable habitat, effects of habitat fragmentation for fishers resulting from the Project are expected to be low.

- Road Traffic
  The Project will result in increased road traffic within the LAA. Both small and large terrestrial mammals are known to use the roadways within the Study Area, as evidenced by first-hand accounts by field staff and winter tracking/pellet survey results. An increase in road traffic will increase the chances of collision and mortality for those animals using the roadways. Most roads within the Study Area are currently used for recreation by ATV, snowmobile, and dirt bike users and for forestry activities. Outside of the construction phase, the Project will only require a small number of technicians to access the site to perform regular maintenance/equipment checks. Considering the pre-existing traffic load and the minimal traffic to be associated with the Project, road traffic is expected to have a negligible to low effect on terrestrial mammals in the LAA.

- Habitat Loss and Fragmentation
  Other non-priority species were observed within the Study Area and make use of various habitat types across this area. Approximately 11.2 km of new road will be constructed within the Study Area, and upgrades to pre-existing roads will be limited to removing small areas of habitat in areas that have already been disturbed. Habitat alteration may result in the removal of refugia which may increase predation risks and disrupt the ecological balance within a community. Patterns of movement/migration across the landscape may also be disrupted by habitat alteration and fragmentation. Evidence of animals using these roads through wildlife surveys and trail camera photos indicate that the creation of additional roads may be creating usable habitat or habitat connectivity for certain species. These linear features allow for easier access across the Study Area, and terrestrial fauna will continue to use these roads post-construction. Direct habitat loss and fragmentation within the LAA will therefore be small and can be mitigated through various strategies to reduce the effects of habitat loss.

- Sensory Disturbance
  Reproduction and survival strategies of terrestrial mammals may be directly or indirectly impacted by sensory disturbances caused by Project construction and operation. Many species have sensitive windows for breeding and birthing, and any small disruption to these activities may reduce reproductive success in the population. Sensory disruptions may result from sound/vibration or excess light. Lovich and Ennen (2013) stress the importance of turbine siting relative to the needs of wildlife to minimize effects. The iterative Project design process has prioritized avoidance and minimization of interactions with important wildlife habitat such as wetlands and mature forest, which will minimize sensory disturbances in these areas.

Project-related noise may impact habitat use, patterns of activity, stress levels, immune response, reproductive success, risk of predation, communication with conspecifics and antipredator predator behaviours, and hearing damage (Rabin et al., 2006; Lovich & Ennen, 2013). The extent that noise associated with wind farms may impact terrestrial mammals is not well studied, and results have been inconclusive thus far (Lovich & Ennen, 2013). The Study Area is, however, already subject to noise from forestry activities and recreation vehicles (snowmobiles, ATVs) and despite the pre-existing noise, different mammal species were still observed across the Study Area so impacts from sensory disruptions caused by the Project within the LAA are anticipated to be low.

Herpetofauna

- <u>Snapping Turtles</u>
  There were three observations of Snapping turtles in the course of assessments, two within the Study Area and one outside. Two of these sitings were along watercourses within 200 m of existing roadways, and one was directly on a road. Although watercourses provided general habitat suitability, the area is characterized by relatively poor habitat conditions.

- <u>Road Traffic</u>
  Increased road traffic may affect herpetofauna within the LAA due to the potential for an increase in risk of traffic collisions with herpetofauna species. Turtles, salamanders, and snakes, if present, may cross roads daily in search of food, or seasonally during migration to find nesting habitat or to escape uninhabitable climatic conditions (Wills, 2021). The pre-existing traffic load and the minimal traffic to be associated with the Project both indicate that road traffic is not expected to have a significant effect on terrestrial herpetofauna in the LAA.

- <u>Habitat Loss</u>
  Terrestrial habitat utilized by herpetofauna includes riparian areas along wetlands and watercourses, forested areas near watercourses, and rocky or gravelly areas such as roadsides. These different habitat types support different biological needs of species and relate directly to life history strategies. The Project layout aims to reduce impacts to intact habitat and has been specifically designed to minimize interactions with riparian areas and intact forest. With approximately 11.2 km of new road being constructed, a small area of new habitat may be created in the form of gravel roadsides and this new habitat may serve as a potential benefit to herpetofauna species. No significant impacts resulting from habitat loss within the LAA are expected.

- <u>Habitat Fragmentation</u>
  Terrestrial herpetofauna utilize the terrestrial environment to move across the landscape, particularly between wetlands and watercourses. The alteration of these habitats and conversion of intact forest to roads may result in a fragmented landscape,

preventing natural patterns of movement across the landscape. Alternatively, these roads can act as corridors for some herpetofauna. Habitat fragmentation has been minimized through the Project design, which prioritized the use of pre-existing roads or otherwise disturbed habitats. Effects to herpetofauna related to habitat fragmentation are expected to be low within the LAA or RAA.

- Disruption of Life History
  Sensitive windows for herpetofauna may relate to migration or nesting periods, and interference with these animals' activities during these windows may disrupt their natural life history. Interference may be both temporal and spatial. Project related activities occurring during sensitive windows may impact migratory or breeding behaviours, and habitat removal or fragmentation may create a physical barrier to herpetofauna species from reaching important habitat. Low impacts to life history are expected due to the small Project footprint and minimized interactions with important habitat features such as wetlands and watercourses.

- Sensory Disturbance
  Given the pre-existing traffic load and the minimal traffic to be associated with the Project, sound and light impacts are expected to be low.

Lepidopterans and Odonates

- Turbine Collision-Induced Mortality
  Swarming and migrating insects, including lepidopteran and odonates, are susceptible to mortality from collisions with wind turbines. There are a number of hypotheses as to whether, or why, these insects are attracted to wind turbines (Long et al., 2011; Rydell et al., 2010; Jansson et al., 2020). Questions remain in the literature concerning how this potential attraction affects mortality rates; whether insect fatalities at wind turbines are contributing to population declines; and how these fatalities are impacting ecological functions (Voigt, 2021). No significant effects to lepidopteran and odonate SOCI are expected as a result of this Project based on current insect population and ecology research and a lack of confirmed lepidopteran and odonate SOCI within the Study Area.

Mitigation Measures

To address the abovementioned effects to terrestrial fauna, the following mitigation measures will be implemented:

Habitat Loss

- Minimize overall area to be cleared by utilizing pre-existing roads and previously altered areas (i.e., clearcuts).
- Continue to review habitat modelling results, field survey results, and guidance from NSNRR through the detail design phase.
- Revegetate roadsides and cleared areas to minimize lost habitat as much as possible.

- Reclaim small roads leading to turbines to minimize long-lasting effects of habitat loss.

Habitat Fragmentation

- Minimize fragmentation and habitat isolation by utilizing pre-existing roads and previously altered areas during the design phase.
- Support connectivity by maintaining vegetated buffers around wetlands and watercourses, where possible.
- Revegetate as much cleared area as possible to limit the effects of fragmentation.

Road Traffic

- Design the Project footprint to minimize road density and utilize pre-existing roads to the greatest extent possible.
- Install traffic signs to alert road users of speed limits and the presence of wildlife in the area.
  - Inform all Project-related staff working on the site of dangers to wildlife and create awareness around wildlife hotspots on the site.
- Minimize Project-related traffic to reduce chances of wildlife collisions and traffic-related stress to wildlife.
- Impose restrictions to site access if deemed necessary due to a substantial increase in wildlife collisions and mortality.

Disease

- Use seed mixes that do not contain clover to avoid attracting deer (which carry ticks) to the area when revegetating road ROWs and other cleared areas requiring revegetation.

Disruption of Life History

- Avoid removal of vegetation/habitat alteration in key habitat areas during sensitive windows for priority species, where possible, including:
  - Mainland moose – late May to early June (birthing season) and September to October (breeding season)
  - Fisher – March to April
  - Wood turtle – late March to October
- Minimize loss of important habitat required by priority species for reproduction events, including:
  - Mainland moose – wetlands and isolated islands/peninsulas
  - Fisher – large diameter snags, large woody debris, or live standing trees in mature, intact forests
  - Snapping turtle – clear, meandering streams with gravel shores, gravel roadsides.
- Minimize overall area to be cleared to maintain refugia and cover for protection from predators.

- Maintain all equipment and machinery on site to reduce noise and vibration emissions associated with malfunctions. Where practical, install vehicles and machinery with noise muffling equipment to limit disturbance.
- Restrict on-site lighting, especially at night, to limit disturbance.
- Prohibit harassment and feeding of wildlife by Project personnel.

Monitoring

A site-specific post-construction Wildlife Management Plan may be developed to inform monitoring activities that will take place to ensure continued protection of known SAR/SOCI in the LAA and RAA. The Proponent will seek to collaborate with relevant stakeholders on a broader regional wildlife monitoring and management plans, including the developers of other wind-power projects, local landowners, consultants, subject-area experts, government departments (i.e., NSECC, NSNRR, ECCC, etc.) and the Mi'kmaq of Nova Scotia.

Conclusion

While effects to mammals, herpetofauna, and insects differ, the effects considered to be of greatest concern include habitat loss, habitat fragmentation, and associated disruption of the life history of populations within these groups. Based on this assessment and through the implementation of proposed mitigation and monitoring activities, residual effects on terrestrial fauna are characterized as follows:

- Low magnitude the project has been designed to maximize use of existing roads to minimize habitat loss and fragmentation.
- Within the LAA.
- Long-term for habitat loss and fragmentation as residual effects will extend through the operational and maintenance phase until after decommissioning, and short term for traffic as it is limited to the construction and decommission phases.
- Continuous but differ seasonally as the needs of species change.
- Reversible as the effects will terminate at the end of the Project lifespan.

As a result, the residual effects are considered not significant.

7.4.4 Bats

7.4.4.1 Overview

A desktop review and field studies were undertaken to gather information on bat species and associated habitat in the Study Area. Objectives were as follows:

- Assess observations, species diversity and habitat utilization of bats within the Study Area during the active bat period (spring to fall).
- Use the information collected to inform and refine the Project design (i.e., avoid impacts to bat SAR/SOCI and their habitats).
- Use the information collected to inform mitigation and management practices.

7.4.4.2 Regulatory Context

There are seven species of bats documented in Nova Scotia, of which four are resident species that reside in the province year-round and three are migratory species that overwinter in the southern United States. Resident species include the Little brown myotis (*Myotis lucifugus*), Northern myotis (*Myotis septentrionalis*), Tri-colored bat (*Perimyotis subflavus*), and Big brown bat (*Eptesicus fuscus*). Migratory species include the Eastern red bat (*Lasiurus borealis*), Hoary bat (*Lasiurus cinereus*), and Silver-haired bat (*Lasionycteris noctivagans*).

Three resident species (the Little brown myotis, Northern myotis, and Tri-colored bat) are protected federally and provincially under *SARA* and the *ESA*. These three species were added to the *ESA* as “Endangered” on July 11, 2013, and were declared “Endangered” under Schedule 1 of *SARA* on November 26, 2014. The designation under *SARA* and the *ESA* was driven by the emergence of white-nose syndrome (a disease caused by the fungus *Geomyces destructans*), which was first detected in Canada in 2010 and led to a 90% population decline in Nova Scotia by 2013 (COSEWIC, 2013b). All three migratory bat species were listed by COSEWIC in May 2023 as “Endangered” (COSEWIC, 2023). The Big brown bat is not listed under either *SARA* or the *ESA*.

7.4.4.3 Desktop Review

Databases and online resources referenced as part of this desktop review include:

- Terrestrial Habitat Mapping (Section 7.4.1)
- Locations of Known Bat Hibernacula in NS (Moseley, 2007)
- Nova Scotia Geoscience Atlas – Abandoned Mine Openings (NSNRR, 2024)
- Nova Scotia Significant Species and Habitats Database (NSNRR, 2023)
- ACCDC Data Report (ACCDC, 2024)

Terrestrial Habitat Mapping

Terrestrial habitat mapping from Section 7.4.1 was used to identify locations of ideal bat foraging and over-day habitat (i.e., day roosts) within the Study Area. Ideal habitats for bat foraging and over-day habitat include lakes, wetlands, watercourses, forest edges, cliffs, rock outcrops, talus slopes, and mature hardwood forests. Identification of ideal habitats from terrestrial mapping was subsequently used to guide field surveys for bats.

There are three habitat features considered to be significant for bats: hibernacula for overwintering, maternity roosts for birthing and raising young, and migratory stopovers for rest periods during spring/fall migration. Hibernacula are overwintering sites that are typically located in abandoned mines or caves and can support hundreds of bats. Maternity colonies are poorly documented in Nova Scotia, with limited desktop information regarding these sites’ location and use (NSNRR, 2020b).

Migration is one of the most poorly understood components of bat biology, at both a regional (<200 km) and long distance (>1000 km) scale. Migratory stopovers utilized for short term rest or sanctuary are thought to be located on islands or shorelines of large bodies of water and along geographic features such as riparian zones or mountain ranges (McGuire et al., 2011). During terrestrial habitat mapping, riparian and shoreline habitats were identified and used to guide field studies.

Locations of Known Bat Hibernacula

Moseley (2007) provides an overview of the known and recorded bat hibernacula located within Nova Scotia. This research indicates 16 known hibernacula within a 100 km radius of the Study Area (Table 7.51).

Table 7.51: Known Bat Hibernacula within 100 km of the Study Area

Hibernaculum	Approximate Distance to Study Area*	Direction
Frenchman's Cave I and II	13 km	NW
Miller's Creek Cave	19 km	NW
Woodville Ice Cave	19 km	N
Centre Rawdon Gold Mine	24 km	N
Cave of the Bats	34 km	NE
Cheverie Cave	38 km	NW
Walton Barite Mine	39 km	N
Peddlar's Tunnel	40 km	N
Minasville Ice Cave	43 km	N
Gayes River Gold Mine	44 km	NE
Hayes Cave	47 km	NE
Black Brook	47 km	NE
The Ovens	55 km	SW
Lear Shaft	69 km	N
Lake Charlotte Gold Mine	69 km	E
Vault Cave	92 km	W

*Distance measured to the nearest point of the Study Area.
Source: (Moseley, 2007)

Four hibernacula are located within 25 km of the Study Area and thus have very high potential sensitivity as per the recommended buffer provided in the NSECC Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia (2021): Frenchman's Cave I and II, Miller's Creek Cave, Woodville Ice Cave, and Centre Rawdon Gold Mine.

Frenchman's Cave I and II, the closest known hibernaculum, is a series of dissolutional caves with an active and connected stream system located in gypsum deposits near St. Croix, Nova Scotia. This site is considered to be a small hibernaculum suspected to support between 10 and 50 overwintering bats. All three resident bat species were documented at this hibernaculum during surveys conducted in 2003. Bats have been recorded using this cave during fall, winter, and summer seasons (Moseley, 2007).

Miller's Creek Cave was a major hibernaculum site where approximately 2000 bats were reported at one time; however, this cave was quarried/destroyed in 1981 (Moseley, 2007).

Woodville Ice Cave is a minor site that is suspected to support <10 bats, as only solitary Little brown myotis individuals have been observed here. This habitat is not considered to be significant due to the cave's low temperatures, large opening/entrance, and unsuitable microclimate (Moseley, 2007).

Lastly, the Centre Rawdon Gold Mine is an abandoned gold mine measuring approximately 293 m in length. This is a significant hibernaculum suspected of supporting approximately 650 bats, in which the composition of species has not been determined (Moseley, 2007).

It should be noted that the aforementioned hibernacula were assessed prior to the onset of white-nose syndrome in Nova Scotia, and therefore populations of bats using these habitats are likely to be smaller than these estimations.

Abandoned Mine Openings

There are no recorded abandoned mine openings located within the Study Area. Outside of the Study Area, there are two concentrated areas of gold shafts: one cluster approximately 6.5 km northeast and another 5.5 km east (NSNRR, 2024). According to the Government of British Columbia (2019), abandoned mine openings may serve as overwintering bat habitat if they have a depth greater than 30 m. Mine openings must also be of a suitable type (i.e., shafts, audits, or pits) and remain accessible to bats (i.e. not flooded, filled, capped, or plugged) in order to provide suitable habitat.

The cluster to the east of the Study Area consists of 48 mine openings, four of which meet the aforementioned criteria and may act as hibernacula for resident bat species. The cluster to the northeast consists of 193 mine openings, 18 of which could potentially provide overwintering habitat for bats (Drawing 7.25). The remainder were not considered potential bat overwintering habitat as they were characterized as pits, trenches, shallow in depth (<30 m, as per recommendations from the Government of British Columbia, 2019), infilled, capped, plugged, or flooded.

Significant Species and Habitat Records

The NSNRR Significant Species and Habitats Database (2023a) contains 53 unique species and habitat records pertaining to bats and associated habitat within a 100 km radius of the Study Area:

- 1 "Species of Concern" record relating to karst.
- 5 "Other Habitat" records relating to karst (4) and cave (1).
- 47 "Species at Risk" records which relate to caves (2), Myotis species (2), unclassified bat species (19), and Little brown myotis (24).

None of these records are located within the Study Area.

ACCDC Records

The ACCDC Data Report (2024) completed for this Project indicates seven bat species of concern recorded within 100 km of the Study Area (Table 7.52).

Table 7.52: Bat Species Recorded within a 100 km radius of the Study Area

Common Name	Scientific Name	COSEWIC Status	*SARA* Status	*ESA* Status	NS S-Rank
Bat species	*Vespertilionidae sp.*	---	---	---	S1S2
Eastern red bat	*Lasiurus borealis*	Endangered	---	---	SUB,S1M
Hoary bat	*Lasiurus cinereus*	Endangered	---	---	SUB,S1M
Little brown myotis	*Myotis lucifugus*	Endangered	Endangered	Endangered	S1
Northern myotis	*Myotis septentrionalis*	Endangered	Endangered	Endangered	S1
Silver-haired bat	*Lasionycteris noctivagans*	Endangered	---	---	SUB,S1M
Tricolored bat	*Perimyotis subflavus*	Endangered	Endangered	Endangered	S1

Source: (ACCDC, 2024)

According the ACCDC Report (2024), a “bat hibernaculum or bat species occurrence” is not known to exist within the Study Area.

7.4.4.4 Field Assessment Methodology

Monitoring conducted within the Study Area consisted of passive acoustic monitoring conducted within the 2022 and 2024 active bat seasons. Monitoring locations were adjusted between 2022 and 2024 to reflect layout changes and provide additional coverage across the Study Area.

Passive acoustic monitoring was conducted within the Study Area in 2022 and 2024 across various representative habitats such as wetlands, riparian river valleys, and forest edges (Drawing 7.25). Monitoring stations were chosen based on habitat mapping and accumulated knowledge from field studies to represent various habitat types present within the Study Area, along with ideal bat habitat for species present in Nova Scotia, including mature hardwood forest, riparian zones, and open wetlands.

Acoustic monitoring was conducted using Song Meter SM4BATs and Song Meter Minis from Wildlife Acoustics in 2022 and only SM4BATs in 2024. The detectors were programmed to monitor from 30 minutes before sunset to 30 minutes after sunrise to correspond with peak bat activity. GPS points and supplementary information (i.e., habitat descriptions) for each monitor location and detector set up were recorded using QuickCapture (an ArcGIS product).

Passive acoustic monitoring in 2022 was conducted for 158 consecutive days within the Study Area between the dates of May 16 and October 21, encompassing the summer and fall active bat seasons. Three detectors were deployed in habitats that were representative of the Study Area and expected to provide suitable foraging habitat for bats (i.e., forest edges, waterbodies, watercourses, and wetlands). Some data was lost due to either depleted batteries or corrupted SD cards from BM1-22 and BM3-22 between June 17 and August 1, 2022.

Detector BM1-22 was deployed adjacent to the forest edge between a bog and the northwestern tip of Little Lake. Detector BM2-22 was deployed in a shrub swamp along the southeastern riparian area of the Melvin Brook Deadwaters. BM3-22 was deployed along the eastern edge of a clearing adjacent to a mature red spruce stand (located roughly 95 m from the Melvin Lake portable radar). Detector locations are outlined in Table 7.53 and shown in Drawing 7.25.

Table 7.53: Monitoring Periods for Detectors (2022)

ID	Detector Location	Habitat Description	Monitoring Duration (2022)	# Of Monitoring Nights	# Of Recordings
BM1-22	44.762578 -63.915131	Forest edge, near lake and open wetland habitat	May 16 to October 21	158	1 085
BM2-22	44.797037 -63.911101	Shrub swamp, riparian area	May 16 to October 21	158	871
BM3-22	44.831463 -63.905334	Clearing adjacent to gravel road	August 29 to October 31	69	519

Passive acoustic monitoring in 2024 was conducted for 155 consecutive days within the Study Area between the dates of April 10 and September 12, encompassing the spring and summer active bat seasons. Six detectors were deployed in habitats that were representative of the Study Area and expected to provide suitable foraging habitat for bats (i.e., forest edges, waterbodies, watercourses, and wetlands). Data was lost from two secure digital (SD) cards resulting in missing data for both BM4-24 and BM9-24 between May 31 and July 9, 2024, likely due to corrupted SD cards. It is also possible that data was lost between September 1 and September 12 due to depleted batteries in all detectors.

Detectors were deployed in the following locations:

- Detector BM4-24 was deployed along Uniacke River near the northwest corner of the Study Area. This is a permanent watercourse that flows out of Granite Lake, which is located southeast of the detector.
- Detector BM5-24 was deployed in a wetland along a wide section of Melvin Brook.
- Detector BM6-24 was deployed in a low shrub wetland along the edge of Beaver Pond in the southern portion of the Study Area.
- Detector BM7-24 was deployed in a fen approximately 95 m from a well-traveled gravel road.
- Detector BM8-24 was deployed near a clearcut at the southeastern edge of the Study Area along Marr Brook between Thompson Lake and an existing gravel road.

- Detector BM9-24 was deployed in a bog near the center of the Study Area approximately 55 m from an old gravel road (see Drawing 7.25 and Table 7.54).

Table 7.54: Monitoring Periods for Detectors (2024)

ID	Detector Location	Habitat Description	Monitoring Duration (2024)	# Of Monitoring Nights	# Of Recordings
BM4-24	44.884482 -63.889043	Mixed wood riparian valley	April 10 to September 12	116	1 710
BM5-24	44.794559 -63.904347	Shrub wetland, riparian habitat	April 10 to September 12	155*	5 879
BM6-24	44.774822 -63.899626	Shrub wetland adjacent to water body	April 10 to September 12	155*	2 904
BM7-24	44.8718 -63.897254	Open wetland	April 10 to September 12	155	643
BM8-24	44.766553 -63.885002	Mixed wood riparian habitat near clearcut	April 10 to September 12	155	5 108
BM9-24	44.84314 -63.891143	Open wetland	April 10 to September 12	116	476

*Denotes detectors missing data due to SD card malfunction.

Acoustic monitoring data (i.e., sonograms) was processed using Kaleidoscope Pro software from Wildlife Acoustics, complementary to the detectors used. Sonograms were analyzed for potential bat generated ultrasonic vocalizations and speciated when possible, first by the automatic identification feature of Kaleidoscope Pro and then manually by a trained biologist.

Due to their similarity, the calls of Nova Scotia's two resident Myotis species (Little brown myotis and Northern myotis) can be difficult to reliably distinguish from one another (O'Farrell et al., 1999), so these calls were not identified to the species level. In addition, bat generated calls were identified as Unknown (UNKW) if the recording was within the correct frequency range for bats but was unable to be speciated based on the quality or length of the recording. Unknown calls between 20 kHz and 40 kHz were labelled as unknown low frequency bats (UNLO) and unknown calls between 40 kHz and 120 kHz were labelled as unknown high frequency bats (UNHI) when possible. Identification codes used for bat species or groups are listed below:

- MYOT Myotis species (Little brown myotis or Northern myotis)
- LABO Eastern red bat
- LACI Hoary bat
- LANO Silver-haired bat
- PESU Tri-colored bat
- EPFU Big brown bat

- UNLO Unknown low-frequency bat (Hoary bat, Silver-haired bat, or Big brown bat)
- UNHI Unknown high-frequency bat (Eastern red bat, Tri-colored bat, or Myotis species)
- UNKW Unknown bat

7.4.4.5 Field Assessment Results

2022

In 2022, 2,475 files were recorded by acoustic detectors, of which 283 were determined to be bat generated ultrasound (Table 7.55). The remaining files were determined to be caused by extraneous noise from sources such as vegetation, wind, or precipitation. The following species were recorded during the acoustic survey:

- Myotis species
- Eastern red bat
- Hoary bat
- Silver-haired bat

Table 7.55: Results of the Passive Acoustic Bat Survey (2022)

Detector	MYOT	LABO	LACI	LANO	UKWN	Calls per Detector
BM1-22	86	8	0	2	0	96
BM2-22	137	13	6	0	0	156
BM3-22	12	10	6	3	0	31
Calls per Species	**235**	**31**	**12**	**5**	**0**	**Survey Total = 283**

In 2022, resident species accounted for 83% of calls while migratory species accounted for the remaining 17%. Detectors BM1-22 and BM2-22 both recorded a higher volume of bat calls compared to BM3-22, which is likely due to the locations of BM1-22 and BM2-22 in suitable foraging habitat (i.e., near freshwater features) as well as the late deployment of BM3-22. It is also important to note that BM3 was deployed atop a 10 m tall tower in an effort to target migratory species.

The number of calls was highest in June and August, with significantly fewer calls recorded during July, September, and October, and no calls recorded in May 2022. Lack of bat activity recorded in July 2022 is likely due to missing data from BM1 and BM3, while lower call volumes in September and October coincides with the end of peak insect (i.e., feeding) season. Migratory species were recorded almost exclusively in June, September, and October 2022. This could indicate that migratory species passed through the site while traveling to and from destinations farther north where they remained during the height of summer. Decreased activity observed during autumn is likely a result of resident species congregating near hibernacula for over-wintering (Figure 7.2).

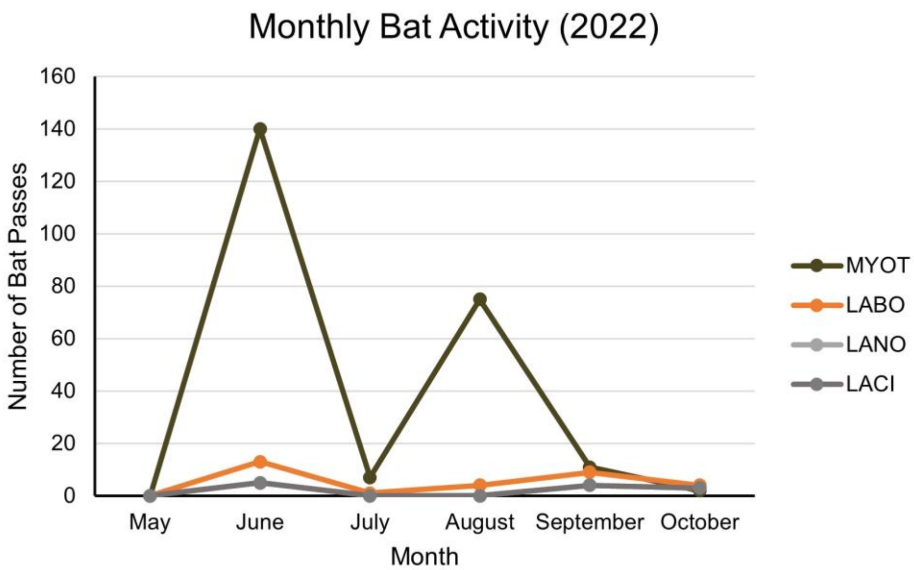


Figure 7.2: Bat Activity Per Month Observed During the Passive Acoustic Survey (2022)

2024

In 2024, 16,720 files were recorded by acoustic detectors, of which 6,088 were determined to be bat generated ultrasound (Table 7.4.4.6). The remaining files were determined to be caused by extraneous noise from sources such as vegetation, wind, or precipitation. The following species were recorded during the acoustic survey:

- Myotis species
- Eastern red bat
- Hoary bat
- Silver-haired bat
- Tri-colored bat
- Big brown bat

Table 7.56: Results of the Passive Acoustic Bat Survey (2024)

Detector	MYOT	LABO	LACI	LANO	PESU	EPFU	UNLO	UNHI	UKWN	Calls per Detector
BM4-24	1462	0	0	0	0	0	0	187	0	1,649
BM5-24	996	52	17	2	1	0	1	668	61	1,798
BM6-24	180	28	10	1	2	0	0	169	0	390
BM7-24	42	0	7	0	2	0	1	20	0	72
BM8-24	1745	5	22	3	2	0	1	322	14	2,114
BM9-24	32	0	4	0	2	1	0	24	2	65
Calls per Species	**4,457**	**85**	**60**	**6**	**9**	**1**	**3**	**1,390**	**77**	**Survey Total = 6,088**

In 2024, resident species accounted for 73% of calls while migratory species accounted for 3% of calls. The remaining 24% of calls consisted of unknown species, with 22% of total calls being high-frequency unknown species and 2% being low-frequency species. Given the high volume of Myotis calls and the very low number of calls attributed to other high frequency bat species (i.e., Eastern red bats and Tri-colored bats), it is likely that most calls labeled UNHI were generated by resident Myotis species. The three monitors located in riparian habitat (BM4-24, BM5-24, and BM8-24) detected a significantly higher volume of calls than the other three detectors which were deployed in wetland habitats lacking significant flowing water.

In 2024, the number of calls was low in April and May compared to the summer months. The sharp decline in the number of calls detected in September is likely the result of monitors being retrieved mid-way through the month and only part of the month's data included in this analysis. The high number of calls from Myotis species during the summer months indicates that resident bat species are active in the Study Area during the breeding period (Figure 7.3).

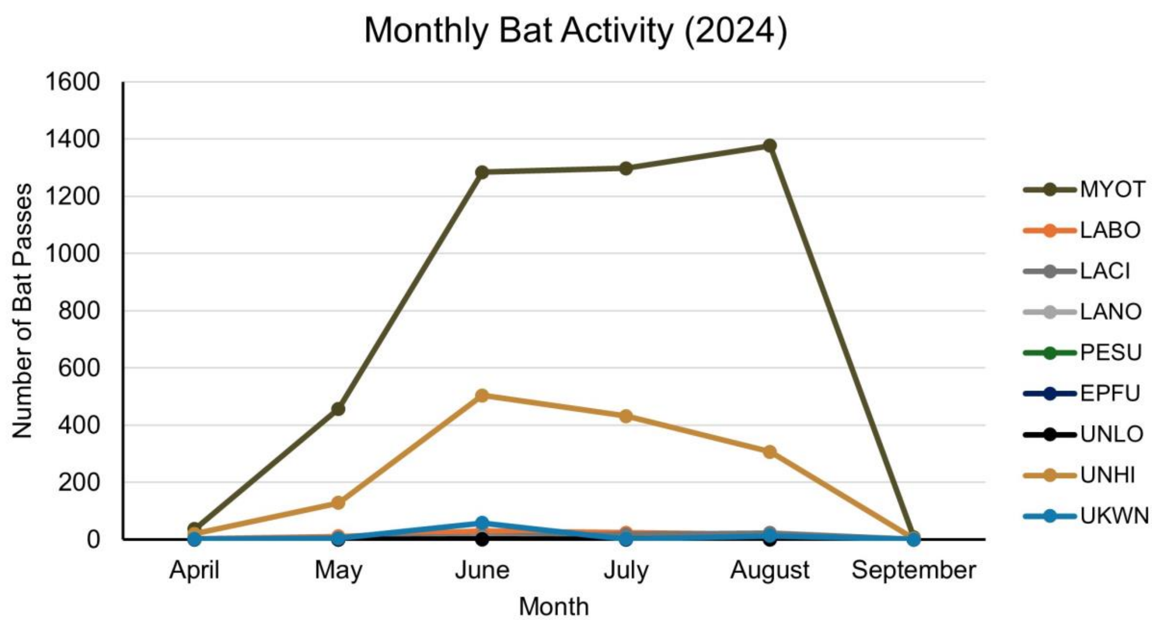


Figure 7.3: Bat Activity Per Month Observed During the Passive Acoustic Survey (2024)

2022 and 2024 Analysis

Overall, the 2024 acoustic monitoring period recorded significantly more bat calls compared to 2022 monitoring period (equivalent to an approximate increase of 2050%), which may be a result of the following:

- Twice as many detectors were deployed in 2024 compared to 2022 to cover the new layout adjustments.
- In 2024, detector placement targeted high-quality bat habitat based on better site knowledge, while 2022 monitoring targeted more general/representative habitats within the Study Area.

- Increase in the detection of calls in 2024 due to better placement/set-up of detectors (e.g., reduced background noise).
- Inter-year variability in bat activity within the Study Area.

Detector BM2-22 and detector BM5-24 were deployed along the same watercourse 600 m apart. Though both detectors recorded a higher number of calls compared to other detectors deployed during the same year, they detected drastically different numbers of bat calls (Table 7.57) suggesting that the Study Area experienced inter-year variability in bat activity.

Table 7.57: Bat Calls Per Month by Year at BM2 and Detector S4U18674

Year	Detector ID	April	May	June	July	August	September	October
2022	BM1-22	N/A	0	9	0	74	7	6
	BM2-22	N/A	0	144	8	0	4	0
	BM3-22	N/A	0	5	0	5	18	3
2024	BM4-24	1	4	0	522	1115	7	N/A
	BM5-24	10	248	964	432	144	0	N/A
	BM6-24	2	12	134	172	70	0	N/A
	BM7-24	3	9	14	21	25	0	N/A
	BM8-24	47	329	783	607	348	0	N/A
	BM9-24	0	2	0	18	41	4	N/A

In 2022, 283 bat calls were detected over a 158-day period resulting in an average of 1.79 bat calls per day. It should be noted that the recorded bat calls may belong to the same or a different individual bat; for example, a bat foraging near a detector may be recorded several times throughout the night and/or over multiple nights. The average number of bat calls per day for each detector are provided below. Only 69 days of monitoring were conducted using BM3-22.

- BM1-22 0.60 bat calls/day
- BM2-22 0.98 bat calls/day
- BM3-22 0.19 bat calls/day

In 2024, 6,088 bat calls were detected over a 155-day period resulting in an average of 39.28 bat calls/day. The average number of bat calls per day for each detector are provided below. Note that data from only 116 days of monitoring were used for BM5-24 and BM9-24.

- BM4-24 14.21 bat calls/day
- BM5-24 11.60 bat calls/day
- BM6-24 2.52 bat calls/day
- BM7-24 0.46 bat calls/day
- BM8-24 13.64 bat calls/day
- BM9-24 0.56 bat calls/day

Bat calls were also analyzed by hour during the night for both 2022 and 2024 datasets (Figure 7.3). Peak hourly bat activity in 2022 was observed near dusk (21:00), near midnight (0:00), and just prior to dawn (5:00). These findings are relatively consistent with the most current and available literature on bat species and nightly activity in Nova Scotia (NSNRR, 2020b).

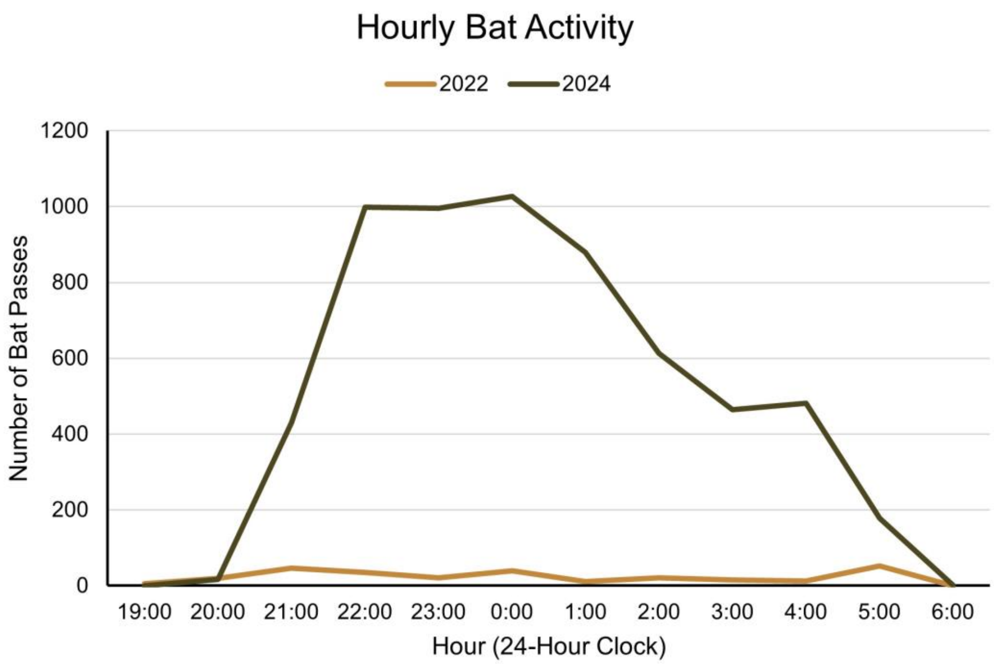


Figure 7.3: Bat Activity Per Hour Observed During the Passive Acoustic Survey

Peak hourly bat activity in 2024 was observed after dusk, remaining high from 22:00 to 1:00 and gradually declining until dawn (Figure 7.x). According to research conducted in West Virginia, Little brown myotis activity peaks five to eight hours after sunset and Northern myotis activity peaks one to four hours after sunset (Johnson et al., 2013). As Myotis species account for most calls recorded during the 2024 monitoring period, the steadily high volume of calls between approximately two and five hours after sunset identified in this dataset is consistent with these findings.

There is limited literature available for species specific levels of bat activity during the night. Factors that may influence the distribution of bat activity throughout the night include environmental conditions, foraging location, time of year, competition and resource partitioning, and/or diet (as cited in Fern et al., 2018).

7.4.4.6 Effects Assessment

Project-Bat Interactions

Project activities, primarily those involving vegetation clearing and turbine operation, have the potential to impact bat and bat habitat (Table 7.58). These activities could result in habitat loss and accidental injury or mortality. Other Project activities during construction and operation may impact bat behaviors such as increased noise and lighting.

Table 7.58: Potential Project-Bat Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Bats				X	X	X						X			

Assessment Boundaries

The LAA for bats includes the Assessment Area, while the RAA includes the Study Area (Drawing 2.2).

Assessment Criteria

Assessment criteria provided in Section 4.6 applies for bats. The VC-specific definition for magnitude is as follows:

- Negligible – no measurable loss of bat habitat or impact to bat behaviours are expected.
- Low – small loss of habitat supporting bats, but loss of individuals is not expected.
- Moderate – loss of habitat supporting bats and minimal loss of individuals or impacts to bat behaviours, and these impacts will only be experienced by individuals rather than entire populations.
- High – high loss of habitat that supports bats and/or loss of individuals or impacts to bat behaviours on a population scale.

Priority Species

Bat SAR/SOCI that were identified during field surveys, have been recorded within a 100 km radius of the Study Area, or have a likelihood of occurrence based on the desktop review and habitat within the Study Area were screened against the criteria outlined in the document Guide to Addressing Wildlife Species and Habitat in an EA Registration Document (NSECC, 2009) to develop a list of priority species. These priority species include:

- Little brown myotis
- Northern myotis
- Tri-colored bat
- Hoary bat
- Silver-haired bat
- Eastern red bat

The Little brown myotis is the most common species in Nova Scotia and is likely ubiquitous in the province (Broders et al., 2003). During the day, the Little brown myotis will roost under rocks or in buildings, trees, wood piles, and caves, often congregating in tight spaces (Fenton & Barclay, 1980). As a non-migratory species, the Little brown myotis hibernates from September to early or mid-May in abandoned mines or caves (Fenton & Barclay, 1980; Mosely, 2007). ACCDC data (2024) indicates that the closest Little brown myotis observation to the Study Area is 10.5 ± 0.1 km away.

The Northern myotis, once considered uncommon across Nova Scotia (Moseley, 2007), is likely ubiquitous in forested regions of the province (Broders et al., 2003). This species is widely distributed in the eastern United States and Canada and is commonly encountered during swarming and hibernation (Caceres & Barclay, 2000). During the day, Northern myotis shows a preference for roosting in trees; however, the habitat preferences of females may vary according to their reproductive status (Garroway & Broders, 2008). Females appear to prefer shade tolerant deciduous trees over coniferous trees, whereas males tend to roost alone in coniferous or mixed-stands in mid-decay stages (Broders & Forbes, 2004). The Northern myotis is also non-migratory and typically associated with the Little brown myotis during hibernation, being found in caves or abandoned mines alongside this species (Moseley, 2007). Hibernation of the Northern myotis is thought to begin as early as September and can last until May (Caceres & Barclay, 2000). ACCDC data (2024) indicates that the closest Northern myotis observation to the Study Area is 18.8 ± 0.15 km away.

The Tri-colored bat only has approximately 10% of its range in Canada and is considered rare in Nova Scotia (COSEWIC, 2013b). Documented observations of the Tri-colored bat predominantly occur in the southwest region of the province, especially during summer (Broders et al., 2003). The Tri-colored bat can be found in a variety of habitats, but typically forages in covered riparian areas and around open bodies of water. Hibernation for this species begins in September and extends to early or mid-May, occurring in abandoned mines or caves with high humidity and above freezing temperatures (COSEWIC, 2013b). The ACCDC Data Report (2024) indicates that the closest Tri-colored bat observation to the Study Area is 18.8 ± 0.15 km away.

Hoary bats have the widest range among all native terrestrial mammals within the Western Hemisphere and are found across Canada and the United States (COSEWIC, 2023). As a result, Hoary bats travel long distances (i.e., across the continent) during migratory periods, residing in coastal regions of Mexico and the United States during winter and migrating north in the spring. Hoary bats can be found roosting in the foliage of trees or shrubs in coniferous or deciduous forests of any age, but they prefer mature stands with abundant canopy cover and open flight space below. Foraging habitat for Hoary bats is associated with open areas containing patches of trees such as fields, grasslands, or wetlands, though they tend to avoid heavily disturbed habitats such as transportation corridors, urban developments, and mines. Migration is thought to occur across coastal and/or large open areas (COSEWIC, 2023). The ACCDC Data Report (2024) indicates that the closest Hoary bat observation to the Study Area is 33.3 ± 0.1 km away.

The Silver-haired bat is also widely distributed across Canada and the United States, extending from southern portions of the Northwest Territories and British Columbia east to Nova Scotia (COSEWIC, 2023). The Silver-haired bat undertakes long distance migrations, residing in coastal regions of British Columbia and across the United States and Mexico during the winter and travelling north in the spring. Silver-haired bats typically roost in cavities or under the bark of large decaying trees. Maternity roosts are usually small and found in decaying deciduous trees or in buildings. Foraging habitat is not well characterized, but is usually associated with forests, including forest edges and openings. Little is known about migration requirements for this species (COSEWIC, 2023). The ACCDC Data Report (2024) indicates that the closest Silver-haired bat observation to the Study Area is 33.0 ± 0.2 km away.

Eastern red bats are typically found east of the Rocky Mountains in Canada and the United States and in northeastern Mexico (COSEWIC, 2023). This species can travel thousands of kilometres north during spring and fall migrations. Eastern red bats roost in similar habitat to Hoary bats (described above), often roosting alone or with pups. Maternity roosts for this species are typically found in large diameter trees that reach or exceed the height of the surrounding canopy. Foraging habitat for Eastern red bats includes both open and forested habitats as well as forest edges. Heavily disturbed habitats such as transportation corridors, urban developments, or mines are typically avoided by this species. Migration is thought to occur across coastal and/or large open areas (COSEWIC, 2023). The ACCDC Data Report (2024) indicates that the closest Eastern red bat observation to the Study Area is 48.1 ± 0.1 km away.

Effects

Potential impacts to bat species from the Project's construction and operation include:

- Habitat fragmentation and/or removal.
- Direct and/or indirect mortality.
- Sensory disturbance (i.e., lighting, noise, human activity, etc.).

Habitat Fragmentation and Removal

There is limited research and knowledge on how wind farm developments impact habitat suitability and populations of bat species (Segers & Broders, 2014). Vegetation clearing required for construction can result in the removal of bat habitat or disrupt corridors between important habitat features (foraging grounds, birthing areas, etc.) (Segers & Broders, 2014). In addition, the construction of roads can potentially impede movement, foraging, flight activity, and habitat use (ECCC, 2015a). One study by Segers & Broders (2014) found that different species of bats respond differently to landscape alteration for wind farm development. Suitable habitat for the Little brown myotis increased after wind turbine installation, which is likely associated with the increase in open areas and forested edges as these are preferred foraging habitats for this species (Segers & Broders, 2014). Alternatively, suitable habitat for Northern myotis bats decreased, likely due to this species' preference to forage in forested areas and around canopy covered streams (Segers & Broders, 2014). Pregnant and lactating female bats have also been shown to be sensitive to habitat degradation as their foraging ranges are more constricted due to decreased energy and caring for young (Henry et al., 2002; Segers & Broders, 2014).

The results of passive acoustic monitoring showed a high volume of bat activity and a drastic increase in activity from 2022 to 2024. Based on recorded bat activity alone, it is possible that maternity roosts of resident species exist within or near the Study Area. Most bats recorded in the Study Area are Myotis species, which typically prefer to roost in trees but may also roost in rock crevices and caves or anthropogenic features such as wood piles or structures (Fenton & Barclay, 1980; Garroway & Broders, 2008). There are no records of caves, karst, or abandoned mines within the Study Area (NSNRR, 2024a) and no incidental observations were reported during field surveys. The Study Area is also located in a "Low Risk" area for karst topography (Section 7.2) (NSNRR, 2019). Additionally, no anthropogenic structures were identified within the Assessment Area.

Large snags suitable for roosting were incidentally observed within the Study Area, primarily in association with mature forests and wetlands. Individual snags were not assessed; however, desktop and field studies were conducted for both old growth forest and wetlands within the Assessment Area. Following field assessments of potential old growth forest, no high potential stands within the Assessment Area were determined to be old growth (see Section 7.4.1.5).

Monitoring showed that most bat activity within the Study Area occurs along watercourses in or near mature forest stands. Several watercourses intersect with existing roads that are part of the Project layout and thus cannot feasibly be avoided, but these habitats are also likely to experience less additional disturbance caused by construction of the Project as they have already been impacted by human activity. Field mapped watercourses that intersect with proposed turbine pads typically occur at the edge of the Assessment Area (Drawing 7.13A-F) and may be avoided during the detailed design phase.

During field surveys, it was observed that the Assessment Area contains both areas dominated by intact forest and areas which are significantly fragmented and disturbed from previous developments, primarily forestry and recreational activities. Impacts to bats as a result of habitat fragmentation and removal are anticipated to be minimal based on widespread existing disturbance and fragmentation within the Study Area, the Project's maximized use of existing roadways, and the lack of and/or ability to avoid important bat habitat within the Assessment Area. Habitat fragmentation and removal will be associated with newly constructed roads (totaling approximately 11.2 km in length), road widening and clearing for turbine pads within the Project Area.

Injury/Mortality

Wind project related bat injuries/mortalities are increasingly becoming a concern as some researchers have highlighted that turbines could have a greater impact on bats than birds (Barclay et al., 2007). Bats have a slower life cycle than birds, resulting in impacts to population dynamics when mortalities occur, especially when populations are already small (Wellig et al., 2018). Bat injuries/mortalities can result either from a direct collision with a turbine blade or from barotrauma, which is caused by the sudden decrease in air pressure following rotating blades (ECCC, 2015a). Bats may collide with blades due to their inability to detect or avoid blades moving at high speeds, which can be up to 300 km/h at the tip (Wellig et al., 2018). In addition, research suggests that bats are attracted to wind turbines because the turbines attract insects due to their light colour, and they are often built in high places that coincide with insect hill-topping behaviours (Guest et al., 2022). Swarms of insects that occur alongside wind turbines provide an excellent foraging opportunity for bats, especially migratory species that rely on stopover sites to feed during their migrations (Guest et al., 2022). Wind turbines may also be perceived as potential mating sites or roost trees (Guest et al., 2022; Wellig et al., 2018). A study by Horn et al. (2008) found that bats actively forage near turbines during operation. During the investigation, researchers observed bats approaching both rotating and non-rotating blades, repeatedly investigating turbine elements, following or becoming trapped by blade-tip vortices, and colliding with turbine blades (Horn et al., 2008).

Long distance migrating bats including the Eastern red bat, Hoary bat, and Silver-haired bat comprise most of the reported mortalities from wind turbines due to their higher flight elevations and long migration distances (Parisé & Walker, 2017; ECCC, 2015a). In the COSEWIC Assessment and Status Report on the Hoary bat, Eastern red bat, and Silver-haired bat (Government of Canada, 2023), wind energy development was determined to have a high to very high impact, with these three species comprising approximately 75% to 80% of bat fatalities associated with wind turbines. Alternatively, *Myotis* species have lower fatality rates due to lower flight elevation and short migrating distances (ECCC, 2015a). In the Recovery Strategy for Little Brown Myotis, Northern Myotis, and Tri-colored Bat, collisions and barotrauma from wind turbines were listed as a high level of concern in areas impacted by white-nose syndrome (such as Nova Scotia), with localized seasonal impacts during the active bat season (ECCC, 2015a).

Bat activity and use of habitat within the Study Area was assessed through passive acoustic monitoring. Bat species identified during monitoring studies include *Myotis* species (i.e., Little brown myotis and/or Northern myotis), Tri-colored bat, Big brown bat, Hoary bat, Silver-haired bat, and Eastern red bat. Far fewer migratory bats were recorded within the Study Area than resident bats, with only 3% of total calls from both years (2022 and 2024) of monitoring originating from migratory species. Resident bat species are at a lower risk for turbine related injuries and mortalities due to their flight patterns typically occurring at lower elevations and thus avoiding intersection with the path of turbine blades. There were also very few migratory bats recorded within the Study Area. Therefore, there is low risk of direct injury/mortality to bats caused by the Project.

Nova Scotia does not have specific thresholds or guidance for bat activity/risk levels for proposed wind developments, and therefore, the Alberta model (Government of Alberta, 2013) was utilized to evaluate potential effects. This model uses a precautionary principle which establishes project-risk levels based on the number of bat passes per night for migratory species:

- Potentially Acceptable Risk = < one migratory bat passes per detector night
- Potentially Moderate Risk = one to two migratory bat passes per detector night
- Potentially High Risk = > two migratory bat passes per detector night

The Alberta thresholds listed above are specific to migratory bat species. Based on precautionary guidance from the Alberta Government (2013), the averages of 0.12 (2022) and 0.02 (2024) bat passes per detector night for migratory species across the Study Area would be considered a “Potentially Acceptable Risk”, which is the lowest risk threshold for bats identified. It should be noted that 24% of calls in 2024 were not able to be identified to a species level and could potentially have been generated by migratory bats. If it is assumed that all bat calls labeled as unknown (i.e., UNLO, UNHI, or UKWN) were generated by migratory bats, this would raise the average in 2024 to 1.90 bat passes per detector night. This would represent a “Potentially Moderate Risk,” however, since Myotis species (high-frequency species) were found to be abundant in the Study Area, it is likely that many of the calls labeled as UNHI were generated by Myotis species (resident species).

It should be noted that turbine pads generally avoid habitats which were associated with high call volumes during passive acoustic monitoring, such as large watercourses and riparian wetlands (Drawing 7.13A-F). The Government of Alberta (2013) also states that “Pre-construction surveys indicating less than one migratory-bat passes/detector-night (equating to less than four mortalities per turbine) suggests that bat fatality issues are unlikely; however, post-construction monitoring is required”.

Sensory Disturbance

Noise and light will be generated during all phases of the Project. During construction, decommissioning, and reclamation, noise and lighting will be generated by heavy equipment. During operations, noise and light will be generated by wind turbines. During construction and reclamation, noise will typically occur during daylight hours, therefore sensory disturbance should be limited to roosting bats. Project related effects will be associated with noise conditions that exceed those levels, whether they be cumulative or independent.

Construction noise (e.g., heavy equipment, blasting, and pile-driving) could potentially affect bats, particularly those species that roost nearby, potentially causing roost abandonment. However, bats are well adapted morphologically, physiologically, and behaviourally to avoid acoustic trauma (California Department of Transportation, 2016). Because they are often exposed to the exceptionally loud sounds of their own echolocation signals [e.g., 110 decibels (dB)], bats have evolved protective mechanisms to prevent sensory overload and damage to their auditory systems (California Department of Transportation, 2016). These mechanisms include behavioral avoidance, changing the shape and orientation of the pinnae (Wever & Vernon, 1961), closing the cartilaginous fold in the outer ear canal (Wever & Vernon, 1961), the tympanic reflex (Wever & Vernon, 1961), and resonance absorption. While these mechanisms are very effective in achieving the needed protection from constant noise exposure (i.e., in the case of wind turbines), it is speculated that these mechanisms also can prevent over exposure from sudden, unexpected anthropogenic noise shocks (e.g., blasting).

For bats, echolocation calls are in the ultrasonic range beyond the upper frequency limits of construction noise (California Department of Transportation, 2016) meaning there is effectively no echolocation masking effect from construction noise. Additionally, the usual lack of construction activity during the active bat period (30 minutes before sunset to 30 minutes after sunrise) further limits any potential masking effects in the ultrasonic ranges.

Sensory disturbance associated with lighting during the construction, operation, and decommissioning phases of the Project may also impact bat behavior. During construction and decommissioning, lighting will be a temporary source of sensory disturbance. During operation, turbine lighting will be restricted to the minimums required by Transport Canada for safety. The impacts of necessary noise and light associated with the Project on bat behaviour and movements are anticipated to be low based on the morphological adaptations and behavioural patterns of bats as well as the anticipated timing of activities that have potential to cause sensory disturbances.

Mitigation

To address the abovementioned effects to bat and bat habitat, the following mitigation measures will be implemented:

- Minimize overall area to be cleared by utilizing pre-existing roads and previously altered areas (i.e., clearcuts) when possible.
- Target clearing activities outside the active bat window (April 1 to September 30).
- Install motion activated lights on infrastructure to reduce insect attraction and subsequent attraction by bats. Motion activated lighting is only applicable to ground-based infrastructure (e.g., at doorways, the substation, etc.) as turbine lighting at the top of individual turbines is regulated by Transport Canada.
- Utilize noise controls (e.g., mufflers) on machinery, equipment, etc. during the construction phase.
- Maintain avoidance of potential bat habitat (i.e., large snags, mature forests, wetlands, and large watercourses) to the greatest extent possible.
- Revegetate roadsides and cleared areas to minimize habitat loss to the greatest extent possible.

Monitoring

A detailed Post Construction Bat Monitoring Plan will be developed and submitted to NSECC and NSNRR for review. Monitoring activities may include:

- Post-construction bat mortality monitoring.
- Adaptive management/contingency plan if post-construction monitoring identifies significant bat mortality, which would include consultation with NSNRR.

Conclusion

After mitigations, residual effects to bats are characterized as follows:

- Within the RAA.
- Moderate magnitude, as some loss of habitat and individuals will occur. Although monitoring and mitigations are expected to minimize any impacts to species, it is inherent that wind projects will result in some bat mortality.
- Medium duration, as effects extend though operation and maintenance phase.
- Continuous frequency throughout the Project lifespan.
- Reversible, as the effects will terminate at the end of the Project lifespan. Despite impacts to individual bats, the Project is not expected to cause long term, population level impacts.

Taking the above characterizations into consideration for the Project, the residual effects are considered not significant.

7.4.5 Avifauna

7.4.5.1 Overview

A desktop review, field program, and habitat modelling were undertaken to gather information on avian species and associated habitat in the Study Area. Objectives were as follows:

- Assess observations, species diversity, and habitat utilization of avian species within the Study Area during all seasons.
- Use the information collected to inform and refine the Project design (i.e., avoid impacts to SAR, SOCI, and their habitats).
- Assess migratory bird activity and assess the risk that the Project poses to migratory birds.
- Use the information collected to inform mitigation and management practices.

7.4.5.2 Regulatory Context

Applicable laws and regulations relating to the protection of avian species include the following:

- *Migratory Bird Convention Act*
- Endangered Species Act, S.N.S., 1998, c.11
- *Species At Risk Act*

The *MBCA* protects all migratory birds while they are present in Canadian Jurisdiction, including on land, in the air, and on the water. The *ESA* and *SARA* prohibit harm to listed SAR along with their habitually occupied spaces and core/critical habitat.

7.4.5.3 Desktop Review

Desktop information was utilized to gain insight into protected avifauna habitats, species utilization of the area, and to identify SOCI potentially occurring at or within the Study Area using the following sources:

- Terrestrial Habitat Mapping (Section 7.4.1)
- Important Bird Areas (IBAs) (Bird Studies Canada & Nature Canada, 2024)
- Maritimes Breeding Bird Atlas (MBBA) (Stewart et al., 2015)
- Nova Scotia Significant Species and Habitats Database (NSNRR, 2023a)
- ACCDC Data Report (ACCDC, 2024)

During GIS desktop review, a variety of publicly available provincial GIS layers were used to assess additional significant areas close to the Study Area (e.g., protected areas, wilderness areas/sanctuaries, and nature reserves).

The Study Area features softwood stands, with a few hardwood dominated slopes, and some mixed wood stands scattered throughout. Much of the forested area is managed for silviculture and has been subject to clear-cutting or thinning activities within the past decade. The varying and intense topography within the Study Area creates a variety of open water and wetland habitat as well. The diversity of habitat types, in particular the prevalence of edge/transitional habitat, provides for the foraging, breeding, and roosting requirements of a variety of resident and migratory bird species.

The closest IBA in Nova Scotia (IBA Canada, 2024) is Wedge Island, one part of the Grassy Island Complex in Mahone and St. Margaret's Bays, NS. Wedge Island lies approximately 1 km off-shore on the east side of St. Margaret's Bay, approximately 23 km southwest of the Project (Drawings 7.26 and 7.27). The Grassy Island complex has been known to serve as breeding grounds for the Roseate Tern (*Sterna dougalii*), a nationally endangered species (IBA Canada, 2024), with numbers fluctuating between the three islands since records began in the 1970s. This IBA is far enough from the Assessment Area that there are no interactions with the Project expected. Wedge Island also represents coastal island habitat, which is not representative of any habitat found within the Study Area.

Pockwock Wilderness Area, also known as Pockwock Lake Wilderness Area, borders the eastern boundary of the Study Area and is approximately 500 m to 1 km away from the nearest located Project infrastructure (Drawing 7.28). Pockwock Lake Wilderness Area protects approximately a third of the Pockwock Lake Watershed Protected Water Area, which is the main drinking water supply for Halifax, Bedford, Sackville, Fall River, Timberlea, and Waverley. This wilderness area is heavily forested with the majority being softwood forest with a variety of hardwood stands throughout (NSECC, n.d.a).

Old Annapolis Road Nature Reserve is approximately 4 km away from the western boundary of the Assessment Area, near the southern border (Drawing 7.28). This nature reserve protects three significant concentrations of old forest within this region, with both softwood and mixedwood stands of forest. This nature reserve offers old forest restoration opportunities in an otherwise disturbed and heavily forested area (NSECC, n.d.b).

Surrounding the Old Annapolis Road Nature Reserve is the Island Lake Wilderness Area, an extension of protected area, which protects a large area of softwood and mixedwood forest (Drawing 7.28). Habitats include mature forest, as well as lakes, wetlands, and watercourses, including part of the lower Ingram River (NSECC, n.d.c).

Across all three of these protected areas and nature reserves are several lakes of varying sizes. These areas also represent anthropogenic recreational opportunities such as hiking, hunting, fishing, and OHV (off-highway vehicle) use. These areas also represent habitats that are present within the Study Area for migratory birds and, despite the disturbance to habitat connectivity due to anthropogenic activities, these areas would provide a homogenous landscape for birds to move across.

The majority of the Assessment Area is contained within the map squares 20MQ25 and 20MQ26 of the MBBA (Stewart et al., 2015). In the most recent edition of the MBBA (2006-2010), 102 species were identified as being possible, probable, or confirmed breeders in square 20NR64, including 28 SOCI:

- American Kestrel (*Falco sparverius*) – “S3B” (ACCDC)
- American Robin (*Turdus migratorius*) – “S3N” (ACCDC)
- Bank Swallow (*Riparia riparia*) – “Threatened” (*SARA* and COSEWIC), “Endangered” (*ESA*), “S2B” (ACCDC)
- Barn Swallow (*Hirundo rustica*) – “Threatened” (*SARA*), “Special Concern” (COSEWIC), “Endangered” (*ESA*), “S3B” (ACCDC)
- Bay-breasted Warbler (*Setophaga castanea*) – “S3S4B” (ACCDC)
- Black-backed Woodpecker (*Picoides arcticus*) – “S3S4” (ACCDC)
- Blackpoll Warbler (*Setophaga striata*) – “S3B” (ACCDC)
- Boreal Chickadee (*Poecile hudsonicus*) – “S3” (ACCDC)
- Canada Goose (*Branta canadensis*) – “SUB” (ACCDC)
- Cape May Warbler (*Setophaga tigrina*) – “S3B, SUM” (ACCDC)
- Chimney Swift (*Chaetura pelagica*) – “Threatened” (*SARA* and COSEWIC), “Endangered” (*ESA*), “S2S3B, S1M” (ACCDC)
- Common Nighthawk (*Chordeiles minor*) – “Threatened” (*SARA* and *ESA*), “Special Concern” (COSEWIC), “S3B” (ACCDC)
- Common Tern (*Sterna hirundo*) – “S3B” (ACCDC)
- Eastern Wood-pewee (*Contopus virens*) – “Special Concern” (*SARA* and COSEWIC), “Vulnerable” (NS *ESA*), “S3S4B” (ACCDC)
- Canada Jay (*Perisoreus canadensis*) – “S3” (ACCDC)
- Long-eared Owl (*Asio otus*) – “S2S3” (ACCDC)

- Northern Goshawk (*Accipiter gentilis*) – “S3S4” (ACCDC
- Olive-sided Flycatcher (*Contopus cooperi*) – “Threatened” (*SARA*), “Special Concern” (COSEWIC), “Threatened” (*ESA*), “S2B” (ACCDC)
- Pine Grosbeak (*Pinicola enucleator*) – “S3B” (ACCDC)
- Pine Siskin (*Pinus spinus*) – “S3” (ACCDC)
- Purple Finch (*Haemorhous purpureus*) – “S3S4N” (ACCDC)
- Red Crossbill (*Loxia curvirostra*) – “S3S4” (ACCDC)
- Rusty Blackbird (*Euphagus carolinus*) – “Special Concern” (*SARA* and COSEWIC), “Endangered” (NS *ESA*), “S2B” (ACCDC)
- Scarlet Tanager (*Piranga olivacea*) – “S2B, SUM” (ACCDC)
- Spotted Sandpiper (*Actitis macularius*) – “S3S4B” (ACCDC)
- Tennessee Warbler (*Vermivora peregrina*) – “SU” (ACCDC)
- Wilson’s Snipe (*Gallinago delicata*) – “S3B” (ACCDC)
- Wilson’s Warbler (*Wilsonia pusilla*) – “SU” (ACCDC)

The NS Significant Species and Habitats database contains 43 unique records pertaining to birds and/or bird habitat (Drawing 7.27) within a radius of approximately 10 km of the Project. These records include but are not limited to:

- 10 records classified in the database as “Other Habitat”, all of which relate to Bald Eagle (*Haliaeetus leucocephalus*).
- 9 records classified as “Species of Concern”, all of which relate to Common Loon (*Gavia immer*). These habitats include Pockwock Lake, Big Indian Lake, and Sandy Lake, all within 2 km and surrounding the Study Area. In the northern part of the Study Area, Big Indian Lake is less than 100 m from the primary, already existing, access road (i.e., Pipeline Road).
- 24 records classified as “Species at Risk” which relate to Pine Siskin (1), Bay-breasted Warbler (1), Eastern Wood-Pewee (1), Boreal Chickadee (2), Canada Warbler (8), Ruby-crowned Kinglet (*Regulus calendula*) (4), Rusty Blackbird (1), Swainson’s Thrush (*Catharus ustulatus*) (4), and Yellow-bellied Flycatcher (*Empidonax Flaviventris*) (2).

The NS Significant Species and Habitats database contains 1489 unique records pertaining to birds and/or bird habitat (Drawing 7.27) within a radius of approximately 100 km of the Project. These records include but are not limited to:

- 371 records classified in the database as “Other Habitat”, most of which relate to Bald Eagle (*Haliaeetus leucocephalus*) (310).
- 200 records classified in the database as “Migratory Bird”, many of which relate to Double-crested cormorant (*Phalacrocorax auritus*) (28), Great Blue Heron (*Ardea herodias*) (28), and Common Eider (*Somateria mollissima*) (28).
- 188 records classified as “Species of Concern” many of which relate to Unclassified Tern (60) and Common Loon (*Gavia immer*) (63).
- 700 records classified as “Species at Risk” many of which relate to Yellow-bellied Flycatcher (27), Golden-crowned Kinglet (*Regulus satrapa*) (125), Ruby-crowned

Kinglet (50), Piping Plover (*Charadrius melodus*) (61), Eastern Wood-Pewee (42), and Canada Warbler (44).

The ACCDC database contains records of 115 bird species within a 100 km radius of the Study Area (Table 7.59).

Table 7.59: Bird Species Recorded within a 100 km Radius of the Study Area

Common Name	Scientific Name	*SARA* Status[1]	*ESA* Status[2]	COSEWIC Status[3]	NS S-Rank[4]
American Bittern	*Botaurus lentiginosus*	---	---	---	S3S4B, S4S5M
American Coot	*Fulica americana*	---	---	Not At Risk	S1B
American Golden-Plover	*Pluvialis dominica*	---	---	---	S2S3M
American Kestrel	*Falco sparverius*	---	---	---	S3B, S4S5M
Arctic Tern	*Sterna paradisaea*	---	---	---	S3B
Atlantic Puffin	*Fratercula arctica*	---	---	---	S2B
Baltimore Oriole	*Icterus galbula*	---	---	---	S2S3B, SUM
Bank Swallow	*Riparia riparia*	Threatened	Endangered	Threatened	S2B
Barn Swallow	*Hirundo rustica*	Threatened	Endangered	Special Concern	S3B
Barrow's Goldeneye – Eastern Population	*Bucephala islandica*	Special Concern	---	Special Concern	S1N, SUM
Bay-breasted Warbler	*Setophaga castanea*	---	---	---	S3S4B, S4S5M
Bicknell's Thrush	*Catharus bicknelli*	Threatened	Endangered	Threatened	S1B
Black Tern	*Chlidonias niger*	---	---	Not At Risk	S1B
Black-backed Woodpecker	*Picoides arcticus*	---	---	---	S3S4
Black-bellied Plover	*Pluvialis squatarola*	---	---	---	S3M
Black-billed Cuckoo	*Coccyzus erythropthalmus*	---	---	---	S3B
Black-headed Gull	*Chroicocephalus ridibundus*	---	---	---	S3N
Black-legged Kittiwake	*Rissa tridactyla*	---	---	---	S2S3B
Blackpoll Warbler	*Setophaga striata*	---	---	---	S3B, S5M
Blue-winged Teal	*Spatula discors*	---	---	---	S3B
Bobolink	*Dolichonyx oryzivorus*	Threatened	Vulnerable	Special Concern	S3B
Boreal Chickadee	*Poecile hudsonicus*	---	---	---	S3
Boreal Owl	*Aegolius funereus*	---	---	Not At Risk	S2?B, SUM

Common Name	Scientific Name	*SARA* Status[1]	*ESA* Status[2]	COSEWIC Status[3]	NS S-Rank[4]
Brant	*Branta bernicla*	---	---	---	S3M
Brown Thrasher	*Toxostoma rufum*	---	---	---	S1B
Brown-headed Cowbird	*Molothrus ater*	---	---	---	S2B
Buff-breasted Sandpiper	*Calidris subruficollis*	Special Concern	---	Special Concern	SNA
Bufflehead	*Bucephala albeola*	---	---	---	
Canada Jay	*Perisoreus canadensis*	---	---	---	S3
Canada Warbler	*Cardellina canadensis*	Threatened	Endangered	Special Concern	S3B
Cape May Warbler	*Setophaga tigrina*	---	---	---	S3B, SUM
Chimney Swift	*Chaetura pelagica*	Threatened	Endangered	Threatened	S2S3B, S1M
Cliff Swallow	*Petrochelidon pyrrhonota*	---	---	---	S2S3B
Common Eider	*Somateria mollissima*	---	---	---	S2B, S2N,S4M
Common Gallinule	*Gallinula galeata*	---	---	---	S1B
Common Goldeneye	*Bucephala clangula*	---	---	---	S4B, S4N,S5M
Common Murre	*Uria aalge*	---	---	---	S1?B
Common Nighthawk	*Chordeiles minor*	Special Concern	Threatened	Special Concern	S3B
Common Tern	*Sterna hirundo*	---	---	Not At Risk	S3B
Cooper's Hawk	*Accipiter cooperii*	---	---	Not At Risk	S1?B, SUN, SUM
Eastern Bluebird	*Sialia sialis*	---	---	Not At Risk	S3B
Eastern Kingbird	*Tyrannus tyrannus*	---	---	---	S3B
Eastern Meadowlark	*Sturnella magna*	Threatened	---	Threatened	SHB
Eastern Whip-Poor-Will	*Antrostomus vociferus*	Threatened	Threatened	Special Concern	S1?B
Eastern Wood-Pewee	*Contopus virens*	Special Concern	Vulnerable	Special Concern	S3S4B
Evening Grosbeak	*Coccothraustes vespertinus*	Special Concern	Vulnerable	Special Concern	S3B, S3N,S3M
Fox Sparrow	*Passerella iliaca*	---	---	---	S3S4B, S5M
Gadwall	*Mareca strepera*	---	---	---	S2B, SUM
Great Cormorant	*Phalacrocorax carbo*	---	---	---	S2S3B, S2S3N

Common Name	Scientific Name	*SARA* Status[1]	*ESA* Status[2]	COSEWIC Status[3]	NS S-Rank[4]
Great Crested Flycatcher	*Myiarchus crinitus*	---	---	---	S1B
Greater Yellowlegs	*Tringa melanoleuca*	---	---	---	S3B, S4M
Harlequin Duck - Eastern population	*Histrionicus histrionicus pop. 1*	Special Concern	Endangered	Special Concern	S2S3N, SUM
Horned Grebe	*Podiceps auritus*	---	---	Special Concern	S3N, SUM
Horned Lark	*Eremophila alpestris*	---	---	---	SHB, S4S5N, S5M
Hudsonian Godwit	*Limosa haemastica*	---	---	Threatened	S2S3M
Indigo Bunting	*Passerina cyanea*	---	---	---	S1?B, SUM
Ipswich Sparrow	*Passerculus sandwichensis princeps*	Special Concern	---	Special Concern	S1B
Killdeer	*Charadrius vociferus*	---	---	---	S3B
Lapland Longspur	*Calcarius lapponicus*	---	---	---	S3?N, SUM
Laughing Gull	*Leucophaeus atricilla*	---	---	---	SHB
Leach's Storm-Petrel	*Hydrobates leucorhous*	---	---	Threatened	S3B
Least Bitten	*Ixobrychus exilis*	Threatened	---	Threatened	SUB
Least Sandpiper	*Calidris minutilla*	---	---	---	S1B, S4M
Lesser Yellowlegs	*Tringa flavipes*	---	---	Threatened	S3M
Long-eared Owl	*Asio otus*	---	---	---	S2S3
Marsh Wren	*Cistothorus palustris*	---	---	---	S1B
Nelson's Sparrow	*Ammospiza nelsoni*	---	---	Not At Risk	S3S4B
Northern Gannet	*Morus bassanus*	---	---	---	SHB
Northern Goshawk	*Accipiter gentilis*	---	---	Not At Risk	S3S4
Northern Mockingbird	*Mimus polyglottos*	---	---	---	S1B
Northern Pintail	*Anas acuta*	---	---	---	S1B, SUM
Northern Shoveler	*Spatula clypeata*	---	---	---	S2B, SUM
Northern Shrike	*Lanius borealis*	---	---	---	S3S4N
Olive-sided Flycatcher	*Contopus cooperi*	Special Concern	Threatened	Special Concern	S3B
Pectoral Sandpiper	*Calidris melanotos*	---	---	---	S3M
Peregrine Falcon - anatum/tundrius	*Falco peregrinus pop. 1*	---	Vulnerable	Not At Risk	S1B, SUM

Common Name	Scientific Name	*SARA* Status[1]	*ESA* Status[2]	COSEWIC Status[3]	NS S-Rank[4]
Philadelphia Vireo	*Vireo philadelphicus*	---	---	---	S2?B, SUM
Pine Grosbeak	*Pinicola enucleator*	---	---	---	S3B, S5N, S5M
Pine Siskin	*Spinus pinus*	---	---	---	S3
Pine Warbler	*Setophaga pinus*	---	---	---	S2S3B, S4S5M
Piping Plover melodus subspecies	*Charadrius melodus melodus*	Endangered	Endangered	Endangered	S1B
Purple Martin	*Progne subis*	---	---	---	SHB
Purple Sandpiper	*Calidris maritima*	---	---	---	S3S4N
Razorbill	*Alca torda*	---	---	---	S2B
Red Crossbill	*Loxia curvirostra*	---	---	---	S3S4
Red Knot rufa subspecies	*Calidris canutus rufa*	Endangered	Endangered	Endangered	S2M
Red Phalarope	*Phalaropus fulicarius*	---	---	---	S2S3M
Red-breasted Merganser	*Mergus serrator*	---	---	---	S3B,S4S5N,S5M
Redhead	*Aythya americana*	---	---	---	SHB
Red-necked Phalarope	*Phalaropus lobatus*	Special Concern	---	Special Concern	S2S3M
Roseate Tern	*Sterna dougallii*	Endangered	Endangered	Endangered	S1B
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	---	---	---	S3B
Rough-legged Hawk	*Buteo lagopus*	---	---	Not At Risk	S3N
Ruddy Duck	*Oxyura jamaicensis*	---	---	---	S1B
Ruddy Turnstone	*Arenaria interpres*	---	---	---	S3M
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Endangered	Special Concern	S2B
Sanderling	*Calidris alba*	---	---	---	S2N, S3M
Scarlet Tanager	*Piranga olivacea*	---	---	---	S2B, SUM
Semipalmated Plover	*Charadrius semipalmatus*	---	---	---	S1B, S4M
Semipalmated Sandpiper	*Calidris pusilla*	---	---	---	S3M
Short-billed Dowitcher	*Limnodromus griseus*	---	---	---	S3M
Short-eared Owl	*Asio flammeus*	Special Concern	---	Threatened	S1B
Spotted Sandpiper	*Actitis macularius*	---	---	---	S3S4B, S5M
Surf Scoter	*Melanitta perspicillata*	---	---	---	S2N,S4M

Common Name	Scientific Name	*SARA* Status[1]	*ESA* Status[2]	COSEWIC Status[3]	NS S-Rank[4]
Tennessee Warbler	*Leiothlypis peregrina*	---	---	---	S3S4B, S5M
Turkey Vulture	*Cathartes aura*	---	---	---	S2S3B, S4S5M
Vesper Sparrow	*Pooecetes gramineus*	---	---	---	S1S2B, SUM
Virginia Rail	*Rallus limicola*	---	---	---	S2S3B
Warbling Vireo	*Vireo gilvus*	---	---	---	S1B, SUM
Whimbrel	*Numenius phaeopus hudsonicus*	---	---	---	S2S3M
Willet	*Tringa semipalmata*	---	---	---	S3B
Willow Flycatcher	*Empidonax traillii*	---	---	---	S2B
Wilson's Snipe	*Gallinago delicata*	---	---	---	S3B, S5M
Wilson's Warbler	*Cardellina pusilla*	---	---	---	S3B, S5M
Wood Thrush	*Hylocichla mustelina*	Threatened	---	Threatened	SUB

Source: ACCDC 2024a
[1]Government of Canada 2023; [2]NS *ESA* 2017; [3]COSEWIC 2024; [4]ACCDC 2024b

7.4.5.4 Field Survey Methodologies

Several types of survey methods were employed to assess the avian species using the Study Area throughout the year. Survey methods were based on the protocols recommended in the document Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds (CWS, 2007), unless otherwise stated. Various CWS environmental guidance documents and updates for environmental assessments for wind turbines and birds were also reviewed during survey design.

Regulatory engagement (i.e., with NSNRR and CWS) started in 2022 and continued into the 2024 season to discuss scoping and methodology for avian surveys and to incorporate recommendations as appropriate.

Habitat descriptions for survey locations are included in Appendix J. Note that weather conditions for survey dates are also included in Appendix J. Refer to Drawing 7.29 for all survey locations.

Point Counts

Point count surveys were used as the primary means of identifying species in the Study Area through all seasons (i.e., spring, summer, fall, and winter). Point counts were 10 minutes in duration and were completed at predetermined locations. All visual and auditory observations of birds were recorded for each point count location, along with relevant behavioural information, such as breeding evidence. Point count locations were determined using terrestrial habitat resources (Section 7.4.1) and in consultation with an experienced birder, with the objective of representing the diversity of habitat within the Study Area. The estimated distance to target, direction, and number of species is recorded, while the observer remains still and silent for the duration of the survey interval. Surveys were completed from 30 minutes before, through 4 hours after dawn in any given season to observe the most active time of day for passerine species. Survey opportunities were maximized for clear weather (i.e., low or no precipitation) and minimal wind within the appropriate timeframe. Habitat data was also collected at each point count location. Incidental observations occurred outside of the allotted point count time duration and/or outside of designated point count locations and radius (i.e., approximately 250m).

Nocturnal Owl and Nightjar Surveys (2022 and/or 2024)

Nocturnal owl surveys were conducted in 2024 and completed at predetermined locations throughout the Study Area. Survey protocol followed the Nova Scotia Nocturnal Owl Survey (ECCC, 2019a). Survey duration was nine and a half minutes which consist of a standard owl playback survey which consists of silent listening periods, Barred Owl calls, and Boreal Owl calls (ECCC, 2019a). Surveys were conducted for a half hour after sunset until all the points were completed. Nights were chosen with low wind and no precipitation.

Nightjar surveys were conducted in 2022 and 2024 following the Canadian Nightjar Survey Protocol (Knight et al, 2019). All birds heard or observed were recorded with information on direction, behaviour (if applicable) and distance from the observer. Survey duration was 6 minutes. Surveys were conducted from dusk until 2 hours after dusk on clear nights with minimal wind and no precipitation.

Diurnal Watch Surveys (2022 and 2024)

Diurnal watch surveys were completed to assess the movement of birds within the Study Area during the day. The 2022 and 2024 diurnal watch surveys were completed for 30 and 90 minutes, respectively. The diurnal watch survey time duration was increased in 2024 owing to regulatory updates and recommendations, as well as reviewing other wind project environmental assessment avian methods. These surveys were completed in the late morning into early afternoon. Observations on the movement of birds were recorded, including bearing from the observer, distance to the target, the direction that the target was moving, its passing height, and any other behavioural notes. Ideal vantage points include wide vantage points and unobstructed views of the sky, including overlooking the proposed turbine locations and lakes were chosen for watch surveys. Data recording methods were similar to that of point count surveys, with a focus on fly-over activity.

Fall Migration Season Bird Surveys (2022 and 2024)

Fall migration surveys were used in tandem with spring migration surveys to determine the migratory species that are moving through or over the Study Area, though at a different time of year. In Nova Scotia, the fall migration period lasts from late August through late October for most species. These surveys included point counts and diurnal watches.

Winter Bird Surveys (2022 and 2024)

Winter bird surveys were completed to establish the species and distribution of resident birds through the winter season. These surveys were conducted in February and March and included point counts.

Spring Migration Season Bird Surveys (2022 and 2024)

Spring migration surveys were completed to inventory species migrating through or over the Study Area. The spring migratory period runs from early April through early June for most species, and surveys included point counts, and diurnal watch surveys.

Breeding Bird Surveys (2022 and 2024)

Breeding bird surveys were completed to inventory avian species and assess their breeding activity within the Study Area during the breeding season. In Nova Scotia, the core breeding season for migratory species runs from early June to late July for most species. In 2022 only point counts were conducted. However, in 2024, breeding bird surveys were conducted using a combination of point count surveys and area searches. Area searches were completed in suitable avian breeding habitat throughout the Study Area with the intention of providing data on avian abundance and breeding status. Area searches were completed from late morning, after the morning point count surveys, to early afternoon throughout the breeding season. Area searches consisted of an experienced birder walking in suitable breeding bird habitat for SAR species previously identified for the Study Area and recording all species identified via audio or visual and recording the breeding status according to the MBBA guidance (e.g., observed, possible, probable, or confirmed breeders) (Stewart et al., 2015). The breeding evidence codes utilized in the MBBA were utilized to make the determination of breeding status (Stewart et al., 2015). Breeding evidence was also recorded during all other survey types outside of the breeding season.

To add context to the varying survey years described above, a full year of field bird surveys were completed in 2022 to support the original Project layout. These locations are primarily along the access roads for the new layout. Although the point count locations do not provide direct coverage at individual turbine locations, these surveys provide migratory species presence throughout the Study Area which can be compared to habitats specific to turbine locations. Spring migration and breeding bird surveys completed in 2024 at the new turbine locations were aimed to provide supplementary information pertaining to specific migratory and breeding habitat within the vicinity of turbines. Due to access and safety constraints, acoustic monitors were also deployed to capture data near turbines that could not feasibly be accessed as part of a normal point count survey.

7.4.5.5 SAR Habitat Modelling Methodology

Based on the variety of avian SAR observed within the Study Area and regulatory recommendations, habitat modelling was completed for these species.

Habitat modelling for SAR observed and heard during field and radar/acoustic surveys (i.e., priority species that may be breeding within the Study Area) was completed. Breeding habitat preferences for these species were incorporated into a GIS model, which was used to estimate the quality and quantity of breeding habitat for each species. The model criterion for each species is summarized below. Results of each model can be reviewed in Drawings 7.30 to 7.38.

Barn Swallow

Barn Swallows forage over a wide range of open and semi-open habitats including natural and anthropogenic environments. They adapt often to nesting on anthropogenic structures such as bridges which were identified in the Study Area and buffered 600 m to allow for their respective foraging range. Open wetlands and open landcover types (e.g., Blueberries or Barren, Brush, Harvests, Urban, Landfill, Quarry, Transport Corridor, Utility Corridor, Water) were considered as valuable habitat in terms of foraging and added (NSNRR, 2020c).

Bobolink *(Dolichonyx oryzivorus*)

Habitat at Melvin Lake does not meet the grassland habitats that can be described by vegetation association (e.g., grass) as well as by land use (e.g., grasslands and pasture) as criteria referenced in the recovery plan. Noted also as open habitats where the combined coverage of trees and tall shrubs (over 1 m) is less than 60%, but not defined on map (ECCC, 2022b).

Canada Warbler

To account for moist forests with a dense, deciduous shrub layer, complex understory, and available perch trees the WAM was filtered to include values up to (0.5m). Forest data was queried to include the FORNON code of 39 which is an area where in part Alders compose 75% or more crown closure. The leading species (SP1) attributes of RM (Red Maple), BF (Balsam Fir), and BS (Black Spruce) were used. Furthermore, to account for wetland features and their respective edge habitat, the Canadian Wetland Inventory (CNWI) data was included (ECCC, 2016a).

Note that including mixedwood and deciduous stands with tall trees (> 12 m) would add significant amounts of habitat and likely cause an over estimation, which is why they were excluded from the model.

Chimney Swift (Chaetura pelagica)

Habitat characteristics that are preferred for Chimney Swift are mainly urban areas that have access to chimneys, grain towers, or other form of cavity. Rural forested areas are atypical; however, cavities are mainly found in dead trees/forest and windthrow areas which can be habitable by Chimney Swifts. There were no such areas identified in the Nova Scotia forestry and landcover datasets within the Study Area. Chimney swifts are also known to inhabit cavities in trees that have a diameter above 50 cm. All treed stands in the Study Area have an average total diameter (AVDI) below 50 cm and therefore were not included as a parameter in the analysis. Due to the observation of Chimney Swift in the Study Area, areas of dead stands were mapped for reference. Areas within 300 m of wetlands were also mapped because 3/5 main insect orders consumed by the Chimney Swift are associated with wetlands (NSNRR, 2007, ECCC, 2007). Dead trees with developed cavities may also exist within wetlands due to the elevated water table (NSNRR, 2023b).

Note that the habitat model is likely an over estimation due to the difficulty of filtering for old growth forest as well as hallowed out snags, as well as not being able to identify trees with a DBH of 50 cm at a desktop level.

Common Nighthawk

Open ground/clearings for nesting and foraging (i.e., sandy areas, open forests, grasslands, wetlands, barrens and other rocky areas) were considered by manual classification. A buffer of 10 m was included on the road network/unpaved forestry roads. The nearby quarry may be appropriate habitat. The CNWI was filtered to include only open wetland types (e.g., Bog, Bog or Fen, Fen, Marsh). The land cover types of 'Urban, Landfill, Quarry, Transport Corridor', 'Utility Corridor', or 'Blueberries or Barren' were filtered (ECCC, 2016c).

Eastern Wood-Pewee

All hardwood dominated stands were included from the land cover dataset. In addition, SP1 was filtered based on all hardwood species with the criteria of crown closure being less than 30. Species listed below from query based on codes: SP1 IN ('TA', 'AS', 'BC', 'BE', 'BP', 'WE', 'GB', 'YB', 'WB', 'IW', 'RO', 'RM', 'SM', 'TH', 'IH', 'OH', 'UH', 'UC', 'WI') And CRNCL <= 30 (ECCC, 2023).

Note that, due to the low observation number of this species in the Study Area, the model focused on breeding/nesting habitat rather than the versatility of this species' foraging habitat (e.g., clear-cuts, edge habitat).

Evening Grosbeak (*Coccothraustes vespertinus*)

The forest inventory was used where the leading species (SP1) matched the attribute of TA (Large Tooth Aspen, and Trembling Aspen). None of the latter were found in the Study Area. Since nesting occurs in large mature mixedwood stands with high % of fir, spruce, tamarack, pine, and aspen these were filtered this from SP1 to include all pine, fir, and spruce species in addition to tamarack that composed greater than 50% but less than 70% of a given stand. Species listed below from query based on codes: SP1 IN ('TL', 'AP', 'JP', 'RP', 'SP', 'WP', 'BF', 'DF', 'BS', 'NS', 'RS', 'SS', 'WS', 'XS') And SP1P IN (5, 6, 7). Harvests were included from the land cover dataset (ECCC, 2022c).

Olive-sided Flycatcher

Forest data queried to include the leading species (SP1) attribute of BS (black spruce), RS (red spruce), WS (white spruce), SP (scots pine), RP (red pine), JP (jack pine), and EH (eastern hemlock), if present. Harvest land cover class was included as well as the CNWI data. Burn data was also included as habitat but no burn areas have been recorded in the Study Area. The nearest burn area is ~ 2.2 km from the edge of the Study Area (ECCC, 2016b).

Rusty Blackbird

The forest inventory data was filtered based on potential wet softwood forests (e.g., fir and all spruce near water bodies or wetlands). The codes used were BF (Balsam Fir), NS (Norway Spruce), RS (Red Spruce), and WS (White Spruce). To capture wet areas containing the softwood specified and potential softwood dominated treed swamps the forestry data was intersected with wet areas mapping of 50 cm or less and the Canadian Nation Wetland Inventory database (ECCC, 2015b).

7.4.5.6 Remote Sensing Methodology

Avian Radar System Deployment

Avian radar assessments were undertaken during the 2022 and 2023 spring and fall migratory periods. Radar was not deployed in 2024. The avian radar system (ARS) was deployed from April 26 to June 30 and August 11 to October 31 in 2022 as well as March 23 to November 22 in 2023. During the deployment period, one Simrad Halo 20 pulse compression marine surveillance radar was used and was angled diagonally at 45° above the horizon. The ARS consists of two x-band pulse-compression surveillance radars oriented specifically to scan the airspace approximately 50 m to 600 m above the Project. The diagonal orientation allowed for a 180° scan of the airspace above the radar while the 180° below the radar is blanked. The diagonal orientation also allows for the calculation of the height of any potential avian target.

An off grid 12V system was designed for optimal active monitoring and specificity in deployment. It was designed to charge and store energy using solar panels and a battery bank, while also powering the radar and associated equipment for data collection and remote communications.

A central location within the Project was chosen for the deployment of the ARS directly to the east of Sandy Brook during both the 2022 and 2023 ARS deployment, albeit minor adjustments during the 2023 monitoring period to reduce trees interference (Drawing 7.29B). This location provided a good line of site (relatively few trees in the immediate areas) into the airspace above the Project as well as southern exposure for solar charging sufficient cellular and satellite coverage for remote communications, and accessibility for spot checks. The ARS was mounted off the ground (approximately 3 m) to minimize ground noise interference and lessen the impacts of local microtopography on data collection and clarity.

Avian Radar Assessment

Avian radar assessment results were processed using the radR platform, an open-source platform designed for the processing of radar data for biological applications (Taylor et al., 2010). Outputs from this platform were then analyzed using Microsoft Excel. Standard settings for the identification of biological targets (BTs), such as birds and bats, were used. Targets reflected by the radar generated blips in the image of the radar scan. The radR platform helps filter sequential images of radar scans to identify blips that occur in the same area over at least four out of five scans. Should these constraints be met, a target is generated. BTs are most likely generated by birds, but could also be bats and insects, or even drones and planes.

Weather occurrences, such as fog, rain, and low cloud cover, may cause interference with the radar (similarly to weather radar), which lowers the effectiveness of the system and reduces the reliability of the system's ability to detect birds. As such, data was excluded from the analysis when the minimum hourly rainfall was ≥ 0.5 mm. Rainfall data was obtained from ECCC's Bedford Range Weather Station.

7.4.5.7 Avian Acoustic Assessment Methodology

Avian acoustic data was collected in 2022, 2023, and 2024. During the 2022 monitoring period, one Wildlife Acoustic SM4 monitor was deployed within the Study Area during the spring (April 26 to June 30, 2022) and the fall (August 11 to October 31, 2022). During the 2023 monitoring period, one Wildlife Acoustic SM4 was deployed in tandem with the 2023 ARS from March 23, 2023, to November 22, 2023 (Drawing 7.29B). The monitor was programmed to record from dusk until dawn with the intention of recording the vocalizations for analysis of species activity during peak seasons.

During the 2024 monitoring period, AudioMoths were deployed throughout the Study Area collecting avian acoustic data starting from April 24, 2024, until mid-November 2024 (Drawings 7.29A, 7.29B, and 7.29C; Table 7.60). Due to the timing of the publication of the EA, data analysis only includes data collected up until the end of October 2024. AudioMoths deployed in 2024 were used in place of point count surveys and deployed in more remote areas with difficult access or in cases where SAR birds were detected. Eleven AudioMoths were deployed during the spring and 16 were deployed in the summer and fall seasons (Drawings 7.29A, 7.29B, and 7.29C; Table 7.60). The reason for the difference in monitor numbers between seasons is that during the spring migration, field staff were having navigation and access issues within the Study Area due to dangerous terrain and intense topography. Strum was also waiting for more monitors to arrive from the AudioMoth manufacturer. During the summer and fall, five additional AudioMoth monitors were acquired and placed in areas with better access to cover more of the Study Area for a total of 16 monitors. More detail, including any constraints and/or technical difficulties, will be provided in the results section.

Table 7.60: 2024 AudioMoth Deployments

Season	Dates Collecting Data	# Monitors Deployed
Spring	May 1 to June 1, 2024	11
Summer	June 3 to July 18, 2024*	16
Fall	August 16 to October 27, 2024**	16

*The data gap between July 18 and August 16 was the result of technical difficulties.
**Data collection continued into November, however due to the timing of the EARD, data analysis will include data collected up until the end of October 27.

7.4.5.8 Avian Acoustic Monitor Processing

Acoustic data collected from the Wildlife Acoustic SM4 monitors between 2022 and 2023 were run through two software programs specializing in the detection and classification of avian acoustics. The programs included BirdNET and Nighthawk. The software program Cornell's Raven Pro software (version 1.6) (Raven Pro) was used as a platform to process the data.

Raven Pro is a software tool designed for visualizing, measuring, and analyzing sound. Avian calls and songs are displayed in spectrograms and can be verified via the spectrogram and the audio. Data collected from AudioMoths deployed in 2024 were processed manually via audio by individuals trained in avian acoustic identification.

Overall, it is important to note that weather conditions can be a cause for constraints regarding detections. Most migrants tend to arrive in a handful of waves, and so if weather conditions are not permissive for detection, then it is possible to miss the optimal migratory window where peak migration occurs (Waters, 2024). Weather data is provided in Appendix J.

BirdNET

BirdNET was run on the 2022 and 2023 data for the Project. BirdNET is a sound ID acoustic analysis software which is an artificial neural network derived from the Cornelle Lab of Ornithology. BirdNET can detect over 3,000 species globally and was programmed to use eBird as its occurrence mask. This software produces species classification and assigns a confidence score to each detection (ranging from 0 to 1). It is assumed that this program is focused on daytime songs and calls and less focused on night flight calls (NFCs). BirdNET was programmed to only focus on SAR and SOCI species potentially present in Canada, filtering out non-SAR and SOCI avifauna and those that are unlikely to be observed. Thus, this process reduces the potential for false detections and classification of species that do not occur in this region. If any outlier species were detected by expert annotators during manual verification, these species were accounted for in the results section.

BirdNET was originally programmed with a confidence score floor of 0.3 to help filter out the abundance of false positive detections. False detections made by BirdNET are likely due to a combination of factors, including an oversensitivity of the software in conjunction with environmental noise (i.e., wind, rain, and ambient noise). BirdNET can single out birds within the dataset. However, the program can sometimes divide individual songs into pieces and attempt to categorize the subdivided pieces into a completely new species, which is why manual verification is necessary. The software was further programmed to collect songs and calls all day, but it does not prioritize collecting NFCs.

BirdNET results were handed off to experienced birders to complete a manual verification by spectrogram interpretation and listening to recordings. Manual verifications of the BirdNET results were completed using Raven Pro. Experienced birders listened to the vocalizations and annotated detections as true, if the software correctly identified the species, or false, if the identification was incorrect. This manual verification was applied to all detections of SAR and SOCI species.

The manual verifications were then fed into a logistic regression model custom-built by Strum using Python programming language. This model was built following guidelines outlined on the Cornell Lab website (Symes et al., 2023). The model was able to generate a probability of a correct classification for any given confidence score for each species classified. It should be noted that in instances where all manual verifications were either affirming (the verifier agreed with all or nearly all of BirdNET's classifications) or dissenting (the verifier did not agree with all or nearly all of BirdNET's classifications), the model was unable to run (the model requires at least two affirming and dissenting verifications to function). Instead, these outcomes were assumed to be either correct or incorrect with a 100% probability. The probability scores were then related to their corresponding confidence scores that BirdNET created. This allowed for the sorting of all calls, verified or not, which achieved a probability of a correct classification greater than 90% to be included in the analysis (Table 1, Appendix J).

The parameters used for the BirdNET detection included:

- Frequency range: 250 – 12000 Hz
- Length of detection: 3 s
- Minimum confidence score: 0.3

Nighthawk

Nighthawk was also run on the 2022 and 2023 acoustic data for the Project. Nighthawk is a machine-learning model for the detection and classification of NFCs in the Americas. It can detect 82 species of avifauna (Table 2, Appendix J) (Van Doren et al., 2023). Nighthawk was programmed to only collect data one hour after sunset and one hour before sunrise.

Nighthawk software can identify vocalizations at the group or family level in instances where it cannot confidently identify at the species level. This is useful because NFCs make it particularly difficult to discern between different species. Nighthawk can also categorize NFCs by vocalization type. For example, a 'ZEEP' call is a vocalization produced by a subset of similar sounding warblers. Nighthawk semi-expertly identifies NFCs, with a strength for warblers and sparrows. The program is excellent at picking out isolated calls uttered by birds in flight, but its weakness is songs and elaborate soundspaces. For bird songs, the program often identified all spectrographs present regardless of its confidence, leading to misidentified species and inorganic-sounding NFCs.
Nighthawk was run in its own computer programming environment using Python programming language at default settings and allowed to detect and classify NFCs throughout the acoustic monitoring period. Nighthawk is innately capable of generating probability scores for its detections. A sub-section of the NFCs detected by Nighthawk were manually verified by environmental scientists with bird identification experience to determine the accuracy of the probability assignments. Manual verifications of the Nighthawk results were completed using Cornell's Raven Pro software (version 1.6).

Based on qualitative determination, Nighthawk was seen as being reasonably accurate for general species and efficient at detecting SAR and SOCI presence. All classifications above an 80% probability score were used for this analysis.

The parameters used for the Nighthawk detection included:

- Model sample rate: 22050 Hz
- Model input duration: 1 s
- Hop size: 20% (percentage of the model input duration)
- Length of detections: 0.2 s

AudioMoth Manual Listening

AudioMoths were used in 2024 in place of point count locations at select locations that could not feasibly be access as part of a normal point count survey (due to safety and access considerations), three dates were selected for manual listening (if there was data recorded representing three dates), whenever possible, for each season the monitor was deployed (i.e., spring, summer, and fall). Reasons for gaps in data are provided in the results section (7.4.5.14). A 10-minute segment was listened to manually in the morning, between 7:00 and 7:40 am, as well as a 10-minute period in the evening between 8:00 and 9:20 pm. Ideal weather conditions were filtered using the Bedford Range ECCC station (see Appendix J). Whenever possible, days with low wind and low amount of precipitation were selected. There were limitations regarding sound quality during this process, including sound inference from humans, frogs, and other wildlife in the area (i.e., deer, bears, etc.).

7.4.5.9 Field Survey Results

Throughout the field survey results section, bird numbers were analyzed based on functional bird groups to understand how each group uses the Study Area. These functional groups include:

1. Waterfowl: Ducks, geese, or other large aquatic birds, especially when regarded as game.
2. Shorebirds: Waders, from the Order Charadriiformes.
3. Other waterbirds: Includes seabirds (i.e., marine birds), grebes (Order Podicipediformes), loons (Order Gaviiformes), Ciconiiformes (i.e., storks, herons, egrets, ibises, spoonbills, etc.), pelicans (Order Pelicaniformes), flamingos (Order Phoenicopteriformes), Gruiformes (i.e., cranes and rails), kingfishers, and dippers (the only family of passerines considered waterbirds).
4. Diurnal Raptors: Birds within the families Accipitridae (i.e., hawks, eagles, buzzards, harriers, kites, and old-world vultures), Pandidonidae (i.e., osprey), Sagittariidae (i.e., secretary bird), Falconidae (i.e., falcons, caracaras, and forest falcons), Cathartidae (i.e., new world vultures), and one species from the Order Strigiformes (i.e., hawk owl).
5. Nocturnal Raptors: Birds of the Order Strigiformes (i.e., owls; with exception of the hawk owl, which is a diurnal species of owl).
6. Passerines: Any bird of the Order Passeriformes, which includes more than half of all bird species. This is with exception of the dippers, which are a passerine considered a waterbird.
7. Other Landbirds: Birds within the Orders Galliformes (i.e., quail, pheasant, and grouse), Columbiformes (i.e., pigeons and doves), Cuculiformes (i.e., cuckoos), Caprimulgiformes (i.e., nighthawks and whip-poor-wills), Apodiformes (i.e., swifts and hummingbirds), and Piciformes (i.e., woodpeckers, flickers, and sapsuckers).

2022 Winter Surveys

Winter surveys were completed on February 6, 7, 20, and 21, 2022; and March 17, and 18, 2022. The surveys included 71 10-minute point counts across 24 locations (Drawings 7.29A, 7.29B, and 7.29C). A total of 25 confirmed species, comprising 233 individual birds, were observed (Table 7.61; Tables 3/4, Appendix J). Black-capped Chickadee (*Poecile atricapilla*), Common Raven (*Corvus corax*), and Red-breasted Nuthatch (*Sitta canadensis*) were the most abundant and commonly observed species. Passerines, the majority being year-round residents, accounted for 88.4% of the individual birds, and 72% of species observed.

Table 7.61: Total Observations by Bird Group – 2022 Winter Bird Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	1	1
Shorebirds	2	0	0
Other Waterbirds	3	0	0
Diurnal Raptors	4	1	1
Nocturnal Raptors	5	2	1
Passerines	6	206	18
Other Landbirds	7	23*	4
Total		**233**	**25**

*One unidentified woodpecker was observed (Other Landbirds)

Five SOCI were observed during the 2022 winter surveys: American Robin (*Turdus migratorius*), Boreal Chickadee, Canada Jay, Northern Shrike (*Lanius borealis*), and Red Crossbill. No SAR were detected. Species diversity was observed to be low during the winter surveys compared to other seasons.

2022 Spring Migration Surveys and Diurnal Raptor Surveys

Spring surveys were completed within the Study Area on April 6, 7; and May 1, 7, 16, and 20, 2022. The surveys included 71 10-minute point counts, and 12 60-minute diurnal watches.

A total of 54 confirmed species, comprising 803 individual birds were observed in the Study Area during spring migration point count surveys (Table 7.62; Tables 5/6, Appendix J) completed on April 6, 7; and May 1, 7, 16, and 20, 2022 (Drawings 7.29A, 7.29B, and 7.29C). American Robin and White-throated Sparrow (*Zonotrichia albicollis*) were the most frequently and abundantly observed species. Passerines accounted for 90.2% of the individual birds and 75.9% of the species observed.

Table 7.62: Total Observations by Bird Group – 2022 Spring Migration Point Count Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	22*	3
Shorebirds	2	0	0
Other Waterbirds	3	5	2
Diurnal Raptors	4	1	1
Nocturnal Raptors	5	0	0
Passerines	6	725	41
Other Landbirds	7	50**	7
Total		**803**	**54**

*One unidentified small duck was observed (Waterfowl)
**Seven unidentified woodpeckers were observed (Other Landbirds)

SOCI encountered throughout the 2022 spring migration point counts included American Robin, Boreal Chickadee, Bufflehead (*Bucephala albeola*), Cape May Warbler, Canada Jay, Pine Siskin, Purple Finch, and Red Crossbill. SAR encountered included Canada Warbler and Olive-sided Flycatcher.

A total of 13 species comprising 42 individual birds were observed in the Study Area during spring migration diurnal watch surveys (Table 7.63; Tables 7/8, Appendix J) completed on April 7; and May 1, 7, and 20, 2022 (Drawings 7.29A, 7.29B, and 7.29C). Bald Eagle was the most frequently and abundantly observed species. Several soaring species were observed, including four diurnal raptor species, though no large flocks of migrating waterfowl were observed. Passerines accounted for 32.6% of individual birds, and 69.2% of species observed.

Table 7.63: Total Observations by Bird Group – 2022 Spring Migration Diurnal Watch Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	0	0
Shorebirds	2	0	0
Other Waterbirds	3	0	0
Diurnal Raptors	4	27	4
Nocturnal Raptors	5	0	0
Passerines	6	15*	9
Other Landbirds	7	0	0
Total		**46****	**13**

*Four passerines observed could only be identified to group
**Six unidentified large and small soaring birds were observed

SOCI observed during the 2022 spring migration diurnal watch surveys included Boreal Chickadee, Pine Siskin, Red Crossbill, and Turkey Vulture (*Cathartes aura*). Olive-sided Flycatcher was the only SAR species encountered during diurnal watch surveys in 2022.

Throughout the 2022 spring migration surveys, no large flocks of migratory waterfowl or shorebirds were observed, though several soaring species were observed.

During the 2022 spring migration surveys, the following species were identified as potentially breeding in the Study Area: Canada Goose and Bald Eagle.

2022 Breeding Bird Surveys

Breeding bird surveys were conducted within the Study Area on June 2, 7, 27 and 30, 2022. In total, 55 10-minute point counts were completed across the Study Area covering a wide range of habitat types and spatial distribution (Drawings 7.29A, 7.29B, and 7.29C). A total of 919 individual birds, representing 61 species, were observed (Table 7.64; Tables 9/10, Appendix J). The most abundant and frequently observed species were the Black-throated Green Warbler (*Dendroica virens*) and White-throated Sparrow. Passerines accounted for 94% of the species and 83.6% of the individual birds observed.

Table 7.64: Total Observations by Bird Group – 2022 Breeding Bird Point Count Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	6	1
Shorebirds	2	0	0
Other Waterbirds	3	5	2
Diurnal Raptors	4	2	2
Nocturnal Raptors	5	0	0
Passerines	6	864	51
Other Landbirds	7	42	5
Total		**919**	**61**

SOCI observed during the 2022 breeding surveys included American Robin, Bay-breasted Warbler, Blackpoll Warbler, Boreal Chickadee, Canada Jay, Pine Siskin, Purple Finch, and Red Crossbill. SAR encountered included Canada Warbler, Common Nighthawk, Eastern Wood-Pewee, and Olive-sided Flycatcher.

During the 2022 spring migration surveys, the following species were identified as breeding in the Study Area: Hairy Woodpecker, Song Sparrow, Blackburnian Warbler, Common Yellowthroat, Winter Wren, Hermit Thrush, Northern Flicker and the following species as potentially breeding: Belted Kingfisher, Dark-eyed Junco (*Junco hyemalis*), and Common Nighthawk. Further detail will be provided in the probable and confirmed breeding section below.

2022 Nightjar Surveys

Two nightjar surveys were completed on July 7 and 15, 2022, during the breeding season. Eighteen 6-minute point counts were completed throughout the Study Area (Drawings 7.29A, 7.29B, and 7.29C), with 16 individual birds representing two species observed (Table 7.65; Tables 11/12, Appendix J). Common Nighthawk and Common Loon were the only two species identified, and Common Nighthawk was the only SAR observed during these surveys. During the 2022 nightjar surveys Common Nighthawk were observed as potentially breeding in the Study Area. Further detail will be provided in the probable and confirmed breeding section below.

Table 7.65: Total Observations by Bird Group – 2022 Nightjar Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	0	0
Shorebirds	2	0	0
Other Waterbirds	3	1	1
Diurnal Raptors	4	0	0
Nocturnal Raptors	5	0	0
Passerines	6	15	1
Other Landbirds	7	0	0
Total		**16**	**2**

2022 Fall Migration Surveys and Diurnal Raptor Surveys

Fall migration surveys were completed on September 21 and 30, and October 8, 9, 17, and 20, 2022. The surveys included 72 10-minute point counts and thirteen 60-minute diurnal watches.

A total of 45 confirmed species, comprising 667 individual birds, were observed during the fall migration point count surveys (Table 7.66; Tables 13/14, Appendix J). Surveys were completed across a wide range of habitats, spatially distributed throughout the Study Area on September 21 and 30, and October 8, 9, 17, and 20, 2022 (Drawings 7.29A, 7.29B, and 7.29C). Dark-eyed Junco, and Black-capped Chickadee were the most abundant and frequently observed species. Passerines accounted for 90.9% of the individual birds, and 77.8% of the species observed.

Table 7.66: Total Observations by Bird Group – 2022 Fall Migration Point Count Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	15	1
Shorebirds	2	1	1
Other Waterbirds	3	0	0
Diurnal Raptors	4	2	2
Nocturnal Raptors	5	0	0
Passerines	6	606*	35
Other Landbirds	7	43	6
Total		**667**	**45**

*13 unidentified blackbirds and warblers were observed (Passerines)

SOCI observed during the fall migratory point count surveys include American Robin, Blackpoll Warbler, Boreal Chickadee, Canada Jay, Pine Siskin, Pine Warbler (*Setophaga pinus*), Purple Finch, and Red Crossbill.

A total of 19 species, comprising 67 individual birds were observed during fall migration diurnal watch surveys (Table 7.67; Tables 15/16, Appendix J). The 13 60-minute diurnal watch surveys were conducted on September 21 and October 8, 19, 17 and 20, 2022, from elevated locations covering a wide range of habitats within the Study Area (Drawings 7.29A, 7.29B, and 7.29C). Blue Jay (*Cyanocitta cristata*), Common Raven, Red Crossbill, and Bald Eagle were the most abundantly observed species. Passerines accounted for 74.6% of the individual birds, and 68.4% of the species observed.

Table 7.67: Total Observations by Bird Group – 2022 Fall Migration Diurnal Watch Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	0	0
Shorebirds	2	2	1
Other Waterbirds	3	0	0
Diurnal Raptors	4	15*	5
Nocturnal Raptors	5	0	0
Passerines	6	50**	13
Other Landbirds	7	0	0
Total		**67**	**19**

*Two raptor observations could not be identified to the species level (included with Diurnal Raptors total)
**Two passerine observations could not be identified to the species level (Passerines)

SOCI observed during the fall migratory diurnal watch surveys include American Robin, Blackpoll Warbler, Canada Jay, Greater Yellowlegs (*Tringa melanoleuca*), Purple Finch, and Red Crossbill.

No high-flying, large migratory flocks were observed during diurnal watch surveys. Most observations consisted of passerine species flying in small groups just above the tree line. Observations of raptors mostly consisted of individual birds.

Two examples of potential migratory behaviour were observed during the month of October 2022:

- Observed a flock of 15 Ring-necked Ducks on Lake Bezanson.
- Observed a flock of nine unidentified blackbird species (i.e., surveyor confirmed as a species other than Common Grackles) flying south.

2024 Winter Surveys

Winter surveys were completed on March 15, 20, and 22, 2024. The surveys included 21 10-minute point counts across 18 locations (Drawings 7.29A, 7.29B, and 7.29C). A total of 19 species, comprising 84 individual birds, were observed (Table 7.68; Tables 17/18, Appendix J).

American Crow, Dark-eyed Junco, and Black-capped Chickadee were the most abundant and commonly observed species.

Table 7.68: Total Observations by Bird Group – 2024 Winter Bird Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	1	1
Shorebirds	2	0	0
Other Waterbirds	3	0	0
Diurnal Raptors	4	3	2
Nocturnal Raptors	5	0	0
Passerines	6	74	12
Other Landbirds	7	6	4
Total		**84**	**19**

*One unidentified woodpecker was observed (Other Landbirds)

Three SOCI were observed during the 2024 winter surveys: American Robin, Canada Goose, and Purple Finch.

Species diversity was observed to be low during the winter surveys compared to other seasons. SOCI observed are generally consistent with those observed during migration and breeding bird surveys and are not expected to be breeding during the winter months. No SAR were observed during winter surveys.

2024 Spring Migration Surveys

Spring surveys were completed within the Study Area on April 18 and 19; and May 7, 8, 21, and 22, 2024 (Drawings 7.29A, 7.29B, and 7.29C). The surveys included 55 10-minute point counts, and 10 60-minute diurnal watches.

A total of 70 species, comprising 1,076 individual birds were observed in the Study Area during spring migration point count surveys (Table 7.70; Tables 19/20, Appendix J). American Robin, Winter Wren, and White-throated Sparrow were the most abundant and commonly observed species. Passerines accounted for 87.5% of the individual birds, and 74.3% of the species observed.

Table 7.70: Total Observations by Bird Group – 2024 Spring Migration Point Count Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	25	3
Shorebirds	2	0	0
Other Waterbirds	3	16	2
Diurnal Raptors	4	10	6
Nocturnal Raptors	5	0	0
Passerines	6	941	52
Other Landbirds	7	84	7
Total		**1,076**	**70**

SOCI encountered throughout the 2024 spring migration point counts included American Kestrel, American Robin, Bay-breasted Warbler, Blackpoll Warbler, Boreal Chickadee, Canada Goose, Lesser Scaup, Northern Goshawk, Pine Grosbeak, Pine Siskin, Purple Finch, Turkey Vulture, and Wilson's Warbler. SAR included Canada Warbler, Evening Grosbeak, and Olive-sided Flycatcher.

2024 Spring Diurnal Raptor Surveys

A total of 38 species comprising 117 individual birds were observed in the Study Area during spring diurnal watch surveys (Table 7.71; Tables 21/22, Appendix J) completed on April 18, 19, 22, 23; May 7, 8, 21, and 22, 2024 (Drawings 7.29A, 7.29B, and 7.29C). Hermit Thrush, White-throated Sparrow, and Northern Flicker were the most abundant and commonly found species throughout the surveys. Bald Eagle, Red-tailed Hawk, and Turkey Vulture are the only raptors observed during the diurnal surveys.

Table 7.71: Total Observations by Bird Group – 2024 Spring Diurnal Watch Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	4	1
Shorebirds	2	0	0
Other Waterbirds	3	1	1
Diurnal Raptors	4	10	4
Nocturnal Raptors	5	0	0
Passerines	6	92	31
Other Landbirds	7	11	2
Total		**117**	**38**

SOCI observed during the 2024 spring diurnal watch surveys included American Robin, Bay-breasted Warbler, Boreal Chickadee, Canada Goose, Canada Jay, Cape May Warbler, Pine Siskin, Purple Finch, and Turkey Vulture. The only SAR species observed during spring diurnal surveys was Olive-sided Flycatcher.

2024 Breeding Bird Surveys

Breeding bird surveys were completed within the Study Area on June 4, 5, 18, 19, July 11 and July 17, 2024 (Drawings 7.29A, 7.29B, and 7.29C). The surveys included 59 10-minute point counts, and nine 30-minute area searches.

A total of 71 species, comprising 1,691 individual birds were observed in the Study Area during 2024 breeding bird surveys (Table 7.72; Tables 23/24, Appendix J). Common Yellowthroat, Hermit Thrush, and White-throated Sparrow were the most abundant and commonly observed species. Passerines accounted for 94.3% of the individual birds, and 81.7% of the species observed.

Table 7.72: Total Observations by Bird Group – 2024 Breeding Bird Point Count Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	3	1
Shorebirds	2	1	1
Other Waterbirds	3	13	2
Diurnal Raptors	4	3	2
Nocturnal Raptors	5	0	0
Passerines	6	1595	58
Other Landbirds	7	76	7
Total		**1691**	**71**

SOCI observed during the 2024 breeding surveys included American Robin, Bay-breasted Warbler, Blackpoll Warbler, Boreal Chickadee, Canada Jay, Cape May Warbler, Pine Grosbeak, Pine Siskin, Purple Finch, Rose-breasted Grosbeak, Red Crossbill, Tennessee Warbler, and Wilson's Warbler. SAR encountered included Canada Warbler, Common Nighthawk, and Olive-sided Flycatcher.

During the 2022 spring migration surveys, the following species were identified as breeding in the Study Area: Hairy Woodpecker, Song Sparrow, Blackburnian Warbler, Common Yellowthroat, Winter Wren, Hermit Thrush, Northern Flicker, and the following species as potentially breeding: Belted Kingfisher, Common Nighthawk, and Dark-eyed Junco.

2024 Nocturnal Owl and Nightjar Surveys

Thirteen nocturnal owl surveys were completed on April 22, 23 and 24, 2024. A total of 19 nightjar surveys were completed on June 26 and July 10, 2024, during the breeding season (Drawings 7.29A, 7.29B, and 7.29C).

A total of 36 bird species, comprising 144 individual birds, were observed within the Study Area during nocturnal owl and nightjar surveys (Table 7.73; Tables 25/26/27/28, Appendix J). Common Nighthawk and Hermit Thrush are the most abundant and commonly found species throughout the surveys.

Table 7.73: Total Observations by Bird Group – 2024 Nocturnal Owl and Nightjar Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	0	0
Shorebirds	2	0	0
Other Waterbirds	3	1	1
Diurnal Raptors	4	0	0
Nocturnal Raptors	5	5	2
Passerines	6	137	30
Other Landbirds	7	1	1
Total		**144**	**36**

SOCI observed during the 2024 nocturnal owl and nightjar surveys included American Robin, Boreal Chickadee, Norther Saw-whet Owl, Purple Finch, and Tennessee Warbler. Common Nighthawk and Olive-sided Flycatcher were the only two SAR species found during these surveys.

2024 Fall Migration Surveys

Fall migration surveys were completed on August 22 and 23, September 10 and 11 as well as October 16, and 17 2024 (Drawings 7.29A, 7.29B, and 7.29C).

A total of 60 confirmed species, comprising 1109 individual birds, were observed during 2024 fall migration point count surveys (Table 7.74; Tables 29/30, Appendix J). Black-capped Chickadee, Dark-eyed Junco, and Blue Jay were the most abundant and frequently observed species. Passerines accounted for 86.7% of the individual birds, and 71.7% of the species observed.

Table 7.74: Total Observations by Bird Group – 2024 Fall Migration Point Count Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	7	1
Shorebirds	2	4	1
Other Waterbirds	3	17	1
Diurnal Raptors	4	9	4
Nocturnal Raptors	5	3	2
Passerines	6	962	43
Other Landbirds	7	107	8
Total		**1109**	**60**

SOCI observed during the fall migratory point count surveys include American Robin, Blackpoll Warbler, Boreal Chickadee, Canada Goose, Canada Jay, Cape May Warbler, Northern Goshawk, Philadelphia Vireo, Pine Grosbeak, Purple Finch, and Red Crossbill. SAR observed during fall migration surveys included Canada Warbler, Olive-sided Flycatcher, and Rusty Blackbird

2024 Fall Diurnal Raptor Surveys

A total of 33 species comprising 143 individual birds were observed in the Study Area during diurnal watch surveys (Table 7.75; Tables 31/32, Appendix J) completed on August 22, 23, September 10, 12 as well as October 16, 17 (Drawings 7.29A, 7.29B, and 7.29C). Black-capped Chickadee, Dark-eyed Junco, and Common Raven were the most abundant and commonly found species throughout the surveys. Bald Eagle, Broad-winger Hawk, Red-tailed Hawk, and Turkey Vulture are the only raptors observed during the diurnal surveys.

Table 7.75: Total Observations by Bird Group – 2024 Fall Diurnal Raptor Surveys

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	0	0
Shorebirds	2	1	1
Other Waterbirds	3	2	2
Diurnal Raptors	4	4	4
Nocturnal Raptors	5	0	0
Passerines	6	125	23
Other Landbirds	7	11	3
Total		**143**	**33**

SOCI observed during the 2024 fall diurnal watch surveys included American Robin, Bay-breasted Warbler, Canada Jay, Red Crossbill, Spotted Sandpiper, and Turkey Vulture. No SAR species were observed during fall diurnal watch surveys.

2024 Incidental Surveys

A total of 44 species comprising 165 individual birds were observed in the Study Area during incidental bird surveys that were completed over the course of the year 2024 (Table 7.76; Tables 33/34, Appendix J); (Drawings 7.29A, 7.29B, and 7.29C). Olive-sided Flycatcher, Common Nighthawk, and Dark-eyed Junco were the species most commonly observed during incidental observations.

Table 7.76: Total Observations by Bird Group – 2024 Incidental Bird Observations

Bird Group	Group #	# Individuals	# Species
Waterfowl	1	1	1
Shorebirds	2	1	1
Other Waterbirds	3	0	0
Diurnal Raptors	4	19	5
Nocturnal Raptors	5	0	0
Passerines	6	146	38
Other Landbirds	7	15	4
Total		**182**	**49**

SOCI observed during 2024 incidental surveys included American Kestrel, American Robin, Bay-breasted Warbler, Black-backed Woodpecker, Boreal Chickadee, Canada Jay, Northern Goshawk, and Pine Grosbeak. SAR species observed during incidental bird surveys included Common Nighthawk, Eastern Wood-Pewee, and Olive-sided Flycatcher.

Habitat Trends with Avian Abundance and Species Diversity

Across all seasons, it is evident that the Study Area supports a variety of avian species due to the diversity of habitats present in the area. Overall, survey locations (Drawing 7.29) that represented edge habitat (i.e., forested habitat on the edge of clear-cut, wetland, or a lake) had the highest numbers of avian abundance and species diversity. Forests ranged in type (e.g., softwood) as well as age. Further details on locations and habitats by season will be included below.

During the 2022 and 2024 winter field seasons, survey locations (i.e., 2022 PCs ML15, ML19, and ML 20, and 2024 PCs 1, 3, and 12) with the highest avian abundances and species diversity included mixedwood forest, softwood forest near the edge of clear-cut, old clear-cut with mixedwood regenerative forest activity, as well as wetland habitat with hardwood forest or softwood forest. During the winter this site supports resident passerines (i.e., including cone-related species such as Pine Siskin, Purple Finch, Red Crossbill, and White-winged Crossbill) as well as a variety of woodpecker species.

During the 2022 and 2024 spring migration field seasons, survey locations (i.e., 2022 PCs ML4, ML14, and ML20, and 2024 PCs 7, 10, 13, and 14) with the highest avian abundances and species diversity had a variety of forest types (i.e., mixedwood and softwood) with a varying degree of clear-cut activity either at the survey location or close-by. Activity ranged from newer clear-cuts to older clear-cuts with regenerative forest activity. These older clear-cuts offered thick, shrubby habitats that supported a variety of warbler and sparrow species.

During the 2022 and 2024 breeding bird field seasons, survey locations (i.e., 2022 PCs ML1, ML4, ML10, and ML 12, and 2024 PCs 1, 2, 3, 5, and 5) with the highest avian abundances and species diversity included older and newer clear-cut areas at or near-by the survey location with either softwood, mixedwood, or hardwood dominated forests. Habitats also include a wetland with hardwood forest, as well as an old growth stand near a lake. Open habitat (i.e., clear-cuts and waterbodies) provide hunting habitat for avian raptor species.

During the 2022 and 2024 fall migration field seasons, survey locations (i.e., 2022 PCs ML16, and 2024 PCs, 5, 11, 17, and 21) with the highest avian abundances and species diversity included mature softwood forest, a lake with riparian wetland habitat, softwood regenerative forest from old clear-cut activity, as well as an older, partially logged mixedwood forest.

7.4.5.10 Probable and Confirmed Breeding in the Study Area During Field Surveys

During the 2022 field season, there were various observations of probable and confirmed breeding activity, as per the MBBA breeding codes, which will be separated by type below. Bolded text are SAR.

Probable breeding behaviour within the 2022 field season:

- Belted Kingfisher: agitation behaviour which indicates a nearby nest was observed.
- Blackburnian Warbler: a male and female pair was observed.
- Bufflehead: male and female pairs were observed.
- Canada Goose: agitation behaviour which indicates a nearby nest was observed.

- **Common Nighthawk:** territorial behaviour (i.e., calling and wing-boom behaviour) were observed on various occasions within clearcuts and close to lakes and watercourses with riparian wetlands.
- Dark-eyed Junco: two separate observations of an agitated male and female pair indicating a nearby nest.
- Song Sparrow: an agitated adult indicating a nearby nest was observed.

Confirmed breeding behaviour within the 2022 field season:

- Blackburnian Warbler: a recently fledged juvenile was observed.
- Canada Jay: recently fledged juveniles were observed.
- Common Yellowthroat: recently fledged juveniles were observed on various occasions.
- Hairy Woodpecker: an active nest with juveniles was observed.
- Hermit Thrush: an adult carrying food was observed.
- Northern Flicker: an active nest was observed.
- Red-tailed Hawk: an adult was observed carrying nesting material.
- Song Sparrow: an adult carrying food was observed.
- Winter Wren: an adult with a juvenile was observed.

During the 2024 field season, there were various observations of probable and confirmed breeding activity, as per the MBBA breeding codes, which will be separated by type below. Bolded text are SAR.

Probable breeding behaviour within the 2024 field season:

- Alder Flycatcher: an agitated individual was observed.
- American Black Duck: a male and female pair was observed.
- American Woodcock: an agitated individual was observed.
- Black-and-white Warbler: territorial singing behaviour was observed.
- Black-capped Chickadee: nest building activity was observed.
- Blue-headed Vireo: a male and female pair was observed.
- Canada Warbler: territorial singing behaviour was observed.
- Cape May Warbler: a male and female pair was observed.
- **Common Nighthawk:** territorial behaviour (i.e., calling and wing-boom behaviour) as well as agitated behaviour was observed on various occasions.
- Common Yellowthroat: agitated behaviour as well as courtship/display behaviour between males and females was observed.
- Hairy Woodpecker: agitated behaviour was observed.
- Magnolia Warbler: an agitated male and female pair was observed.
- Northern Flicker: a male and female pair was observed.
- **Olive-sided Flycatcher:** agitated behaviour as well as territorial singing behaviour was observed on various occasions. One occasion of courtship/display behaviour was observed as well. Another observation that is important to note is one possible male

and female pair observed near Thompson Lake (i.e., near 2024 PC 14) within the section of wetland (WL) 78 that extends out of the Study Area.
- Palm Warbler: multiple male and female pairs were observed conducting courtship/display behaviour, including one pair visiting a probable nest site.
- Purple Finch: courtship/display behaviour was observed between a male and female.
- Ring-necked Duck: a male and female pair was observed.
- Spruce Grouse: agitated behaviour was observed.
- Swamp Sparrow: a male and female pair conducting courtship/display behaviour was observed.
- White-throated Sparrow: a male and female pair was observed.

Confirmed breeding behaviour within the 2024 field season:

- American Robin: recently fledged juveniles, as well as a used nest with an adult conducting a distraction/injury feigning display were observed. These were two separate observations.
- American Kestrel: a male and female pair was observed.
- Black-capped Chickadee: various observations of recently fledged juveniles.
- Black-throated Green Warbler: a nest with juveniles was observed, as well as a recently fledged juvenile with an adult conducting a distraction/injury feigning display. These were two separate observations.
- Blue Jay: a nest with juveniles observed with an adult conducting a distraction/injury feigning display.
- Canada Jay: recently fledged juveniles with an adult conducting a distraction/injury feigning display was observed.
- Cedar Waxwing: recently fledged juveniles were observed, as well as a nest with juveniles. These were two separate observations.
- Common Yellowthroat: recently fledged juveniles with an adult conducting a distraction/injury feigning display was observed.
- Hairy Woodpecker: a nest with a juvenile was observed, as well as another observation of juveniles.
- Northern Flicker: recently fledged juveniles were observed, a nest with juveniles was observed, and an adult seen leaving and entering a nest site was observed. These were all three separate observations.
- Palm Warbler: recently fledged juveniles were observed.
- Pileated Woodpecker: an active nest was heard with a breeding pair of adults located at 2024 PC 4 by turbine 2; although location was not able to be confirmed, it is possibly located inside the projected turbine pad for the Project.
- Song Sparrow: recently fledged juveniles were observed.
- Spruce Grouse: an adult with juveniles was observed.
- Yellow-rumped Warbler: two separate observations of recently fledged juveniles.

Although no confirmed breeding behaviour was observed for avian SAR during the 2024 field season, a variety of probable breeding behaviour was observed, as listed above. Overall, the locations of the observations include:

- Common Nighthawk probable breeding observations were located throughout the Study Area within newer and older clear-cuts, as well as within vicinity to lakes and wetlands.
- Olive-sided Flycatcher probable breeding observations were located throughout Study Area along the edges of lakes and riparian wetlands to watercourses, as well as within/along the edges of wetlands and clearcuts.

Overall, it is important to note that any other species observed in appropriate breeding habitat during the breeding/nesting season could be considered as possible breeders.

7.4.5.11 SAR Habitat Modelling Results

Following a review of desktop resources and the completion of field assessments, a habitat model for SAR encountered during breeding season field surveys was constructed based on their respective breeding habitat requirements, as described above.

The table below (Table 7.77) lists all avian SAR observations within the Study Area and the amount of habitat within the Study Area and Assessment Area that the model calculated as predictive habitat.

Table 7.77: SAR Habitat Modelling Results – Amount of SAR Habitat by Species within the Study Area and Project Area

SAR Species	Amount in Study Area (ha)	Amount in Assessment Area (ha)	% of Study Area	% of Assessment Area
Barn Swallow	656.9	93.2	11.9%	20.3%
Bobolink*	0	0	0.0%	0.0%
Canada Warbler	301.2	11.9	5.5%	2.6%
Chimney Swift	3567.1	305.0	64.9%	66.5%
Common Nighthawk	701.1	99.4	12.8%	21.7%
Eastern Wood-peewee	119.5	2.9	2.2%	0.6%
Evening Grosbeak	2756.1	234.9	50.1%	51.2%
Olive-sided Flycatcher	2413.6	181.9	43.9%	39.6%
Rusty Blackbird	257.1	17.3	4.7%	3.8%

*The model predicted no habitat for this species and any presence of Bobolink may indicate a migration route through the Study Area.

Overall, based on where SAR were observed in the Study Area, the SAR habitat modelling was found to be relatively accurate. Further detail on habitat suitability and SAR field survey, ARS, acoustic monitor, and AudioMoth data will be included in subsequent sections of this report.

The results of the modelling are shown in Drawings 7.30-7.38. Due to no habitat for Bobolink being predicated within the Study Area, a drawing depicting potential habitat outside of the Study Area was created (Drawing 7.31).

7.4.5.12 Remote Sensing Results

Avian Radar Assessment

Data collected by the avian radar system (ARS) for 2022 and 2023 monitoring periods were analyzed to provide the number of BTs by date, wind direction, and by height (Tables 35/36/37/38, Appendix J). Data was divided into separate monitoring periods where appropriate: spring 2022 (April 26 to June 30), fall 2022 (August 11 to October 31), spring 2023 (March 23 to May 31), summer 2023 (June 1 to July 31), and fall 2023 (August 1 to November 22).

2022 Monitoring Period

The ARS identified no BTs during the spring monitoring period. No BTs could be accurately detected between April 26 and June 25, however it is expected that some migration did occur outside of the detection range or scanned area of the ARS.

During the 2022 fall monitoring campaign the ARS identified 9,090 BTs (Table 35, Appendix J). The majority of the BTs detected during this monitoring campaign were detected during the period from September 16 to September 26, 2022 (nBTs = 5445). Notable numbers of BTs were also detected on October 6 (nBTs = 2159), October 17 (nBTs = 808), and October 19, 2022 (nBTs = 503). Most BTs were detected at heights between 250 m to 2000 m (nBTs = 6019), however the greatest number of detections occurred in the 25m to 50m height bin (nBTs = 2968). All the detections for the 25 to 50 m height bin occurred between September 16 to September 20, 2022 (Table 35, Appendix J).

2023 Monitoring Period

The ARS identified 3,947 BTs during the 2023 spring monitoring campaign. Most of these BTs were detected during consecutive days from April 25 to May 21, with a peak of 1,315 occurring on May 17, 2023 (Table 36, Appendix J). Most BTs were detected at heights between 500 m to 1,500 m, with an outlier of 127 BTs occurring within the 150 m to 200 m height bin. The largest number of BTs were detected between 500 m and 1,000 m (nBTs = 2,499) (Table 36, Appendix J).

The ARS identified 9,435 BTs during the 2023 summer monitoring period. Most of these BTs were detected on June 25 and 30 (nBTs = 1,140 and 1,603), July 21 (nBTs = 3,149), and July 27 (nBTs = 1,059) (Table 37, Appendix J). Most BTs were detected at heights between 250 m to 2,000 m. Similar to the spring monitoring campaign, there was an outlier within the 150 m to 200 m height bin (nBTs = 403). The highest BTs detection was within the 500 m to 1,000 m height bin (nBTs = 5,720) (Table 37, Appendix J).

The ARS identified 13,618 BTs in the fall monitoring campaign (Table 38, Appendix J). Initial detections during the fall monitoring program occurred on August 5 (nBTs = 2,259), with a series of detections occurring from September 10 to 21 (nBTs = 10,132). Detections lasted until late November, with peaks on October 10 (nBTs = 331) and November 11, 2023 (nBTs = 461). Most targets detected during this time were between the heights of 250 m to 2,000 m, but there was also high detection within the 100 m to 150 m height bin. The largest number of BTs were detected between 500 m and 1,000 m (Table 38, Appendix J).

Results throughout the 2022 and 2023 monitoring campaigns suggest that avian migration activity occurred stochastically throughout (and possibly before/after) the monitoring periods. The ARS detected large migration events where a noticeable number of BTs were detected in comparison to other days. While most BTs were observed during a few specific migration events, it is expected that the number of days where monitoring took place also contributes to the variance in total BTs detected.

Overall, the daily total of BTs detected was highly variable during the ARS monitoring campaign, indicating that migratory bird activity is somewhat stochastic during migration seasons.

Cues for Avian Migration

The stochastic nature of migratory bird activity is likely attributable in large part, to weather, as it is well understood that weather and atmospheric conditions influence bird migration activity (Richardson, 1990), especially wind speed and direction (Liechti & Bruderer, 1998). Conditions when tailwinds assist the migration objective are often exploited by migrating birds to travel farther with less energy (Liechti & Bruderer, 1998). Most birds in the region migrate south in the fall from breeding grounds in northern North America, to wintering grounds in Central and South America. Likewise, in spring, most species make the reverse journey, moving northward. The Nova Scotia peninsula extends along the southwest to northeast axis, and birds in the province often migrate along this axis, following the Atlantic coast. As such, birds migrating into Nova Scotia during the spring are likely to also proceed in an easterly direction in addition to a northly direction. Likewise in the fall, migrating birds may move to the west and south as they head to southerly wintering grounds. Cues that are theorized and studied to play a role in avian migration include the following:

- Wind speed and direction (Liechti & Bruderer, 1998)
- Temperature (Brisson-Curadeau et al., 2020; Burnside et al., 2021)
- Photoperiod (Sockman & Hurlbert, 2020; Assadi & Fraser, 2021; Robart et al., 2018)
- Changes in migration cohort or population sizes (Miller-Rushing et al., 2008)
- Food Availability (Robart et al., 2019)

Wind Direction

Figure 7.4 shows that the largest proportion of BT detections during the 2022 fall monitoring campaign were detected when the winds were from the north (25%) and the east (21%), with some detections from the southwest (14%). This is unexpected as migrating birds often used winds from the west and south to travel to southerly wintering grounds (Liechti & Bruderer, 1998). Nonetheless, birds may show no wind selectivity when other cues are present during migration (Thorup et al., 2006).

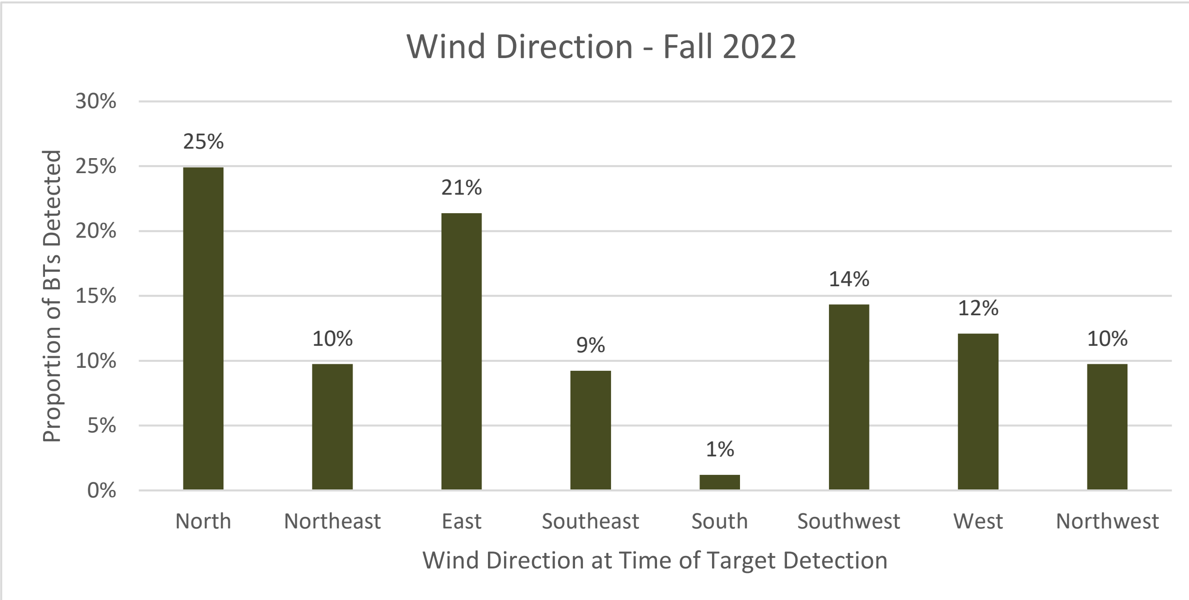


Figure 7.4: Wind Direction by proportion of BTs Detected, Fall 2022

The largest proportion of BT detections during the 2023 spring monitoring campaign were detected when the winds were from the northeast (36%), with some detections coming from the north (19%), south (17%) and northwest (13%) (Figure 7.5). While detections within the northern and northeastern wind are expected as birds took advantage of the tailwind during spring migration, detections within other wind direction may also suggest that birds show no wind selectivity during migration (Thorup et al., 2006).

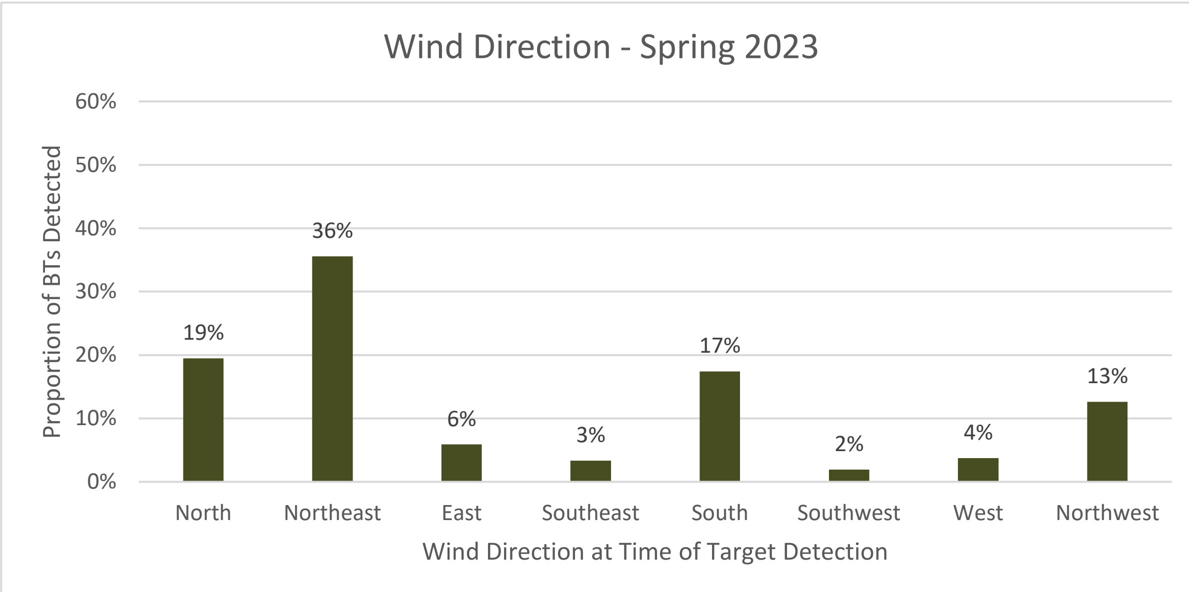


Figure 7.5: Wind Direction by proportion of BTs Detected, Spring 2023

Figure 7.6 shows that the largest proportion of BT detections in summer 2023 was associated with winds from the south (42%) and southeast (40%). As these months are within the peak breeding seasons, bird detections during this time mostly pertain to peak breeding activity and thus might not show wind selectivity.

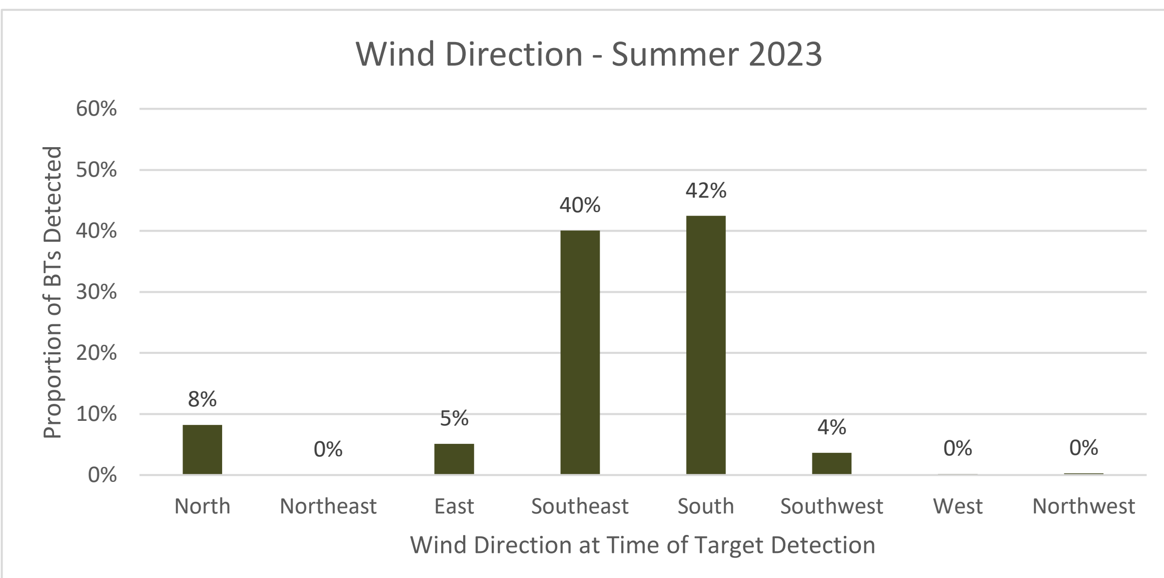


Figure 7.6: Wind Direction by proportion of BTs detected, Summer 2023

During the fall 2023 monitoring period, Figure 7.7 shows that the largest proportion of BT detections was associated with winds from the south (53%), followed by southeast (21%) and southwest (13%). This is expected as birds utilize the southern tailwind to travel south to their wintering grounds, expediting their migratory journey and reducing their energy consumption during the migration period (Liechti & Bruderer, 1998).

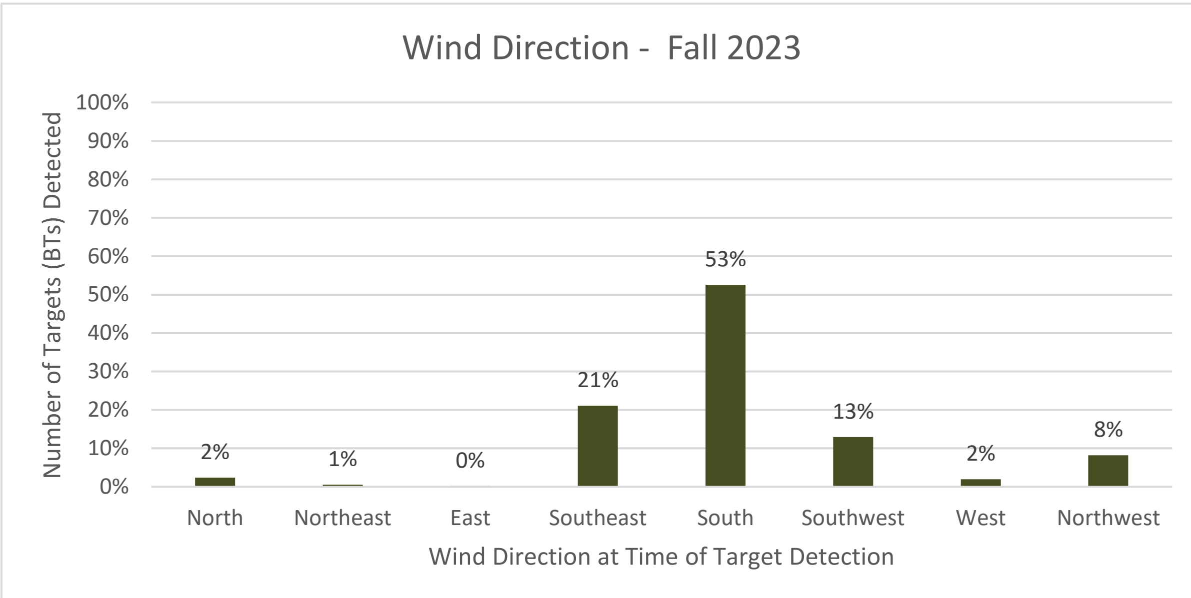


Figure 7.7: Wind Direction by proportion of BTs Detected, Fall 2023

Temperature

Figure 7.8 shows that all the major migration events observed during the fall 2022 monitoring campaign occurred shortly after daily average temperatures began to decrease below 20°C and became less consistent in accordance with the seasonal shift from late summer to fall. This result is not unexpected as many North American birds are climate migrants that have certain temperature thresholds that will trigger their migratory movements (Frei et al. 2024).

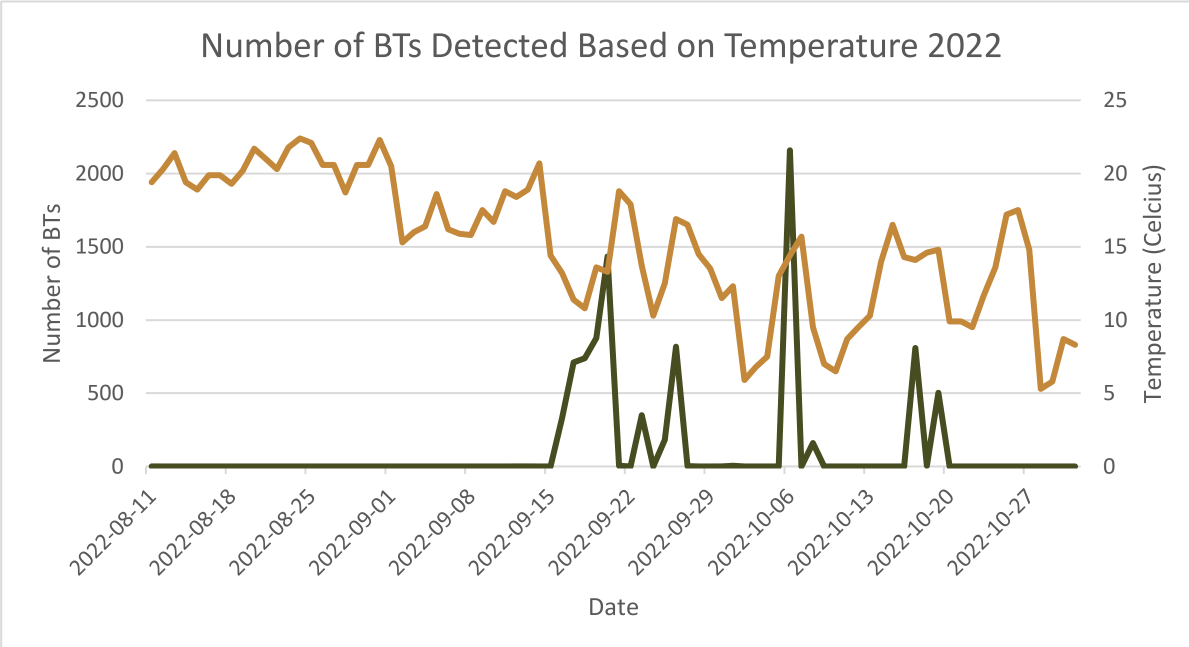


Figure 7.8: Number of biological targets detected during the 2022 ARS monitoring campaign compared to daily mean temperatures (°C)

Figure 7.9 shows that, like in 2022, several migration events observed during the 2023 monitoring campaign occurred during noticeable temperature fluctuations. During the spring and summer monitoring period, most migration events were observed when daily average temperatures were rising toward the season's high. During the fall monitoring campaign, the most noticeable migration events occurred relatively late in the season right before average daily temperatures began to decrease sharply. This result is also not unexpected as late autumn migrations have been observed elsewhere with warmer fall temperatures caused by climate change being seen as a likely cause (Brisson-Curadeau et al., 2020; La Sorte et al., 2015).

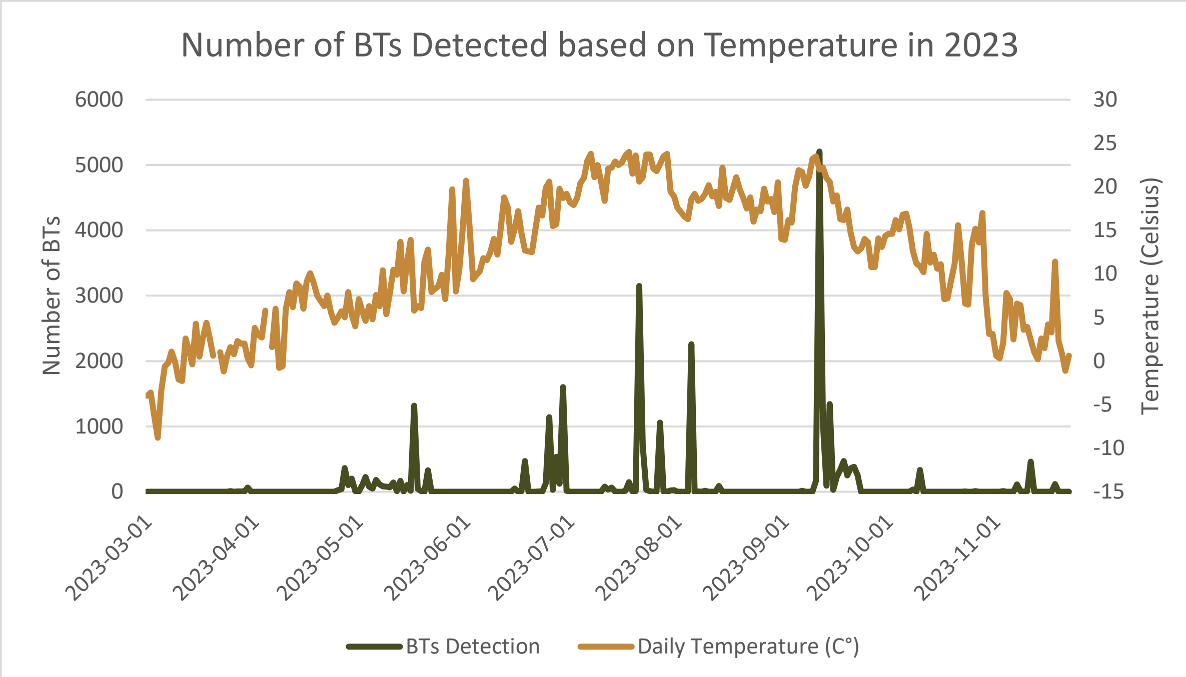


Figure 7.9: Number of biological targets detected during the 2023 ARS monitoring campaign compared to daily mean temperatures (°C)

Photoperiod

Figure 7.10 shows that most BT spikes in fall 2022 occurred when daylight hours were below 14 hours. This data corroborated research on photoperiods affecting migration, indicating that the vast majority of migrations took advantage of longer daily durations of sunlight to anticipate migration (Sockman & Hubert, 2020; Assadi & Fraser, 2021; Robart et al., 2018). This demonstrates the use of photoperiod in predicting migratory preparation and peak migration events during both peak migration and breeding seasons.

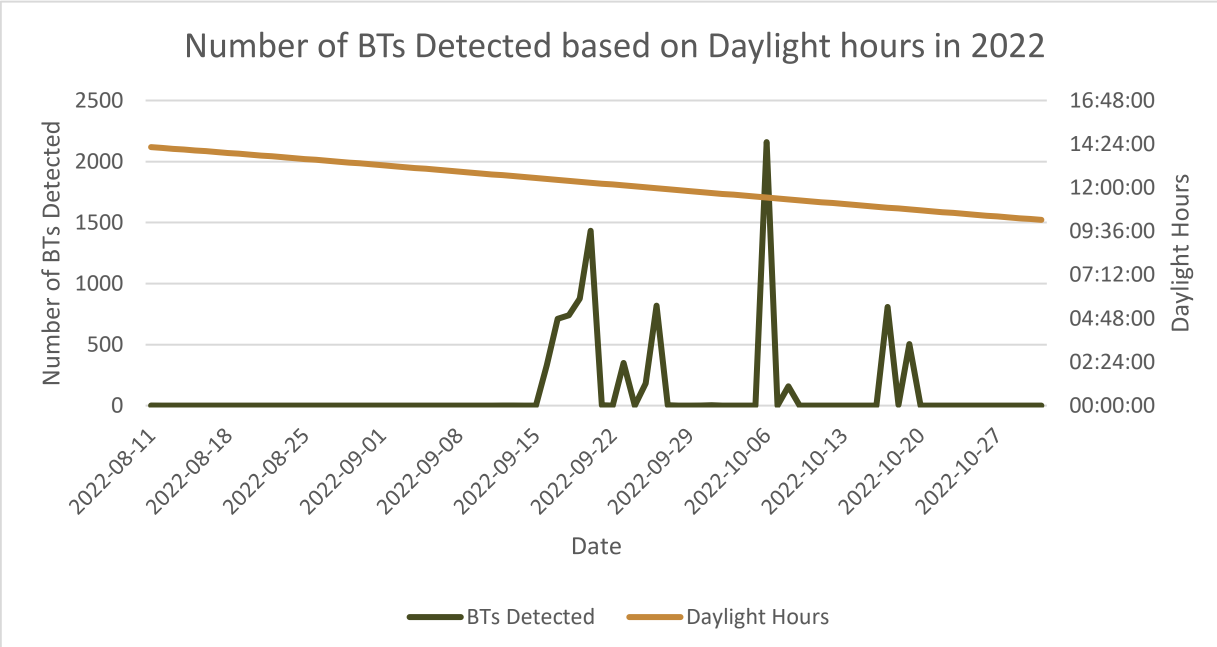


Figure 7.10: Number of biological targets detected during the 2022 monitoring period compared to daily daylight hours.

Figure 7.11 shows that during the 2023 monitoring campaign most BT spikes occurred when daylight hours were longest (i.e., above 14 hours). Further, the highest spike in BTs detections occurred just before daylight hours decreased below 12 hours. These results are not unexpected and provide further support to the relationship between photoperiod and migratory movements that was observed during the fall 2022 monitoring period.

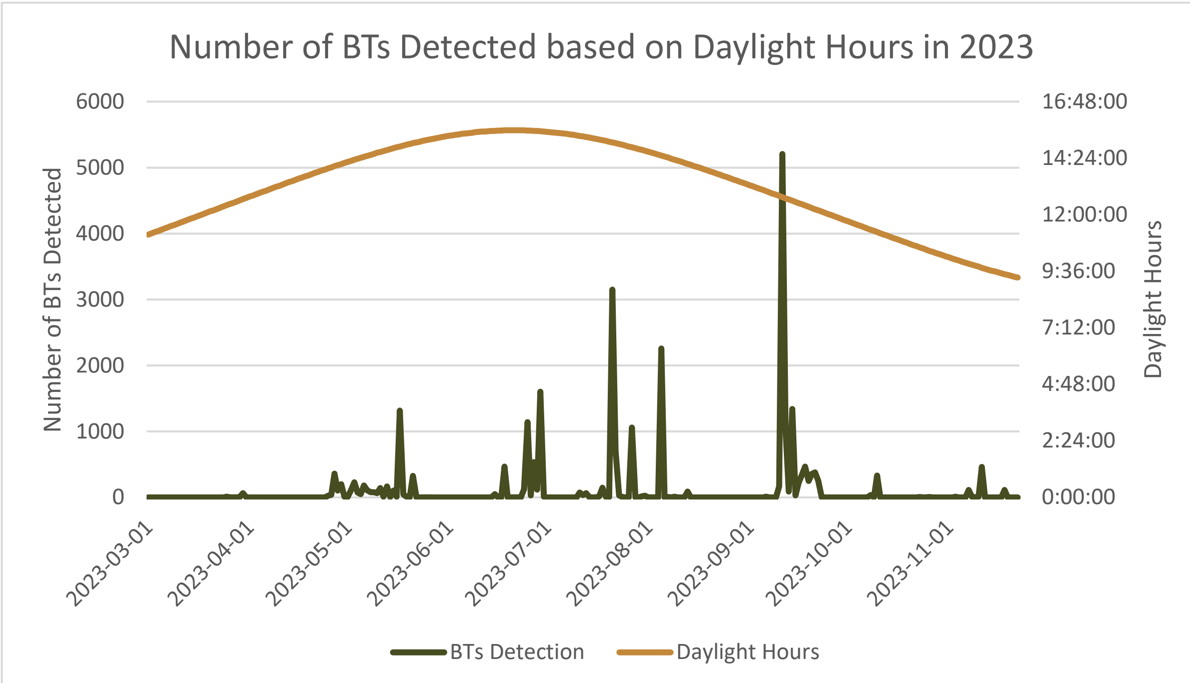


Figure 7.11: Number of biological targets detected during the 2023 monitoring period compared to daily daylight hours.

Determining Migratory Bird Density

The Halo 20+ radar emits a beam that is angled 12.5° upward and downward from the radar's antenna. As the radar beam extends outwards, the volume of airspace that the radar scans increase with range. Therefore, the number of BTs detected by the ARS generally increases with range, until such a point that the radar becomes limited by range and the number of BTs detected drops. To correct the distortions in BT detection counts at different ranges, it is necessary to correct for the airspace volume scanned by the radar at each height bin.

Based on the geometry of the radar's beam angle, the volume of airspace scanned in each of the height bins was determined using CAD software. These volumes are shown for each height bin in Tables 7.78, 7.79, 7.80, and 7.81 along with the number of BTs detected in each height bin, and the target density (i.e., the number of targets detected per cubic kilometer of airspace) for the fall monitoring period. Birds per km^3 have been used as a metric of bird migration in avifauna for other studies (Farnsworth, 2013). Target density is representative of, and likely proportional to, the migratory bird activity in the airspace above the Study Area for the cumulative monitoring period.

Table 7.78: Target Density– Fall 2022

Height Bin (m)	Airspace Scanned (km^3)	Number of Targets (BTs) Detected	Target Density (BT/km^3)
0-25	0.1015	1	0
25-50	0.1016	2968	29212.598
50-100	0.2036	8	39.293
100-150	0.2043	2	9.790
150-200	0.2052	22	107.212
200-250	0.2063	70	339.312
250-500	1.052	571	542.776
500-1000	2.226	2310	1037.736
1000-1500	2.337	2514	1075.738
1500-2000	2.426	624	257.214
2000-3000	3.774	0	0
Total	**12.8375**	**9,090**	**32631.520**

The ARS detected the most targets within the 25 m to 50 m height bin during the 2022 fall monitoring period (Figure 7.9). This peak is associated with the large migration events observed from September 16 to Sepetember 20, 2022 (nBTs = 2,968). The majority of targets were, however, detected in the height bins from 250 to 2000m. Approximately 57.7% of BTs (nBTs = 6,019) were detected within this range (Table 7.78). The target density during this monitoring campaign shows more variation than target counts with density peaking at the 25 m to 50 m height bin before rapidly decreasing (Figure 7.12).

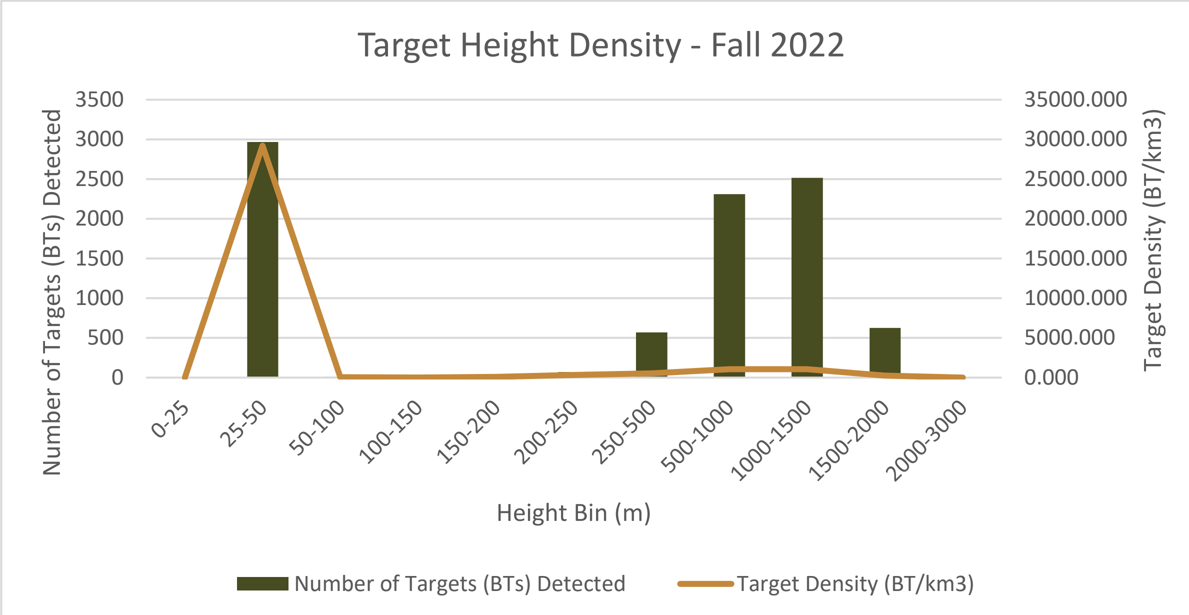


Figure 7.12: Targets Detected and Target Density – Fall 2022

The diagonal radar orientation provided reliable resolution on the height at which BTs were detected during the monitoring campaigns. The number of targets as well as the target density detected by the ARS increases with height, until the radar signal decay becomes a limiting factor in detecting targets at range (Figure 7.12, 7,13, 7.14, and 7.15).

The ARS detected most targets within the 500 m to 1,000 m height bin during the 2023 spring monitoring period (Figure 7.13). This peak is associated with the large migration events observed from April 26 to May 21, 2023 (nBTs = 2,481). Approximately 63.3% of BTs (nBTs = 2,499) were detected within this height bin (Table 7.79). The target density for this range bin shows more variation than target counts in the 150 m to 200 m height bin, but peaking at 500 m and 1,000 m height bin before rapidly decreasing (Figure 7.10).

Table 7.79: Target Density– Spring 2023

Height Bin (m)	Airspace Scanned (km^3)	Number of Targets (BTs) Detected	Target Density (BT/km^3)
0-25	0.1015	0	0
25-50	0.1016	0	0
50-100	0.2036	4	19.646
100-150	0.2043	77	376.897
150-200	0.2052	127	618.908
200-250	0.2063	10	48.473
250-500	1.052	494	469.582
500-1000	2.226	2499	1122.642
1000-1500	2.337	657	281.130
1500-2000	2.426	79	32.564
2000-3000	3.774	0	0
Total	**12.8375**	**3,947**	**307.459**

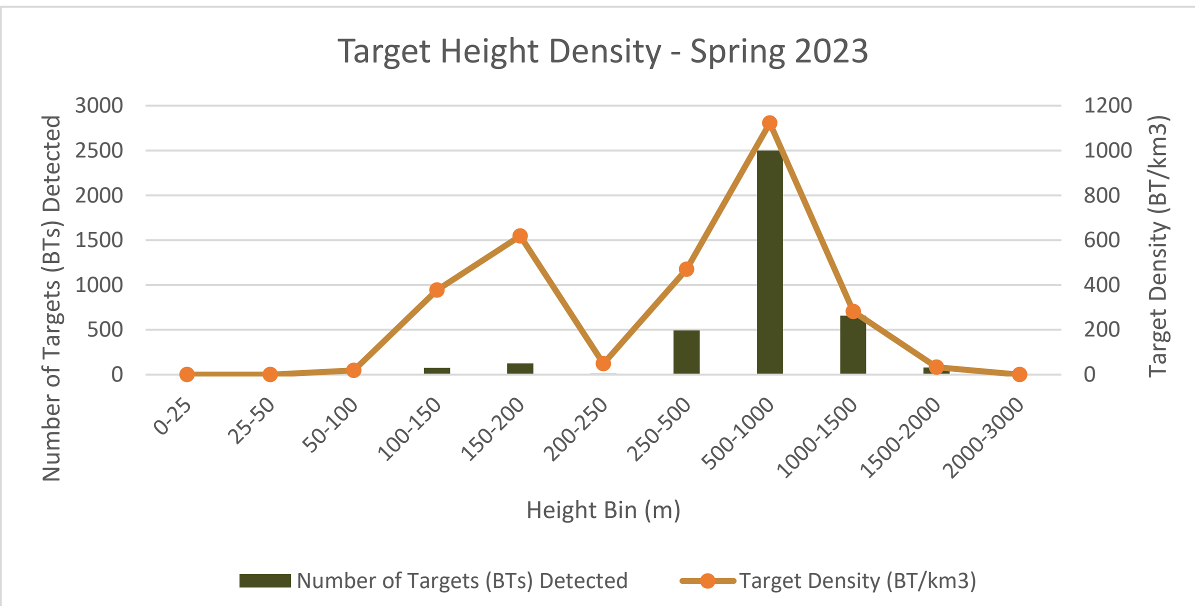


Figure 7.13: Targets Detected and Target Density – Spring 2023

The ARS detected most targets in the 500 m to 1,000 m height bin during the 2023 summer monitoring campaign (Figure 7.14). This peak is associated with the migration events observed from June 24 to June 29 (nBTs = 1,774), a single peak on July 22 (nBTs = 1,520), and two smaller spikes on July 22 and July 27 (nBTs = 326 and 534). Approximately 48.4% of BTs (nBTs = 4,562) were in this height bin (Table 7.80). Similar to the 2023 spring monitoring period, target density for this range bin shows more variation than target counts within the 150 m to 200 m height bin. Notably, the target density peak in this height bin is slightly lower than the target density in the 500 m to 1,000 m height bin (Figure 7.14).

Table 7.80: Target Density– Summer 2023

Height Bin (m)	Airspace Scanned (km^3)	Number of Targets (BTs) Detected	Target Density (BT/km^3)
0-25	0.1015	0	0
25-50	0.1016	0	0
50-100	0.2036	17	83.497
100-150	0.2043	44	215.370
150-200	0.2052	403	1963.938
200-250	0.2063	110	533.204
250-500	1.052	1508	1433.460
500-1000	2.226	4562	2049.416
1000-1500	2.337	2239	958.066
1500-2000	2.426	552	227.535
2000-3000	3.774	0	0
Total	**12.8375**	**9,435**	**734.956**

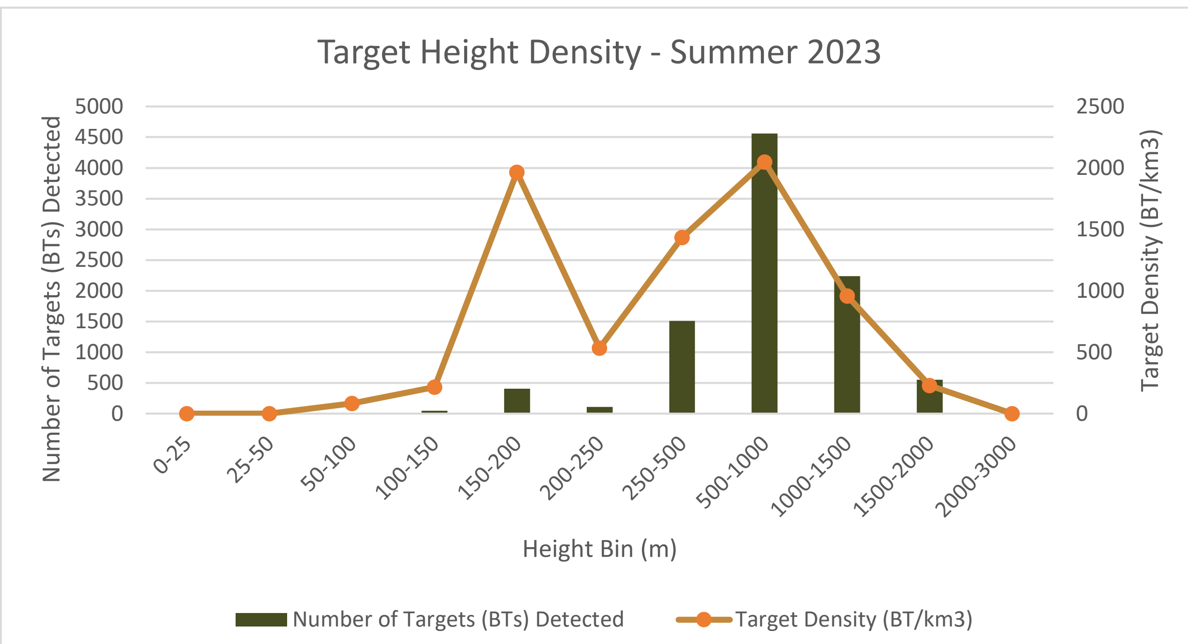


Figure 7.14: Target Detected and Target Density – Summer 2023

Similar to the spring and summer monitoring periods, the ARS detected most targets in the 500 m to 1,000 m height bin during the 2023 fall monitoring campaign. This peak is associated with the migration events observed on August 5 (nBTs = 1,122), followed by sporadic spikes from September 10 to 16 (nBTs = 3,899). Approximately 40.6% of BTs (nBTs = 5,535) were in this height bin (Table 7.81). The target density for this range bin some more variation than target counts, with the highest peak seen within 100 m to 150 m before rapidly decreasing (Figure 7.15).

Table 7.81: Target Density– Fall 2023

Height Bin (m)	Airspace Scanned (km³)	Number of Targets (BTs) Detected	Target Density (BT/km³)
0-25	0.1015	0	0
25-50	0.1016	0	0
50-100	0.2036	15	73.674
100-150	0.2043	2347	11488.01
150-200	0.2052	162	789.474
200-250	0.2063	106	513.815
250-500	1.052	1692	1608.365
500-1000	2.226	5535	2486.523
1000-1500	2.337	3056	1307.659
1500-2000	2.426	705	290.602
2000-3000	3.774	0	0
Total	**12.8375**	**13,618**	**1060.798**

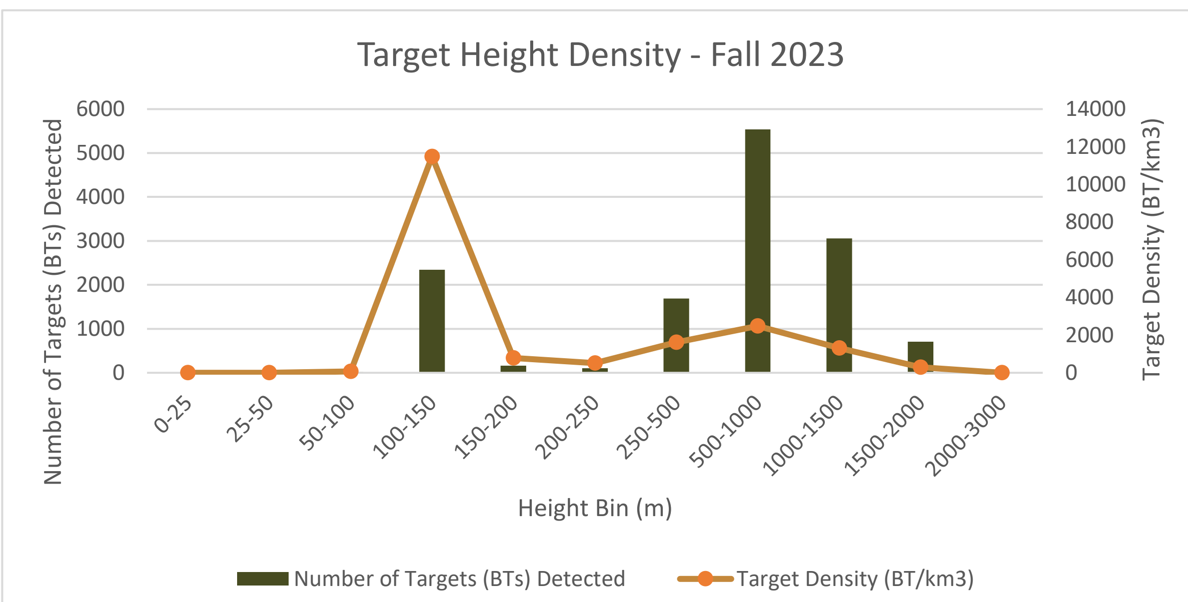


Figure 7.15: Target Detected and Target Density – Fall 2023

Based on the height of the proposed wind turbines and the diameter of the turbine blades, birds flying at the heights between 43.5 m and 206.5 m would be at potential risk of interacting with the turbines. During the 2022 fall monitoring period 33% of BTs were detected in this height range, most of which were detected in the 25 m to 50 m height bin from September 16 to September 20, 2022. During the 2023 spring and summer monitoring periods approximately 5% of observed BTs were detected within this height corridor, the fall monitoring period saw 19% of observed BTs within the height corridor.

Avian Interaction Model

The level of interaction between migratory birds and the Project turbines can be estimated using data collected from the radar monitoring in 2022 and 2023. Interactions may include sensory disturbance to birds passing near the turbines, a requirement for birds to maneuver around the turbines (thus forcing migratory birds to expend energy), bird collisions with the turbine components, or blade strikes (for operating turbines).

The migratory bird interaction index (MBII) (***M***) is an estimate of the level of risk that aerial infrastructure for a Project poses to migratory birds. This index is calculated using the following expression.

Equation 1:

$$\boldsymbol{M = D \div I}$$

Where ***D*** is the migratory bird density, and ***I*** is the volume of airspace that the infrastructure being assessed would occupy.

To represent the volume of airspace occupied by the infrastructure (I), the volume of airspace where avifauna would interact with the turbines was estimated using CAD software that is based on morphology of the proposed turbines. An over-estimate of the volume of the turbine's physical components was used to represent the larger volume of airspace where the turbines would influence avifauna. Table 7.82 shows the turbine dimensions for this Project and the parameters used to calculate the interaction airspace volume for the turbine model.

Table 7.82: Turbine – Avifauna Interaction Volume Calculation Information

Turbine Model Information	
Component	**Description**
Turbine Model	Nordex N163/5.x
Number of Turbines	23
Hub Height	125 m
Total Height	206.5 m
Rotor Diameter	163 m
Blade Length	81.5 m
Rotor Sweep Area	20,867 m^2

The ARS data was used to determine target density for each day of the monitoring program (calculated from values in Tables 35/36/37/38, Appendix J) and the interaction airspace volume was used to calculate and project the MBII (Figures 7.16, 7.17, 7.18, and 7.19).

During the 2022 fall monitoring period, the MBII value spiked several times from September 12 to October 19, with the largest spike occurring on October 6, 2022 (Figure 7.16). These peaks suggest that fall migration in 2022 may have occurred sporadically within the Study Area, potentially due to fluctuating temperatures and reduced daylight hours (Frei et al. 2024, Sockman & Hubert, 2020).

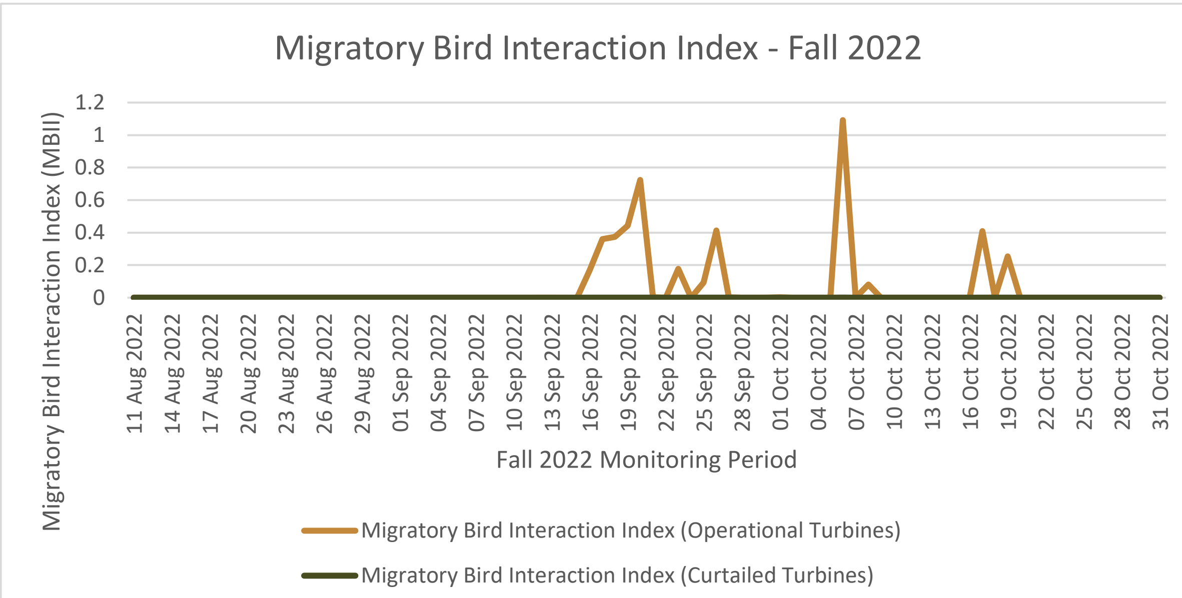


Figure 7.16: Migratory Bird Interaction Index – Projected Daily for the Fall 2022 Monitoring Period

During the 2023 spring monitoring period, the MBII value spiked from April 25 to May 21, with the largest spike occurring on May 17, 2023 (Figure 7.17). These peaks suggest that spring migration may have occurred rapidly within the Study Area and in short duration to compete for forage and breeding opportunities, regardless of ideal weather conditions (Nilsson et al., 2013). Similar to the spring monitoring period, the summer monitoring period also see a series of smaller peaks from June 17 to June 30 before a large peak on July 21 (Figure 7.18). During the 2023 fall monitoring period, the MBII value spiked on August 5, followed by a larger spike on September 11 and a series of smaller sporadic spikes into October and November (Figure 7.19). While the spring monitoring period saw continuous spikes across consecutive days, the fall monitoring period saw more sporadic spikes across the fall season, suggesting that fall migration happened in longer duration (Nilsson et al., 2013).

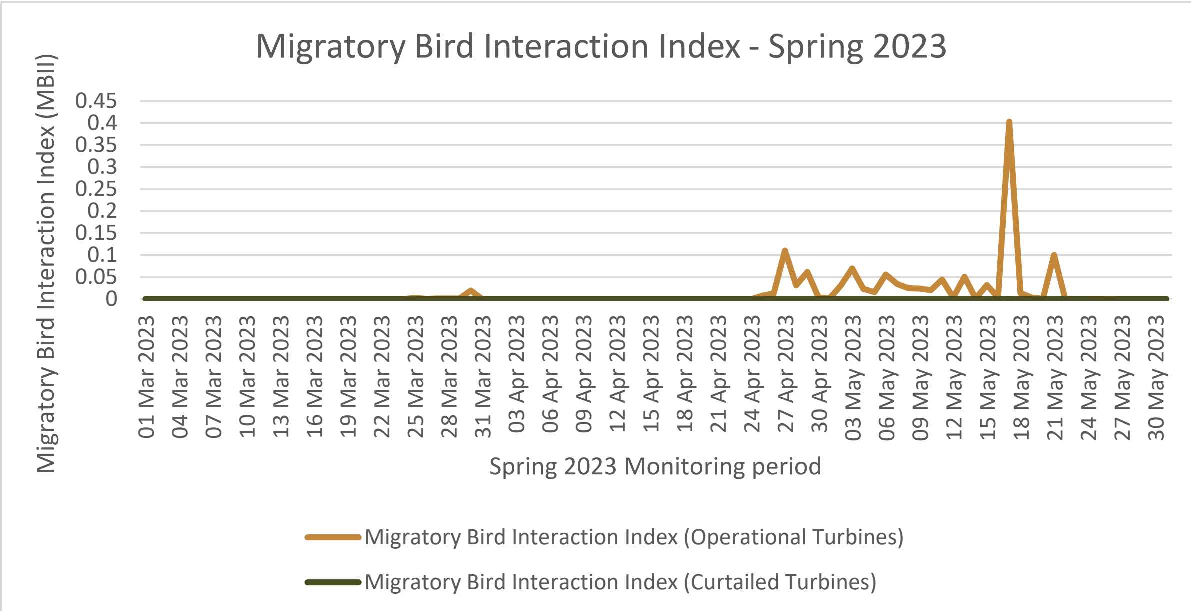


Figure 7.17: Migratory Bird Interaction Index – Projected Daily for the Spring 2023 Monitoring Period

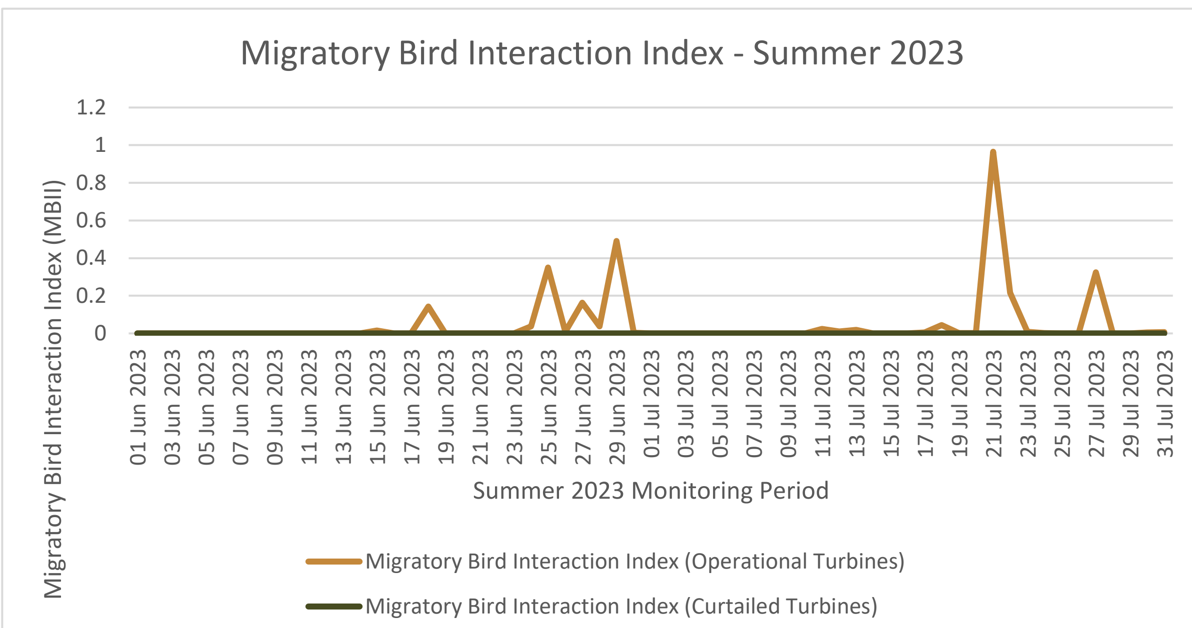


Figure 7.18: Migratory Bird Interaction Index – Projected Daily for the Summer 2023 Monitoring Period

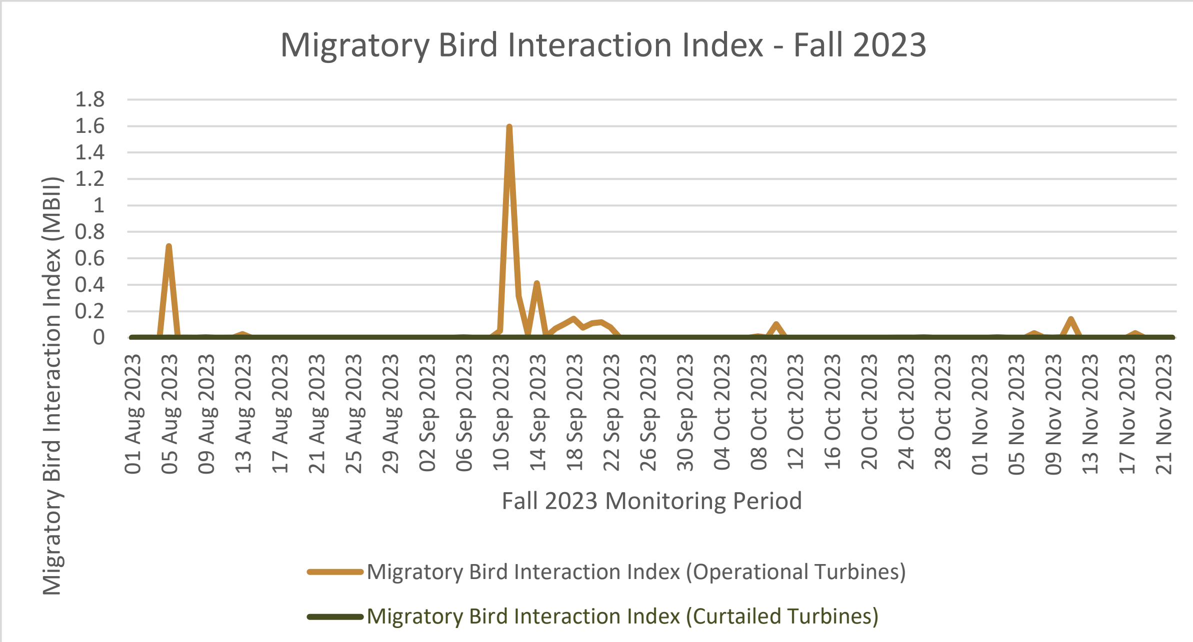


Figure 7.19: Migratory Bird Interaction Index – Projected Daily for the Fall 2023 Monitoring Period

7.4.5.13 Acoustic Monitoring Results

Data collected by the ARU for the 2022 and 2023 monitoring period was verified to provide a list of confirmed species utilizing the site across seasons (Tables 39/40/41/42, Appendix J). The ARU was deployed attached to the ARS, in an open area to the east of Sandy Brook (Drawing 7.29B). As the ARS and ARU were retrieved during the early summer months and redeployed in late August in 2022, little data was available for the 2022 summer monitoring period.

Seasonally, 870 vocalizations (including songs/calls and NFCs) were identified during spring migration, 334 vocalizations during summer breeding, and 898 vocalizations were identified during fall migration across both 2022 and 2023. During the manual verification process for the 2022 and 2023 BirdNET and Nighthawk data, 59 unique bird species were confirmed, including 23 SOCI species and five SAR species.

Results presented in this report and described below include avian data as follows:

- BirdNET: Detected SAR and SOCI species only (song and call)
- Nighthawk: All bird species detected (NFCs)

2022 and 2023 BirdNET Results: SAR and SOCI

BirdNET identified 5,531 sounds in the 2022 dataset and identified 14,644 sounds in the 2023 dataset, to which experienced ornithologists manually verified 7% and 12%, respectively, to feed into a linear regression model (Tables 39/41, Appendix J). A majority of the false predictions were due to noise from Spring peepers (*Pseudacris crucifer*), a species of frog that creates a loud noise from late March until mid-June when their breeding period is over. This noise interferes with the ARU as the noise occupies the same sound frequency and duration as several avian species.

During the 2022 spring monitoring period, the manually verified SAR and SOCI calls and songs peaked on May 12, 2022 (vocalizations = 105), with most peak occurring in May (Figure 7.20). Out of the manually verified calls during this period, American Robin (200) and Purple Finch (60) produced the highest number of songs/calls. Chimney Swift, Common Nighthawk, and Olive-sided Flycatcher were the three SAR observed during this time. Notably, Spotted Sandpiper (two) was the only shorebird observed during this period.

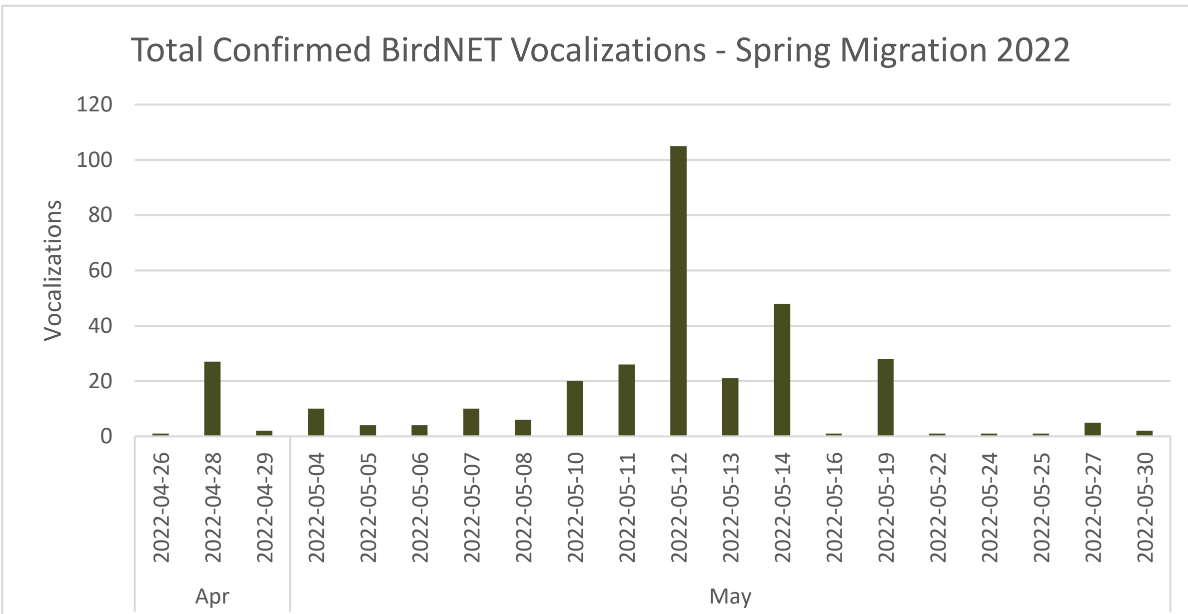


Figure 7.20: Manually Verified SAR and SOCI Avian Acoustic Activity by Date During the 2022 Spring Migration Period

While the ARU was not deployed for the entire 2022 summer, BirdNET identified 61 vocalizations in June (Figure 7.21). These songs and calls occurred between early to mid-June, with Common Nighthawk producing the highest number of vocalizations (59). Common Nighthawk and Chimney Swifts were the only two SAR species and the only two species recorded during this period.

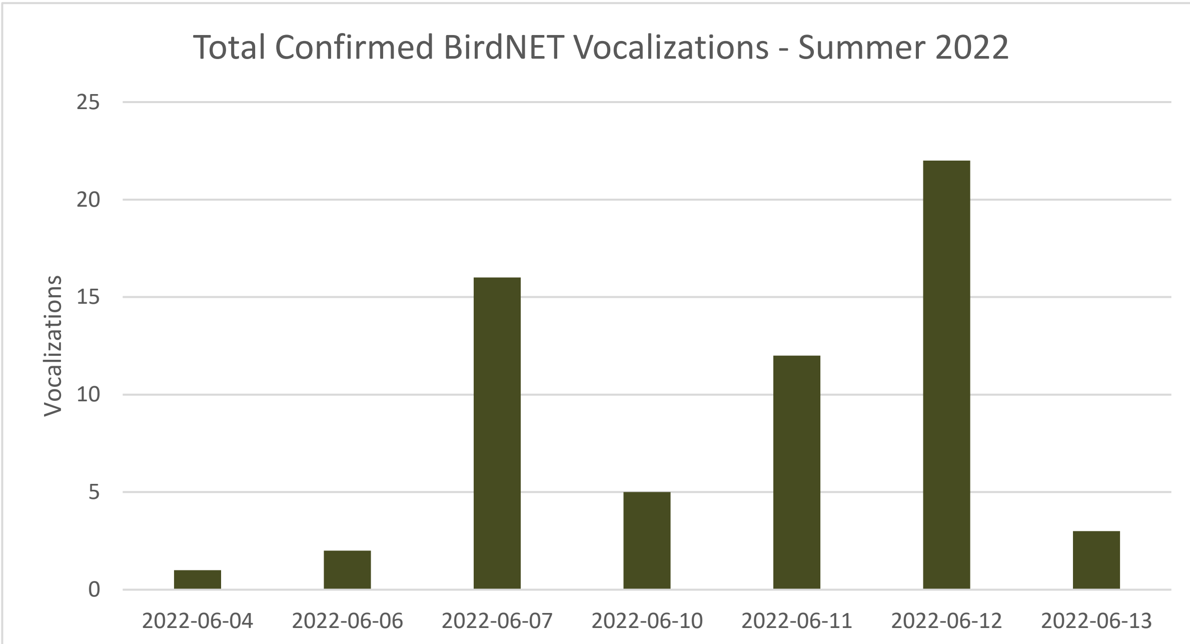


Figure 7.21: Manually Verified SAR and SOCI Avian Acoustic Activity by Date During the 2022 Summer Breeding Period

During the 2022 fall migration period, BirdNET identified less vocalizations, with most of the manually verified SAR and SOCI calls and songs detected in October (vocalizations = 19) (Figure 7.22). Out of the manually verified calls, Boreal Chickadee (15) and American Robin (7) produced the highest number of vocalizations. Common Nighthawk and Olive-sided Flycatcher were the two SAR recorded during this monitoring period.

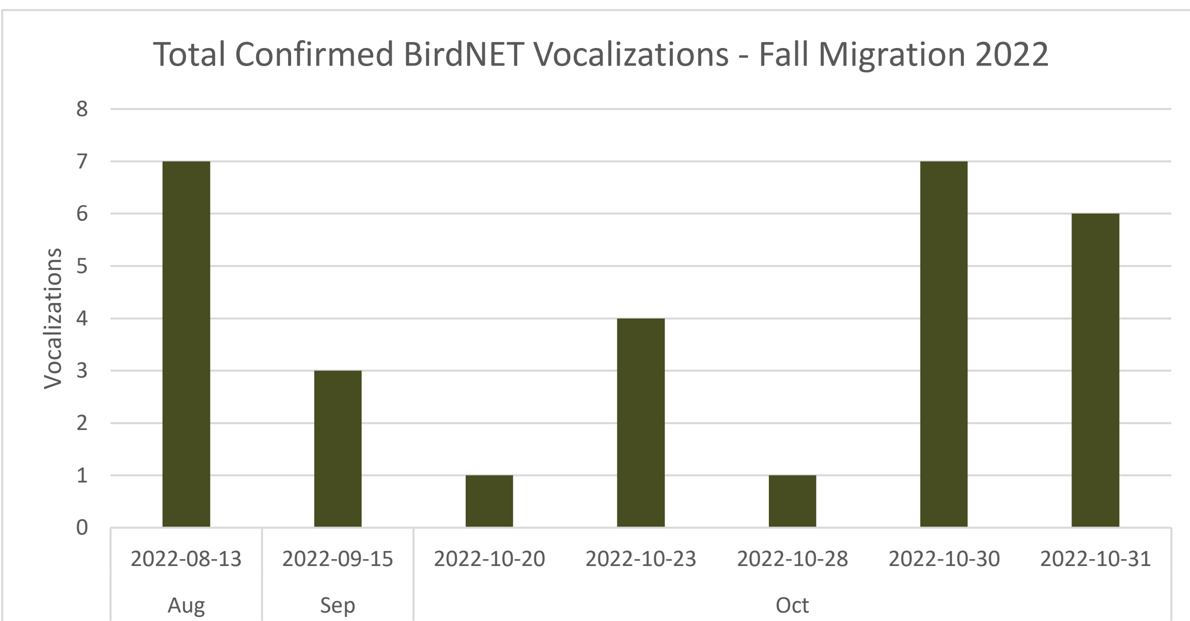


Figure 7.22: Manually Verified SAR and SOCI Avian Acoustic Activity by Date During the 2022 Fall Migration period.

Throughout the 2022 ARU monitoring period, species richness for SAR and SOCI was highest in June and August with four species (Figure 7.23). During the manual verification process, 12 bird species were confirmed, including eight SOCI species and three SAR species. Since the ARU was only deployed until mid-June and re-deployed in late August, a portion of the summer breeding and fall migration were excluded from the 2022 ARU monitoring period.

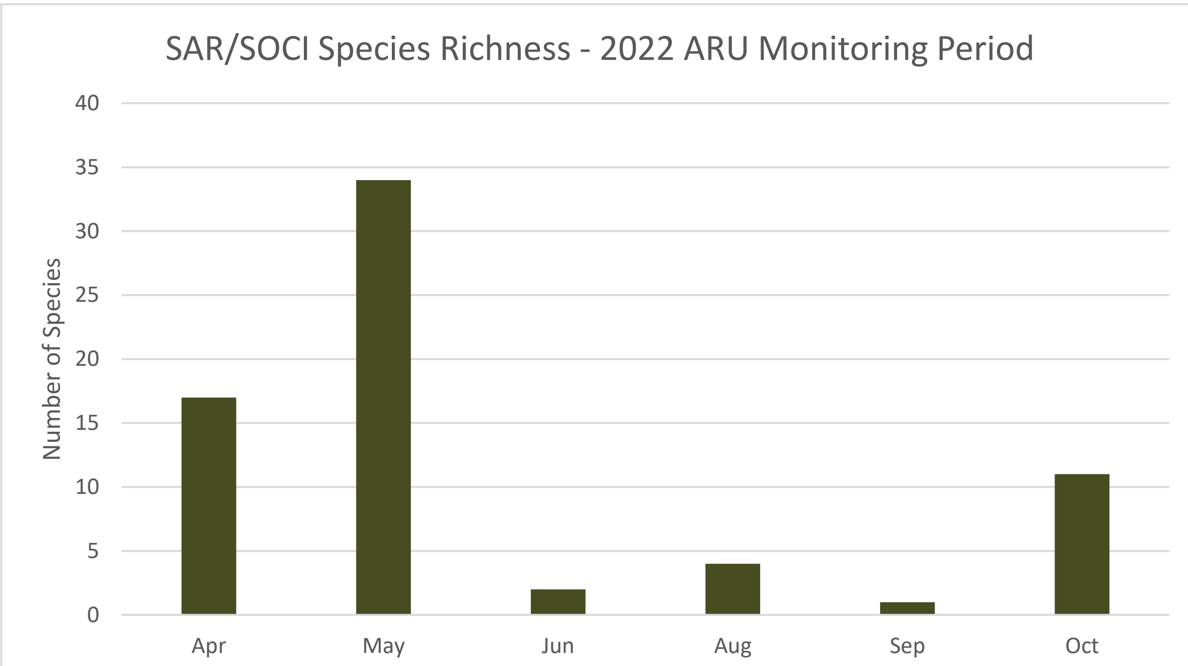


Figure 7.23: SAR and SOCI Species Richness during the 2022 ARU Monitoring Period.

During the 2023 spring monitoring period, the manually verified SAR and SOCI calls and songs peaked on May 6, 2023 (vocalizations = 12) with another spike on May 17, 2023 (vocalizations = 8) (Figure 7.24). Out of the manually verified calls during this period, American Robins produced the highest number of songs/calls (29). Similar to the 2022 spring monitoring period, Spotted Sandpiper (two) was the only shorebird observed during the 2023 spring monitoring period.

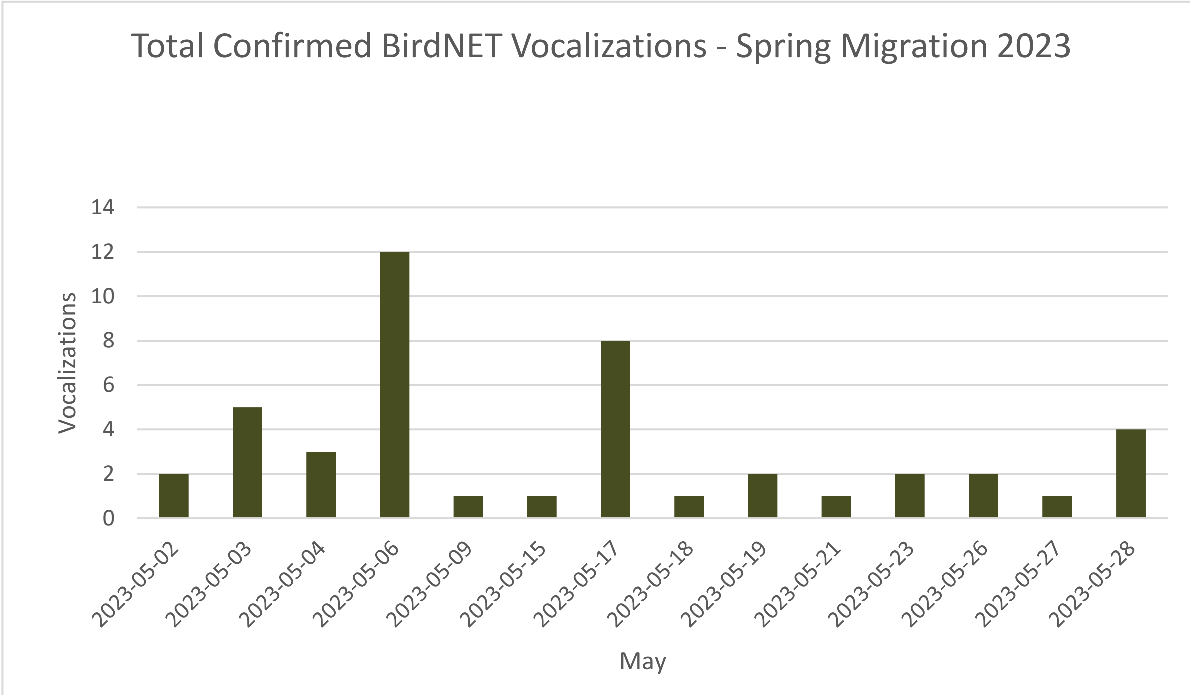


Figure 7.24: Manually Verified SAR and SOCI Avian Acoustic Activity by Date During the 2023 Spring Migration Period

During the 2023 summer monitoring period, the manually verified SAR and SOCI songs/calls were highest in July (vocalizations = 120) with peak dates on July 5, 8, 13, 17 and 19, 2023 (vocalizations = 21, 14, 20, 12, 10, respectively) (Figure 7.25). American Robin (42), Purple Finch (48), and Common Nighthawk (34) produced the highest number of vocalizations. Common Nighthawk was the only SAR recorded during the summer monitoring period. Notably, these calls were recorded during nighttime or early morning, suggesting that the species was more active around this time.

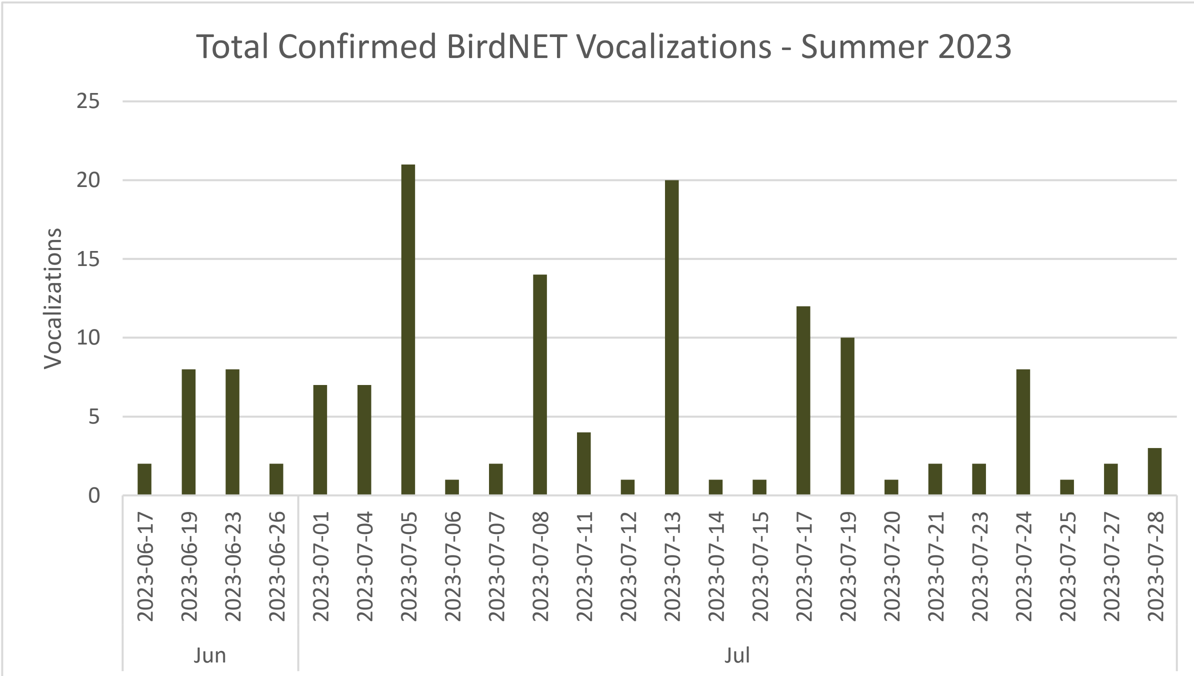


Figure 7.25: Manually Verified SAR and SOCI Avian Acoustic Activity by Date During the 2023 Summer Breeding **Period**

During the 2023 fall migration period, most of the manually verified SAR and SOCI calls and songs were detected in October (vocalizations = 172), with sporadic detections from mid-August into early November (Figure 7.26). Out of the manually verified calls, American Robin (21), Canada Goose (64), Canada Jay (52), Pine Siskin, and Pileated Woodpecker (18) produced the highest number of vocalizations. Common Nighthawk was the only SAR recorded during this monitoring period. It is worth noting that during mid-August to early September, Solitary Sandpiper (two) and Black-headed Gull (one) was the only shorebird recorded.

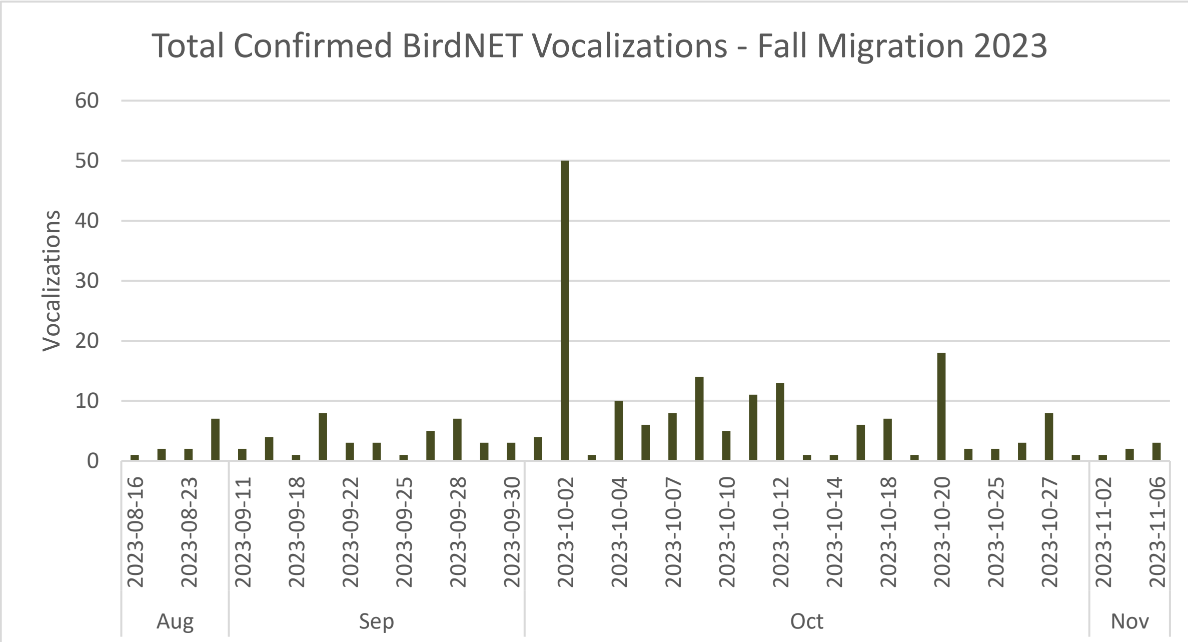


Figure 7.26: Manually Verified SAR and SOCI Avian Acoustic Activity by Date During the 2023 Fall Migration **Period**

Throughout the 2023 ARU monitoring period, species richness for SAR and SOCI was highest in June and August with four species (Figure 7.27). During the manual verification process, 24 bird species were confirmed, including 20 SOCI species and one SAR species. Since BirdNET was focused on SAR and SOCI, these results are more restrictive than those of Nighthawk. While Gray-cheeked Thrush, Great Blue Heron, and Pileated Woodpecker are not SOCI or SAR, they are protected by the *Migratory Birds Convention Act* and thus are included within BirdNET species list.

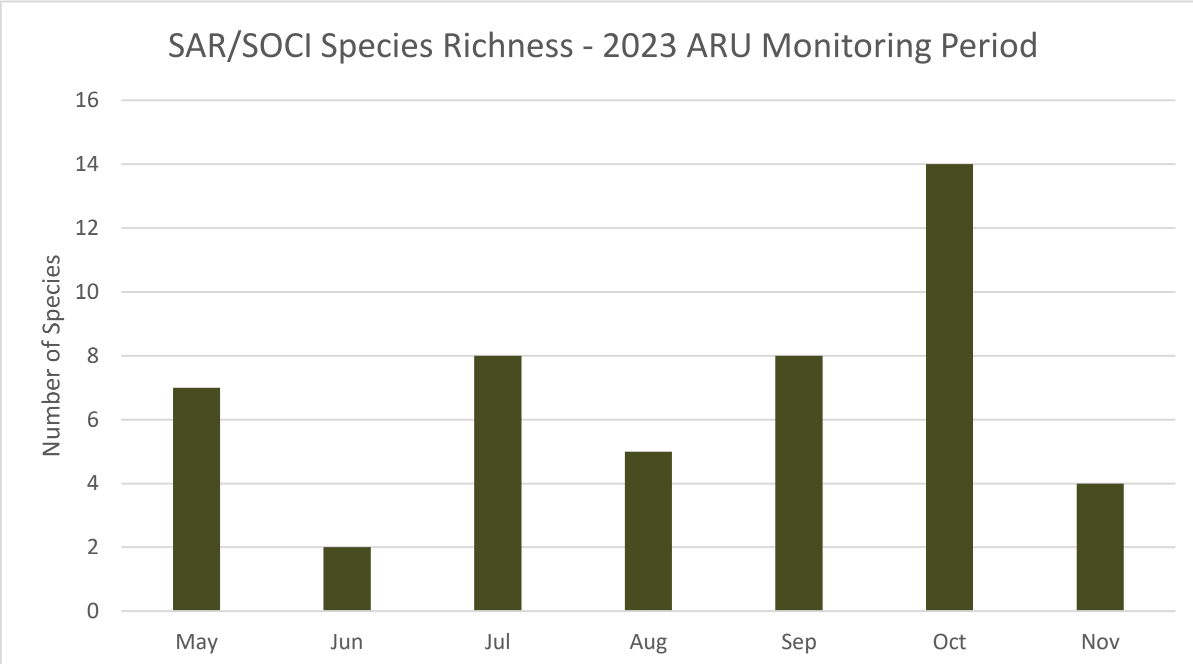


Figure 7.24: SAR and SOCI Species Richness during the 2023 ARU Monitoring Period

Table 7.83 is a summary of all the confirmed SAR and SOCI species detected through BirdNET during the acoustic analysis and their conservation status. The ACCDC maintains a comprehensive provincial list of plant and animal species, designating each with a conservation status rank (S-rank) and legal status for each species in each province (ACCDC, 2024). Twenty-seven species, including 24 species ranked of conservation concern (i.e., S-ranks between S1 and S3S4), were detected in the 2023 dataset.

Table 7.83: Summary of SAR and SOCI Species Confirmed during 2022 and 2023 BirdNET Acoustic Analysis

Common Name	Scientific Name	COSEWIC Status[1]	*SARA* Status[1]	*ESA* Status[2]	NS S-Rank[3]
American Robin	*Turdus migratorius*	---	---	---	S5B, S3N
Bay-breasted Warbler	*Setophaga castanea*	---	---	---	S3S4B, S4S5M
Black-billed Cuckoo	*Coccyzus erythropthalmus*	---	---	---	S3B
Black-headed Gull	*Chroicocephalus ridibundus*	---	---	---	S3N
Blackpoll Warbler	*Setophaga striata*	---	---	---	S3B, S5M
Canada Goose	*Branta canadensis*	---	---	---	SUB, S4N, S5M
Canada Jay	*Perisoreus canadensis*	---	---	---	S3

Common Name	Scientific Name	COSEWIC Status[1]	*SARA* Status[1]	*ESA* Status[2]	NS S-Rank[3]
Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	Endangered	S2S3B, S1M
Common Nighthawk	*Chordeiles minor*	Special Concern	Special Concern	Threatened	S3B
Gray-cheeked Thrush	*Catharus minimus*	---	---	---	SUB
Great Blue Heron	*Ardea Herodias*	---	---	---	S4B, S4S5M
Greater Yellowlegs	*Tringa melanoleuca*	---	---	---	S3B, S4M
Least Sandpiper	*Calidris minutilla*	---	---	---	S1B, S4M
Olive-sided Flycatcher	*Contopus cooperi*	Special Concern	Special Concern	Threatened	S3B
Pileated Woodpecker	*Dryocopus pileatus*	---	---	---	S5
Pine Grosbeak	*Pinicola enucleator*	---	---	---	S3B, S5N, S5M
Pine Siskin	*Spinus pinus*	---	---	---	S3
Pine Warbler	*Setophaga pinus*	---	---	---	S2S3B, S4S5M
Purple Finch	*Haemorhous purpureus*	---	---	---	S4S5B, S3S4N, S5M
Red Crossbill	*Loxia curvirostra*	---	---	---	S3S4
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	---	---	---	S3B
Solitary Sandpiper	*Tringa solitaria*	---	---	---	SUB, S3S4M
Spotted Sandpiper	*Actitis macularius*	---	---	---	S3S4B, S5M
White-crowned Sparrow	*Zonotrichia leucophrys*	---	---	---	SUM
Wilson's Snipe	*Gallinago delicata*	---	---	---	S3B, S5M
Wilson's Warbler	*Cardellina pusilla*	---	---	---	S3B, S5M

Source: ACCDC 2024
[1]Government of Canada, 2023; [2]NS *ESA,* 2023; [3]ACCDC, 2024

2022 and 2023 Nighthawk Software Results: All Birds

The Nighthawk software identified 106,116 sounds in the 2022 dataset and identified 20,150 sounds in the 2023 dataset, of which a portion of these sounds were manually listened and verified to be bird NFCs (Tables 40/42, Appendix J). Similar to the BirdNET program, most sounds were filtered out as external interferences and thus reducing the identified sounds to only adequately identifiable avifauna NFCs. Nighthawk did not identify audible NFCs during the short summer monitoring period in 2022.

During the 2022 spring monitoring period, the highest NFCs spikes occurred in May with the highest peaks on May 7 and May 8, 2022 (NFCs = 20 for both) (Figure 7.25). Nighthawk did not identify audible NFCs during the summer monitoring period in 2022, as explained in the methods section. Most of the NFCs recorded during this period were produced by White-throated Sparrow (37), Hermit Thrush (15), and Dark-eyed Junco (10). American Robin was the only SOCI found during the 2022 spring monitoring period.

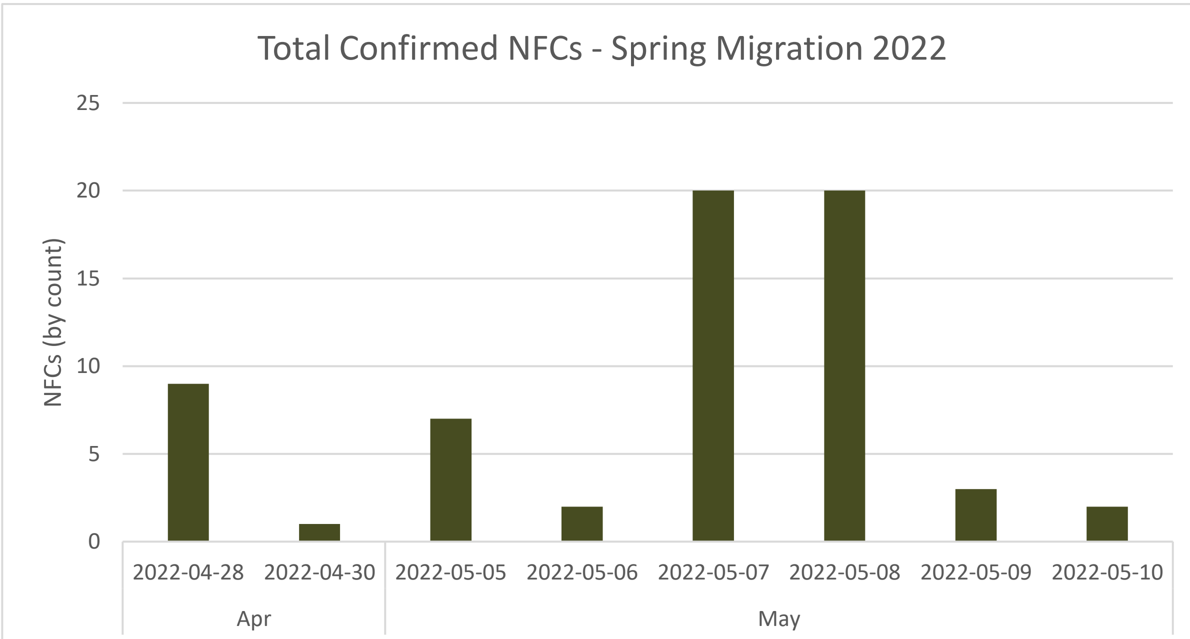


Figure 7.25: Manually verified Night Flight Calls by Date During the 2022 Spring Migration Period.

During the 2022 fall monitoring period, the software identified prominent spikes on August 13 (NFCs = 36), August 15 (NFCs = 19), September 13 (NFCs = 36), and September 15 (NFCs = 22) (Figure 7.26). Further, Nighthawk identified September to have the highest number of NFCs throughout the entire 2022 ARU monitoring period, with NFCs detections diminishing by late September. White-throated Sparrow (39), Hermit Thrush (20), and Black-and-white Warbler (16) produced the most abundant number of NFCs. SOCI species that were identified during this period include American Robin, Cape May Warbler, Greater Yellowlegs, Rose-breasted Grosbeak, Spotted Sandpiper, Vesper Sparrow, and Wilson’s Warbler. Canada Warbler was the only SAR species identified in the 2022 fall monitoring period.

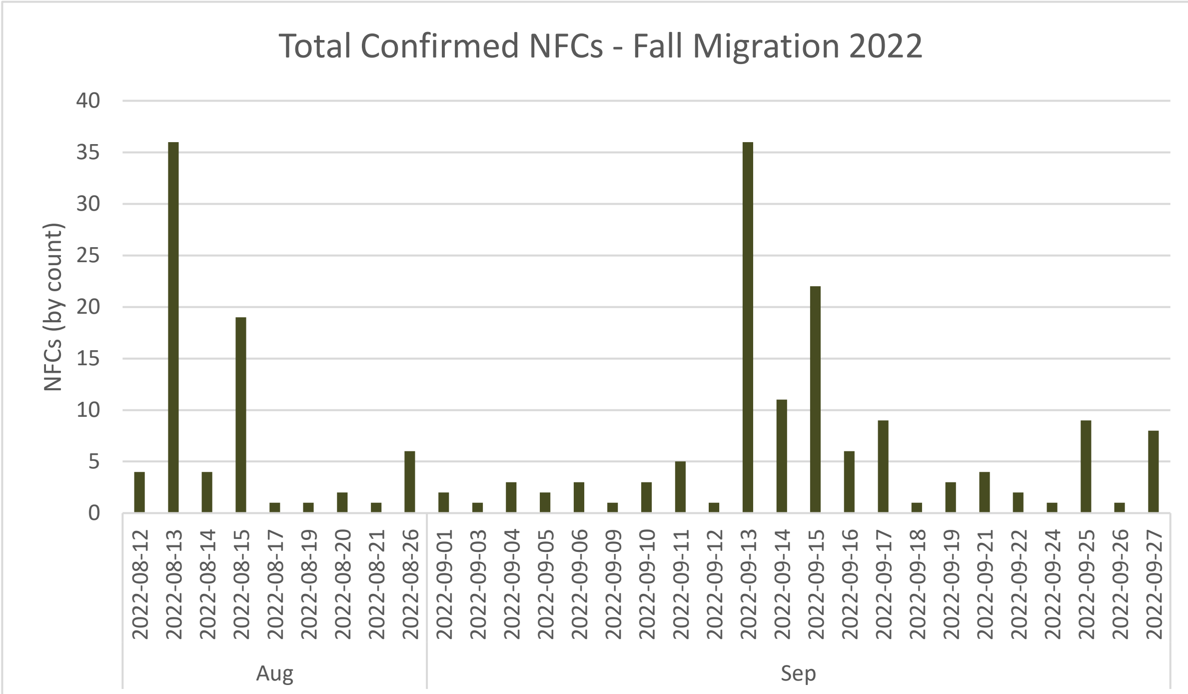


Figure 7.26: Manually verified Night Flight Calls by Date During the 2022 Fall Migration Period.

Species richness was higher during fall migration than spring migration, with five total verified species in April and May and 25 total verified species in August and September (Figure 7.27). Seasonally, the manual verification process confirmed 24 bird species, including seven SOCI and one SAR species. Notably, Nighthawk did not identify NFCs in early June, which may indicate birds have moved onto breeding activities and thus no longer displaying NFCs. Furthermore, Nighthawk captured less NFCs than BirdNET identified songs/calls in the 2022 spring monitoring period, suggesting that peak spring migration may have occurred earlier than the ARU deployment period.

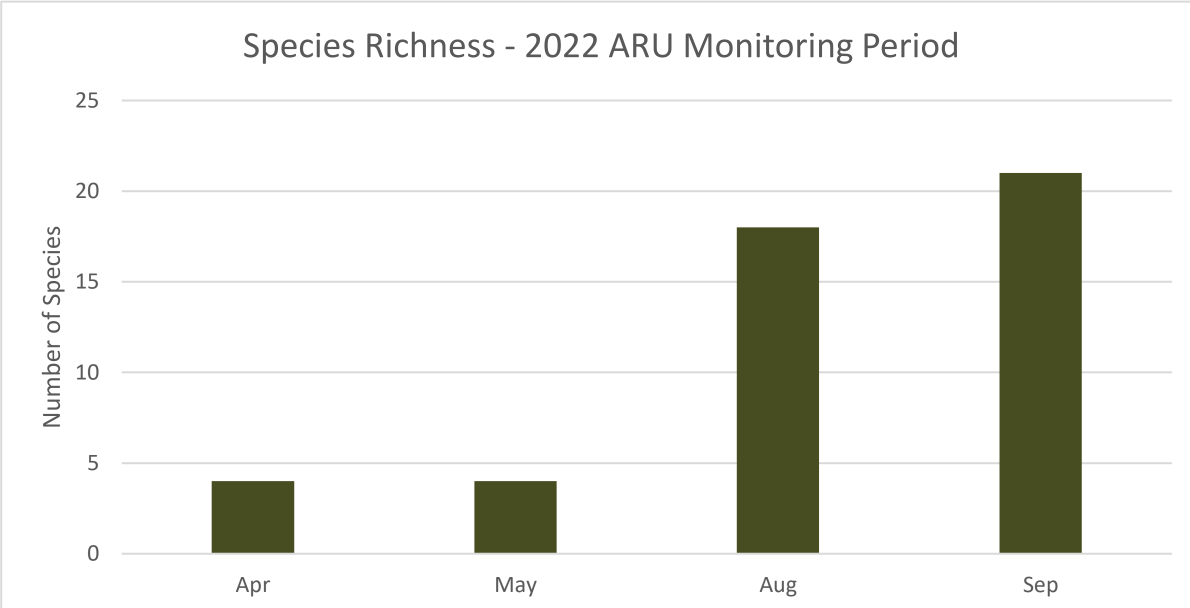


Figure 7.27: Species Richness (number of species in the dataset) by Month in 2022.

During the 2023 spring monitoring period, a prominent spike occurred on April 17, 2023 (NFCs = 57) followed by a larger observation on May 27, 2023 (NFCs = 145) (Figure 7.28). High spikes continue into the end of May (Figure 7.28). Most of the NFCs recorded from April to May were produced by White-throated Sparrow (196), Cape May Warbler (115), and Dark-eyed Junco (65). American Robin, Cape May Warbler, and Scarlet Tanager were the SOCI found during this period.

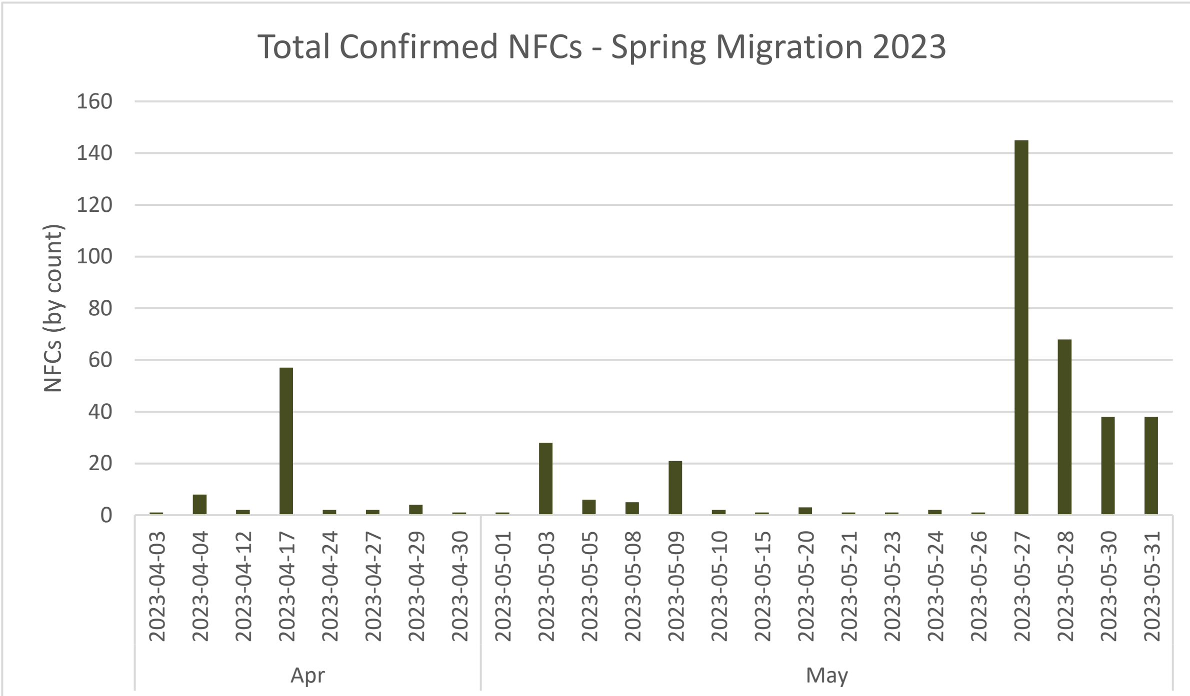


Figure 7.28: Manually Verified Night Flight Calls by Date During the 2023 Spring Migration Season

During the 2023 summer monitoring period, the program identified the highest NFCs spike on June 9, 2023 (NFCs = 31), followed by detections into early July (Figure 7.29). It should be noted that detections in early June could still be associated with spring migrants. Notably, Nighthawk identified less NFCs than BirdNET identified songs during the summer monitoring period, suggesting that birds have mostly moved to breeding behaviours and thus display less NFCs. Most of the NFCs recorded during this time were produced by Cape May Warbler (69) and Hermit Thrush (30). Cape May Warbler and Grey-cheeked Thrush were the only two SOCI species observed during this time.

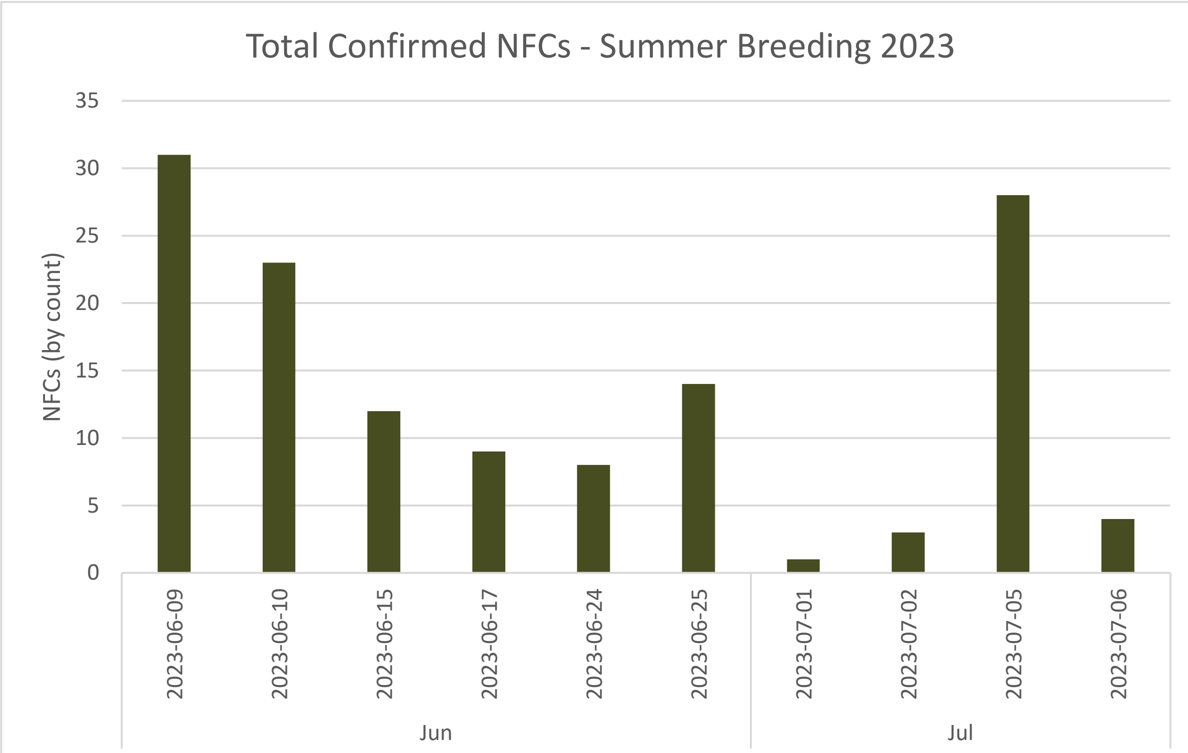


Figure 7.29: Manually Verified Night Flight Calls by Date During the 2023 Summer Breeding Season

During the 2023 fall monitoring period, Nighthawk identified the highest peak in late August (NFCs = 191), followed by consistent detections from September into early November (Figure 7.30). American Redstart (87), Hermit Thrush (34), Swainson's Thrush (35), and White-throated Sparrow (34) were the most commonly observed species during manual verification. Notably, Nighthawk detected Solitary Sandpiper (1) during August. Seven SOCI were observed during the 2023 fall monitoring period. Canada Warbler and Bobolink were the only SAR species found during this time.

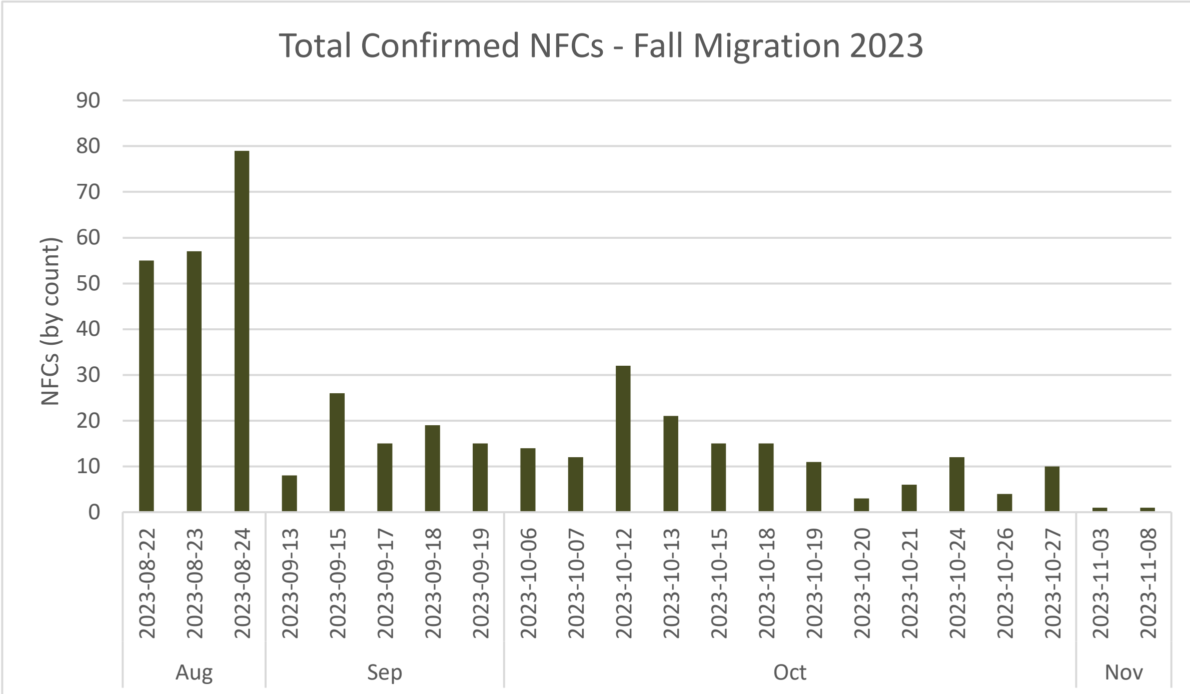


Figure 7.30: Manually Verified Avian Acoustic Activity by Date During the 2023 Fall Migration Season

Species richness was high during both peak spring and fall migration seasons, with 10 verified species in May and 19 verified species in August (Figure 7.31). Seasonally, the manual verification process confirmed 31 bird species, including 10 SOCI species. Notably, Nighthawk demonstrated higher species richness during the 2023 fall monitoring period than that of the spring monitoring period, and higher total species richness than that of BirdNET across all monitoring periods in 2023. This is because BirdNET only analyzed SAR and SOCI songs/calls.

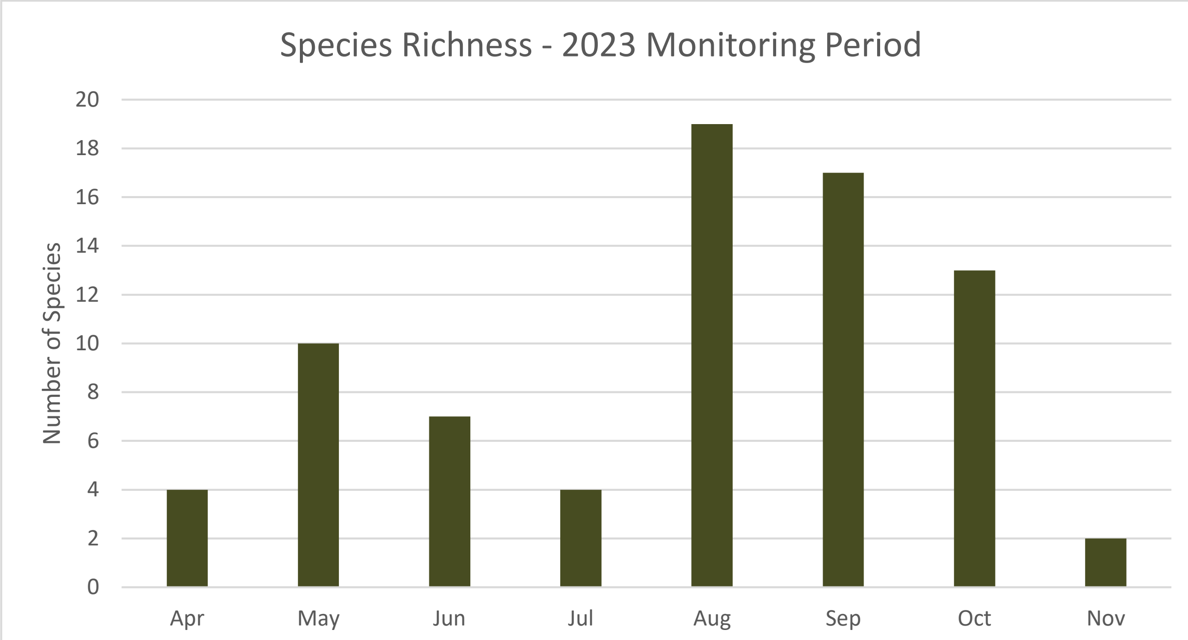


Figure 7.31: Species Richness (number of species in the dataset) by Month During 2023

Table 7.84 is a summary of all the confirmed species detected using Nighthawk during the 2022 and 2023 acoustic analysis and their conservation status. A total of 12 species ranked of conservation concern (S-ranks between S1 and S3S4) were detected in both datasets. Two SAR species were observed throughout the ARU monitoring period.

Table 7.84: Summary of Species Confirmed during 2022 and 2023 Nighthawk Acoustic Analysis

Common Name	Scientific Name	COSEWIC Status[1]	*SARA* Status[1]	*ESA* Status[2]	NS S-Rank[3]
Alder Flycatcher	*Empidonax alnorum*	---	---	---	S5B
American Redstart	*Setophaga ruticilla*	---	---	---	S5B
American Robin	*Turdus migratorius*	---	---	---	S5B, S3N
American Tree Sparrow	*Spizelloides arborea*	---	---	---	S5N
Black-throated Blue Warbler	*Setophaga caerulescens*	---	---	---	S5B
Bobolink	*Dolichonyx oryzivorus*	Special Concern	Threatened	Vulnerable	S3B
Cape May Warbler	*Setophaga tigrine*	---	---	---	S3B, SUM
Canada Warbler	*Cardellina canadensis*	Special Concern	Threatened	Endangered	S3B
Chestnut-sided Warbler	*Setophaga pensylvanica*	---	---	---	S5B
Common Yellowthroat	*Geothlypis trichas*	---	---	---	S5B

Common Name	Scientific Name	COSEWIC Status[1]	*SARA* Status[1]	*ESA* Status[2]	NS S-Rank[3]
Dark-eyed Junco	*Junco hyemalis*	---	---	---	S4S5
Greater Yellowlegs	*Tringa melanoleuca*	---	---	---	S3B, S4M
Grey-cheeked Thrush	*Catharus minimus*	---	---	---	SUB
Hermit Thrush	*Catharus guttatus*	---	---	---	S5B
Hooded Warbler	*Setophaga citrina*	Not at Risk	---	---	SNA
Mourning Warbler	*Geothlypis Philadelphia*	---	---	---	S4B, S5M
Nashville Warbler	*Leiothlypis ruficapilla*	---	---	---	S4B, S5M
Northern Parula	*Setophaga americana*	---	---	---	S5B
Northern Waterthrush	*Parkesia noveboracensis*	---	---	---	S4B, S5M
Ovenbird	*Seiurus aurocapilla*	---	---	---	S5B
Palm Warbler	*Setophaga palmarum*	---	---	---	S5B
Red-breasted Nuthatch	*Sitta canadensis*	---	---	---	S4S5
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	---	---	---	S3B
Savannah Sparrow	*Passerculus sandwichensis*	---	---	---	S4S5B, S5M
Scarlet Tanager	*Piranga olivacea*	---	---	---	S2B, SUM
Solitary Sandpiper	*Tringa solitaria*	---	---	---	SUB, S3S4M
Spotted Sandpiper	*Actitis macularius*	---	---	---	S3S4B, S5M
Swainson Thrush	*Catharus ustulatus*	---	---	---	S4B, S5M
Veery	*Catharus fuscescens*	---	---	---	S4B
Vesper Sparrow	*Pooecetes gramineus*	---	---	---	S1S2B, SUM
White-throated Sparrow	*Zonotrichia albicollis*	---	---	---	S4S5B, S5M
Wilson’s Warbler	*Cardellina pusilla*	---	---	---	S3B, S5M
Yellow-billed Cuckoo	*Coccyzys americanus*	---	---	---	SNA

Source: ACCDC 2024
[1]Government of Canada, 2023; [2]NS *ESA,* 2023; [3]ACCDC, 2024

7.4.5.14 AudioMoth Manual Listening Results

Avian SAR detected during AudioMoth recording analyzation include Barn Swallow, Common Nighthawk, Eastern Wood-pewee, and Olive-sided Flycatcher (Tables 49/50/51, Appendix J). Out of 27 total avian SAR observations, 74% of the individuals were observed during the breeding bird season. Common Nighthawk had the highest number of observations (i.e., 18 individuals), which centered around late May/early June to mid-August. Common Nighthawks were heard displaying wing-boom behaviour during the month of May, which is classified as probable breeding behaviour (i.e., territorial display). Olive-sided Flycatcher had the second highest number of observations (i.e., seven individuals), which centered around late May/early June to mid-July. Due to the higher number of records of Common Nighthawk and Olive-sided Flycatcher, these individuals were likely foraging and breeding in the area and it is possible that the same individual was recorded more than once.

AudioMoths that had Common Nighthawk observations (i.e., AudioMoths 1, 3, 5, 8, 15, 21, and 22) and Olive-sided Flycatcher observations (i.e., AudioMoths 1, 20, and 21) were all placed within/near clearcuts or near open wetlands and/or lakes with edge habitat nearby (Drawing 7.29). This habitat could provide opportunities for both breeding and foraging activities.

AudioMoth 15 had the Barn Swallow observation, which was located in a clearcut (Drawing 7.29). There are open wetlands and lakes located within range (i.e., 500 m to 1 km) of this location that could provide appropriate foraging habitat.

AudioMoth 10 had the Eastern Wood-pewee observation, which was located on the edge of a wetland with a lake less than 250 m away from the location (Drawing 7.29). This habitat could provide opportunities for both breeding and foraging activities for Eastern Wood-pewees.

2024 Spring Migration

During the 2024 spring migration season, AudioMoths detected 342 individual birds, representing 44 species (Table 7.85). The most abundant and frequently observed species were the Canada Goose and Hermit Thrush. A total of 33 species were observed in the passerines bird group, five species were observed in the other landbirds bird group, two species were observed in the shorebirds bird group, two species were observed in the waterfowl bird group, one species was observed in the nocturnal raptors bird group, and one species was observed in the other waterbirds bird group. Passerines accounted for 75% of the species and 81.9% of the individual birds observed.

Table 7.85: 2024 Spring Migration AudioMoth Detections by Species

Common Name	# Individuals
Alder Flycatcher	2
American Crow	3
American Goldfinch	5
American Robin	8
Bay-breasted Warbler	5
Black-and-white-Warbler	9

Common Name	# Individuals
Blackburnian Warbler	2
Black-capped Chickadee	2
Black-throated Blue Warbler	2
Black-throated Green Warbler	16
Blue Jay	6
Blue-headed Vireo	5
Brown Creeper	2
Canada Goose	40
Common Grackle	2
Common Loon	2
Common Nighthawk	2
Common Yellowthroat	26
Dark-eyed Junco	10
Downy Woodpecker	1
Golden-crowned Kinglet	9
Greater Yellowlegs	1
Hairy Woodpecker	2
Hermit Thrush	36
Magnolia Warbler	15
Mallard or American Black Duck	1
Mourning Dove	1
Nashville Warbler	2
Northern Flicker	7
Olive-sided Flycatcher	3
Ovenbird	1
Palm Warbler	5
Purple Finch	1
Red-eyed Vireo	6
Ruffed Grouse	4
Song Sparrow	3
Spotted Sandpiper	1
Swainson's Thrush	13
Swamp Sparrow	8
White-throated Sparrow	25
Winter Wren	22
Yellow Warbler	1
Yellow-bellied Flycatcher	3
Yellow-rumped Warbler	22
Total	**342**

During the 2024 spring migration season, SOCI that were observed by AudioMoths included American Robin, Bay-breasted Warbler, Greater Yellowlegs, Purple Finch, and Spotted Sandpiper. SAR detected included Common Nighthawk and Olive-sided Flycatcher.

Between early May to mid-May, AudioMoths 1 and 3 picked up large groupings of Canada Geese (i.e., between 10 and 20 individuals). This could be an indication of migratory behaviour.

2024 Breeding Bird

During the 2024 breeding bird season, AudioMoths detected 474 individual birds, representing 44 species (Table 7.86). The most abundant and frequently observed species were the Hermit Thrush, Swainson's Thrush, and Common Yellowthroat. A total of 36 species were observed in the passerines bird group, five species were observed in the other landbirds bird group, one species was observed in the diurnal raptors bird group, one species was observed in the nocturnal raptors bird group, and one species was observed in the other waterbirds bird group. Passerines accounted for 81.8% of the species and 93.7% of the individual birds observed.

Table 7.86: 2024 Breeding Bird AudioMoth Detections by Species

Common Name	# Individuals
American Crow	1
American Goldfinch	2
American Redstart	4
American Robin	10
Barn Swallow	1
Bay-breasted Warbler	2
Black-and-white Warbler	15
Black-backed Woodpecker	1
Blackburnian Warbler	7
Black-capped Chickadee	7
Black-throated Blue Warbler	1
Black-throated Green Warbler	19
Blue Jay	6
Blue-headed Vireo	10
Brown Creeper	2
Canada Jay	3
Cedar Waxwing	11
Common Loon	3
Common Nighthawk	14
Common Yellowthroat	40
Dark-eyed Junco	30
Downy Woodpecker	1

Common Name	# Individuals
Eastern Wood-Pewee	1
Golden-crowned Kinglet	6
Hairy Woodpecker	2
Hermit Thrush	50
Least Flycatcher	11
Magnolia Warbler	23
Mourning Dove	1
Nashville Warbler	4
Northern Flicker	7
Olive-sided Flycatcher	4
Osprey	1
Ovenbird	5
Palm Warbler	10
Red-eyed Vireo	6
Red-winged Blackbird	1
Ruby-crowned Kinglet	1
Song Sparrow	7
Swainson's Thrush	42
Swamp Sparrow	16
White-throated Sparrow	34
Winter Wren	22
Yellow-rumped Warbler	30
Total	**474**

During the 2024 breeding bird season, SOCI that were observed by AudioMoths included American Robin, Bay-breasted Warbler, Black-backed Woodpecker, and Canada Jay. SAR detected included Barn Swallow, Common Nighthawk, Eastern Wood-pewee, and Olive-sided Flycatcher.

During the breeding bird season, 35% of the 474 individuals observed were in mid-July. Note that patterns could be due to data gaps and limitations.

The only breeding activity picked up was a likely breeding pair of Common Loons near AudioMoth 10 during the month of June.

2024 Fall Migration

During the 2024 fall migration season, AudioMoths detected 256 individual birds, representing 43 species (Table 7.87). The most abundant and frequently observed species were the Yellow-rumped Warbler and Magnolia Warbler. A total of 37 species were observed in the passerines bird group, two species were observed in the other landbirds bird group, one species was observed in the diurnal raptors bird group, one species was observed in the nocturnal raptors bird group, one species was observed in the waterfowl bird group, and one species was observed in the other waterbirds bird group. Passerines accounted for 86% of the species and 91.8% of the individual birds observed.

Table 7.87: 2024 Fall Migration AudioMoth Detections by Species

Common Name	# Individuals
American Crow	1
American Goldfinch	6
American Redstart	3
American Robin	5
Black-and-white Warbler	13
Black-capped Chickadee	19
Blackpoll Warbler	9
Black-throated Blue Warbler	3
Black-throated Green Warbler	3
Blue Jay	11
Blue-headed Vireo	1
Brown Creeper	2
Canada Goose	1
Canada Jay	4
Cape May Warbler	1
Cedar Waxwing	8
Chestnut-sided Warbler	1
Common Loon	4
Common Nighthawk	2
Common Yellowthroat	5
Dark-eyed Junco	7
Golden-crowned Kinglet	9
Grey Catbird	1
Hairy Woodpecker	3
Hermit Thrush	5
Magnolia Warbler	28
Northern Flicker	10
Northern Parula	6
Northern Waterthrush	1
Osprey	1
Ovenbird	5
Palm Warbler	17
Pine Siskin	2

Common Name	# Individuals
Purple Finch	1
Red Crossbill	1
Red-breasted Nuthatch	1
Savannah Sparrow	1
Snow Bunting	1
Song Sparrow	3
Swainson's Thrush	3
Swamp Sparrow	1
White-throated Sparrow	15
Yellow-rumped Warbler	32
Total	**256**

During the 2024 fall migration season, SOCI that were observed by AudioMoths included American Robin, Blackpoll Warbler, Cape May Warbler, Canada Jay, Pine Siskin, Purple Finch, and Red Crossbill. SAR detected included Common Nighthawk.

During fall migration the highest number of recordings (i.e., 93% of the individuals observed) occurred between mid-August to mid-September. Note that patterns could be due to data gaps and limitations.

AudioMoth Data Gaps and Limitations

Note that, as stated in the methods above, certain monitors were only deployed during the breeding bird and fall migration seasons (i.e., AudioMoths 14, 15, 20, 21, and 22; Drawings 7.29A and 7.29C). The reason for the difference in monitor numbers between seasons is that during the spring migration, field staff were having navigation and access issues within the Study Area due to dangerous terrain and intense topography. Based on the results of the spring surveys, five more AudioMoth monitors were acquired and placed in areas with better access to cover more of the Study Area.

Limitations and data gaps did result from AudioMoth deployment and data analyzation, which include:

- Interference from deer and black bears (i.e., noise and physical tampering with the monitors).
- Anthropogenic interference from humans making noise within detection range of monitors during recordings or physically tampering with the units (e.g., turning off monitors and/or removing batteries and SD cards).
- Errors during installation and maintenance by field staff (i.e., not programming correctly which results in a period of non-recording).
- Human health and safety issues while deploying and checking on equipment (i.e., dangers posed by hunting activity in the area).

- Software issues and issues with sound quality, including interference from frogs and wildlife (i.e., deer, bears, etc.).
- Weather conditions impacting sound quality (although good weather days were selected for listening when possible).
- Access issues into the site during deployment of the AudioMoths in the spring. Certain locations, trails, and roads to get into the Study Area had restricted access.

Note that the limitations and issues involving bears, hunting, and humans tampering with the monitors mainly occurred during the fall migration season.

Despite these limitations, all AudioMoths recorded data with the exception of one monitor (i.e., AudioMoth 16 due to a technical issue). Certain monitors were deployed for all seasons (i.e., AudioMoths 1, 2, 3, 8, and 10). There were a few AudioMoths that only recorded data during certain time periods, which include (Drawings 7.29A, 7.29B, and 7.29C):

- AudioMoth 6 was deployed during the spring migration season and had to be removed due to dangerous terrain and access issues.
- AudioMoths 4, 5, 7, and 12 were deployed during the spring migration and breeding bird seasons. AudioMoths 4, 5 and 7 were left unchecked during most of the fall migration season due to suspicious hunting activities (i.e., bear baiting) that posed safety concerns for field staff. AudioMoth 7 was moved due to dangerous terrain and access issues. AudioMoth 12 was removed during the fall migration season due to a bear biting and physically removing the monitor from the tree.
- AudioMoth 90 was deployed during the fall migration season only. This monitor was deployed in a new area of the site in place of AudioMoth 12, as that area had an active bear.

7.4.5.15 SAR Detected in Study Area

Table 7.88 includes all SAR detected in the Study Area throughout 2022, 2023, and 2024 acoustic and field surveys. SAR abundance was observed to be moderate, while distribution was observed to be stochastic. Due to the sensitive nature of avian SAR observations, location data will be available to the Client and regulatory bodies but will not be included in this report. Trends regarding habitat types and avian SAR distribution within the Study Area will be discussed in further sections.

Table 7.88: SAR Detected in Study Area

Common Name	SAR Status	2022 Season	2023 Season (Acoustics Only)	2024 Season
Barn Swallow	SARA: Threatened NSESA: Endangered SRank: S3B	-	-	Summer
Bobolink	SARA: Threatened NSESA: Vulnerable SRank: S3B	-	Fall	-
Canada Warbler	SARA: Threatened NSESA: Endangered	Spring, Summer, Fall	Fall	Summer, Fall

Common Name	SAR Status	2022 Season	2023 Season (Acoustics Only)	2024 Season
	SRank: S3B			
Chimney Swift	SARA: Threatened NSESA: Endangered SRank: S2S3B, S1M	Spring, Summer	-	-
Common Nighthawk	SARA: Special Concern NSESA: Threatened SRank: S3B	Spring, Summer, Fall	Summer, Fall	Spring, Summer, Fall
Eastern Wood-Pewee	SARA: Special Concern NSESA: Vulnerable SRank: S3S4B	Summer	-	Spring, Summer
Evening Grosbeak	SARA: Special Concern NSESA: Vulnerable SRank: S3B, S3N, S3M	-	-	Spring
Olive-sided Flycatcher	SARA: Special Concern NSESA: Threatened SRank: S3B	Spring, Summer	-	Spring, Summer, Fall
Rusty Blackbird	SARA: Special Concern NSESA: Endangered SRank: S2B	-	-	Fall

7.4.5.16 SAR Habitat Suitability Analysis

A habitat suitability analysis was conducted of SAR avifauna detected during field surveys and acoustics in the Study Area (see Table 7.89). Out of the observed SAR species within the Study Area, Bobolink, and Chimney Swift were recorded outside of their preferred habitat and outside of the expected nesting period during the summer. While Rusty Blackbird was observed within its preferred habitat, the timing of observations during the 2024 field surveys suggests high probability of fall migration passing through the Study Area. Overall, SAR observations within the Study Area were adequately correlated with their preferred habitat, suggesting high habitat suitability for breeding and foraging behaviours.

Table 7.89: Habitat Suitability Analysis of SAR avifauna within the Study Area

Common Name	Source of Observation	Observed Habitat	Preferred Habitat	Study Area Habitat Suitability
Barn Swallow	2024 Acoustic	Open clearcut, moderate to severe human disturbance	Forage: open and semi-open habitat (e.g., lakes and open wetlands), including natural and anthropogenic habitats	Foraging
Bobolink	2023 Acoustic	Open boulder pit, moderate to severe human disturbance	Grassland obligates	Spring/Fall migrant
Canada Warbler	2022 Spring Migration 2022 BBS 2024 Spring Migration 2024 BBS 2024 Fall Migration Incidental	Wetland edges, mixedwood forest, little to moderate human disturbance	Riparian wetlands to lakes/watercourses, moist forests, mature forests with gaps in the canopy	Breeding Foraging Spring/Fall migrant

Common Name	Source of Observation	Observed Habitat	Preferred Habitat	Study Area Habitat Suitability
	2023 Acoustic			
Chimney Swift	2022 CONI 2022 Acoustic	Open boulder pit, high human disturbance	Urban areas with access to chimneys or other cavities, Dead trees/forest and windthrow areas	Spring/Fall migrant Potential Breeding and Foraging
Common Nighthawk	2022 CONI 2022 BBS 2024 CONI 2024 BBS Incidental 2024 Acoustic	Mixedwood forest, moderate to severe human disturbance, roadsides, open clearcuts, wetlands.	Open and partially open habitats	Breeding Foraging Spring/Fall migrant
Eastern Wood-pewee	2022 BBS 2024 Acoustic	Forest edges alongside a large waterbody	Intermediate to mature deciduous and mixedwood forests, Clearings and early successional forests, Forest edges, including both dry and wet forest	Breeding Foraging Spring/Fall migrant
Evening Grosbeak	2024 Spring Migration	Young conifer forest, moderate to severe human disturbance	Conifer and mixedwood forests	Breeding Foraging Year-Round Resident
Olive-sided Flycatcher	2022 Spring Migration 2022 BBS 2024 Spring Migration 2024 BBS 2024 Fall Migration Incidental 2022 Acoustic 2024 Acoustic	Coniferous forests adjacent to open areas, moderate to severe human disturbance, logging	Edges of coniferous or mixed forests with tall trees and snags alongside open areas	Breeding Foraging Spring/Fall migrant
Rusty Blackbird	2024 Fall Migration	Forest edge beside a large waterbody.	Wet softwood forests (e.g., fir and spruce near water bodies or wetlands).	Spring/Fall migrant Potential Breeding and Foraging

7.4.5.17 Effects Assessment

Project-Avifauna Interactions

Project activities, primarily those that involve earth moving or vegetation removal, or interactions with avifauna in the airspace have the potential to impact avifauna (Table 7.90). These activities could result in habitat removal, reductions in food availability, and direct bird-turbine interactions. Other Project related activities, including during construction and operation, may impact avifauna behaviours, such as increased traffic and sensory disturbances (i.e., light and noise).

Table 7.90: Potential Project-Avifauna Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Avifauna		X		X	X	X			X	X		X	X		X

Assessment Boundaries

For the purposes of this assessment, the LAA for avifauna includes the Assessment Area as well as the airspace that is directly surrounding the turbines, as described above in the MBII. The RAA for avifauna includes the surrounding landscape, and the airspace above these areas, up to approximately 3000 m (Drawing 7.27).

Assessment Criteria

Assessment criteria provided in Section 4.6 also apply for avifauna. The VC-specific definition for magnitude is as follows:

- Negligible – no loss of important avifauna habitat (e.g., breeding bird habitat) and no impacts to migratory avifauna are expected.
- Low – small loss of important habitat supporting avifauna and/or impacts to migratory avifauna are expected to be low.
- Moderate – moderate loss of important avifauna habitat and/or moderate impacts to migratory avifauna.
- High – high loss of important avifauna habitat and/or high impact to migratory that would be sufficient to impact species on a population scale.

Effects

Habitat Loss and Fragmentation

Across all seasons, it is evident that the Study Area supports a variety of avian species due to the diversity of habitats present in the area. Overall, survey locations that represented edge habitat (i.e., forested habitat on the edge of clear-cut, wetland, or a lake) had the highest numbers of avian abundance and species diversity. Forests ranged in type (e.g., softwood) as well as age. Further details on locations and habitats by season will be included below.

Across Canada, forest harvesting, and silviculture are leading causes of habitat loss for forest-dependent avian species, with mining and energy exploration also contributing to habitat loss, as well as to the disruption of individuals and their migratory and breeding behaviours (ECCC, 2016b).

Based on the terrestrial habitat desktop assessment (Section 7.4.1.3), approximately 3.5% of the Assessment Area is harvested, 0.1% is utility corridor, and 0.2% is urban/landfill/quarry/roads. It is important to note that, based on the age range of this desktop data and continuing forestry activity in the area, these numbers are a minimum and the extent of disturbed habitat is likely a lot higher. The extent of treated and cleared areas, based on field observations, was found to be greater than the desktop review suggested.

The footprint of the Project, particularly the area that will impact intact habitat, is relatively small compared to other developments in the natural resource sector. Approximately 24.3 km of existing roads have been incorporated into the Project design, while 11.4 km of new road construction will be required. Because of the increase in road length, the Project may cause some additional habitat fragmentation in the RAA. Additionally, the size of habitat gaps may increase for roads requiring widening. Upgrades to pre-existing roads will be limited to removing small areas of habitat in areas that have already been disturbed. Habitat loss and fragmentation effects to avifauna are therefore expected to be low. Although fragmentation tends to be a concern for mammals, birds that prefer large tracts of undisturbed forest can be impacted by fragmentation as well.

The Project design also prioritized the avoidance of old growth forests and has minimized the loss of wetland habitat. Based on field surveys, no old growth stands were found within the Assessment Area. Although a few older stands (i.e., 100 years or more) were found, they did not qualify for old growth designation. Despite no old growth detected in the Assessment Area, based on desktop review there are a few old growth stands within the Study Area that so do not overlap the Assessment Area (see Section 7.4.1.3). There is a potential for up to 1.27 ha of wetland habitat to be impacted (Section 7.3.3.6). Twelve of the associated upgrades will be to existing roads and the remaining potential alterations will be for the construction of new roads or turbine pads. Detailed design will prioritize minimizing impacts to wetlands to the greatest extent possible.

Additional evaluation of habitat loss and availability was completed for SAR observed within the Study Area during field surveys.

There is appropriate breeding/nesting habitat for all avian SAR observed within the Study Area except for Bobolink (Drawing 7.31). Overall, due to the higher number of Common Nighthawk and Olive-sided Flycatcher observed throughout the seasons compared to other avian SAR, as well as the probable and confirmed breeding behaviour observed for these species, it is highly likely that these two species are both foraging and breeding in the area. The extent of Chimney Swift potential habitat, as stated in the SAR modelling section above, is difficult to estimate due to the difficulty of calculating old growth habitat and large hallowed out snags using aerial imagery and provincial GIS layers. Based on field survey data, although there are mature stands of forest in the Study Area although none qualified as old growth. Although the Assessment Area provides foraging habitat for Chimney Swifts (7.33), it is difficult to estimate potential breeding/nesting habitat. The Rusty Blackbird was observed in a riparian wetland area during the fall migration season, although there is appropriate foraging and breeding/nesting habitat for them in the Study Area. The Bobolink observed were likely migrating through the area. Eastern Wood-Pewee and Evening Grosbeak were also observed, and it is possible they are both foraging and breeding/nesting in the Study Area. Barn Swallows were observed foraging within the Study Area, however no nesting habitat was observed by surveyors.

Based on the SAR habitat modelling, the species will the most predictive habitat modelling within the Assessment Area were Chimney Swift (66.5%; Drawing 7.33), Evening Grosbeak (51.2%; Drawing 7.36), Olive-sided Flycatcher (39.6%; Drawing 7.37), and Common Nighthawk (40.74%; Drawing 7.34). As discussed in the SAR habitat modelling methods and results section, the Chimney Swift predictive habitat model was likely over-estimated. Although there is foraging habitat available for the Chimney Swift, the amount of breeding/nesting habitat is difficult to predict due to modelling constraints. Despite the level of impact that will occur in the Assessment Area, it is important to note that Common Nighthawk are an example of a species that adapts to human disturbance (ECCC, 2016c). Multiple Common Nighthawk field observations within the Study Area were within fresh or older clear-cuts. In addition, the construction of turbine pads and new gravel roads may create additional suitable breeding habitat for Common Nighthawks. Evening Grosbeak is also an example of a species that adapts to human disturbance and is found in harvested areas (e.g., edge habitat, thinned stands, etc.) (ECCC, 2022c). Olive-sided Flycatcher and Eastern Wood-pewees are another example of species that use edge habitat for foraging, including clear-cuts (ECCC, 2023; ECCC, 2016b).

Various avian SAR observed within the Study Area rely on wetlands for various life stages (e.g., Barn Swallow, Canada Warbler, Eastern Wood-pewee, Olive-sided Flycatcher, and Rusty Blackbird). The Project design has prioritized the use of existing roads and minimized alterations to wetlands. Overall, impacts to these species' habitat is expected to be low.

Road Traffic

Many species of avifauna are known to use the roadways within the Study Area, as evidenced by field survey results (Tables 3 to 34, Appendix J). An increase in road traffic will increase chances of mortality to those avifauna using the roadways, especially Ruffed Grouse, Spruce Grouse, and similar species, as they are known to use roadways for travel and nesting. Most roads within the Study Area are currently used for recreation by off-highway vehicle users and forestry activities. Outside of the construction phase, the Project will only require technicians to access the site to perform regular maintenance/equipment checks. Considering the pre-existing traffic load and the minimal traffic to be associated with the Project, road traffic is expected to have a negligible to low effect on avifauna in the LAA.

Bird Strikes

Bird strikes are a primary concern when considering the interactions of avifauna with the Project, as turbine blades spin at high speeds through the airspace frequented by a variety of species at all different altitudes within the rotor swept area. Bird strikes include instances when birds are struck by the rotating turbine blades, or birds collide with the turbine tower or nacelle structures, which can cause injury or mortality to birds.

The ARS data indicates that the density of migratory avifauna varied based on the height bin and time of year and was inconsistent above the lower height bins that the proposed turbines would occupy. This indicates that there would likely be some level of interaction between migratory avifauna and the Project during operation, however the majority of migratory movement occurs above the heights expected to be most impacted.

Observed migration events were stochastic throughout the fall migration season, and are likely influenced by weather, particularly wind direction. This is consistent with the findings of a large-scale avian radar study conducted in the continental United States, which determined that most migratory bird movements occur on just 10% of a migration season's nights (Horton et al., 2021). Interactions with the turbine infrastructure would vary over time, with variations in migratory bird density. Bird strikes and avian mortalities are likely to be proportional to migratory bird activity. MBII values (Drawings 7.13 to 7.16) cannot be used as a predictor of avian mortality rates, as not every interaction would result in mortality.

Other studies that examined interactions between wind turbines and avifauna have determined the level of avian mortality caused by wind turbines to be low (Zimmerling et al., 2013), including several post-construction avian mortality monitoring programs conducted by Strum at operating wind power projects in Nova Scotia within the past decade (i.e., >1 detectable bird mortality[4] per wind turbine per year on average). The MBII model projection indicates that interactions would have occurred on just a few nights in fall, indicating that the level of avian mortality caused by the Project would be low for the vast majority of the Project's operation, and mortality events (if any) would be limited to a few events during the migration periods.

Collision mortality is influenced by abundance, frequency of passage, flight behaviour, weather, and topography (De Lucas et al., 2008). The prediction of collision risk by migratory birds with turbines using pre-construction data is complex and has not been well established in Atlantic Canada. The best indicator of risk is the volume of birds migrating at the rotor swept area (RSA), though only a small fraction of the birds migrating at this height may collide with the turbine rotors. Verification of collision is confirmed through post-construction mortality monitoring.

In Canada, 69% of bird fatalities recorded from wind power projects were passerines (Bird Studies Canada et al., 2016). It is likely that passerines make up an even larger percentage of

[4] Detectable bird mortalities are determined during post-construction avian mortality monitoring programs by searching for bird carcasses under operating wind turbines using human searchers. This technique is subject to error from scavenger removal and searcher efficiency, so the actual bird mortality levels are likely higher than the detectable levels.

fatalities than estimated, due to the difficulty in detection of individuals during surveys than larger birds (Erickson et al., 2014), as well as rapid scavenger removal (i.e., 70 to 80% within two days) (Lekuona & Ursua, 2007). Avoidance behaviour varies between species (Whitfield, 2009), with raptors appearing to be more vulnerable to collision with turbines than most other avian groups (Erickson et al., 2002; Young et al., 2003).

Behaviour of diurnal migrants such as raptors makes them potentially more vulnerable to collisions with turbines, particularly during hunting (Higgins et al., 2007), or while using thermal updrafts to increase altitude and conserve energy. Barrios and Rodriguez (2004) reported increased mortality during fall/winter migration, with birds flying closer to turbines. Some studies have also correlated raptor abundance with a higher collision risk. Breeding grounds and areas with foraging habitat have been identified as sites that increase high flight abundance (Bevanger, et al., 2009; Eichhorn et al., 2012).

Additionally, diurnal migrants (raptors, vultures, etc.) are more constrained by topographical features than nocturnal migrants – they tend to be concentrated along linear features such as rivers, ridges, and valleys (Richardson, 2000); resulting mitigation suggests placing turbines away from such features. From a developmental perspective, the Project has been placed in a location that does not contain significant landscape features that encourage nocturnal migration, such as those noted above.

Ferrer et al. (2012) further suggests there is clear evidence that the likelihood of bird collisions with turbines depends critically on species behaviour and topographic factors, not solely local abundance. Birds do not move over the area at random, but follow main wind currents, which are affected by topography. Therefore, certain locations of turbines could be harmful for birds even where there is a relatively low density of birds, whereas other locations would be relatively risk-free even with higher densities of birds (Ferrer, et al., 2012).

The risk to avian species for collision with turbines is highest during migration periods (AEP, 2018), when the most fatalities tend to be reported. Fatalities can also occur from meteorological (MET) towers and guywires, or through nest mortality/disturbance from clearing of vegetation/loss of habitat (Band et al., 2007). Bird fatalities due to turbine collision have been identified as an ecological challenge in wind energy (Drewitt & Langston, 2006), however, mitigating this is not forthright, due to the complexity of factors influencing collisions. Bird collision likelihood depends on species, turbine height, location, and elevation, implicating species-specific and topographic factors in collision mortality. There is no evidence of an association between collision likelihood and turbine type or the position of a turbine in a row (De Lucas et al., 2008).

Populations of several groups vulnerable to collisions are increasing across Canada (e.g., waterfowl, raptors). This suggests collision mortality at current levels does not limit population growth. The factors that contribute to a species' vulnerability to collisions include species that flock, have rapid flight, and are large with slow maneuverability (i.e., high wing loading and low wing aspect ratio) (Rioux et al., 2013).

Since it is difficult to predict mortality events at wind sites before operations occur and mortality events can vary greatly based on species, weather, location, and time of year, post-construction avian mortality surveys are important to implement to understand this further.

Bird Strike Risk Based on Field and Radar Data

Based on the height of the proposed wind turbines and the diameter of the turbine blades, birds flying at the heights between 43.5 m and 206.5 m would be at potential risk of interacting with the turbines.

Across all years and seasons, 120 fly-over observations were observed during field surveys. Based on the height of these observations, 51 (i.e., 42.5%) were within the risk zone of interacting with the turbines. Species that were observed within the risk zone flight height included American Black Duck, American Crow, American Robin, Bald Eagle, Black-throated Green Warbler, Belted Kingfisher, Blue Jay, Common Grackle, Common Nighthawk, Common Loon, Common Raven, Greater Yellowlegs, Pine Siskin, Purple Finch, Red Crossbill, Red-tailed Hawk, Sharp-shinned Hawk, Turkey Vulture, and Winter Wren. It is important to note that fly-over height is estimated by the surveyor and may vary in accuracy based on the surveyor and weather conditions and even if birds were observed flying within the risk zone, avoidance measures are taken and vary by avian species as described above. No migration corridors or patterns were observed by surveyors within the Study Area.

During the 2022 fall radar monitoring period, 33% of BTs were detected the 43.5 m to 206.5 m height range, most of which were detected in the 25 m to 50 m height bin from September 16 to September 20, 2022. During the 2023 spring and summer monitoring periods approximately 5% of observed BTs were detected within this height corridor, the fall monitoring period saw 19% of observed BTs within the height corridor. It is important to note that the majority of these observations could have been within the 24 m to 43 m no-risk height range. Overall, the daily total of BTs detected was highly variable during the ARS monitoring campaign, indicating that migratory bird activity is somewhat stochastic during migration seasons.

There are limitations with using field and radar data to quantify risk as there are constraints with surveyor accuracy as well as observation locations. The radar (ARS) was only in one location and, although point count survey locations covered a large proportion of the Study Area, any lack of observations does not necessarily mean there is no migration behaviour occurring in the area.

Sensory Disturbance

The Project could impact bird migration directly (e.g., turbine strike), or indirectly (e.g., sensory disturbance or requiring excess calorie expenditure that would compromise a bird’s ability to migrate).

The target height density for the radar monitoring period indicates some level of interaction between migratory avifauna and the Project as any avifauna flying at heights between 43.5 m to 206.5 m would potentially be at risk of interacting with a turbine. While both spring and summer monitoring periods observed approximately 5% of observed BTs within this height corridor, the fall monitoring period saw 19% of observed BTs within the height corridor.

The MBII model shows that interactions between birds and the turbines would be relatively low, with infrequent spikes during migration events. Turbine lighting could cause sensory disturbances that disrupt migration activity, as migratory birds are attracted to sources of light at night, especially in low visibility conditions. Operating turbines can also cause sensory disturbances, causing birds to divert course, and possibly spend excess caloric energy, thus compromising migration success.

Light sensory disturbance that can impact birds includes behavioural effects such as disorientation, avoidance, or attraction (Longcore and Rich, 2004). In turn, these behavioural changes can affect the success of foraging, reproduction, and communication of wildlife (Longcore and Rich, 2004) and can disrupt habitat connectivity (Bliss-Ketchum et al., 2016). It has been known that exterior structures such as substations, buildings, and other floodlit structures can attract birds during the night and lead to mortality events. In addition, migratory birds during fall and spring are especially attracted to lighting on tall structures. Modifications and timing of use for lighting can be managed to limit impacts on birds.

Lighting associated with the Project will be minimal, and the turbines will be un-lit at night (apart from a red navigation hazard light mounted on the turbine’s nacelle). As such, lighting is not expected to impact bird migration. Other research that addresses the impacts of operating wind turbines on migratory bird movements has determined that the machines do not significantly alter migratory bird movements (d’Entremont et al., 2017) suggesting that impacts to migration as a whole would be minimal.

Another potential form of sensory disturbance to birds is ambient noise levels caused by Project activities. Noise and vibrations are provincially regulated under the Workplace Health and Safety Regulations, N.S. Reg. 52/2013 to protect the health and safety of site workers and the general public, which will help mitigate any negative impacts to bird species. Sensory disturbance from noise can impact birds in a number of ways. Birds can exhibit greater susceptibility to noise impacts as many species rely on vocal communication (Blickley & Patricelli, 2010). Avifauna may be displaced from areas adjacent to the Project from construction related noise. Impacts can also differ between acute and chronic noise sources. Chronic exposure may degrade auditory cues, feedback, and vocal development over time, important for predator/prey detection, communication, breeding, and orientation (Blickley & Patricelli, 2010; Marler et al., 1973; Shannon et al., 2016). A direct physiological impact causing a temporary decrease in auditory sensitivity can occur at acute noise levels above 93 dBA, while permanent damage to avian auditory systems is not recorded until 125 to 140 dBA (Blickley & Patricelli, 2010).

Some bird species may not be impacted by sensory disturbances. A study of the impact of logging truck traffic on bird reports no observed effects on nesting at noise levels of 53 dBA (Grubb et al., 1998). It was also found that noise tolerant species had increased nesting success through decreasing nest predation (Francis et al., 2009). A literature review conducted by Shannon et al. (2016) found that birds have the potential to exhibit changes in song characteristics, reproduction, abundance, stress levels, and species richness at levels greater than 45 dBA. All noise attenuates (diminishes) with distance from the source (California Department of Transportation, 2016). This occurs through geometric spreading and signal reduction from ground and atmospheric absorption. Noise from point sources (i.e., construction equipment) travelling through a soft site (e.g., a forest or meadow), are reduced by attenuation rates of 7.5 dBA for each doubling of distance (i.e., based on 50 feet) (California Department of Transportation, 2016). The Project sound attenuation during construction, with the exception of intermittent blasting (if required) or intermittent truck horns, is expected to meet the 45 dBA range as stated in the project information sections.

Mitigation Measures

Adaptive management of potential effects will be addressed through the development and implementation of a Wildlife Management Plan which will include mitigation and monitoring for avian species. The primary mitigation for avifauna is avoidance in the siting of infrastructure, including:

- Avoidance of topographic funnels, such as within lake or river valleys, for turbine placement to reduce the likelihood of interactions with concentrated bird movements.
- Avoidance, to the extent possible, of important bird habitats, such as wetlands, waterbodies, watercourses, old growth forest, etc. to reduce the impact of habitat changes (e.g., riparian buffers). This includes siting Project infrastructure within areas with existing disturbances, such as existing roads and cutover areas of forest.

Mitigations to reduce effects on avifauna include:

- Adhere to ECCC guidelines on clearing windows for nesting migratory birds. If possible, vegetation and tree clearing activities will be conducted outside of the nesting/breeding period that is generally from April 1 to September 30 each year. Timing of clearing activities are generally dependent on seasonal conditions.
    - If vegetation and tree clearing activities during the nesting/breeding season cannot be avoided, nest sweeps will be conducted by a qualified avian biologist to search for any confirmed activity which must be avoided (i.e., active nests and recently fledged juveniles).
    - Regulatory bodies will be contacted, when necessary, to receive advice on construction buffers for any avian activity that must be avoided during the nesting/breeding season.
- When vegetation and tree clearing activities take place during the non-nesting/breeding season, crew must be aware and look out for nests protected year-round under the 2022 update to the Migratory Bird Regulations (under the *MBCA*), which includes Great Blue Heron and Pileated Woodpecker nests (i.e., inactive Pileated Woodpecker nests are protected for three years and inactive Great Blue Heron nests are protected for two years).

- Avoid disturbance of any ground- or burrow-nesting species should they initiate breeding activities within stockpiles or exposed areas during construction or operations, until chicks can fly, and the nesting areas are no longer being used.
- Consider limiting turbine operations around peak periods detected from the acoustic and radar data (e.g., between sunset and sunrise during peak migration periods).
- Establish speed limits for construction vehicles to mitigate the effect of vehicle-avifauna collisions.
- Service construction equipment and vehicles regularly and loud machinery will be muffled.
- Incorporate a lighting plan for construction-related activities into the Wildlife Management Plan.
- Maintain good housekeeping practices during construction to avoid indirectly feeding birds, and potentially attracting nuisance wildlife.
- Develop a spill response plan, and an emergency response plan to mitigate the impacts of spills, hazardous substances, and other emergencies. Equip site machinery with spill kits and instruct site personnel on their use.
- Develop a fire response plan in accordance with provincial standards.
- Revegetate disturbed areas, as appropriate.
- Install avian deflectors on powerlines, including any powerline spans, or areas of line that will be identified in the Wildlife Management Plan as requiring mitigation based on monitoring results.
- Minimize lighting, to the extent possible (e.g., downward facing lights and motion-activated lighting).
- Develop a site reclamation plan in accordance with engineering standards and in consultation with NSECC and NSNRR.
- Plan any potential future infrastructure development and construction to avoid fragmenting or altering critical habitats for SAR avifauna.

Monitoring

A site-specific post-construction Wildlife Management Plan, which will include an avian management plan, will be developed to inform monitoring activities that will take place to ensure continued protection of known SAR in the LAA and RAA. The Proponent will seek to collaborate with relevant stakeholders on a broader regional wildlife monitoring and management plans, including the developers of other wind-power projects, local landowners, consultants, subject-area experts, government departments (i.e., NSECC, NSNRR, ECCC, etc.) and the Mi'kmaq of Nova Scotia. Some preliminary monitoring activities related to avifauna may include:

- Conduct post-construction avian mortality monitoring to assess mortality levels caused by turbine operations. During avian mortality monitoring, if it results in a concerning number of avian injuries and/or deaths, regulatory recommendations will be sought out and additional mitigation measures may need to be implemented in the future as part of adaptive management (i.e., painting wind turbine blades, shutting off wind turbines during extreme weather events or high-migration periods, etc.).

- Conduct breeding bird surveys post-construction to establish potential impacts to the breeding bird community, while also addressing changes in population dynamics, with special attention to SAR.

Conclusion

Based on other data sources (e.g., ACCDC, MBBA, eBird, Christmas Bird Count, etc.), the bird species observed during the avian studies for the Project were normal for this area throughout the spring migration, breeding, and fall migration seasons. Through desktop analysis and field observations, it is apparent that the general area supports various life stages for migratory birds due to the variety of habitats (e.g., various wetland types, watercourses, forested areas, open habitat (clearcut areas), etc.). Locations that offer a variety of habitat types (i.e., edge habitat) tend to offer the highest avian abundance and avian species diversity. Although migratory activity was observed, no significant migration corridors or patterns emerged from analysis of field survey and radar/acoustic data.

While effects on avifauna species differ, the effects considered to be of greatest concern include habitat loss, habitat fragmentation, migratory disruption, and bird strikes. Based on this assessment and through the implementation of proposed mitigation and monitoring activities, residual effects to avifauna are characterized as follows:

- Low magnitude as the Project has been designed to maximize use of existing roads to minimize habitat loss and fragmentation, and impacts to migratory birds are expected to be low within the RAA.
- Long-term as residual effects will extend through the operational and maintenance phase until after decommissioning, and short term for traffic as it is limited to the construction and decommission phases.
- Continuous but differ seasonally due to migratory patterns and the needs of species changing over time.
- Reversible as the effects will terminate at the end of the Project lifespan.

As a result, the residual effects are considered not significant.

Field Data Constraints and Data Limitations

Field data limitations that are specific for avifauna include:

- There are a potentially infinite number of methods in which human activity can influence wildlife behaviours and populations and merely demonstrating that one factor is not operative does not negate the influence of the remainder of possible factors.
- A limitation with field surveys is that if no migration patterns are observed, it does not mean they do not exist in the area.
- Bird detectability depends on (i) species biology and behaviour (abundance, activity, species body size and conspicuousness, and ecological traits), (ii) individual characteristics within the species (sex and age), (iii) environmental factors (habitat,

weather, phase of season, and time of day), and iv) methodology of counts and skills of observers.
- An essential assumption of distance sampling methods is that distances to individuals are accurately estimated, a task not easy to accomplish under normal field conditions and are based on the perspective of the observer.

8.0 SOCIO-ECONOMIC ENVIRONMENT

8.1 Economy

8.1.1 Overview and Assessment Methodology

The assessment of the economy included consideration of local demographics, income, and businesses, as well as the economic contributions of the Project to the local economy through a review of the following resources:

- Census of Population – Statistics Canada (2023a)
- Taxation legislation
- Public mapping resources
- Economic data from the Proponent

8.1.2 Existing Environment

The Project is located in both Hants and Halifax Counties, near the communities of Head of St. Margarets Bay (7.5 km south), Upper Tantallon (3 km south), Stillwater Lake (6.7 km southeast), Upper Hammonds Plains (5 km southeast), Pockwock (1.5 km southeast), Mount Uniacke (3.5 km northeast), and Lakelands (4.3 km north). The counties are divided into census subdivisions (CSDs), including East Hants Municipal District (MD) and HRM.

Population statistics for the province, East Hants MD, and HRM were summarized using the 2016 and 2021 Census of Population (Table 8.1).

Table 8.1: Population Characteristics from 2016-2021 for Nova Scotia, East Hants MD, and HRM

Population Statistics	Nova Scotia	East Hants, MD	HRM
Population in 2021	969,383	22,892	439,819
Population in 2016	923,598	22,453	403,131
Population change from 2016-2021	+5.0%	+2.0%	+9.1%
Total private dwellings in 2021	476,007	10,046	200,473
Land area	52,824.71 km^2	1,786.53 km^2	5,475.57 km^2
Population density	18.4/km^2	12.8/km^2	80.3/km^2

Source: (Statistics Canada, 2023)

The age distribution in East Hants MD reveals a median age of 44.4 years, which is slightly lower than the provincial median age (45.6) and higher than HRM (40.4) (Statistics Canada, 2023). Further statistics on age distribution in 2021 were compared for the province, East Hants MD, and HRM (Table 8.2).

Table 8.2: Age Distribution in 2021 in Nova Scotia, East Hants MD, and HRM

Age Statistics	Nova Scotia	East Hants, MD	HRM
0 - 14 years	136,710 (14.1%)	3,715 (16.2%)	65,025 (14.8%)
15 - 64 years	617,345 (63.7%)	14,970 (65.4%)	298,640 (67.9%)
65+ years	215,325 (22.2%)	4,210 (18.4%)	76,150 (17.3%)
Total Population	**969,380 (100%)**	**22,890 (100%)**	**439,820 (100%)**

Source: (Statistics Canada, 2023)

Average housing costs and average individual incomes in 2020 for East Hants MD and HRM were compared to the provincial and federal averages (Table 8.3).

Table 8.3: Housing Costs and Average Individual Income in 2020 for Canada, Nova Scotia, East Hants MD, and HRM

Housing and Income Statistics	Canada	Nova Scotia	East Hants, MD	HRM
Average Total Income	$54,450	$47,480	$48,240	$52,900
Average Dwelling Value	$618,500	$295,600	$296,000	$403,600
Average Monthly Shelter Costs for Owned Dwellings	$1,498	$1,070	$1,144	$1,386
% of Owner Households Spending 30% or More of Its Income on Shelter Costs	14.8%	9.7%	10.3%	10.8%
Average Monthly Shelter Costs for Rented Dwellings	$1,209	$1,083	$1,083	$1,251
% of Tenant Households Spending 30% or More of Its Income on Shelter Costs	33.2%	34.7%	27.6%	36.7%

Source: (Statistics Canada, 2023)

Most residents in both East Hants MD (98.4%) and HRM (96.8%) use English as their first official language spoken (Statistics Canada, 2023). All public outreach and communication for the Project has been and will continue to be in English. There is some knowledge of other languages in the RAA, though no communication has been requested in other languages.

Several fire stations and departments exist in the area including the Uniacke & District Volunteer Fire Department, located approximately 4 km northeast of the Study Area on Nova Scotia Trunk 1, Mount Uniacke. Fire Station No. 11 Upper Sackville is also nearby, located approximately 11 km east of the Study Area on Patton Road, Upper Sackville, and the Halifax Region Fire & Emergency Station 65, located approximately 14 km south of the Study Area on Scholars Road, Upper Tantallon.

Health and emergency services also exist in the area and are accessible to Project workers if the need should arise. The closest location is the Cobequid Community Health Centre, approximately 21 km southeast of the Study Area on Freer Lane in Lower Sackville. In the opposite direction is the Hants Community Hospital, approximately 25 km northwest of the Study Area on Payzant Drive in Windsor. Finally, the QEII Halifax Infirmary is also nearby, approximately 31 km southeast of the Study Area on Robie Street in Halifax.

Statistics for East Hants MD indicate that the unemployment rate in 2021 was 10.8%, and 11.4% for HRM, both being lower than the provincial rate of 12.7% (Statistics Canada, 2023). The East Hants MD employment rate was 57.8%, and 58.1% for HRM, which are both higher than the provincial rate of 51.9% (Statistics Canada, 2023).

The top five industries in the province in 2017 were compared with the top industries in East Hants MD and HRM (Table 8.4). The highest proportion of workers fall into the "construction" (12.6%) and "retail trade" (11.4%) industries in East Hants MD, and the "health care and social assistance" (13.4%) and "retail trade" (11.2%) industries in HRM. Other significant industries include "public administration" and "educational services" (Statistics Canada, 2023).

Both East Hants MD and HRM had top industries that were different from the top industries in the province as a whole. In East Hants MD, the fifth top industry was "transportation and warehousing", with 8.1% (compared to 4.1% in the province). For HRM, the fourth top industry was "professional, scientific and technical services", with 9.1% (compared to 6.4% in the province) (Statistics Canada, 2023).

Table 8.4: Top Industries for the Employed Labour Force in 2017 in Nova Scotia Compared to East Hants MD, and HRM

Industry	Nova Scotia	East Hants, MD	HRM
Total employed labour force 15 years +	487,260	12,400	242,690
Health care and social assistance	70,595 (14.5%)	1,310 (10.6%)	32,610 (13.4%)
Retail trade	58,985 (12.1%)	1,415 (11.4%)	27,065 (11.2%)
Public administration	42,070 (8.6%)	1,055 (8.5%)	24,935 (10.3%)
Educational services	38,425 (7.9%)	700 (5.6%)	20,065 (8.3%)
Construction	35,720 (7.3%)	1,560 (12.6%)	16,235 (6.7%)

Source: (Statistics Canada, 2023)

There are several communities within a 15 km radius of the Project that offer a range of business services. A review of some of the businesses located near the Project is provided in Table 8.5.

Table 8.5: Local Businesses and Proximity to Study Area

Business	Distance and Direction to the Project*
Custom Millwork Atlantic Inc	30 km north, on Evangeline Trail, Mount Uniacke
Uniacke Lodge	34 km north, on Evangeline Trail, Mount Uniacke
Withrow's Farm Centre	35 km northeast, on Highway 1, Mount Uniacke
Hogan's Christmas Tree Farm	10 km northeast, on Etter Road, Mount Uniacke
Hypersportz Paintball	9 km northeast, on Etter Road, Mount Uniacke
Atlantic Splash Adventure	29 km southeast, on Lucasville Road, Hammonds Plains
The Madeline Assisted Living	30 km south, on Podwock Road, Upper Hammons Plains
Plain's Firewood	9 km south, on Anderson Road, Upper Hammonds Plains
Henault Metal Trading	10 km south, on Wright Lake Run, Upper Tantallon
Train Station Bike & Bean	14 km south, on St Margarets Bay Road, Upper Tantallon

*All distances were measured from the centre of the Study Area, using the most direct route.

Aside from the immediate area and associated businesses, the nearby communities are highly dependant on the greater Halifax area for many of their regular shops and services, including indoor recreation, big-box stores, and significant health care facilities including emergency services and inpatient care. Many residents of the communities surrounding the Project commute daily to Halifax and the surrounding business parks.

8.1.3 Effects Assessment

Project-Economy Interactions

Project activities have the potential to interact with the economy during all phases of the Project (Table 8.6).

Table 8.6: Potential Project-Economy Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Economy	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Assessment Boundaries

The LAA for economy is East Hants MD and HRM. The RAA for economy includes the entire province.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for the economy as well. The VC-specific definition for magnitude is as follows:

- Positive – Project is expected to have a positive effect on the economy.
- Negative – Project is expected to have a negative effect on the economy.

Effects

It is estimated that the Project will result in approximately $230-$255 million in investments into the province of Nova Scotia prior to operations at the end of 2028. The Proponent is committed to sharing economic opportunities with the local community throughout the development and lifespan of the Project via the use of local skills and labour where possible, municipal tax revenue, and on-going energy literacy/education (such as presentations about renewable energy at local schools, community meetings or for municipal councils, windfarm tours and visits, etc.). The Proponent has and will continue to engage the community, local businesses, and municipal staff and leaders to help identify Project-related opportunities and benefits for the local community.

The Proponent understands the importance of supporting local suburban and rural communities. The Proponent is committed to using as many local skills as possible. Potential work includes environmental studies, geotechnical investigation, engineering, land and snow clearing, surveying, worksite security, road construction and maintenance, turbine component transportation, turbine foundation construction, turbine installation, collector system construction, and substation construction. Specifically, elements of job creation throughout the lifespan of the Project may include:

- Project Development – During the development phase of the Project, Nova Scotian professionals have and will continue to deliver services in a variety of areas, including civil and electrical engineering, geotechnical engineering, legal, environmental, and biological surveys, archaeological, land and community relations, and many others. Approximately 85 professionals within Nova Scotia will render their services as part of the development of the Project; many of whom will be Indigenous professionals.

- Construction – Though the construction phase of the Project is relatively short (i.e., 18-24 months), it will require a large workforce that will fluctuate throughout the construction period. Much of the construction employment will come through contracting and subcontracting of Canadian, and where possible, Nova Scotian construction firms and specialized service providers related to the balance of plant and installation and commissioning of the wind turbines. It is estimated that the Project will require approximately 85 jobs for varying scope and duration throughout the approximately two-year construction period. The largest construction scopes of work are anticipated to be:

- Civil installation, that is, land clearing, grubbing, road construction, and foundation installation, which includes:
  - Excavating
  - Rebar supply and installation
  - Anchor bolt supply and installation
  - Concrete forming
  - Concrete supply and pouring
  - Grouting
- Electrical installation, that is, transmission line, collector line and substation infrastructure installation, and connection to the NS Power grid, which includes:
  - Underground and overhead installation
  - Cable terminations
  - Electrical testing
  - Instrument installation and testing
- Turbine installation, that is, the offloading of turbine components, stacking of the wind turbine generators, and commissioning, which includes:
  - Crane supply
  - Turbine offload and erection
  - Mechanical works inside turbines
  - Electrical work inside turbines

- The Proponent believes that communities in proximity to its projects should receive preferential attention and access to business and employment opportunities. The Proponent is committed to sourcing projects from local content by supporting capacity building, joint venture agreements, and community and Indigenous-owned entities for the projects they develop. The Proponent will look to maximize local content where appropriate, including hosting supplier sessions and/or career fairs in the local region.

- Operations and Maintenance - Operational wind projects require long-term operations and maintenance technicians to be located either on-site or within short driving distance of the Project. It is generally anticipated that an on-site operations manager will be required to run the day-to-day operations. This individual will work closely with local service providers who will carry out high-voltage maintenance work, collection maintenance work, snow removal, road maintenance, and vegetation removal. In addition, a team of two to five turbine maintenance technicians will be required to maintain the wind turbines. In all, it is anticipated that there will be 75 to 125 full-time and part-time jobs associated with the Project, including the maintenance technicians described above. The employment associated with operations and maintenance is long-term, local, stable, and well-paying jobs requiring skillsets such as experience managing facilities, working on wind farms, or working with high-voltage (HV) systems. These jobs include:
  - HV Technicians/Electricians

  - Wind Technicians
  - Road Maintenance Workers
  - Vegetation Management Service Providers

- In addition to operations and maintenance of the wind turbines, there will be a variety of wind farm activities that will require on-going resources such as snow removal and road surface maintenance, administrative support, inventory/materials management, shipping, scheduling, and coordination of maintenance inspections to accommodate the facility's operation (i.e., power collection system, electrical substation inspections, etc.).

In addition to the direct investments that the Project would bring to Nova Scotia's economy, the Project will result in indirect and induced economic benefits that will be realized by governments, local businesses, communities, and residents. Workers that are directly involved with the development, construction, and operations would contribute to the local economy by redistributing wealth to a variety of goods and services such as hotels, restaurants, and grocery stores (NREL, 2016).

As outlined in the *Wind Turbine Facilities Municipal Taxation Act*, S.N.S. 2006, c. 22, Hants and Halifax County will receive tax revenues per MW on an annual basis, and as such, the royalty will annually increase as the Consumer Price Index rises. The Project is expected to enhance the community's economic development by providing tax revenues of approximately $800,000 annually to the Municipality, increasing each year of operation. As the Project is spread across both Hants and Halifax County, the distribution of the tax revenue will be spread out based on the distribution of the turbines.

A renewable energy project in a community provides residents with the opportunity to gain a better understanding of wind technology and how wind power can help reduce reliance on fossil fuels. Energy literacy is an increasingly important skill in today's economy, and the Proponent is committed to promoting energy literacy initiatives in the surrounding communities and is available to answer questions and provide a better understanding of local and provincial energy issues.

Mitigation Measures
The economic impact to the LAA and RAA is positive; therefore, no mitigation is proposed.

Monitoring
A specific monitoring program for the economy is not recommended.

Conclusion
The impacts to the economy are characterized as follows:

- Have a positive impact on the economy.
- Extend to the RAA.

- Be of medium duration as the effects will last through the operation and maintenance phase.
- Occur continuously during the Project lifespan.
- Irreversible as the effects are unlikely to be reversed.

8.2 Land Use and Value

8.2.1 Overview and Assessment Methodology

The assessment of land use and value was completed through a review of desktop resources and in consideration of feedback from public engagement to evaluate how the Project may interact with this VC. The following resources were reviewed:

- Nova Scotia property records
- Public mapping resources
- Literature review of property values and wind farms

8.2.2 Existing Environment

The Study Area consists of a combination of Crown and private land. Land use around the Study Area is primarily used for forestry and silviculture use. There are two wind projects within the immediate vicinity of the Project, the Chebucto Pockwock Community Wind Project, located approximately 7 km southeast of the Study Area, and the Ellershouse Wind Project, located approximately 15 km northwest of the Study Area. Nova Scotia Power also uses some of the roads in the southern portion of the Study Area for accessing, maintaining, and operating the St. Margarets Bay hydroelectric system.

Several public protected lands and parks are also located in the vicinity (Drawing 7.18). These include wilderness areas, nature reserves and provincial parks:

- Pockwock Wilderness Area (immediately adjacent east of the Study Area)
- Island Lake Wilderness Area (approximately 4 km southwest of the Study Area)
- Sackville River Wilderness Area (approximately 9 km northeast of the Study Area)
- Devils Jaw Wilderness Area (approximately 15 km north of the Study Area)
- Blue Mountain – Birch Cove Lakes Wilderness Area (approximately 14 km southeast of the Study Area)
- Old Annapolis Road Nature Reserve (approximately 5 km southwest of the Study Area)
- Eagles Nest Nature Reserve (approximately 11 km northwest of the Study Area)
- Panuke Lake Nature Reserve (approximately 16 km west of the Study Area)
- Bell Provincial Park (approximately 9 km northeast of the Study Area)
- Jerry Lawrence Provincial Park (approximately 15 km south of the Study Area)

There are no Mi’kmaq reserve lands within 10 km of the Study Area, nor any mineral leases known to be held for the Study Area, aside from abandoned quarries and borrow pits along the primary access roads. Further consideration of Mi’kmaq resources and the results of the MEKS are included in Section 5.0, and further consideration of the Project's geophysical environment are included in Section 7.2.

8.2.3 Effects Assessment

Project-Land Use and Value Interactions

Project activities have the potential to interact with land use and value during all phases of the Project (Table 8.7).

Table 8.7: Potential Project-Land Use and Value Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Land Use and Value	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Assessment Boundaries

The LAA for land use and value includes both East Hants MD and HRM. The RAA is not applicable.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for land use and value as well. The VC-specific definition for magnitude is as follows:

- Negligible – no change in land value expected and surrounding land use can largely continue as is.
- Low – small change in land value expected and/or minor limitations to surrounding land use.
- Moderate – moderate change in land value and/or moderate limitations to surrounding land use.
- High – high change in land value and/or widespread limitation to surrounding land use.

Effects

Due to the nature of wind turbines being tall structures with small footprints, they are highly compatible with other land uses like agriculture, forestry, and ground-based recreation. The forestry activities in the area will not be disrupted by the Project. Upgraded roads and infrastructure will improve access, limit weather-related access disruptions, and improve the access road conditions, which will reduce wear on vehicles and other industrial equipment. None of the existing and permitted users of the Crown land are expected to be impacted by the Project.

A 2017 study mentions that given the traditional energy industry's impacts on conservation in both direct and indirect ways, wind energy can be seen as a complementary land use to conservation and protected areas in a broad way, as wind energy is not a carbon emitter (Wind Europe, 2017). Given the context of Nova Scotia where the traditional energy source has primarily been coal, land use for wind energy can be seen as a positive step.

Potential effects on property value are often a concern of neighbouring residents due largely to anecdotal reports from appraisers of drastic declines in property values following the nearby installation of a wind energy facility (Gulden, 2011). Despite these concerns, many rigorous and statistically defensible studies have concluded that wind energy developments have had no significant effect on surrounding property values.

Prior to 2013, the most comprehensive study on the impact of wind farms on property values had been completed by Hoen et al. (2009). This research analyzed data on nearly 7,500 sales of single-family homes situated within 16 km of 24 existing wind farms in the United States. Eight different hedonic pricing models failed to generate statistically significant evidence that property values for houses located within 16 km of wind farms are influenced by the developments. Subsequent research by the same researchers but employing additional analyses confirmed these results (Hoen et al., 2011).
Carter (2011) analyzed home transactions in a rural landscape surrounding small (one to four turbines) wind energy developments while employing a hedonic model to statistically control for variables affecting all real estate transactions such as square footage, age of home, and school zone. This study concluded that proximity to the wind farms did not impact the average selling price of homes; in fact, in one case, homes closer to a wind farm sold for significantly higher than those elsewhere (Carter, 2011).

A study by Hinman (2010) tracked property transactions in communities located close to a 240-turbine wind farm for an eight-year period that spanned pre-development and operation stages. Hinman (2010) found that before project approval, property values in the area decreased. This was attributed to a fear of the unknown effects that the development would have; an effect known as anticipation stigma. However, once the development became operational, property values recovered. This recovery was attributed to a greater understanding of the operational effects of the development. Anticipation stigma, however, was not detected in a similar study in Colorado (Laposa & Mueller, 2010), in which it was concluded that the announcement of a large wind energy development did not significantly reduce the selling prices of homes surrounding the proposed development.

Until recently, the primary limitation of previous research on the effects of wind energy facilities on surrounding home values has been that research has been based on relatively small sample sizes (data sets) of relevant home-sale data. The inability to account for the complexity of the various factors which affect property values has also been cited as a limitation to previous studies. In particular, data had been limited for homes located within approximately 800 m of turbines, where impacts would be expected to be the largest: Hinman (2010) (sample size of 11); Carter (2011) (sample size of 41). This is in part because setback requirements generally result in wind facilities being sited in areas with relatively few dwellings, limiting the number of sales transactions available to be analyzed (Hoen et al., 2013). Although these smaller data sets are adequate to examine large impacts (e.g., over 10%), they are less likely to reveal small effects with any reasonable degree of statistical significance.

A study published in August 2013 by Berkeley National Laboratory (Hoen et al., 2013) was conducted to address these gaps in data and included the largest home-sale dataset to date. Researchers collected data from 51,276 home sales spanning 27 counties in nine states, related to 67 different wind facilities (Hoen et al., 2013). These homes were within 16 km of 67 different wind facilities, and 1,198 of the sales analyzed were within 1.6 km of a turbine, giving a much larger dataset than previous studies have collected. The data span the periods well before announcement of the wind facilities to well after their construction (Hoen et al., 2013).

Two types of models were employed during Hoen et al.'s (2013) study to estimate property-value impacts: (1) an ordinary least squares model, which is standard for this type of study, and (2) a spatial-process model, which accounts for spatial variability. These models allow the researchers to control for home values before the announcement of a wind facility (as well as the post-announcement, pre-construction period), the spatial dependence of unobserved factors affecting home values, and value changes over time. A series of robust models were also employed to add an additional level of confidence to the study results (Hoen et al., 2013).

Regardless of model specification, the results of Hoen et al.'s (2013) study revealed no statistical evidence that home values near turbines were affected in the post-construction or post-announcement/pre-construction periods. Therefore, the authors concluded that if effects do exist, either the average impacts are relatively small (within the margin of error in the models) and/or sporadic (impacting only a small subset of homes) (Hoen et al., 2013).

A study analyzing more than 7,000 home and farm sales from 2002 to 2010 in the Melancthon Township and 10 surrounding counties found that Ontario's first and largest wind farm (133 turbines) had "no statistically significant effect" on property values. Further, the study found a lack of significant effect is similar across both rural residential properties and agricultural properties (Vyn & McCullough, 2014).

A recent review based on housing and property values within specific radii of wind farms and other energy infrastructure by Brinkley and Leach (2019) found that while most energy infrastructure has an impact on nearby land values, renewable energy projects (including wind farms) do not have statistically significant impacts. These findings are based on seven individual studies of varying scales that all consider the value of property relative to the proximity to wind power, whether a single turbine or more (Brinkley & Leach, 2019).

In 2019, researchers at the University of California, Davis conducted an analysis of property values research in the energy sector. Their analysis found that studies on wind turbines and property values overwhelmingly find that wind turbines do not negatively impact property values at any point during their installment (ACP, 2023).

Research has consistently demonstrated that, in a variety of spatial settings and across a wide temporal scale, sale prices for homes surrounding wind energy facilities are not significantly different from those attained for homes sited away from wind energy facilities.

Mitigation Measures
The Project has been designed to minimize potential effects to land use and value through siting considerations and engagement with neighbouring landowners. This has included additional noise modelling and visual impact assessments at the request of local homeowners (not included in the EA), open communication with community stakeholders on the placement of turbines and the results of desktop, field, and modelling studies to minimize visual disturbance to existing homes. Furthermore, the Project has a large spatial (committed to a 1 km minimum setback from dwellings) and topographic separation from most dwellings which will avoid other nuisance interactions such as shadow flicker and wind turbine-related noise. No specific mitigation related to land use and value is recommended.

Monitoring
A specific land use and value monitoring program is not recommended. The Proponent will maintain ongoing communication with landowners to minimize impacts to nearby residential dwellings.

Conclusion
The impact to land use and value is expected to be negligible and is therefore considered not significant.

8.3 Traffic and Transportation

8.3.1 Overview and Assessment Methodology
The assessment of traffic and transportation was completed using information provided by the Proponent and gathered during stakeholder engagement to understand how the Project may interact with existing traffic volume and patterns.

8.3.2 Existing Environment
The center of the Project is located approximately 8 km southwest of Highway 101 and 12 km north of Highway 103, and is centered between Big Indian Lake and Pockwock Lake. Bowater Mersey Road, accessed from St Margarets Bay Road, eventually turns into Hiking Trail Road (near Highway 103), and connects to Pipeline Road. Pipeline Road is the primary road running south to north through the Study Area, beginning approximately 11 km south of the center of the Project. Pockwock Road provides access to the southeastern part of the Study Area, beginning at Highway 213, approximately 12 km southeast from the Project center, and

eventually connecting to Pipeline Road in the southern part of the Study Area. Further, Service Road HAN 101, beginning at Williams Road, approximately 16 km northwest from the Project center, provides access to the northern part of the Study Area.

Pipeline Road is a 15 km out-and-back multi-use trail and is accessible by trucks as well as other vehicles designed for rough dirt roads and tracks. It is considered an easy route and is great for off-road driving, scenic driving, hiking, and running. Due to the relatively remote location and lack of year-round inhabitants, there is very little through traffic. Smaller roads that cover the Study Area, many of which are dead ends, are primarily used for ATVs year-round, though most see very little traffic. Access is limited in the winter to users with specific equipment depending on the depth of snow, or who are travelling on foot. Some plowing in the southern portion of the Study Area by Nova Scotia Power has been observed, presumably for access to the hydroelectric infrastructure.

The transportation route to deliver turbine components to the Project is subject to the final turbine technology provider, who will undertake a comprehensive logistics study to determine the transportation route from the receiving and unloading port. Primary access routes during the operational lifespan of the Project are expected to be by the Bowater Mersey Road and Pipeline Road. Appropriate permits and engagement with NSPW will occur prior to transportation.
Air Navigation, communications, and navigation aids are addressed in Section 10.2.

8.3.3 Regulatory Context

The following permits and considerations are anticipated to be required for the transportation of turbine components:

- Work Within Highway Right of Way Permit (NSPW)
  - Required if removing access signs and guard rails.
- Overweight Special Moves Permit (Service NS and Internal Services)
  - Required to transport oversized and overweight components. In some cases, due to the size and weight of the components, some may only be transported on Sundays.
- Provincial road weight restrictions will also need to be considered, especially spring weight restrictions, for heavier equipment and materials that will be transported to the Project.
- Access points will be designed with proper height and width to accommodate large trucks and will adhere to commercial stopping sight distances.

8.3.4 Effects Assessment

Project-Transportation Interactions

As on-site traffic is minimal, Project activities primarily have the potential to interact with transportation during the delivery and removal of turbine components (Table 8.8).

Table 8.8: Potential Project-Transportation Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Transportation							X							X	

Assessment Boundaries

The LAA for transportation is East Hants MD and HRM. The RAA extends from the LAA to the Port of Halifax. A route study is currently underway to determine the exact transportation route that turbine components will follow to reach the Project.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for transportation as well. The VC-specific definition for magnitude is as follows:

- Low – small change in traffic levels and/or minimal disruptions to traffic flow and routing.
- Moderate – moderate change in traffic levels and/or moderate disruptions to traffic flow and routing.
- High – high change in traffic levels and/or high disruptions to traffic flow and routing.

Effects

The transportation route may require road modifications, including the removal of signage and guardrails. Upgrades will also be made to roads and overhead wires, branches, and signs if conflicts arise.

During the Project's construction phase, trucks and other vehicles will be frequently visiting the area resulting in increased vehicular sound and air emissions. During construction, most days will have 20 to 40 trucks per day, with a few days potentially requiring up to 100 trucks. Outside of the construction phase, the Project will only require a small number of technicians to access the site to perform regular maintenance/equipment checks.

The Proponent has committed to not restricting public access to roads and trails in the area with the exception of active construction sites. During certain periods of construction, restrictions are necessary due to safety considerations. In such circumstances, signs will be posted and physical barriers such as cones, candle sticks, t-posts, and rope will be erected.

Mitigation Measures

- Install notices in public areas to inform residents of signage removal or road infrastructure alterations, as well as notify relevant municipal government staff of construction scheduling and safety measures.
- Replace removed signage and guardrails immediately with appropriate temporary signage to ensure the safety of travelling public.
- Complete upgrades to roads and overhead wires, branches, and signs if conflicts arise.
- Complete modifications and associated reinstatement to relevant specifications.
- Avoid, to the extent possible, transportation through urban areas during high traffic times (e.g., 7:00 to 9:00 and 15:00 to 18:00; Monday through Friday).
- Conduct all travel using safe work practices for transporting oversized loads.
- Utilize the minimum number of vehicles possible to minimize impacts to road-way flow and air quality due to exhaust emissions.
- Ensure vehicles only visit and work on-site during normal daytime hours of operation, where possible, and avoid high-traffic times of day to reduce local traffic congestion.

Monitoring

A specific traffic monitoring program is not recommended. However, the Project will develop a complaint response protocol, which will consider complaints related to traffic.

Conclusion

After mitigations, the residual effects on traffic and transportation are characterized as follows:

- Moderate as disruptions to traffic flow may occur during construction and the transportation of turbines to the Project site.
- Within the RAA as turbine transportation will extend from the Port of Halifax, although most traffic disruption associated to construction activities will be isolated to the LAA.
- Short duration as the effects will be restricted to the construction phase.
- Of intermittent frequency as disruptions to traffic will occur only during certain periods of construction.
- Reversible, as effects will terminate at the end of the construction phase.

As a result, the residual effects are considered not significant.

8.4 Recreation and Tourism

8.4.1 Overview and Assessment Methodology

The assessment of recreation and tourism was completed through a review of desktop resources and in consideration of feedback from public engagement to evaluate how the Project may interact with this VC. The following resources were reviewed:

- Recreational Impact Assessment Report (St. Margarets Bay Stewardship Association, 2024)
- Nova Scotia Visitor Exit Survey (2019)
- Literature review of wind farm impacts on tourism and recreation
- Review of East Hants and Halifax Regional Municipality websites

8.4.2 Existing Environment

The Project is located on the border of Hants and Halifax Counties, between Lower Sackville and Windsor. The nearest tourism centres are in the urban core of Halifax, including the Halifax Waterfront and the Halifax Citadel National Historic Site, both being approximately 32 km southeast from the Study Area. Peggy's Cove is also nearby, approximately 35 km south from the Study Area.

The communities of Upper Tantallon, Upper Hammonds Plains, Pockwock, Mount Uniacke, and Lakelands, as well as other communities near the Study Area, are home to a variety of primarily outdoor recreational activities. In the summer, ATV use on various trails used for snowmobiling in the winter and the use of other outdoor facilities are the primary recreational draws.

Blue Mountain – Birch Cove Lakes Wilderness Area is located approximately 13 km southeast of the Study Area and is frequented for a variety of recreational uses, including paddling, angling, snowshoeing, skating, hiking, skiing, and portage (NSECC, n.d.d.). It is also currently in the planning phase for development as a National Urban Park. Jerry Lawrence Provincial Park, a small picnic park located in Upper Tantallon in the South Shore region, is also nearby, approximately 15 km south, and is an accessible park for seniors and those with disabilities, providing drive-in picnic areas, a fishing pier, and accessible trails that connect to the St. Margarets Bay Rails to Trails (Nova Scotia Parks, n.d.).

East Hants MD is also home to the Uniacke Estate Museum Park, approximately 10 km north of the Study Area. This museum park is part of what was the expansive country estate of Attorney-General Richard John Uniacke. It was built in 1813 and 1815 and is one of the finest examples of Georgian architecture in Canada. The park includes the historic Halifax-to-Windsor stagecoach route – the province's first highway, the Post Road Tea Room, the grand Uniacke House, as well as seven hiking trails (Nova Scotia Museum, n.d.).

Despite the lack of direct tourism destinations within the Study Area, there are many tourists who pass near the area on Highway 101 to the north. It is the primary access route in the area to get to the Annapolis Valley or to the urban core of Halifax in the opposite direction. Further, many tourists pass near the area on Highway 103 to the south, travelling east towards Halifax or southwest towards Chester. As the Study Area is located between these regions, there are several restaurants and accommodations in the area and most tourist attractions in the area are less than an hour drive.

St Margarets Bay is well known for its white sand and warm saltwater beaches. The most popular beaches on the South Shore are Cleveland Beach Provincial Park (13.5 km southwest of the Study Area), Queensland Beach Provincial Park (16 km southwest of the Study Area), and Hubbards Beach (17.5 km southwest of the Study Area).

Most recreation within the Study Area is concentrated around the existing roads and trails. ATV use in the warmer months and snowmobile use in the winter account for most of the recreational use. Hiking and mountain biking are also popular along the Bowater Trail originating at the start of Pipeline Road, outside of the Study Area, and numerous other unmarked trails. Canoeing and camping are popular within many of the lakes in the Study Area, as well as Big Indian Lake and Wirght's Lake, which abut the Study Area. Popular unofficial campsites are located throughout the shores of these lakes, as well as along ATV trails within the Study Area.

The standard deer hunting season in Nova Scotia stretches from the last Friday in October through the first Saturday in December. There is no hunting allowed on Sundays, except for the first two Sundays of the deer hunting season. Evidence of hunting was observed throughout the Study Area, through direct encounters with hunters, hunting blinds, trail cameras and bait barrels.

Several fish are confirmed to be present in the Indian and MacEachern's lakes and several avian species were observed, which could be of interest to birdwatchers. There are access points to the edges of the lakes, granting reasonably unobstructed access, indicating possible fishing and/or waterfowl hunting in this area. A tangle of fishing line was encountered on the shoreline of Melvin Lake, suggesting that fishing has occurred at the lake in the past.

8.4.3 Effects Assessment

Project-Recreation and Tourism Interactions

Project activities have the potential to interact with recreation and tourism during all phases if access is changed, is temporarily limited to facilitate work, or if changes to the visual environment impact the user's experience (Table 8.9). Note that further details regarding visual impacts are addressed in Section 10.4.

Table 8.9: Potential Project-Recreation and Tourism Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Recreation and Tourism	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Assessment Boundaries

The LAA for recreation and tourism is East Hants MD and HRM. The RAA is not applicable.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for recreation and tourism as well. The VC-specific definition for magnitude is as follows:

- Negligible – no expected changes to recreation and tourism.
- Low – small change to tourism expected and/or minor limitations to recreation use.
- Moderate – moderate change to tourism and/or moderate limitations to recreation use.
- High – high change to tourism and/or widespread limitation to recreation use.

Effects

The 2019 Nova Scotia Visitor Exit survey, administered by Tourism Nova Scotia from January 1 to December 31, 2019, shows little information about attractions that could be related to the region surrounding the Project (Tourism NS, 2019). No spatial data is available regarding the places visited within province, limiting the understanding of the impact that tourism has on the communities that surround the Project. Given that the main attractions discussed in the exit survey report are coastal scenery, the world's highest tides, lobster consumption, and the attractions in the HRM, the communities surrounding the Project do not appear to be significant tourist destinations, indicating that the Project is not likely to have a significant impact on inter-provincial tourism in the area.

It is difficult to determine with certainty how tourists will react to a wind power development. Wind farms are objects of fascination for many and thus could generate tourism for the local community, while others consider them to be an "eyesore". Some wind farms attract thousands of visitors per year and the benefits of even drawing a fraction of that number of visitors to a community can be felt by many businesses including shops, restaurants, and hotels (CanWEA, 2006a). Pincher Creek, Alberta developed a 19 MW wind farm in 1993. Since that time, tourism revenue from visitors from as far away as Russia has generated $5,000 in annual sales of clothing and souvenirs branded with the "Naturally Powerful Pincher Creek" logo (CanWEA, 2006a). The North Cape Wind Farm, a 10.56 MW wind facility located near Tignish, Prince Edward Island, has become a regional attraction, bringing in over 60,000 visitors per year. PEI's provincial government constructed a restaurant and gift shop at the site, resulting in a capital expenditure of $1.4 million. At the time of publication, the restaurant and gift shop were generating approximately $260,000 in annual revenue and employing 20 seasonal workers from mid-May to the end of October (CanWEA, 2006b). In Nova Scotia, the Pubnico Point wind farm has a positive public perception, despite being very visible from most of the surrounding communities (Municipality of Argyle, 2014).

There is visual evidence of the forestry operations in the Study Area. Although the Project is generally well-hidden from surrounding vantage points, some of the wind turbines proposed will be visible from several locations along Highway 101, Highway 213, and Highway 103. For further information on the view planes and landscape impacts related to the proposed turbines, see Section 10.4.

Understanding that recreational opportunities exist in the surrounding areas, the Proponent has engaged with the SMBSA and the SMATVA to understand how the Project can create a positive relationship with those users of the area (see Section 6.0 for the consultation log). Except periodically during construction, access to the Study Area will not be restricted to the public. Apart from a fenced in enclosure around the substation, once operational, the site will not have any fencing or gates. Upgrades to Pipeline Road and the access roads to the trails will support local recreation users of the Study Area by improving accessibility to hiking trails, ATV trails and lakes.

The Proponent is committed to working with local recreational groups to ensure continued access to the area and associated trails, within the bounds of all safety considerations, particularly during construction. As discussed above, the presence of turbines is highly compatible with most land-based recreation activities and is not expected to limit the usability of the area.

Mitigation Measures

- Continue to work with local recreation groups to ensure continued access within the Study Area for recreation and hunting/trapping.
- Continue to work with nearby landowners to ensure there is a positive relationship within the community.

Monitoring

A specific tourism and recreation monitoring program is not recommended.

Conclusion

After mitigations, residual effects on recreation and tourism are characterized as follows:

- Low magnitude due to the possibility for minor limitations for land users, particularly during construction.
- Within the LAA.
- Medium duration as the residual effects will extend throughout the operational and maintenance phase.
- Intermittent as impacts to land use and access are expected to be limited during construction, or maintenance events.
- Reversible as the effects will terminate at the end of the Project lifespan.

As a result, the residual effects are considered not significant.

8.5 Other Wind Farm Undertakings in the Area

The nearest wind development to the Study Area is the Chebucto Pockwock Community Wind Project, located in Halifax County, approximately 2.8 km east of the Study Area with five turbines and an installed capacity of 10 MW. Approximately 3.5 km from the nearest proposed Project turbine, these turbines were included in the noise modelling (Section 10.5). The Ellershouse Wind Farm in West Hants is also nearby, situated approximately 15 km northwest, consisting of 10 Enercon E-92 wind turbines. Additionally, the Ellershouse 3 Wind Farm is a proposed development which received EA approval from NSECC in July 2023 (NSECC, 2023a). The proposed development is south of the existing Ellershouse Wind Farm and will be a 12 turbine, 66 MW wind project.

9.0 ARCHAEOLOGICAL RESOURCES

9.1 Overview

The purpose of the Archaeological Resource Impact Assessment (ARIA) is to identify areas of high archaeological potential within the Assessment Area. Boreas Heritage Consulting Inc. (Boreas) was contracted to conduct the ARIA. Assessments for the ARIA took place in 2023 and 2024 to accommodate changes to the Project layout. This section discusses the results of the most recent assessment which is based on the current layout.

9.2 Regulatory Context

The *Special Places Protection Act,* R.S.N.S. 1989, c. 438 provides the province of Nova Scotia with a mandate to protect important archaeological, historical, and paleontological sites and remains, including those underwater. A permit is required for any archaeological or paleontological exploration or excavation in Nova Scotia. The permit system ensures that work is completed based on established standards by qualified applicants.

As archaeological work can often result in findings or information that is confidential or sensitive, a summary of the results of the ARIA are provided in the EA, with the ARIA report itself provided directly to NSCCTH for review. It is understood that the findings and recommendations of the ARIA are considered “draft” until the report is accepted by NSCCTH.

9.3 Assessment Methodology

The objectives of the ARIA were to:

- Evaluate archaeological potential within the Assessment Area.
- Identify, delineate, and investigate (where recommended) areas considered to exhibit high potential for encountering archaeological resources.
- Provide detailed and accurate information on the results of the field investigations of the ARIA.
- Provide comprehensive recommendations so that appropriate archaeological resource management strategies can be devised.

To achieve these objectives, Boreas designed an assessment strategy consisting of a desktop component (background screening) and a field component (archaeological reconnaissance).

The desktop component examined three elements: the environmental context, the archaeological context, and the historical context of the Assessment Area. The environmental context is examined to identify past and current environmental influences or conditions that may elevate archaeological potential (e.g., topography, local resources, and potential for agriculture). The archaeological context is examined to identify how people used and occupied the surrounding landscape based on evidence from previously registered archaeological sites and past archaeological work conducted near the Project. The historical context is examined to identify how people used and occupied the local region based on evidence from published archival documents, ethno-historic records, local oral traditions, historic maps, local and/or regional histories, scholarly texts, and available property records.

In Nova Scotia, the Maritime Archaeological Resource Inventory (MARI) is maintained by the Nova Scotia Museum, on behalf of NSCCTH. Reports from past archaeological assessments and academic research conducted near the Project provide archaeological context, which informs the interpretation and evaluation of any potential archaeological resources identified during the field component of the ARIA.

Additionally, the desktop component involved a general review of topographic maps, coastal charts and aerial photographs to identify topographical and hydrological attributes that correlate with high archaeological potential (e.g., waterfalls/rapids as focal points for fishing or requiring portage, submerged marine terraces representing former coastline). These attributes were also incorporated into the archaeological potential model, developed by Boreas.

The field component involved an on-site visual examination (field-truthing phase) of the Assessment Area. The research team transected the Assessment Area to visually assess archaeological potential, as ascribed by the background study and potential model. These transects assist in maintaining effective coverage. The field truthing phase assisted in the recognition of topographic and/or vegetative anomalies that may inform the extent and nature of previous disturbance factors in the Assessment Area (e.g., clear-cutting, ploughing, construction earthworks), or suggest an elevation in archaeological potential, including evidence of buried archaeological resources (e.g., small knolls, apple trees in the forest, overgrown depressions, or abandoned roads).

As a follow-up to the archaeological potential modelling and field-truthing phase, further fieldwork for the ARIA, conforming to the guidelines set by NSCCTH (Special Places), consisted of archaeological reconnaissance. The goals of the archaeological field reconnaissance were to conduct a visual inspection of the proposed infrastructure area to search for and document any exposed archaeological resources and to further delineate areas of archaeological potential (low, moderate, and high). The investigation was guided by the results of engagement, background research, potential model and field-truthing and took care to note any cultural landscape indicators. The researchers transected all portions of the proposed infrastructure, enabling diligent observations within areas that were identified by the modelling and field truthing as having elevated archaeological potential.

Field geomatic data and tracklogs were recorded with handheld GPS with +/- 5 m accuracy. Field observations were recorded through the combination of georeferenced photographs, field sketches, and field notes.

Upon completion of field activities, analysis and interpretation, the results of the ARIA were summarized in the report (submitted under separate cover), including recommendations for appropriate resource management strategies. Photos, detailed plans, and GIS-based mapping of the testing area and specific find locations (if applicable) were also incorporated.

9.4 Assessment Results

The field recon portion of the ARIA was carried out during July 2023 and October 2024, and resulted in the identification of twelve areas considered to exhibit high potential for encountering archaeological resources (HPAs):

- Four HPAs are located within turbine pad areas. All are associated with watercourse features and will be avoided through Project micrositing (but will be subjected to shovel testing if avoidance is not possible).
- One HPA is located along the collector line route. It is expected that pole placement will be able to avoid this area.
- One HPA is located along a new access road. If it cannot be avoided during detailed design, the area will be subject to shovel testing if avoidance is not possible.
- Six HPAs are located along existing access roads. All are associated with a watercourse or wetland. Detailed design will review methods for avoidance but will be subject to shovel testing if avoidance is not possible.

With the exception of the 12 HPAs identified, all remaining portions of the Assessment Area are considered to exhibit low archaeological potential for encountering archaeological resources. As a result, Boreas recommends these areas be cleared by NSCCTH of any further requirement for future archaeological assessment.

9.5 Effects Assessment

Project-Archaeological Resources Interactions

Project activities could interact with archaeological resources during earth moving activities in the construction phase (Table 9.1).

Table 9.1: Potential Project-Archaeological Resources Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Archaeological Resources		X		X	X	X									

Assessment Boundaries

The LAA for archaeological resources is the Assessment Area. The RAA is not applicable.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for archaeological resources. The VC-specific definition for magnitude is as follows:

- Negligible – activities have no potential for encountering archaeological resources during ground disturbance.
- Low – activities have a low potential for encountering archaeological resources during ground disturbance.
- Moderate – activities have a moderate potential for encountering archaeological resources during ground disturbance.
- High – activities have a high potential for encountering archaeological resources during ground disturbance.

Effects

There is low potential for effects to archaeology resources across most of the Assessment Area. No artifacts of archaeological significance were identified, and twelve HPAs were identified, which will be avoided or subject to a shovel testing program prior to ground disturbance. The Proponent is committed to following forthcoming recommendations from the archaeologist and NSCCTH related to this work.

Mitigation

The following mitigation measures are recommended:

- Conduct shovel testing when HPAs cannot be avoided to the specifications per the recommendations of Boreas and NSCCTH.
- Conduct vegetation removal within areas of potential archaeological resources (especially within the transmission corridors) by hand-clearing and make use of swamp mats where heavy machinery must transit these areas to avoid ground disturbance.
- Develop a chance find procedure in the contingency plan related to the potential unexpected discovery of archaeological items or sites during construction. This would include halting any work immediately upon discovery of suspected resources and contacting NSCCTH. If the resources are suspected to be of Mi'kmaq origin, the Executive Director of KMKNO would also be contacted.
- Conduct additional archaeological assessment if, during the detail design phase, it is determined that ground disturbance is required in areas not previously assessed. The EA Branch will be provided with the acceptance letter from NSCCTH prior to completion of any disturbance in newly proposed areas.

Monitoring

No monitoring programs are recommended.

Conclusion

With the implementation of the above mitigation measures, the residual effects to Archeological resources are characterized as thus:

- Low magnitude, as there is low potential for encountering archaeological resources outside of the identified HPAs.
- Within the LAA.
- Short-term as the effects will be restricted to the construction phase.
- Occur as a single event associated with ground disturbance during construction.
- Irreversible, as archaeological resource cannot be repaired once altered.

As a result, the residual effects are considered to be not significant.

10.0 OTHER CONSIDERATIONS

10.1 Electromagnetic Interference

10.1.1 Overview

The rotating blades and support structures of wind turbines can interfere with various types of electromagnetic signals emitted from telecommunication and radar systems (RABC & CanWEA, 2020).

EMI created by a wind turbine can be classified into two categories: obstruction and reflection. Obstruction occurs when a wind turbine is placed between a receiver and a transmitter, creating an area where the signal is weakened and/or blocked. Reflection is caused by the distortion between a raw signal and a reflection of the signal from an object. Scatter is a sub-category of reflection caused by the rotor blade movement.

The EMI assessment identified point-to-point, broadcast systems, radar, navigation, and communications systems susceptible to the effects of windfarm interference. 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.

10.1.2 Assessment Guidelines

The Radio Advisory Board of Canada (RABC) and CanWEA developed guidelines for assessing the EMI potential from a wind turbine development: Technical Information and Coordination between Wind Turbines and Radiocommunication and Radar Systems; hereafter referred to as the RABC Guidelines (RABC & CanWEA, 2020).

These guidelines outline a consultation-based assessment protocol that establishes areas, called “consultation zones”, around transmission systems, based on the type and function of the system.

10.1.3 Assessment Methods

Consultation is generally the best method of notification, and this process typically begins with a letter distribution to those parties affected by the development. A summary of the RABC Guidelines for determining consultation zones can be found in Table 10.1.

Table 10.1: RABC Guidelines – Recommended Consultation Zones

Systems	Consultation Zone
Point-to-Point Systems above 890 MHz	**1 km**
Broadcast Transmitters (AM, FM, and TV stations)	AM station: **5 km** for omnidirectional (single tower) antenna system **15 km** for directional (multiple towers) antenna system FM station: **2 km** TV station: **2 km**
Over-the-Air Reception (TV off-air pickup, consumer TV receivers)	Analog TV Station (NTSC): **15 km** Digital TV (DTV) station (ATSC): **10 km**

Systems	Consultation Zone
Cellular Type Networks, Land Mobile Radio Networks, and Point-to-Point Systems below 890 MHz	**1 km**
Satellite Systems (Direct to Home, Satellite Ground Stations)	**500 m**
Air Defence Radars, Vessel Traffic Radars, Air Traffic Control Radars, and Weather Radars	DND Air Defence Radar: **100 km** DND or Nav Canada Air Traffic Control Primary Surveillance Radar: **80 km** DND or Nav Can Air Traffic Control Secondary Surveillance Radar: **10 km** DND Precision Approach Radar: **40 km** Canadian Coast Guard Vessel Traffic Radar System: **60 km** Military or Civilian airfield: **10 km** Environment and Climate Change Canada Weather Radar: **50 km**
Very High Frequency (VHF) OmniRange	**15 km**

To conduct an EMI assessment, the following information regarding turbine design and placement is generally required to complete notifications:

- Turbine UTM coordinates
- Number of turbines
- Ground elevation
- Tower/hub height of each turbine
- Nacelle height
- Rotor diameter
- Turbine blade sweep diameter (or length of blades)

Response time and feedback from the various organizations vary and can take up to 12 weeks. If turbine type, layout, or design changes, many organizations will need to be re-consulted prior to proceeding.

10.1.4 Assessment Results

Consultation with relevant agencies was completed and results are provided in Table 10.2. Responses are provided in Appendix K.

Table 10.2: EMI Consultation Results

Operator	Signal Source(s)	Consultation Results
Innovation, Science and Economic Development Canada (ISED)	Regulator • General Radiofrequency database • Spectrum Direct • Broadcasting database • Integrated Spectrum Observation Centre	Notification letter sent September 2024. ISED acknowledged that package was received.
Department of National Defense (DND)	Military Air Defence and Air Traffic Control Radars Military Radiocommunication Users	Notification letter sent September 2024. Acknowledgement of receipt and request for NAV CANADA Land Use number received September 2024. Wind turbine submission form sent November 4, 2024.
Royal Canadian Mounted Police (RCMP)	Radiocommunication Systems	Notification letter sent September 2024. No objection confirmation received September 2024 with recommendation to consult with Bell.
Canadian Coast Guard	Maritime Vessel Traffic System Radars	Notification letter sent September 2024. Confirmation of no objection received October 2024.
Environment Canada (ECCC)	Weather Radars	Notification letter sent September 2024. Acknowledgement email received from ECCC in September 2024. Update email received October 30, 2024, indicating that the assessment is ongoing, and an update will be provided shortly.
NAV Canada	Civilian Radar Air Traffic Control Radar Air Navigation Equipment VHF omnidirectional range	Notification letter sent September 2024. Land Use number received September 2024. Land Use Proposal Submission sent November 6, 2024.
Mount Uniacke RCMP	Radiocommunication Systems	Notification letter mailed September 2024.
Tantallon RCMP	Radiocommunication Systems	Notification letter mailed September 2024.
Halifax Regional Fire	Emergency Services	Notification letter sent September 2024.

Operator	Signal Source(s)	Consultation Results
		No objection confirmation received from HRF in September 2024.
Uniacke & District Volunteer Fire Department	Emergency Services	Notification letter sent September 2024. No objection confirmation received September 2024.
NCS Managed Services	Telecommunications Inc.	Notification letter sent September 2024.
Bell Alliant	Telecommunications	Notification letter sent September 2024. Supplemental KMZ file provided November 4, 2024.
Eastlink	Telecommunications	Notification letter sent September 2024. Acknowledgement email received September 2024.
Rogers Communications	Telecommunications	Notification letter mailed in September 2024.
Seaside Communications	Telecommunications	Notification letter sent September 2024.

10.1.5 Effects Assessment

Project-EMI Interactions

Project activities only interact with electromagnetic signals during operations (Table 10.3).

Table 10.3: Potential Project-EMI Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
EMI												X			

Assessment Boundaries

Assessment boundaries align with the consultation boundaries established by the RABC Guidelines.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for EMI. The VC-specific definition for magnitude is applied to each operator individually as follows:

- Low – letter of no objection received.
- Moderate – organization requests additional consultation.
- High – letter of objection received.

Effects

As shown in Table 10.2, 15 notifications were submitted in total.

Confirmed indications of no objections were received from RCMP, Canadian Coast Guard, Mount Uniacke RCMP, Halifax Regional Fire and Uniacke & District Volunteer Fire Department.

Acknowledgement of receipt was received from NCS Managed Services Inc., Eastlink, Bell, NAV CANADA, ECCC, DND and ISED.

ECCC is completing further internal consultation in regard to potential impacts to their Gore weather station.

Additional consultation was recommended by RCMP with Bell, who were part of the original consultation. Bell is currently reviewing the Project for potential interference.

No response was received from Tantallon RCMP, Seaside Communications, Rogers Communications Canada Inc.

Mitigation

The following general mitigation measures regarding EMI will be implemented:

- Ensure operators are consulted on any future layout updates.
- Continue consultation with operators who have not yet responded to the notification letters and/or who expressed concerns with the initial layouts presented.

Should additional layout modifications be required, the above agencies will be provided with updated information, as appropriate.

Monitoring

No monitoring programs are recommended.

Conclusion
After mitigations, the residual effects are considered:

- Moderate magnitude as additional consultation was requested from certain operators.
- Within the consultation zones defined by RABC guidelines.
- Of medium duration as any effects would extend through the operation and maintenance phase.
- Continuous.
- Reversible with decommissioning of the Project.

The residual effects were determined to be not significant.

10.2 Shadow Flicker

10.2.1 Overview
Shadow flicker can occur when rotating blades cast flickering shadows during times of direct sunlight. The magnitude of shadow flicker is determined by the position and height of the sun, wind speed and direction, geographical location, time of year, cloud cover, turbine hub height and rotor diameter, and proximity to the turbine.

For shadow flicker to occur, the following criteria must be met:

- The sun must be shining and not be obscured by clouds/fog.
- The source turbine must be operating.
- The wind turbine must be situated between the sun and the shadow receptor.
- The wind turbine must be facing directly towards, or away from, the sun such that the rotational plane of the blades (i.e., rotor plane) is perpendicular to the azimuth of incident sun rays. For this to occur, the wind direction would have to be parallel to the azimuth of the incident sun rays throughout the day.
- The line of sight between the turbine and the shadow receptor must be clear. Light-impermeable obstacles, such as vegetation, tall structures, etc., will prevent shadow flicker from occurring at the receptor.
- The shadow receptor has to be close enough to the turbine to be in the shadow.

10.2.2 Regulatory Context
There are no municipal, provincial, or federal guidelines related to shadow flicker, but many jurisdictions, including Nova Scotia (through NSECC) have adopted the industry guideline of no more than 30 hours of shadow flicker per year, and no more than 30 minutes of shadow flicker on the worst day of the year at residential receptors (NSECC, 2021).

10.2.3 Assessment Methodology
The shadow flicker assessment was completed through modelling to achieve the following objectives:

- Identify receptors that may potentially experience shadow flicker from the Project's operation.
- Quantify the expected duration and frequency of shadow flicker for receptors over a calendar year and during the modelled worst day.
- Assess if applicable guidelines are expected to be met.
- Propose mitigation should shadow flicker levels exceed the guideline levels.

Potential receptors located within 2 km of the turbine locations were identified using GIS data from the Nova Scotia Geomatics Centre and aerial imagery. As a conservative measure, no distinction was made between habitable dwellings and barns, sheds, or outbuildings.

An analysis was conducted using the WindPRO version 4.0.547 software package under 'worst-case' modelling, which is the most conservative approach and assumes that all the criteria listed in Section 10.2.1 are always met. Worst-case modelling assumes conditions that are impossible to occur in practice but provides a starting point for assessing potential shadow flicker issues. For clarity, worst-case modelling assumes the following conditions are met:

- The sun is shining from sunrise to sunset (i.e., no cloud obstruction).
- The rotor plane is always perpendicular to the line from the turbine to the sun.
- The turbine is always operating.
- The receptor building is a 'greenhouse', having windows on all exterior surfaces.
- There are no line-of-sight obstacles (e.g. trees, vegetation) between turbines and receptors.

Shadow flicker modelling included contributions from the existing Pockwock Wind Farm turbines, which are within 3 km of the Project turbines, to include any predictive cumulative shadow flicker levels at receptors. Although the Project is proposed for up to 7.0MW per turbine, the Nordex N163/5.X model turbines were used for the shadow flicker assessment to represent a worst-case scenario situation, as they have a slightly higher hub height (125 m vs 118m).

Model results are presented graphically as contour lines showing the number of shadow flicker hours anticipated under the modelled scenario in the surrounding area in hours per calendar year and minutes per day on the day that the most shadow flicker would be expected for a given receptor (i.e., the maximum shadow minutes per day).

10.2.4 Assessment Results

A total of 27 potential receptors were identified within 2 km of the Project turbines. Model results show that, under worst-case modelling, all receptors are expected to experience less than the guideline levels of 30 hours of shadow flicker per year or 30 minutes per day (Table 10.4; Drawing 10.1A-B). Detailed results showing all receptors within 2 km of the turbine locations are provided in Appendix L.

Table 10.4: Potential Receptors Impacted by Shadow Flicker – Assessment Scenario A

Receptor ID*	Hours of Shadow Flicker per Year	Minutes of Shadow Flicker per Day (on the worst day)
E	25:30	0:24
N	21:44	0:23
O	21:00	0:19
M	20:00	0:22
F	18:38	0:20
C	15:55	0:19
B	13:29	0:18
L	13:29	0:19
Q	13:00	0:20
K	12:47	0:20
D	12:23	0:18
Z	9:40	0:22
T	9:27	0:22
J	9:22	0:19
I	7:43	0:16
A	5:53	0:17
R	5:39	0:18
P	5:31	0:17
G	4:47	0:16
H	4:43	0:16

* Receptor ID corresponds to labelling on Drawings 10.1A-10.1B.

10.2.5 Effects Assessment

Project-Shadow Flicker Interactions

Project activities only interact with shadow flicker during wind turbine operations (Table 10.5).

Table 10.5: Potential Project-Shadow Flicker Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Shadow Flicker												X			

Assessment Boundaries
The LAA for shadow flicker includes a 2 km area around the Project turbines (Drawings 10.1A – 10.1B). The RAA is not applicable for shadow flicker.

Assessment Criteria
Assessment criteria provided in Section 4.6 apply for shadow flicker. The VC-specific definition for magnitude is as follows:

- Negligible – no measurable shadow flicker predicted at receptor location(s).
- Low – measurable shadow flicker predicted at receptor locations, but results are below guidance.
- High – shadow flicker predicted to exceed guidance at receptor locations.

Effects
Shadow flicker modelling results demonstrate that expected shadow flicker amounts comply with required guidelines levels of less than 30 hours per year and 30 minutes per day.

Mitigation
No mitigation is recommended for shadow flicker.

The Project will develop a complaint response protocol, which will consider complaints related to shadow flicker and outline a process to investigate complaints. During all phases of the Project, including operations, contact information from the Proponent's point of contact will be made available and displayed publicly should the public have any questions, inquiries, or complaints. The Proponent representative will respond to each communication accordingly. Each question, inquiry and complaint will be logged electronically with the following information, if provided: date of question, inquiry or complaint, name, phone number, e-mail address of the individual, response, date of response, and any follow-up, as required. Mitigation to resolve complaints, if determined to be necessary, will be completed on a case-by-case basis in consultation with the affected landowner and may include the provision of screening, the development of a turbine-specific curtailment plan, or a negotiated form of compensation.

Monitoring

No monitoring programs are recommended.

Conclusion

Residual effects of shadow flicker are characterized as follows:

- Low magnitude as all receptors are within the guidelines of 30 hours per year and 30 minutes per day.
- Within the LAA.
- Medium duration as the residual effects will extend through the operational and maintenance phase.
- Of intermittent frequency as shadow flicker only occurs when climatic conditions align.
- Reversible as the effect will terminate at the end of the Project lifespan.

As a result, the residual effects are considered not significant.

10.3 Visual Impacts

10.3.1 Overview

The development of wind turbines has the potential to change the visual landscape and/or aesthetics of a local area. The level of change varies depending on the significance of the landscape, local topography, and the degree to which the turbines alter or modify the landscape. Locations of concern may include:

- Public viewpoints
- Protected areas
- Areas of local significance
- Recreational areas (hiking trails, biking routes, etc.)

Lighting associated with wind turbines may also result in visual impacts, especially during the nighttime.

10.3.2 Regulatory Context

There are no provincial or federal guidelines related to viewscapes. At the municipal level, visual impacts are considered during the review and approval of development permits as prescribed within the Halifax Regional Municipal Planning Strategy (HRM, 2014) and the Municipality of East Hants Municipal Planning Strategy (MOEH, 2023).

Operational turbine lighting is regulated by NAV Canada and Transport Canada.

10.3.3 Assessment Methodology

Visual simulations were undertaken to assess the wind turbines' impact on the visual landscape and local aesthetics. Locations for the visual assessment were selected based on known significant viewpoints (i.e., lookouts, hiking trails, etc.) within the area surrounding the Project and through engagement with and consideration of local stakeholders/users. During the public open houses completed for the Project, participants were asked if they recommended particular locations for additional visual simulations, which helped inform the selection of visual simulation locations. The following locations were selected for visual simulations (Drawing 10.2A):

- An unmarked camping spot west of Clay Lake, as recommended by the SMBSA (coordinates provided in Drawing 10.2B)
- Wrights Lake Dock (coordinates provided in Drawing 10.2C and 10.2D)
- The intersection of Oceanstone Drive and Falcourt Run (coordinates provided in Drawing 10.2E)
- The St. Margarets Bay Trail along the Mersey Bowater Road (coordinates provided in Drawing 10.2F)

Photos were taken using a Canon EOS REBEL T7 camera with a 50 mm lens. Precise location, time, direction of view, and weather conditions at the time of the photo were also recorded.

The visual simulations were completed using WindPro software that incorporates elevation, turbine location, and camera/photo location information to simulate what the landscape will look like after the wind turbines have been constructed. Weather conditions (clear sky, overcast, etc.) and visibility (clear, fog, etc.) can be selected during the process to demonstrate the visual aesthetics of the Project during various environmental conditions. Although the Project is proposing up to 7.0 MW turbines, the Nordex N163/5.9 model was used in the simulations as they have a higher hub height than the NordexN163/6.X MW model (206 m total height versus 199.5 m total height) and provide a worst-case scenario in the event the Proponent decides to use the 5.9 MW model.

The result is a series of photos showing the landscape from selected locations with the turbines in place.

10.3.4 Assessment Results

Visual simulations are provided in Drawings 10.2B to 10.2F.

Turbines will be equipped with pilot warning and obstruction avoidance lighting to ensure compliance with NAV Canada and Transport Canada safety requirements.

10.3.5 Effects Assessment

Project-Visual Aesthetics Interactions

Project activities only interact with visual aesthetics during operations (Table 10.6).

Table 10.6: Potential Project-Visual Aesthetics Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Visual Aesthetics												X			

Assessment Boundaries

The LAA for visual effects includes the observer locations. The RAA is not applicable for visual effects.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for visual effects. The VC-specific definition for magnitude is applied to each observer location individually as follows:

- Negligible – Project components cannot be seen from the observer location.
- Low – Project components may be seen from the observer location, but do not stand out or are not discernible in the view (i.e., low exposure on the horizon).
- Moderate – Project components can be seen from the observer location but are not a prominent feature in the view.
- High – Project components are a prominent feature in the view from the observer location.

It is noted that the magnitude criteria for visual effects is considered a neutral criteria as the perception of a change to the visual landscape can be adverse or positive depending on the individual observer.

Effects

Based on the simulations, portions of the turbines are visible from all observer locations. The turbines are more prominent at locations closer to turbine locations, as to be expected (West of Clay Lake and Wright's Lake Public Dock). The Proponent worked with the SMBSA on two independent recreation assessments for the area. These reports will be used to further address the visual impacts on recreational activities and engagement is ongoing.

Operational lighting could be visible from the turbines during the night. However, potential impacts to residents are expected to be limited due to the distance between the Project turbines and nearest potential receptor. Lighting intensity and flashes will be minimized, as allowable by Transport Canada, and the exterior turbine maintenance lights will be turned off prior to maintenance staff leaving the site. In addition, the Proponent expects to install a light mitigation system. The technologies under consideration are a light dimming system whereby the turbine lights would be dimmed by up to 90% during high visibility conditions (i.e., clear skies), or an aircraft detection system where the lights would be turned off when no aircraft are detected within a certain distance of the Project. The Proponent will make a final decision once the Project design has been further advanced and a final turbine technology has been selected.

Mitigation
No mitigation is recommended related to viewscapes.

The following mitigation is recommended regarding turbine lighting:

- Limit lighting on turbine hubs and blades to minimum levels while still meeting requirements of NAV Canada and Transport Canada.
- Prohibit general lighting within the Project Area. Lighting will only be used when technicians are working on-site.

Construction activities will be limited to daytime hours when possible. It is noted that the turbine may be erected during the evening as the activity must be completed when the wind is less than 8 m/s as a safety measure. On-site lighting will be pointed downward to minimize light throw.

Monitoring
No monitoring programs are recommended.

Conclusion
Effects related to visual impacts are characterized as follows:

- Moderate to high magnitude, as turbines are quite prominent at locations in close proximity to the Project (notably the location west of Clay Lake).
- Within the LAA.
- Medium duration as the effects will extend through the operational and maintenance phase.
- Continuous.
- Reversible as the effects will terminate at the end of the Project lifespan.

The effects are considered to be not significant.

10.4 Sound

10.4.1 Overview

The assessment of sound considered both construction and operational generated noise from the Project. During construction, heavy equipment, machinery, and light vehicles will emit sound to the surrounding environment from activities associated with the development of wind turbine pads, roads, the transmission interconnection and grid connection, along with the subsequent assembly of wind turbines. To quantify potential impacts, noise levels of equipment anticipated to be used for the Project's construction were used to calculate noise levels at set distances from the Assessment Area in consideration of nearby receptors.

During the operational phase of the Project, wind turbines will emit sound to the surrounding environment from mechanical equipment operation and the turbines interaction with the surrounding air (aerodynamic sound). Design and engineering of wind turbine components (e.g., anti-vibration products) have reduced, but not eliminated, mechanical and aerodynamic sound and its associated impacts. To quantify potential impacts of turbine generated noise on nearby receptors, detailed sound modeling was completed.

10.4.2 Regulatory Context

Changes to the acoustic environment during construction and operational activities could result in displacement, annoyance, and interference of communication, sleep, or working efficiency. As such, sound levels are regulated at the various government levels (Table 10.7).

Table 10.7: Summary of Sound Level Regulations and Guidelines

Regulated By	Regulation/Guidance	Sound Level (dBA)	Hours / Duration
For Residential Receptors			
Nova Scotia Department of Environment and Labour (now NSECC)	Guidelines for Environmental Noise Measurement and Assessment (NSECC, 2023b)	≤ 65	0700 to 1900
		≤ 60	1900 to 2300
		≤ 55	2300 to 0700
NSECC	Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia (NSECC, 2021)	≤ 40	During the operation of wind turbines
Halifax Regional Municipality (HRM)	By-Law Number N-200 Noise By-Law (HRM, 2022)	"*Activity that unreasonably disturbs or tends to disturb the peace and tranquility of a neighbourhood*"	At all times
Municipality of the District of West Hants	Guideline/by-laws for noise are not established	---	---
For Occupational Safety			
Workplace Health and Safety Regulations &	Noise – Occupational Exposure Limits in Canada	85	8-hour maximum

Regulated By	Regulation/Guidance	Sound Level (dBA)	Hours / Duration
Canadian Centre for Occupational Health and Safety (CCOHS)	(Workplace Health and Safety Regulations & CCOHS, 2022)		

There are no municipal, provincial, or federal regulations related to operational wind turbine sound. However, Nova Scotia (through NSECC) has adopted the industry standard that comprehensive sound levels, including project-related sound contributions, must not exceed 40 dBA at the exterior of a receptor.

10.4.3 Assessment Methodology

Ambient Sound

Aerial imagery and field observations were used to identify nearby sources of sound and characterize the ambient sound within the Study Area.

Construction Sound

The assessment of construction sound is based on desktop studies and addresses Project-related effects on human receptors. The objectives aim to achieve the following:

- Establish the construction sound levels produced by the Project.
- Identify nearby receptors that may be exposed to construction sound produced by the Project.
- Determine if applicable guidelines are met.
- Mitigate impacts experienced by nearby receptors, if required.

Receptors, as defined in the Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia (NSECC, 2021), located within 2 km of the Assessment Area were identified using GIS data from the Nova Scotia Geomatics Centre and aerial imagery.

Note, sound levels and impacts from blasting activities have not been included in this assessment as blasting requirements have not been confirmed. If blasting is determined to be required during construction, the Proponent will notify NSECC and apply for any required permits and approvals. Any potential impacts, mitigation, and subsequent required monitoring will be described in a Project specific Blasting Plan.

Operational Sound

The operational sound assessment was completed through a combination of desktop studies and modelling with the following objectives in mind, per NSECC Guidelines:

- Identify receptors within 2 km of turbines.
- Identify existing operational turbines within 3 km of the Project.

- Identify and assess comprehensive sound levels at the exterior of identified receptors, including cumulative effects from neighbouring turbines (within 3 km), if present.
- Propose mitigation of Project generated sound on nearby receptors, if required.

The sound assessment was completed using the WindPRO version 4.0.547 software package. For the purposes of this model, receptors included all structures identified in GIS data from the Nova Scotia Geomatics Centre, as well as any additional identifiable structures based on aerial imagery. No attempt to distinguish sheds and outbuildings from dwellings or cottages was made. Sound modelling included contributions from the existing Pockwock Wind Farm turbines, which are within 3 km of the Project turbines, to include any predictive cumulative noise levels at receptors. Although the Project is proposed for up to 7.0MW per turbine, the Nordex N163/5.X model turbines were used for the sound assessment to represent a worst-case scenario situation, as they are louder than the Nordex N163/6.X model.

The model followed ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method and calculations, and was based on the following input information:

- Universal Transverse Mercator (UTM) coordinates for the wind turbines.
- 1/1 Octave band sound power level data, provided by the manufacturer for the wind turbines.
- UTM coordinates for receptors (all non-Project participant structures within a 2 km radius of the Project turbines were evaluated).
- A wind speed of 10 m/s, the speed at which the highest sound power level output is achieved (based on test data from the manufacturer).
- Topographic data for the surrounding area.

The ISO 9613-2 calculation method assumes meteorological conditions that are ideal for noise propagation, including a ground temperature of 10°C and 70% relative atmospheric humidity. A ground factor of 0.7 was applied to the model, representing predominantly porous ground (i.e., capable of vegetative growth) interspersed with hard surfaces (e.g., water). An ambient noise level of 35 dB was incorporated into the modelling.

Modelling results were mapped and presented as a heat-map demonstrating the sound levels expected at the exterior of each receptor.

10.4.4 Sound Assessment Results

Ambient Sound

Ambient, or background sound levels are considered when calculating the expected overall sound levels at Project receptors. Several existing sound sources may contribute to the ambient sound levels of receptors in the Study Area, including:

- Active forestry (throughout and surrounding the Study Area)
- Existing Pockwock Wind Farm turbine sound output

- St. Margarets Bay Hydroelectric System
- Highway 101

Sounds associated with these activities include operation of heavy machinery, tree felling, logging trucks, etc. Recreational and local traffic also exists within the Study Area, increasing ambient sound levels from cars, ATV, dirt bikes, etc. Lastly, in addition to anthropogenic sources, there are also natural sources of sounds originating from wildlife, wind, water, and vegetation.

Construction Sound

During construction activities, sound will predominantly be generated through the operation of construction equipment and heavy machinery such as cranes, backhoes, excavators, dump trucks, graders, and transportation vehicles. A summary of sources and anticipated volumes of sound produced during the Project's construction have been provided in Table 10.8.

Table 10.8: Decibel Limits of Construction Equipment Required for the Project

Equipment	Average Noise Level Ranges (dBA)
Road, Transmission Line, Grid Connection, and Turbine Pad Development	
Blasting	137[1]
Backhoe	85-104[1]
Concrete Truck/Pump	103-108[2]
Dozer	89-103[1]
Dump Truck	84-88[1]
Excavator	97-106[2]
Harvesting Equipment (log truck, manual faller, etc.)	85-103[3]
Roller	95-108[2]
ATV	97[4]
Loaders	88[3]
Pickup Trucks	95[4]
Tracked Drilling Units	91-107[5]
Tracked Dump Truck/Decks	91[6]
Tracked Man Lift/Bucket Machines	85[6]
Tracked Radial Boom Derricks/Cranes	93-98[2/6]
Turbine Assembly	
Crane	78-103[1]
Handheld Air Tools	115[2]
Compressor (drilling, pneumatic tools, etc.)	85-104[7]

Note that measurements shown are relevant to the decibel level ranges within close proximity (i.e., less than 15 m of distance) between a receptor and the relevant piece of equipment.

Sources: [1]New Gold (2015)
[2]WorkSafe BC (n.d.)
[3]Transport Scotland (n.d.)
[4]WorkSafe BC (2016)
[5]Government of Oregon (n.d.)
[6]The Driller (2005)
[7]SCE (2016)
[8]Government of Ontario (2021)

The range of decibels anticipated for the Project's construction activities will be between 78 to 137 dBA (from a single piece of equipment within 15 m from the source).

Assuming that sound attenuates at the standard rate of 6 dBA per doubling in distance from a given point source, approximate sound levels experienced at incremental distances during construction activities for the Project are provided in Table 10.9. The attenuation rate of sound presented below does not consider local landscape/topography or buildings, and therefore, is considered a "worst-case" scenario for sound levels produced by a single piece of equipment. During construction, the nearest receptor to all Project infrastructure may experience median sound levels up to 57.7 dBA.

Table 10.9: Attenuation of Construction Related Sounds

Case	Example Equipment Type	Sound Level at 15 m (dBA)*	Point Source Sound Levels (dBA) at Incremental Distances					
			50 m	100 m	200 m	500 m	1,000 m	2,000 m
Minimum	Crane	78	67.5	61.5	55.5	47.5	41.5	35.5
Median	Pickup/ATV	96	85.5	79.5	73.5	65.5	59.5	53.5
Maximum	Handheld Air Tools	115	104.5	98.5	92.5	84.5	78.5	72.5
	Blasting	137	126.5	120.5	114.5	106.5	100.5	94.5

*Approximate point source sound levels, based on data collected in Table 10.9 above. Combined sound levels produced by multiple pieces of equipment operating simultaneously have not been included in the assessment.

Operational Sound

A total of 27 receptors were identified within 2 km of the Project turbines. The nearest non-participating receptor to a turbine is 1.7 km from a Project turbine. Results of the sound modelling (presented as a heat map) are shown on Drawing 10.3 and detailed results are provided in Appendix M. No receptors exceeded the recommended guideline of 40 dBA cumulative sound in the sound modelling. The highest predicted sound level at a receptor is 38.3 dBA, which incorporates sound from the existing Pockwock Turbines in the modelling.

Information from the turbine manufacturer supplied the 1/3 octave low frequency power levels at 118 m hub height. The power levels were entered into a Finland low frequency model in WindPRO software to produce the maximum dBA at each receptor. No potential receptors exceed the most critical noise demand from WindPRO's Finland low frequency model of 59.1 dB; therefore, low frequency sound is not expected to be a concern. The Finland low frequency model along with a literature review of low frequency/infrasound is provided in Appendix M.

10.4.5 Effects Assessment

Project-Sound Interactions

Project activities will interact with the acoustic environment during all phases of the Project. Sound related to the decommissioning phase is not specifically addressed because sound levels are expected to be comparable to construction levels (Table 10.10).

Table 10.10: Potential Project-Sound Interactions

Valued Component	Site Preparation and Construction											Operations and Maintenance		Decommissioning	
	Land Surveys	Geotechnical Investigations	Placement of Sedimentation and Erosion Control Measures	Clearing and Grubbing	Access Road Upgrading and Construction	Laydown Area and Turbine Pad Construction	Transportation of Turbine Components	Turbine Assembly	Grid Connection	Removal of Temporary Works and Site Restoration	Commissioning	General Operation and Maintenance	Vegetation Management	Infrastructure Removal	Site Reclamation
Sound		X		X	X	X	X	X	X			X	X	X	X

Assessment Boundaries

The LAA for sound includes a 2 km buffer around the Project turbines (Drawing 10.3). The RAA is not applicable for sound.

Assessment Criteria

Assessment criteria provided in Section 4.6 apply for sound. The VC-specific definition for magnitude is provided for construction and operational sound as follows:

Construction Sound

- Negligible – sound levels from Project activities are expected to be ≤55 dBA at residential and sensitive receptor locations.
- Low – sound levels from Project activities may measure between 55-65 dBA at residential and sensitive receptor locations.
- Moderate – sound levels from Project activities may exceed 65 dBA at residential and sensitive receptor locations, but only during high-impact activities (intermittently).
- High – sound levels from Project activities are expected to exceed 65 dBA at residential and sensitive receptor locations during multiple activities (continuously).

Operational Sound

- Low – measurable sound levels predicted at receptor location(s), but results are below NSECC guidance.
- High – sound levels predicted to exceed NSECC guidance at receptor exterior.

Effects

During construction of the Project, decibel limits above 55 dBA at residential receptors can result in disruptions of sleep during nighttime hours while sounds above 65 dBA may cause annoyance and disturbance during daytime hours. Sounds produced during construction have the potential to exceed these thresholds at some residential receptors located within close proximity to activities at some locations within the Project Area. Median sound levels produced during construction activities will be within the ≤65 dBA daytime guideline at a distance of approximately 500 m or greater from the point of emission. No receptors are located within 500 m of the road and turbine layouts, or proposed construction activities. of construction activities.

Given that the construction footprint is widespread, Project-related construction noise potentially exceeding NSECC guidance at individual receptors would occur over a very short time frame and may not overlap with the use of these properties. Furthermore, the median sound level from construction is similar to sound produced from an ATV or pick-up truck, which is already a common source of sound within the Study Area, as are logging trucks and harvesting equipment. As a result, most Project-related construction sound will be consistent with existing sound levels. Activities producing higher levels of sound such as blasting or handheld air tools will be less frequent and last for a very short duration.

Modelled operational sound at receptor locations is predicted to comply with the 40 dBA guidelines adopted for wind projects in Nova Scotia.

Proposed Mitigation

To minimize construction sound and the potential disturbance of receptors during the construction phase of the Project, the following mitigation measures will be implemented, as required:

- Use noise suppressants (e.g., mufflers) on vehicles/equipment, where possible.
- Limit unnecessary vehicle idling.
- Conduct construction activities within the recommended daytime hours of 7:00 to 22:00 to the extent possible
- If determined necessary based on geotechnical studies, blasting activities will follow the guidelines and requirements in the Blasting Safety Regulations. Mitigation and monitoring for potential blasting will be included in a Project specific Blasting Plan.

To minimize disturbance from sound during operation, the following mitigations will be implemented:

- Regular maintenance of turbines to ensure they are in good working order and continue to comply with sound level standards.

The Project will develop a complaint response protocol, which will consider complaints related to sound and outline a process to investigate complaints. Mitigation to resolve complaints, if determined to be necessary, will be completed on a case-by-case basis in consultation with the affected complainant. If necessary, noise monitoring will be included as part of this process to evaluate ambient and operational noise in areas of concern.

Monitoring
No monitoring programs are recommended.

Conclusion
Construction phase results are characterized as low magnitude, within the LAA, short duration, continuous, reversible, and not significant.

Operational phase results are characterized as low magnitude, within the LAA, medium duration, continuous, reversible, and not significant.

10.5 Electromagnetic Fields

EMFs are a form of naturally occurring energy that is produced by equipment or electrical appliances, not unique to wind turbines or farms. EMFs are concentrated near the source, quickly dissipating with distance (Health Canada, 2020). Sources of low frequency EMFs may be associated with the following Project components:

- Wind turbines
- Transmission lines
- Underground cables
- Generator transformers

Limited research has been conducted on EMF emissions from wind turbines and associated transmission infrastructure (ODH, 2022). While EMFs are a form of radiation, the low- to mid-frequency EMFs associated with wind turbines and power transmission infrastructure are within the non-ionizing portion of the electromagnetic spectrum. Non-ionizing radiation does not damage living cells or deoxyribonucleic acid (DNA) and therefore is not identified as a carcinogenic form of radiation (NCI, 2022).

Multiple assessments of the EMF generated by wind turbines have found that the amount of non-ionizing radiation produced even amidst large quantities of turbines is low, similar or lower than levels found in urban areas (Alexias et al. 2020). The authors of a study in Bulgaria found that levels of non-ionizing radiation were more than four orders of magnitude lower than the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guideline for the general public for acute exposure (Israel et al. 2011; ICNIRP, 2010).

Several studies and reports have demonstrated that EMFs generated by wind turbines and associated infrastructure are not considered to be a concern to human health (CMOH, 2010; Knopper et al., 2014; & McCallum et al., 2014). Therefore, impacts to human health from Project emitted EMFs are negligible.

10.6 Ice Throw

Ice throw and ice shedding occurs when ice builds up and releases from the turbine's rotor blades, tower, or nacelle. This phenomenon is possible under a variety of freezing conditions when air temperatures range from 0°C to -12°C because of accumulation of ice caused by fog, rain, or snow. Ice fragments can either be thrown from the rotor due to centrifugal and aerodynamic forces or fall to the ground during idle or shutdown periods (CREA, 2020).

Typically, ice buildup is associated with high winds or extreme weather events when the turbines are already shut down. Ice throw typically only occurs due to a malfunction of the control system or during start-up when speeds are low. The risk of injury or damage because of ice throw is present within the maximum throwing distance of ice from a turbine, as determined using the following equation (CREA, 2020):

$$d_t = 1.5 * (D + H)$$

Where:
d_t = Maximum throwing distance (m)
D = Rotor diameter (m)
H = Hub height (m)

Based on the above equation and turbine model specifications (163 m rotor diameter and 118 m hub height), the maximum throwing distance associated with the Project's turbines is 421.5 m. Turbines for the proposed Project are located 1.5 km from the nearest receptor. The closest public road to a turbine is Highway 101 which is approximately 1 km north of the nearest turbine. Therefore, there is no risk associated with ice throw to the public using these roads. However, there is a collection of logging roads and trails that exists throughout the Study Area, which are frequented by recreationalists for hiking, snowmobiling, hunting, and ATV use. Additionally, ice throw also presents a risk to maintenance workers who will frequent the Project throughout its operational lifespan. Such access may be required when icing is a factor, and possibly because of icing.

Mitigation measures to protect recreation users and site workers from ice throw or shedding will include:

- Continue engagement and education with local recreational users (Section 8) regarding the safe continued use of lands within the Study Area.
- Install signage illustrating and warning of potential hazards associated with ice throw and shedding around wind turbines, including on any recreational or logging trails or roads within the danger zone of ice throw or shedding.
- Equip staff and workers accessing the Project Area for maintenance or other purposes with necessary PPE and associated safety protocols and procedures to mitigate risk of injury and/or fatality, especially during potential icing conditions.

With the implementation of these mitigation measures, the impacts to human health from ice throw are negligible.

10.7 Electrical Fires

Wind turbines contain the key elements required for fire: fuel, oxygen, and a source of ignition. These elements are housed in the turbine nacelle, which is a compact and enclosed space at a height of 118 m. Fires in wind farms are most often caused by lightning strikes, mechanical and hydraulic faults, and electrical installation failure (You et al., 2023). Publicly available data cannot provide exact statistics, but the rate of fire is estimated to be between 1-in-2,000 and 1-in-15,000, or between a 0.05% and 0.007% chance of fire (Krcmar, 2021), though this will be affected by the installation of fire mitigation technologies such as lightning protection systems. The height and remote nature of the turbines may make the early detection and effective control of fires difficult. However, these factors also reduce the direct impacts of electrical fires to human health.

Various standards and guidelines have been implemented to minimize the chances of fires occurring in turbines and associated infrastructure. The addition of fire-suppression systems has the potential not only to save project infrastructure in the event of a fire, but also protect the surrounding environment (Krcmar, 2021). The turbines planned for use in this Project are compliant with the International Electrotechnical Commission's IEC 61400 international standard to avoid damage from hazards during their operational lifespan. This includes lightning and surge protection measures. Additionally, the Project has large setbacks from potential receptors (1.5 km from the nearest residence) and public roads (1 km from Highway 101).

A fire prevention and evacuation plan will be developed, in addition to general safety protocol and training. Impacts to human health from electrical fires are therefore expected to be negligible.

In addition, the following measures have been taken to protect against the risk posed to human health by potential fires:

- Considering the installation of dry hydrants where suitable near large waterbodies to allow fire and emergency response workers access to water.
- Consultation with local fire departments to ensure access routes are suitable for emergency vehicle access during all project phases.
- Development of an emergency response plan, including circulation to local fire departments for input and awareness.

Accidental fires, including wildfires, are discussed further in Section 13.2.

11.0 EFFECTS OF THE UNDERTAKING ON THE ENVIRONMENT

11.1 Summary of Effects of the Undertaking on the Environment

Table 11.1 summarizes the results of the effects assessment for each VC.

Table 11.1: Effects of the Undertaking on the Environment Summary

VC	Magnitude of Effects	Geographic Extent of Effects	Timing and Duration of Effects	Frequency of Effects	Reversibility of Effects	Significance Level	Mitigation and/or Monitoring Required?
Atmosphere and Air Quality	Low to negligible – Minimal to no changes are expected to ambient air quality	Within the Project Area	Seasonal aspects not applicable; short-term duration	Intermittent	Reversible	Not significant	Mitigation required; no monitoring required
Climate Change	Positive – A positive effect on GHG emissions is expected	Not Applicable	Seasonal aspects not applicable; medium-term duration	Continuous	Irreversible	Significant (positive)	Mitigation required; no monitoring required
Geophysical Environment	Low – impacts to the geophysical environment and quality/quantity of groundwater wells are not anticipated (no wells exist within 800 m of the Assessment Area)	Within the Assessment Area	Seasonal aspects not applicable; short-term duration	Intermittent	Reversible	Not significant	Mitigation required; monitoring may be required
Waterbodies and Watercourses	Moderate – small loss of aquatic habitat, with expected potential for altered hydrology	Within the Assessment Area	Seasonal aspects not applicable; short-term duration	Single event	Reversible	Not significant	Mitigation and monitoring required
Fish and Fish Habitat	Low – small loss of fish habitat or impact to fish behaviours	Within the Assessment Area	Seasonal aspects not applicable; short-term duration	Single event	Reversible	Not significant	Mitigation and monitoring required
Wetlands	Low – Direct loss of wetland habitat, but overall wetland functions remain intact.	Within the Assessment Area	Seasonal aspects not applicable; short-term duration	Single event	Reversible	Not significant	Mitigation and monitoring required
Terrestrial Habitat	Low – Some loss of terrestrial habitat, but overall habitat functions remain intact	Within the Assessment Area	Seasonal aspects not applicable; medium-term duration	Continuous	Reversible	Not significant	Mitigation required; no monitoring required

VC	Magnitude of Effects	Geographic Extent of Effects	Timing and Duration of Effects	Frequency of Effects	Reversibility of Effects	Significance Level	Mitigation and/or Monitoring Required?
Terrestrial Flora	Negligible to Low – No loss of habitat supporting terrestrial flora SAR/SOCI; low potential for habitat loss and invasive species.	Within the Assessment Area	Seasonal aspects not applicable; long-term duration (for habitat, N/A for individual SAR/SOCI)	Continuous (N/A for individual SAR/SOCI)	Reversible	Not significant	Mitigation required; no monitoring required
Terrestrial Fauna	Low – Small loss of habitat supporting fauna, but no impacts to fauna behaviours expected	Within the Assessment Area	Seasonal aspects applicable; long-term duration	Continuous	Reversible	Not significant	Mitigation and monitoring required
Bats	Moderate – Minimal loss of individuals or impacts to bat behaviours, but these impacts will only be experienced by individuals rather than entire populations.	Within the Study Area	Seasonal aspects not applicable; medium-term duration	Continuous	Reversible	Not significant	Mitigation and monitoring required
Avifauna	Low – Small loss of important habitat supporting avifauna and/or impacts to migratory avifauna are expected to be low	Within the RAA	Seasonal aspects not applicable; medium-term duration	Continuous	Reversible	Not significant	Mitigation and monitoring required
Economy	Positive – A positive effect on the economy is expected	Within Nova Scotia	Seasonal aspects not applicable; medium-term duration	Continuous	Irreversible	Significant (positive)	No mitigation or monitoring required
Land Use and Value	Negligible – No change in land value expected and surrounding land use can largely continue					Not significant	No mitigation or monitoring required

VC	Magnitude of Effects	Geographic Extent of Effects	Timing and Duration of Effects	Frequency of Effects	Reversibility of Effects	Significance Level	Mitigation and/or Monitoring Required?
Traffic and Transportation	Moderate – Moderate change in traffic levels and/or moderate disruptions to traffic flow and routing	Within the area of East Hants MD and HRM extending to the Port of Halifax.	Seasonal aspects not applicable; short-term duration	Intermittent	Reversible	Not significant	Mitigation required; no monitoring required
Recreation and Tourism	Low – small change to tourism expected and/or minor limitations to recreation use	Within East Hants MD and HRM	Seasonal aspects not applicable; medium-term duration	Intermittent	Reversible	Not significant	Mitigation required; no monitoring required
Archaeological Resources	Low – Activities have a low potential for encountering archaeological resources outside identified HPAs.	Within the Assessment Area	Seasonal aspects not applicable; short-term duration	Single event	Irreversible (to be confirmed based on any identified resources, as applicable)	Not significant	Mitigation required; no monitoring required
Human Health	Negligible – No expected impacts to human health					Not significant	Mitigation required; no monitoring required
Electromagnetic Interference	Moderate – Additional consultation was requested.	Within consultation zones as defined by RABC Guidelines	Seasonal aspects not applicable; medium-term duration	Continuous	Reversible	Not significant	Mitigation required; no monitoring required
Shadow Flicker	Low – Measurable shadow flicker predicted at receptor location(s), but results are below guidance	Within 2 km buffer around Project turbines	Seasonal aspects applicable; medium-term duration	Intermittent	Reversible	Not significant	No mitigation or monitoring required
Visual Impacts	Moderate to high – turbines are prominent in locations in close proximity to the Project.	Within observer locations	Seasonal aspects not applicable; medium-term duration	Continuous	Reversible	Not significant	Mitigation required; no monitoring required

VC	Magnitude of Effects	Geographic Extent of Effects	Timing and Duration of Effects	Frequency of Effects	Reversibility of Effects	Significance Level	Mitigation and/or Monitoring Required?
Sound: Construction Phase	Low – sound levels from Project activities may measure between 55-65 dBA at residential and sensitive receptor locations	Within 2 km buffer around Project turbines	Seasonal aspects not applicable; short-term duration	Continuous	Reversible	Not significant	Mitigation required; no monitoring required
Sound: Operation Phase	Low – Measurable sound levels predicted at receptor location(s), but results are below NSECC guidance	Within 2 km buffer around Project turbines	Seasonal aspects not applicable; medium-term duration	Continuous	Reversible	Not significant	No mitigation or monitoring required

11.2 Summary of Mitigation Measures

A compiled list of mitigation measures identified throughout the EA is provided below.

Atmospheric Environment

In addition, general mitigation measures for fugitive (dust), exhaust, and GHG emissions include:

- Conduct grading and site preparation in phases to minimize disturbed soil areas until just prior to construction activities.
- Stabilize exposed soil surfaces by sloping or using vegetation, stone, soil, or geotextiles to prevent dust and airborne particles.
- Compact and/or ridge disturbed soil to prevent dust formation.
- Cease dust-generating construction activities during periods of excessive wind.
- Enclose or cover soil storage and/or stockpile areas.
- Wet (with water) aggregate and soil stockpiles to control dust.
- Design storage areas and material stockpiles with prevailing wind directions in mind.
- Wet roadways and heavy traffic areas with water or dust suppressant technologies to minimize airborne emissions.
- Tie down, cover, and/or store loose site materials and/or products prior to inclement weather and wind events to prevent materials from becoming airborne.
- Wash down vehicles and equipment using hoses and water to remove accumulated mud/dirt on undercarriages, tracks, or wheel wells.
- Ensure Project personnel adhere to all safety protocols and wear appropriate personal protective equipment (PPE) during significant fugitive emissions events (i.e., windstorms, dust storms).
- Ensure equipment meets all applicable provincial and air quality regulations and emissions standards.
- Ensure equipment is fueled using low-sulphur diesel (to reduce SO_x air emissions).
- Maintain engines and exhaust systems according to the manufacturer's specifications and the recommended maintenance schedule.
- Remove from service malfunctioning equipment and/or equipment generating excess amounts of smoke, odour, or noise until an assessment and necessary repairs can be completed.
- Remove from service construction equipment with improperly functioning emissions control systems.
- Restrict the idling of equipment where feasible.
- Use locally sourced materials, where possible, to reduce CO_2, CH_4, and NO_x emissions associated with transport.
- Incorporate the shortest construction/transport routes where possible to minimize the use of fossil fuels during construction.
- Recover and recycle construction and demolition/decommissioning waste, where possible.
- Recycle and compost workforce waste (i.e., food waste). Diverting this waste will reduce methane generated in landfills as it decomposes.

- Minimize deforestation during land clearing by only clearing the area that will be needed. This will reduce CH_4 and NO_x emissions associated with soil disturbance and limit the use of equipment (lowering emissions produced during equipment operations).
- Plan construction activities to reduce the double handling of materials, reducing GHG emissions associated with heavy equipment operations.
- Use recycled or repurposed materials, where possible, to reduce GHG emissions associated with embodied energy (i.e., the energy associated with manufacturing a product or service).
- Ensure Project equipment meets all applicable provincial and air quality regulations and emissions standards.
- Maintain engine and exhaust systems according to the manufacturer's specifications and applicable maintenance schedule.
- Remove from service malfunctioning equipment or equipment generating excess amounts of smoke, odour, or noise until an assessment and necessary repairs can be completed.
- Ensure construction equipment with an improperly functioning emission control system is not operated.
- Ensure regular equipment maintenance is undertaken to maintain good operations and fuel efficiency.
- Ensure equipment containing coolant (i.e., air conditioning units) undergoes preventative maintenance and inspections (i.e., leak testing).
- Train Project personnel (as appropriate) in the proper disposal of halocarbon-containing substances.
- Hire from a local labour force to reduce emissions associated with workforce transportation.
- Dispose of halocarbon-containing substances at an approved hazardous waste facility per applicable regulations and in compliance with local requirements.
- Ensure trucks removing waste from or bringing materials to the Project are filled to the maximum allowable capacity where practical (dependent on the truck size and load weight) to reduce transportation requirements and limit the number of trips.
- Implement an anti-idling policy to limit GHG emissions from vehicles and equipment and limit the use of fossil fuels.
- Incorporate energy-efficient infrastructure (i.e., solar panels) where feasible to limit GHG emissions and the use of fossil fuels resulting from standard equipment (e.g., diesel-powered generators or light stands).

Geophysical Environment

General mitigation measures for avoidance of geologic hazards and groundwater resources include:

- Conduct blasting, if required, in accordance with provincial legislation and subject to terms and conditions of applicable permits.
  - Conduct pre-blast surveys for wells within 800 m of blasting activities.
  - Ensure all blasts are conducted and monitored by certified professionals.
  - Notify landowners in advance of any blasting activities.

- Recover and revegetate exposed soils or bedrock as required to minimize any exposure following blasting.
- Develop site-specific mitigation for sulphide bearing materials if they are identified through pre-construction geotechnical surveys.
- Ensure rock removal in known areas of elevated sulphide potential will conform to the Sulphide Bearing Material Disposal Regulations, N.S. Reg. 57/95 and in consultation with relevant regulatory departments.
- Store any soil needed for backfilling, after foundations have been poured, temporarily adjacent to the excavations until needed. Any remaining excavated material will be used on-site or removed and sent to an approved facility.
- Install erosion and sedimentation control measures prior to excavation activities and inspect controls on a regular basis.
- Remove temporary erosion and sedimentation controls once backfilled material has stabilized. Attention will be paid during site reinstatement to ensure areas will promote wildlife return to the area, to the extent possible.

Aquatic Environment

General mitigation measures for impacts to watercourses, waterbodies, fish and fish habitat, and wetlands include:

- Educate Project personnel on the sensitivity of aquatic habitat.
- Flag watercourses and avoid impacts to the watercourse and adjacent riparian habitat to the extent possible.
- Ensure watercourses are clearly marked and avoid impacts to the watercourse and adjacent riparian habitat to the extent possible.
- Revegetate along the watercourse edge and above the ordinary high-water mark to stabilize the area.
- Redesign existing watercourse crossings to facilitate habitat upgrades, including unblocking culverts and making waterways more conducive to fish passage.
- Conduct work between June 1 and September 30 to avoid sensitive periods in the life cycles of fish, to better control water flow, and to allow for a faster revegetation period (NSECC, 2015c).
- Complete a fish rescue, as required, during crossing construction.
- Plan any activities to align with low-flow periods.
- Design any necessary alterations in a way that maintains the natural grade of the watercourse, to ensure the hydroperiod remains as it was pre-alteration.
- Develop a site-specific erosion and sedimentation plan during the detailed design phase.
    - The plan will target the disturbance to banks (as required) and adjacent land, and will address the type of control structures, proper installation techniques, grading, maintenance and inspection, timing of installation, and revegetation.
- Limit the area of exposed soil and the length of time soil is exposed without mitigation (e.g., mulching, seeding, rock cover).

- Limit the slope and gradient of disturbed areas to minimize the velocity of surface water runoff.
- Integrate water management systems including diversion and collection ditches, roadside drainage channels, vegetated swales, and stormwater retention ponds.
- Fit any watercourse crossings with appropriately sized infrastructure, as prescribed by a certified Watercourse Alteration Installer/Sizer.
- Leave riparian vegetation as intact as Project developments will allow.
- Integrate outlet protection features to dissipate flow velocities and decrease erosion at the outflow.
- Require that surface run-off containing suspended materials or other harmful substances is minimized.
- Ensure that if concrete is to be used, it is pre-cast and cured for at least one week prior to use at a crossing site (NSECC, 2015c).
- Utilize untreated, rot-resistant timber (e.g., hemlock, tamarack, juniper, or cedar) below the ordinary highwater mark to avoid the leaching of toxic preservatives into waterways (NSECC, 2015c).
- Utilize rock material that is clean, coarse granular, non-ore-bearing, non-watercourse-derived, and non-toxic to aquatic life (NSECC, 2015c).
- Engage Halifax Water with any road upgrades that may be required within the Assessment Area that overlaps with the Pockwock Water Supply Area.
- Blasting, if required, will follow the guidelines presented in Wright and Hopky (1998).
- Leave riparian vegetation as intact as Project developments will allow.
- Integrate outlet protection features to dissipate flow velocities and decrease erosion at the outflow.
- Storage of any on-site machinery and potential pollutants in areas sited above the flood water limits.
- Areas for fuel storage, refueling, or lubrication of equipment should be located at least 30 m from any water body, watercourse, or wetland.
- Washing and servicing of machinery and equipment should not be completed within 30 m of a waterbody or in an area where wash water will run into a water body, watercourse, or wetland.
- Containment of all construction debris in areas where flood water will not come in contact with debris.
- Flag wetlands to avoid interference with wetland habitat to the extent possible.
- Complete in-season wetland surveys for areas subject to minor layout modifications (refer to Section 7.3.3.5).
- Avoid impacts to wetlands to the extent possible.
  - Where unavoidable, complete wetland alterations in accordance with the NS Wetland Conservation Policy and the wetland alteration process during the permitting stage, which includes a requirement to compensate for lost wetland habitat and functions.
  - Design wetland crossings to occur at the narrow part of the wetland or the wetland's edges, to the extent possible.

- Design wetland crossings to avoid permanent diversion, restriction, or blockage of natural flow, such that hydrologic function of wetlands will be maintained.
- Use the existing roads and access routes to the extent feasible.
- Avoid travel through wetlands. If travel through wetlands is required:
  - Use anti-rutting mitigation (e.g., mud mats), as appropriate.
  - Cross the wetland at the narrowest portion, where possible.
  - Time work to occur during frozen ground conditions, where possible.
- Direct run-off from construction activities away from wetlands.
- Use water or an approved dust suppressant to control dust on roads, as required.
- Enforce site speed limits to minimize dust generation.
- Use quarried, crushed materials for road construction to reduce the introduction of invasive vascular plant species, where possible.
- Prior to arrival on site equipment will be cleaned and inspected to prevent the introduction of invasive/non-native species.
- Train staff on the requirements for work in and around wetlands.

Terrestrial Environment

General mitigation measures for impacts to terrestrial habitat, flora, fauna, bats, and avifauna include the following:

- Minimize overall area to be cleared, fragmentation of habitats, and isolation of existing habitats by utilizing pre-existing roads and previously altered areas (e.g., clearcuts) during detailed design.
- Minimize the Project footprint, especially within old-growth and other late-successional stands, by clearing only the area necessary for turbine erection and operation.
- Restore cleared areas where it is possible to reduce permanent habitat loss, primarily through revegetation of road rights of way and other areas cleared temporarily for construction.
- Revegetate disturbed areas, exposed soils, and cleared areas using native seed mixes.
- Minimize use of road salt to minimize attraction of ungulates to roadsides during the winter.
- Avoid areas with known flora SOCI occurrences during the design phase.
  - Desktop and field assessments identified locations with important habitat features potentially supporting terrestrial flora SOCI which are to be avoided during the design phase.
- Educate Project personnel about the potential for plant or lichen SOCI during construction.
  - Guidance will be provided to Project personnel to raise awareness of terrestrial flora SOCI that are known to exist within the Study Area to increase the number of trained eyes looking for these species.
- Consult with NSNRR if an unexpected flora SOCI is encountered during construction activities. Potential mitigation measures based upon recognized practices to transplant or collect seeds can be used as a contingency if flora SOCI are unexpectedly

encountered during construction activities. A transplantation plan will be developed along with a monitoring protocol through consultation with NSNRR should this be required during construction.

- Minimize (through avoidance) the loss of important habitat that supports terrestrial flora SOCI during the detailed design phase.
- Restore as much habitat as possible through revegetation (with native seed mix) to promote continued growth of terrestrial flora across the Study Area.
- Use native seed mixes when revegetating cleared areas.
- Ensure equipment is as clean as possible to prevent the introduction of non-native species into previously untouched areas.
    - Because non-native species are already present within the Study Area, care will be taken when travelling from developed areas to intact areas so that plant material is not transferred between locations.
- Continue to review habitat modelling results, field survey results, and guidance from NSNRR through the detail design phase.
- Revegetate roadsides and cleared areas to minimize lost habitat as much as possible.
    - Reclaim small roads leading to turbines to minimize long-lasting effects of habitat loss.
- Minimize fragmentation and habitat isolation by utilizing pre-existing roads and previously altered areas during the design phase.
- Support connectivity by maintaining vegetated buffers around wetlands and watercourses, where possible.
- Install traffic signs to alert road users of speed limits and the presence of wildlife in the area.
    - Inform all Project-related staff working on the site of dangers to wildlife and create awareness around wildlife hotspots on the site.
- Minimize Project-related traffic to reduce chances of wildlife collisions and traffic-related stress to wildlife.
- Impose restrictions to site access if deemed necessary due to a substantial increase in wildlife collisions and mortality.
- Use seed mixes that do not contain clover to avoid attracting deer (which carry ticks) to the area when revegetating road ROWs and other cleared areas requiring revegetation.
- Avoid removal of vegetation/habitat alteration in key habitat areas during sensitive windows for priority species, where possible, including:
    - Mainland moose – late May to early June (birthing season) and September to October (breeding season)
    - Fisher – March to April
    - Wood turtle – late March to October
- Minimize loss of important habitat required by priority species for reproduction events, including:
    - Mainland moose – wetlands and isolated islands/peninsulas
    - Fisher – large diameter snags, large woody debris, or live standing trees in mature, intact forests

  - Snapping turtle – clear, meandering streams with gravel shores, gravel roadsides.
- Minimize overall area to be cleared to maintain refugia and cover for protection from predators.
- Maintain all equipment and machinery on site to reduce noise and vibration emissions associated with malfunctions. Where practical, install vehicles and machinery with noise muffling equipment to limit disturbance.
- Restrict on-site lighting, especially at night, to limit disturbance.
- Prohibit harassment and feeding of wildlife by Project personnel.
- Target clearing activities outside the active bat window (April 1 to September 30).
- Install motion activated lights on infrastructure to reduce insect attraction and subsequent attraction by bats. Motion activated lighting is only applicable to ground-based infrastructure (e.g., at doorways, the substation, etc.) as turbine lighting at the top of individual turbines is regulated by Transport Canada.
- Utilize noise controls (e.g., mufflers) on machinery, equipment, etc. during the construction phase.
- Maintain avoidance of potential bat habitat (i.e., large snags, mature forests, wetlands, and large watercourses) to the greatest extent possible.
- Avoidance of topographic funnels, such as within lake or river valleys, for turbine placement to reduce the likelihood of interactions with concentrated bird movements.
- Avoidance, to the extent possible, of important bird habitats, such as wetlands, waterbodies, watercourses, old growth forest, etc. to reduce the impact of habitat changes (e.g., riparian buffers). This includes siting Project infrastructure within areas with existing disturbances, such as existing roads and cutover areas of forest.
- Adhere to ECCC guidelines on clearing windows for nesting migratory birds. If possible, vegetation and tree clearing activities will be conducted outside of the nesting/breeding period that is generally from April 1 to September 30 each year. Timing of clearing activities are generally dependent on seasonal conditions.
  - If vegetation and tree clearing activities during the nesting/breeding season cannot be avoided, nest sweeps will be conducted by a qualified avian biologist to search for any confirmed activity which must be avoided (i.e., active nests and recently fledged juveniles).
  - Regulatory bodies will be contacted, when necessary, to receive advice on construction buffers for any avian activity that must be avoided during the nesting/breeding season.
- When vegetation and tree clearing activities take place during the non-nesting/breeding season, crew must be aware and look out for nests protected year-round under the 2022 update to the Migratory Bird Regulations (under the *MBCA*), which includes Great Blue Heron and Pileated Woodpecker nests (i.e., inactive Pileated Woodpecker nests are protected for three years and inactive Great Blue Heron nests are protected for two years).
- Avoid disturbance of any ground- or burrow-nesting species should they initiate breeding activities within stockpiles or exposed areas during construction or operations, until chicks can fly, and the nesting areas are no longer being used.

- Consider limiting turbine operations around peak periods detected from the acoustic and radar data (e.g., between sunset and sunrise during peak migration periods).
- Establish speed limits for construction vehicles to mitigate the effect of vehicle-avifauna collisions.
- Service construction equipment and vehicles regularly and loud machinery will be muffled.
- Incorporate a lighting plan for construction-related activities into the Wildlife Management Plan.
- Maintain good housekeeping practices during construction to avoid indirectly feeding birds, and potentially attracting nuisance wildlife.
- Develop a spill response plan, and an emergency response plan to mitigate the impacts of spills, hazardous substances, and other emergencies. Equip site machinery with spill kits and instruct site personnel on their use.
- Develop a fire response plan in accordance with provincial standards.
- Revegetate disturbed areas, as appropriate.
- Install avian deflectors on powerlines, including any powerline spans, or areas of line that will be identified in the Wildlife Management Plan as requiring mitigation based on monitoring results.
- Minimize lighting, to the extent possible (e.g., downward facing lights and motion-activated lighting).
- Develop a site reclamation plan in accordance with engineering standards and in consultation with NSECC and NSNRR.
- Plan any potential future infrastructure development and construction to avoid fragmenting or altering critical habitats for SAR avifauna.

Socio-Economic Environment

General mitigation measures for traffic, transportation, recreation, and tourism include:

- Install notices in public areas to inform residents of signage removal or road infrastructure alterations, as well as notify relevant municipal government staff of construction scheduling and safety measures.
- Replace removed signage and guardrails immediately with appropriate temporary signage to ensure the safety of travelling public.
- Complete upgrades to roads and overhead wires, branches, and signs if conflicts arise.
- Complete modifications and associated reinstatement to relevant specifications.
- Avoid, to the extent possible, transportation through urban areas during high traffic times (e.g., 7 am to 9 am and 3 pm to 6 pm; Monday through Friday).
- Conduct all travel using safe work practices for transporting oversized loads.
- Utilize the minimum number of vehicles possible to minimize impacts to road-way flow and air quality due to exhaust emissions.
- Ensure vehicles only visit and work on-site during normal daytime hours of operation, where possible, and avoid high-traffic times of day to reduce local traffic congestion.
- Continue to work with local recreation groups to ensure continued access within the Study Area for recreation and hunting/trapping.

- Continue to work with nearby landowners to ensure there is a positive relationship within the community.

Archaeological Resources

- Conduct shovel testing when HPAs cannot be avoided to the specifications per the recommendations of Boreas and NSCCTH.
- Conduct vegetation removal within areas of potential archaeological resources (especially within the transmission corridors) by hand-clearing and make use of swamp mats where heavy machinery must transit these areas to avoid ground disturbance.
- Develop a chance find procedure in the contingency plan related to the potential unexpected discovery of archaeological items or sites during construction. This would include halting any work immediately upon discovery of suspected resources and contacting NSCCTH. If the resources are suspected to be of Mi'kmaq origin, the Executive Director of KMKNO would also be contacted.
- Conduct additional archaeological assessment if, during the detail design phase, it is determined that ground disturbance is required in areas not previously assessed. The EA Branch will be provided with the acceptance letter from NSCCTH prior to completion of any disturbance in newly proposed areas.

Other Considerations

General mitigation measures for impacts to human health, shadow flicker, EMI, visual impacts, and sound include the following:

- Ensure operators are consulted on any future layout updates.
- Continue consultation with operators who have not yet responded to the notification letters and/or who expressed concerns with the initial layouts presented.
- Use noise suppressants (e.g., mufflers) on vehicles/equipment, where possible.
- Limit unnecessary vehicle idling.
- Conduct construction activities within the recommended daytime hours of 7:00 am to 10:00 pm to the extent possible
- Develop complaint response protocol and display Proponent contact information publicly.
- Limit lighting on turbine hubs and blades to minimum levels while still meeting requirements of NAVCAN and Transport Canada.
- Limit general lighting within the Project Area. Lighting will only be used when technicians are working on-site.
- If determined necessary based on geotechnical studies, blasting activities will follow the guidelines and requirements in the Blasting Safety Regulations. Mitigation and monitoring for potential blasting will be included in a Project specific Blasting Plan.
- Continue engagement and education with local recreational users (Section 8) regarding the safe continued use of lands within the Study Area.
- Install signage illustrating and warning of potential hazards associated with ice throw and shedding around wind turbines, including on any recreational or logging trails or roads within the danger zone of ice throw or shedding.

- Equip staff and workers accessing the Project Area for maintenance or other purposes with necessary PPE and associated safety protocols and procedures to mitigate risk of injury and/or fatality, especially during potential icing conditions.
- Considering the installation of dry hydrants where suitable near large waterbodies to allow fire and emergency response workers access to water.
- Consultation with local fire departments to ensure access routes are suitable for emergency vehicle access during all project phases.
- Development of an emergency response plan, including circulation to local fire departments for input and awareness.

12.0 EFFECTS OF THE ENVIRONMENT ON THE UNDERTAKING

The following section discusses potential effects of the natural environment, including natural hazards and weather events, on the infrastructure and operation of the Project. Potential sources of effects from the environment are described below, including mitigation and design strategies.

The primary mitigative measure employed during the construction and operation of the Project will be to educate and train site personnel. Environmental and safety orientations will be conducted prior to the start of construction and all staff will be informed of the potential effects of the environment on the Project. Staff responsible for the operation and maintenance of the Project will be trained on the design and operation of the turbines, including applicable operating procedures, safety protocols, and evacuation plans. To further mitigate damages that cannot be controlled by education and training alone, the Project will be equipped with safety mechanisms to limit damage resulting from extreme weather events.

12.1 Climate Change

Climate change is the persistent change in the state of the climate which lasts for decades or longer (IPCC, 2018). Climate change may impact the Project through increased occurrences of extreme weather, precipitation, and subsequent flooding. In addition, increased weather extremes due to climate change may impact turbines, powerlines, and/or roadways, causing washouts and/or damage to infrastructure.

12.1.1 Temperature

One major change associated with climate change is global warming, which is defined as an increase in global mean surface temperature averaged over a 30-year period, relative to preindustrial temperatures (IPCC, 2018). Projected rising temperatures associated with global warming may impact many phases of the Project and on-site personnel. Under the high emissions scenario of the Coupled Model Intercomparison Project Phase 6 (CMIP6), annual average temperatures in the Study Area are expected to increase from the 1981 to 2010 baseline of 7.0°C to 9.0°C in the 2021-2050 period (ClimateData.ca, 2024). Furthermore, the number of days annually with maximum temperature exceeding 27°C is expected to increase from 9 to 20 days under the same future climate scenario. These impacts, including acute temperature spikes and longer and more intense heat waves may increase risks of heat-related illnesses, food and water-borne contamination, and forest fires during both construction and operations (Government of Canada, 2019c). Requirements for stopping work or taking regular breaks to cool down and rehydrate will be mandated throughout the Project's lifetime to protect Project personnel. If it is unsafe to work due to severe conditions, a stop-work-authority may be issued.

Warmer temperatures can also spread forest and agricultural pests and disease vectors (i.e., ticks) to the Project location. Invasive plant species are discussed in greater detail in Section 7.4.2.

12.1.2 Sea Level Rise

The Project Area runs parallel to Big Indian Lake and Pockwock Lake, both lakes are part of the East/Indian River primary watershed, which discharges to the Atlantic Ocean. The most southernly edge of the Study Area is approximately 6.8 km from the head of St. Margarets Bay, however the damming required for the St. Margarets Bay Hydro System has eliminated tidal influence into the two secondary watersheds in which the Project is situated. The elevation for most of the Study Area is over 100 masl, with lower-lying areas (around 80 masl) found close to Green Lake. The proposed turbine locations are between approximately 94 to 190 masl. Based on the distance from and elevation above sea level, project infrastructure is unlikely to be impacted by rising water levels within the lifespan of the Project.

12.1.3 Flooding

Flooding in the Study Area may increase due to more frequent severe precipitation associated with climate change. Due to the effects of ocean warming, climate change is predicted to change precipitation amounts and patterns. Future climate scenarios do not predict drastic changes in total annual precipitation within the Project's lifespan, from a 1981 to 2010 baseline of 1,367 mm to 1,447 mm during 2021 to 2050 under a high-emissions scenario (ClimateData.ca, 2024). However, under the high-emissions future climate scenario, the number of wet days (≥ 20 mm) is expected to increase from a baseline of 19 to 21 days (ClimateData.ca, 2024), which may result in increased flood risk (US EPA, 2022b). Flooding may impact both terrestrial and aquatic habitat, damage Project infrastructure, and limit site access. The Project will mitigate the risks of flooding by concentrating the road and turbine layout in high elevation areas, situating turbines a minimum of 30 m from watercourses, maintaining regular upkeep and grading of roads to reduce formation of ruts, designing roadside ditches and water offtake infrastructure next to all roads to encourage drainage of rainwater off the roads, and revegetating roadsides to absorb excess water. A stormwater management plan will be developed during detailed engineering to mitigate potential flooding risks through drainage or other project design features.

12.2 Natural Hazards

12.2.1 Severe Weather Events

Nova Scotia is subject to severe weather events including flooding, blizzards, hurricanes, and wildfires, all of which may lead to negative outcomes including power outages, health related emergencies, infrastructure damage, and road damage, and therefore may pose direct risks to wind farm infrastructure (Government of Canada, 2018). Heavy rainfall is a common, highly probable natural hazard in Nova Scotia. Short duration heavy rainfall is defined as 25 mm or more of rain within one hour, while long duration heavy rainfall can range from 25 mm of rain or more within 24 hours during winter, or 50 mm of rain or more within 24 hours during summer (ECCC, 2020a). Heavy rain has the potential to flood the Project Area, making the roads impassable. Project design features noted in Section 12.1.3, where the risk of increased occurrence of heavy rain events is noted under future climate change scenarios, will also mitigate the effects of heavy rainfall. Project design features noted in Section 12.1.3 will also mitigate the effects of heavy rainfall and snow melt to maintain road access during severe precipitation events.

Wind and lightning, which may be associated with heavy rainfall or hurricane conditions, may increase the risk of mechanical issues or electrical fires. Restricted access to the site during severe weather events may limit the ability to shut down the system to prevent damage. To mitigate this risk, the turbines will be equipped with an automatic shut down when thresholds for wind speeds are reached and will also be designed with a built-in grounding system for lightning strikes. In addition, the Proponent will ensure access is maintained, either by clearing the roads or providing vehicles that can traverse all conditions.

12.2.2 Turbine Icing

Turbine icing occurs when ice accumulates on the surface of turbine blades, a condition created by specific temperatures and levels of humidity or the presence of freezing rain. The chance of turbine icing increases when the blades reach 150 m above ground, where the lower clouds may contain supercooled rain (Seifert et al., 2003). Turbine icing may lead to ice throw or ice fall, and the distance and direction in which the ice is thrown/falls is dependent on factors such as wind speed, rotor speed, rotor azimuth, the position of the ice on the blade, and the characteristics of the ice itself. Due to the numerous factors contributing to where these ice fragments may land when thrown/fallen, the likelihood of a human being struck is insignificant and thus the risk of injury is low (LeBlanc, 2007).

The Wind Power Icing Atlas (WIceAtlas) was consulted to estimate in-cloud icing severities. This tool predicts icing frequencies using cloud base height and freezing temperatures from over 4000 meteorological stations as a proxy for in-cloud icing conditions (VTT, n.d.). The Study Area has been identified as a moderate to high icing frequency area, with an estimated duration of meteorological icing of 3-5% per year, based on the atmospheric characteristics, therefore, there is a minimal risk associated with ice throw events within the Study Area (VTT, n.d.).

The impacts from turbine icing on human health were discussed in greater detail in Section 10.1.2, including the low-downtime predicted for wind turbines in this region according to the WIceAtlas (VTT, n.d.). To further reduce the risk of injury from ice throw or falling ice, restricted site use may be enforced when the ideal weather conditions for turbine icing are present. Education of operators, adequate signage warning of falling ice, and the requirement to wear hardhats around operational turbines will also be implemented. Additionally, the turbines will be equipped to automatically shut down when thresholds for ice formation are detected.

12.2.3 Wildfire

Wildfire is potentially a risk during all phases of the Project. During construction and decommissioning, the use of power tools and machinery presents a risk of producing fire starts. The Forest Fire Protection Regulations, NS Reg. 135/2019 outline restrictions for burning and operating power saws during the fire season (March 15 to October 15). Burning restrictions are determined daily, depending on the Fire Weather Index (FWI). The Nova Scotia government employs an FWI during the fire season to determine fire danger across the forested areas in Nova Scotia (NSNRR, 2021g). A higher FWI score indicates that if a fire were to start it would be of high intensity and pose greater danger than a lower FWI score. Operation of power saws and/or clearing saws in forested areas within the Project Area will only occur when and as permitted under the Forest Fire Protection Regulations. Any activities requiring burning during the Project lifetime will be timed according to local burning restrictions.

As a best practice, the FWI can be used to determine fire danger associated with activities that may result in burning. The FWI during the summer months of 2023 across the Study Area ranged from low (0-5) to high (10-20) (NRCan, 2022b). Federal and provincial FWI data is updated daily, with the closest provincial weather stations to the Study Area being ‘MacLeod Settlement’ (NSNRR, 2021g; NRCan, 2022b). Although most days in the 2023 wildfire season had a low FWI score, to mitigate potential risk of wildfire, safety protocols will be put into place such as implementing a fire prevention and site evacuation plan. Furthermore, the FWI will be checked regularly at nearby weather stations during summer months to determine the potential for highly dangerous wildfires. Precautions should be taken when undergoing construction or maintenance activities that could result in fires on days when FWI scores are >5, such as mechanical brushing/land clearing, using spark-producing tools, or piling of woody debris (Government of BC, 2023). In consultation with first responders, the Proponents is considering the installation of dry hydrants adjacent to the Project Area. Should the risk of fires increase throughout the lifetime of the Project, mitigation strategies to protect Project infrastructure and relevant VCs will be adapted accordingly.

During the Project’s operation and maintenance phases, turbines have the potential to initiate wildfires through several means including attracting lightning strikes, equipment overheating, power surges causing sparks, and by fires that start in equipment and spread to the surrounding environment. The potential for, possible effects of, and mitigative actions to prevent wildfire started by these means are discussed further in section 10.1 Human Health.

12.3 Summary of Effects

Environmental effects associated with climate change and natural hazards have the potential to impact the Project. Project location siting and design measures will minimize many of the risks associated with these environmental hazards, and the mitigation measures described above will allow for both proactive and adaptive management of any remaining risks, thus limiting the likelihood of impacts on all phases of the Project.

13.0 ACCIDENTS AND MALFUNCTIONS

Without proper mitigation, accidents and malfunctions can interact with many VCs and potentially result in adverse effects. However, implementing preventative measures limits the probability of occurrence, and having appropriate response procedures in place reduces the magnitude of residual effects.

Accidents, malfunctions, and unplanned events considered for this Project include:

- Erosion and Sediment Control Failure
- Fire
- General Hazardous Material Spills
- Structural Damage
- Transportation-related Incidents
- Ice throw (addressed in Section 10.1)

The safety of on-site personnel is a vital Project component; however, it is not specifically considered in the EA, as workplace occupational health and safety is regulated by the policies, procedures, plans, and codes of practice set in the Nova Scotia *Occupational Health and Safety Act*, SNS. 1996, c. 7. A site-specific contingency plan will be developed to address accidents, spills and malfunctions.

Additionally, the Proponent has developed a preliminary Emergency Response Plan for the Project, which outlines emergency response jurisdictions, contact information, directions to the nearest emergency services, training, and other resources and actions important for implementation in a variety of emergency situations, especially those resulting from an accident or malfunction. This draft Emergency Response Plan has already been circulated to nearby fire stations or departments for input and feedback. Maintaining access for emergency services during all Project phases is a priority for the Proponent, who has made substantial efforts to consult with first responders on accessibility and their service needs.

13.1 Erosion and Sediment Control Failures

Failure of erosion and sedimentation controls may result in potential adverse effects on VCs (primarily during construction), most notably on watercourses, wetlands, and fish and fish habitat. Erosion and sedimentation controls may fail due to extreme weather conditions (e.g., flooding), improper installation, improper maintenance, and unforeseen accidents (e.g., collisions). Failure of these control measures may release sediment into the environment, impacting water quality and aquatic and terrestrial habitats.

Mitigation measures to limit the probability of an occurrence and reduce the magnitude and extent of potential effects include:

- Provide workers with training to properly install and repair erosion and sediment controls.

- Implement all mitigation related to erosion and sediment control provided in Sections 7.2, 7.3.1, 7.3.2, and 7.3.3.
- Develop and implement an erosion and sedimentation control plan for all phases of the Project.
- Install erosion and sediment controls per the manufacturer's specifications or site-specific requirements.
- Stabilize erosion and sediment controls in advance of and following extreme weather events.
- Conduct regular monitoring of all the erosion and sediment controls and repair or replace them as necessary.
- Maintain function of erosion and sediment controls.

13.2 Fire

An accidental fire could potentially adversely affect the atmospheric environment (emissions), vegetation, and wildlife during all Project phases. Accidental fires could start from fueling, use of power tools and machinery, on-site burning, and other human activities.

Mitigation measures to limit the probability of an occurrence and reduce the magnitude and extent of potential effects include:

- Prohibit the use of campfires or burning within the Project Area by staff and contractors.
- Dispose of all flammable waste regularly at an approved facility (e.g., flammable chemicals, fuels, vegetation).
- Implement mitigation related to chemical and fuel storage (Section 13.3).
- Allow smoking in designated areas only.
- Equip heavy machinery and turbines with fire suppressant equipment.
- Develop a contingency plan including fire safety plan.
- Continue to engage with first responders on site access.
- Maintain corridors containing electrical infrastructure during operations.

13.3 General Hazardous Material Spills

Hazardous spills resulting from fuel (i.e., storage, refueling, operation of internal-combustion vehicles, transportation accidents) and other on-site chemicals may occur during Project construction and operations activities. Hazardous spills can adversely impact air, soil, surface water, groundwater quality, human health, and safety. In addition, hazardous spills may risk the health of aquatic, avian, and terrestrial wildlife. The severity of the impacts will depend on the nature of the hazardous material and the quantity spilled.

Mitigation measures to limit the probability of an occurrence and reduce the magnitude and extent of potential effects include:

- Develop spill prevention and response procedures as part of the Project's Contingency Plan, which will set out spill prevention and response procedures.

- Store all fuels, lubricants, and hazardous material in designated containers and areas.
- Provide secondary containment in storage areas (where possible).
- Inspect equipment for fluid leaks.
- Locate fuel storage areas, refueling, and/or equipment lubrication a minimum of 30 m from surface water (i.e., watercourse) and groundwater feature (i.e., well).
- Refuel machinery and equipment on an impervious surface, where possible. If this is not possible, require that the work is completed in a designated area, greater than 30 m from a watercourse/water body/wetland.
- Complete equipment servicing off-site, where possible. If this is not possible, require that the work is completed in a designated area, greater than 30 m from a watercourse/water body/wetland.
- Store all dangerous goods in compliance with the Workplace Hazardous Material Information System.
- Equip mobile equipment with spill kits stocked with appropriate spill containment materials for the activities taking place, such as soaker pads, oil-absorbing materials, and containment booms.
- Locate stationary spill kits or spill drums at work areas utilizing mobile equipment, hazardous fluids and/or in proximity to environmentally sensitive areas (i.e., wetlands or watercourses).
- Stock spill kits with the appropriate quantity and type of material for the anticipated product type(s) and volume(s) in use.
- Train site workers on site specific spill response requirements and equipment.

With the implementation of the above preventative measures, the likelihood of an accident or a malfunction is low. Appropriate response plans will be put in place to ensure any interactions with VCs from an accident or malfunction are limited and the effects can be quickly contained.

13.4 Transportation-related Incidents

Operator error or techno-mechanical malfunctions may occur during all stages of the Project's lifespan, although the type and intensity of vehicular traffic will vary depending on the Project phase. The construction and decommissioning phases will see the highest volume of traffic and largest vehicles both travelling to and on the site. On the site especially, where workers may be near light to heavy-duty traffic, there is a higher risk of incidents affecting human health (Health and Safety Executive, n.d.). During operation, vehicular access by technicians also presents risks that must be managed. While vehicular use has implicit risks that cannot be fully eliminated, an established Traffic Management Plan will ensure that these risks are mitigated to the highest degree possible and that they are understood by anyone accessing the Project Area. A Traffic Management Plan will be developed during detailed design.

Additionally, mitigation measures to limit the probability of an incident and reduce the magnitude and extent of potential effects include:

- Conduct preventative vehicle inspections to ensure all mobile equipment is in good condition (breaks, light system, leaks absent).

- Set in place as many traffic signs as necessary according to the Traffic Signs Regulations (*Motor Vehicle Act c. 293*).
- Develop and maintain roads according to the Erosion and Sedimentation Control Plan.
- Establish, post, and enforce speed limits on site.
- Require that public road speed limits are followed by Project vehicles.
- Require that drivers follow all laws and regulations pertaining to distracted (e.g. cell phone usage) or impaired driving on and off site.
- Minimize traffic in school zones and on school bus routes during school hours and bus pick-up and drop-off times.
- Follow weather statements and alerts and adjust plans accordingly to avoid transportation in extreme weather conditions.
- Install signage where existing trails cross access roads to avoid potential interactions with trail users when heavy equipment is in use.
- Establish the following practices within the Project Area, to the extent feasible (Health and Safety Executive, n.d.):
    a. Create clear, separate paths or zones for vehicles and pedestrians to reduce the risk of accidents.
    b. Minimize vehicle movements.
    c. Minimize reversing by providing adequate room to turn vehicles.
- Ensure adequate visibility by operating in appropriate weather and providing ample lighting and visibility aids (e.g. mirrors around tight turns).
- Ensure visitors are familiar with the Project layout or are accompanied whether in vehicles or on foot.
- Develop a Traffic Management Plan

Detailed information regarding vehicle collision prevention and response procedures will be outlined in the Contingency Plan.

13.5 Structural Damage

Wind turbine damage up to and including failure may result from a variety of factors both human and environmental, presenting risks to human health, infrastructure, and the environment. The most frequent causes of damage to turbines that may result in failure include damage from lightning, material fatigue over time, leading edge erosion, and damage from icing, which is covered in greater detail in section 12.2 (Katsaprakakis, 2021). While damage by these mechanisms and others is unavoidable in many cases, preventing failure or harm to human or environmental health is key. This typically involves detecting damage before it can result in a complete failure, including partial or full blade detachment. Wind turbine structural health monitoring, through use of advanced sensors, detects anomalies in performance, and the presence of abnormal vibrations that might indicate an imbalance that should be investigated (Algolfat et al., 2023).

Regular monitoring and inspections are critical to ensuring the continued structural integrity of all components of turbines (Enlita, 2024), and the Proponent will engage in mitigative actions, to limit the probability of an occurrence and reduce the magnitude and extent of potential effects, that include:

- Ensure sufficient lubrication in bearings, and that bearings are free of debris that would cause excess friction.
- Prepare and enact severe weather plans to reduce the risk of physical damage from flying debris or hail and minimize the risk that thermo-electric damage by lightning results in blade failure.
- Inspect and properly maintain turbine brake function.
- Check and change lubrication regularly in the turbine gearboxes to prevent excess heat and minimize wear.
- Test full suite of sensors regularly to ensure that anomalous conditions
- are detected early and managed before they result in damage to turbines, other infrastructure, or harm human health.

The separation of turbines from people (approximately 1.5 km from turbine to nearest receptor) and public roads (1.3 km to Pipeline Road) also mitigates the risk to human health and public infrastructure in the highly unlikely event of a failure.

14.0 CUMULATIVE EFFECTS

14.1 Overview

Cumulative effects are changes to environmental, social, and economic values caused by the combined effect of past, present, and potential future human activities and natural processes (Government of British Columbia, n.d). Concerns are often raised about long-term changes that may occur not only as a result of a single action but of the combined effects of each successive action on the environment (Hegman et al., 1999). While a single undertaking might not cause significant adverse effects, multiple undertakings may result in incremental impacts, referred to as cumulative effects. These cumulative effects may potentially result in an overall impact to a VC of interest.

14.1 Other Undertakings in the Area

There is one wind farm development located within 3 km of the Study Area, as per the recommended buffer in the Guide to Preparing an EA Registration Document for Wind Power Projects in Nova Scotia (NSECC, 2021). The Chebucto Pockwock Community Wind Project, located on the eastern side of Pockwock Lake, consists of five Vestas V100-2.0 MW wind turbines (hub height of 100 m) for a total capacity of 10 MW (Government of Canada, 2024).

The nearest wind development outside that buffer is the Ellershouse Wind Farm Project and its Expansion which collectively consists of 10 Enercon E-92 wind turbines. A further expansion of this wind development, referred to as Ellershouse 3 Wind Farm, received EA Approval with Conditions from NSECC in July 2023. Ellershouse 3 Wind Farm is proposed to be a 12 turbine, 66 MW wind project located south of the existing Ellershouse Wind Farm Project and its Expansion (NSECC, 2023a).

Table 14.1 summarizes other industrial activities/developments near the Assessment Area (within approximately 5 km).

Table 14.1: Nearby Industrial Activities/Developments

Development	Development Activity	Status of Activity	Activity Location	Distance to AA*
Forestry	Harvests, thinning, plantations, & other treatments.	Active	Throughout Study Area	Within AA
Nova Scotia Power St. Margarets Bay Hydroelectric System	Multiple hydroelectricity facilities/associated reservoirs	Active	Big Indian Lake, Five Mile Lake, Pockwock Lake, Wrights Lake, Sandy Lake, Coon Pond, Mill Lake	1.7 km (to nearest infrastructure)
Pockwock Pumping Station and Water Treatment Facility	Pumping station and water treatment facility for drinking water.	Active	Pockwock Lake	2.8 km

*Approximate distance to nearest point of the Assessment Area

14.2 Cumulative Effects Assessment

Cumulative effects were assessed for the Project by taking into consideration the potential residual effects of significance (as identified in VC sections) in relation to the activities that have taken place in the past, those that currently exist, and those that can be reasonably expected to be developed within the area surrounding the Project (i.e., undergoing regulatory approval/under construction). Table 14.2 summarizes the potential for VCs to have cumulative impacts with other undertakings in the area.

Table 14.2: Potential for Cumulative Effects on Identified VCs

VC	Cumulative Effects Assessed	Reasoning
Atmosphere	No	Residual positive impacts in regards to provincial GHG emissions from the use of renewable energy resources.
Geology	No	The Project will not impact the geologic environment outside the Project Area or interact with nearby industrial activities.
Waterbodies & Watercourses	No	The Project is maximizing use of existing roadways, minimizing the disturbance of surface freshwater resources. Residual impacts will be mitigated, monitored, and be contained within the Project Area.
Fish & Fish Habitat	No	Utilization of existing roadways and watercourse crossing locations, minimizing the requirement for new crossings/disturbance of potential fish habitat. Structures that are suitable for fish passage (e.g., embedded box or round bottom

VC	Cumulative Effects Assessed	Reasoning
		culverts, span bridges) will be utilized for any watercourse crossings that are new or require replacements. Watercourse crossings will have applied mitigation and monitoring.
Wetlands	No	Compensation of impacted wetland habitat.
Terrestrial Habitat	No	Project Area is located within an active forest management area on both private and Crown land, such that a large portion of tree removal would have been subject to future harvesting in the absence of the Project. Cleared areas will be re-vegetated where possible. The Project will minimize impacts to forests by only clearing what is necessary and avoiding old-growth forests on Crown Land.
Terrestrial Flora	No	Cleared areas will be re-vegetated where possible. In addition, the Project will minimize the loss of habitat that supports SAR and SOCI.
Terrestrial Fauna	No	Existing cleared areas will be used as much as possible to reduce fragmentation. Cleared areas will be re-vegetated where possible. In addition, the Project will minimize the loss of habitat that supports the prey habitat and the habitat of SAR and SOCI.
Bats	Yes	Wind development is within 3 km of the Project.
Avifauna	Yes	Wind development is within 3 km of the Project.
Economy, Land Use, Transportation, & Recreation/Tourism	No	Residual impacts considered not significant or positive.
Archeology, Culture, & Heritage	No	Avoidance of archaeological, historical, or culturally significant areas.
Human Health	No	Residual impacts to human health are not anticipated.
EMI	No	Residual impacts considered not significant.
Shadow Flicker	Yes	Wind development is within 3 km of the Project.
Visual Aesthetics	Yes	Wind development is within 3 km of the Project.
Sound	Yes	Wind development is within 3 km of the Project.

The following VCs are assessed for cumulative effects:

- Bats
- Avifauna
- Shadow flicker
- Visual aesthetics
- Sound

Bats & Avifauna

Bats and avifauna are discussed in terms of cumulative effects based on the Project's proximity to other wind developments along with the cumulative potential for injury/mortality of SAR. The Chebucto Pockwock Community Wind Project is considered a small sized wind farm (i.e., 5 wind turbines). As part of the EA for the Chebucto Pockwock Community Wind Project, pre-construction avian surveys were completed and the EA determined that impacts to avifauna would not be significant.

Based on the small scale of the existing wind power development nearby and the EA conclusions, the anticipated cumulative effects on bats and avifauna from the operation of the combined wind developments are anticipated to be not significant.

Historic forestry activities have already resulted in wide-spread habitat removal and an existing road network throughout the Study Area which the Project is utilizing to minimize requirements for clearing. It is also likely that a large portion of the remaining required tree removal for the Project would have been subject to future harvesting in the absence of the Project. Therefore, the effects of forestry activities are not considered to be cumulative with the Project.

Shadow Flicker, Visual Aesthetics, and Sound

Potential effects on human health and enjoyment of the area near the Project are discussed due to the Project's proximity to another wind development. Wind projects have the potential to create cumulative effects when the shadow flicker and sound from more than one wind facility both affect a single receptor. Additionally, the visual impact of wind projects can be cumulative when co-located near one another, which can be interpreted differently by various parties.

Both shadow and noise modelling incorporated the Pockwock Wind Farm turbines, so the effects assessment associated with each (see Section 10.3 and Section 10.5) are applicable as the results of cumulative effects for both existing and proposed turbines. Visual effects assessment used imagery captured after construction of the existing turbine, and therefore the cumulative effects are included within the effects assessment for visual effects (see Section 10.4).

15.0 CONCLUSION

In accordance with A Proponent's Guide to Environmental Assessment (NSECC, 2017), the studies, regulatory assessments, and VC evaluations described within this EA report have been considered both singularly and cumulatively, for all phases of the Project.

The results of this assessment indicate that in consideration of the Project's mitigative and protection measures, adverse residual effects are not anticipated to be significant.

16.0 CLOSURE

This EA report was completed by Strum Consulting, an independent, multi-disciplinary team of consultants with extensive experience with submission of EA Registration documents for undertakings within Atlantic Canada. Curriculum vitae for EA report contributors and Project Team members are provided in Appendix N. A list of the Project Team and their associated roles is provided below.

Senior review and oversight
- Meghan Johnston, MES, Vice President, Environmental Assessment and Approvals
- Melanie Smith, MES, Vice President, Environmental Assessment and Approvals

Project management and technical oversight
- Heather Mosher, MSc., Senior Environmental Scientist

Environmental Assessment Authors
- Alex Scott, BSc., Environmental Scientist
- Angus Doane, MREM, Environmental Scientist
- Lyndsay Eichinger, MREM, Environmental Scientist
- Dafna Schultz, MREM, EPt, Environmental Scientist
- Frank Gascon, P.Eng., Environmental Engineer
- David Foster, PhD, Environmental Scientist
- Cole Vail, MREM, Environmental Scientist
- Leah Riehl, BSc., Environmental Scientist
- Polly Nguyen, MREM, Environmental Scientist
- Rohan Kariyawansa, NRET, Environmental Scientist

Geomatics
- Mathew Savelle, BSc., Adv Dipl, Manager, Geomatics
- Peter Opra, MSc., GIS Specialist
- Eric Johnson, BSc., Adv Dipl., GIS Technician
- Kerry Wallace, BSc., Adv. Dipl., Geomatics Technician

17.0 REFERENCES

Activities Designation Regulations, N.S. Reg. 47/95

Adamus, P.R. (2021). *Wetland Ecosystem Services Protocol – Atlantic Canada (WESP-AC).* Retrieved from MCFT Training Course.

Air Quality Regulations, N.S. Reg. 8/2020

Alexias, A., Kiouvrekis, Y., Tyrakis, C., Alkhorayef, M., Sulieman, A., Tsougos, I., Theodorou, K., Kappas, C. May 2020. Extremely low frequency electromagnetic field exposure measurement in the vicinity of wind turbines. *Radiation Protection Dosimetry*, 189(3), 395–400. https://doi.org/10.1093/rpd/ncaa053

Allen, A.W. (1983). *Habitat Suitability Index Models: Fisher*. Retrieved from https://www.govinfo.gov/content/pkg/GOVPUB-I49-PURL-LPS101837/pdf/GOVPUB-I49-PURL-LPS101837.pdf

Alberta Environment and Parks (AEP). (2018). *Wildlife directive for Alberta wind energy projects.* Retrieved from https://open.alberta.ca/dataset/2d992aec-2437-4269-9545-cd433ee0d19a/resource/e77d2f25-19dc-4c9e-8b87-99d86cd875f1/download/wildlifewindenergydirective-sep17-2018.pdf

Algolfat, A., Wang, W., & Albarbar, A. (2023). *Damage Identification of Wind Turbine Blades—A Brief Review. Journal of Dynamics, Monitoring and Diagnostics, 2(3*), Article 3. https://doi.org/10.37965/jdmd.2023.422

American Clean Power Association (ACP). (2023). *Property values are not affected by land-based wind turbines.* Retrieved from https://cleanpower.org/wp-content/uploads/gateway/2023/12/ACP_Property-Values-Land-Based-Wind-Turbines_Fact-Sheet-Dec-2023.pdf

Assadi, S.B., and Fraser, K.C. (2021). Experimental manipulation of photoperiod influences migration timing in a wild, long-distance migratory songbird. *Proc. R. Soc. B, 288*. https://doi.org/10.1098/rspb.2021.1474

Atlantic Canada Conservation Data Centre (ACCDC). (2024). *Data Report 8064: Melvin Lake, NS. Retrieved from ACCDC.*

Band, W., Madders, M., & Whitfield, D. P. (2007). Developing field and analytical methods to assess avian collision risk at wind farms. Retrieved from https://www.naturalresearch.org/application/files/4114/9182/2839/Band_et_al_2007.pdf

Barrios, L., & Rodriguez, A. (2004). Behavioural and environmental correlates of soaring-bird mortality at on-shore wind turbines*. Journal of Applied Ecology, 41*(1), 72-81. https://doi.org/10.1111/j.1365-2664.2004.00876.x

Bevanger, K., Flagstad, O, Follestad, A., & Gjershaug, J. O. (2009). Pre- and postconstruction studies of conflicts between birds and wind turbines in coastal Norway*.* Retrieved from https://www.researchgate.net/publication/239567330_Pre-_and_postConstruction_Studies_of_Conflicts_between_Birds_and_Wind_Turbines_in_Coastal_Norway

Biodiversity Act, SNS 2021, c 3

Bird Studies Canada & Nature Canada. (2024). *Canada important bird areas interactive map*. Retrieved from https://www.ibacanada.com/mapviewer.jsp?lang=EN

Blickley, J. L., & Patricelli, G. (2010). Impacts of anthropogenic noise on wildlife: Research priorities for the development of standards and mitigation*. Journal of International Wildlife Law and Policy, 13*(4), 274-292. http://dx.doi.org/10.1080/13880292.2010.524564

Bliss-Ketchum, L. L., de Rivera, C. E., Turner, B. C., & Weisbaum, D. M. (2016). *The effect of artificial light on wildlife use of a passage structure.* Biological Conservation, 199, 25-28. https://doi.org/10.1016/j.biocon.2016.04.025

Bowlby, H.D., Horsman, T., Mitchell, S.C., Gibson, A.J.F. (2013). *Recovery Potential Assessment for Southern Upland Atlantic Salmon. Canadian Science Advisory Secretariat Maritimes Region Research Document 2013/006.* Retrieved from https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/359664.pdf

Brinkley, C. & Leach, A. (2019). Energy next door: a meta-analysis of energy infrastructure impact on housing value. *Energy Research & Social Science, 50*, 51-65.

Brisson-Curadeau, É., Elliott, K. H., & Côté, P. (2020). Factors influencing fall departure phenology in migratory birds that bred in northeastern North America. The Auk, 137(1), ukz064.

British Columbia Ministry of Environment and Climate Change (BCECC). (2018). Inventory and Survey Methods for Rare Plants and Lichens. *Standards for Components of British Columbia's Biodiversity No. 43.* Retrieved from https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/nr-laws-policy/risc/inventory_and_survey_methods_for_rare_plants_and_lichens.pdf

Broders, H., Quinn, G. M., & Forbes, G.J. (2003). Special Status, and the Spatial and Temporal Patterns of Activity of Bats in Southwest Nova Scotia, Canada. *Northeastern Naturalist, 10*(4), 383-398.

Broders, H., & Forbes, G. (2004). Interspecific and intersexual variation in roost-site selection of northern long-eared and little brown bats in the Greater Fundy National Park Ecosystem. *Journal of Wildlife Management, 68,* 602-610.

Burnside, R.J., Salliss, D., Collar, N.J., and Dolman, P.M. (2021). Bird use individually consistent temperature cues to time their migration departure. *118*(28). DOI: https://doi.org/10.1073/pnas.2026378118

Caceres, C. & Barclay, R. (2000). Myotis septentrionalis. *Mammalian Species, 634,* 1-3.

California Department of Transportation. (2016). *Technical guidance for assessment and mitigation of the effects of traffic noise and road construction noise on bats*. Retrieved from https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/noiseeffects-on-bats-jul2016-a11y.pdf

Canada Wildlife Act, R.S.C. 1985, c. W-9

Canadian Centre for Occupational Health & Safety (CCOHS). (2022). *Noise – Occupational Exposure Limits in Canada*. Retrieved from https://www.ccohs.ca/oshanswers/hsprograms/occ_hygiene/occ_exposure_limits.html

Canadian Council of Ministers of the Environment (CCME). (n.d.). *CAAQS*. Retrieved from https://ccme.ca/en/air-quality-report#slide-7

Canadian Environmental Protection Act, SC 1999, c. 33

Canadian Navigable Waters Act, RSC 1985, c. N-22

Canadian Renewable Energy Association (CanWEA). (2006a). *Community benefits: why wind is right – right now.* Retrieved from https://www.northlandpower.com/en/resourcesGeneral/ProjectDocuments/Grand%20Bend/12_community_benefits.pdf

Canadian Renewable Energy Association (CanWEA). (2006b). *Visual and sound: the sights and sounds of wind.* Retrieved from https://www.northlandpower.com/en/resourcesGeneral/ProjectDocuments/Grand%20Bend/7_visual_and_sound.pdf

Carter, J. (2011). *The effect of wind farms on residential property values in Lee County, Illinois*. [Master's Thesis, Illinois State University]. Retrieved from https://www.livingstoncounty-il.org/wordpress/wp-content/uploads/2014/11/PR-Ex.-33-2011-Wind-Farms-Effect-on-Property-Values-in-Lee-County.pdf

CBC News. (2022, November 21). *Nova Scotia designates blue felt as its provincial lichen.* Retrieved from https://www.cbc.ca/news/canada/nova-scotia/nova-scotia-blue-felt-provincial-lichen-1.6658795

Centre for Plant Conservation (CPC). (2020). *What Makes a Plant Rare?* Retrieved from https://saveplants.org/rarity-mini-article/

Chief Medical Officer of Health (CMOH) of Ontario. (2010). *Potential Health Impacts of Wind Turbines.* Retrieved from https://www.northlandpower.com/en/resourcesGeneral/ProjectDocuments/Grand%20Bend/cmoh_report_may_2010_potential_health_impact_of_wind_turbines.pdf

ClimateData.ca. (2024). *Annual Values for Hammonds Plains*. Retrieved from https://climatedata.ca/explore/location/?loc=CAPJF

Colby, D. (2008). *The Health Impact of Wind Turbines: A Review of Current White, Grey, and Published Literature.* Retrieved from https://www.wind-works.org/cms/fileadmin/user_upload/Files/Health_and_Wind_by_C-K_Health_Unit.pdf

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). (2010). *Atlantic salmon (Salmo salar): COSEWIC assessment and status report*. Retrieved from https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/atlantic-salmon.html.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). (2012). *COSEWIC Assessment and Status Report on the American Eel Anguilla rostrata*. Retrieved from https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_anguille_amer_eel_1012_e.pdf

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). (2013a). *COSEWIC status appraisal summary on the Frosted Glass-whiskers Sclerophora peronella in Canada*. Retrieved from https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/frosted-glass-whiskers-appraisal-summary-2014.html

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). (2013b). *COSEWIC assessment and status report on the Little Brown Myotis Myotis lucifugus, Northern Myotis Myotis septentrionalis and Tri-colored Bat Perimyotis subflavus in Canada*. Retrieved from https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/cosewic/sr_Little%20Brown%20Myotis%26Northern%20Myotis%26Tri-colored%20Bat_2013_e.pdf

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). (2020). *COSEWIC Assessment and Status Report on the Canada Warbler Cardellina canadensis in Canada.* Retrieved from https://wildlife-species.canada.ca/species-risk-registry/virtual_sara/files/cosewic/sr_Canada_Warbler_2020_e.pdf.

Committee on the Endangered Status of Wildlife in Canada (COSEWIC). (2023). *COSEWIC Wildlife Species Assessments*. Retrieved from: https://www.cosewic.ca/images/cosewic/pdf/2023-wildlife-species-assessments-detailed-may-en.pdf/

Committee on the Endangered Status of Wildlife in Canada (COSEWIC). (2024). *COSEWIC status report in preparation with anticipated assessment dates.* Retrieved from https://www.cosewic.ca/index.php/en/status-reports.html

Canadian Renewable Energy Association (CREA). (2020). *Best Practices for Wind Farm Icing and Cold Climate Health & Safety.* Retrieved from https://renewablesassociation.ca/wp-content/uploads/2021/01/Best-Practices-for-Wind-Farm-Icing-and-Cold-Climate_June2020.pdf

DataStream Initiative. (2021). *Dissolved Oxygen A Water Monitor's Guide to Water Quality*. Retrieved from https://datastream.cdn.prismic.io/datastream/a7aeae1b-a092-43d2-877a-acfbffa75c92_Dissolved_Oxygen.pdf.

Davis, D., & Browne, S. (1996). *The Natural History of Nova Scotia*. Nova Scotia Museum, Halifax, NS. p. 304.

De Lucas, M., Janss, G. F. E., Whitfield, D. P., & Ferrer, M. (2008). *Collision fatality of raptors in wind farms does not depend on raptor abundance.* Journal of Applied Ecology, 45(6), 1695-1703. https://doi.org/10.1111/j.1365-2664.2008.01549.x.

Drewitt, A. L., & Langston, R. H. W. (2006). *Assessing the impacts of wind farms on birds.* International Journal of Avian Science, 148(s1), 29-42. https://doi.org/10.1111/j.1474-919X.2006.00516.x.

Duiker, S. W. (2005). *Effects of Soil Compaction*. Retrieved from https://extension.psu.edu/effects-of-soil-compaction.

Eichhorn, M., Johst, K., Seppelt, R., & Drechsler, M. (2012). *Model-based estimation of collision risks of predatory birds with wind turbines*. Ecology and Society, 17(2), 1-12. https://doi.org/10.5751/ES-04594-170201.

Electrical Academia. (n.d.). *Wind turbine parts and functions*. Retrieved from https://electricalacademia.com/renewable-energy/wind-turbine-parts-functions/#:~:text=A%20wind%20turbine%20consists%20of,a%20wind%20turbine%20cannot%20function.&text=The%20foundation%20is%20under%20the,it%20is%20covered%20by%20soil.

Ellenbogen, J., Grace, S., Heiger-Bernays, W., Manwell, J., Mills, D., Sullivan, K., & Weisskopf, M.G. (2012). *Wind Turbine Health Impact Study: Report of Independent Expert Panel.* Prepared for Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health.

Knight, E., Hannah, K., Brigham, M., McCracken, J., Falardeau, G., Julien, M.-F., Guénette, J.-S. (2019). Canadian Nightjar Survey Protocol. Retrieved from https://wildresearch.ca/wp-content/uploads/2019/05/National-Nightjar-Survey-Protocol-WildResearch-2019.pdf.

Endangered Species Act, SNS 1998, c. 11

Enlita. (2024). *Wind Turbine Failures: Causes, Consequences, and Impact on Energy Output*. Retrieved from: https://www.enlitia.com/resources-blog-post/wind-turbine-failures-causes-consequences-and-impact-on-energy-output

Environment Act, SNS 1994-95, c. 1

Environmental Assessment Regulations, NS Reg. 221/2018

Environment Canada and Climate Change (ECCC). (2015a). *Recovery Strategy for Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) in Canada.* Retrieved from https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_LittleBrownMyotisNorthernMyotisTricoloredBat_e_proposed.pdf

Environment Canada and Climate Change (ECCC). (2015b). *Management Plan for the Rusty Blackbird (Euphagus carolinus) in Canada.* Species at Risk Act Management Plan Series. Environment Canada, Ottawa. iv + 26 pp

Environment Canada and Climate Change (ECCC). (2016a). *Recovery Strategy for the Canada Warbler (Cardellina canadensis) in Canada.* Retrieved from https://www.sararegistry.gc.ca/virtual_sara/files/plans/rs_canada%20warbler_e_final.pdf

Environment Canada and Climate Change (ECCC). (2016b). *Recovery Strategy for the Olive-sided Flycatcher (Contopus cooperi) in Canada.* Retrieved from https://novascotia.ca/natr/wildlife/species-at-risk/docs/RECOVERY_PLAN_Adopted_Olive_sided_flycatcher_10Feb21.pdf

Environment Canada and Climate Change (ECCC). (2016c). *Recovery Strategy for the Common Nighthawk (Chordeiles minor) in Canada.* Retrieved from https://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/rs_common%20nighthawk_e_final.pdf

Environment and Climate Change Canada (ECCC). (2019). Nova Scotia Nocturnal Owl Survey. Guide for Volunteers. 19 pp. Available Online: https://birdscanada.org/wp-content/uploads/2022/03/NS_owl_instructions_2022.pdf

Environment and Climate Change Canada (ECCC). (2020a). *Criteria for public weather events*. Retrieved from https://www.canada.ca/en/environment-climate-change/services/types-weather-forecasts-use/public/criteria-alerts.html#rainfall

Environment and Climate Change Canada (ECCC). (2020b). *Management Plan for the Snapping Turtle (Chelydra serpentina) in Canada 2020*. Retrieved from https://speciesregistry.canada.ca/index-en.html#/documents/2908.

Environment and Climate Change Canada (ECCC). (2020c). *Recovery Strategy for the Wood Turtle (Glyptemys insculpta) in Canada*. Species at Risk Act recovery strategy series. Retrieved from: https://www.publications.gc.ca/site/eng/9.894777/publication.html.

Environment and Climate Change Canada (ECCC). (2022a). *Management Plan for the Blue Felt Lichen (Degelia plumbea) in Canada. Species at Risk Act Management Plan Series. Environment and Climate Change Canada, Ottawa. iv + 23 pp*. Retrieved from https://sararegistry.gc.ca/virtual_sara/files/plans/mp_blue_felt_lichen_e_final.pdf

Environment and Climate Change Canada (ECCC). (2022b). *Recovery Strategy for the Bobolink (Dolichonyx oryzivorus) in Canada [Proposed].* Species at Risk Act Recovery Strategy 5 Series. Environment and Climate Change Canada, Ottawa. viii + 141 pp

Environment and Climate Change Canada (ECCC). (2022c). *Management Plan for the Evening Grosbeak (Coccothraustes vespertinus) in Canada [Proposed].* Species at Risk Act Management Plan Series. Environment and Climate Change Canada, Ottawa. v + 45 pp.

Environment and Climate Change Canada (ECCC). (2023). *Management Plan for the Eastern Wood-pewee (Contopus virens) in Canada [Proposed].* Species at Risk Act 5 Management Plan Series. Environment and Climate Change Canada, Ottawa. 6 iv + 46 pp.

Environment Canada and Climate Change (ECCC). (2024a). *Pockwock Lake, NS*. Retrieved from https://climate-change.canada.ca/climate-data/#/daily-climate-data

Environment Canada and Climate Change (ECCC). (2024b). *Halifax International Airport, NS*. Retrieved from https://climate-change.canada.ca/climate-data/#/daily-climate-data

Environment and Climate Change Canada (ECCC). (2024c). *Nova Scotia – Air quality health index – Provincial summary*. Retrieved from https://weather.gc.ca/airquality/pages/provincial_summary/ns_e.html

Environmental Goals and Sustainable Prosperity Act, SNS 2007, c 7

Environmental Laboratory. (1987). *Corps of Engineers Wetlands Delineation Manual, US Army Corp of Engineers, 1987.* Retrieved from https://www.lrh.usace.army.mil/Portals/38/docs/USACE%2087%20Wetland%20Delineation%20Manual.pdf

Erickson, W. P., Wolfe, M. M., Bay, K. J., Johnson, D. H., & Gehring, J. L. (2014*). A comprehensive analysis of small-passerine fatalities from collision with turbines at wind energy facilities.* PloS ONE, 9(9). https://doi.org/10.1371/journal.pone.0107491

Erickson, W., Johnson, G., Young, D., Strickland, D., Good, R., Bourassa, M., Bay, K., & Sernka, K. (2002). *Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments*. Retrieved from https://www.nrc.gov/docs/ML1409/ML14098A019.pdf

Evans, T., Cooper, J., & Lenchine, V. (2013). *Infrasound Levels Near Windfarms and in Other Environments.* Prepared for the South Australia Environmental Protection Agency

Farmer, A. M. (2003). *The effects of Dust on Vegetation - A Review. Environmental Pollution*. Retrieved from https://www.sciencedirect.com/science/article/abs/pii/026974919390179R

Farnsworth, A. (2013). *Understanding Radar and Birds*. Retrieved from https://birdcast.info/news/understanding-birds-and-radar/

Fenton, M. B. & Barclay, R. (1980). Myotis lucifugus. *Mammalian Species, 42*, 1-8.

Fern, R.R., Davis, H.T., Baumgardt, J.A., Morrision, M.L., & Campbell, T.A. (2018). Summer activity patterns of four resident south Texas bat species. Global *Ecology and Conservation, 16*.

Ferrer, M., De Lucas, M., Janss, G. F. E., Casado, E., Muñoz, A. R., Bechard, M. J., & Calabuig, C. P. (2012). *Weak relationship between risk assessment studies and recorded mortality in wind farms.* Journal of Applied Ecology, 49(1), 38-46. https://doi.org/10.1111/j.1365-2664.2011.02054.x

Fisheries Act, RSC 1985, c. F-14

Fisheries and Oceans Canada (DFO). (1996). *Trout in Canada's Atlantic Provinces*. Retrieved from https://waves-vagues.dfo-mpo.gc.ca/Library/40628887.pdf

Fisheries and Oceans Canada (DFO). (2003). *Interim policy for the use of backpack electrofishing units*. Retrieved from https://waves-vagues.dfompo.gc.ca/librarybibliotheque/273626.pdf.

Fisheries and Oceans Canada (DFO). (2022a). *The Marshall Decisions.* Retrieved from https://www.dfo-mpo.gc.ca/fisheries-peches/aboriginal-autochtones/moderate-livelihood-subsistance-convenable/marshall-overview-apercu-eng.html.

Fisheries and Oceans Canada (DFO). (2022b). *Aquatic species at risk map*. Retrieved from https://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html

Francis, C. D., Ortega, C. P., & Cruz, A. (2009). *Noise pollution changes avian communities and species interactions.* Current Biology, 19(16). 1415-1419. https://doi.org/10.1016/j.cub.2009.06.052

Frei, B., Cox, A, Morales, A, & Roy, C. 2024. Community-science reveals delayed fall migration of waterfowl and spatiotemporal effects of a changing climate. Journal of Animal Ecology, 93(4). 377-392

Garroway, C. & Broders, H. (2008). Day roost characteristics of northern long-eared bats (Myotis septentrionalis) in relation to female reproductive status. *Ecoscience 15,* 89-93.

GeoNova. (2022). *Nova Scotia topographic database - Water features (line layer).* Retrieved from https://data.novascotia.ca/Lands-Forests-and-Wildlife/Nova-Scotia-Topographic-DataBase-Water-Features-Li/fpca-jrmt

Government of British Columbia. (n.d.). *Cumulative effects framework.* Retrieved from https://www2.gov.bc.ca/gov/content/environment/natural-resource-stewardship/cumulative-effects-framework

Government of Canada. (2011). *Aboriginal Consultation and Accommodation: Updated Guidelines for Federal Officials to Fulfill the Duty to Consult*. Retrieved from https://www.rcaanc-cirnac.gc.ca/eng/1100100014664/1609421824729

Government of Canada. (2013). *Fact sheet on halocarbon regulations on federal and Aboriginal lands*. Retrieved from https://publications.gc.ca/collections/collection_2014/ec/En14-108-1-2013-eng.pdf

Government of Canada. (2018). *Regional Hazards: Nova Scotia*. Retrieved from https://www.getprepared.gc.ca/cnt/hzd/rgnl/ns-en.aspx

Government of Canada. (2019a). *Causes of climate change*. Retrieved from https://www.canada.ca/en/environment-climate-change/services/climate-change/causes.html

Government of Canada. (2019b). *Canada's changing climate report*. Retrieved from https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_FULLREPORT-EN-FINAL.pdf

Government of Canada. (2019c). *Changes in temperature*. Retrieved from https://www.canada.ca/en/environment-climate-change/services/climate-change/canadian-centre-climate-services/basics/trends-projections/changes-temperature.html

Government of Canada. (2023). *Species at Risk Public Registry*. Retrieved from https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html

Government of Ontario. (2021). *A guide to the Noise Regulation under the Occupational Health and Safety Act Appendix D: Noise in construction, mining, farming and firefighting operations.* Retrieved from https://www.ontario.ca/document/guide-noise-regulation-under-occupational-health-and-safety-act/appendix-d-noise-construction-mining-farming-and-firefighting-operations

Government of Oregon. (n.d.). *ATV sound.* Retrieved from https://www.oregon.gov/oprd/ATV/Pages/ATV-Sound.aspx

Government of the Northwest Territories. (2013). *Conductivity Environment and Natural Resources.* Retrieved from https://www.enr.gov.nt.ca/en

Government of Nova Scotia (NS). (2021). An Act Respecting Environmental Goals and Climate Change Reduction. Retrieved from: https://nslegislature.ca/sites/default/files/legc/statutes/environmental%20goals%20and%20climate%20change%20reduction.pdf.

Government of Nova Scotia (NS). (2022). *Species At Risk – Recovery Update.* Retrieved from https://novascotia.ca/natr/wildlife/species-at-risk/

Government of Nova Scotia (NS). (2023). Nova Scotia's 2030 Clean Power Plan. Retrieved from https://beta.novascotia.ca/sites/default/files/documents/1-3582/nova-scotia-clean-powerplan-presentation-en.pdf.

Grant, C. G. J. and E. M. Lee. 2004. *Life History Characteristics of Freshwater Fishes Occurring in Newfoundland and Labrador, with Major Emphasis on Riverine Habitat Requirements*. Can. Manuscr. Rep. Fish. Aquat. Sci. 2672: xii + 262p.

Grubb, T. G., Pater, L. L., & Delaney, D. K. (1998). *Logging truck noise near nesting northern goshawks.* Retrieved from https://research.fs.usda.gov/treesearch/30632

Gulden, W. E. (2011). A review of the current evidence regarding industrial wind turbines and property values from a homeowner's perspective. *Bulletin of Science, Technology & Society*, *31*(5), 363-368.

Halifax Regional Municipality (HRM). (2014). *Regional Municipal Planning Strategy*. Retrieved from https://cdn.halifax.ca/sites/default/files/documents/about-the-city/regional-community-planning/regionalmunicipalplanningstrategy-24jun13-minorrev2023-01065-haf-toclinked.pdf

Halifax Regional Municipality (HRM). (2022). *By-Law Number N-200 Noise By-Law.* Retrieved from https://www.halifax.ca/sites/default/files/documents/city-hall/legislation-by-laws/By-LawN-200.pdf

Hammonds Plains Historical Society. (n.d.). *Hammonds Plains – A Traditional Lumbering Community: A History*. Retrieved October 21, 2024, from https://www.hammondsplainshistoricalsociety.ca/hammonds-plains-a-traditional-lumbering-community-a-history/

Hatch. (2008). *Nova Scotia wind integration study*. Retrieved from https://energy.novascotia.ca/sites/default/files/NS-Wind-Integration-Study-FINAL.pdf

Health and Safety Executive. (n.d.). *Traffic management on site*. Retrieved from: https://www.hse.gov.uk/construction/safetytopics/vehiclestrafficmanagement.htm

Health Canada. (2014). *Wind Turbine Noise and Health Study: Summary of Results.* Retrieved from https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/everyday-things-emit-radiation/wind-turbine-noise/wind-turbine-noise-health-study-summary-results.html

Health Canada. (2020). *Radiofrequency electromagnetic fields (EMF).* Retrieved from https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/types-sources/radiofrequency-fields.html

Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations, SOR/2013-24

Hegmann, G., Cocklin, C., Creasey, R., Dupuis, S., Kennedy, A., Kingsley, L., Ross, W., Spaling, H., & D. Stalker. (1999). *Cumulative effects assessment practitioners' guide.* Retrieved from https://publications.gc.ca/collections/Collection/En106-44-1999E.pdf

Henry, M., Thomas, D., Vaudry, R., & Carrier, M. (2002). Foraging Distances and the Home Range of Pregnant and Lactating Little Brown Bats (Myotis Lucifugus). *Journal of Mammalogy, 83*(3), 767-774.

Higgins, K. F., Osborn, R., & Naugle, D. E. (2007). *Effects of wind turbines on birds and bats in southwestern Minnesota, USA.* In M. De Lucas, G. F. E. Janss, & M. Ferrer (Eds.), Birds and wind farms: Risk assessment and mitigation (pp. 153-175). Quercus, Madrid, Spain

Hill, N. M., Crowell, M., Lapaix, R., Hicks, S. (2018). *The Rare Southern Twayblade (Neottia bifolia): Sentinel of Ecosystem Integrity for Sphagnous Swamps.* Rhodora, 120(982).

Hinman, J. L. (2010). *Wind farm proximity and property values: a pooled hedonic regression analysis of property values in Central Illinois*. [Thesis, Illinois State University]. Retrieved from https://puc.sd.gov/commission/dockets/electric/2017/el17-055/exhibit4.pdf

Hoen, B., Wiser, R., Cappers, P., Thayer, M., & Sethi, G. (2009). *The impact of wind power projects on residential property values in the United States: a multi-site hedonic analysis*. Retrieved from https://www.osti.gov/servlets/purl/978870

Hoen, B., Wiser, R., Cappers, P., Thayer, M., & Sethi, G. (2011). Wind energy facilities and residential properties: the effect of proximity and view on sales prices. *Journal of Real Estate Research, 33.*

Hoen, B., Brown, J. P., Jackson, T., Wiser, R., Thayer, M., & Cappers, P. (2013). *A spatial hedonic analysis of the effects of wind energy facilities on surrounding property values in the United States.* Retrieved from https://www.energy.gov/eere/wind/articles/spatial-hedonic-analysis-effects-wind-energy-facilities-surrounding-property

Horn, J., Arnett, E., & Kunz, T. (2008). Behavioral Responses of Bats to Operating Wind Turbines. *Journal of Wildlife Management, 72*(1), 123-132.

Horton, K.G., Van Doren, B.M., Albers, H.J., Farnsworth, A. & Sheldon, D., 2021. Near-term ecological forecasting for dynamic aeroconservation of migratory birds. *Conservation Biology, 35*(6), pp.1777-1786.

Howe, Gastmeier, Chapnick Ltd (HGC). (2010). *Low Frequency Noise and Infrasound Associated With Wind Turbine Generator Systems: A Literature Review*. Prepared for the Ontario Ministry of the Environment.

IBA Canada. (2024). *Important Bird and Biodiversity Areas in Canada-Grassy Island Complex Mahone Bay and Margaret's Bay, Nova Scotia*. Retrieved from: https://www.ibacanada.com/site.jsp?siteID=NS026

Impact Assessment Act, SOR/2019-285

Intergovernmental Panel on Climate Change (IPCC). (2018). Annex I: Glossary. In *Global Warming of 1.5°C. An IPCC Special Report…*. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 541-562. https://doi.org/10.1017/9781009157940.008

Intergovernmental Panel on Climate Change (IPCC). (2022). *Climate Change 2022 - Impacts, Adaptation and Vulnerability.* Retrieved from https://www.ipcc.ch/report/ar6/wg2/

International Commission on Non-Ionizing Radiation Protection (ICNIRP). (2010). *ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz)*. Health Physics, 99(6): 818-836.

International Standards Organization (ISO). (2019). *ISO 14064*., Geneva, Switzerland.

Iowa State University. (2024). *Station data and met data: Halifax International Airport*. Retrieved from https://mesonet.agron.iastate.edu/sites/dyn_windrose.phtml?station=CYHZ&network=CA_NS_ASOS

Israel, M., Ivanova, P., (2011). *Electromagnetic fields and other physical factors around wind power generators (pilot study)*. Environmentalist. 31:161-168.

Jansson, S., Malmqvist, E., Brydegaard, M., Akesson, S., & Rydell, J. (2020). A Scheimpflug Lidar used to observe insect swarming at a wind turbine. *Ecological Indicators*, 117, 106578.

Johnson, D. H., Shrier, B. M., O'Neal, J. S., Knutzen, J. A., Augerot, X., O'Neil, T. A., & Pearsons, T. N. (2007). *Salmonid field protocols handbook: Techniques for assessing status and trends in salmon and trout populations*. American Fisheries Society in association with State of the Salmon, 478. https://doi.org/10.47886/9781888569926.

Katsaprakakis, D. A., Papadakis, N., & Ntintakis, I. (2021). *A Comprehensive Analysis of Wind Turbine Blade Damage*. Energies, 14(18). https://doi.org/10.3390/en14185974

Keith, S. E. (2018). Wind turbine low frequency and infrasound propogation and sound pressure level calculations at dwellings. *The Journal of Acoustical Society of America, 144*(981).

Kenter, P. (2017). *Nova Scotia contractor completes massive single-day wind turbine pour*. Retrieved from https://canada.constructconnect.com/dcn/news/projects/2017/02/nova-scotia-contractor-completes-massive-single-day-wind-turbine-pour-1021503w

Knopper, L.D., Ollson, C.A, McCallum, L. C., Aslund, M. L., Berger, R. G., Souweine, K., & McDaniel, M. (2014). Wind turbines and human health. *Public Health*, 19.

Krcmar, A. (2021). *Turbines and fire risk*. Wind Systems Magazine, 21–22.

Laposa, S. & Mueller, A. (2010). Wind farm announcements and rural home prices: Maxwell Ranch and rural Northern Colorado. *Journal of Sustainable Real Estate, 2*(1), 383-402.

La Sorte, Frank A., Wesley M. Hochachka, Andrew Farnsworth, Daniel Sheldon, Daniel Fink, Jeffrey Geevarghese, Kevin Winner, Benjamin M. Van Doren, and Steve Kelling. (2015). Migration timing and its determinants for nocturnal migratory birds during autumn migration. Journal of Animal Ecology, 84(5), 1202-1212.

LeBlanc, M.P. (2007). *Recommendations for risk assessments of ice throw and blade failure in Ontario*. Retrieved from https://d3n8a8pro7vhmx.cloudfront.net/uplandprairiewind/pages/64/attachments/original/1492703881/ice_throw_document_%28002%29.pdf?1492703881

Lekuona, J.M., & Usua, C. 2007. Avian mortality wind power plants of Navarra (Northern Spain). In: Lucas, M., Janss, G.F.E. & Ferrer, M. (eds), Birds and wind farms: risk assessment and mitigation. Quercus. Madrid, Spain, pp. 177-192.

Leventhall, G. (2006). Infrasound from Wind Turbines – Fact, Fiction or Deception. *Canadian Acoustics*, *34*(2), 29-36.

Liechti, F., & Bruderer, B. (1998). The Relevance of Wind for Optimal Migration Theory. *Journal of Avian Biology, 29*(4), 561–568.

Long, C.V., Flint, J.A., Lepper, & P.A. (2011). Insect attraction to wind turbines: does colour play a role? *European Journal of Wildlife Research,* 57, 323-331.

Longcore, T., & Rich, C. (2004). *Ecological light pollution.* Frontiers in Ecology and the Environment. 2(4), 191-198. https://doi.org/10.1890/1540-9295(2004)002[0191:ELP]2.0.CO;2

Lovich, J.E. & Ennen, J.R. (2013). Assessing the state of knowledge of utility-scale wind energy development and operation on non-volant terrestrial and marine wildlife. *Applied Energy,* 103, 52–60.

Maijala, P. P., Kurki, I., Vainio, L., Pakarinen, S., Kuuramo, C., Lukander, K., Virkkala, J., Tiippana, K., Stickler, E. A., & Sainio, M. (2021). Annoyance, perception, and physiological effects of wind turbine infrasound. *The Journal of the Acoustical Society of America, 149*, 2238.

Marler, P., Konishi, M., Lutjen, A., & Waser, M. D. (1973). *Effects of continuous noise on avian hearing and vocal development.* Proceedings of the National Academy of Sciences of the United States of America, 70(5), 1393-1396. https://doi.org/10.1073/pnas.70.5.1393

Maryland Department of Natural Resources. (2012). *Brook Trout*. Retrieved from https://dnr.maryland.gov/education/Documents/BrookTrout.pdf

Meyer, R. (2007). *Martes pennanti*. In: *Fire Effects Information System* (online). Retrieved from https://www.fs.usda.gov/database/feis/animals/mammal/pepe/all.html

McCallum, L. C., Aslund, M. L., Knopper, L.D., Ferguson, G. M., & Ollson, C.A. (2014). Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern? *Environmental Health*, 13(9).

McGuire, L.P., Guglielmo, C. G., Mackenzie, S.A., & Taylor, P. D. (2011). Migratory stopover in the long-distance migrant silver-haired bat, *Lasionycteris noctivagans*. *Journal of Animal Ecology*, 81(2), 377-385.

McGrath, T., Pulsifer, M., Seymour, R., Doucette, L., Forbes, G., McIntyre, R., Milton, R., Cogan, L., Retallack, M., & Crewe, T. (2021). *Nova Scotia Silvicultural Guide for the Ecological Matrix.* Retrieved from https://novascotia.ca/ecological-forestry/docs/silvicultural-guide.pdf

Migratory Birds Convention Act, S.C. 1994, c. 22

Miller-Rushing, A. J., Lloyd-Evans, T. L., Primack, R. B., & Satzinger, P. (2008). Bird migration times, climate change, and changing population sizes. Global Change Biology, 14(9), 1959-1972.

Ministry of Transportation of Ontario (MTO). (2009). *Environmental Guide for Fish and Fish Habitat, Section 5: Impact Assessment and Mitigation.* Retrieved from: https://longpointbiosphere.com/download/fish__water/MTO-Fish-Guide-June-2009-Final.pdf

Mitsch, W. J., & Gosselink, J. G. (2001). Wetlands (third edition). *Regulated Rivers Research and Management, 17*(3), 295–295.

Moseley, M. (2007). *Records of bats (Chiroptera) at caves and mines in Nova Scotia.* Retrieved from the Nova Scotia Museum.

Municipality of Argyle. (2014). *Pubnico: Nova Scotia's first wind farm* (video). Retrieved from https://www.youtube.com/watch?v=-eBZKBA4_AU

Municipality of East Hants (MOEH). (2021). *Municipal Planning Strategy: East Hants Official Community Plan Bylaw P-400.* Retrieved from https://www.easthants.ca/wp-content/uploads/2024/01/MPS-Plan-East-Hants-Section-A-Intro.pdf.

National Cancer Institute (NCI) (2022). *Electromagnetic Fields and Cancer.* Retrieved from https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/electromagnetic-fields-fact-sheet.

National Geographic. (2022). *Invasive Species.* Retrieved from https://education.nationalgeographic.org/resource/invasive-species

National Renewable Energy Laboratory (NREL). (2016). *Interpreting JEDI results.* Retrieved from https://www.nrel.gov/analysis/jedi/results.html

National Renewable Energy Laboratory (NREL). (2017). *2015 cost of wind energy review*. Retrieved from https://www.nrel.gov/docs/fy17osti/66861.pdf

Natural Resources Canada (NRCan). (2017). *About Renewable Energy*. Retrieved from https://www.nrcan.gc.ca/our-natural-resources/energy-sources-distribution/renewable-energy/about-renewable-energy/7295

Natural Resources Canada (NRCan). (2022a). *CanVec Database – Hydrographic Features*. Retrieved from https://open.canada.ca/data/en/dataset/8ba2aa2a-7bb9-4448-b4d7-f164409fe056

Natural Resources Canada (NRCan). (2022b). *CWFIS: Interactive Map.* Retrieved from https://cwfis.cfs.nrcan.gc.ca/interactive-map?zoom=8&center=2292290.966344817%2C10933.87960105588&month=7&day=9&year=2022#iMap

NatureServe. (2024a). *Listera australis - Southern Twayblade.* Retrieved from https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.141348/Listera_australis

NatureServe. (2024b). Pectenia plumbea - Blue Felt Lichen. Retrieved from https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.126158/Pectenia_plumbea

Neily, P., Basquil, S., Quigley, E., & Keys, K. (2017). Ecological Land Classification for Nova Scotia. Retrieved from https://novascotia.ca/natr/forestry/ecological/pdf/Ecological-Land-Classification-guide.pdf.

New Brunswick Department of Environment and Local Government (NBDELG). (2018). *Manual for wetland ecosystem services protocol for Atlantic Canada (WESP-AC): Non-tidal wetlands.* Retrieved from: https://www.researchgate.net/publication/323992875_Manual_for_Wetland_Ecosystem_Services_Protocol_for_Atlantic_Canada_WESP-AC_Tidal_Wetlands.

Niemi, G. J., DeVore, P., Detenbeck, N., Taylor, D., Lima, A., Pastor, J. J., Yount, J. D., & Naiman, R. J. (1990). *Overview of case studies on recovery of aquatic systems from disturbance*. Environmental Management 14(5): 571-587. https://doi.org/10.1007/BF02394710.

Nilsson, C., Klaassen, R. H. G., & Alerstam, T. (2013). Differences in speed and duration of bird migration between spring and autumn. *American Naturalist*, 181(*6*), 837-845. https://doi.org/10.1086/670335

Nordex SE. (2024). *Nordex obtains 300 MW order for major project in India*. Retrieved from https://www.nordex-online.com/en/2019/01/nordex-obtains-300-mw-order-for-major-project-in-india/#:~:text=The%20Nordex%20Group%20will%20build,vicinity%20of%20the%20wind%20farm.

Nova Scotia (NS) Department of Agriculture and Fisheries. (2005). *Nova Scotia Trout Management Plan.* Retrieved from https://novascotia.ca/fish/documents/special-management-areas-reports/NSTroutManplandraft05.pdf

Nova Scotia Environment and Climate Change (NSECC). (n.d.). *Blue Mountain - Birch Cove Lakes Wilderness Area.* Retrieved from https://www.novascotia.ca/nse/protectedareas/wa_BlueMountainBirchCove.asp

Nova Scotia Environment and Climate Change (NSECC). (1993). *Procedure for conducting a pre-blast survey*. Retrieved from NSECC.

Nova Scotia Environment and Climate Change (NSECC). (2009). *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*. Retrieved from https://novascotia.ca/nse/ea/docs/EA.Guide-AddressingWildSpecies.pdf

Nova Scotia Environment and Climate Change (NSECC). (2011). *Nova Scotia 1:10,000 Primary Watersheds*. Retrieved from https://www.novascotia.ca/nse/watercourse-alteration/docs/Watercourse-Alterations-Standard.pdf

Nova Scotia Environment and Climate Change (NSECC). (2012). *Wetland Indicator Plant List – July 12, 2012*. Retrieved from https://novascotia.ca/nse/wetland/indicator.plant.list.asp

Nova Scotia Environment and Climate Change (NSECC). (2015a). Nova Scotia Groundwater Observation Well Network. Retrieved from https://novascotia.ca/nse/groundwater/groundwaternetwork.asp

Nova Scotia Environment and Climate Change (NSECC). (2015b). *Nova Scotia Watercourse Alterations Standard*. Retrieved from https://www.novascotia.ca/nse/watercourse-alteration/docs/Watercourse-Alterations-Standard.pdf

Nova Scotia Environment and Climate Change (NSECC). (2015c). *Guide to Altering Watercourses*. Retrieved from https://novascotia.ca/nse/watercourse-alteration/docs/NSE-Watercourse-Alteration-Program-May29.pdf

Nova Scotia Environment and Climate Change (NSECC). (2017). *A Proponent's Guide to Environmental Assessment.* Retrieved from https://novascotia.ca/nse/ea/docs/EA.Guide-Proponents.pdf

Nova Scotia Environment and Climate Change (NSECC). (2019). *Nova Scotia wetland conservation policy*. Retrieved from https://novascotia.ca/nse/wetland/docs/Nova.Scotia.Wetland.Conservation.Policy.pdf

Nova Scotia Environment and Climate Change (NSECC). (2020a). *Standards for Quantification, Reporting, and Verification of Greenhouse Gas Emissions*. Retrieved from https://climatechange.novascotia.ca/sites/default/files/QRV_Standards.pdf

Nova Scotia Environment and Climate Change (NSECC). (2020b). Nova Scotia Well Logs Database. Retrieved from https://novascotia.ca/nse/groundwater/welldatabase.asp.

Nova Scotia Environment and Climate Change (NSECC). (2021). *Guide to preparing an EA registration document for wind power projects in Nova Scotia*. Retrieved from https://novascotia.ca/nse/ea/docs/EA.Guide-Proponents-WindPowerProjects.pdf
Nova Scotia Environment and Climate Change. (2022). *Wet Area Mapping Database.* Provided by NSECC through data sharing agreement.

Nova Scotia Environment and Climate Change (NSECC). (2023a). *Ellershouse 3 wind project.* Retrieved from https://novascotia.ca/nse/ea/ellershouse-3-wind/

Nova Scotia Environment and Climate Change (NSECC). (2023b). *Guidelines for environmental noise measurement and assessment*. Retrieved from https://novascotia.ca/nse/air/docs/guidelines-environmental-noise-measurement-and-assessment.pdf

Nova Scotia Environment and Climate Change (NSECC). (2024a). *Nova Scotia environment ambient air quality data*. Retrieved from https://novascotia.ca/nse/airdata/

Nova Scotia Environment and Climate Change (NSECC). (2024b). *Parks and protected areas interactive map*. Retrieved from https://novascotia.ca/parksandprotectedareas/plan/interactive-map/

Nova Scotia Environment and Climate Change (NSECC). (n.d.a). *Pockwock Wilderness Area*. Retrieved from https://novascotia.ca/nse/protectedareas/wa_pockwock.asp.

Nova Scotia Environment and Climate Change (NSECC). (n.d.b). *Old Annapolis Road*. Retrieved from https://novascotia.ca/nse/protectedareas/nr_oldannapolisroad.asp.

Nova Scotia Environment and Climate Change (NSECC). (n.d.c). *Island Lake Wilderness Area*. Retrieved from https://www.novascotia.ca/nse/protectedareas/wa_IslandLake.asp.

Nova Scotia Environment and Climate Change (NSECC). (n.d.d.). *Blue Mountain – Birch Cove Lakes Wilderness Area.* Retrieved from https://novascotia.ca/nse/protectedareas/wa_BlueMountainBirchCove.asp

Nova Scotia Environment and Climate Change (NSECC) & Nova Scotia Natural Resources and Renewables (NSNRR). (2009). *Online interactive groundwater map*. Retrieved from https://nsefp.ca/wp-content/uploads/2014/07/droponwaterFAQ_InteractiveGroundwaterMap.pdf

Nova Scotia Museum. (n.d.) *Uniacke Estate Museum Park.* Retrieved from https://uniacke.novascotia.ca/

Nova Scotia Natural Resources and Renewables (NSNRR). (2002*). Mineral Resource land use atlas*. Retrieved from https://novascotia.ca/natr/meb/geoscience-online/interactive-nts-map.asp

Nova Scotia Natural Resources and Renewables (NSNRR). (2009). *Potential for Radon in Indoor Air.* Retrieved from https://fletcher.novascotia.ca/DNRViewer/?viewer=Radon

Nova Scotia Natural Resources and Renewables (NSNRR). (2012a). *Potential Boreal Felt Lichen habitat layer.* Retrieved from NSNRR.

Nova Scotia Natural Resources and Renewables (NSNRR). (2012b). *Protocol for Mainland Moose Snow Tracking Survey.* Retrieved from NSNRR.

Nova Scotia Natural Resources and Renewables. (NSNRR). (2017a). *Arsenic Risk in Bedrock Water Wells*. Retrieved from https://fletcher.novascotia.ca/DNRViewer/?viewer=As_Risk_Wells

Nova Scotia Natural Resources and Renewables. (NSNRR). (2017b). *Provincial landscape viewer.* Retrieved from https://nsgi.novascotia.ca/plv/

Nova Scotia Natural Resources and Renewables (NSNRR). (2018). *At-Risk Lichens–Special Management Practices.* Retrieved from https://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_BFL_At-Risk-Lichens.pdf

Nova Scotia Natural Resources and Renewables (NSNRR). (2019). *Karst risk map.* Retrieved from https://fletcher.novascotia.ca/DNRViewer/?viewer=Karst

Nova Scotia Natural Resources and Renewables (NSNRR). (2020a). *Wetlands of Special Significance Database.* Retrieved from NSNRR.

Nova Scotia Natural Resources and Renewables (NSNRR). (2020b). *Recovery Plan for Tri-colored bat (Perimyotis subflavus) in Nova Scotia [Final].* Retrieved from https://novascotia.ca/natr/wildlife/species-at-risk/docs/RECOVERY_PLAN_Tri_colored_Bat_27Sept20.pdf

Nova Scotia Natural Resources and Renewables (NSNRR). (2020c*). Recovery Plan for the Barn Swallow (Hirundo rustica) in Nova Scotia [Final].* Nova Scotia Endangered Species Act Recovery Plan Series.

Nova Scotia Natural Resources and Renewables (NSNRR). (2020d). Uranium Risk in Bedrock Wells. Retrieved from https://fletcher.novascotia.ca/DNRViewer/index.html?viewer=Uranium_Risk.

Nova Scotia Natural Resources and Renewables (NSNRR). (2021a). *Acid Rock Drainage*. Retrieved from https://novascotia.ca/natr/meb/hazard-assessment/acid-rock-drainage.asp.

Nova Scotia Natural Resources and Renewables (NSNRR). (2021b). *Wet Areas Mapping (WAM).* Retrieved from NSNRR.

Nova Scotia Natural Resources and Renewables (NSNRR). (2021c). *Wetlands inventory*. Retrieved from NSNRR.

Nova Scotia Natural Resources and Renewables (NSNRR). (2021d). *Geographic Data Directory: Forest Resource Inventory*. Retrieved from https://nsgi.novascotia.ca/gdd/

Nova Scotia Natural Resources and Renewables (NSNRR). (2021e). *Forest Vegetation types - TH5*. Retrieved from https://novascotia.ca/natr/forestry/veg-types/th/th5.asp.

Nova Scotia Natural Resources and Renewables (NSNRR). (2021f). *Recovery Plan for the Moose (Alces alces Americana) in Mainland Nova Scotia*. Retrieved from https://novascotia.ca/natr/wildlife/biodiversity/pdf/recoveryplans/mainlandmooserecoveryplan.pdf

Nova Scotia Natural Resources and Renewables (NSNRR). (2021g). *Fire Weather Forecast Maps and Indices.* Retrieved from https://novascotia.ca/natr/forestprotection/wildfire/forecasts.asp

Nova Scotia Natural Resources and Renewables (NSNRR). (2022a). *Nova Scotia Pumping Test Database*. Retrieved from https://novascotia.ca/natr/meb/download/dp498.asp

Nova Scotia Natural Resources and Renewables (NSNRR). (2022b). *An Old-Growth Forest Policy for Nova Scotia.* Retrieved from https://novascotia.ca/ecological-forestry/docs/old-growth-forest-policy.pdf

Nova Scotia Natural Resources and Renewables (NSNRR). (2022c). *Old Forest Assessment - Procedures Version 1.3 August 15, 2022*. Retrieved from, https://novascotia.ca/natr/forestry/programs/ecosystems/pdf/old-forest-scoring-procedures.pdf

Nova Scotia Natural Resources and Renewables (NSNRR). (2023a). *Significant species and habitats database*. Retrieved from NSNRR.

Nova Scotia Natural Resources and Renewables (NSNRR). (2023b). *Recovery Plan for the Chimney Swift (Chaetura pelagica) in Nova Scotia [Final].* Nova Scotia Endangered Species Act Recovery Plan Series.

Nova Scotia Natural Resources and Renewables (NSNRR). (2024a). *Nova Scotia GeoscienceAtlas*. Retrieved from https://novascotia.ca/natr/meb/geoscience-online/geoscience_about.asp

Nova Scotia Natural Resources and Renewables (NSNRR). (2024b). *Nova Scotia Groundwater Atlas*. Retrieved from https://fletcher.novascotia.ca/DNRViewer/?viewer=Groundwater.

Nova Scotia Parks. (n.d.). *Jerry Lawrence*. Retrieved from https://parks.novascotia.ca/park/jerry-lawrence

Nova Scotia Power. (2018). *Nova Scotia Power Incorporated Hydro Asset Study*. Retrieved from https://www.nspower.ca/docs/default-source/irp/20181221-ns-power-hydro-asset-study-redacted.pdf?sfvrsn=a8dabcf6_1.

Nova Scotia Power. (2024). *Clean energy*. Retrieved from https://www.nspower.ca/cleanandgreen/clean-energy#how

Number Three Wind LLC. (2018). *Construction Traffic and Wind Turbine Delivery Vehicles – Case Number 16-F-0328, Submission 948*. Retrieved from https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=16-F-0328&CaseSearch=Search

O'Farrell, M.J & Gannon, W.L. (1999). A Comparison of Acoustic Versus Capture Techniques for the Inventory of Bats. *Journal of Mammalogy, 80*(1), 24-30.

Occupational Health and Safety Act, S.N.S. 1996, c. 7

Ontario Ministry of Natural Resources (OMNR). (2000). *Conserving the forest interior: a threatened wildlife habitat*. 12 pp

Office of L’nu Affairs (OLA). (2012). Proponent’s guide: The role of proponents in crown consultation with the Mi’kmaq of Nova Scotia. Retrieved from https://novascotia.ca/nse/ea/docs/eaproponents-guide-to-mikmaq-consultation.pdf.

Office of L'nu Affairs (OLA). (2015). Aboriginal people in Nova Scotia. Retrieved from https://novascotia.ca/abor/aboriginal-people/

Open Data Nova Scotia (NS). (2022). *Nova Scotia Hydrographic Network*. Retrieved from https://data.novascotia.ca/Environment-and-Energy/Nova-Scotia-Hydrographic-Network/dk27-q8k2/data

Ozone-depleting Substances and Halocarbon Alternatives Regulations, SOR/2016-137

Padey, P., Blanc, I., Le Boulch, D., & Xiusheng, Z. (2012). A simplified life cycle approach for assessing greenhouse gas emissions of wind electricity. *Journal Of Industrial Ecology*, 16, S28-S38. Doi: 10.1111/j.1530-9290.2012.00466.x

Parisé, J., & Walker, T. (2017). Industrial wind turbine post-construction bird and bat monitoring: A policy framework for Canada. *Journal of Environmental Management, 201*, 252-259.

Province of Nova Scotia (NS). (2015). *Electricity Review Report*. Retrieved from https://energy.novascotia.ca/sites/default/files/Electricity%20System%20Review_Report.pdf

Province of Nova Scotia (NS). (2018). *Nova Scotia Wet Places*. Retrieved from https://novascotia.ca/natr/wildlife/habitats/nswetlands/

Province of Nova Scotia (NS). (2024a). *Geographic Data Directory: Old Growth Forest Policy*. Retrieved from https://nsgi.novascotia.ca/gdd/

Province of Nova Scotia (NS). (2024b). Nova Scotia Topographic DataBase - Roads, Trails and Rails Map. Retrieved from https://data.novascotia.ca/Roads-Driving-and-Transport/Nova-Scotia-Topographic-DataBase-Roads-Trails-and-/62ap-bhwk/

Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations, SOR 2010-201

Radio Advisory Board of Canada (RABC) & Canadian Renewable Energy Association (CanWEA). (2020). Technical Information and Coordination Process Between Wind Turbines and Radiocommunication and Radar Systems. Retrieved from https://www.rabc-cccr.ca/about/publications/wind-turbines-radio-radar/

Rabin, L., Coss, R., & Owings, D. (2006). The effects of wind turbines on antipredator behavior in California ground squirrels (Spermophilus beecheyi). Biological Conservation, 131(3), 410–420.

Reed, P.B. (1988). National List of Plant Species that Occur in Wetlands: NE Region (Region 1) U.S. Fish and Wildlife Service, Washington, DC. Retrieved from https://digitalmedia.fws.gov/digital/api/collection/document/id/1348/download

Regulations Respecting Greenhouse Gas Emissions, NS Reg 260/2009

Richardson, W. J. (2000). Bird migration and wind turbines: Migration timing, flight behaviour, and collision risk. Retrieved from https://www.semanticscholar.org/paper/Bird-Migration-andWind-Turbines-%3A-Migration-TimingRichardson/313c72c0801218e573ee1d3e466a9f792c490c0b

Richardson, W.J. (1990). Timing of Bird Migration in Relation to Weather: Updated Review. Bird Migration, 78-101. https://doi.org/10.1007/978-3-642-74542-3_6

Rioux, S., Savard, J. P. L., & Gerick, A. A. (2013). Avian mortalities due to transmission line collisions: A review of current estimates and field methods with an emphasis on applications to the Canadian electric network. Avian Conservation and Ecology, 8(2), 7. http://dx.doi.org/10.5751/ACE-00614-080207

Robart, A.R., McGuire, M.M.K., and Watts, H.E. (2018). Increasing photoperiod stimulates that initiation of spring migratory behaviour and physiology in a facultative migrant, the pine siskin. Royal Society Open Science, 5(8). https://doi.org/10.1098/rsos.180876

Robart, A.R., Morado, M.I., and Watts, H.E. (2019). Declining food availability, corticosterone, and migratory response in a nomadic irruptive migrant. Hormones and Behaviour, 110, 56-67. https://doi.org/10.1016/j.yhbeh.2019.02.007

Rydell, J., Bach, L., Dubourg-Savage, M.-J., Green, M., Rodrigues, L., & Hedenstrom, A. (2010). Mortality of bats at wind turbines links to nocturnal insect migration? *European Journal of Wildlife Research,* 56, 823-827.

Sabean, B. (1989). *The Fisher in Nova Scotia*. Retrieved from https://novascotia.ca/NATR/wildlife/conserva/fishers.asp.

Scott, W.B. and M.G. Scott. 1998. *Atlantic fishes of Canada. Canadian Bulletin of Fisheries and Aquatic Sciences*.

Segers, J., & Broders, H. (2014). *Interspecific effects of forest fragmentation on bats*. Canadian Journal of Zoology, 92(8), 665-673.

Seifert, H., Westerhellweg, A., & Kroning, J. (2003). *Risk Analysis of Ice Throw from Wind Turbines.* Retrieved from http://www.mi-group.ca/files/boreas_vi_seifert_02.pdf

Simonson, T. D., & Lyons, J. (1995). *Comparison of catch per effort and removal procedures for sampling stream fish assemblages*. North American Journal of Fisheries Management, 15(2), 419-427. https://doi.org/10.1577/1548-8675(1995)015%3C0419:COCPEA%3E2.3.CO;2.

Smith M.W. and J.W. Saunders. 1955. *The American eel in certain fresh waters of the maritime provinces of Canada*. J Fish Res Board Can 12: 238−269.

Sockman, K. W., & Hurlbert, A. H. (2020). How the effects of latitude on daylight availability may have influenced the evolution of migration and photoperiodism. Functional ecology, 34(9), 1752-1766.

Special Places Protection Act, RSNS 1989, c 438

Species at Risk Act, SC 2002, c. 29

Squared Consultants Inc. (2022). *GHGenius*. Retrieved from https://ghgenius.ca/

Statistics Canada. (2023). *Census profile, 2021 census of population*. Retrieved from https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E

Stewart, R.L.M., Bredin, K.A., Couturier, A.R., Horn, A.G., Lepage, D., Makepeace, S., Taylor, P.D., Villard, M.-A., and Whittam, R.M. (eds). 2015. *Second Atlas of Breeding Birds of the Maritime Provinces.* Bird Studies Canada, Environment Canada, Natural History Society of Prince Edward Island, Nature New Brunswick, New Brunswick Department of Natural Resources, Nova Scotia Bird Society, Nova Scotia Department of Natural Resources, and Prince Edward Island Department of Agriculture and Forestry, Sackville, 528 + 28 pp.

St. Margarets Bay Stewardship Association. (2024). *Recreational Impact Assessment Report*.

Sulphide Bearing Material Disposal Regulations, NS Reg. 57/95

Symes, L., Sugai, L.S.M., Gottesman, B., Pitzrick, M., Wood, C. (2023). Acoustic analysis with BirdNET and (almost) no coding: practical instructions. *Zenodo,* https://doi.org/10.5281/zenodo.8357176

Taylor, P.D., Brzustowski, J.M., Matkovich, C., Peckford, M.L., Wilson, D. (2010). *radR: an open-source platform for acquiring and analysing data on biological targets observed by surveillance radar.* BMC Ecology, 10(22), https://doi.org/10.1186/1472-6785-10-22

The Driller. (2005). *Hearing protection and air-rotary drilling – Part 1.* Retrieved from https://www.thedriller.com/articles/86218-hearing-protection-and-air-rotary-drilling-part-1#:~:text=The%20sound%20level%20measurements%20around,to%20107%20dB(A)

Thorup, K., Alerstam, T., Hake, M., Kjellén, N. (2006). *Traveling or stopping of migrating birds in relation to wind: an illustration for the osprey*. Behaviorial Ecology, 17(3), 497-502. https://doi.org/10.1093/beheco/arj054

Tilman, D., Siemann, E., Wedin, D., Knops, J., Reich, P., & Ritchie, M. (1997). Influence of Functional Diversity and Composition on Ecosystem Processes. *Science, 277* (5330): 1300-02.

Tomie, J.P.N. 2011. The ecology and behaviour of substrate occupancy by the American eel. MSc thesis, University of New Brunswick. 98 pp.

Tourism Nova Scotia (NS). (2019). *2019 Nova Scotia visitor exit survey: overall results.* Retrieved from https://tourismns.ca/sites/default/files/2021-01/2019%20VES%20Full%20Year%20Report.pdf

Transport Scotland. (n.d.). *Appendix A17.1 Typical construction plant and noise levels*. Retrieved from https://www.transport.gov.scot/media/42094/appendix-a171-typical-construction-plant-and-noise-levels.pdf

Trautman, M.B. 1981. *The fishes of Ohio with illustrated keys*. Ohio State University Press, Columbus. xxv + 782p.

Trombulak, S. C., & Frissell, C. A. (2000). Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. *Conservation Biology, 14*(1), 18–30.

United States Department of Agriculture (USDA) - Natural Resources Conservation Service (NRCS). (2010). *Field Indicators of Hydric Soils in the United States: A Guide for Identifying and Delineating Hydric Soils.* Retrieved from http://fwf.ag.utk.edu/mgray/wfs340/PDF/NRCSHydricSoils_FieldIndicators.pdf

United States Environmental Protection Agency (US EPA). (2013). *Streams, Types of Streams.* Retrieved from https://archive.epa.gov/water/archive/web/html/streams.html

United States Environmental Protection Act (US EPA) (2014). *Near Roadway Air Pollution and Health: Frequently Asked Questions*. Retrieved from https://www.epa.gov/sites/default/files/2015-11/documents/420f14044_0.pdf

United States Environmental Protection Agency (US EPA). (2021). *Overview of greenhouse gases*. Retrieved from https://www.epa.gov/ghgemissions/overview-greenhouse-gases#f-gases

United States Environmental Protection Agency (US EPA). (2022a). *pH*. Retrieved from https://www.epa.gov/caddis-vol2/ph

United States Environmental Protection Agency (US EPA). (2022b). *Climate Adaptation and Storms & Flooding*. Retrieved from https://www.epa.gov/arc-x/climate-adaptation-and-storms-flooding

United States Environmental Protection Agency (US EPA). (2024). *Health and environmental Effects of particulate matter (PM).* Retrieved from https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm

United States Fish and Wildlife Service (US FWS). (2021). *Brook Trout*. Retrieved from https://www.fws.gov/fisheries/freshwater-fish-of-america/brook_trout.html#:~:text=HABITAT%3A%20Brook%20trout%20occur%20in,spring%2C%20summer%20and%20late%20fall.

United States Energy Information Administration (US EIA). (2022). *How much carbon dioxide is produced per kilowatthour of U.S. electricity generation?*. Retrieved from https://www.eia.gov/tools/faqs/faq.php?id=74&t=11

University of Bath. (2011). Inventory of Carbon & Energy *(ICE) v.2.0*. Retrieved from https://perigordvacance.typepad.com/files/inventoryofcarbonandenergy.pdf

Van Doren, B.M., Farnsworth, A., Stone, K., Osterhaus, D.M., Drucker, J., and Van Horn, G. (2023). *Nighthawk*: *acoustic monitoring of nocturnal bird migration in the Americas*. Ecology and Evolution, 15(2), https://doi.org/10.1111/2041-210X.14272

Voigt, C. (2021). Insect fatalities at wind turbines as biodiversity sinks. *Conservation Science and Practice,* 3, e366.

Volkoff, H., & Rønnestad, I. (2020). Effects of temperature on feeding and digestive processes in fish. *Temperature, 7*(4), 307–320. https://doi.org/10.1080/23328940.2020.1765950

VTT. (n.d). Wind Power Icing Atlas. VTT Technical Research Centre of Finland Ltd. Retrieved from: https://projectsites.vtt.fi/sites/wiceatlas/www.vtt.fi/sites/wiceatlas.html.

Vyn, R. J. & McCullough, R. M. (2014). The effects of wind turbines on property values in Ontario: does public perception match empirical evidence? *Canadian Journal of Agricultural Economics, 62*(3), 365-392.

Waters, H 2024. *This Wave Theory of Spring Migration Will Prepare You for Your Next Birding Outing.* National Audubon Society. Available Online: https://www.audubon.org/news/wave-theory-of-bird-migration

Wellig, S., Nusslé, S., Miltner, D., Kohle, O., Glaizot, O., Braunisch, V., Obrist, M.K., & Arlettaz, R. (2018). Mitigating the negative impacts of tall wind turbines on bats: Vertical activity profiles and relationships to wind speed. *PloS One,* 13(3), 1-16.

Wever, E. G., & Vernon, J. A. (1961). *The protective mechanisms of the bat's ear*. Annals of Otology, Rhinology and Laryngology, 70(1). https://doi.org/10.1177/000348946107000101

Whitfield, D. P. (2009). *Collision avoidance of golden eagles at wind farms under the 'band' collision risk model*. Retrieved from https://tethys.pnnl.gov/sites/default/files/publications/Whitfield-2009.pdf

Wildlife Act, R.S.N.S. 1989, c. 504

Wills, M. (2021, June 26). Road Density Threatens Turtle Populations. *JSTOR Daily.* Retrieved from https://daily.jstor.org/road-density-threatens-turtle-populations/

Wind Europe. (2017). *Mainstreaming energy and climate policies into nature conservation*. Retrieved from https://windeurope.org/wp-content/uploads/files/policy/topics/sustainability/WindEurope-Paper-on-the-role-of-wind-energy-in-wildlife-conservation.pdf

Wind Turbine Facilities Municipal Taxation Act, S.N.S. 2006, c. 22

Workplace Health and Safety Regulations, N.S. Reg. 52/2013, Part 2, s. 2.1-2.3

WorkSafe BC. (n.d.). *How loud is it? – Construction.* Retrieved from https://www.worksafebc.com/resources/health-safety/hazard-alerts/how-loud-is-it-construction?lang=en

WorkSafe BC. (2016). *How loud is it? – Forestry.* Retrieved from https://www2.bcforestsafe.org/files/Safety_Alert_WSBC-How_Loud_Is_It-Forestry.pdf

Wright, D.G., and G.E. Hopky. 1998. *Guidelines for the use of explosives in or near Canadian fisheries waters*. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv + 34p.

You, F., Shaik, S., Rokonuzzaman, M., Rahman, K. S., & Tan, W.-S. (2023). *Fire risk assessments and fire protection measures for wind turbines: A review*. Heliyon, 9(9). https://doi.org/10.1016/j.heliyon.2023.e19664

Young, Jr. D. P., Erickson, W. P., Strickland, M. D., Good, R. E., & Sernka, K. J. (2003). *Comparison of avian responses to UV-light-reflective paint on wind turbines*. Retrieved from https://www.nrel.gov/docs/fy03osti/32840.pdf

Zedler, J. B., & Kercher, S. (2004). Causes and Consequences of Invasive Plants in Wetlands: Opportunities, Opportunists, and Outcomes. *Critical Reviews in Plant Sciences, 23*(5), 431–452.

Zimmerling, R.J., Pomeroy, A.C., d'Entremont, M.V., & Francis, C.M. (2013). *Canadian Estimate of Bird Mortality Due to Collisions and Direct Habitat Loss Associated with Wind Turbine Developments.* Avian Conservation and Ecology 8(2):10

Zinck, M. (1998). *Rolands Flora of Nova Scotia*. Nimbus Publishing, Nova Scotia.

APPENDIX A
ENGAGEMENT

Melvin Lake Wind
Open House

Wednesday, Sept. 15, 7 to 9 pm
Upper Hammonds Plains
Community Centre
711 Pockwock Road

Please join us

Learn about the proposed Melvin Lake Wind project to be located on Crown Land and private land, just south of Highway 101 and west of Pockwock Lake.

Meet the partners, learn about the development process, how the turbines will look and sound, and about environmental studies underway. Hear about jobs and contract opportunities and community benefits.

We look forward to meeting you. Please contact us anytime through the website.

www.melvinlakewind.ca

COVID-19

Twenty-nine new cases reported in N.S.

About 15,000 more must book vaccination to meet Phase 5 goal

JOHN MCPHEE
THE CHRONICLE HERALD
jmcphee@herald.ca
@HaliJohnMcPhee


About 15,000 Nova Scotians must book a COVID-19 vaccination appointment to reach the province's immunization goal of 75 per cent of population by Sept. 15. POSTMEDIA NEWS

There have been 29 new cases of COVID-19 in Nova Scotia reported since Friday.

Fifteen of the new cases are in the central zone, two in the eastern zone, six in the northern zone and six in the western zone.

There are now 58 active cases in the province, up by three since the last report on Friday. There have been 26 recoveries.

Seven new cases were reported on Saturday; 11 new cases on Sunday; seven new cases on Monday; and four new cases were reported on Tuesday.

Of the new cases in the central zone, nine are related to travel, three are close contacts of previous cases and three are under investigation.

Six cases are in the western zone with four related to travel. Two are close contacts of previously reported cases.

Six cases are in the northern zone with two are related to travel. Three are close contacts of previously reported cases and one is under investigation.

Two cases in the eastern zone are both related to travel.

As of Tuesday, Nova Scotia has 58 active cases of COVID-19. Of those, two people are in hospital COVID-19 units.

Nova Scotia Health Authority's labs completed 3,523 tests on Friday; 2,252 tests on Saturday; 2,511 tests on Sunday and 2,327 tests on Monday.

Since April 1, there have been 4,334 positive COVID-19 cases and 28 deaths. Cases range in age from under 10 to over 90. There are 4,248 resolved cases.

VACCINATION UPTAKE

As of Monday, 1,454,814 doses of COVID-19 vaccine have been administered.

Of those, 695,524 Nova Scotians have received their second dose, which is about 71.6 per cent of the population. That's up by only 0.2 per cent compared to Friday's numbers.

A Health Department spokeswoman said an additional 15,000 Nova Scotians must book a COVID-19 vaccination appointment in order to reach the province's immunization goal by Sept. 15.

Nova Scotia has said 75 per cent of the population must be double vaccinated before it implements the last phase of reopening that would lift most restrictions.

"It takes 10,000 people with two doses to increase the number of people who are fully vaccinated by one percentage point," said spokeswoman Marla MacInnis in an email Tuesday.

"Provided all scheduled appointments are maintained, we need about another 15,000 to get vaccinated by Sept. 15."

MacInnis declined to predict — based on past vaccination schedule trends — whether the department expects that goal to be reached.

Premier Tim Houston and Dr. Robert Strang, chief medical officer of health, will provide an update Wednesday at 3 p.m.

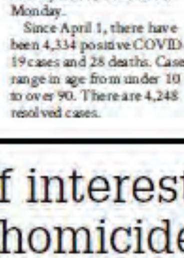
The Health Department encourages everyone who has not yet had their first or second dose of COVID-19 vaccine to do so, MacInnis said.

On Tuesday, Prince Edward Island announced it would postpone Phase 5 of its reopening. At a news briefing, P.E.I.'s chief medical officer Heather Morrison said the emergence of the aggressive Delta variant in other parts of Canada is a "game-changer" so the province no longer plans to loosen its restrictions on Sept. 12.

Morrison said the national trend is disturbing with daily new-case counts rising sharply in some provinces. If the current trends continue, she said the country could see 15,000 new cases a day by next month.

Person of interest arrested in Truro homicide

RICHARD MACKENZIE
SALTWIRE NETWORK
richard.mackenzie@saltwire.com


Truro Police Service Chief Dave MacNeil

TRURO — It is too early to speculate as to whether the weekend homicide of Prabhjot Singh was racially motivated, Truro Police Service Chief Dave MacNeil said.

"Contrary to social media, we have no confirmation as to motive that we're releasing at this time," MacNeil said, while meeting with reporters Tuesday morning in front of the Truro Police Service building.

"Should it become clear to our investigation that is a motive or factor in this case, then appropriate charges will be laid at the time. Right now, there is nothing to substantiate that."

Singh, 23, was killed sometime early Sunday morning. MacNeil said during the news conference that officers found Singh with life-threatening injuries after responding to a call that morning at 2 a.m. to 494 Robie Street. He was taken to the Colchester East Hants Health Centre in Truro where he later died.

The chief did not disclose the cause of death or whether the homicide occurred inside or outside the Robie Street apartment building.

"We're not releasing anything at this time that would hamper the investigation," he said.

MacNeil said several search warrants were executed during the Labour Day weekend and that a person of interest had been arrested and released.

"They have since been released from our custody with no charges related to this homicide at this time," he said, adding the individual remains a person of interest.

MacNeil said he met with the victim's family and friends the evening before.

"This is a very heartbreaking case," MacNeil said. "They are very patient and understanding of where we are in the investigation, and we have offered all the supports and services our community can provide.

"The community is outraged by this. This is a senseless, tragic loss of life of a hard working young man with a bright future. This should not have happened to him."

Melvin Lake Wind

Welcome to the Open House and thank you for attending.
Please sign in.

Name	Address	Phone Number	Email
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Melvin Lake Wind

Welcome to the Open House and thank you for attending.
Please sign in.

CommunityWind powered through partnership

ABO WIND

Name	Address	Phone Number	Email
[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]

Melvin Lake Wind
Open House

Wednesday
September 15
7 pm to 9 pm

Upper Hammonds Plains
Community Centre
711 Pockwock Rd.

Community Benefits

- Power generated by Melvin Lake Wind would feed into local power lines, providing **clean renewable energy**.
- The project would pay a substantial amount of money in property **taxes** each year to the Municipality.
- Local people would benefit from **jobs** in site clearing, road building and concrete work.
- There would be **permanent jobs** for operation and maintenance.
- The project will need the help of **local businesses** for clearing land, supplying gravel, for improving existing roads and building new ones. There will be a need for local goods and services during the life cycle of the wind farm.
- There will be **ongoing contracts** for snow clearing, road maintenance and land reclamation.
- In addition, ABO Wind and Community Wind are looking at ways to partner with post-secondary schools to offer **education and training opportunities** in the field of renewable energy.

Let Us Know

We would also like to hear your suggestions on the best way to use a **community benefit fund**. Please come to the meeting with your ideas or send us an email.

Please join us at the Open House

- Learn more about the proposed Melvin Lake Wind project
- Meet the partners – Nova Scotia company Community Wind and international renewable energy experts ABO Wind Canada
- Learn more about the construction schedule and process, how the turbines will look and sound, and about environmental studies underway
- Hear about opportunities
- Provide your input on how to use a community benefit fund from the project

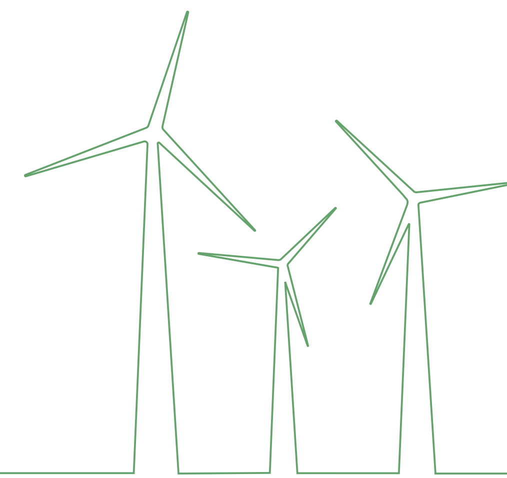
We look forward to meeting you.

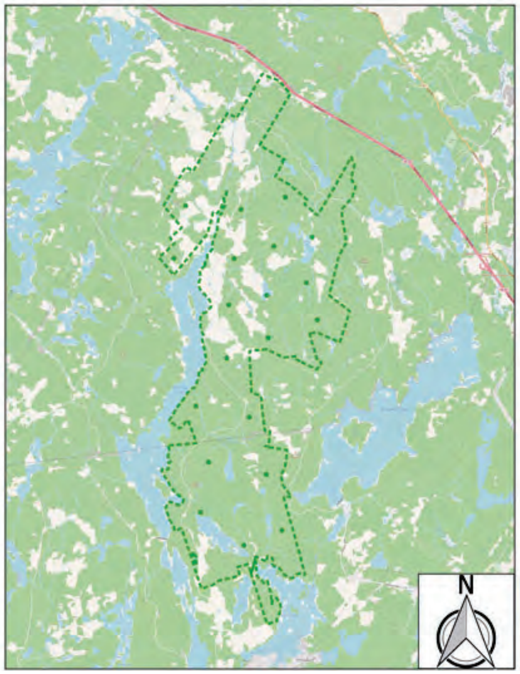
If you have questions or concerns, please contact us anytime through the website:

www.melvinlakewind.ca

CommunityWind powered through partnership

ABO WIND





At Melvin Lake Wind farm, up to 16 turbines will provide carbon-free power for more than 23,000 homes in Nova Scotia, and municipal tax revenue, local jobs and contracts for local businesses.

About the Project

This wind farm will generate approximately 80 megawatts of clean green renewable energy. Power from the site will help meet the Nova Scotia goal to close all coal-fired power plants by 2030.

Community Wind is working with ABO Wind to develop and manage the project. Much of the construction will be done by local businesses.

Location

Wind turbines will be on Crown Land and private land, just south of Highway 101 and west of Pockwock Lake. The map shows preliminary placement of turbines.

At What Stage is the Project?

So far, the project team has conducted desktop studies and a preliminary environmental review and they have measured the wind strength.

They have been visiting landowners and talking to individuals and groups that may be involved in the project, or be in the area.

Tentative Schedule

- ABO Wind and Community Wind are planning to submit a proposal to the Province of Nova Scotia later this fall.
- If the project gets selected, the next steps will be to get environmental approval. We would carry out field studies of birds and other wildlife, consult the Mi'kmaq and local communities, and hold ongoing public information sessions and conversations.
- Construction will begin likely in Spring 2023, with clearing and road building. We expect the wind farm to be operational by late 2024.

What Will the Turbines Look Like?

We will have large poster boards at the meeting showing how the wind turbines will likely look from different locations. We will post these visualizations to the website at www.melvinlakewind.ca

What Will We Hear?

The closest residential properties are more than a kilometre from the wind turbines. It is unlikely there will be any noise from the site.
We are careful to respect setbacks to homes and businesses.

Studies show average noise levels from wind turbines at 1,000 metres are around 35 average decibels – a bit louder than a whisper. Most first-time visitors are surprised by how quiet wind farms are. You can have a conversation below a turbine without raising your voice.

Melvin Lake Wind

up to 16 turbines approximately 80 megawatts of renewable energy

low carbon power for more than 23,000 homes

lowers emissions by more than 150,000 tonnes

local benefits include property tax revenue, local jobs, contracts and payments to land owners

Welcome

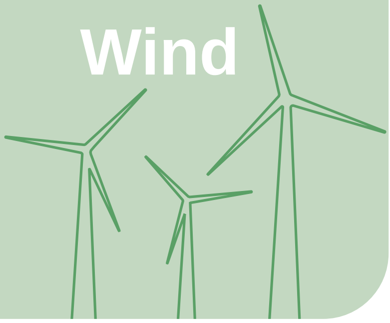
We acknowledge that we are in Mi’kma’ki, the ancestral and unceded territory of the Mi’kmaq People. This territory is covered by the 1725 Treaties of Peace and Friendship.

The Melvin Lake Wind project has a capacity of approximately 80 megawatts of green renewable energy. Power from the site will help meet the Nova Scotia goal to close all coal-fired power plants by 2030.

Community Wind, a local renewable energy company, is working with ABO Wind Canada, part of ABO Wind AG, a global company with extensive experience in renewable energy development. Together, we are developing green energy from Nova Scotia’s excellent wind.

We are glad that you are here. We hope to answer your questions.

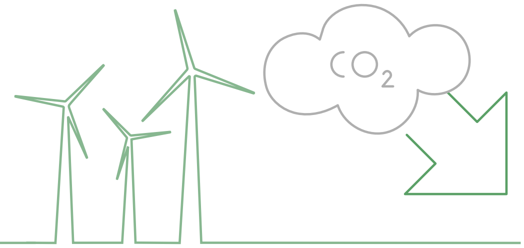
Melvin Lake Wind



Why Wind Energy Works

Offsets Emmissions

A wind farm with a capacity of 80 megawatts a year can offset 150,000 tonnes of carbon dioxide annually



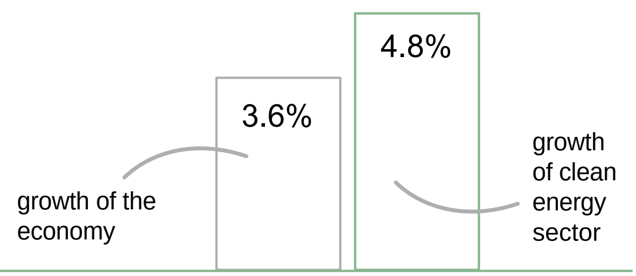
Evolving Technology

A turbine in 2021 can produce 3 times the power of a typical turbine from 2000

Growing Sector

Canada's clean energy is a rapidly growing and diversifying industry

6,000 people in Nova Scotia work in the environment and clean tech sectors



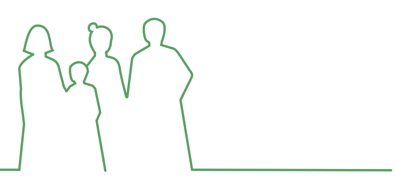
Lower Impact on Environment

Renewable energy, such as wind development, can have a reduced impact on our environment as turbines can be removed and recycled

Human Health

Project will be designed to meet or exceed provincial regulations and guidelines to protect our health

Health Canada, Statistics Canada and experts concluded in a 2014 study that turbine noise was not linked to self-reported illnesses and health conditions

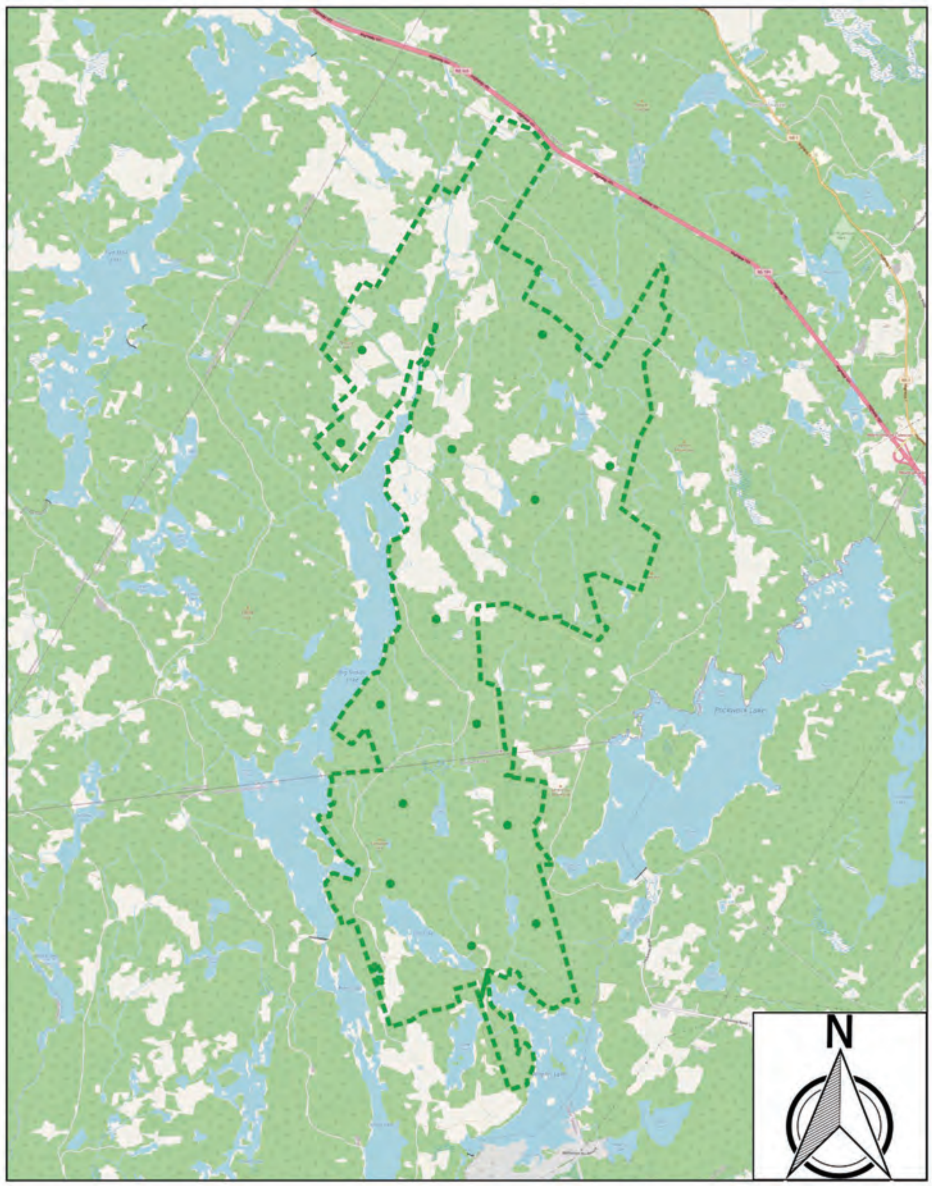


Melvin Lake Wind

What will the turbines look like?

Location

The wind turbines would be located on Crown Land and private land, just south of Highway 101 and west of Pockwock Lake. The map shows the preliminary location of the wind turbines.

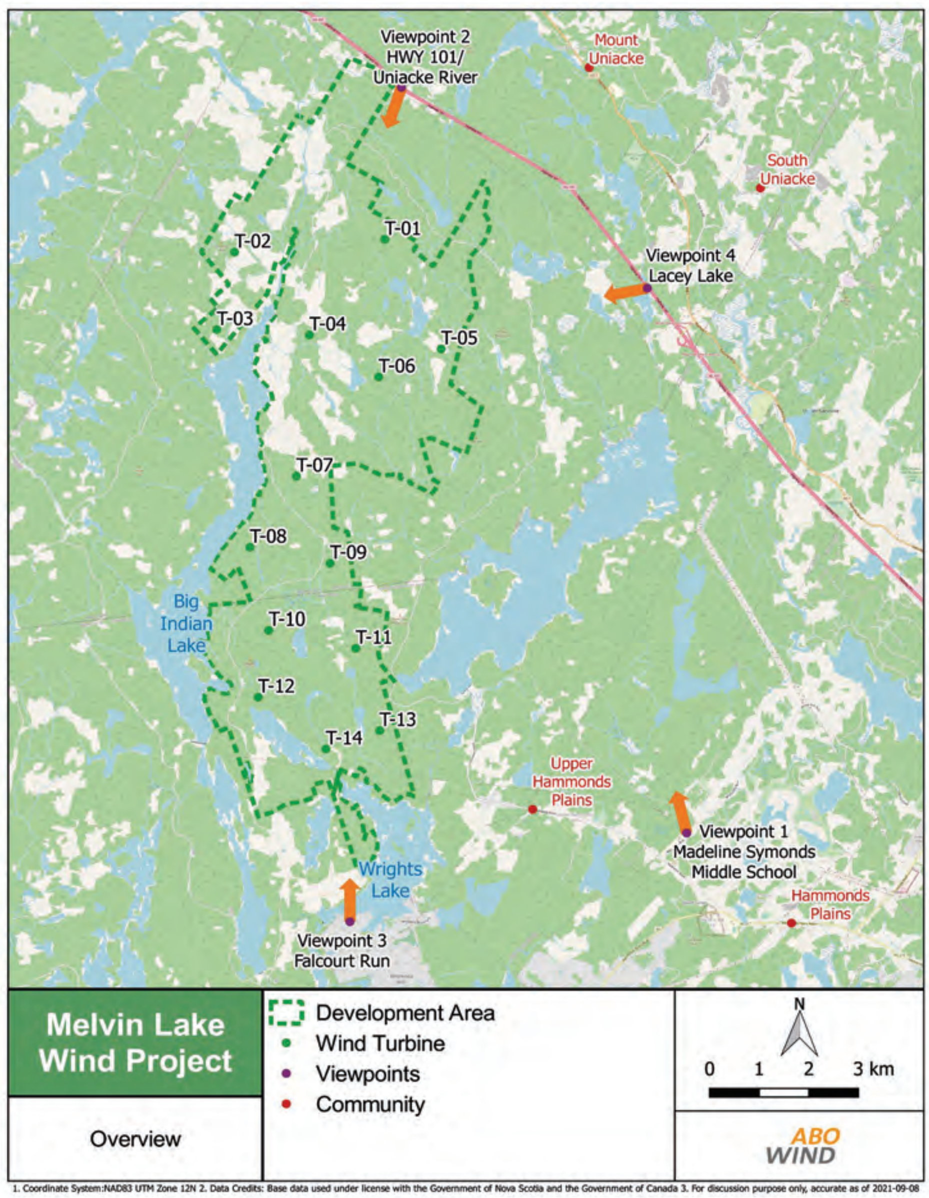


Melvin Lake Wind

What will the turbines look like?

Visualizations

The photos on the following posters were taken from the viewpoints on the map, so that you can see what the wind turbines might look like.

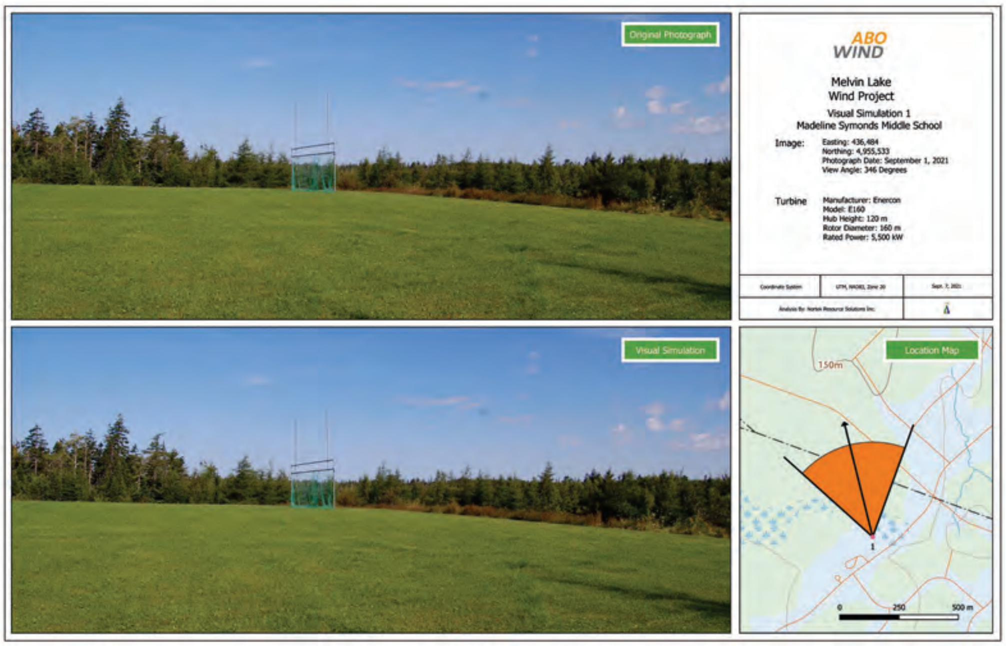


Melvin Lake Wind

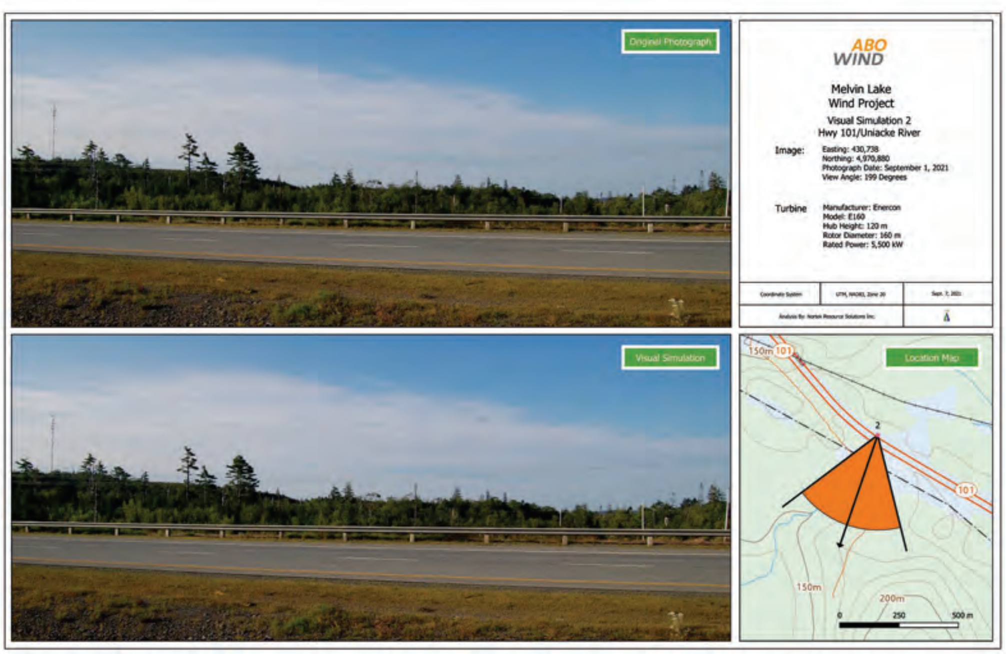
What will the turbines look like?

Visualizations

These photos were taken from various locations facing the position of the turbines. We inserted wind turbines into the photos, so you can see how it will look.



Visualization
Madeline Symonds
Middle School



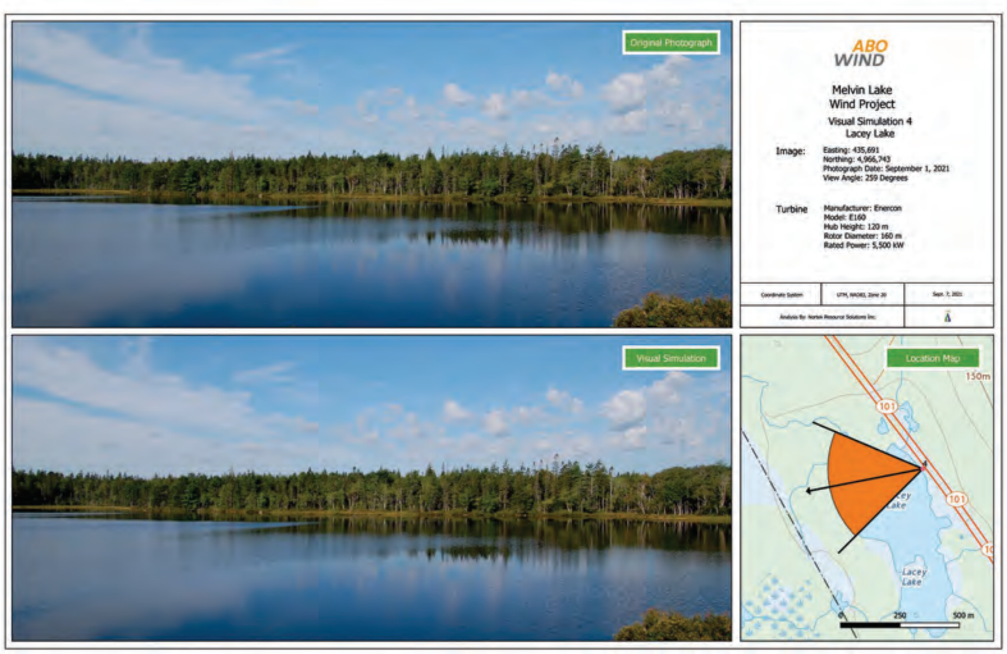
Visualization
Hwy 101/
Uniacke River

Melvin Lake Wind

What will the turbines look like?

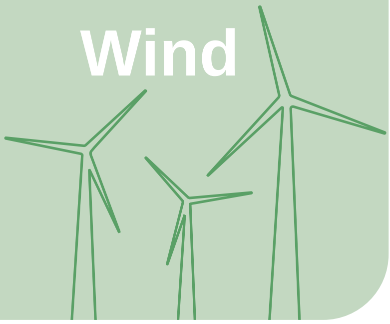
Visualizations

Visualization
Falcourt Run

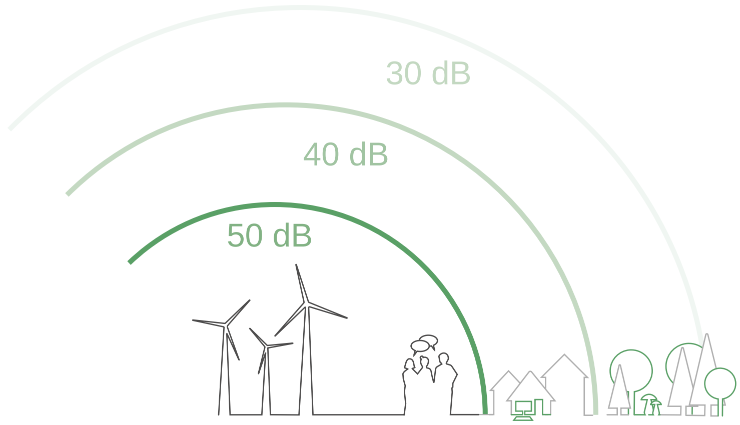


Visualization
Lacey Lake

Melvin Lake Wind

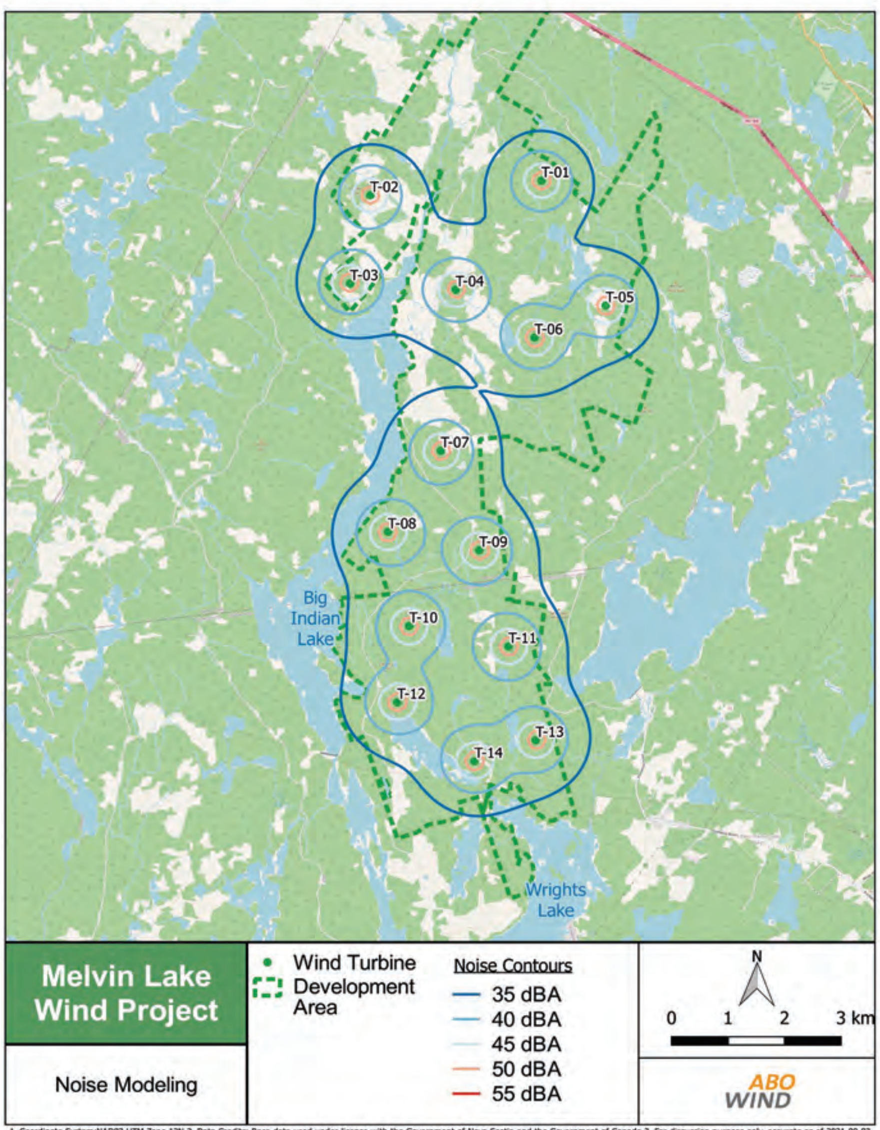


Sound



What Will You Hear?

The closest residential properties are more than a kilometre from the wind turbines. It is unlikely there will be any noise from the site.



Sometimes local residents may hear turbine sound. This map (left) shows the 40 dBA (average decibels) sound contour. That's the sound level of a quiet library – the regulated level allowed in homes in Nova Scotia. DBA stands for A-weighted decibel, a measurement of the relative loudness of sounds in air adjusted to the human ear.

Will the Project affect the environment?

Environmental Studies

The Process

The Project will carry out a variety of environmental and other studies as part of an Environmental Registration application to Nova Scotia's Department of Environment and Climate Change. A provincial guide outlines the requirements that wind project proponents must follow.

The environmental assessment (EA) involves consulting with experts and interested parties and gathering feedback from the public through information sessions and online channels. This information will help us determine what to study.

Valued Environmental Components

VECs may be of interest to First Nations, individuals and other stakeholders who may be affected by the Project. Examples are species or elements in the environment that have social, cultural or economic values, or that may be protected under federal and provincial legislation.

Melvin Lake Wind

Will the Project affect the environment?

Work to Date

We have performed desktop research using public information and professional opinion to determine areas that require formal, detailed surveys. Those surveys will be conducted by an environmental consultant during sampling windows in 2022. Studies will focus on birds, bats, species at risk, wetlands, and other components.

This data will help us determine what features require avoidance or additional mitigation.

Mi’kmaq Ecological Knowledge Study

The Project will carry out a Mi’kmaq Ecological Knowledge Study and a heritage resource assessment.

Updates on Surveys

We will provide information on field surveys and other work for the environmental assessment process through future open houses and the Project website.

Melvin Lake Wind

How long will it take to complete the wind farm?

2021

- Wind measurement, desktop studies, early environmental review
- Conversations with property owners, the Mi'kmaq and community partners
- Open House
- Proposal to the Province

2022

- More Open Houses and community conversations
- Wind measurement continues
- Environmental studies continue

2023

- Engineering
- Building roads
- Construction

2024

- Turbine Installation
- Operations

Measuring the wind

Building the tower

Moving the hub

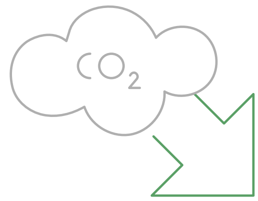
Single blades mounting

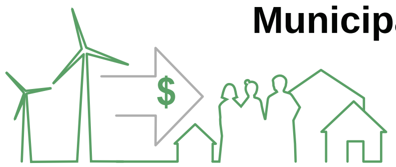
Completed turbine

Community Benefits

Carbon-Free Energy

- Power generated by Melvin Lake Wind would feed into local power lines, providing clean renewable energy for local electricity users





Municipal Taxes

- Melvin Lake Wind would pay more than $500,000 annually in property taxes to the municipality

Local Contracts and Jobs

During development and construction

- Jobs in site clearing, road building and concrete work
- More demand for local services, such as restaurants and motels
- Contracts for local businesses for clearing land, supplying gravel and road work

During operation

- Permanent operation and maintenance jobs
- Ongoing contracts for snow clearing, road maintenance and land reclamation
- Ongoing demand for local goods and services during life cycle of the wind farm

Community Benefits Fund

Melvin Lake Wind will establish this fund to contribute to...

- Well-being of surrounding communities
- Post-secondary schools for education and training in renewable energy
- Other ideas?

Melvin Lake Wind

Community Benefits

Have Your Say

The Community Benefits Fund will recognize the community's support and commitment to renewable energy in the area. What are your ideas about how to use the money? Use a sticky note to vote, or to write your own idea. Just post it on the board. You can also send us an email through the contact form at **www.melvinlakewind.ca**

Support for Students Studying Engineering and the Environment

Community Halls/ Recreation Centres

Local Environmental Programs

Your Ideas

Melvin Lake Wind

Who is planning the wind farm?

The Partners

Community Wind

Community Wind Farms Inc. works with local, national and international partners to help communities develop renewable energy.

Based in Halifax, Nova Scotia, the company works to develop the excellent wind resources of Atlantic Canada for the benefit of local landowners and communities, and to bring stability to electricity consumers across the region.

Community Wind has more than a decade of experience building wind farms with municipalities, local community groups and First Nations across Atlantic Canada.

CommunityWind
powered through partnership

ABO Wind Canada

ABO Wind is a renewable energy company developing projects in 16 countries. It was founded in Germany in 1996 and has grown to be one of Europe's leading developers with over 3,600 MW of developed capacity.

The company's business focuses on planning, financing, and managing wind farms, solar farms and hybrid energy systems. We are currently working on the development of new projects with a total capacity of about 15 gigawatts, exceeding the capacity of four average nuclear power plants. ABO Wind employs over 800 people, including seven staff based in Calgary.

ABO
WIND

Melvin Lake Wind

Thank You For Coming

We would like to hear from you. Send us a note through the contact form on the website. Check back regularly for more information and updates.

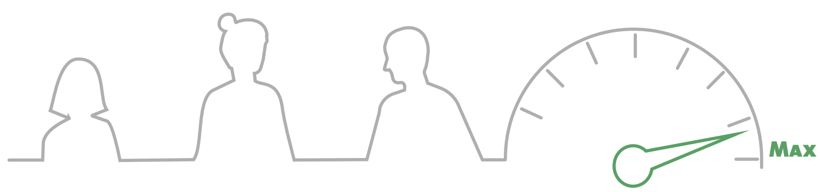
www.melvinlakewind.ca

Melvin Lake Wind

Masks Required

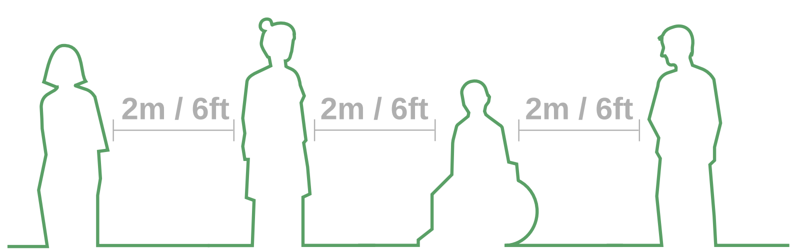
Maximum Occupancy

In an effort to protect the public and employees from the spread of COVID-19, we are limiting the number of people in this space.



Physical Distancing

Please keep 2 metres/6 feet away from others.



Feedback and Questions After the Open House

What are some ways this Project can provide a benefit to the community?

This Project will help Nova Scotia achieve its goal to close coal-fired power stations by 2030. With a great wind resource, our province can provide a highly competitive low carbon option compared to traditional non-renewable resources.

Electricity generated from the Project will feed into local transmission lines, providing renewable energy to homes and businesses within the area.

One financial benefit to the community is support for municipal services as the Project would pay a substantial amount in property taxes. For instance, a project with 16 turbines and a generating capacity of 80 megawatts would pay approximately $500,000 in property taxes to the municipality each year.

If the Project is awarded a contract to construct, we will hold a local job fair. We expect the construction and installation to require more than 200 person-years of work. The Project will require 2 to 3 full-time wind turbine service technicians at all times during its operating life.

The Project will require services and materials that our team will aim to source locally. We will work with local contractors and businesses to let them know of opportunities. These services could include road building and construction teams, general labourers, site security, pressure washing services, waste disposal, sanitary services, material suppliers (grout, safety equipment), welding services, snow removal and office trailers.

We have proposed that a Community Benefit Fund be established by the proponents, with the funding level determined by the size of the Project. The Fund would support community-level initiatives determined by a fund management committee. The committee would consist of community members and at least one representative from ABO Wind and/or Community Wind. We welcome ideas and suggestions about how the Fund could be used.

Q: How do we keep the community involved and up to date?
A: Community Wind and ABO Wind will mail updates to addresses in the areas surrounding the proposed Project. We will also update information on the website (www.melvinlakewind.ca) so that stakeholders outside of the immediate Project area can also stay informed.

Q: When is the next Open House?
A: If the proposed Project receives a power purchase agreement, we plan on holding another open house in spring 2022. By then, we will have more detailed information on the site, for instance, on wind speeds, the environment, suitable turbine technology and construction plans.

As important as sharing information, the open house would also allow us to collect more feedback, to better design and plan the Project.

Q: Will you be updating these assessments?
A: The proposed layout and turbine technology will likely change. We will update the visual and sound assessments to reflect the most up-to-date plan.

Q: What does the Project boundary mean?
A: The Project boundary is the outer limit of lands under contract for the Project. It does not necessarily mean that infrastructure will be placed on these lands. The final boundary may be much smaller than the proposed site.

Q: Will a turbine be placed on my land?
A: Community Wind and ABO Wind have contracts in place with landowners who will have infrastructure on their property.

Q: Can people continue using the land as they are (hunting, fishing, cutting wood)?
A: Project planning will be done to minimize restrictions on land use. Typically, most activities underway before construction of a wind site can continue afterwards.

Q: How do you protect wildlife?
A: As part of the regulatory approval process, an environmental assessment will be undertaken to understand the relationship between wind turbines and the local environment. This is a requirement of the Province of Nova Scotia. Through this analysis, our team will make the necessary adjustments to the Project to avoid or reduce potential impact on wildlife.

Q: What type of access is needed for the turbines?
A: An approximately 12-metre wide access road would be used for the construction phase. It would be reclaimed to a 5-metre wide access road for the life of the Project.

Q: How do you select the areas for the turbines?
A: We select sites by assessing wind patterns in the area – while maintaining the distance from the Project boundary, environmental features, and homes. Other factors are the ability to access and construct turbines at the location.

Q: How much tree clearing is needed?
A: Typically, 5 to 6 acres of land would be cleared for each turbine. Tree clearing is usually needed for

- access roads (described above)
- an area for construction, component staging and an office (approximately 200 metres by 200 metres)
- collector lines (approximately 5- to 10-metres in width)
- access to turbines once they are built (about 100 metres around each)

Q: What is the life expectancy of the Project?

A: The lifecycle of a turbine is typically 20 to 30 years. The life expectancy of this Project will be subject to the requirements set out by the Province of Nova Scotia within the Power Purchase Agreement, which we expect to be 25 years.

Q: Is your schedule achievable?
A: The current Project schedule is subject to change depending on the criteria in the upcoming Request For Proposals (RFP) by the Province of Nova Scotia.

Q: Who maintains the turbines, access road, equipment, etc.?
A: During the life of the Project, there will be a local site manager who will ensure the turbines, roads and equipment are well maintained and operating safely.

Q: When and what are you submitting? What is involved in the permitting process?
A: Community Wind and ABO Wind will submit a proposal in the Rate Based Procurement RFP issued by the Province of Nova Scotia. The submission deadline is expected to be in early 2022.

If the proposed Melvin Lake Wind Project receives a Power Purchase Agreement, the developers will carry out a variety of environmental and other studies, including those required by the Environmental Assessment Regulations set by Nova Scotia's Department of Environment and Climate Change. In addition to these studies, our team will conduct a consultation process with the local community before the Project moves forward.

Q: Why is the Project this size?
A: Several factors contribute to the size of a project such as the Melvin Lake site

- available lands under contract
- local electrical grid capacity
- wind profile
- local environmental features, and
- any applicable criteria outlined in the RFP.

Melvin Lake Wind Open House

Thank You for Attending

Community Wind and ABO Wind held an information session at Upper Hammonds Plains Community Centre on Sept. 15 about a proposed wind project that would be located on Crown Land and private land, south of Highway 101 and west of Pockwock Lake.

We wish to thank the many people who attended the event. They met the developers, learned about the development process and environmental studies underway and viewed illustrations of how the turbines might look and sound. They heard about jobs and contract opportunities and community benefits.

There were many questions. We will post our responses on the website in the near future.

Please contact us anytime through the contact form at www.melvinlakewind.ca

Bacon remembered as people's politician

Nova Scotia's 21st premier dies at his Upper Nappan home at 95

DARRELL COLE
SALTWIRE NETWORK

Former Nova Scotia premiers John Buchanan, left, and Roger Bacon, centre, speak with Cumberland South MLA Tory Rushton during a nominating meeting in 2018. SALTWIRE NETWORK

AMHERST — People always came first for Roger Bacon.

Before, during and after his storied political career — that lasted 35 years and included a short stint as Nova Scotia's premier — Bacon never forgot about the people who elected him first to Cumberland County's municipal council in 1958 and then to several terms in the provincial legislature beginning in 1970.

Cumberland County's "people's politician" died at home Monday evening. He was 95.

"He was a community leader and he showed that through his service on the council and as an MLA and then eventually as premier," said Morris Haugg, who wrote Bacon's biography, Me and My Team: From Farmer to Premier, in 2018. "His community service didn't end with his political career. I was part of helping to convince him to take on the chairmanship of the local hospital foundation and helped us with the Above and Beyond Campaign. That campaign would not have succeeded the way it did without his leadership and his own personal interest."

Bacon was a dairy farmer and a pioneer in the blueberry industry before being elected and serving as the MLA for the former riding of Cumberland East between 1970 and 1993. He was minister of tourism, agriculture, housing and deputy premier starting in 1978.

He was premier between Sept. 12, 1990 and Feb. 26, 1991, replacing John Buchanan, who resigned to accept a seat in the Senate.

In a 2018 interview following the release of Haugg's book, Bacon said he never aspired to be a politician.

"My goal in life was to be a farmer … my greatest recognition was when I had the reserve grand champion bull at the Royal Winter Fair in Toronto," Bacon said in the interview.

Haugg said Bacon was one of the first individuals he got to know when he arrived in Canada from Germany in 1980. He quickly became a close friend and supporter of Bacon's political life.

"For me this represents a huge personal loss," he said. "He was highly respected in the community as a farmer and as an entrepreneur as well as a sportsman."

Bacon was an avid hockey and baseball player when he was younger, as well as an active golfer and curler until his health would no longer permit it. Haugg said the former premier was a huge fan of Sidney Crosby and regretted never getting the opportunity to meet the Pittsburgh Penguins' star and Cole Harbour native.

Even though Bacon's political career ended with the 1993 provincial election, he stayed active in the community, at first supporting the campaign that resulted in a new regional hospital. He continued to support the hospital and the foundation through the creation of an endowment fund following the death of his wife, Clara, to help support the education of health-care professionals.

Bacon's son, Doug, said his father was always proud of where he came and was always a fierce supporter of the agriculture industry in Nova Scotia and the Maritimes.

"He lived a very fruitful, meaningful life," Doug said. "He got a lot of stuff done."

Bacon said his father always put community first, from his work on the farm, to his involvement in the Nappan United Church and the local hospital.

In 2005 he was presented an honorary doctorate of laws from Dalhousie University Agricultural College in Truro, he was honoured by the Amherst Rotary Club with its Community Paul Harris Fellowship and was presented with a Distinguished Service Award by the Cumberland Health Care Foundation.

"He did charity auctions, sang in the choir and his passion was agriculture," he said. "His life was farming, that's where it started. He got into municipal council because people wanted him to run. He said he was farming and didn't have time to campaign, but he still won."

Last year, the new bridge over the Nappan River on Highway 2 that runs by his Upper Nappan home was renamed the Roger S. Bacon Bridge.

Cumberland North MLA Elizabeth Smith-McCrossin sought advice from Bacon many times, including when she decided to run for the party leadership in 2018.

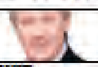
"He meant a lot to me. He was a mentor and a friend," Smith-McCrossin said. "In politics, there are not a lot of people you can trust, but I trusted him and I respected him. I really appreciated the advice he gave. He always stayed grounded regardless of how successful he was. … He loved Cumberland County and Nova Scotia. He was a very humble man, who was true to his Cumberland County roots."

Smith-McCrossin said the best advice she received from Bacon was to remember who she worked for — the people of Cumberland County.

Former Cumberland-Colchester MP Bill Casey said Bacon was a mentor to a lot of politicians.

"He inspired a lot of people to go into politics and the thing about him to me was he could predict the outcome of an election better than anybody, even long after he was out of politics," Casey said. "He had his finger on the pulse of politics around Nova Scotia. He could predict what was going to happen."

We won't see another Roger Bacon, and that's a pity



JIM VIBERT
SALTWIRE NETWORK
jim.vibert@saltwire.com
@JimVibert

Roger Bacon served just 167 days as Nova Scotia's premier, but the fact that he was there at all is testament to the esteem, trust and affection his colleagues held for him.

Bacon died Monday at the age of 95.

He was elevated to the premier's office in September 1990 after long-serving (1978-90) premier John Buchanan resigned amid controversy and more than a hint of scandal. Buchanan accepted then-prime minister Brian Mulroney's offer of a rainbow thanks, otherwise known as a Senate seat.

Bacon served as premier until the Tories elected Donnie Cameron their new leader, and premier, in a hotly contested race that included other Tory heavyweights Rollie Thornhill and Tom McInnis.

Bacon, the province's 21st premier, was untouched by the allegations of corruption and political patronage that plagued Buchanan and, by extension, his government during the latter years of Buchanan's tenure.

That unassailable record of integrity, along with his long service in the legislature — he was first elected in Cumberland East in 1970 and served until 1993 — made Bacon an attractive, but not obvious, choice to lead the government and party through what could have been a traumatic time.

He wasn't the obvious choice because the Tory caucus at the time was packed with more high-profile ministers, like Jack MacIsaac, Terry Donahoe and Ron Russell. None would seek the party leadership, so all were available to fill the premier's chair until a new leader and premier was selected.

But the Tories went with Bacon, and he turned out to be just what the doctor ordered.

With MacIsaac as his strong right hand, Bacon shepherded the government and party through the troubled waters Buchanan had left behind with a quiet, even demeanour and unfailing good humour.

He brought a sense of calm to a government that had been buffeted by stormy political weather for most of Buchanan's fourth and final term (1988-90).

Bacon was one of the more colourful politicians in Nova Scotia at a time when the province was awash in colourful politicians, like Harry How, Billie Joe MacLean, MacIsaac, Thornhill and more.

Bacon also possessed an uncanny ability to leave reporters scratching their heads because, while he seemed to answer their questions, few were able to discern precisely what those answers were.

Bacon was famed for his unique, occasionally hilarious, facility to mold and mangle the language in a way that always conveyed his meaning, but in unexpected ways.

I recall like it was yesterday when Bacon stood in the house and berated opposition MLAs for the "insinuendos" they were hurling about the place with little or no basis in fact.

His unexpected combination of insinuation and innuendo had its desired effect. It entertained his Tory colleagues immensely, left opposition members speechless and perplexed, and sent reporters scurrying for dictionaries to see if "insinuendo" was an English word.

A more famous Baconism — I didn't hear it, but have on good authority that he said it — was again in response to what he felt were the unfair and unjustified attacks on the government by members of the opposition — Liberals and very few New Democrats in those days.

"Mr. Speaker, I have heard the allegations and I know who the alligators are," Bacon is alleged to have said and, because I've heard many Baconisms, I have no reason to doubt it.

Whether the Baconisms — as they were then known — were a slip of the tongue or intended, as many of his colleagues maintained, we'll never know for sure. But they were invariably uttered with that telling twinkle in Mr. Roger's eye, which is a pretty strong hint that he knew exactly what he was saying.

The penchant for perplexing prose only seemed to bolster his stature as a simple, country farmer, and that's all he ever claimed to be.

He served in a variety of cabinet posts, including tourism, housing and the environment, but he cherished and distinguished himself as minister of agriculture, a post he held for most of Buchanan's 11-plus years in the premier's office.

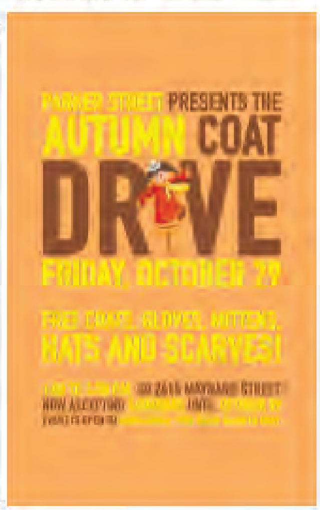
Roger Bacon was a farmer and the farmers' friend.

He infuriated opposition MLAs who questioned any aspect of the government's agriculture policy by accusing them of being "against the farmers."

I don't believe Nova Scotian farmers ever had a more dedicated champion in government than Bacon, and I doubt that Nova Scotia will ever see a politician like him again.

And that's a pity.

Journalist and writer Jim Vibert has worked as a communications adviser to five Nova Scotia governments.



Melvin Lake Wind
Project Update
March 2022

ABO Wind Canada and Community Wind are proposing the 100-megawatt Melvin Lake Wind project in response to Nova Scotia's Rate Based Procurement program for low-carbon, low-cost energy to fight climage change.

Up to 18 wind turbines would be placed on Crown land and private land south of Highway 101 and west of Pockwock Lake. This renewable energy project would produce enough electricity for 28,000 homes and displace approximately 2.2 million tonnes of CO2 equivalent over its liftime.

We appreciate your questions and comments. The Project continues to be informed by input from the community, regulators, and from environmental and technical experts.

We are mailing an update to households in communities close to the project, with a new map of the proposed development area. To learn more or to send a note see **www.melvinlakewind.ca**

CommunityWind powered through partnership

ABO WIND

DARTMOUTH PROVINCIAL COURT

Man arraigned in high-profile rape case

Complainant does not want publication ban on her identity: Crown

STEVE BRUCE
THE CHRONICLE HERALD
sbruce@herald.ca
@Steve_Courts

A man was arraigned in Dartmouth provincial court Tuesday on a charge of sexual assault in a high-profile case.

Brent Alexander Julien, 33, of no fixed address was arrested Feb. 2 and charged with sexually assaulting Carrie Low almost four years ago.

Low contacted police May 19, 2018, to report she had been abducted by a group of men outside a Dartmouth bar the night before and raped at a residence in East Preston.

Almost two years went by before Alexander Joseph Frederick Thomas of East Preston was arrested and charged in February 2020.

Thomas, 35, was awaiting

Carrie Low says she was abducted by a group of men outside a Dartmouth bar in May 2018 and raped at a residence in East Preston. Brent Alexander Julien, 33, was arraigned in Dartmouth provincial court Tuesday on a charge of sexual assault. FACEBOOK

trial on charges of sexual assault and forcible confinement when he was shot and killed at a home on Braeside Court in Dartmouth last Nov. 13. The charges were dismissed in provincial court three days later.

Low went to provincial court last October to get the publication ban on her identity lifted. "I have nothing to hide," she told The Chronicle Herald after appearing in court with a lawyer.

On Tuesday, prosecutor Alicia Kennedy told the court the Crown was not requesting a publication ban this time around, "given the wishes of the complainant."

Defence lawyer Tony Arnold, who appeared on behalf of Julien, requested a five-week adjournment to allow the evidence to be disclosed by the Crown.

The case will return to court April 19. Julien remains free on an undertaking to police that prohibits contact with Low.

Julien, formerly of Lake Echo, has been convicted of more than 45 criminal offences in Nova Scotia since 2007. His record includes 11 convictions for assault-related offences.

At his most recent sentencing in June 2021, he received 90 days in jail, followed by 18 months' probation, after pleading guilty to charges of assault, uttering threats and breaching release conditions.

Low has criticized police for their handling of her case.

In May 2019, after months of inaction by investigators, she filed a complaint against Halifax Regional Police with the Nova Scotia Office of the Police Complaints Commissioner.

The complaint was promptly rejected on the basis that it had been filed beyond the six-month window for complaints against municipal police officers.

Low then went to Nova Scotia Supreme Court for a judicial review of the commissioner's decision. In a ruling released in April 2020, Justice Ann Smith set aside the decision and sent the complaint back to the commissioner for determination.

Low also filed a lawsuit against HRP and the RCMP, accusing them of mishandling her case after a member of the integrated sexual assault team told her the matter wasn't being investigated properly.

ST. PATRICK'S DAY

No 'Kiss me, I'm Irish'

March 17 will be festive, with caution

STEPHEN COOKE
THE CHRONICLE HERALD
scooke@herald.ca
@SH_scooke

COVID-19 restrictions have eased enough that local Irish-themed establishments can celebrate St. Patrick's Day for the first time in three years this week, but it's still not quite the pot of gold at the end of the rainbow.

"For one thing, I don't think anyone's going to be saying, 'Kiss me, I'm Irish,'" chuckled the Old Triangle's proprietor Brian Doherty, who's curious to see what the turnout will be when the Bedford Row pub opens its doors for the traditional fry-up breakfast with a pint of Guinness at 7 a.m. on Thursday.

Like many establishments around the city, from Durty Nelly's and the Carleton up the hill to Serpent Brewing in Spryfield and Fisher's in Bedford, there will be live Celtic music and yes, in some places the return of green-dyed beer is being proclaimed as an attraction. But with Phase 2 restrictions still in effect, only days before COVID-19 restrictions are lifted entirely on March 21, things will be a little more subdued than on St. Paddy's Days of yore.

"It's not going to be the sort of free-for-all it was, where people can mill around all over the place and just go where they want to go," said Doherty, who also performs his first set in seven months with his musical partner Kevin Evans in the Triangle's upstairs Snug venue on Thursday night.

"You come in, you sit down, you have your meal and a few drinks, and the mingling aspect has been removed, compared to what it used to be."

Currently, licensed establishments can operate at 75 per cent capacity with a distance of two metres between tables, and a maximum of 25 people per table. Masks will still be required to be worn when not seated, and live music is permitted as long as performers maintain a minimum physical distance of two metres from patrons.

Dancing is also permitted, with a mask, but social distancing requirements will make that difficult in most busy Irish pubs, so in most places, patrons will have to be content with tapping their

With the recent easing of COVID-19 restrictions, Nova Scotian Irish folk duo Evans & Doherty are able to perform their first show since September on St. Patrick's Day at the Old Triangle in Halifax. CONTRIBUTED

minimally about whether or not to celebrate St. Patrick's day this year, but our employees and our guests basically said they're ready to move on," said Durty Nelly's owner Joe McGuinness, who will also be open early on Thursday for pre-workday breakfasts and pints.

"I was a little concerned about reopening too soon, because we've all come so far. Collectively, Nova Scotians have done a phenomenal job, but here we are, we're about to open up fully on the 21st, but our employees and our customers do wish to celebrate, so we will accommodate them within the constraints of the existing restrictions. We'll be mindful of making sure people have a good time with some sense of normalcy while observing the good practices of wearing masks, sanitizing and social distancing wherever possible."

COVID-19 reached the pandemic stage in Canada in mid-March of 2020, shutting down St. Patrick's Day events for that year, and a year later in 2021, most drinking establishments wisely opted not to encourage mass gatherings since most Nova Scotians weren't vaccinated and more stringent restrictions were still in effect.

For some, venturing out to a crowded restaurant, bar or brewery on March 17 is something best left

watching John Ford's classic County Galway-filmed classic The Quiet Man starring John Wayne and Maureen O'Hara at Cineplex Park Lane Theatre to a free streaming concert with artists from Nova Scotia and around the world presented by Halifax's ReJigged Festival and the Goderich Celtic Roots Festival on Thursday at 7 p.m.

Halifax musician and folklorist Dusty Keleher, a regular performer at the Halifax Brewery Market, is kicking off the musical lineup at Finbar's in Bedford on Thursday, and is looking forward to being back on stage. But as a board member for An Cumann — Irish Association of Nova Scotia, he has an option for those who'd prefer to raise a glass at home.

"We are again disappointed not to have our annual family Ceili for the third year in a row," said Keleher, who points interested participants to An Cumann's online celebration.

"We asked musicians in the Irish music and dance communities to submit tunes and songs, and Ronan O'Driscoll submitted a video of a reading from his novel, Chief O'Neill. It can be found on the An Cumann — Irish Association of Nova Scotia YouTube page."

For Stewart MacNeil of Cape Breton family Celtic band the Barra MacNeils, playing on St. Patrick's Day

played bash at the Lower Deck and a concert at the Rebecca Cohn Auditorium in the middle of a blizzard to the many symphony shows they've been invited to take part in on the Irish holiday that's taken on a kind of pan-Celtic acknowledgement of the island's cultural contributions.

On Thursday, the Barra MacNeils play their first concert since the Omicron wave brought the group's Christmas tour to a premature end in December, with a special St. Patrick's Day celebration at Sydney's Membertou Trade & Convention Centre, with special guests, Mi'kmaq fiddler and singer-songwriter Morgan Toney and the MacArthur School dancers.

"It's a licensed event, but it's an all-ages event as well, and the COVID protocol is being followed, in case people are worried about going," said band member Stewart MacNeil, eager to see an annual tradition return to the band's event calendar.

"There are still people who are worried about going out, but it's going to be a blast and we hope to see people come out. It's a big space, the ventilation is good, and it has the best sound in Cape Breton. If somebody wanted to get up and move around a bit, I'm sure it wouldn't be an issue."

Just remember to keep the equivalent of two shillelaghs between your bubble and the folks doing a jig next to you.

Why we need wind power

The Government of Nova Scotia has introduced legislation that requires 80 per cent of electricity to be supplied by renewable energy by 2030. This commitment to a greener source of energy requires the province to phase out the use of coal over the next 8 years.

To meet these targets, the province has asked renewable energy companies to propose projects to supply low-carbon, low-cost energy. This spring, companies will bid into a request for proposals (RFP) process through the Rate Based Procurement Program. The winning bids will be awarded Power Purchase Agreements with Nova Scotia Power Inc. to supply renewable electricity generation for their customers.

In addition to supporting Nova Scotia's goals to fight climate change, this procurement will encourage investment and create jobs. See https://novascotiarbp.com

Expected Timeline

Spring 2022	ABO Wind and Community Wind submit RFP proposal Begin environmental and other studies required by Environmental Assessment (EA) Regulations
Summer 2022	If the Project receives a Power Purchase Agreement, install wind measurement tower and continue environmental studies
Fall 2022	Environmental studies continue
Winter 2022-2023	EA submission goes to the Province
Summer 2023	EA receives approval from the Province
Fall 2023	Construction begins with clearing and road building
Summer 2025	Commissioning – turn on the wind farm

Project Consultation

Consultation will continue through the life of the Project with stakeholders and First Nations. Currently, we are in the planning stage. There will be ample opportunity to ask questions, make comments and provide input during the Project design and environmental assessment stage.

We will continue to provide Project updates and correspond on a timely basis, through our website, open houses, mail-outs, personal meetings and expanded communication channels. Our objective is to facilitate open, honest and respectful discussion with all those interested in the Project.

Our Partnership

Community Wind Farms Inc. (Community Wind) is a local renewable energy company with development projects across Atlantic Canada.

ABO Wind Canada Ltd. (ABO Wind), a wholly owned subsidiary of ABO Wind AG, is a global company with extensive experience in renewable energy development.

Together, we are developing renewable energy projects throughout Nova Scotia.

Our Values

We commit to being part of the solution by working on projects that help reduce carbon emissions. The transition to a climate friendly, sustainable energy supply, based on renewable energies, is critical.

We value input from communities and First Nations and commit to promoting and participating in open, honest and respectful communication. We understand and acknowledge that projects can have an impact, and we work to minimize those impacts and to maximize social benefits.

Contact us

Send us an email through the website.
You can also contact us directly.

Bill MacLean, President
Community Wind Farms Inc.
Email: bill@communitywind.ca
Phone: (902) 222-9810

Dave Berrade, Social Impact and Engagement Lead
ABO Wind Canada Ltd.
Email: dave.berrade@abo-wind.com
Phone: (902) 802-4540

www.melvinlakewind.ca

CommunityWind
powered through partnership

ABO WIND

Melvin Lake Wind Project Update

March 2022

Community Wind and ABO Wind Canada are proposing the 100-megawatt Melvin Lake Wind Project in response to Nova Scotia's recent Rate Based Procurement Program. An estimated 18 wind turbines would be placed on Crown land and private land, just south of Highway 101 and west of Pockwock Lake. This renewable energy project would generate enough electricity for 28,000 homes and displace approximately 2.2 million tonnes of CO_2 equivalent during its lifetime.

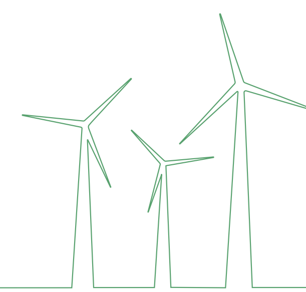
Thank you for your feedback

We held our first open house for the proposed Project in September 2021. We appreciate community members taking the time to come out to the event to learn more and discuss the Project.

Thank you for your calls and emails. We continue to respond to your questions and comments. We have captured many of the questions at **www.melvinlakewind.ca**.

Our Project continues to be informed by ongoing input from the community, regulators, and environmental and technical experts.

See inside for a revised map of the proposed Project area



12 Questions

Here are the most common questions that we have heard from community members. For more topics, please see **www.melvinlakewind.ca**

1 **Are wind turbines really that "green"?**

Third-party studies have confirmed that wind turbines typically offset greenhouse gases emitted as part of their production and installation within the first year of operation. When the whole cycle of production and operations is considered, wind energy is recognized as one of the "greenest" or least carbon intensive forms of energy production.

2 **How do you select the areas for the turbines?**

There are many factors to consider in siting wind turbines – our ability to keep setbacks to at least 1,000 metres from homes, the wind resource, environmental features, access to transmission lines, and the ability to access and build turbines at the location.

3 **What will we see?**

The visibility of each turbine depends on the viewpoint. On the Project website there are preliminary visual simulations prepared by a third party. During development, we will ask community representatives to offer more viewpoints for more detailed visual impact assessments.

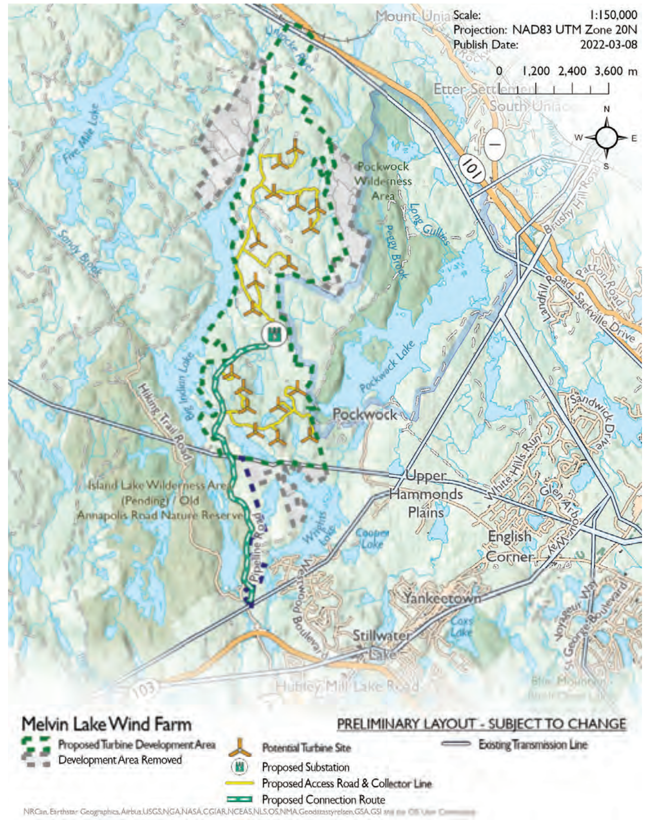
4 **Will the turbines be noisy?**

During development, we will prepare a detailed noise impact assessment with a map showing sound emissions in relation to nearby residential properties. As the Project team gains more information about the area and the wind, the engineers adjust their recommendations about turbine models. Once we have selected a model, more information will be made available.

5 **How does the community benefit from this Project?**

We anticipate many benefits to the community such as

- tax revenue for the municipalities to provide services to residents
- short-term and long-term jobs and contracts in site clearing, road building, electrical, construction and concrete work, and ongoing maintenance
- revenue to local businesses during construction, for accommodations, restaurants and catering, and other services
- benefit funds to provide financial support to the community hosting the Project, for community-level initiatives
- revenue to local landowners from leases signed with the developer



This updated map is preliminary and subject to change based on additional stakeholder, environmental, regulatory, and technical input.

6 **How do you protect wildlife?**

As part of the regulatory approval process, an environmental assessment will be undertaken to understand the relationship between wind turbines and the local environment. This is a requirement of the Province of Nova Scotia. Through this analysis, our team will make the necessary adjustments to avoid or reduce potential impact on wildlife.

7 **Will people be able to use the land as they have been (hunting, fishing, cutting wood)?**

Project planning will be done to minimize restrictions on land use. Typically, most activities underway before construction of a wind site can continue afterwards.

8 **How will traffic be affected during construction?**

Before constuction begins, the Project team will circulate a traffic management plan to the municipality, local police services and the community. It will outline mitigation measures, such as site speed limits and daily work hours. There will be public notification of various stages of construction traffic to and from the site.

9 **Who maintains the turbines, access road, equipment, etc.?**

During the life of the Project, there will be a local site manager who will ensure the turbines, roads and equipment are well maintained and operating safely.

10 **How big will the turbines be?**

A few factors contribute to the choice of wind turbines, such as the wind profile and the height of nearby vertical obstacles. The Project is still at a preliminary stage. Once we have more wind data to tell us where the wind blows strongest, we can choose a turbine. We anticipate the hub height would range from about 100 to 120 metres with an approximate blade length between 60 and 85 metres.

11 **Will safety lights have to be on all night?**

Aviation warning lights on wind turbines are required by Transport Canada regulations. However, the Project is exploring the feasibility of light mitigation options to reduce the visibility to those on the ground.

12 **Will the wind farm affect property values**?

Studies have been conducted on property sale data in and around wind farms in Canada, the United States, and internationally. Data gathered cannot support or disprove the impact on property values.

In Ontario, the Municipal Property Assessment Corporation examined assessments of properties located at 1, 2, and 5 kilometres from wind turbines. The studies found that for 2012 and 2016, there were no conclusive findings on the prices of residential properties resulting from the proximity to a turbine. See https://www.mpac.ca/en/PropertyTypes/SpecialStructuresProperties/Windturbinesnearorproperties.

Our options for producing renewable power are shaped by Nova Scotia's geography and weather. The most affordable and reliable option is harnessing the strong winds. The requirements for good wind projects limit where they can be located. We are proposing this Project for a specific area with strong wind, where we can meet setback requirements from homes and we can access power transmission lines.

Melvin Lake Wind
Project Update
May 2022

Community Wind and ABO Wind Canada are proposing the 100-megawatt Melvin Lake Wind project in response to Nova Scotia's Rate Base Procurement program for low-carbon, low-cost energy to fight climate change.

Project layout revised based on community input

After hearing feedback from the community, we are removing 3 wind turbines from the proposed Melvin Lake Wind site. There are now 15 turbines instead of 18.

Please check the mail for a new flyer showing a revised map, and the website for updates at www.melvinlakewind.ca.

Consultation will continue throughout the life of the project, with those living in the area, First Nations, and local businesses. If you would like to speak to a project team member directly, please call Dave Berrade, Social Impact and Engagement Lead, at 902-802-4540.

CommunityWind
powered through partnership

ABO WIND

SEASONAL HOMEOWNERS TAX

New plan to be changed: premier

STUART PEDDLE
THE CHRONICLE HERALD
speddle@herald.ca
@Goylabs

Premier Tim Houston holds court at the Halifax Chamber of Commerce as he gives the state of the province address at the Halifax Convention Centre Tuesday. ERIC WYNNE • THE CHRONICLE HERALD

Nova Scotia is adjusting the planned tax on out-of-province home ownership following an outcry from seasonal residents.

Premier Tim Houston told a gathering of Halifax Chamber of Commerce members during his state of the province address on Tuesday that his government will change the plan so that serving military members will be exempt and the tax will be applied on a graduated basis, so homes with lower assessments will get a lower rate.

"We move fast," Houston said. "Sometimes we need to pause and adjust course. You folks do that every day in business and government should be no different. We're not so arrogant that we can't admit when we need to adjust."

Assessments up to $150,000 will be exempt; the tax will be 0.5 per cent on value between $150,000 and $250,000 and the tax will be two per cent on the value above $250,000.

"We looked at the average home size, we looked at what's happening with assessments and we figured that that was kind of a reasonable amount," Houston told assembled media after his speech in front of more than 800 lunch guests at the Halifax Convention Centre.

"Obviously we want to protect the family cottage, that's a main driver in this whole discussion, is we want to protect that. So we figured with that $150,000 and then have the additional (level) over that, that that protects the family cottage."

All vacant residential land owned by non-residents will be taxed at two per cent regardless of the assessed value.

The premier said the change will affect the projected revenue from the plan, which was initially more than $80 million. It will instead take in $25.2 million.

"It's significant," he said. "We protected a lot of property owners."

No changes will be made to the spring budget's deed transfer tax, and the premier said he had not heard any push-back on that.

"Nova Scotians were very clear with me on the weekend," Houston said. "I was out around two fire departments, craft sales, even the hair salon getting my hair done and I spoke to a lot of Nova Scotians and directionally, they like what's happening here. That was overwhelmingly positive, but they said just make sure that you find that balance."

He said his government is happy with the policy. In announcing the changes during his speech, said it was "a more than fair" compromise.

DEFICIT CONCERNS

In response to Chamber concerns about the projected $500 million deficit and increasing debt, Houston also touted the province's plans to improve health care, invest in infrastructure and commitment to increasing housing supplies.

"I can tell you as an accountant, as a Progressive Conservative, a $500 million deficit is turning my hair even a little bit greyer, for sure," Houston said. "But I have great faith in Minister (Allan) MacMaster and his team and in preparing the budget, there's really only one question we asked ourselves: What type of province do we want? What type of province do Nova Scotians want? When you really focus on that guiding principle, the path is always clear. We have to invest in people."

He said the province's population has topped one million and he wants to see that double so that businesses will not find it such a struggle to find staff.

"We know that people won't make their home here if they can't access health care, so we're focused on health care," he said to media after his speech. "We know that housing is an issue for people, so we're focused on housing. As a government, we're focusing on the things that Nova Scotians have asked us to focus on and people want to be here."

He said population growth will drive the economy over the long term. During his speech, he cited Statistics Canada data saying Nova Scotia's economy has grown faster than other provinces with the exception of P.E.I. and British Columbia.

"Our economy is growing, we are on the move," Houston told the audience. "Nova Scotia has every potential. … You can do whatever you want right here in this province."

HEALTH CARE

He also said there was a lot of work to do to fix health care.

"I want you to know that we're on it," he said. "We just passed the largest health care budget in our province's history – $5.7 billion in health care spending alone."

Houston said it's about making the investment count, as opposed to just throwing money at the problem.

"We increased the wages of our CCAs without being under the pressure of contract negotiations. (We) gave them a fair wage – a fair wage that's now the highest in Atlantic Canada."

He also touted the moves to open urgent treatment centres in Cape Breton and Cumberland County as well as providing presumptive drug coverage to firefighters for a variety of cancers and supports for those seeking fertility treatments.

Other concerns raised in a question-and-answer session after his speech included rising cost of living and whether something can be done to tackle fuel costs.

"We'll continue to evaluate and assess," he said to media. "The swings on the world market have been pretty extreme. It's been very difficult for any provincial government to tamp those swings down. … My message to Nova Scotians is we understand the pressures you're feeling and where we can take steps to support you, we will continue to do that as a constant exercise."

Houston told the crowd the province will encourage the trades by making removing provincial income tax for tradespeople under the age of 30 on the first $50,000. There will also be a rewards program of some sort coming soon called Nova Scotia Loyal to reward consumers who buy from local producers to stimulate the economy.

OPPOSITION REACTION

Outgoing Liberal party Leader Iain Rankin was happy the government adopted what he said was the Liberal party's idea on exempting military members.

"They also eased the burden on the majority of the people that will be impacted, so we're pleased to see that," Rankin told media after the event. "It is bad policy but at least they're showing that they're listening to people's concerns."

But, he said, the money should be going to municipalities and the province shouldn't be reaching into municipal jurisdiction.

"I think that you have a lot of people that this is going to protect, but still, I think it's bad policy. People who have seasonal property here spend a lot of money and our caucus stood up for those people."

Rankin said the plan is still a tax grab, just not as bad as before.

NDP finance critic Lisa Lachance said the fact changes needed to be made so soon reflects how rushed the spring session of the legislature was.

"I think one of our main concerns is that people who talk about this, people who write newsletters, the voices we heard, everyone's been empathetic to the need for more housing in Nova Scotia, but this actually isn't dedicated for housing money. So I think one of our main concerns about this tax is if we're going to have it, it needs to go toward housing."

Melvin Lake Wind
Project Update

May 2022

Community Wind and ABO Wind Canada are proposing the 100-megawatt Melvin Lake Wind project in response to Nova Scotia's Rate Base Procurement Program. We will submit our proposal this month. The project would provide local green energy into the power grid for local residences and businesses to use. It would help Nova Scotia achieve its goal to phase out the burning of coal as an energy source – and displace approximately 2.2 million tonnes of CO_2 equivalent during its lifetime.

Revised project layout based on community input

After hearing recent feedback from the community, we are removing 3 wind turbines from the proposed Melvin Lake Wind site.

The project is currently in the early stages of development, and this layout is still preliminary. It continues to be informed by ongoing input from the community, regulators, and environmental and technical experts. If the project is successful in the request for proposals, there will be ample opportunity to provide input during the design and environmental assessment (EA) stage. An independent third-party will conduct the EA, which we anticipate will go to the Province for review in December 2022. The public will be able to make comments.

Consultation will continue throughout the life of the project, with those living in the area, First Nations, and local businesses.

Benefits to Community

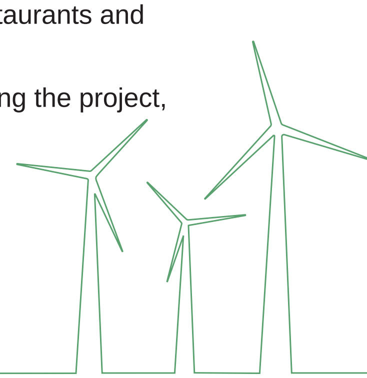
Up to $22 million in property tax to the municipality over the life of the project that can be used for local services and infrastructure

Short-term and long-term jobs and contracts in site clearing, road building, electrical, construction, concrete work, and ongoing maintenance – including 75 to 125 local jobs during construction, and high-paying permanent jobs for operations and maintenance

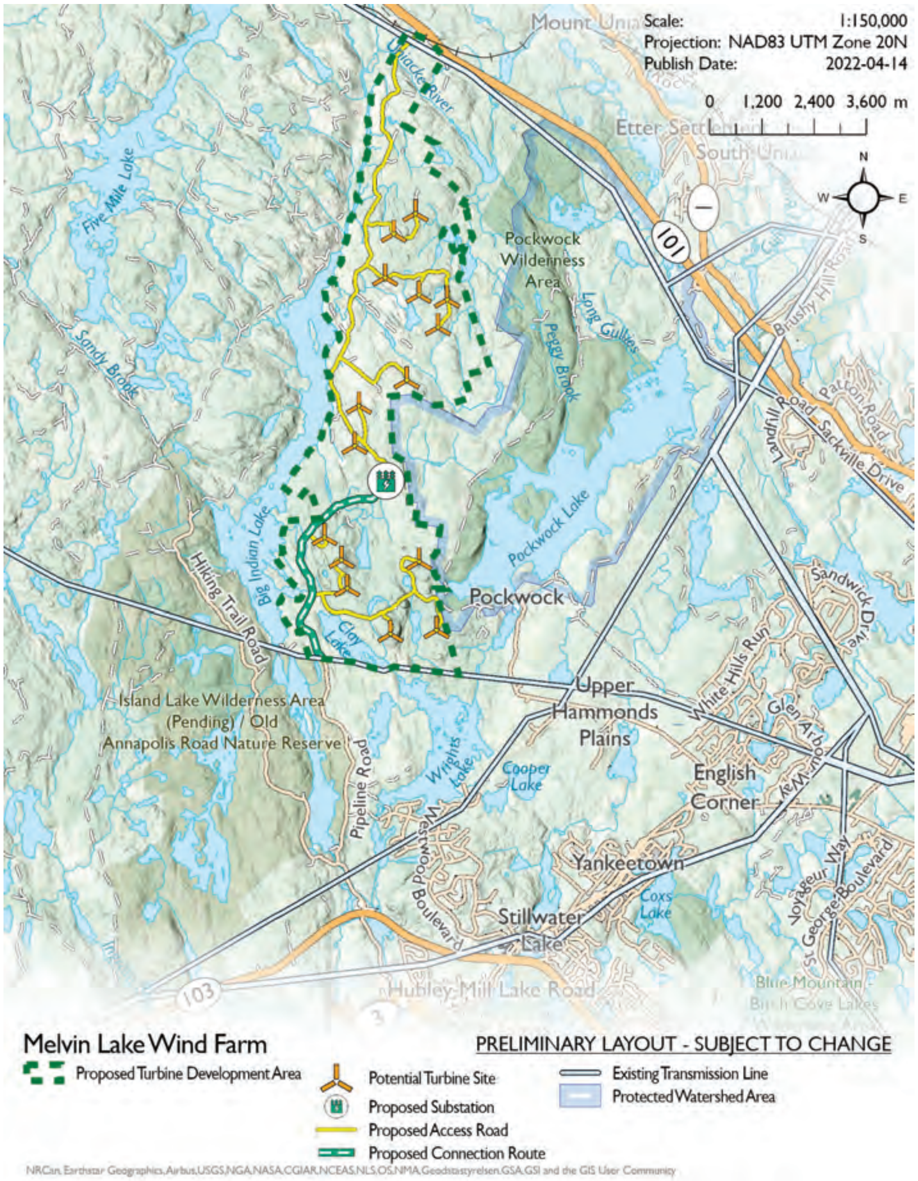
Revenue to local businesses – during the construction period, tens of millions of dollars in materials and services could come from local businesses, including for accommodations, restaurants and catering, and other amenities

Benefit funds will go to the community hosting the project, for community-level initiatives

Revenue to local landowners from leases signed with the developer



Please flip over to see an updated map



In this updated map, there are 15 turbines rather than 18. The project would generate enough green power for 28,000 homes. Note: The proposed turbine locations are subject to change, based on local resident, community, environmental, regulatory, and technical feedback.

We acknowledge that the proposed project is in Mi'kma'ki, the ancestral, unceded territory of the Mi'kmaq people. We are grateful for the Treaties of Peace and Friendship with the Mi'kmaq people, which set out long-standing promises, mutual obligations, and benefits for all parties involved.

www.melvinlakewind.ca

We will continue to provide updates through our website, open houses, mail-outs, and through meetings and correspondence. Our objective is to facilitate open, honest, and respectful discussion with all those interested in the project. If you have any questions or concerns, please contact us below or through the website form. We can also meet virtually or in person.

Bill MacLean, President
Community Wind Farms Inc.
Email: bill@communitywind.ca
Phone: (902) 222-9810

CommunityWind powered through partnership

Dave Berrade, Social Impact and Engagement Lead
ABO Wind Canada Ltd.
Email: dave.berrade@abo-wind.com
Phone: (902) 802-4540

ABO WIND

Melvin Lake Wind Project

June 2023

We would like to give you an update on our Melvin Lake Wind Project, a collaboration of ABO Wind Canada Ltd. (ABO Wind) and Acadia First Nation.

Upcoming Open House

ABO Wind invites you to attend an upcoming information session to learn more about the Project:

Thursday, July 13 - 6pm - 8:30pm (drop-in)
Estabrooks Community Hall
4408 St Margarets Bay Rd
Lewis Lake

ABO WIND

The Project

Renewable Energy in Nova Scotia

Nova Scotia has one of the most ambitious climate change plans in Canada with a target to close all the coal power plants and reach 80% renewable energy by 2030. These ambitious targets require more renewable energy in our province.

The Green Choice Program (**www.novascotiagcp.com**) was developed collaboratively between the Province of Nova Scotia, renewable energy developers, Nova Scotia Power, and large energy buyers. It will allow participating customers to purchase up to 100% of their electricity from local renewable energy sources.

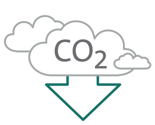
About the Project

The Melvin Lake Wind Project ("the Project") is being proposed by ABO Wind Canada Ltd. ("ABO Wind") in response to the Green Choice Program. ABO Wind is partnering with Acadia First Nation to develop the Project. As a 51% partner, Acadia First Nation is actively collaborating with ABO Wind to conduct environmental assessments, develop capacity building, employment and economic opportunities, and acting as an environmental steward for the land.

The Project would place 15 wind turbines on Crown and private land south of Highway 101 and west of Pockwock Lake. The Project area of interest was initially selected due to low grid connection cost and proximity to Halifax, favourable wind speeds, an existing network of forestry roads, land topography, grid capacity and the ability to adhere to and exceed company, municipal and provincial setback guidelines.

The Project will:

- Have an expected capacity of 105 megawatts, providing clean energy to the grid, powering local residences and businesses, generating enough energy for 25,000 homes annually.



- Help Nova Scotia achieve its goal to phase out burning coal as an energy source and displace approximately 2.2 million tonnes of CO2 equivalent during its operational lifetime.

- Include other associated infrastructure, including a substation, a control building for site maintenance, access roads, underground collector lines, a transmission line, and meteorological towers.

Environmental Studies

Updated information on environmental studies, potential impacts, and mitigation measures will be shared in more detail in our next mailout and at our open house.

ABO Wind is working with local third-party experts to complete the required technical and environmental studies needed to support the siting of wind turbines. Studies include analysis of shadow flicker, visualizations/renderings of turbine locations, expected sound levels, and more. This information will be incorporated into an environmental assessment ("EA") submission to the Provincial government this year. Some of the study results include:

- Wildlife surveys, including targeted Mainland moose surveys, identified a variety of species including White-tailed deer, Eastern coyote, Snowshoe hare and Bobcat. Although no evidence of Mainland moose was observed, potential habitat has been identified and documented.

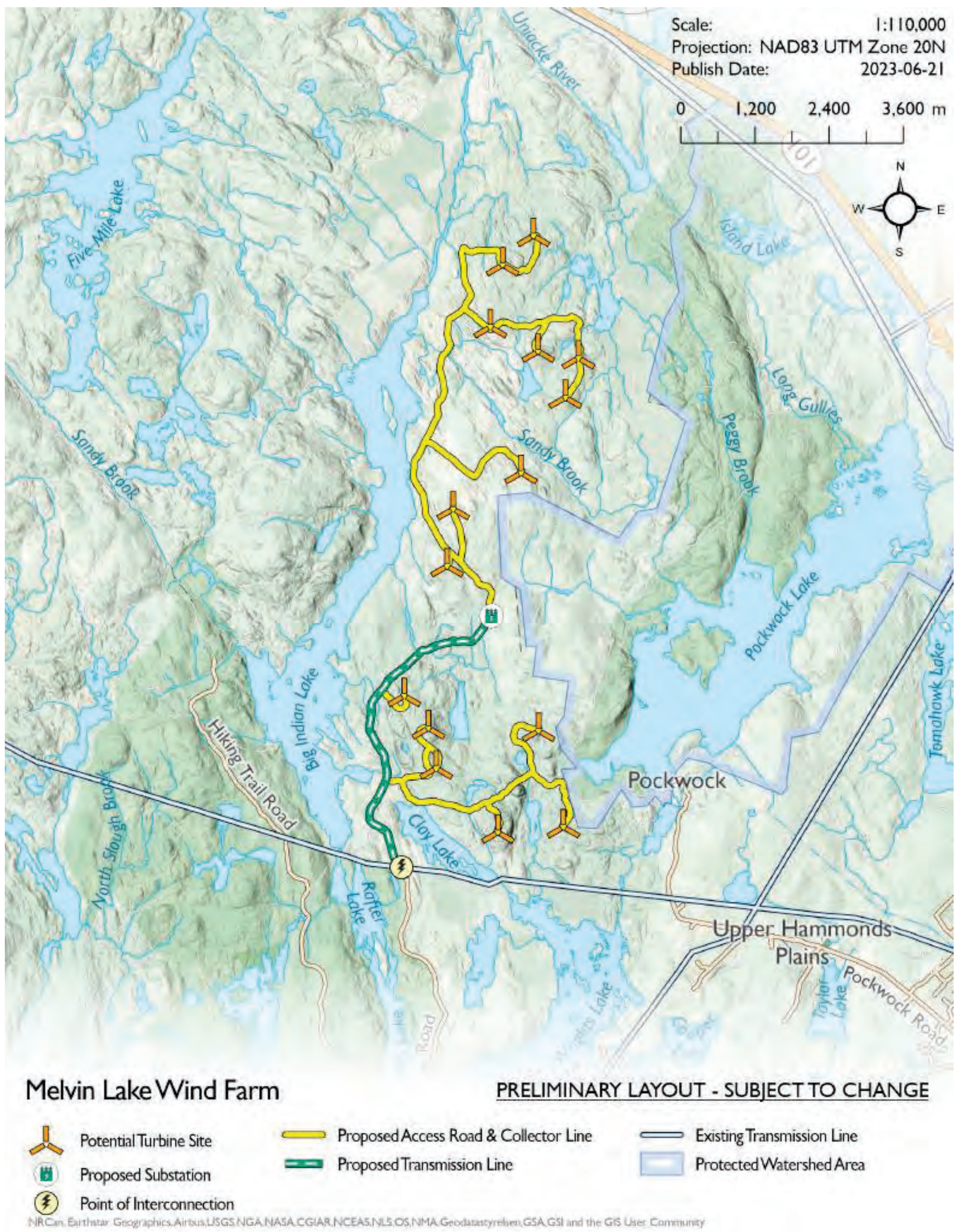
- Identification of old growth stands and lichen species at risk to avoid, including blue felt lichen.

- Wetland and watercourses were mapped throughout the site and incorporated into Project design to minimize direct impacts.

- Avian (bird) assessments included year-round surveys to highlight species presence on site, as well as radar surveys to document large-scale migratory events and avian activity within the airspace of the Project.

A Mi'kmaq Ecological Knowledge Study (MEKS) is being completed to understand any historic and current Mi'kmaq land and resource use.

Field studies have already resulted in adjustments to turbine locations, informed by the mainland moose recovery plan, and to avoid old growth forest and wetlands. Our Project continues to be informed by ongoing input from the community, regulators, and environmental and technical experts.



Benefits to Community

An estimated $20-25M in property tax to municipalities over the life of the Project that can be used for local services and infrastructure.
Short-term and long-term jobs and contracts in site clearing, road building, electrical, construction, concrete work, and ongoing maintenance – including 75 to 125 local jobs during construction, and several permanent jobs for operations and maintenance.
Revenue to local businesses – during the construction period, tens of millions of dollars in materials and services could come from local businesses, including construction subcontracts, accommodations, restaurants and catering, and other amenities.
Benefit funds will go to the community hosting the Project, for community-level initiatives and regional investment.
Revenue to local landowners from leases signed.

Ongoing opportunities for feedback

Ample opportunities remain to ask questions, make comments, and provide input throughout 2023 as ABO Wind continues to consult the community and proceed with our project planning. ABO Wind will continue to provide updates through the Project website, open houses, mail-outs, meetings, and correspondence. ABO Wind's objective is to facilitate open, honest, and respectful discussion with all those interested in the Project.

Timeline

Ongoing	ABO Wind's team is working on engagement with local community groups and businesses, First Nations, government, and other relevant organizations in the region. Consultation will continue throughout the life of the Project.
Summer 2023	Open House information session on July 13, 6pm-8:30pm, Estabrooks Community Hall, Lewis Lake.
September 2023	The Project's EA will be submitted to the Provincial government for review and approval. The EA process provides additional opportunities for citizens to share feedback on the Project.
December 2023	The Project will be submitted for the Green Choice Program.
March 2024	Anticipated Green Choice project award.
2024	Construction begins with tree and road clearing.
2026	Commissioning – The Project is producing clean energy.

Questions and additional information

If you have any questions or concerns ABO Wind invites you to reach out to Heidi Kirby, Communications Coordinator at the Halifax office: **heidi.kirby@abo-wind.com or (902) 329-9907**. ABO Wind is open to meet virtually or in person. Many of the questions already asked by the public have responses available at **www.melvinlakewind.ca**

ABO Wind Canada acknowledges that the proposed project is in Mi'kma'ki, the ancestral, unceded territory of the Mi'kmaq people. We are grateful for the Treaties of Peace and Friendship with the Mi'kmaq people, which set out long-standing promises, mutual obligations, and benefits for all parties involved.

ABO WIND

ABO Wind's Open House

Melvin Lake Wind Project

ABO Wind Canada invites you to attend an upcoming information session to learn more about the Project

Thursday, July 13

6pm - 8:30pm (drop-in)

Estabrooks Community Hall
4408 St Margarets Bay Rd.
Lewis Lake

ABO WIND

www.melvinlakewind.ca

ABO Wind Company Profile

~1,000 employees worldwide, ~25 in Canada
Headquarters in Germany, 28 office locations worldwide

Internationally active in 16 countries
Europe, North & South America, Africa

Core business is development & construction
Wind, solar, green hydrogen and battery systems

$7 billion invested in Projects
Approx. 5,000 megawatts developed and sold

21,000 megawatts under development
supported by $200 million in equity & favourable financing

Listed on the stock market since 2012
Profitable since company's inception in 1996

Melvin Lake Wind Project **Local Benefits**

ABO Wind commits to creating a lasting positive impact in the communities where we develop renewable projects.

The Melvin Lake Wind Project will generate the following positive benefits for the surrounding community:

- An estimated $20-25 million in property tax to the municipalities over the life of the Project that can be used for local services and infrastructure
- During construction, tens of millions of dollars in materials and services could come from local businesses, including construction sub-contracts, accommodations, restaurants and catering, and other amenities
- 75 to 125 short-term and long-term jobs/contracts in site clearing, road building, electrical, construction and concrete work, and ongoing maintenance
- Revenue to landowners from leases signed with the developer
- Hundreds of thousands of dollars for local community initiatives

Scan the QR Code to learn more about the Project and access interactive maps:

www.melvinlakewind.ca

Melvin Lake Wind Project Part of Nova Scotia's Clean Energy Transition

ABO WIND

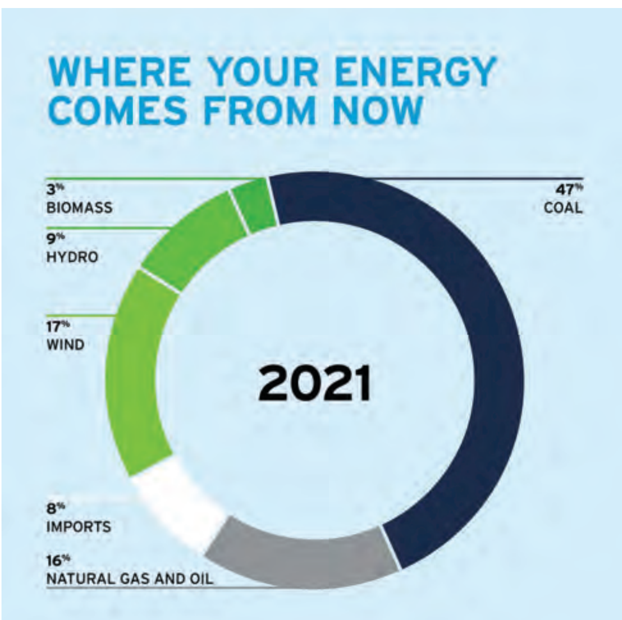
The Melvin Lake Wind Project is being proposed by ABO Wind Canada in response to the Green Choice Program.
ABO Wind is partnering with Acadia First Nation to develop the Project. As a 51% partner, Acadia First Nation is actively collaborating with ABO Wind to create capacity building, employment and economic opportunities, and acting as an environmental steward for the land.

Clean Energy for Nova Scotia

This Project will harness our Province's wind to produce enough clean energy for **25,000 homes annually**.

Nova Scotia has one of the most ambitious climate change plans in Canada with a target to close all the coal power plants and reach 80% renewable energy by 2030. These ambitious targets require more renewable energy in our province.

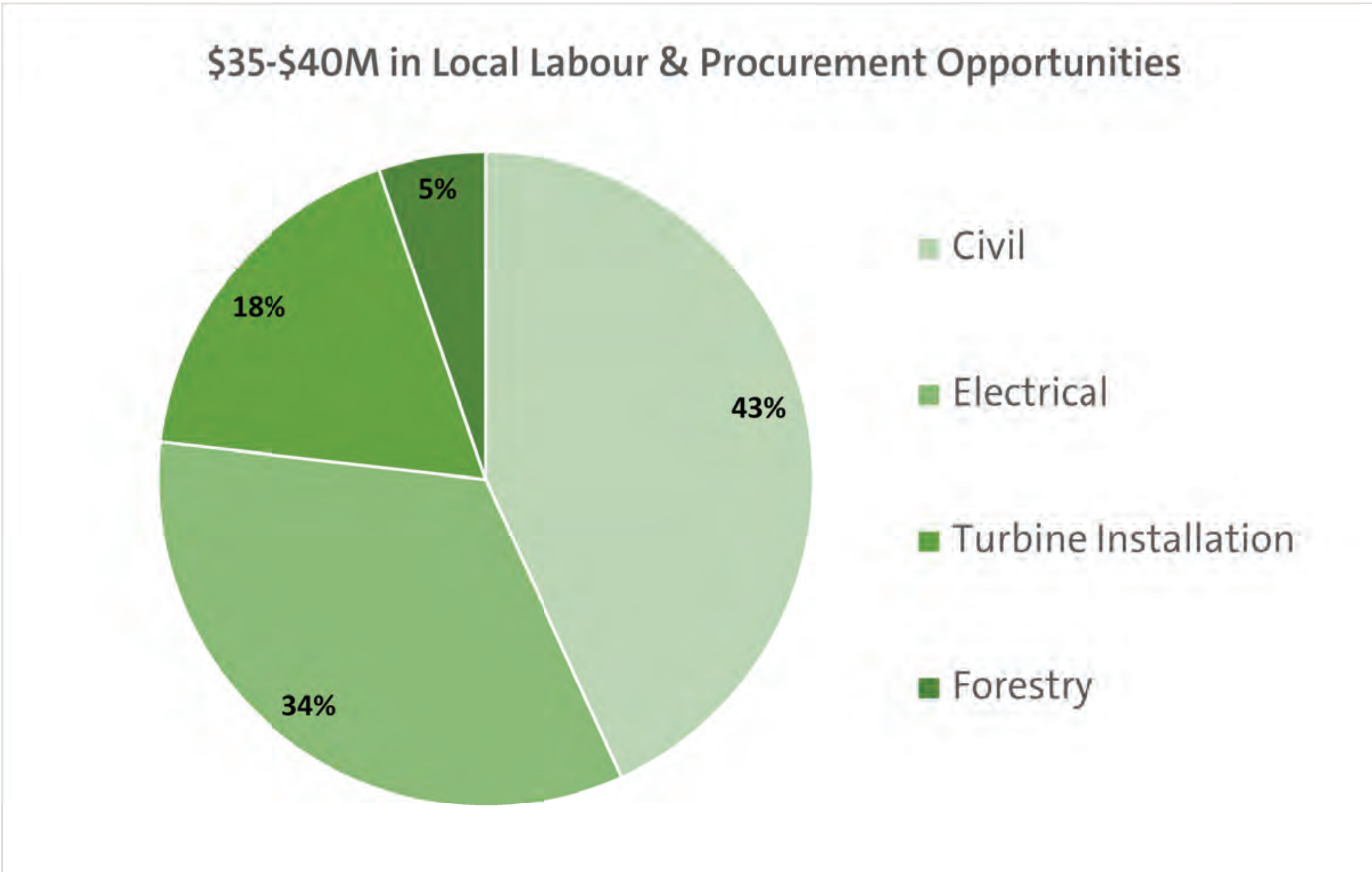
The Green Choice Program (www.novascotiagcp.com) was developed collaboratively between the Province of Nova Scotia, renewable energy developers, Nova Scotia Power, and large energy buyers. It will allow participating customers to purchase up to 100% of their electricity from local renewable energy sources.



(Nova Scotia Power, 2021)

Scan the QR Code to learn more about the Project and access interactive maps:

A **significant** Project for the Region: Labour, Construction and Suppliers



Melvin Lake Wind Project **Consultation and Community Engagement**

ABO WIND

- ABO commits to forthright and meaningful communication that is timely and respectful.
- We aim to carry forth discussions with interested parties and commit to the thoughtful consideration of feedback into our project planning in order to mitigate and avoid impact.
- We will discuss options, alternatives and mitigation measures related to presented concerns where feasible.
- We will provide responses to questions in a clear and easily understandable way.
- If you have questions or comments about the Melvin Lake Wind Project, please contact:

Heidi Kirby (Halifax Office)
by email at **heidi.kirby@abo-wind.com** or
phone at: 902-329-9907
For more information about the Melvin Lake Wind Project please visit:
www.melvinlakewind.ca

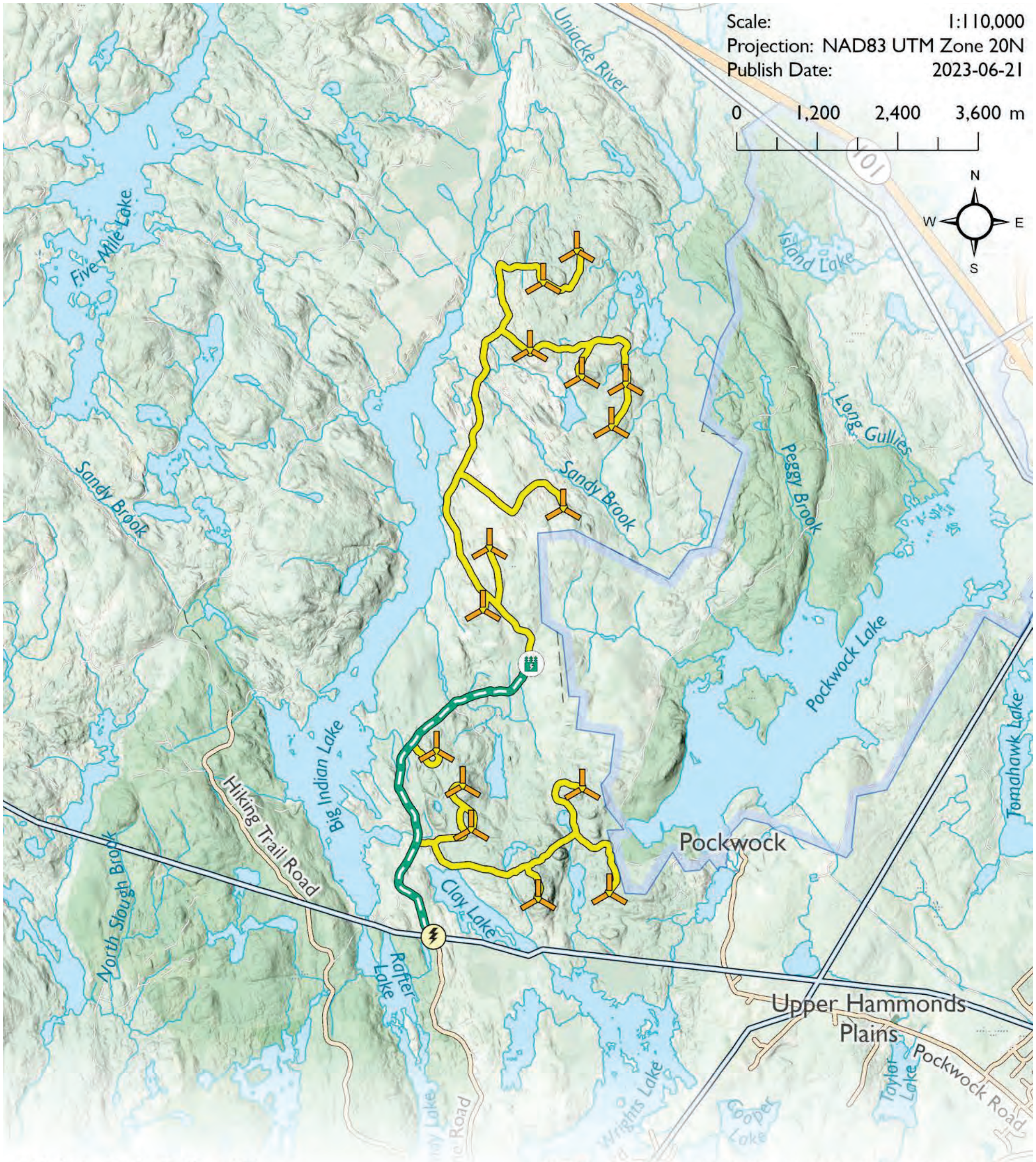
Scan the QR Code to learn more about the Project and access interactive maps:

Melvin Lake Wind Project Community Liaison Committee

ABO Wind invites interested individuals, including property owners/residents, First Nations, local businesses, elected officials, community or environmental groups to form a Community Liaison Committee (CLC). If you are interested, please reach out to Heidi Kirby, ABO Wind (contact detail noted above).

The purpose of a CLC is to act as an advisory body to a project proponent by providing input on existing or potential concerns of the community with respect to the project plan and activities; and to represent community interest by providing an avenue for the mutual exchange (Province of Nova Scotia, 2010).

Melvin Lake Wind Project **Map**



Melvin Lake Wind Farm

PRELIMINARY LAYOUT - SUBJECT TO CHANGE

- Potential Turbine Site
- Proposed Substation
- Point of Interconnection
- Proposed Access Road & Collector Line
- Proposed Transmission Line
- Existing Transmission Line
- Protected Watershed Area

NRCan, Earthstar Geographics, Airbus, USGS, NGA, NASA, CGIAR, NCEAS, NLS, OS, NMA, Geodatastyrelsen, GSA, GSI and the GIS User Community

Scan the QR Code to learn more about the Project and access interactive maps:

www.melvinlakewind.ca

Melvin Lake Wind Project Environmental Studies

ABO WIND

Environmental Study Results

- Environmental studies were completed by Strum Consulting in 2022 and 2023. The studies consisted of desktop assessments and field surveys to characterize the existing environment on the Project site.
- Wildlife surveys, including targeted Mainland moose surveys, identified a variety of species including White-tailed deer, Eastern coyote, Snowshoe hare and Bobcat. Although no evidence of Mainland moose was observed, potential habitat has been identified and documented.
- Terrestrial habitat assessments included identification of old growth stands and lichen species at risk, including blue felt lichen.
- Avian assessments included year round surveys to highlight species presence on site, as well as radar surveys to document large-scale migratory movements and avian activity in the area.

As one of many studies completed for the Project, Pellet Group Studies were completed to help inform habitat use of various species in the Melvin Lake area (May 2023).

Environmental Mitigations and Reporting

- Based on the field results ABO undertook additional infrastructure siting activities to avoid wetlands and wildlife features, where feasible.
- Wetland and watercourses were delineated throughout the site and incorporated into Project design to minimize direct impacts.
- Construction footprint and disturbance of regular activity reduced:
  - Existing access roads will be used where possible to minimize the footprint of disturbance.
  - No gates are anticipated to be installed at the Project with the exception of fencing around the substation for safety reasons. Recreational use and hunting activities will not be disrupted, with the exception of some construction related safety measures and temporary road closures.

Next steps

- Environmental Assessment Registration (late summer/fall 2023).
- ABO Wind will develop mitigation and monitoring plans. These plans will include:
  - Wildlife Management Plan
  - Bird and Bat Mortality Monitoring Program
  - Sediment and Erosion Control Plan
  - Surface Water Management Plan
  - Contingency Plan
  - Environmental Management Plan
  - Complaint Resolution Plan
  - Mainland Moose Monitoring Plan

strum CONSULTING

Melvin Lake Wind Project Sound

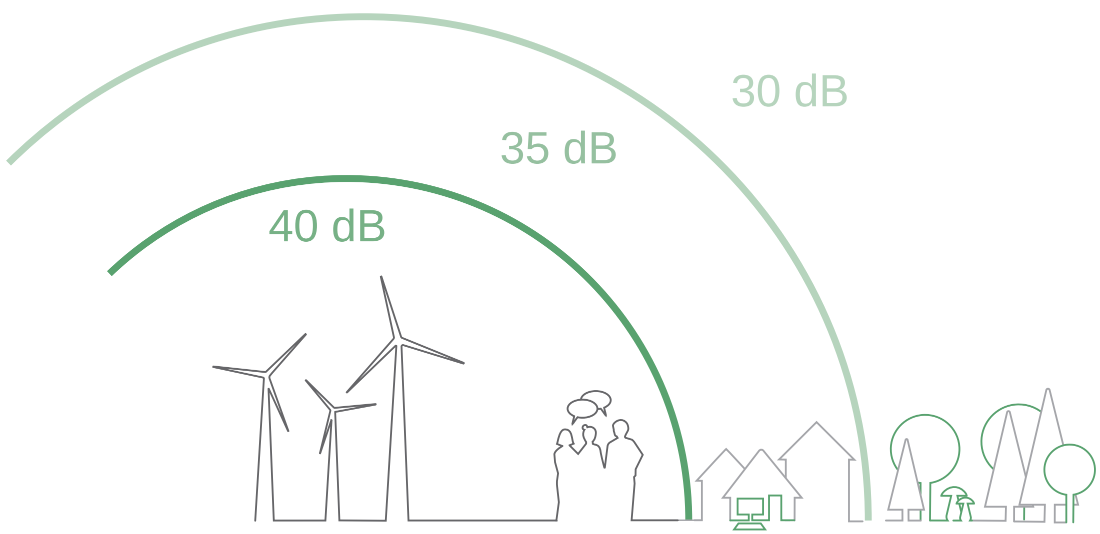
Noise Levels

The Project will be designed in accordance with the Province of Nova Scotia's Environmental Assessment ("EA") requirements for Wind Power Projects.

This Project not only meets, but exceeds the requirement for sound levels: "a proponent must ensure that the wind farm design and turbine siting does not cause sound levels to exceed 40 dBA (A-weighted decibels) at the exterior of receptors" (Province of Nova Scotia, 2021).

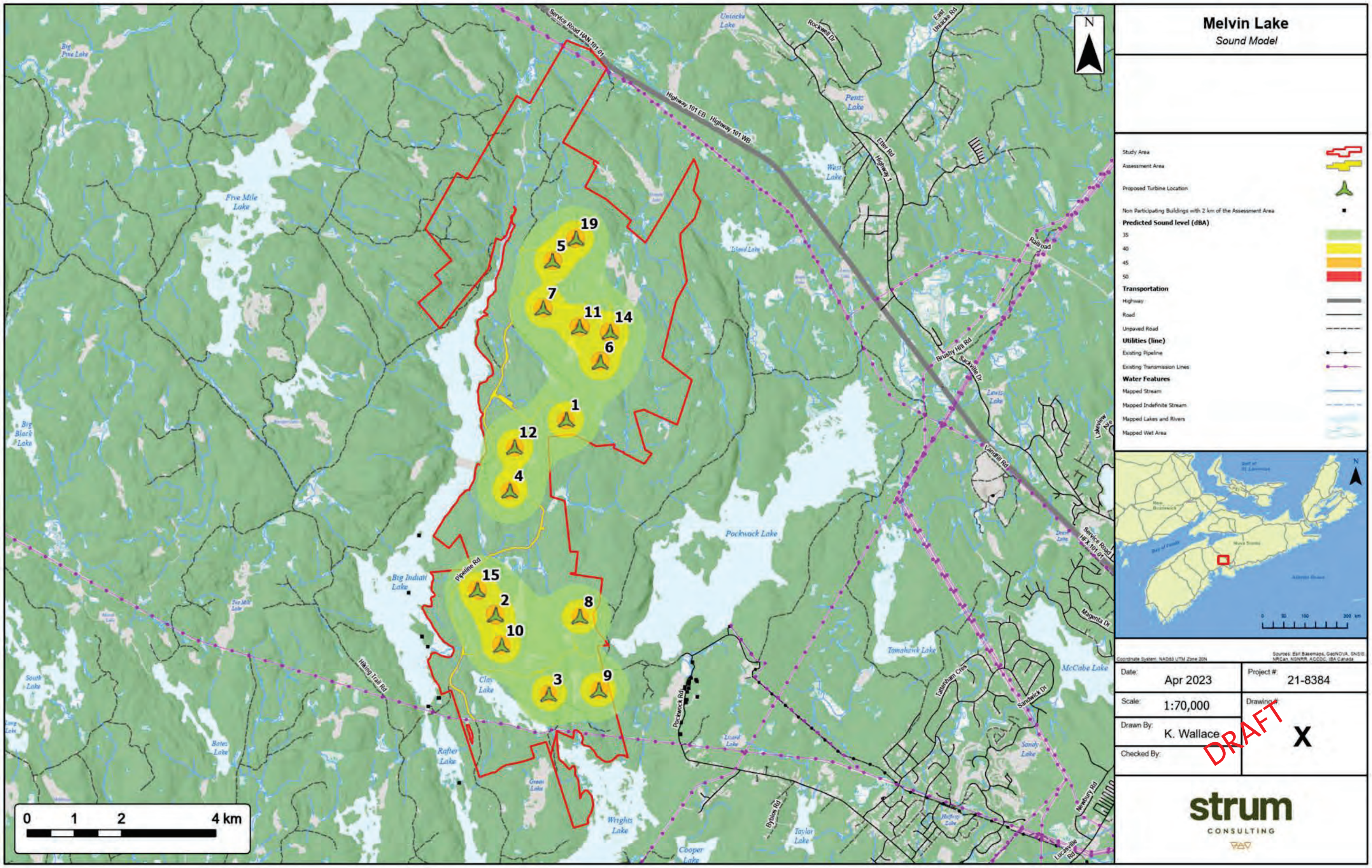
Our third-party expert's noise modelling study indicates that cumulative noise level, including turbine-generated noise, will not exceed 40 dBA at any existing receptors (residences).

A 40 dBA sound level is similar to a quiet library or a suburban area at night.



Examples of common sound levels (dBA)

140	Threshold of pain
130	Jet take off
120	Rock concert
110	Jackhammer
100	Power saw
90	Street traffic
80	Doorbell
70	Office
60	Normal conversation
50	Quiet urban neighborhood, daytime
40	Library
30	Soft whisper
20	Ticking of a wrist watch
10	Rustling leaves


Melvin Lake
Sound Model
Study Area
Assessment Area
Proposed Turbine Location
Non Participating Buildings with 2 km of the Assessment Area
Predicted Sound level (dBA)
35
40
45
50
Transportation
Highway
Road
Unpaved Road
Utilities (line)
Existing Pipeline
Existing Transmission Lines
Water Features
Mapped Stream
Mapped Indefinite Stream
Mapped Lakes and Rivers
Mapped Wet Area
Date: Apr 2023
Project #: 21-8384
Scale: 1:70,000
Drawing #: X
Drawn By: K. Wallace
Checked By:
DRAFT
strum CONSULTING
0 1 2 4 km
19
5
7
11
14
6
1
12
4
15
2
10
8
3
9
Five Mile Lake
Pockwock Lake
Big Indian Lake
Clay Lake
Rafter Lake
Wrights Lake
Pipeline Rd
Pockwock Rd
Hiking Trail Rd
Highway 101 EB
Highway 101 WB
Service Road HAN 101 01
Big Black Lake
Big Pine Lake
McCabe Lake
Tomahawk Lake
Cooper Lake
Taylor Lake
Pentz Lake
West Lake
Uniacke Lake
N

Shadow Flicker

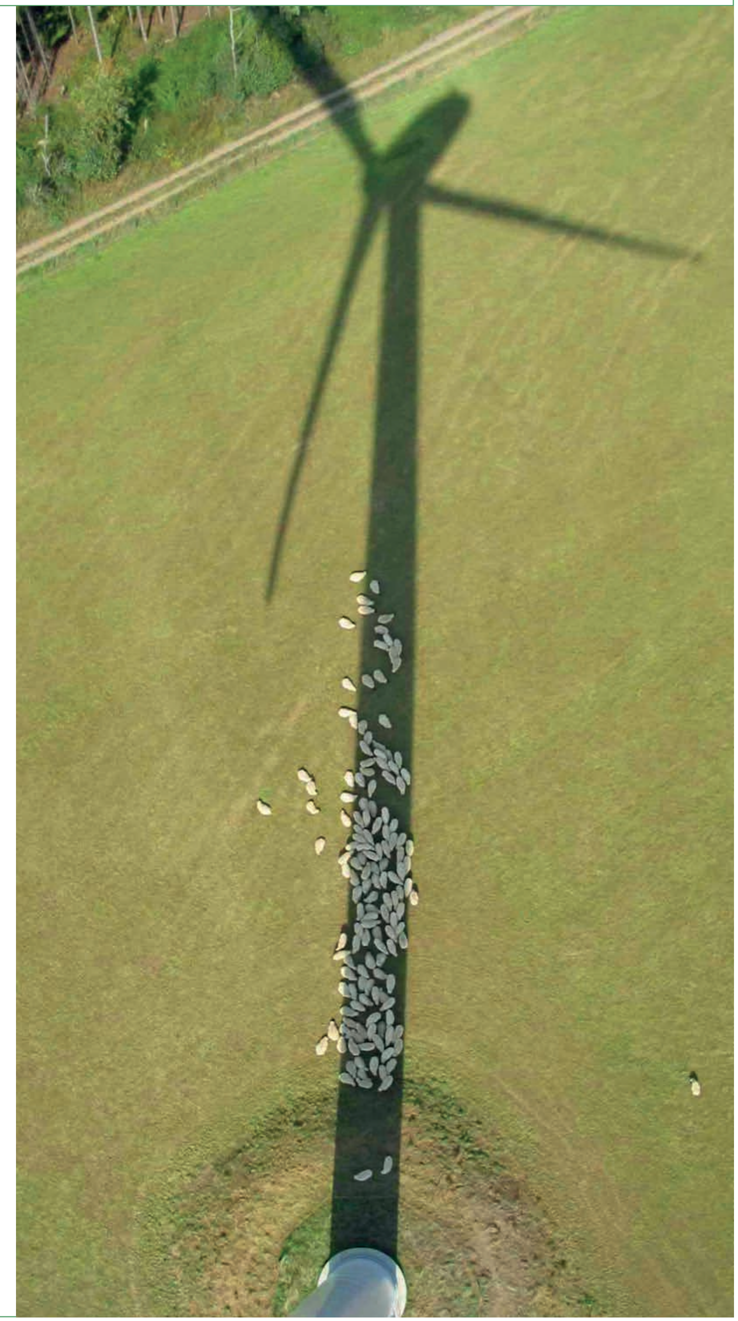
Shadow flicker occurs when the spinning rotor is located between the sun and a building, and the turbine blades alternately block and allow the sunlight to shine through. This causes a 'flicker' effect and only occurs when certain conditions are met such as the sun shining and turbine(s) operating.

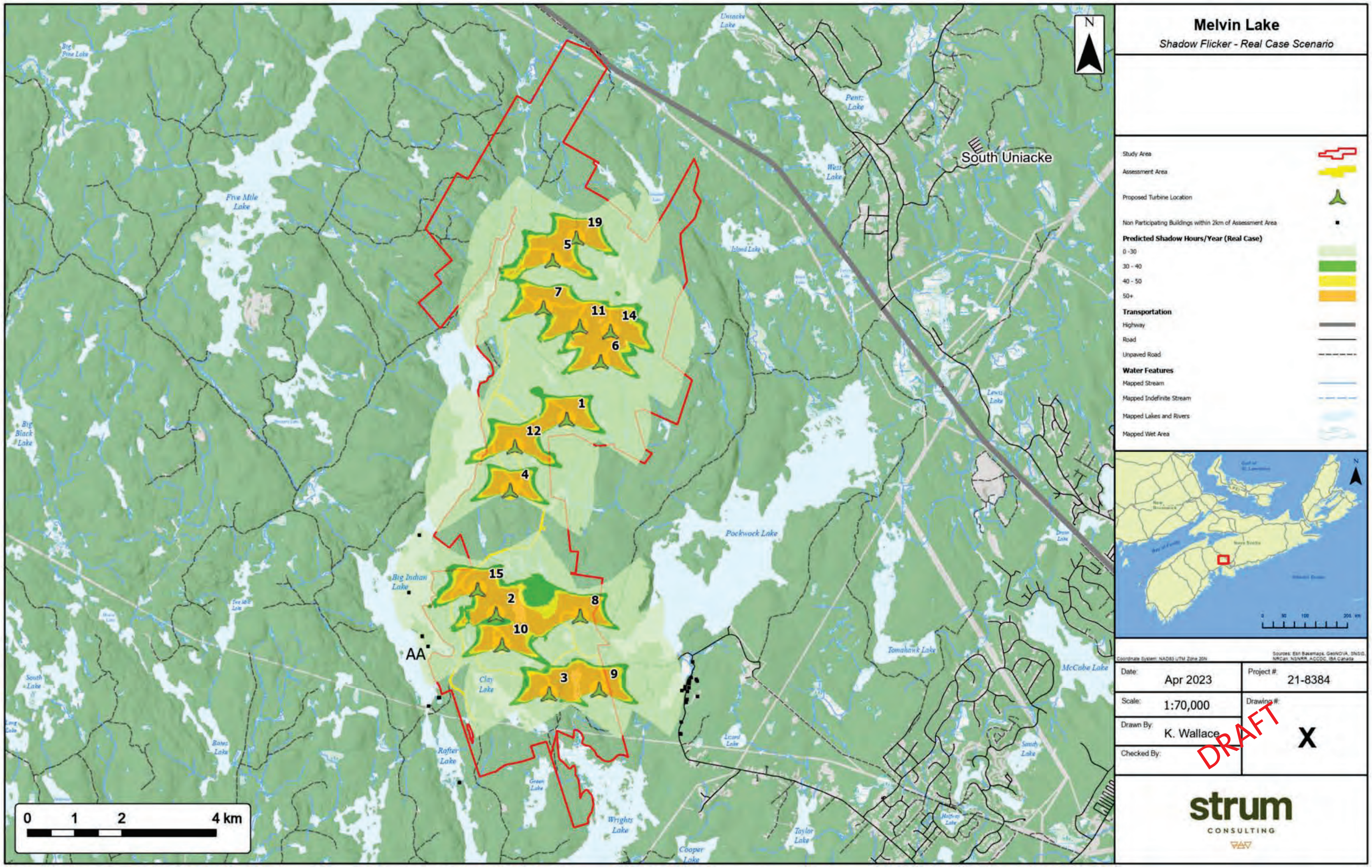
A Shadow Flicker study has been conducted to assess the potential for shadow flicker at nearby receptors (residences).

The assessment will be included in the Project Environmental Assessment that is being submitted to the Province of NS for approval.

Shadow Flicker Study Results:

- Shadow flicker modeling indicates that regulatory thresholds will be met by the Project.
- There are no predicted exceedances of 30 mins per day and/or 30 hours per year at any existing residential receptors.




Melvin Lake
Shadow Flicker - Real Case Scenario
Study Area
Assessment Area
Proposed Turbine Location
Non Participating Buildings within 2km of Assessment Area
Predicted Shadow Hours/Year (Real Case)
0 -30
30 - 40
40 - 50
50+
Transportation
Highway
Road
Unpaved Road
Water Features
Mapped Stream
Mapped Indefinite Stream
Mapped Lakes and Rivers
Mapped Wet Area
Date: Apr 2023
Project #: 21-8384
Scale: 1:70,000
Drawing #: X
Drawn By: K. Wallace
Checked By:
DRAFT
strum
CONSULTING
South Uniacke
Five Mile Lake
Pockwock Lake
Big Indian Lake
Clay Lake
Rafter Lake
Wrights Lake
Tomahawk Lake
McCabe Lake
AA
19
5
7
11
14
6
1
12
4
15
2
8
10
3
9
0 1 2 4 km
N

Melvin Lake Wind Project Project Timeline*

Activity	Timeline
Environmental Field Studies	2022 - 2023
Project Information Mailout	June - Early July 2023
Open House	July 13, 2023
Community, First Nations and Government Engagement	Ongoing - Through the life of the Project
Environmental Assessment submission to the Province, with additional opportunities for Project feedback	September 2023
The Project will be submitted for the Green Choice Program	December 2023
Anticipated Green Choice RFP Award	March 2024
Construction begins with tree and road clearing	2024
Commissioning – The Project is producing clean energy	2026

*Project timeline is preliminary and subject to change.

Scan the QR Code to learn more about the Project and access interactive maps:

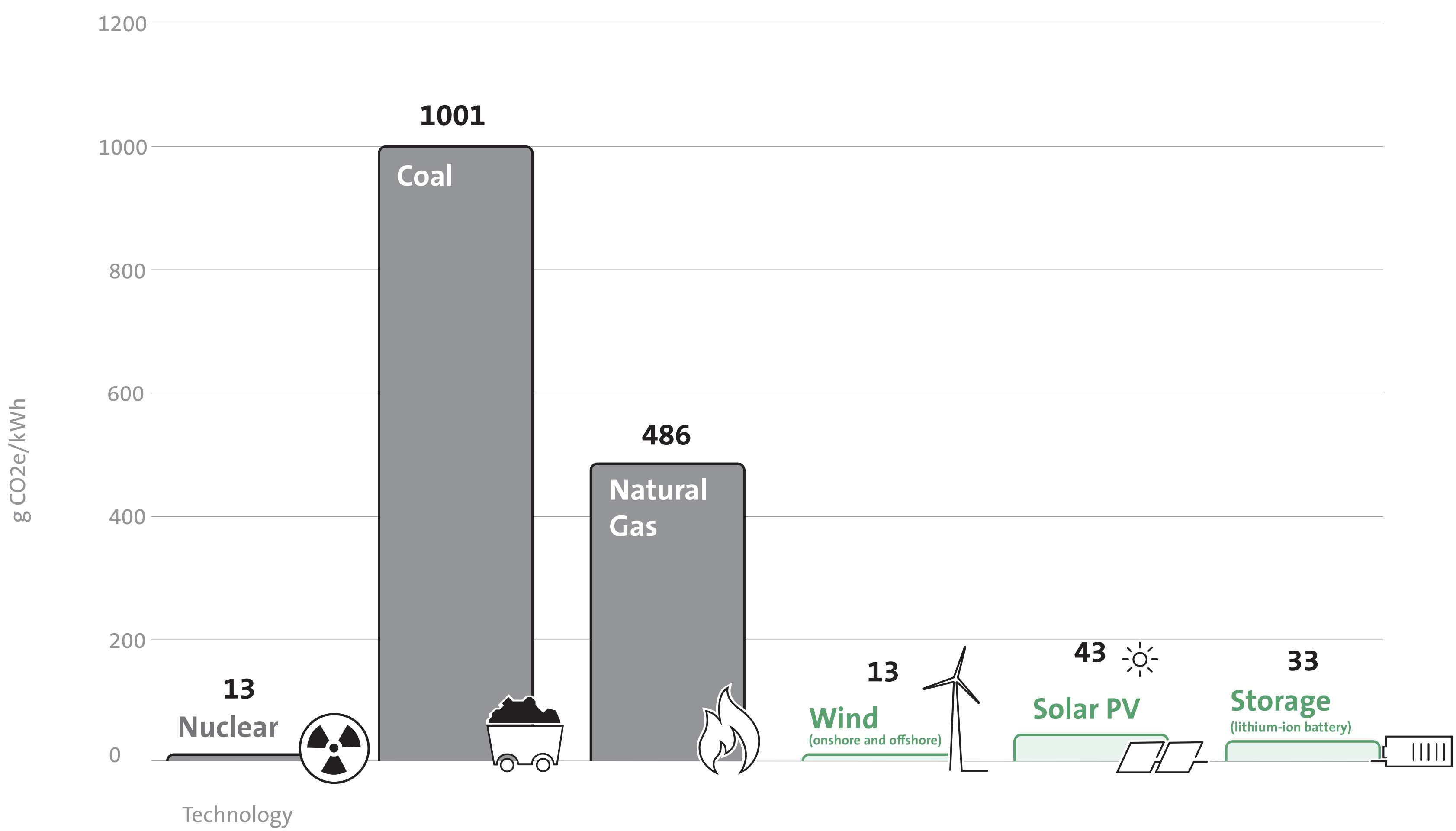
www.melvinlakewind.ca

Emissions of various energy sources

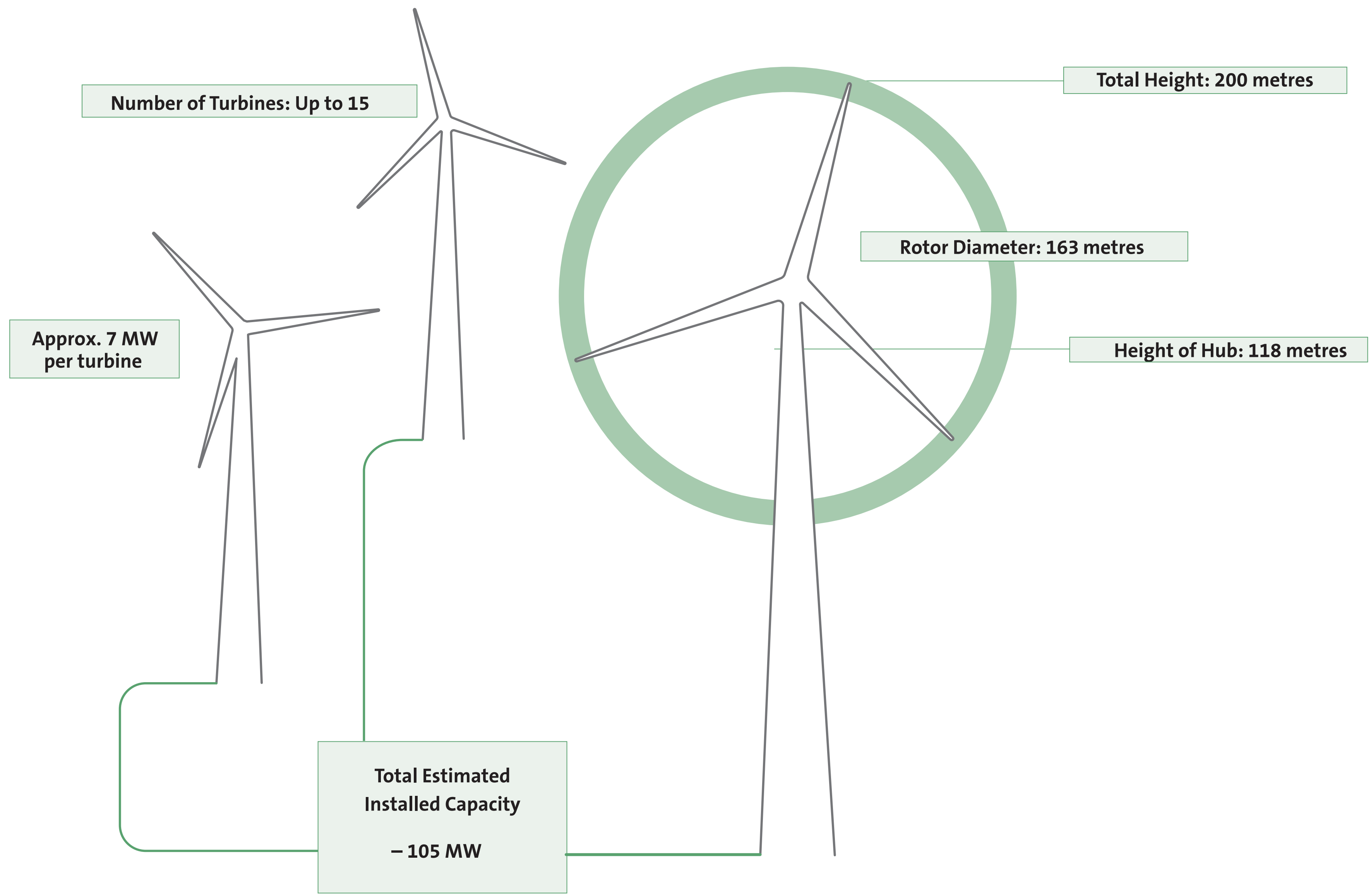
ABO WIND

The chart shows the total life cycle emissions in grams of carbon dioxide equivalent per kilowatt-hour for different electricity generation technologies.

Source: NREL's Life Cycle Greenhouse Gas Emissions from Electricity Generation: Update; September 2021



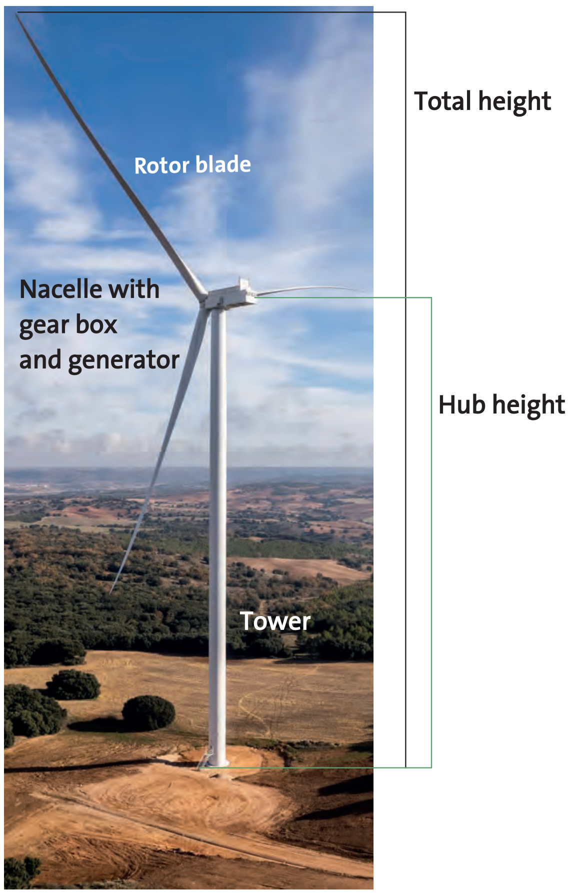
Project Overview

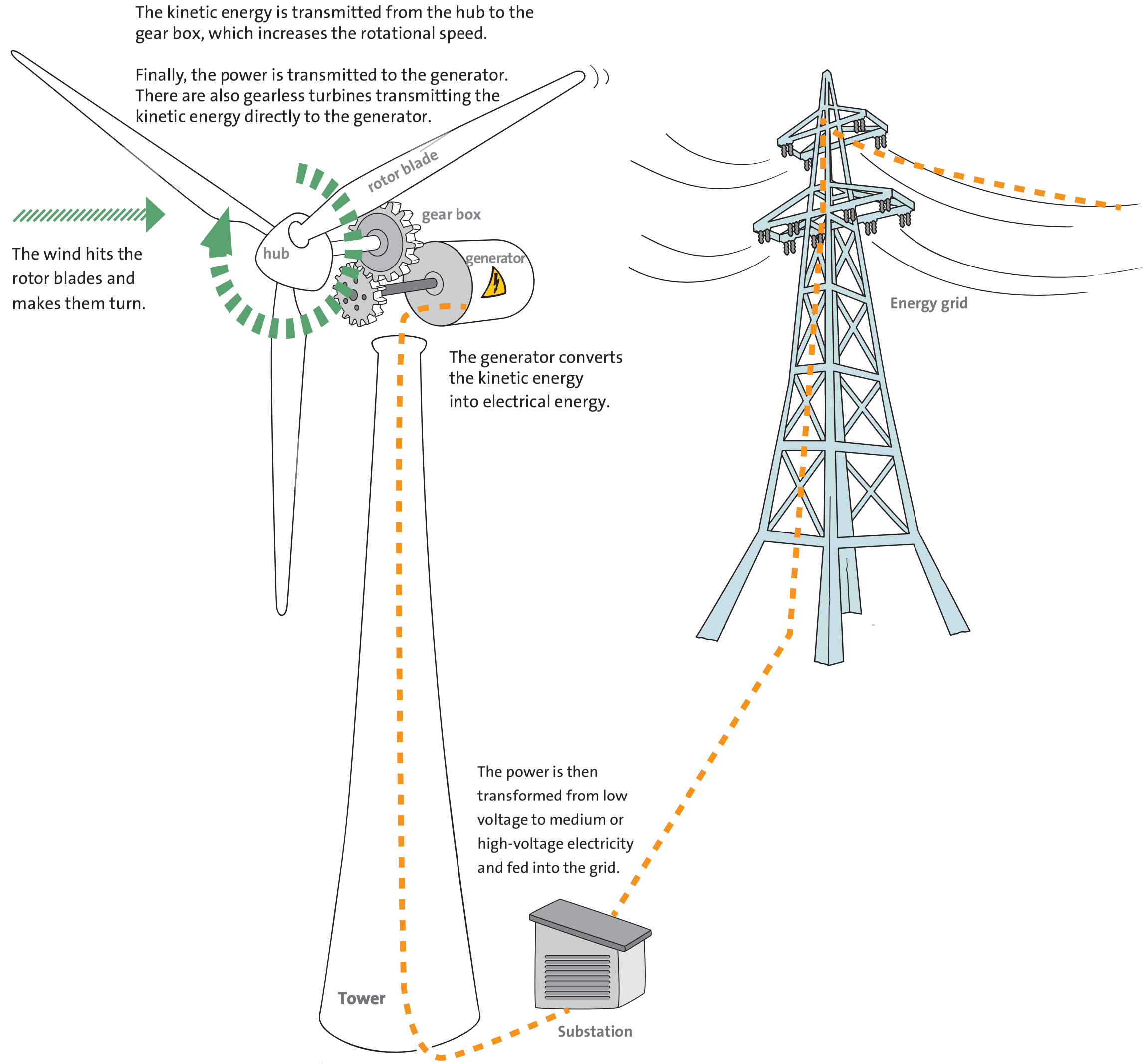


How does a wind turbine work?

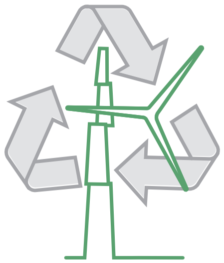
Wind Turbine Components

The main components of a wind turbine are the tower, nacelle and three blades attached to the hub. Put simply, the energy in the wind turns the blades around the hub. The hub is connected to a generator via a drive shaft, which creates electricity when the blades spin.





Decommissioning



What will be recycled and who will pay?

The main components of a wind turbine that can be recycled, repurposed, or salvaged include: Steel tower sections, steel reinforcement, electrical equipment and cables, precious metals, and concrete. Other materials or pieces of equipment that cannot be recycled, repurposed, or salvaged will be disposed of according to local/provincial regulations.

Two of the largest turbine manufacturers have created the first set of turbine blades that are fully recyclable. The use of these blades will be evaluated for this project.

Dismantling wind farm

Deconstruction of foundation